offices' websites and included Brazoria, Chambers, Fort Bend, Galveston, Harris, Montgomery, Nueces, San Patricio, Waller, and Webb counties.[28]

- **City and town population data** from the US Census Bureau.[29] These data were used to classify new homes by census division and stratify the data into segments representing urbanized areas, urban clusters, and rural areas.

Participant Group

The EM&V team defined the participant group as homes that participated in ERCOT utilities' new homes programs in PY2018. These accounts came from three utility companies: American Electric Power-Texas Central Company (AEP), CenterPoint Energy (CenterPoint), and Texas-New Mexico Power Company (TNMP).

Comparison Group

To analyze the efficiency of homes that did not participate in the program, we used a group of non-program customers with meters that came online in 2017 to late 2018 as the comparison group. These non-participants were selected from the three utility companies with new homes programs to control for differences in code enforcement or building practice across counties. All non-program customers were selected from counties that had at least 50 program participants. Furthermore, only counties with publicly downloadable tax data that contained square footage were used as this data point was an important factor used during the analysis.

Analysis Sample

Data Screening

Using the initial treatment and comparison groups, the EM&V team cleaned the data and screened for several criteria to identify the final analysis samples. The consumption analysis was conducted using participants with 12 full months of consumption data in calendar year 2019. Account-level reviews were performed on all individual households' monthly consumption to identify anomalies (e.g., periods of unoccupied units or missed readings) that could potentially bias results.

The EM&V team used the following screening criteria to remove anomalies, incomplete records, and outlier accounts that could potentially bias savings estimates:

- Accounts that could not be matched between participant program tracking data and consumption data (e.g., missing meter data or tracking data).
- Comparison accounts located in counties without sufficient participant accounts or in counties with inaccessible tax data. The EM&V team determined that non-participant accounts located in counties without sizeable participant populations would not provide appropriate comparisons because of different climate and code-enforcement conditions.
- Accounts that have solar interconnect agreements. Since these accounts produce some or all of their own electricity, we would not have complete consumption data.
- Accounts that recorded their first meter-reading after January 1, 2019, or recorded their last meter reading before December 31, 2019. In other words, accounts that had less

[28] See Appendix E

[29] US Census City and Town Population Total (2010-2019), https://www2.census.gov/programs-surveys/popest/tables/2010-2019/cities/totals/SUB-IP-EST2019-ANNRES-48.xlsx

than one full year of meter readings. Industry-standard practice in consumption analyses is to use one full year of usage data pre- and post-treatment; however, since these are new measures, no pre-treatment data exists.

- Accounts that recorded their first full day of non-zero kWh meter usage after January 1, 2019, which controlled for homes that were unoccupied at the start of the year. Given that the accounts in this analysis are new construction, it is important to consider that they may not be occupied at the start of the measured period, even if meters are installed. Accounts with extended periods of zero meter-usage indicated that base-load appliances were not yet installed. While it is a proxy for occupancy, the EM&V team felt that using the first date with a full day of meter-readings indicated that major appliances had been installed and thus occupancy was plausible.
- Accounts that were missing more than the equivalent of 12 hours total of consumption data (i.e., missing more than 48 15-minute meter data readings across the entire 365 days, not necessarily 48 consecutive 15-minute readings). This rule allows us to retain accounts with relatively small amounts of missing data, thus preserving the size and heterogeneity of the analysis group, while excluding those where large amounts of missing data could bias model coefficients. These levels were set at half of the values used in the retrofit analysis because the new homes analysis only uses one year of meter readings.
- Accounts with 15 days (1,440 15-minute meter data readings) of meter readings of zero kWh, in aggregate. Large amounts of meter readings of zero kWh indicate periods of vacancy, meter reading failure, or other issues that could bias model results. Meter readings of zero kWh are somewhat common; therefore, retaining accounts with some zero kWh readings was essential to preserve the size of the analysis group. As with the missing data metric, the threshold here was indexed at half the limit of the retrofit analysis.
- Accounts with total usage that was excessively high or low during the program year (less than 1,000 kWh or greater than 70,000 kWh). These accounts are outliers. The average consumption in the pre-period is about 15,000 kWh, and these accounts represent uncommon situations of drastically high or low consumption, which could influence model results.
- Comparison accounts with square footage below the participant minimum or greater than the participant maximum (under 784 or over 7,522 square feet). Comparison accounts that were outliers due to household size were deemed unlikely to prove useful for this analysis as they likely had characteristics that differentiated them from the participant population.
- Comparison accounts that were identified as cellular network towers, cable or phone relays, or other types of commercial accounts by the utility companies.

Model Attrition

Following these data screening steps, we retained a matched analytic sample consisting of 13,760 treatment and 17,288 comparison group accounts. Table 118 provides details of the screening process for accounts in the new homes program, and Table 119 provides utility-specific attrition. The data for the program participants tended to have fewer missing data than those found in the comparison group. Most of the participant accounts that were removed were due to excessive numbers of zero kWh readings, indicating potential irregularities in the smart meter function; however, this issue was still more pronounced in the comparison group.

Table 118. New Homes Program Screening - Statewide

Screen	Participant Group		Comparison Group	
	Accounts Remaining	Percentage Remaining	Accounts Remaining	Percentage Remaining
Original electric accounts	14,123	100%	56,150	100%
Did not match to billing data	14,120	100%	56,089	100%
Accounts from irrelevant comparison counties or counties with insufficient data	14,031	99%	46,941	84%
Accounts with solar interconnects	14,000	99%	46,884	83%
Accounts with insufficient start or end dates	13,958	99%	24,154	43%
Accounts that were not occupied at the start of 2019	13,958	99%	23,827	42%
Accounts with excessive missing meter reads	13,912	99%	22,687	40%
Accounts with excessive zero-kWh meter reads	13,763	97%	20,747	37%
Accounts that were usage or square-footage outliers	13,760	97%	18,264	33%
Accounts that were identified as commercial	13,760	97%	17,288	31%
Final Analysis Group	**13,760**	**97%**	**17,288**	**31%**

Table 119. New Homes Program Screening - Utility

Participant Group	AEP	CenterPoint	TNMP
Original Accounts	743	12,769	611
Final Accounts	592	12,569	599
Percentage Retained	**80%**	**98%**	**98%**
Comparison Group			
Original Accounts	10,436	43,169	2,545
Final Accounts	1,342	15,150	796
Percentage Retained	**13%**	**35%**	**31%**

Comparison meters had many reasons that contributed to a retention rate of approximately 33 percent. Most of the account loss stemmed from the original comparison account population having less selective criteria than the participants and can be attributed to specific data cleaning steps.

AEP and TNMP both provided many accounts that were in counties scattered throughout the state of Texas that did not correspond with where participant accounts were located. These accounts were in different counties and the code enforcement, market conditions, and building practices would likely differ and thus would not provide a relevant comparison. As a result, they are unlikely to make useful comparisons for the participant accounts. Additionally, some of the counties that had sizeable populations did not have any publicly downloadable databases that included square footage, so these were dropped from the comparison group. CenterPoint had many accounts that started after January 1, 2019, and thus were missing a full twelve months of data, which lead to a loss of almost half of their comparison accounts. While we attempted to screen ineligible accounts prior to requesting meter data, CenterPoint identified a group of approximately 1,000 comparison accounts that were commercial customers, and thus were removed from this analysis. CenterPoint also identified a group of accounts that were potentially multi-unit households, however due to the difficulty differentiating between true multi-unit buildings and single-family homes built close together, these were ultimately kept in the analysis. All the utilities suffered from issues with missing and zero kWh readings, which lead to further attrition that ultimately resulted in the relatively low retention rate.

Modeling Approach

Household-level weather normalization models

The team ran account-level regression models with weather-normalized hourly consumption to estimate the effect of weather on each household's energy consumption[30]. Results were then averaged across the sample to determine utility, census division, heating type, and statewide program findings. We originally calculated normalization models using both hourly and daily electricity usage aggregation; however, ultimately decided to use hourly normalization models as they fit the data more accurately.

- For the energy model analysis, treatment accounts were weather-normalized, and their usage was compared to the TRM usage estimates.

[30] For further details, see Appendix C.

- For the comparison analysis, both treatment accounts and comparison accounts were weather-normalized, and the two groups were compared.

Savings Calculation

The EM&V team derived gross energy consumption for the new homes programs using the following equation to compare the evaluated participant savings with those projected by the energy models defined in the TRM. The *plug load* variable used in the formula below represents the percentage of electrical consumption attributable to discretionary electrical consumption. The TRM estimates only include major appliances and heating and cooling; to compare meter data with the TRM estimates, we must include a correction for plug load.

$$Adj.\,Gross\ Consumption = \left(Normalized\ Usage_{Participant}\right)(1 - plug\ load)$$

$$Consumption\ Difference = (Adj.\,Gross\ Consumption) - (TRM\ Modeled\ Consumption)$$

For the comparison analysis, the EM&V team derived adjusted gross energy savings for the new homes programs compared to the comparison group using the formula below. This analysis represents the effect the new homes programs have on household consumption independent of standard building practices in their respective markets. These calculations do not include adjustments for plug load under the assumption that participant and comparison households use similar amounts of energy as plug load.

$$Adj.\,Gross\ Savings = Normalized\ Annual\ Usage_{Comparison} - Normalized\ Annual\ Usage_{Participant}$$

Similarly, we calculated peak energy reductions between the participant and comparison groups. We identified the normalized peak energy usage based on the *top 20 hours* methodology defined in the TRM.

$$Adj.\,Gross\ Peak\ Reduction = Normalized\ Peak\ Usage_{Comparison} - Normalized\ Peak\ Usage_{Participant}$$

Findings: Energy Models

Overall Results

This section presents evaluated savings estimates for the new homes programs at the statewide level, as well as by census division and heating type.

The EM&V team included weather-normalized annual consumption in these results to characterize the average energy consumption of the participant group; this helps control for variation in the temperatures during the program year that may have differed from conditions in a typical year in the same location.

After calculating weather-normalized consumption, usage was compared to the planning estimates reported in the utility tracking databases that are required to be consistent with the statewide TRM (which values are referred to as *TRM* in the tables below). It is important to note that there are differences in the methods used to calculate the evaluated estimates here and those methods used to estimate savings through the TRM. Specifically:

- ***Baseload Consumption*** – Billing analysis includes all electrical consumption during the program period, including the associated discretionary plug load. The TRMs are typically designed to estimate usage based on heating and cooling projections and consumption

associated with major installed appliances that such as refrigerators, laundry machines, etc. Because plug load is not included in the TRM estimate, we must account for it before we can compare the two values and estimate it as 15 percent of overall consumption based on existing research[31].

- ***Weather*** – There may be some slight distinctions in weather data that may result in minor differences. As noted, this study uses data from 59 ASOS stations, specifically located nearest to each household in the analysis. However, the TRM primarily uses seven to nine regional stations to more broadly cover the state.

Statewide Findings

Table 120 provides model savings compared to TRM values by census classification and statewide.[32] The TRM is only meant to be accurate at a statewide level. However, we acknowledge there are differences in utilities' service areas that might affect the performance of homes, and one of these differences is the jurisdictions where the homes are built. Local jurisdictions are responsible for code enforcement, and the size of jurisdiction might affect that enforcement.

The US Census Bureau delineates geographic areas based on their population. It classifies areas with more than 50,000 people as *urbanized areas*, areas with between 2,500 and 50,000 as *urban clusters*, and all other areas as *rural*. While we present these additional findings by census division groups here, our focus will continue to be on the overall statewide results.

Statewide, the consumption model average savings converged closely with the TRM estimated savings. The EM&V team feels that the differences in average participant savings between the consumption model and the TRM could very plausibly be attributed to the limitations of estimating discretionary plug load.

Table 120. Census Division and Statewide Savings Summary

Census Division	n	Average Participant Annual Consumption			Average Participant Savings		Percentage of Savings Compared to TRM	Savings as a Percentage of Reference	
		Reference	Model	TRM	Model	TRM		Model	TRM
Urbanized Area	3,970	11,843	9,833	10,262	2,010	1,581	127%	17%	13%
Urban Cluster	9,014	12,177	10,468	10,461	1,709	1,716	100%	14%	14%
Rural Area	776	11,730	11,105	10,097	625	1,633	36%	5%	14%
All	**13,760**	**12,055**	**10,321**	**10,383**	**1,735**	**1,672**	**104%**	**14%**	**14%**

At the census division level, the models performed differently across the stratifications. Overall, results were in line with TRM estimates; however, in urbanized areas, the results indicated that the TRM might be underestimating savings compared to modeled usage (13 percent compared

[31] https://www.esource.com/es-wp-14/mind-gap-taking-comprehensive-look-plug-load-energy-use

[32] See Appendix F for similar results tables with confidence intervals.

to 17 percent). In rural areas, the TRM appears to be overestimating savings (14 percent compared to 5 percent).

Utility Findings

Table 121 provides model savings compared to TRM values by participating utility. Three utility programs participated in the new homes programs and used smart meters to measure usage: AEP, CenterPoint, and TNMP.

At the utility level, results varied widely. CenterPoint had, by far, the largest number of accounts and yielded the most similar results to the TRM estimate. The high number of accounts would suggest that the results are robust, and the models are performing well with a large population. Table 5 summarizes the results of utility savings.

Table 121. Utility Savings Summary

Utility	n	Average Participant Annual Consumption			Average Participant Savings		Percentage of Savings Compared to TRM	Savings as a Percentage of Reference	
		Reference	Model	TRM	Model	TRM		Model	TRM
AEP TCC	592	13,325	11,196	11,803	2,129	1,522	140%	16%	11%
Center Point	12,569	12,009	10,244	10,344	1,765	1,666	106%	15%	14%
TNMP	599	11,770	11,056	9,804	714	1,966	36%	6%	17%

AEP and TNMP both had results that were significantly different from the TRM estimates. The consumption model yielded higher savings for AEP than the TRM predicted (140 percent of TRM savings), while TNMP yielded lower savings (36 percent of TRM savings). The variation in these two utilities' results could potentially be the result of much smaller population sizes compared to CenterPoint, and it is possible that with additional participants, their results would converge on a point closer to the TRM estimates.

Heating Type Findings

Table 122 provides savings compared to TRM values by household space heating technology. Most of the accounts in this sample used natural gas (92 percent), while electric heat pumps (5 percent) and electric resistance (2 percent) made up the remainder.

As with the results overall, we expect to see some natural variation in this comparison due to plug load assumptions. For natural gas accounts, the differences between the calculated savings and TRM estimates were minuscule, echoing the previous finding that the TRM is performing well for homes using natural gas, which constitute the majority of homes in the program.

Table 122. Heating Type Savings Summary

Heating Type	n	Average Participant Annual Consumption			Average Participant Savings		Percentage of Savings Compared to TRM	Savings as a Percentage of Reference	
		Reference	Model	TRM	Model	TRM		Model	TRM
Electric Resistance	329	13,760	12,053	12,769	1,707	991	199%	12%	7%
Heat Pump	706	15,720	11,748	13,534	3,972	2,186	182%	25%	14%
Natural Gas	12,725	11,808	10,197	10,146	1,611	1,662	97%	14%	14%

The TRM estimates performed less well with the electric heating types, whose modeled usage both varied from the TRM estimates. In both cases, the model estimated average savings much higher than the TRM estimates. Accounts with electric resistance heating yielded average savings similar to households with natural gas, but nearly double what the TRM had predicted. For accounts with heat pumps, average savings were both substantially higher than the TRM estimates and far higher than other accounts overall.

Findings: Comparison Models

Overall Results

This section presents evaluated savings estimates for the new homes programs at the statewide level and census division, as well as by utility and heating type.

The EM&V team included the same weather-normalized annual consumption in these results to characterize the average energy consumption of the participant group, but also followed a similar procedure to normalize the average energy consumption for the comparison group. This weather-normalization helps control for variation in the temperatures during the program year that may have differed from conditions in a typical year in the same location.

Overall, the results of the comparison analysis indicate that the participant accounts are not using less energy than the comparison group. The EM&V team hypothesizes that this is likely due to market transformation stemming from a combination of market forces, including the new homes programs and outside influences.

The EM&V team took steps to ensure that the comparison group shared similar characteristics with the participant group; however, ultimately, it is difficult to be confident that the group provides an accurate analog. Additional information about the comparison group, including additional building or household characteristics, might allow for more accurate analyses in the future.

Statewide Findings

Table 123 provides modeled consumption both for the participant and comparison groups by census division and statewide.[33] At a statewide level, participating homes used slightly less energy than comparison homes on an annual basis.

When considering the weather-normalized energy consumption between the participant and comparison groups, we identified that the comparison households tended to be systematically smaller than the participant households. Since household square footage is related to electricity

[33] See Appendix F for similar results tables with confidence intervals.

associated with heating and cooling, this discrepancy causes the participants to use more electricity overall. To account for these differences, we also calculated the energy intensity of square footage by dividing household annual consumption by square footage for both the participant and comparison groups and then multiplied that by the category average square footage. Table 124 shows the results of this square footage adjusted consumption.

Table 123. Census Division and Statewide Consumption Summary

Census Division	Group	n	Model Average Consumption (kWh)	Participant Savings Versus Comparison	Participant Savings as a Percentage of Comparison Group
Urbanized Area	Participant	3,970	9,928	643	6%
	Comparison	8,023	10,572		
Urban Cluster	Participant	9,014	10,486	-410	-4%
	Comparison	8,151	10,075		
Rural Area	Participant	776	11,101	-38	0%
	Comparison	1,144	11,064		
All	**Participant**	**13,760**	**10,348**	**21**	**0%**
	Comparison	**17,288**	**10,369**		

Table 124. Census Division and Statewide Consumption Summary (Square Footage Adjusted)

Census Division	Group	n	Group Average Sq. Ft.	Model Average Energy Intensity (kWh/Sq. Ft.)	Census Division Average Sq. Ft.	Sq. Ft. Adjusted Average Consumption	Participant Savings versus Comparison	Participant Savings as a Percentage of Comparison Group
Urbanized Area	Participant	3,970	2,506	4.8	2,444	10,050	596	6%
	Comparison	8,023	2,397	5.1		10,646		
Urban Cluster	Participant	9,014	2,757	4.5	2,622	10,138	540	5%
	Comparison	8,151	2,421	4.8		10,678		
Rural Area	Participant	776	2,725	4.8	2,571	10,493	763	7%
	Comparison	1,144	2,369	5.2		11,255		
All	**Participant**	**13,760**	**2,680**	**4.6**	**2,553**	**10,091**	**673**	**6%**
	Comparison	**17,288**	**2,408**	**5.0**		**10,764**		

When we account for the differences in square footage between groups, the models yield energy savings for participants. However, compared with the Energy Models analysis results (14 percent savings over reference), the comparison group analysis suggests that savings above-market practices are less than 50 percent of the gross savings estimated by the TRM.

As indicated previously, market transformation is one possible explanation for this reduction in savings. If the industry standard has changed to build more energy-efficient housing, the TRM is not designed to represent this phenomenon when estimating energy consumption. If that is the case, it would explain why the energy model analyses appear to be performing well (the TRM is accurately estimating consumption in the participant group), but the comparison models show diminished savings.

Utility Findings

Table 125 and Table 126 provide modeled consumption for both participants and the comparison group, which are broken down by utility using the same methodology as in the previous section. Notably, TNMP shows savings higher than the TRM estimated savings when accounting for square footage.

As with the state and region level, initially, the results here indicated little to no savings across the utilities. When we account for square footage, we see considerable savings associated only with TNMP. One likely explanation for this discrepancy is that TNMP had a much larger difference in average square footage between its participants (2,725 square feet) and its comparison group (2,000 square feet) compared with AEP (1,977 square feet and 1,996 square feet, respectively) and CenterPoint (2,721 square feet and 2,450 square feet, respectively).

Table 125. Utility Consumption Summary

Utility	Group	n	Model Average Consumption (kWh)	Participant Savings Versus Comparison	Participant Savings as a Percentage of Comparison Group
AEP TCC	Participant	592	11,097	219	2%
	Comparison	1,342	11,316		
CenterPoint	Participant	12,569	10,244	33	0%
	Comparison	15,150	10,278		
TNMP	Participant	599	11,053	-534	-5%
	Comparison	796	10,520		

Table 126. Utility Consumption Summary (Square Footage Adjusted)

Utility	Group	n	Group Average Sq. Ft.	Model Average Energy Intensity (kWh/Sq. Ft.)	Utility Average Sq. Ft	Sq. Ft. Adjusted Average Consumption	Participant Savings versus Comparison	Participant Savings as a Percentage of Comparison Group
AEP TCC	Participant	592	1,977	6.8	1,985	11,428	301	3%
	Comparison	1,342	1,996	7.0		11,728		
Center Point	Participant	12,569	2,721	4.5	2,594	9,917	627	6%
	Comparison	15,150	2,450	4.8		10,543		
TNMP	Participant	599	2,725	5.0	2,411	10,211	2,936	22%
	Comparison	796	2,000	6.4		13,147		

As mentioned above, the results for TNMP show savings higher than the TRM estimates. These higher savings results might be a limitation of the square footage adjustment methodology. However, this might also reflect market practices within TNMP's service area, such as a lag in code adoption or enforcement or at least building practices closer to the code baseline. These results are based on the smallest number of observations for any of the utilities.

Heating Type Findings

The last stratification technique that the EM&V team was interested in was examining the results by heating technology. This stratification presented a unique challenge because, unlike the participant group, there was no heating information provided for the comparison accounts. To overcome this problem, we utilized a train-test split and cross-validation using the participant accounts to develop a model that would predict the heating type in the comparison group based on usage patterns[34].

While this model proved effective in testing and correctly identifying gas accounts, it could not reliably and consistently differentiate between accounts with electric resistance and heat pumps. Because of these limitations, for the comparison analysis, we ultimately decided to group electric heating types and compare them to gas heating.

Table 127 and Table 128 provide modeled consumption for participants and the comparison group stratified by heating fuel (or predicted heating fuel) using the same methodology as in the previous section.

The initial results by heating type yielded similar findings to the other analyses described previously. Without accounting for square footage, the models indicate higher usage for participant homes than comparison homes. Once we adjust for average square footage, we see savings that are larger than in previous stratifications, but still considerably less than the energy models predicted.

Table 127. Heating Type Consumption Summary

Heating Type	Group	n	Model Average Consumption (kWh)	Participant Savings Versus Comparison	Participant Savings as a Percentage of Comparison Group
Electric Heat	Participant	1,035	11,595	-278	-2%
	Comparison	1,342	11,316		
Natural Gas Heat	Participant	12,725	10,208	82	1%
	Comparison	15,946	10,290		

[34] See Appendix D for further details.

Table 128. Heating Type Consumption Summary (Square Footage Adjusted)

Heating Type	Group	n	Group Average Sq. Ft.	Model Average Energy Intensity (kWh/ Sq. Ft.)	Heating Type Average Sq. Ft	Sq. Ft. Adjusted Average Consumption	Participant Savings versus Comparison	Participant Savings as a Percentage of Comparison Group
Electric Heat	Participant	1,035	2,292	6.8	2,199	11,682	1,310	10%
	Comparison	1,342	1,996	7.0		12,992		
Natural Gas Heat	Participant	12,725	2,717	4.5	2,579	9,861	802	8%
	Comparison	15,946	2,427	4.9		10,663		

Peak Demand Results

As a part of the comparison analysis, the EM&V team also developed a method for calculating peak demand by adapting the method in the TRM, as was laid out in the savings calculation section. The peak demand savings estimates for the new homes programs overall are presented below in Table 129.

It is important to note that winter peak demand is typically only calculated for homes that use electric heating. Based on the tracking data, the EM&V team already knew that most of the participants' accounts use natural gas for heating. However, because the heating fuel is unknown for the comparison group, we again used predicted heat type to present results stratified by heating fuel. The results of this second calculation for the winter peak season are shown in Table 130.

Overall, the results of the peak demand calculation were consistent with the energy portion of the comparison group analysis in that it does not appear that participants reduced demand versus the comparison group. While there initially appeared to be a reduction in winter peak consumption, once heating type was disaggregated, these apparent savings could be attributed to natural gas heated accounts. Winter peak is only calculated for homes with electric heat, and those accounts did not yield savings.

Table 129. Peak Demand Summary

Season	Participant Peak Demand	Comparison Peak Demand	Demand Reduction	Demand Reduction as a Percentage of Comparison Peak
Summer	3.93	3.75	-0.17	-5%
Winter	1.05	1.76	0.71	40%

Table 130. Winter Peak Demand Summary by Heating Type

Season	Heating Type	Participant Peak Demand	Comparison Peak Demand	Demand Reduction	Demand Reduction as a Percentage of Comparison Peak
Winter	Electric Heat	3.23	3.20	-0.02	-1%
	Natural Gas Heat	0.87	1.64	0.77	47%

While the TRM does not provide a method for calculating peak demand reductions in natural gas heated homes, the observed savings are a potentially intriguing finding. Hypothetically, electrical consumption in these homes would not be affected by heating in winter, except for the electrical components associated with ventilation. It is possible that when heating and cooling are not factored into consumption, there are features of participant homes that set them apart from the comparison group in terms of energy efficiency.

Since the comparison group homes are smaller on average than participant homes, we also ran an analysis that adjusted peak demand based on average square footage within each group. The results of this calculation for the entire population are shown in Table 131, and results stratified by heating type are in Table 132.

Table 131. Peak Demand Summary (Square Footage Adjusted)

Season	Participant Peak Demand Intensity (kW/sq. ft.)	Comparison Peak Demand Intensity (kW/sq. ft.)	Sq. ft. Adjusted Participant Peak Demand	Sq. ft. Adjusted Comparison Peak Demand	Sq. ft. Adjusted Demand Reduction	Sq. ft. Adjusted Demand Reduction Percentage
Summer	0.0015	0.0016	3.74	3.98	0.23	6%
Winter	0.0004	0.0007	1.00	1.87	0.87	46%

Table 132. Winter Peak Demand Summary by Heating Type (Square Footage Adjusted)

Season	Heating Type	Participant Peak Demand Intensity (kW/sq. ft.)	Comparison Peak Demand Intensity (kW/sq. ft.)	Sq. ft. Adjusted Participant Peak Demand	Sq. ft. Adjusted Comparison Peak Demand	Sq. ft. Adjusted Demand Reduction	Sq. ft. Adjusted Demand Reduction Percentage
Winter	Electric Heat	0.0014	0.0016	3.10	3.53	0.43	12%
	Natural Gas Heat	0.0003	0.0007	0.83	1.74	0.92	52%

As Table 131 illustrates, once we included the adjustment for the different average square footage between groups, the analysis produced very modest demand savings for all accounts during summer peak (6 percent reduction) and slightly more pronounced demand reduction in winter (46 percent reduction).

When heating type is considered, all-electric homes yielded peak demand savings of 12 percent for the winter season. Accounts with natural gas heating showed substantial savings during the winter peak (52 percent). The results overall, as well as by heating type, indicate that peak demand reductions were much higher in the winter compared to summer, both in terms of relative percent of peak demand as well as absolute peak kW.

APPENDIX 2-D: HEAT TYPE PREDICTION DETAILS

The EM&V team utilized a model training and testing approach to predict the heating type in the comparison group. This method entailed randomly splitting the complete participant data set into a training subset (70 percent of the data) and a testing subset (30 percent of the data). Using the consumption and demographic details, we trained a model on the characteristics specific to different heating types. We then used this model to predict the heating type in the test portion of the participant population. Because we knew the heating type of all the participant accounts, we could compare whether the model accurately predicted the heating type in the test group (whose heating type we also knew) to evaluate its accuracy.

This testing process was repeated six times with different random samples of the population to further refine the training model to reduce bias and cross-validate results. After each round, the predictions were compared to actual heating types so that model accuracy could be tested. The accuracy was averaged over the six periods to arrive at approximately 94 percent. Upon examination of the misidentified accounts, nearly all appeared to be either heat pumps or electric resistance. This finding indicated that, while the model appeared capable of distinguishing natural gas versus electric heat, it was not sensitive enough to differentiate different types of electric heat. Due to this limitation, the EM&V team ultimately decided that we were not confident we could separate heat pumps and electric resistance and grouped the electric heating types to minimize identification errors.

Finally, once the model was trained and tested, it was applied to the comparison group to predict the heating type of these accounts based on their consumption and demographic details. The predicted results showed that the sample contained 1,342 electric heating accounts (7.3 percent) and 16,922 natural gas heating accounts (92.7 percent). The predicted results matched the participant group closely, which had 1,035 combined electric heating accounts (7.5 percent) and 12,725 natural gas heating accounts (92.5 percent).

APPENDIX 2-E: COUNTY DATA DETAILS

This appendix describes counties and county tax data relevant to the new homes programs analyses in greater detail. We used county tax data downloads to obtain household square footage for accounts in the comparison group.

One of the characteristics of the raw comparison group data was a much wider dispersal of accounts throughout the state than in the participant group. In order to make the sample distribution as similar as possible to the participant accounts, the decision was made to only include comparison accounts from counties with at least 50 participants. Ten counties met this initial requirement: Brazoria, Chambers, Fort Bend, Galveston, Harris, Montgomery, Nueces, San Patricio, Waller, and Webb.

Seven of these counties (all except Chambers, Waller, and Webb) had publicly available tax record data that could be downloaded and contained household square footage. Chambers county had publicly downloadable data; however, it did not contain square footage. Waller and Webb counties both had searchable databases that allowed individual address searches, but not downloadable data.

Due to the posed limitations, we took an alternative approach to get square footage for homes in these counties. Rather than individually query households one at a time, we instead looked for overlapping records from other neighboring counties; this allowed us to get the square footage data for a small subset of homes in these counties. However, this subset was enough to serve as a comparison in those areas. Table 133 illustrates the final numbers of participant and comparison accounts retained in each of the counties used in this analysis.

Table 133. County Distribution Summary

County Name	Group	n
Brazoria County	Participant	1,070
	Comparison	1,631
Chambers County	Participant	101
	Comparison	293
Fort Bend County	Participant	3,642
	Comparison	3,001
Galveston County	Participant	742
	Comparison	1,138
Harris County	Participant	6,296
	Comparison	10,131
Montgomery County	Participant	1,050
	Comparison	545
Nueces County	Participant	271
	Comparison	676
San Patricio County	Participant	75
	Comparison	154
Waller County	Participant	267
	Comparison	183
Webb County	Participant	246
	Comparison	512

APPENDIX 2-F: RESULTS TABLES WITH CONFIDENCE INTERVALS

This appendix contains similar tables to the results sections, but they have been expanded to include precision levels at the 90 percent confidence interval. These precision values were added and subtracted from the mean to provide the lower and upper bounds of the estimate at 90 percent confidence. The purpose of these tables is to provide additional information about the precision with which we calculated the means used in the primary results section. number of accounts that received the measure as well as the precision of the estimate.

Table 134 through Table 136 provide precision levels for the energy models, while

Table 137 through Table 139 provide precision levels for the comparison analysis. One important note is that as the sample is stratified into groups with fewer accounts, the precision level tends to fall, indicating that the results are less reliable. In these results, it is generally the case that strata with fewer than 1,000 accounts tended to suffer diminished precision.

Table 134. Census Division and Statewide Savings Summary with 90% Confidence Interval

Census Division	n	Average Participant Annual Consumption			Average Participant Savings		Percentage of Savings Compared to TRM	Savings as a Percentage of Reference		Average Model Savings Confidence Interval at 90%		
		Reference	Model	TRM	Model	TRM		Model	TRM	Precision	Lower Bound	Upper Bound
Urbanized Area	3,970	11,843	9,833	10,262	2,010	1,581	127%	17%	13%	4.6%	1,918	2,102
Urban Cluster	9,014	12,177	10,468	10,461	1,709	1,716	100%	14%	14%	3.8%	1,644	1,775
Rural Area	776	11,730	11,105	10,097	625	1,633	36%	5%	14%	39.7%	377	874
All	**13,760**	**12,055**	**10,321**	**10,383**	**1,735**	**1,672**	**104%**	**14%**	**14%**	**3.0%**	**1,682**	**1,787**

Table 135. Utility Savings Summary with 90% Confidence Interval

Utility	n	Average Participant Annual Consumption			Average Participant Savings		Percentage of Savings Compared to TRM	Savings as a Percentage of Reference		Average Model Savings Confidence Interval at 90%		
		Reference	Model	TRM	Model	TRM		Model	TRM	Precision	Lower Bound	Upper Bound
AEP TCC	592	13,325	11,196	11,803	2,129	1,522	140%	16%	11%	10.5%	1,906	2,352
Center Point	12,569	12,009	10,244	10,344	1,765	1,666	106%	15%	14%	3.1%	1,710	1,820
TNMP	599	11,770	11,056	9,804	714	1,966	36%	6%	17%	36.6%	452	975

Table 136. Heating Type Savings Summary with 90% Confidence Interval

Heating Type	n	Average Participant Annual Consumption			Average Participant Savings		Percentage of Savings Compared to TRM	Savings as a Percentage of Reference		Average Model Savings Confidence Interval at 90%		
		Reference	Model	TRM	Model	TRM		Model	TRM	Precision	Lower Bound	Upper Bound
Electric Resistance	329	13,760	12,053	12,769	1,707	991	199%	12%	7%	18.4%	1,393	2,021
Heat Pump	706	15,720	11,748	13,534	3,972	2,186	182%	25%	14%	3.4%	1,557	1,665
Natural Gas	12,725	11,808	10,197	10,146	1,611	1,662	97%	14%	14%	6.0%	3,732	4,212

Table 137. Census Division and Statewide Consumption Summary with 90% Confidence Interval

Census Division	Group	n	Model Average Consumption (kWh)	Participant Savings Versus Comparison	Participant Savings as a Percentage of Comparison Group	Precision	Lower Bound	Upper Bound
Urbanized Area	Participant	3,970	9,928	644	6%	1.1%	9,822	10,035
	Comparison	8,023	10,572			1.2%	10,443	10,700
Urban Cluster	Participant	9,014	10,486	-441	-4%	0.7%	10,409	10,562
	Comparison	8,151	10,075			1.1%	9,966	10,184
Rural Area	Participant	776	11,101	-37	0%	2.9%	10,782	11,420
	Comparison	1,114	11,064			2.8%	10,753	11,374
All	**Participant**	**13,760**	**10,348**	**21**	**0%**	**0.6%**	**10,286**	**10,410**
	Comparison	**17,288**	**10,369**			**0.8%**	**10,288**	**10,451**

Table 138. Utility Consumption Summary with 90% Confidence Interval

Utility	Group	n	Model Average Consumption (kWh)	Participant Savings Versus Comparison	Participant Savings as a Percentage of Comparison Group	Precision	Lower Bound	Upper Bound
AEP TCC	Participant	592	11,097	219	2%	2.3%	10,839	11,355
	Comparison	1,342	11,316			2.0%	11,095	11,537
CenterPoint	Participant	12,569	10,244	37	0%	0.6%	10,180	10,309
	Comparison	15,150	10,278			0.9%	10,188	10,367
TNMP	Participant	599	11,053	-534	-5%	2.8%	10,748	11,359
	Comparison	796	10,520			2.5%	10,259	10,780

Table 139. Heating Type Consumption Summary with 90% Confidence Interval

Heating Type	Group	n	Model Average Consumption (kWh)	Participant Savings Versus Comparison	Participant Savings as a Percentage of Comparison Group	Precision	Lower Bound	Upper Bound
Electric Heat	Participant	1,035	11,595	-278	-2%	1.8%	11,388	11,801
	Comparison	1,342	11,316			2.0%	11,095	11,537
Natural Gas Heat	Participant	12,725	10,208	82	1%	0.6%	10,144	10,272
	Comparison	15,946	10,290			0.8%	10,203	10,376

TECHNICAL APPENDIX 3: CONSUMPTION ANALYSIS RECOMMENDATIONS

This appendix provides recommendations for program year (PY) 2021 residential standard offer, hard-to-reach and low-income programs in response to the PY2019 EM&V residential consumption analysis results. The goal of these recommendations is to most effectively address differences in the technical reference manual (TRM) deemed savings and actual savings for the primary measures investigated in the consumption analysis. These recommendations were discussed with the TRM Working Group and each utility individually as part of the PY2019 EM&V results meeting.

Introduction

A residential consumption analysis of the standard offer, hard-to-reach and low-income programs was conducted as part of the PY2019 EM&V effort. The residential consumption analysis demonstrated that these programs are delivering significant savings to participants, measured by how much less energy they use annually. At the same time, it also demonstrated that the TRM deemed savings are overestimating claimed savings for the following measures: central AC, heat pumps, duct sealing, ceiling insulation, and air infiltration. Central A/C is the measure performing most closely to the deemed savings estimates in delivering savings. Air infiltration has the poorest performance in delivering savings comparable to TRM deemed savings. The reader is referred to the Residential Consumption Analysis Technical Appendix A that details consumption analysis results compared to TRM deemed savings by measure across the three programs as well as the supporting data and analysis methodology.

This section includes both PY2021 TRM updates and PY2021 implementation recommendations. The recommendations are based on various analyses of the consumption results and discussions with the TRM Working Group held on July 7 and July 14. A draft memo provided the basis for continued collaboration between the utilities, EM&V team, and PUCT staff in July and August. The goal of the collaboration was to agree on recommendations and incorporate these recommendations prior to launching the 2021 residential programs. This appendix presents the final version of this memo. While the recommendations include further considerations for future program years, we strove to keep recommendations feasible for 2021 implementation while addressing the critical need for more accurate claimed savings.

Next, we summarize observations based on EM&V analysis of what we believe are the primary causes of differences between actual and deemed savings for measures as follows: HVAC, duct sealing, ceiling insulation and air infiltration. We then list the actions to address these causes both in the PY2021 TRM and program implementation.

HVAC

Baselines

Observation: Claiming electric resistance heat as a baseline is a potential driver of differences between TRM deemed savings and consumption analysis results for heat pumps. Other issues may include TRM calculation methodology, or service provider data entry. This issue and proposed solutions also apply to the all envelope measures.

Objective: Ensure accurate selection of baseline equipment and evaluate other potential causes of the savings difference.

Next, we discuss how this objective will be achieved through TRM updates and utility implementation recommendations.

TRM 2021 Updates:

- Update measure requirements to clearly define and track both existing and baseline heating and cooling types, including defining the difference between central electric resistance furnace and electric resistance space heating
- Electric resistance heat baselines may not be claimed in multifamily properties when changing heating types from chiller to heat pump, except when the utility obtains advance review and approval by the EM&V team of project documentation that the planned heating type was electric resistance.
- Update measure requirements to include a tracking system indicator for projects that change heating types so that they can be easily identified in future consumption analyses

2021 Implementation Recommendations for Utilities:

- Track both existing and baseline heating and cooling types
- Track when heating types change so projects can be easily identified in future consumption analyses
- Conduct 100% utility QA/QC of electric resistance heat baselines for the first six months of the program year. After the first six months of PY2021, utilities may choose to decrease to 50% QA/QC of projects for service providers who have achieved a 100% passing rate for a minimum of 30 projects at different locations. Utilities may determine their preferred process to conduct QA/QC (videos, photos, interval meter data, etc.) of electric resistance heat baselines.

Future Considerations:

Utilities can further decrease QA/QC of electric resistance heating baselines based on service provider performance in future program years

Customer Behavior

Observation: Improper use of programmable thermostats designed to optimize HVAC equipment can decrease savings from new equipment (e.g., manual adjustments of thermostats can make heat pumps less efficient by triggering the electric resistance component)

Objective: Promote proper participant use of HVAC equipment and programmable thermostats as part of the program

TRM 2021 Updates:

- None

2021 Implementation Recommendations for Utilities:

- Consider developing and distributing customer education materials on correct HVAC set points and proper use of programmable thermostats

Future Considerations:

- Future EM&V participant surveys should assess the effectiveness of program education on customer use of HVAC equipment and controls
- Adjust TRM heat pump energy use to include backup and auxiliary electric resistance heat

Duct Sealing

Multi-family versus single-family

Observation: Multi-family consumption results for this measure are substantially less than single-family

Objective: Deliver duct sealing consistent with where actual savings occur based on the consumption analysis.

Next, we discuss how this objective will be achieved through TRM updates and utility implementation recommendations.

TRM 2021 Updates:

- Limit eligibility to single-family homes
- Modify documentation requirements to increase confidence in inside-to-outside testing only
- Apply an energy use multiplier for electric resistance heat that does not use duct systems (e.g., space heating)

2021 Implementation Recommendations for Utilities:

- Conduct 100% utility QA/QC of electric resistance heat for the first six months of the program year. After the first six months of PY2021, utilities may choose to decrease to 50% QA/QC of projects for service providers who have achieved a 100% passing rate for a minimum of 30 projects at different locations. Utilities may determine their preferred process to conduct QA/QC (videos, photos, interval meter data, etc.) of electric resistance heat.

Future Considerations:

- Consider tracking primary and secondary heating and cooling systems
- Utilities can further decrease QA/QC of electric resistance heating based on service provider performance in future program years
- Assess the TRM alternative streamlined approach and results of this approach
- Consider if a multi-family option should be developed and offered in future program years
- Review best practices across other utility programs and identify opportunities for Texas

Ceiling Insulation

Baselines

Observation: The majority of projects claim baseline insulation levels less than R-5 and electric resistance heat; these are also the projects most overestimating savings when comparing actual and deemed savings.

Objective: Set a minimum insulation baseline and requirements when claiming electric resistance heat

Next, we discuss how this objective will be achieved through TRM updates and utility implementation recommendations.

TRM 2021 Updates:

- Set the minimum baseline R-value to 5
- Define when existing (and baseline) resistance heat can be claimed
- Apply an energy use multiplier for electric resistance space heat (similar to existing room air conditioner measure)

2021 Implementation Recommendations:

- Conduct 100% utility QA/QC of electric resistance heat baselines for the first six months of the program year. After the first six months of PY2021, utilities may choose to decrease to 50% QA/QC of projects for service providers who have achieved a 100% passing rate for a minimum of 30 projects at different locations. Utilities may determine their preferred process to conduct QA/QC (videos, photos, interval meter data, etc.) of electric resistance heat.

Future Considerations:

- Consider tracking primary and secondary heating and cooling systems
- Consider if the energy use multiplier needs to be used if the baseline insulation is less than R5
- Consider if a R5 baseline (instead of the median point of the R5-R9 deemed savings) can be used for non-electric heating sources in 2021
- Adjust savings calculations to include primary and secondary heating and cooling system types, when applicable
- Determine if the energy models include approximately R-2 for non-insulation ceiling materials
- Review best practices across other utility programs and identify opportunities for Texas
- If future analysis shows the TRM deemed savings are no longer overestimating savings, re-visit the possibility of a conservative baseline approach for projects that may have less than R5
- Utilities can further decrease QA/QC of electric resistance heating based on service provider performance in future program years

Air Infiltration

Residential vs. Hard-to-Reach results

Observation: The residential standard offer program results showed no savings for air infiltration, whereas savings were found in the hard-to-reach program (though still considerably less than the TRM deemed savings). Some of the EM&V on-site inspections of sampled projects resulted in savings adjustments based on major leaks found by the EM&V team. While this was a small number, it suggests improper implementation of the measure could be part of why this measure is seeing small savings in the consumption analysis.

Objective: Address proper implementation of this measure coupled with a focused effort on those who are most likely to benefit

Next, we discuss how this objective will be achieved through TRM updates and utility implementation recommendations.

TRM 2021 Updates:

- Limit eligibility to low-income/hard-to-reach participants
- Reduce leakage caps for maximum pre-leakage and leakage reduction (analysis in progress to determined recommended cap)
- Apply cap to all sectors
- Require documentation similar to above-cap projects as outlined in the current TRM
- Apply an energy use multiplier for electric resistance space heat (similar to existing room air conditioner measure)

2021 Implementation Recommendations:

- Train contractors on the proper implementation of this measure
- Consider if a contractor certification requirement (i.e., HERS rater or BPI certified) could help improve results based on Texas' and other utilities' experience across the country, utilities may or may not decide this is a practical or helpful solution for them
- Conduct 100% utility QA/QC of electric resistance heat baselines (via virtual or remote inspections or other viable alternative for the utility; this does not have to be on-site inspections)

Future Considerations:

- If strategies show success, this measure may be expanded beyond hard-to-reach programs, beginning with residential single-family homes
- Investigate a streamlined approach to claim actual CFM reduced per house (and/or other metrics) coupled with an incentive structure that effectively addresses potential for gaming
- Review energy models to determine if smaller increments of leakage improvements should be modeled

- Review best practices across other utility programs and identify opportunities for Texas

Conclusion

For the residential measures covered in this memo, the EM&V team and PUCT staff would like to focus future discussions and collaboration on the above listed recommendations for 2021, welcoming additional questions or input from the utilities.

Public Utility Commission of Texas

Volume 2. Utility-Specific Energy Efficiency Portfolio Report Program Year 2019

TETRA TECH

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GLOSSARY: ACRONYMS/ABBREVIATIONS/DEFINITIONS

Acronym	Description
AC	Air conditioner
AEP TCC	American Electric Power Texas Central Division
AEP TNC	American Electric Power Texas North Division
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
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
EUMMOT	Electric Utility Marketing Managers of Texas
GSHP	Ground-source heat pump
HCIF	Heating/cooling interactive factor
HOU	Hours of use
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

Acronym	Description
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
PUCT	Public Utility Commission of Texas
PV	Photovoltaics
PY	Program Year
QA/QC	Quality assurance/quality control
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
TRM	Technical reference manual
WACC	Weighted average cost of capital
Xcel Energy SPS	Southwestern Public Service Company (Subsidiary of Xcel Energy)

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) 2019. It is a companion document to Volume 1 of the Statewide Energy Efficiency Portfolio Report. A summary report, "2019 Energy Efficiency Accomplishments," is also available at www.puc.texas.gov.

PY2019 is the eighth program year evaluated as part of the statewide EM&V effort. The PY2019 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 provide 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 M&V information.

The PY2019 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
- Public Utility Commission of Texas (PUCT) and Texas utilities' priorities
- prior EM&V results
- known and anticipated changes in the markets in which the programs operate

1.1 REPORT ORGANIZATION

Section 1.2 summarizes the evaluation approach. Sections 2 through 10 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

[1] Public Utility Commission of Texas EM&V Plans for Texas Utilities' Energy Efficiency and Load Management Portfolios—Program Year 2019, June 2019.

methodology are in Appendix B. The EM&V team's quality assurance plan for the reported evaluated savings is in Appendix C.

Detailed desk review and on-site M&V are provided to utilities in separate documents.

1.2 EVALUATION APPROACH

This section discusses the PY2019 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 PY2019 program data was 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 further assess the accuracy of the claimed savings.

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 that is believed—with some stated level of confidence—to contain the true population quantity. The confidence level is the probability that the interval actually contains 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 10 percent, then the interval is 530 ±53 kWh.

In reporting estimates from a sample, it is essential to provide both the precision and its corresponding confidence level. In general, high levels of confidence 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 statement of precision 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, and 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 to have less uncertainty, when in reality, 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, along with census reviews of residential deemed savings and load management savings.

1.2.1.1 Tracking System and Desk Reviews

For each residential program, 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. 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 are consistent with those listed in the tracking system. Second, the desk reviews verified that the savings estimates in the tracking system are 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 On-Site Measurement and Verification

For sampled projects across each utility portfolio, the EM&V team conducted on-site M&V. The on-site visits had two principal objectives: (1) verify the installation and operation of the equipment/systems, and (2) verify key assumptions made in calculating claimed savings estimates.

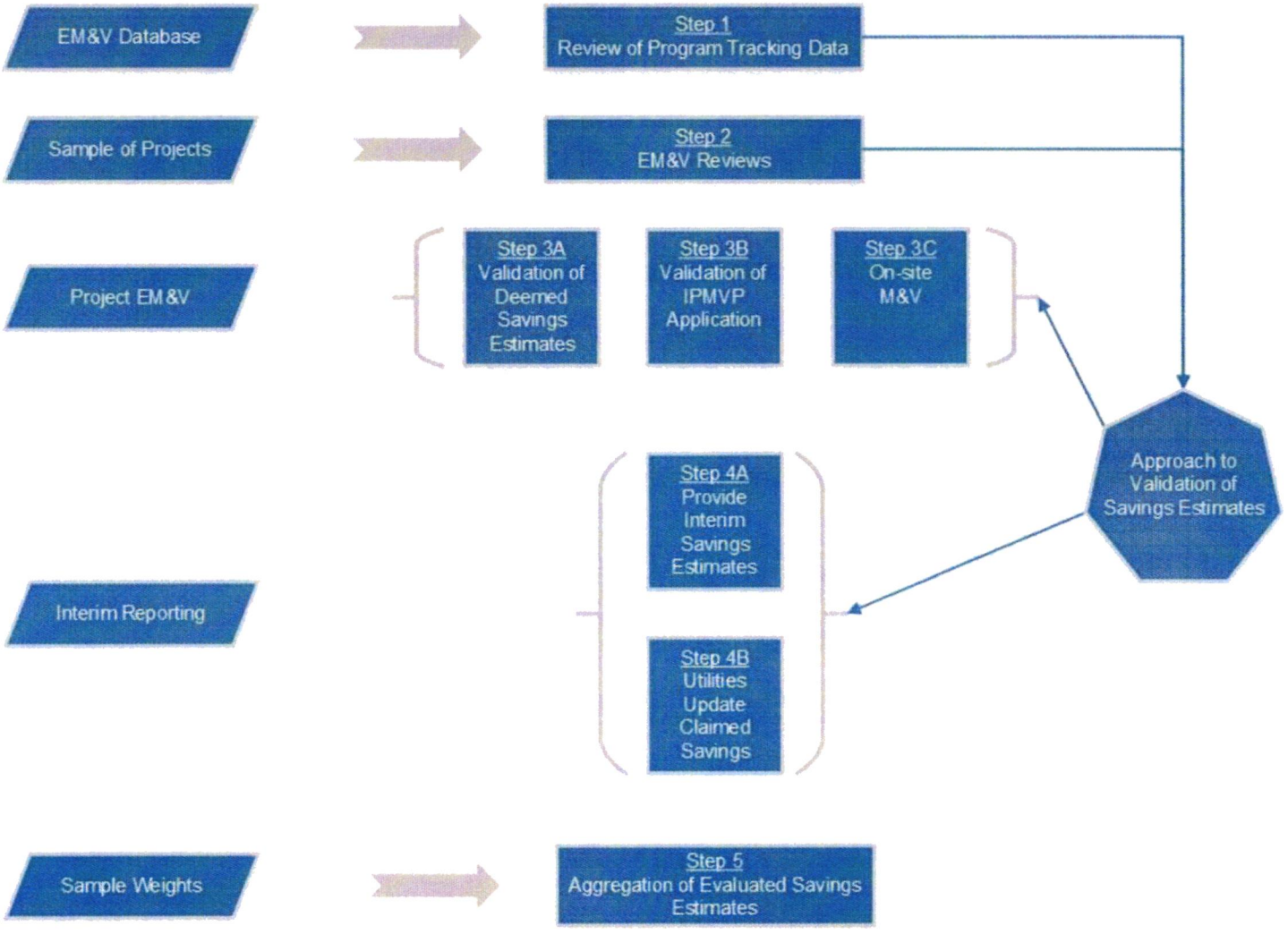
- Installations were verified via on-site data collection related to the number of measures installed and the location of the systems. Additionally, equipment nameplate information was documented, and a thorough visual inspection was completed in order to ensure the systems were working as intended. This was a basic inspection audit that took approximately one to two hours to complete.
- Site measurements, spot metering, or short-, and in some cases, long-term metering, were appropriated to develop an independent estimate of savings to compare to the utility's claimed savings estimates. This was a more comprehensive audit that sought to verify key input assumptions used to develop ex-ante claimed savings estimates from deemed savings algorithms or M&V plans for custom projects such as baseline energy use, operating hours, efficiency performance, and potentially interactive effects.

1.2.1.3 Realization Rates

The evaluated savings are based on project-level realization rate calculations that are then weighted to represent program-level and then portfolio-level realization rates. These realization rates incorporate any adjustments for incorrect application of deemed savings values and any

equipment details determined through the tracking system and desk reviews. For example, baseline assumptions or hours of use may be corrected through the evaluation and thus affect the realization rates. In order to calculate evaluated savings, we apply the realization rate determined from the EM&V sample to the population of projects. A flow chart of the realization rate calculations is shown in Figure 1.

Figure 1. Realization Rate Flowchart



1.2.1.4 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. For nonresidential programs, this included completed savings calculators, customer invoices, pre- and post-inspection reports, and equipment cut sheets. For residential programs, the documentation provided all inputs needed to replicate the savings calculations based on the deemed savings manual or the approved calculation method as well as supporting materials.

Limited documentation is defined as the documentation that was 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 PY2019 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/demand savings	Measure type	EM&V database
Summer/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[2]	Program/portfolio	EM&V team budgets
Performance bonus[3]	Portfolio	EEPRs
Avoided costs	Statewide	PUCT (utilities)
Weighted average cost of capital (WACC)	Utility	Utilities
Line loss factor (non-ERCOT utilities only)	Utility	Utilities
Realization rates	Program	Evaluation results

[2] EM&V costs were not known at the time of utilities' original cost-effectiveness analysis.
[3] Performance bonuses as an input into cost-effectiveness testing came into effect in 2012.

The EM&V team conducted PY2019 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 PY dollars. Benefits resulting from energy savings occurring in future years are net to PY dollars using the utility's WACC as the discount rate.

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.

In addition, the EM&V team reported the cost per lifetime kWh and kW. This 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 *prior* to drafting the annual statewide portfolio report. This allows 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 PY2019, the metrics to be used as the basis for recommendations in the reports are the program's 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 programs' cost-effectiveness.

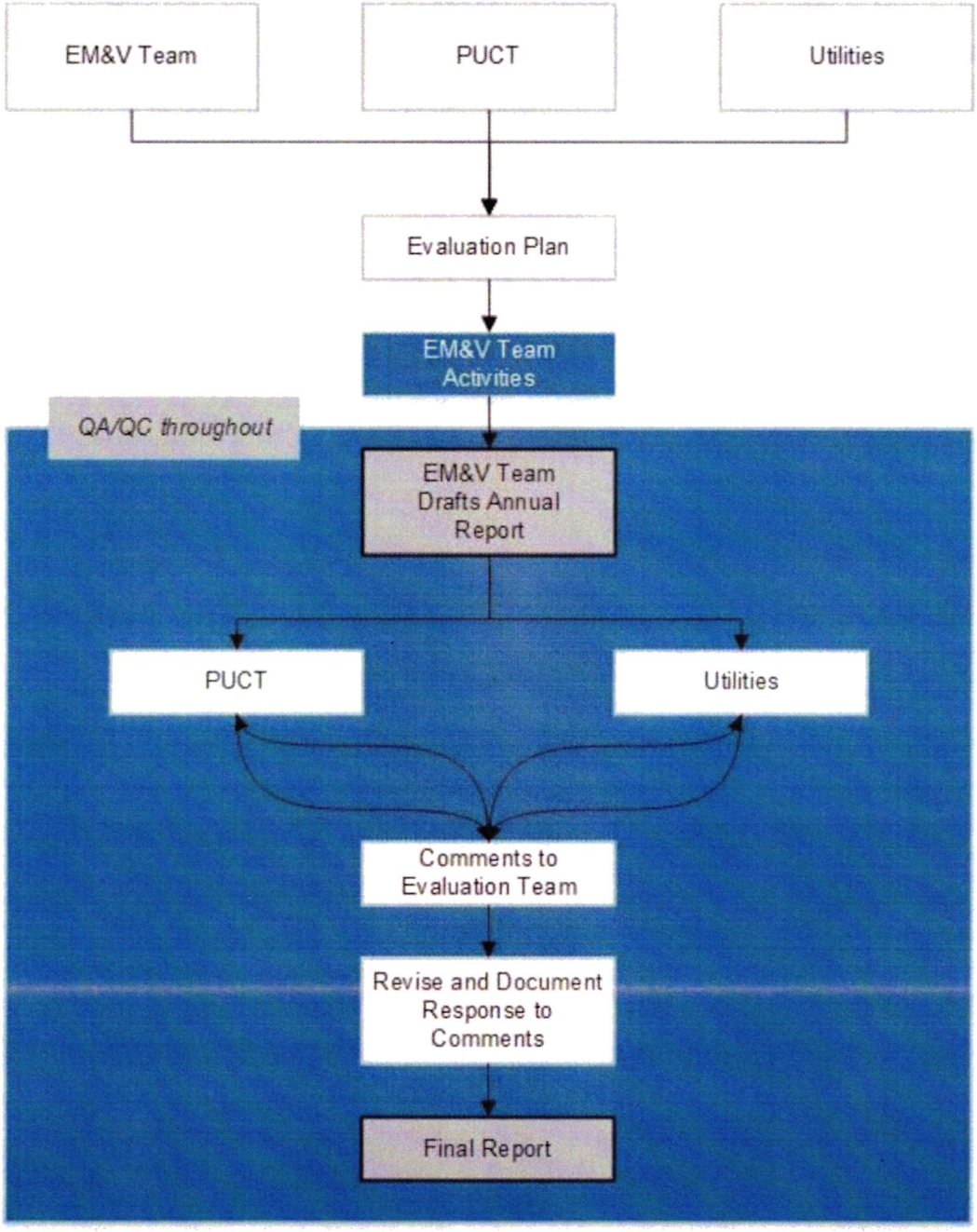
The EM&V database is at the core of reporting results. It houses the claimed and evaluated savings. The database allows structured queries to provide results by utilities, program categories and types, measure types, or sectors. QA and QC are conducted to ensure that results being entered into and extracted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

[4] Program categories are currently defined as nonresidential, residential, low-income, load management, and pilots.

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 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 CENTRAL COMPANY IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for American Electric Power Texas Central Company's (AEP TCC) 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 priority for which claimed savings were verified through the EM&V database are included.

2.1 KEY FINDINGS

2.1.1 Evaluated Savings

AEP TCC's evaluated savings for PY2019 were 39,665 in demand (kW) and 58,365,545 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are approximately 100 percent. AEP TCC was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 5), which also supported healthy realization rates.

Table 2 shows the claimed and evaluated demand savings for AEP TCC's portfolio and broad customer sector/program categories.

Table 2. AEP TCC PY2019 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%**	**39,662**	**39,665**	**100.0%**	**0.1%**
Commercial	25.1%	9,950	9,953	100.0%	0.2%
Residential	28.3%	11,218	11,218	100.0%	0.0%
Low-income	2.2%	869	869	100.0%	0.0%
Load management*	44.4%	17,612	17,612	100.0%	0.0%
Pilot	0.0%	13	13	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 TCC's portfolio and broad customer sector/program categories for PY2019.

Table 3. AEP TCC PY2019 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%**	**58,337,806**	**58,365,545**	**100.0%**	**0.2%**
Commercial	62.4%	36,408,991	36,436,730	100.1%	0.3%
Residential	34.9%	20,375,757	20,375,757	100.0%	0.0%
Low-income	2.3%	1,350,919	1,350,919	100.0%	0.0%
Load management*	0.2%	103,072	103,071	100.0%	0.0%
Pilot	0.2%	99,067	99,067	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 program documentation score of good, fair, or limited, as discussed in Section 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 improvements identified; and a score of "limited" indicates program documentation improvements across more individual programs or high savings programs have been identified. AEP TCC received a "good" program documentation score for all evaluated programs.

2.1.2 Cost-Effectiveness Results

AEP TCC's overall portfolio had a cost-effectiveness score of 2.3, or 2.6 excluding low-income programs.

The more cost-effective programs were Commercial Solutions MTP and Commercial Standard Offer Program (SOP). The less cost-effective programs were Targeted Low-Income Energy Efficiency Program and Residential Pool Pump Pilot MTP. The pilot did not pass cost-effectiveness but was not required to do so in its first year of operation.

The lifetime cost of evaluated savings was $0.012 per kWh and $20.28 per kW.

Table 4. AEP TCC Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total Portfolio	**2.3**	**2.3**	**2.1**
Total Portfolio excluding low-income programs	**2.6**	**2.6**	**2.3**
Commercial	**3.2**	**3.2**	**2.8**
Commercial Solutions MTP	4.5	4.6	4.0
Commercial SOP	3.6	3.6	3.3
CoolSaver A/C Tune-Up MTP	2.4	2.4	2.0
Open MTP	2.0	2.0	1.9
SCORE/CitySmart MTP	3.3	3.3	3.0
SMART Source Solar PV MTP	2.0	2.0	2.0
Residential	**2.1**	**2.1**	**1.9**
CoolSaver A/C Tune-Up MTP	1.6	1.6	1.3
High-Performance New Homes MTP	2.2	2.2	1.6
Residential SOP	2.3	2.3	2.1
SMART Source Solar PV MTP	1.8	1.8	1.8
Hard-to-Reach SOP	1.9	1.9	1.9
Low Income*	**1.4**	**1.4**	**1.4**
Targeted Low-Income Energy Efficiency Program*	1.4	1.4	1.4
Load Management	**2.0**	**2.0**	**2.0**
Load Management SOP	2.0	2.0	2.0
Pilot	**0.5**	**0.5**	**0.4**
Residential Pool Pump Pilot MTP	0.5	0.5	0.4

* The low-income program is evaluated using the 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 TCC's June 1 filing.

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	-2.90	-29,550.00
Commercial SOP	-7.70	-26,932.00
Open MTP	-1.30	-4,763.00
SCORE/CitySmart MTP	39.10	92,956.00
Total	**27.20**	**31,711.00**

2.3 DETAILED FINDINGS—COMMERCIAL (MEDIUM EVALUATION PRIORITY)

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
2.5%	1,001	1,000	99.9%	9.4%	5,499,427	5,514,069	100.3%	Good

Completed desk reviews*	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 PY2019 Commercial Solutions 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 adjusted the claimed savings for five projects. Two projects had adjustments of less than five percent, and three projects had adjustments greater than five percent compared to the originally claimed savings. AEP TCC accepted the evaluated results and matched the claimed savings to those of the evaluations for the projects with significant adjustments, and therefore, the final program realization rates are nearly 100 percent kW and 101 percent kWh. Further details of the EM&V findings are provided below.

Participant ID 1201115: The energy efficiency project included interior lighting retrofits at a large retail store with a supermarket. During the desk review and on-site M&V visit, the EM&V team adjusted both the pre- and post-retrofit quantities for several locations in the

[5] Energy efficiency cost recovery factor

building. Overall, the adjustments resulted in realization rates of 100 percent for both kW and 106 percent kWh.

Participant ID 1201154: The energy efficiency project included interior lighting retrofits at a large 24-hour retail store. During the desk review, the EM&V team corrected the climate zone from zone 3 (Houston area) to zone 4 (Corpus Christi area). This adjusted the coincidence factor for peak kW. In addition, the pre-retrofit quantity of lamps that were not replaced was adjusted to zero in the calculator. This decreased the baseline consumption and did not affect the post-retrofit consumption, which resulted in zero savings for these lamps. Overall, the adjustments resulted in realization rates of 94 percent for both kW and kWh.

Participant ID 1237483: The energy efficiency project included exterior lighting retrofits at a retail strip mall. During the desk review and on-site M&V visit, the EM&V team adjusted the quantity for one line item in the calculator from eight light-emitting diode (LED) fixtures claimed to six. In addition, the wattage of one LED fixture was adjusted from 199.0 W to 199.5 W based on the DesignLights™ Consortium (DLC) qualified products list. The 2019 version of the lumens per square foot (LSF) calculator allows for wattages in 0.5 increments; therefore, the rated wattage was rounded to the nearest half-watt denomination. Overall, the corrections resulted in a negligible increase in peak demand and energy savings and realization rates of 100 percent for both kW and kWh.

Participant ID 1239494: The energy efficiency project was a new construction warehouse that installed LED fixtures with occupancy sensors inside and timeclocks outside. During the desk review, the EM&V team corrected the climate zone from zone 1 (Amarillo area) to zone 3 (Houston area). This adjusted the coincidence factor for peak kW. In addition, wattages for several installed fixtures were rounded incorrectly, resulting in the adjustment of one fixture from 175.0 W to 175.5 W and one fixture from 247.0 W to 247.5 W in the LSF calculator. Overall, the corrections resulted in realization rates of 97 percent kW and 100 percent kWh.

Participant ID 1252316: The energy efficiency project included interior and exterior lighting retrofits at a warehouse. During the desk review, the EM&V team adjusted the savings calculation from a refrigerated warehouse and office to a non-refrigerated warehouse building type with air conditioning based upon photo documentation. This correction decreased both the peak and energy savings. Overall, the corrections resulted in realization rates of 99 percent kW and 92 percent kWh.

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, AHRI (Air-conditioning, Heating, and Refrigeration Institute) certifications) for all 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- and post-inspection notes, project savings calculators, and photographic documentation of existing and new equipment. 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
7.9%	3,147	3,151	100.1%	24.5%	14,268,008	14,281,814	100.1%	Good

Completed desk reviews*	On-site M&V
12	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 PY2019 Commercial SOP 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 adjusted the claimed savings for seven projects. Four projects had adjustments of less than five percent, and three projects had adjustments greater than five percent compared to the originally claimed savings. AEP TCC 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 slightly above 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1229630: The energy efficiency project included interior lighting retrofits at a retail strip mall. During the desk review and on-site M&V visit, the EM&V team adjusted the quantity of LED tubes installed from eight to four. This adjustment resulted in a negligible increase in peak demand and energy savings and realization rates of 100 percent for both kW and kWh.

Participant ID 1229674: The energy efficiency project included the early replacement of three water-cooled chillers at a large office building. During the desk review and on-site M&V visit, the EM&V team slightly adjusted the baseline chiller size (from 70.0 tons to 76.1 tons) based on performance data gathered by the on-site engineer. Overall, the change in savings was minimal, and resulted in realization rates of 103 percent kW and 102 percent kWh.

Participant ID 1229716: The energy efficiency project included interior and exterior lighting retrofits and an early replacement of heating, ventilation, and air conditioning (HVAC) equipment at an office building. During the desk review, the EM&V team used the 2019 technical reference manual (TRM) calculation, which adjusted savings slightly from the submitted calculation, which followed the 2018 TRM calculation. The EM&V team also adjusted the installed HVAC unit model number based on the submitted post-install photos. This reduced the rated efficiency of the installed units, but they still qualified for incentives. In addition, three types of LED tube model numbers were adjusted to match the invoice submitted; the first had no adjustment to wattage consumed, the second fixture's wattage was adjusted from 44.0 W to 56.5 W, and the third fixture's wattage was adjusted from 22.0 W to 28.0 W using the DLC qualified product list. Overall, the

adjustments reduced peak demand and energy savings and resulted in the realization rates of 98 percent for kW and 87 percent for kWh.

Participant ID 1229939: The energy efficiency project included interior lighting retrofits at a retail store. During the desk review, the EM&V team adjusted the installed equipment wattage for a single type of LED tube by 0.5 W (from 15.0 W claimed to 14.5 W) to account for the 0.5 W increments allowed by the LSF calculator. Overall, the adjustments resulted in realization rates of 102 percent for both kW and kWh.

Participant ID 1229944: The energy efficiency project included interior and exterior lighting retrofits at a primary school. During the desk review and on-site M&V visit, the EM&V team adjusted wattages for several installed fixtures using the DLC and ENERGY STAR® qualified products lists: from 7.0 W claimed to 6.5 W, from 32.0 W claimed to 31.5 W, from 15.0 W claimed 14.5 W, from 124.0 W claimed to 123.5 W, and from 114.0 W claimed to 113.5 W. These adjustments were to account for the 0.5 W increments allowed by the LSF calculator. Overall, the adjustments increased peak demand and energy savings and resulted in the realization rates of 103 percent kW and 102 percent kWh.

Participant ID 157032: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review and M&V phone interview, the EM&V team adjusted the quantity of two fixture types, one- and two-lamp recessed fixtures and downlights. Overall, the adjustments resulted in realization rates of 94 percent for both kW and kWh.

Participant ID 1257127: The energy efficiency project included the new construction of a secondary school that installed 64 packaged rooftop air conditioning units and installed energy efficient lighting. During the desk review, the EM&V team adjusted the capacity of the rooftop air conditioning units to match the AHRI-rated value instead of the nominal capacity. Overall, the adjustments resulted in realization rates of 94 percent kW and 97 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for 10 of the 12 projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation at these sites included invoices, QPL qualifications, pre- and post-inspection notes, project savings calculators, and photographic documentation of existing and new equipment. However, partial documentation was provided for the other two projects—one was missing post-install photos and final calculator, and the other was missing a significant amount of documentation including the pre- and post-install calculators, pre-install photos, pre- and post-install field notes, itemized invoices, and several rating certifications. 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 Open 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
2.2%	863	863	100.0%	6.0%	3,487,391	3,487,508	100.0%	Good

Completed desk reviews*	On-site M&V
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 PY2019 Open 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 adjusted the claimed savings for six projects. One project had adjustments of less than five percent, and five projects had adjustments greater than five percent compared to the originally claimed savings. AEP TCC accepted the evaluated results and matched the claimed savings to those of the evaluations for the projects with significant adjustments, and therefore, the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1201021: The energy efficiency project included interior lighting retrofits at a service building. During the desk review and on-site M&V visit, the EM&V team corrected the wattage and quantity of the LED lighting installed. The installed lighting LED tubes were adjusted from 18.0 W to 21.5 W using the DLC qualified products list. In addition, the quantity of installed LED tubes was reduced to 98, as identified during the on-site visit. Overall, the adjustments resulted in realization rates of 92 percent for both kW and kWh.

Participant ID 1201083: The energy efficiency project included interior lighting retrofits at a service building. During the desk review and on-site M&V visit, the EM&V team corrected the wattage and quantity of the LED lighting installed. One lighting LED tube model installed was adjusted from 18.0 W to 20.5 W using the DLC qualified products list. In addition, the quantity of LED tubes installed was reduced from 70 to 66 as identified during the on-site visit. Overall, the adjustments resulted in realization rates of 95 percent for both kW and kWh.

Participant ID 1201089: The energy efficiency project included interior lighting retrofits at an office building. During the desk review, the EM&V team adjusted wattages for the installed LED tubes from 18.0 W claimed to 20.5 W using the DLC qualified products list. Overall, the adjustments resulted in realization rates of 93 percent for both kW and kWh.

Participant ID 1236307: The energy efficiency project included interior lighting retrofits at a strip mall. During the desk review, the EM&V team adjusted wattages for the installed LED tubes from 18.0 W claimed to 20.0 W using the DLC qualified products list. Overall, these corrections decreased peak demand and energy savings and resulted in realization rates of 93 percent kW and 95 percent kWh.

Participant ID 1236313: The energy efficiency project included interior lighting retrofits at a service building. During the desk review and on-site M&V visit, the EM&V team corrected wattages for two installed LED tubes—the four-foot-long tube was adjusted from 18.0 W claimed to 20.0 W, and the eight-foot-long tube was adjusted from 42.0 W claimed to 41.5 W. Overall, these corrections decreased peak demand and energy savings and resulted in realization rates of 91 percent kW and 93 percent kWh.

Participant ID 128410: The energy efficiency project included interior lighting retrofits at a strip mall. During the desk review and on-site M&V visit, the EM&V team adjusted the quantity of the LED tubes from 90 claimed to 88. This correction slightly increased peak demand and energy savings and resulted in realization rates of 101 percent for both kW and kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for five projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications, equipment specification, post-inspection notes, the project savings calculations, and photographic documentation. However, the three projects sampled in Q3 did not have the calculator files available for documentation. Each project calculations were provided with the Q4 documentation. Complete documentation at the time of energy savings evaluation enhances the accuracy and transparency of project savings along with ease of evaluation. Although the calculator was delivered later than expected, it was provided before the last data request. Overall, the EM&V team assigned a program documentation score of "good."

2.3.4 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
4.7%	1,867	1,867	100.0%	11.4%	6,648,742	6,647,916	100.0%	Good

Completed desk reviews*	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 PY2019 SCORE/CitySmart 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 adjusted the claimed savings for all four projects. Two project had adjustments of less than five percent, and two projects had adjustments greater than five percent compared to the originally claimed savings. AEP TCC accepted the evaluated results and matched the

claimed savings to those of the evaluations for the projects with significant adjustments, and therefore, the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1200834: The energy efficiency project included exterior lighting retrofits at a vehicle bridge. During the desk review and on-site M&V visit, the EM&V team adjusted the quantity of exterior pole-mounted fixtures replaced based on change orders that occurred during installation. This correction increased peak demand and energy savings and resulted in realization rates of 128 percent for both kW and kWh.

Participant ID 1201094: The energy efficiency project included interior and exterior lighting retrofits at a high school. During the desk review, the EM&V team corrected wattages for one model of installed LED tube from 18.0 W claimed to 19.0 W. In addition, several equipment classifications were adjusted from *LED-FIXT* (fixture) to *LED-SCRW* (screw-in lamp), although this adjustment did not impact ex-post energy savings. Overall, the corrections decreased peak demand and energy savings and resulted in realization rates of 99 percent for both kW and kWh.

Participant ID 1251687: The energy efficiency project included interior and exterior lighting retrofits at a school building. During the desk review and on-site M&V visit, the EM&V team adjusted the quantity for one line-item in the LSF calculator from four LED tubes to two. In addition, one exterior line item was moved to the interior section of the LSF calculator because this area was found to be an electrical/mechanical closet that is only accessible from the interior. Overall, the corrections resulted in realization rates of 100 percent for both kW and kWh.

Participant ID 1252257: The energy efficiency project included a controls upgrade for HVAC system, including a building management system (BMS) and new temperature setpoints at a school building. During the desk review, the EM&V team adjusted the peak kW calculation method to match the top 20 PDPF (peak demand probability factor) methodology in the TRM. The adjusted calculation increased peak demand and resulted in realization rates of 117 percent kW and 100 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for three of the four projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications, equipment specifications, pre- 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. However, partial documentation was provided for the other project because it was a custom project and required more detailed descriptions of the activity completed. 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."

2.4 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

2.4.1 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
44.4%	17,612	17,612	100.0%	0.2%	103,072	103,071	100.0%	Good

Completed desk reviews*	On-site M&V
N/A	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 Commercial Load Management SOP by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments at the electric service identifier (ESI ID) level. Load management events in PY2019 occurred on the following dates and times:

- May 20, 2019, from 3:00 p.m. to 4:00 p.m. (scheduled)
- August 12, 2019, from 3:00 p.m. to 6:00 p.m. (unscheduled)
- August 12, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- August 13, 2019, from 3:00 p.m. to 6:00 p.m. (unscheduled)
- August 13, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)

The EM&V team received interval meter data as well as a spreadsheet that summarized the event-level savings for the seven sponsors across 81 sites. Only 54 of the sites participated in the scheduled event, which was used as a test event. Fourteen of the 81 sites participated in the unscheduled events that occurred from 3:00 p.m. to 6:00 p.m., and 50 sites participated in the unscheduled events that occurred from 3:00 p.m. to 5:00 p.m. Seven sites did not have any load data associated with them as they did not participate in any event.

AEP TCC calculated kW savings for each site by applying a weighted average to the kW reductions across the unscheduled events. To calculate kWh savings, AEP TCC summed kW reductions of all events (including the scheduled event) and multiplied it by the total number of event hours. In applying this method to the meter-level data and following the TRM, the EM&V team calculated kW and kWh savings that matched that of AEP TCC. A negligible difference in kWh is attributed to rounding practices during calculations. The table above shows both the EM&V team and AEP TCC's calculated kW and kWh savings.

Evaluated savings for the Load Management SOP are 17,612 kW and 103,071 kWh. The realization rate for both kW and kWh is 100 percent.

2.5 SUMMARY OF TRACKING-SYSTEM-ONLY EVALUATED PROGRAMS

Table 6 provides a summary of claimed savings for AEP TCC's programs in PY2019 that only received a tracking system review for program impacts. The programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

Table 6. PY2019 Claimed Savings (Tracking-System-Only Evaluated 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 (Com)	7.3%	2,883	2,883	100.0%	10.1%	5,897,031	5,897,031	100.0%
High-Performance New Homes MTP	3.9%	1,530	1,530	100.0%	3.5%	2,037,375	2,037,375	100.0%
Residential SOP	15.7%	6,218	6,218	100.0%	18.0%	10,489,450	10,489,450	100.0%
CoolSaver A/C Tune-Up MTP (Res)	3.0%	1,202	1,202	100.0%	6.7%	3,937,486	3,937,486	100.0%
Hard-to-Reach SOP	5.3%	2,106	2,106	100.0%	5.7%	3,340,316	3,340,316	100.0%
Targeted Low-Income Energy Efficiency Program	2.2%	869	869	100.0%	2.3%	1,350,919	1,350,919	100.0%

2.6 SUMMARY OF LOW PRIORITY EVALUATION PROGRAMS

Table 7 provides a summary of claimed savings for AEP TCC's low evaluation priority programs in PY2019, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

Table 7. PY2019 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)
SMART Source Solar PV MTP (Com)	0.5%	189	189	100.0%	1.0%	608,392	608,392	100.0%
SMART Source Solar PV MTP (Res)	0.4%	161	161	100.0%	1.0%	571,131	571,131	100.0%
Residential Pool Pump Pilot MTP	0.0%	13	13	100.0%	0.2%	99,067	99,067	100.0%

3.0 AMERICAN ELECTRIC POWER TEXAS NORTH COMPANY IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for American Electric Power Texas North Company's (AEP TNC) 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 priority for which claimed savings were verified through the EM&V database are included.

3.1 KEY FINDINGS

3.1.1 Evaluated Savings

AEP TNC's evaluated savings for PY2019 were 6,582 in demand (kW) and 11,989,010 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are approximately 100 percent. AEP TNC was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 11), which also supported healthy realization rates.

Table 8 shows the claimed and evaluated demand savings for AEP TNC's portfolio and broad customer sector/program categories.

Table 8. AEP TNC PY2019 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%**	**6,582**	**6,582**	**100.0%**	**0.0%**
Commercial	27.1%	1,786	1,786	100.0%	0.1%
Residential	26.5%	1,742	1,742	100.0%	0.0%
Low-income	1.8%	119	119	100.0%	0.0%
Load management*	44.6%	2,935	2,935	100.0%	0.0%

* 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 9 shows the claimed and evaluated energy savings for AEP TNC's portfolio and broad customer sector/program categories for PY2019.

Table 9. AEP TNC PY2019 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%**	**11,988,626**	**11,989,010**	**100.0%**	**0.1%**
Commercial	71.8%	8,605,789	8,606,175	100.0%	0.1%
Residential	26.4%	3,162,462	3,162,462	100.0%	0.0%
Low-income	1.7%	199,824	199,824	100.0%	0.0%
Load management*	0.2%	20,550	20,549	100.0%	0.0%

* 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 program documentation score of good, fair, or limited, as discussed in Section 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 improvements identified; and a score of "limited" indicates program documentation improvements across more individual programs or high savings programs have been identified.

AEP TNC received "good" documentation scores for all evaluated programs except its Commercial SOP, which received a "fair" documentation score.

3.1.2 Cost-Effectiveness Results

AEP TNC's overall portfolio had a cost-effectiveness of 2.2, or 2.5 excluding low-income programs.

The more cost-effective programs were Commercial Standard Offer Program (SOP) and SCORE/CitySmart Market Transformation Program (MTP). The less cost-effective programs were the Targeted Low-Income Energy Efficiency Program and Commercial SMART Source Solar PV MTP. The low-income program falls just slightly short of 1.0 using the SIR test (.95 cost-effectiveness, which rounds to 1.0 in the table below). This may be a result of a small difference in the average rate being used by the EM&V team and AEP[8]. The lifetime cost of evaluated savings was $0.012 per kWh and $19.52 per kW.

Table 10. AEP TNC Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total Portfolio	**2.2**	**2.2**	**2.1**
Total Portfolio excluding low-income programs	**2.5**	**2.5**	**2.3**
Commercial	**2.7**	**2.7**	**2.5**
Commercial Solutions MTP	3.2	3.2	2.8
Commercial SOP	3.8	3.8	3.4
Open MTP	1.4	1.4	1.3
SCORE/CitySmart MTP	3.7	3.7	3.3
SMART Source Solar PV MTP	1.2	1.2	1.2
Residential	**2.2**	**2.2**	**2.1**
Residential SOP	2.5	2.5	2.2
SMART Source Solar PV MTP	2.0	2.0	2.0
Hard-to-Reach SOP	2.0	2.0	2.0
Low Income*	**1.0**	**1.0**	**1.0**
Targeted Low-Income Energy Efficiency Program*	1.0	1.0	1.0
Load Management	**1.8**	**1.8**	**1.8**
Load Management SOP	1.8	1.8	1.8

* The low-income program is evaluated using the 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 11 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume the following adjustments will be included in AEP TNC's June 1 filing.

Table 11. Evaluation, Measurement, and Verification Claimed Savings Adjustments by Program (Prior to EECRF[6] Filing)

Program	EM&V demand claimed savings adjustments (kW)	EM&V energy claimed savings adjustments (kWh)
Commercial SOP	-55.90	-239,603.00
Open MTP	-3.30	-15,489.00
Total	**-59.20**	**-255,092.00**

[6] Energy efficiency cost recovery factor

3.3 DETAILED FINDINGS—COMMERCIAL (MEDIUM EVALUATION PRIORITY)

3.3.1 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
9.3%	615	615	100.0%	26.9%	3,227,496	3,227,486	100.0%	Good

Completed desk reviews*	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 PY2019 Commercial Solutions 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 suggest any savings adjustments, and therefore, the final program 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, AHRI certifications) for three of the four 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- 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. However, one midstream lighting project had limited documentation about the lighting equipment QPL certifications, project site type, and savings calculations. 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
7.1%	469	469	100.0%	18.5%	2,213,656	2,214,298	100.0%	Fair

Completed desk reviews*	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 PY2019 Commercial SOP 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 adjusted the claimed savings for three projects. Two projects had adjustments of less than five percent, and one project had adjustments greater than five percent compared to the originally claimed savings. AEP TNC accepted the evaluated results and matched the claimed savings to those of the evaluations for the project with significant adjustments, and therefore, the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1198238: The energy efficiency project included interior and exterior lighting retrofits at a retail building. During the desk review and on-site M&V visit, the EM&V team adjusted wattages for several installed fixtures using the DLC qualified products lists: from 40.0 W claimed to 42.0 W, from 100.0 W claimed to 98.5 W, from 10.0 W claimed to 13.5 W, from 16.5 W claimed to 17.0 W, from 109.0 W claimed to 108.0 W, from 105.0 W claimed to 105.5 W, and from 112.0 W claimed to 114.0 W. The TRM allows for wattages in 0.5 increments; therefore, for some fixtures, the rated wattages were adjusted to the closest half-watt. In addition, the quantity was corrected for several lighting fixtures (from 36 claimed fixtures to 40 and from 10 claimed to 7) to match actual equipment installed. Overall, the adjustments resulted in the realization rate remaining at 100 percent kW and kWh.

Participant ID 1198240: The energy efficiency project included interior lighting retrofit at a manufacturing facility that was converted to a warehouse building. During the desk review and on-site M&V visit, the EM&V team adjusted the savings calculation from a retrofit to a new construction warehouse because the project was a major retrofit and change of facility type. This correction significantly decreased peak and energy savings. In addition, wattages for several installed fixtures were rounded incorrectly from 69.1 W per DLC certification to 69.5 W. These wattages were adjusted to 69 W. Overall, the corrections resulted in realization rates of 66 percent kW and kWh.

Participant ID 1224591: The energy efficiency project included an interior lighting retrofit at an enclosed mall retail facility. During the desk review, the EM&V team adjusted the installed equipment wattage for a single type of lighting fixture by 0.5 W (from 32.0 W claimed to 31.5 W) to account for the 0.5 W increment allowed by the TRM. Overall, the change in the savings calculation approach was minimal, and the realization rate for both kW and kWh remained at 100 percent.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for three projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation at these sites included invoices, QPL qualifications, pre- and post-inspection notes, project savings calculators, and photographic documentation of existing and new

equipment. However, partial documentation was provided for the other project, which was missing the pre- and post-calculators, AHRI certification, and post-install notes to accompany the post-install photos. 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."

3.3.3 Open 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
4.9%	325	325	100.0%	11.1%	1,331,577	1,331,331	100.0%	Good

Completed desk reviews*	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 PY2019 Open 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 adjusted the claimed savings for all four projects. Three projects had adjustments of less than five percent, and one project had adjustments greater than five percent compared to the originally claimed savings. AEP TNC accepted the evaluated results and matched the claimed savings to those of the evaluations for the project with significant adjustments, and therefore, the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1200852: The energy efficiency project included an exterior lighting retrofit. During the desk review and on-site M&V visit, the EM&V team noted that the project included the replacement of three 1,500 W lighting fixtures, which were calculated as forty-five 100 W fixtures, overestimating the baseline energy consumption. The EM&V team corrected the calculation to match actual baseline conditions. This correction significantly decreased peak and energy savings. In addition, the on-site M&V found that the quantity of LED fixtures installed at one location was 6 fixtures (adjusted from 2). Overall, the corrections resulted in realization rates of 49 percent kW and 53 percent kWh.

Participant ID 1201038: The energy efficiency project included interior lighting retrofits at a strip mall retail facility. During the desk review, the EM&V team corrected wattages for an installed fixture from 42.0 W claimed to 41.0 W using the DLC qualified products list. Overall, this adjustment slightly increased peak demand and energy savings and resulted in realization rates of 101 percent kW and kWh.

Participant ID 1201043: The energy efficiency project included an interior lighting retrofit at a retail facility. During the desk review and on-site M&V visit, the EM&V team adjusted the wattages for several installed fixtures to the closest half-watt allowed by the TRM. In

addition, it appears that the lighting control savings were manually adjusted in the tracking system but included in the final calculator. This was supported by the on-site M&V, which identified that the occupancy sensors were removed. Overall, these corrections resulted in a small decrease in energy savings and realization rates of 98 percent kW and kWh.

Participant ID 1250835: The energy efficiency project included interior lighting retrofits at a construction equipment rental and retail location. During the desk review, the EM&V team corrected the lighting equipment classification from *integrated ballast LED* to *LED fixture* for one installed fixture. This adjustment did not change the overall project savings. The realization rates remained at 100 percent kW and kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for two projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications, equipment specifications, post-inspection notes, project savings calculators, and photographic documentation of existing and new equipment. However, partial documentation was provided for the other two projects. Each project was missing documentation to confirm equipment installed, including equipment specification sheets or invoices. Since the projects were small business projects, it was not expected to include pre-install and post-install calculators. 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."

3.3.4 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%	328	328	100.0%	14.0%	1,680,000	1,680,000	100.0%	Good

Completed desk reviews*	On-site M&V
2	1

* 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 PY2019 SCORE/CitySmart 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 suggest any savings adjustments, and therefore, the final program 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, AHRI certifications) for both projects that had desk reviews completed because sufficient documentation was provided for the sites. Project

documentation included invoices, QPL qualifications, equipment specifications, pre- 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."

3.4 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

3.4.1 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
44.6%	2,935	2,935	100.0%	0.2%	20,550	20,549	100.0%	Good

Completed desk reviews*	On-site M&V
N/A	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 Load Management SOP by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments at the ESI ID level. Load management events in PY2019 occurred on the following dates and times:

- May 20, 2019, from 4:00 p.m. to 5:00 p.m. (scheduled)
- August 12, 2019, from 4:00 p.m. to 7:00 p.m. (unscheduled)
- August 12, 2019, from 4:00 p.m. to 6:00 p.m. (unscheduled)
- August 13, 2019, from 3:00 p.m. to 6:00 p.m. (unscheduled)
- August 13, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)

The EM&V team received interval meter data as well as a spreadsheet that summarized the event-level savings for the four sponsors across 23 sites. Twenty sites participated in the scheduled event that was used as a test event. Eleven of the 23 sites participated in the three-hour unscheduled events, and eight sites participated in the two-hour unscheduled events. Four sites did not have any load data associated with them as they did not participate in any event.

AEP TNC calculated kW savings for each site by applying a weighted average to the kW reductions across the unscheduled events. To calculate kWh savings, AEP TNC summed kW reductions of all events (including the scheduled event) and multiplied it by the total number of event hours. In applying this method to the meter level data and following the TRM, the EM&V team calculated kW and kWh savings that matched that of AEP TNC. A negligible difference in kWh is attributed to rounding practices during calculations. The table above shows both the EM&V team and AEP TNC's calculated kW and kWh savings.

The evaluated savings for the Load Management SOP are 2,935 kW and 20,549 kWh. The realization rate for both kW and kWh is 100 percent.

3.5 SUMMARY OF TRACKING-SYSTEM-ONLY EVALUATED PROGRAMS

Table 12 provides a summary of claimed savings for AEP TNC's programs in PY2019 that only received a tracking system review for program impacts. The programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

Table 12. PY2019 Claimed Savings (Tracking-System-Only Evaluated 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)
Residential SOP	16.0%	1,054	1,054	100.0%	15.4%	1,844,161	1,844,161	100.0%
Hard-to-Reach SOP	9.1%	600	600	100.0%	8.3%	994,684	994,684	100.0%
Targeted Low-Income Energy Efficiency Program	1.8%	119	119	100.0%	1.7%	199,824	199,824	100.0%

3.6 SUMMARY OF LOW PRIORITY EVALUATION PROGRAMS

Table 13 provides a summary of claimed savings for AEP TNC's low evaluation priority programs in PY2019, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

Table 13. PY2019 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)
SMART Source Solar PV MTP (Com)	0.7%	49	49	100.0%	1.3%	153,060	153,060	100.0%
SMART Source Solar PV MTP (Res)	1.3%	88	88	100.0%	2.7%	323,617	323,617	100.0%

4.0 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 priority for which claimed savings were verified through the EM&V database are included.

4.1 KEY FINDINGS

4.1.1 Evaluated Savings

CenterPoint's evaluated savings for PY2019 were 193,946 in demand (kW) and 213,808,816 in energy (kWh) savings. The overall kW and kWh 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 17), which also supported healthy realization rates.

Table 14 shows the claimed and evaluated demand savings for CenterPoint's portfolio and broad customer sector/program categories.

Table 14. CenterPoint PY2019 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%**	**193,945**	**193,946**	**100.0%**	**0.0%**
Commercial	10.5%	20,360	20,360	100.0%	0.0%
Residential	14.3%	27,769	27,769	100.0%	0.0%
Low-income	2.2%	4,329	4,329	100.0%	0.0%
Load management*	73.0%	141,487	141,488	100.0%	0.0%
Pilot	0.0%	0	0	n/a	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 15 shows the claimed and evaluated energy savings for CenterPoint's portfolio and broad customer sector/program categories for PY2019.

Table 15. CenterPoint PY2019 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%**	**213,808,816**	**213,808,816**	**100.0%**	**0.0%**
Commercial	58.9%	125,995,633	125,995,633	100.0%	0.0%
Residential	36.4%	77,863,862	77,863,862	100.0%	0.0%
Low-income	3.1%	6,710,433	6,710,433	100.0%	0.0%
Load management*	0.4%	848,928	848,928	100.0%	0.0%
Pilot	1.1%	2,389,960	2,389,960	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 program documentation score of good, fair, or limited, as discussed in Section 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 improvements identified; and a score of "limited" indicates program documentation improvements across more individual programs or high savings programs have been identified.

CenterPoint received a "good" documentation score for all evaluated programs.

4.1.2 Cost-Effectiveness Results

CenterPoint's overall portfolio had a cost-effectiveness of 2.6, or 2.8 excluding low-income programs.

The more cost-effective programs were Advanced Lighting (both commercial and residential) and CenterPoint Energy High Efficiency Homes® MTP. The less cost-effective programs were Multifamily MTP and Residential Demand Response Program. The Multifamily MTP did not pass cost-effectiveness for the market-rate sector.

The lifetime cost of evaluated savings was $0.011 per kWh and $18.08 per kW.

Table 16. CenterPoint Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total Portfolio	**2.6**	**2.6**	**2.2**
Total Portfolio excluding low-income programs	**2.8**	**2.8**	**2.4**
Commercial	**2.8**	**2.8**	**2.5**
Large Commercial SOP	3.3	3.3	3.0
Commercial MTP (SCORE, Healthcare , Data Center)	2.6	2.6	2.3
Retro-Commissioning MTP	1.4	1.4	1.3
REP (Commercial CoolSaver)	2.4	2.4	1.9
Advanced Lighting Commercial	5.7	5.7	5.1
Residential	**3.1**	**3.1**	**2.5**
REP (CoolSaver & Efficiency Connection)	1.5	1.5	1.2
Residential & SC SOP	1.4	1.4	1.2
Advanced Lighting Residential	9.1	9.1	8.2
Residential Pool Pump & A/C Distributor MTP	2.0	2.0	1.7
Multi-Family MTP	0.8	0.8	0.6
CenterPoint Energy High Efficiency Homes MTP	3.9	3.9	2.7
Hard-to-Reach SOP	1.1	1.1	1.1
Multi-Family MTP (HTR)	0.8	0.8	0.8
Low Income*	**3.0**	**3.0**	**3.0**
Targeted Low Income MTP (Agencies in Action)*	3.0	3.0	3.0
Load Management	**1.7**	**1.7**	**1.7**
Large Commercial Load Management SOP	1.9	1.9	1.9
Residential Demand Response Program	1.0	1.0	1.0
Pilot	**1.2**	**1.2**	**1.0**
Smart Thermostat Program (Pilot)	1.2	1.2	1.0

* The low-income program is evaluated using the SIR.

4.2 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 17 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.

Table 17. 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)	-359.90	-279,511.70
Large Commercial Load Management SOP	302.50	1,815.40
Large Commercial SOP	5.10	43,320.00
Total	**-52.30**	**-234,376.30**

4.3 DETAILED FINDINGS—COMMERCIAL (MEDIUM EVALUATION PRIORITY)

4.3.1 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
5.0%	9,670	9,670	100.0%	29.6%	63,217,038	63,217,038	100.0%	Good

Completed desk reviews*	On-site M&V
21	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 PY2019 Commercial 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 adjusted the claimed savings for ten projects. Five projects had adjustments of less than five percent, and five projects had adjustments greater 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, and therefore, the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1262749: The energy efficiency project included interior and exterior lighting retrofits at a school building. During the desk review and on-site M&V visit, the EM&V

[7] Energy efficiency cost recovery factor

team adjusted the air conditioning type for one of the line items in the LSF calculator from *air-conditioned* to *none*, and the lighting control type for the installed LED exit signs from *occupancy sensors control (OS)* to *none*. Fixture quantities were also corrected for three rooms in the school: from 56 LED tubes claimed to 84, from 27 LED tubes claimed to 24, and from 4 LED tubes claimed to 2. In addition, the EM&V team adjusted wattages for two types of interior fixtures from 14.0 W claimed to 14.5 W and from 21.0 W claimed to 20.5 W using the DLC qualified products list. The TRM allows for wattages in 0.5 increments; therefore, the rated wattages were rounded to the nearest half-watt denomination. Similarly, wattages were also corrected for several exterior screw-in lamps from 11.0 W to 10.5 W. This did not affect the evaluated savings because the canopy lights and outdoor screw-in LEDs did not have the required control devices. Overall, the adjustments resulted in a slight decrease in peak demand and energy savings and realization rates of 99 percent for both kW and kWh.

Participant ID 1264370: The energy efficiency project included interior and exterior lighting retrofits at a school building. During the desk review and on-site M&V visit, the EM&V team adjusted fixture quantities for several interior areas in the school: from 16 LED tubes claimed to 12, from 16 LED tubes claimed to 12, from 32 LED tubes claimed to 34, from 16 LED tubes claimed to 12, and from 68 LED tubes claimed to 34. Quantities were also corrected for exterior fixtures: from 3 LED fixtures claimed to 2 and from 5 LED fixtures claimed to 4. In addition, the EM&V team removed the fixtures of two line items in the LSF calculator per on-site visit findings. Overall, the adjustments resulted in a decrease in peak demand and energy savings and realization rates of 96 percent for both kW and kWh.

Participant ID 1277269: The energy efficiency project included the new construction of interior and exterior lighting at a school building with a sports field. During the desk review and on-site M&V visit, the EM&V team removed the sports field lighting from the interior inventory and adjusted the project building type from *sports arena* to *school/university*. The square footage of the track and field area was also removed from the total facility gross lighted floor area. These corrections drastically decreased peak demand and energy savings. In addition, several fixtures had minor wattage adjustments based on the DLC qualified products list: from 29.0 W claimed to 28.5 W, from 17.0 W claimed to 16.5 W, from 84.0 W claimed to 84.5 W, and from 179.0 W claimed to 178.5 W. The TRM allows for wattages in 0.5 increments; therefore, the rated wattages were rounded to the nearest half-watt denomination. Overall, the corrections resulted in realization rates of 37 percent kW and 39 percent kWh.

Participant ID 1277436: The energy efficiency project included an early replacement of HVAC equipment at a school building. During the desk review and on-site M&V visit, the EM&V team found the pre-retrofit cooling coil type to be an Al/Cu condenser coil instead of the claimed MCHX (microchannel heat exchanger) type. The baseline of the pre-retrofit chiller was adjusted from 194.9 tons claimed to 194.0 tons. In addition, the capacity of the installed chiller was corrected from 190.0 tons claimed to 190.3 tones, based on the submitted performance data and the on-site M&V findings. Overall, the adjustments reduced peak demand and energy savings and resulted in realization rates of 95 percent kW and 98 percent kWh.

Participant ID 1280188: The energy efficiency project included interior and exterior lighting retrofits at a school building. During the desk review, the EM&V team noted that the tracking system did not claim savings from the screw-in light bulbs, which were included in

the calculator. This adjustment resulted in a slight increase in peak demand and energy savings and realization rates of 102 percent for both kW and kWh.

Participant ID 1280525: The energy efficiency project included the installation of an optimization control system and related control points on seven existing chillers and associated pumps and cooling towers at a large hospital. During the desk review, the EM&V team determined that the ex-ante savings calculation was unacceptable. The EM&V team accepted an updated analysis developed by CenterPoint and individuals knowledgeable of the project. The ex-post regression analysis adjusted the updated analysis by creating hourly readings for the time period between June 25, 2019 and July 10, 2019 to match the detail of the pre- and post-data-collection readings. The ex-post calculation also incorporated the temperature readings into the baseline and developed a regression using both load and outdoor air temperature. The corrections resulted in realization rates of 93 percent kW and 128 percent kWh.

Participant ID 1281828: The energy efficiency project included the new installation of interior lighting, oil-cooling units on servers (thus eliminating the need for server fans), and water-cooled chillers at a data center. The project was smaller than the original design previously reviewed by the EM&V team due to the removal of the uninterruptible power supply (UPS). During the desk review, the EM&V team adjusted the lighting portion of the project. The lighting custom savings calculation was reduced because the HVAC interactive effects identified in the lighting calculation were also included in the cooling savings. In addition, the EM&V team determined that removing UPSs from the design is not an energy efficiency improvement but rather a design modification. The EM&V team asked for further documentation and justification regarding the design decision for further consideration, but none was provided in the final documentation. Overall, the corrections resulted in a decrease in peak demand and energy savings and realization rates of 87 percent for both kW and kWh.

Participant ID 1287275: The energy efficiency project included the installation of an ENERGY STAR® roof at a school building. During the desk review and on-site M&V visit, the EM&V team adjusted the installed roof area from 112,800 claimed to 111,280 square feet. This correction resulted in realization rates of 99 percent for both kW and kWh.

Participant ID 1288268: The energy efficiency project included interior lighting retrofits and an early replacement of HVAC equipment at a school building. During the desk review and on-site M&V visit, the EM&V team used the regression analysis equations derived from monitoring to identify the peak demand (kW) from the top 20 PDPF hours from the TRM for climate zone 3. This increased the savings over the assumed average kW from summer because it eliminated the June and July months for the school peak demand calculation. This correction resulted in realization rates of 191 percent kW and 100 percent kWh.

Participant ID 1288286: The energy efficiency project included the new construction of interior lighting with controls and exterior lighting at a school building. During the desk review, the EM&V team adjusted the building type from *performing arts theater* to *school/university*. This adjustment reduced savings from the interior lighting portion of the project. Lighting controls, exterior lighting, and HVAC savings remained the same. Overall, the corrections drastically reduced peak demand and energy savings and resulted in realization rates of 36 percent kW and 37 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for 20 projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications or AHRI certifications, pre- 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. Partial documentation was provided for one custom project that did not provide a clear description of the methodologies used to calculate savings and lacked inspection notes and photos. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of "good."

4.3.2 Large 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
4.6%	8,999	8,999	100.0%	26.0%	55,504,907	55,504,907	100.0%	Good

Completed desk reviews*	On-site M&V
17	9

*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 PY2019 Large Commercial SOP 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 adjusted the claimed savings for eight projects. Six projects had adjustments of less than five percent, and two projects had adjustments greater 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, and therefore, the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1196336: The energy efficiency project included exterior lighting retrofits at a parking lot. During the desk review and on-site M&V visit, the EM&V team adjusted the air-conditioning type from *air-conditioned* to *none*. The non-operational fixtures ratio in this project was over 10 percent. CenterPoint's calculator only applies this adjustment to the individual line item; however, the TRM requires that the adjustment be applied to all exterior inventory. In addition, the quantity of the 225 W LED pole light fixtures installed was adjusted for one area of the parking lot from four claimed to two per on-site M&V findings. Overall, the corrections resulted in realization rates of 100 percent kW and 105 percent kWh.

Participant ID 1196339: The energy efficiency project included exterior lighting retrofits at a retail building. During the desk review, the EM&V team adjusted the pre- and post-retrofit quantities for the 42 W fluorescent wall pack replacement from two and one, respectively (claimed), to four and three, respectively. This correction resulted in a negligible increase in peak demand and energy savings and realization rates of 100 percent for both kW and kWh.

Participant ID 1196353: The energy efficiency project included interior and exterior lighting retrofits at a manufacturing facility. During the desk review, the EM&V team used the LSF calculator v2019.1 to calculate savings because the project interior lighting fixtures exceeded the ten percent threshold for non-operational fixtures, and the CenterPoint calculator does not follow the TRM for that specific case. The LSF calculator adjusted the savings to apply the TRM-intended reduction for the interior lighting portion of the project. Minor baseline equipment wattages and post-retrofit fixtures wattages were also applied. In addition, the EM&V team corrected the wattages for several fixtures from 147.0 W claimed to 147.5 W and from 60.0 W claimed to 61.0 W based on the DLC qualified products list. Overall, the adjustments increased peak demand and energy savings and resulted in realization rates of 105 percent kW and 106 percent kWh.

Participant ID 1196369: The energy efficiency project included interior and exterior lighting retrofits at a manufacturing facility. During the desk review and on-site M&V visit, the EM&V team adjusted the quantities of the installed interior LED fixtures for two line items in the calculator from 67 claimed to 63 and from 27 claimed to 28. The installed fixture control type for those two line items was corrected from *none* to *occupancy sensor control*. Overall, the adjustments increased peak demand and energy savings and resulted in realization rates of 110 percent for both kW and kWh.

Participant ID 1196376: The energy efficiency project included exterior lighting retrofits at a parking lot. During the desk review and on-site M&V visit, the EM&V team corrected several fixtures' wattage from 299.0 W claimed to 299.5 W based on the DLC qualified products list. The TRM allows for wattages in 0.5 increments; therefore, the rated wattages were rounded to the nearest half-watt denomination. The adjustment resulted in a negligible decrease in energy savings and realization rates of 100 percent for both kW and kWh.

Participant ID 1213712: The energy efficiency project included interior lighting retrofits at a non-refrigerated warehouse with offices. During the desk review and on-site M&V visit, the EM&V team removed the occupancy sensor controls for three line items in the savings calculator and confirmed that the rest of indoor lighting is controlled by relay switches. The fixture quantity was also adjusted for one line item in the calculator from 85 three-lamp troffer fixtures claimed to 86, per on-site M&V findings. Overall, the adjustments resulted in a slight increase in peak demand and energy savings and realization rates of 101 percent for both kW and kWh.

Participant ID 1213756: The energy efficiency project included the new construction of interior lighting, exterior lighting, and HVAC equipment at a warehouse building. During the desk review, the EM&V team adjusted the wattages of five different fixtures to the nearest half-watt denomination using DLC or ENERGY STAR® qualified products lists since the 2019 version of the TRM allows for wattages in 0.5 increments. The wattage was also corrected for other fixtures from 12.0 W to 13.0 W. In addition, 13 fixtures were removed from the savings calculation because they were found to be non-qualified. Overall, the

adjustments resulted in a negligible decrease in peak demand and energy savings and realization rates of 100 percent for both kW and kWh.

Participant ID 1213763: The energy efficiency project included interior lighting retrofits at a 24-hour supermarket. During the desk review, the EM&V team corrected the wattage of several fixtures from 73.3 W claimed to 73.5 W to match the TRM-specified increments. The adjustment resulted in a negligible decrease in peak demand and energy savings and realization rates of 100 percent for both kW and kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for 16 projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications or AHRI certifications, pre- 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. Partial documentation was provided for one lighting project that lacked certifications and invoices. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of "good."

4.3.3 Retro-Commissioning 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
0.4%	861	861	100.0%	2.1%	4,458,399	4,458,399	100.0%	Good

Completed desk reviews*	On-site M&V
1	1

*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 PY2019 Retro-commissioning 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 suggest any savings adjustments, and therefore, the final program 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, AHRI certifications) for the project that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications, equipment specifications, pre- 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."

4.3.4 Multifamily Market Transformation Program (MTP)

Market-Rate

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%	226	226	100.0%	0.4%	867,075	867,075	100.0%	Good

Hard-to-Reach

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%	130	130	100.0%	0.3%	584,614	584,614	100.0%	Good

Completed desk reviews*	On-site M&V
10	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 PY2019 Multifamily MTP evaluation efforts focused on desk reviews. The number of sampled and completed desk reviews for this program is listed above.

The EM&V team did not make any adjustments to this program. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across a sample of projects by completing desk reviews to check that measure data collected by contractors on forms aligned correctly with that in the tracking system.

Desk reviews were completed for 10 projects and resulted in desk review realization rates of 100 percent for both demand and energy savings.

Documentation Score

The EM&V team was able to verify all key inputs and assumptions (e.g., pre- and post-condition) for the sampled boiler project. For direct installs such as low-flow showerheads and LEDs, the EM&V team was able to verify key inputs and assumptions with the documentation provided. Because sufficient documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of "good."

4.4 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

4.4.1 Large 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
63.8%	123,670	123,670	100.0%	0.3%	742,022	742,022	100.0%	Good

Completed desk reviews*	On-site M&V
N/A	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 Large Commercial Load Management SOP by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments at the ESI ID level. Load management events occurred on the following dates and times:

- July 10, 2019, from 2:00 p.m. to 5:00 p.m.
- August 12, 2019, from 3:30 p.m. to 6:30 p.m.

The EM&V team received the interval meter data as well as spreadsheets detailing the CenterPoint calculated savings results for the event and each ESI ID. In reviewing individual meter savings differences, the EM&V team found that, although CenterPoint set savings to zero in cases where the calculation methodology produced negative savings, that was not reflected in CenterPoint's claimed savings. Per TRM 6.0, in cases where the savings algorithm produces negative savings, the negative savings can be set to zero. The EM&V team informed CenterPoint about the discrepancies between their load management savings calculation and their claimed savings, and CenterPoint notified us that the final claimed savings will be adjusted to match their load management savings calculation and the evaluated savings. The table above shows both the EM&V team and CenterPoint's calculated kW and kWh savings.

Evaluated savings for the Large Commercial Load Management SOP are 123,670 kW and 742,022 kWh. The realization rate for both kW and kWh is 100 percent.

4.4.2 Residential Demand Response 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
9.2%	17,817	17,818	100.0%	0.1%	106,905	106,906	100.0%	Good

Completed desk reviews*	On-site M&V
N/A	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 Residential Demand Response Program by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments at the ESI ID level. Load management events occurred on the following dates and times:

- July 10, 2019, from 2:00 p.m. to 5:00 p.m.
- August 12, 2019, from 3:30 p.m. to 6:30 p.m.

The EM&V team received the interval meter data as well as spreadsheets detailing the CenterPoint calculated savings results for the event and each ESI ID. After applying the "high 3 of 5 baseline" calculation method, the EM&V team was able to calculate savings for all participating sites but one site that had load data for only four days. The EM&V applied the average savings value to that site, which resulted in an insignificant increase in kW savings. The kWh savings were calculated by multiplying the kW savings by the total number of event hours. The table above shows both the EM&V team and CenterPoint's calculated kW and kWh savings.

Evaluated savings for the Residential Demand Response Program are 17,818 kW and 106,905 kWh. The realization rate for both kW and kWh is 100 percent.

4.5 SUMMARY OF TRACKING-SYSTEM-ONLY EVALUATED PROGRAMS

Table 18 provides a summary of claimed savings for CenterPoint's programs in PY2019 that only received a tracking system review for program impacts. The programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

Table 18. PY2019 Claimed Savings (Tracking-System-Only Evaluated 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)
Advanced Lighting Commercial	0.1%	247	247	100.0%	0.6%	1,347,321	1,347,321	100.0%
REP (Commercial CoolSaver)	0.3%	584	584	100.0%	0.7%	1,467,968	1,467,968	100.0%
Residential & SC SOP	0.2%	396	396	100.0%	0.6%	1,329,658	1,329,658	100.0%
CenterPoint Energy High Efficiency Homes MTP	7.2%	13,999	13,999	100.0%	13.2%	28,280,400	28,280,400	100.0%
Advanced Lighting Residential	2.4%	4,683	4,683	100.0%	12.0%	25,599,104	25,599,104	100.0%
REP (CoolSaver & Efficiency Connection) (Res)	1.8%	3,509	3,509	100.0%	4.4%	9,347,520	9,347,520	100.0%
Hard-to-Reach SOP	0.7%	1,357	1,357	100.0%	0.9%	1,940,952	1,940,952	100.0%
Targeted Low-Income MTP (Agencies in Action)	2.2%	4,329	4,329	100.0%	3.1%	6,710,433	6,710,433	100.0%
Smart Thermostat Program (Pilot)	0.0%	0	0	n/a	1.1%	2,389,960	2,389,960	100.0%

4.6 SUMMARY OF LOW PRIORITY EVALUATION PROGRAMS

Table 19 provides a summary of claimed savings for CenterPoint's low evaluation priority programs in PY2019, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

Table 19. PY2019 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)
Residential Pool Pump & A/C Distributor MTP	1.8%	3,469	3,469	100.0%	4.6%	9,914,539	9,914,539	100.0%

5.0 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 priority for which claimed savings were verified through the EM&V database are included.

5.1 KEY FINDINGS

5.1.1 Evaluated Savings

El Paso Electric's evaluated savings for PY2019 were 19,424 in demand (kW) and 24,819,876 in energy (kWh) savings. The overall kW and kWh 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 (Table 23), which also supported healthy realization rates.

Table 20 shows the claimed and evaluated demand savings for El Paso Electric's portfolio and broad customer sector/program categories.

Table 20. El Paso Electric PY2019 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%	19,424	19,424	100.0%	0.1%
Commercial	21.4%	4,153	4,152	100.0%	0.3%
Residential	10.6%	2,062	2,062	100.0%	0.0%
Load management*	59.1%	11,473	11,475	100.0%	N/A
Pilot	8.9%	1,736	1,736	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 21 shows the claimed and evaluated energy savings for El Paso Electric's portfolio and broad customer sector/program categories for PY2019.

Table 21. El Paso Electric PY2019 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%	24,825,788	24,819,876	100.0%	0.2%
Commercial	80.9%	20,078,411	20,072,503	100.0%	0.3%
Residential	18.9%	4,685,464	4,685,464	100.0%	0.0%
Load management*	0.1%	17,209	17,212	100.0%	N/A
Pilot	0.2%	44,705	44,698	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 sub-sections. 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 program documentation score of good, fair, or limited, as discussed in Section 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 improvements identified; and a score of "limited" indicates program documentation improvements across more individual programs or high savings programs have been identified.

El Paso Electric received a "Good" program documentation score for all evaluated programs in 2019.

5.1.2 Cost-Effectiveness Results

El Paso Electric's overall portfolio had a cost-effectiveness score of 3.2.

The more cost-effective programs were Large C&I Solutions MTP and Texas SCORE MTP. The less cost-effective programs were Load Management SOP and Demand Response Pilot Program. The Demand Response Pilot Program did not pass cost-effectiveness.

The lifetime cost of evaluated savings was $0.010 per kWh and $15.95 per kW.

Table 22. El Paso Electric Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total Portfolio	**3.2**	**3.2**	**2.9**
Commercial	**4.3**	**4.3**	**3.9**
Small Commercial Solutions MTP	3.2	3.2	3.0
Large C&I Solutions MTP	4.9	4.9	4.3
Texas SCORE MTP	4.2	4.2	3.8
Residential	**2.1**	**2.1**	**1.9**
Residential Solutions MTP	2.8	2.8	2.5
LivingWise MTP	2.1	2.1	1.7
Texas Appliance Recycling MTP	1.8	1.8	1.4
Hard-to-Reach Solutions MTP	1.8	1.8	1.8
Load Management	**1.6**	**1.6**	**1.6**
Load Management SOP	1.6	1.6	1.6
Pilot	**0.7**	**0.7**	**0.7**
Demand Response Pilot Program	0.7	0.7	0.7

5.2 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 23 summarizes claimed savings adjustments recommended by the EM&V team. All commercial adjustments were made prior to the EEPR filing on April 1, 2020. Realization rates assume the following adjustments will be included in El Paso Electric's May 1 filing.

Table 23. Evaluation, Measurement, and Verification Claimed Savings Adjustments by Program (Prior to EECRF[8] Filing)

Program	EM&V demand claimed savings adjustments (kW)	EM&V energy claimed savings adjustments (kWh)
Large C&I Solutions MTP	-12.2	-57,210.1
Small Commercial Solutions MTP	-0.8	-2,930.0
Texas SCORE MTP	2.8	21,930.0
Total	**-10.2**	**-38,210.1**

[8] Energy efficiency cost recovery factor

5.3 DETAILED FINDINGS—COMMERCIAL (MEDIUM EVALUATION PRIORITY)

5.3.1 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)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
12.3%	2,395	2,395	100.0%	46.3%	11,493,121	11,493,134	100.0%	Good

Completed desk reviews*	On-site M&V
6	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 PY2019 Large C&I Solutions 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 adjusted the claimed savings for three projects. Two projects had adjustments of less than five percent, and one project had adjustments greater than five percent compared to the original claimed savings. El Paso Electric accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects, and therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1200972: The energy efficiency project included the new construction of chillers and heat pumps at a healthcare facility. During the desk review and on-site M&V visit, the EM&V team verified the nameplate information, type, and quantities of the installed HVAC equipment. The quantity of the variable refrigerant flow (VRF) heat pumps with a cooling capacity of 48,000 BTUH was adjusted from two to one per on-site M&V visit findings. This adjustment decreased peak demand and energy savings and resulted in realization rates of 99 percent kW and 98 percent kWh.

Participant ID 1201087: The energy efficiency project included interior and exterior lighting retrofits at a retail building. During the desk review and on-site M&V visit, the EM&V team corrected wattages for several installed exterior fixtures using the DLC qualified products list from 40.0 W claimed to 39.5 W. The LSF calculator allows for wattages in 0.5 increments; therefore, the rated wattage was adjusted to the closest wattage in the LSF calculator. The wattage adjustment resulted in a negligible decrease in peak demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1241520: The energy efficiency project included the installation of a new air compressor at a manufacturing facility. During the desk review and on-site M&V visit, the EM&V team used the savings methodology of the stipulated analysis from Volume 4 of the TRM V6.0 to determine the energy savings because the documentation did not include

pre-install energy logging of the air compressor. Changing the calculation resulted in a large adjustment in peak demand and energy savings and realization rates of 39 percent kW and 44 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for most projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and AHRI certifications, pre- 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. Partial documentation was provided for two projects: one lighting project lacked some QPL certifications, and one custom M&V project was well defined and documented but lacked an explanation of reasons for the utility's savings or incentives cap. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of Good.

5.3.2 Small 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
4.2%	818	818	100.0%	13.0%	3,232,821	3,232,821	100.0%	Good

Completed desk reviews*	On-site M&V
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 PY2019 Small Commercial Solutions 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 adjusted the claimed savings for five projects. Four projects had adjustments of less than five percent, and one project had adjustments greater than five percent compared to the original claimed savings. El Paso Electric accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with significant adjustments, and therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1200210: The energy efficiency project included interior and exterior lighting retrofits at a non-refrigerated warehouse. During the desk review and on-site M&V visit, the EM&V team adjusted the building type from "office" to "warehouse non-refrigerated" based on the area usage. The air conditioning type was also adjusted to "none" for the building dock. In addition, the EM&V team corrected wattages for several installed fixtures

using the DLC and ENERGY STAR® qualified products lists: from 36.0 W claimed to 34.5 W, from 15.0 W claimed to 18.0 W, from 25.0 W claimed to 25.5 W, and from 10.0 W claimed to 10.5 W. The LSF calculator allows for wattages in 0.5 increments; therefore, for some fixtures, the rated wattages were adjusted to the closest wattages in the LSF calculator. Overall, these corrections reduced peak demand and energy savings and resulted in realization rates of 94 percent kW and 95 percent kWh.

Participant ID 1200226: The energy efficiency project included interior and exterior lighting retrofits at a school building. During the desk review, the EM&V team adjusted the wattages for several installed fixtures from 140.0 W claimed to 141.0 W (interior) and from 150.0 W claimed to 144.5 W (exterior) using the DLC qualified products list. The qualification of several exterior fixtures was also corrected from "DLC" to "non-qualified." Overall, these adjustments resulted in a negligible increase in peak demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1200245: The energy efficiency project included exterior lighting retrofits at a non-air-conditioned parking garage. During the desk review and on-site M&V visit, the EM&V team corrected the number of fixtures installed in the stairs area of the garage from four to three LED tubes. This minor quantity adjustment resulted in a negligible increase in peak demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1200257: The energy efficiency project included exterior lighting retrofits at a retail strip mall building. During the desk review, the EM&V team adjusted wattages for several installed fixtures using the DLC qualified products list: from 300.0 W claimed to 299.5 W, from 60.0 W claimed to 59.0 W, from 55.0 W claimed to 56.5 W, and from 40.0 W claimed to 38.5 W. The LSF calculator allows for wattages in 0.5 increments; therefore, for some fixtures, the rated wattages were adjusted to the closest wattages in the LSF calculator. The wattage corrections resulted in a negligible increase in energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1236293: The energy efficiency project included interior and exterior lighting retrofits at a non-refrigerated warehouse. During the desk review and on-site M&V visit, the EM&V team corrected wattages for several installed exterior fixtures from 119.5 W claimed to 119.0 W using the DLC qualified products list. The LSF calculator allows for wattages in 0.5 increments; therefore, the rated wattage was adjusted to the closest wattage in the LSF calculator. The wattage adjustment resulted in a negligible increase in energy savings and realization rates of 100 percent kW and kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for most projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and AHRI certifications, pre- 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. Partial documentation was provided for two projects: one lighting project lacked specification sheets, QPL certifications, and invoices, and another lighting project lacked the pre- and post- savings calculators, invoices, and some specification sheets. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of Good.

5.3.3 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
4.8%	940	939	99.8%	21.6%	5,352,469	5,346,548	99.9%	Good

Completed desk reviews*	On-site M&V
4	1

*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 PY2019 Texas SCORE 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 adjusted the claimed savings for two projects. One project had adjustments of less than five percent, and one project had adjustments greater than five percent compared to the original claimed savings. El Paso Electric accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with significant adjustments, and therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1241943: The energy efficiency project included interior and exterior lighting retrofits with controls at a parking garage. During the desk review and on-site M&V visit, the EM&V team corrected wattages for several installed fixtures from 54.0 W claimed to 54.5 W and from 117.0 W claimed to 117.5 W using the DLC qualified products list. The LSF calculator allows for wattages in 0.5 increments; therefore, the rated wattages were adjusted to the closest wattages in the LSF calculator. In addition, the control types were adjusted for all interior equipment from "none" to "occupancy sensor" and for all exterior lighting equipment from "timeclock" to "photocell" per on-site M&V visit findings. Overall, these corrections increased the peak demand and energy savings and resulted in realization rates of 105 percent kW and 106 percent kWh.

Participant ID 1290093: The energy efficiency project included interior and exterior lighting retrofits at a school building. During the desk review, the EM&V team adjusted wattages for several installed fixtures using the DLC qualified products list: from 40.0 W claimed to 39.0 W, from 40.0 W claimed to 39.5 W, and from 87 W claimed to 87.5 W. The LSF calculator allows for wattages in 0.5 increments; therefore, for some fixtures, the rated wattages were adjusted to the closest wattages in the LSF calculator. The wattage corrections resulted in a negligible increase in energy savings and realization rates of 100 percent kW and kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications) for all projects that had desk reviews completed

because sufficient documentation was provided for the sites. The project documentation included invoices, QPL qualifications, pre- and post-inspection notes, project savings calculators, and photographic documentation of the existing and new lighting types, which are significant efforts by the utility to verify equipment conditions and quantities. Therefore, the EM&V team assigned a program documentation score of Good.

5.4 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

5.4.1 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
59.1%	11,473	11,475	100.0%	0.1%	17,209	17,212	100.0%	Good

Completed desk reviews*	On-site M&V
N/A	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 Load Management SOP by applying the "high 5 of 10 baseline" TRM calculation methodology to interval meter data. The meter data was supplied in 30-minute increments at the meter level. A single scheduled load management event occurred in PY2019 on June 14, 2019, from 1:00 p.m. to 2:30 p.m.

The EM&V team received the interval meter data as well as spreadsheets detailing the El Paso Electric calculated baseline load, event load, and savings results for each event and meter. The EM&V team reviewed the data for the 13 sponsors across 23 sites. All sites participated in the 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 El Paso provided for all but one site. When selecting baseline days using the "high 5 of 10" method for that site, six days were selected as baseline days instead of the five highest loads and closest to the event, as recommended by the TRM 6.0 Volume 4. The adjustment in savings calculation resulted in an insignificant increase in kW. The kWh savings were calculated by multiplying the kW savings by the total number of event hours. The table above shows both the EM&V team and EPE's calculated kW and kWh savings.

Evaluated savings for the El Paso Electric Load Management program are 11,475 kW and 17,212 kWh. The realization rate for both kW and kWh is 100 percent.

5.5 DETAILED FINDINGS—PILOT PROGRAMS (MEDIUM EVALUATION PRIORITY)

5.5.1 Demand Response Pilot 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
8.9%	1,736	1,736	100.0%	0.2%	44,705	44,698	100.0%	Good

Completed desk reviews*	On-site M&V
N/A	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 Demand Response pilot program by applying the deemed savings value from the TRM. The meter data was supplied in 30-minute increments at the meter level. Demand-response events in PY2019 occurred on the following dates and times:

- June 26, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- July 8, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- July 12, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- July 18, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- August 5, 2019, from 3:00 p.m. to 6:00 p.m. (unscheduled)
- August 6, 2019, from 3:00 p.m. to 6:00 p.m. (unscheduled)
- August 29, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- September 3, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- September 11, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- September 18, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- September 20, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)
- September 23, 2019, from 3:00 p.m. to 5:00 p.m. (unscheduled)

The EM&V team received a list of participants in the program and event summary documentation from both program implementers (Nest and Bring Your Own Thermostat). The EM&V team was able to gather the necessary information from the participants' list and summary documentation and applied the new deemed savings value from TRM version 7.0, following El Paso Electric's calculation approach.

The provided participants' list included information about the participation status of all meters: full participation, partial participation, or opt outs. Meters that opted out from the program were excluded from the savings calculation. Partial participants included meters that were offline or were in an incompatible mode for at least part of the event. These meters were included in the savings calculation even when participating for less than 50 percent of the event duration. Per TRM 7.0, participants are defined as smart thermostats, which participated no less than 50

percent of the time during the total event duration. The EM&V team recognizes that excluding meters that opted out during the event (even after participating for more than 50 percent of the event) was a conservative approach, but we recommend excluding the partial participants who participated in the event for less than 50 percent of the event duration, per TRM guidance. For PY2019, excluding these partial participants resulted in a negligible decrease in kW savings (3 kW). Since TRM 7.0 is effective starting in 2020, the EM&V accepted the savings calculated by El Paso Electric. A negligible difference in kWh is attributed to rounding practices during calculations.

The EM&V team will continue discussing the savings calculation with El Paso Electric to ensure that there is a clear understanding of the TRM guidance and identify areas in the TRM that need updates to avoid any confusion in the future.

Evaluated savings for the El Paso Electric Demand Response program are 1,736 kW and 44,698 kWh. The realization rate for both kW and kWh is 100 percent.

5.6 SUMMARY OF TRACKING-SYSTEM-ONLY EVALUATED PROGRAMS

Table 24 provides a summary of claimed savings for El Paso Electric's programs in PY2019 that only received a tracking system review for program impacts. The programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

The EM&V team noted several fields that were not provided to support TRM savings calculations for several measures in the Residential and Hard-to-Reach Solutions MTPs. These fields include:

- heating type,
- cooling type,
- roof reflectance,
- steep/low slope,
- existing ceiling/roof deck insulation type,
- house square feet.

Table 24. PY2019 Claimed Savings (Tracking-System-Only Evaluated 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)
Residential Solutions MTP	3.1%	601	601	100.0%	4.9%	1,228,399	1,228,399	100.0%
Hard-to-Reach Solutions MTP	4.0%	781	781	100.0%	4.5%	1,112,828	1,112,828	100.0%
Texas Appliance Recycling MTP	0.6%	107	107	100.0%	3.5%	868,560	868,560	100.0%
LivingWise MTP	2.9%	572	572	100.0%	5.9%	1,475,677	1,475,677	100.0%

6.0 ENTERGY TEXAS, INC. IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for Entergy Texas, Inc.'s (Entergy) 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 priority for which claimed savings were verified through the EM&V database are included.

6.1 KEY FINDINGS

6.1.1 Evaluated Savings

Entergy's evaluated savings for PY2019 were 20,993 in demand (kW) and 44,586,227 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are approximately 100 percent. Entergy was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (Table 28), which also supported healthy realization rates.

Table 25 shows the claimed and evaluated demand savings for Entergy's portfolio and broad customer sector/program categories.

Table 25. Entergy PY2019 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%	20,993	20,993	100.0%	0.0%
Commercial	26.0%	5,451	5,451	100.0%	0.0%
Residential	37.1%	7,794	7,794	100.0%	0.0%
Load management*	36.9%	7,747	7,747	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 26 shows the claimed and evaluated energy savings for Entergy's portfolio and broad customer sector/program categories for PY2019.

Table 26. Entergy PY2019 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%	44,586,227	44,586,227	100.0%	0.0%
Commercial	70.4%	31,401,593	31,401,593	100.0%	0.0%
Residential	29.4%	13,110,881	13,110,881	100.0%	0.0%
Load management*	0.2%	73,753	73,753	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 sub-sections. 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 program documentation score of good, fair, or limited, as discussed in Section 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 improvements identified; and a score of "limited" indicates program documentation improvements across more individual programs or high savings programs have been identified. Entergy received good documentation scores for all of their evaluated programs in PY2019.

6.1.2 Cost-Effectiveness Results

Entergy's overall portfolio had a cost-effectiveness score of 3.2.

The more cost-effective programs were Commercial Solutions MTP and Residential Solutions. The less cost-effective programs were Hard-to-Reach SOP and Load Management SOP. All of Entergy's programs passed cost-effectiveness in 2019.

The lifetime cost of evaluated savings was $0.009 per kWh and $13.84 per kW.

Table 27. Entergy Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total Portfolio excluding low-income programs	**3.2**	**3.2**	**2.8**
Commercial	**4.5**	**4.5**	**4.0**
Commercial Solutions MTP	4.5	4.5	4.0
Residential	**2.4**	**2.4**	**2.0**
Residential SOP	2.3	2.3	2.0
Residential Solutions	2.8	2.8	1.9
Hard-to-Reach SOP	2.0	2.0	2.0
Load Management	**1.7**	**1.7**	**1.7**
Load Management SOP	1.7	1.7	1.7

6.2 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 28 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume the following adjustments will be included in Entergy's May 1 filing.

Table 28. Evaluation, Measurement, and Verification Claimed Savings Adjustments by Program (Prior to EECRF[9] Filing)

Program	EM&V demand claimed savings adjustments (kW)	EM&V energy claimed savings adjustments (kWh)
Commercial Solutions MTP	6.30	10,020.00
Total	**6.30**	**10,020.00**

[9] Energy efficiency cost recovery factor

6.3 DETAILED FINDINGS—COMMERCIAL (MEDIUM EVALUATION PRIORITY)

6.3.1 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
26.0%	5,451	5,451	100.0%	70.4%	31,401,593	31,401,593	100.0%	Good

Completed desk reviews*	On-site M&V
14	7

*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 PY2019 Commercial Solutions 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 adjusted the claimed savings for five projects. Four projects had adjustments of less than five percent, and one project had adjustments greater than five percent compared to the original claimed savings. Entergy accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects, and therefore, the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1200760: The energy efficiency project included a new energy management system (EMS) for optimized HVAC system control at an army reserve building. During the desk review and on-site M&V visit, the EM&V team adjusted the savings calculation approach for the peak kW to match the peak demand hours in the TRM. The amount of savings claimed for this project appears to exceed the savings reduction estimate achieved by EMS upgrade alone; therefore, it is expected that the installer also completed additional commissioning type measures as part of the install. Defining these additional commissioning activities will improve the regression analysis by helping with the correlation of the equations to operations between the pre-install and post-install analysis. Based on the information available in the documentation and during the desk review, it is determined that the savings are acceptable. Overall, the change in the savings calculation approach resulted in realization rates of 103 percent kW and 100 percent kWh.

Participant ID 1200998: The energy efficiency project included interior and exterior lighting and motor retrofits and at a hotel building. During the desk review, the EM&V team adjusted the lighting portion of the project. For interior lighting, 69 fixtures were disqualified since no qualification certificates were provided and could not be found. For exterior lighting, the replacement of metal halide fixtures with LED fixtures for the building façade and dock was added to the savings calculation based on provided invoices and post-retrofit photos. This change, however, resulted in a negligible increase in peak demand and energy savings because the LED fixtures installed for the building façade were non-

qualified. Overall, the adjustments resulted in realization rates of 101 percent kW and 100 percent kWh.

Participant ID 1201004: The energy efficiency project included interior and exterior lighting retrofits at a non-refrigerated warehouse. During the desk review, the EM&V team updated the submitted Phase 1 and Phase 2 LSF calculators from v2018.5 to v2019.1 and incorporated post-inspection notes that were not included in the calculations. For the Phase 1 LSF calculator, the fixture code and wattage were adjusted for several LED tubes from "LED037-FIXT" to "LED025-TUBE." The qualification for these LED tubes was also corrected from "DLC" to "Ltg facts." For the Phase 2 LSF calculator, the EM&V team added a few line items to the calculator and removed others according to post-inspection notes. The pre-retrofit fixture code and quantity were adjusted for one line item in the calculator from four "CF32/1-SCRW" (screw-in lamps) to two "F42GLL" (2-T8 lamps). The fixture quantity and wattage were accordingly adjusted for the post-retrofit fixtures based on the provided documentation from four 22 W LED fixtures to two 28 W LED fixtures. Overall, the adjustments resulted in a decrease in energy savings and realization rates of 100 percent kW and 98 percent kWh.

Participant ID 1201015: The energy efficiency project included interior and exterior lighting retrofits at an office building. During the desk review and on-site M&V visit, the EM&V team corrected the fixture quantity in one of the offices from two to four LED fixtures. This adjustment resulted in a small decrease in peak demand and energy savings and realization rates of 98 percent kW and 99 percent kWh.

Participant ID 1201029: The energy efficiency project included interior and exterior lighting retrofits at a retail building. During the desk review and on-site M&V visit, the EM&V team corrected wattages for several installed fixtures from 18 W claimed to 16.5 W using the ENERGY STAR® qualified products list. Other pre-retrofit and post-retrofit fixtures were added to the LSF calculator in addition to occupancy sensors per on-site M&V visit findings. Some of these fixtures and occupancy sensors were removed from the savings calculator by earlier inspection visits. These items were put back into the LSF calculator and represented in total savings. The increase in peak demand and energy savings from the occupancy sensors were added to the LED lighting measure savings because the LED controls measure does not exist in the evaluation tracking system. Overall, the adjustments resulted in realization rates of 123 percent kW and 132 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications, AHRI certifications) for most projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and AHRI certifications, pre- and post-inspection notes, the project savings calculators, and photographic documentation of existing and new equipment, which are significant efforts by the utility to verify equipment conditions and quantities. Partial documentation was provided for two lighting projects that lacked specification sheets and QPL certifications. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of Good.

6.4 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

6.4.1 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
36.9%	7,747	7,747	100.0%	0.2%	73,753	73,753	100.0%	Good

Completed desk reviews*	On-site M&V
N/A	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 Entergy's Load Management program by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments. Load management events in PY2019 occurred on the following dates and times:

- June 13, 2019, from 2:00 p.m. to 3:00 p.m. (scheduled)
- June 14, 2019, from 2:00 p.m. to 3:00 p.m. (scheduled)
- August 13, 2019, from 3:00 p.m. to 4:00 p.m. (unscheduled)
- August 15, 2019, from 1:00 p.m. to 5:00 p.m. (unscheduled)
- August 16, 2019, from 1:00 p.m. to 5:00 p.m. (unscheduled)

The EM&V team received interval meter data as well as a spreadsheet that summarized the event-level savings for the eight sponsors across 53 sites. All sites participated in one scheduled event that was used as a test event (15 sites participated in the event on June 13, 2019, and 38 sites participated in the event on June 14, 2019). Several sites did not have any load data associated with them for at least one of the unscheduled events as they did not participate in those events (8–12 sites per event). Two of those sites had a meter changed after the test event and, therefore, did not have load data for all unscheduled events.

To calculate savings at the site level, Entergy averaged the kW reductions for each site, whether or not the site participated in all events (one scheduled event and three unscheduled events). The kWh savings were calculated by adding the achieved kW savings and multiplying them by the total number of event hours. In applying this method to the meter level data and following the TRM, the EM&V team calculated kW and kWh savings that matched that of Entergy. Therefore, no adjustments were made to the program savings. The table above shows both the EM&V team and Entergy's calculated kW and kWh savings.

Evaluated savings for the Entergy Load Management program are 7,747 kW and 73,753 kWh. The realization rate for both kW and kWh is 100 percent with a documentation score of Good.

6.5 SUMMARY OF TRACKING-SYSTEM-ONLY EVALUATED PROGRAMS

Table 29 provides a summary of claimed savings for Entergy's programs in PY2019 that only received a tracking system review for program impacts. The programs' claimed savings were verified against the final PY2019 tracking data provided to the EM&V team for the EM&V database.

Table 29. PY2019 Claimed Savings (Tracking-System-Only Evaluated 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)
Residential SOP	18.9%	3,962	3,962	100.0%	12.8%	5,725,406	5,725,406	100.0%
Residential Solutions	9.4%	1,973	1,973	100.0%	10.6%	4,710,435	4,710,435	100.0%
Hard-to-Reach SOP	8.9%	1,859	1,859	100.0%	6.0%	2,675,040	2,675,040	100.0%

7.0 ONCOR ELECTRIC DELIVERY, LLC IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for Oncor Electric Delivery, LLC's (Oncor) 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 priority for which claimed savings were verified through the EM&V database are included.

7.1 KEY FINDINGS

7.1.1 Evaluated Savings

Oncor's evaluated savings for PY2019 were 167,467 in demand (kW) and 260,120,505 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are approximately 100 percent. Oncor was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (Table 33), which also supported healthy realization rates.

Table 30 shows the claimed and evaluated demand savings for Oncor's portfolio and broad customer sector/program categories.

Table 30. Oncor PY2019 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%**	**167,449**	**167,467**	**100.0%**	**0.2%**
Commercial	16.9%	28,349	28,367	100.1%	1.2%
Residential	27.1%	45,426	45,426	100.0%	0.0%
Low-income	2.5%	4,249	4,249	100.0%	0.0%
Load management*	53.4%	89,425	89,425	100.0%	0.0%

* 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 31 shows the claimed and evaluated energy savings for Oncor's portfolio and broad customer sector/program categories for PY2019.

Table 31. Oncor PY2019 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%**	**260,088,858**	**260,120,505**	**100.0%**	**0.3%**
Commercial	51.7%	134,340,038	134,371,685	100.0%	0.6%
Residential	45.2%	117,448,637	117,448,637	100.0%	0.0%
Low-income	3.1%	8,031,890	8,031,890	100.0%	0.0%
Load management*	0.1%	268,294	268,294	100.0%	0.0%

* 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 sub-sections. 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 program documentation score of good, fair, or limited, as discussed in Section 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 improvements identified; and a score of "limited" indicates program documentation improvements across more individual programs or high savings programs have been identified. Oncor received a “good” program documentation score for all but one of its evaluated programs. The exception is its Basic Commercial SOP, which received a documentation score of “fair”.

7.1.2 Cost-Effectiveness Results

Oncor's overall portfolio had a cost-effectiveness score of 2.9, or 3.1 excluding low-income programs.

The more cost-effective programs were Retail Platform Market Transformation Program (MTP) and Basic Commercial Standard Offer Program (SOP). Commercial Retail Platform MTP shows particularly high cost-effectiveness since the program allocates five percent of the lamps sold and budget from the residential sector program. The commercial sector applies higher savings assumptions, resulting in higher cost-effectiveness results. The less cost-effective programs were Retro-Commissioning MTP and Residential Demand Response SOP. All of Oncor's programs were cost-effective in 2019.

The lifetime cost of evaluated savings was $0.010 per kWh and $16.26 per kW.

Table 32. Oncor Cost-Effectiveness Results

Level of analysis	Claimed savings results	Evaluated savings results	Net savings results
Total Portfolio	**2.9**	**2.9**	**2.7**
Total Portfolio excluding low-income programs	**3.1**	**3.1**	**2.8**
Commercial	**3.8**	**3.8**	**3.5**
Custom Commercial SOP	3.0	3.0	2.7
Basic Commercial SOP	4.0	4.0	3.6
Solar PV SOP	1.5	1.5	1.5
Small Business Direct Install MTP	1.9	1.9	1.8
Retail Platform MTP	52.7	52.7	47.4
Retro-Commissioning MTP	1.3	1.3	1.2
Residential	**2.8**	**2.8**	**2.6**
Home Energy Efficiency SOP	2.4	2.4	2.2
Solar PV SOP	1.5	1.5	1.4
Retail Platform MTP	6.8	6.8	6.1
Hard-to-Reach SOP	2.0	2.0	2.0
Low Income*	**2.9**	**2.9**	**2.9**
Targeted Weatherization Low-Income SOP*	2.9	2.9	2.9
Load Management	**1.4**	**1.4**	**1.4**
Commercial Load Management SOP	1.4	1.4	1.4
Residential Demand Response SOP	1.3	1.3	1.3

* The low-income program is evaluated using the SIR.

7.2 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 33 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume the following adjustments will be included in Oncor's June 1 filing.

Table 33. Evaluation, Measurement, and Verification Claimed Savings Adjustments by Program (Prior to EECRF[10] Filing)

Program	EM&V demand claimed savings adjustments (kW)	EM&V energy claimed savings adjustments (kWh)
Basic Commercial SOP	0.00	-130,941.00
Small Business Direct Install MTP	-22.60	-33,880.90
Total	**-22.60**	**-164,821.90**

7.3 DETAILED FINDINGS—COMMERCIAL (MEDIUM EVALUATION PRIORITY)

7.3.1 Basic 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
11.1%	18,669	18,683	100.1%	35.9%	93,296,463	93,286,426	100.0%	Fair

Completed desk reviews*	On-site M&V
11	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 PY2019 Basic Commercial SOP 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 adjusted the claimed savings for six projects. Three projects had adjustments of less than five percent, and three projects had adjustments greater than five percent compared to the originally claimed savings. Oncor accepted the evaluated results and matched the claimed kWh savings to those of the evaluations for the one project with significant adjustments and a realization rate lower than 100 percent kWh. The final program realization rate is, therefore, nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1196430: The energy efficiency project included interior and exterior lighting retrofits at a uniform retail and cleaning facility. During the desk review and on-site M&V

[10] Energy efficiency cost recovery factor