

Volume 2. Utility-specific Energy Efficiency Portfolio Report Program Year 2018



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GLOSSARY: ACRONYMS/ABBREVIATIONS/DEFINITIONS

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
CMTTP	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
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
RMTTP	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) 2018. It is a companion document to Volume 1 of the Statewide Energy Efficiency Portfolio Report. A summary report, “2018 Energy Efficiency Accomplishments,” is also available at www.puc.texas.gov.

PY2018 is the seventh program year evaluated as part of the statewide EM&V effort. The PY2018 scope is targeted impact evaluations for the savings areas of the highest uncertainty identified in the prior program years’ EM&V results. 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 measurement and verification (M&V) information.

The PY2018 EM&V plans¹ 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—percentage of contribution to the portfolio of programs’ impacts
- Level of relative uncertainty in estimated savings
- Level and quality of existing quality assurance (QA/QC) and verification data from on-site inspections completed by utilities or their contractors
- Stage of program or programmatic component (e.g., pilot, early implementation, mature)
- Importance to future portfolio performance
- 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 two 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

¹Public Utility Commission of Texas EM&V Plans for Texas Utilities’ Energy Efficiency and Load Management Portfolios—Program Year 2018, June 2018.

cost test (PACT, also known as the Utility Cost Test) cost-effectiveness methodology are in Appendix B.

1.2 Evaluation Approach

This section discusses the PY2018 EM&V methodology. The foundation of the evaluation process was to create a statewide EM&V database with a streamlined data request process and secure retrieval system. Complete PY2018 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 review of claimed savings
- Program tracking system reviews
- Efficient sampling across utilities and programs.

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 series of desk reviews for an initial assessment of the reasonableness of the claimed savings. Primary data was 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 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 or 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 M&V

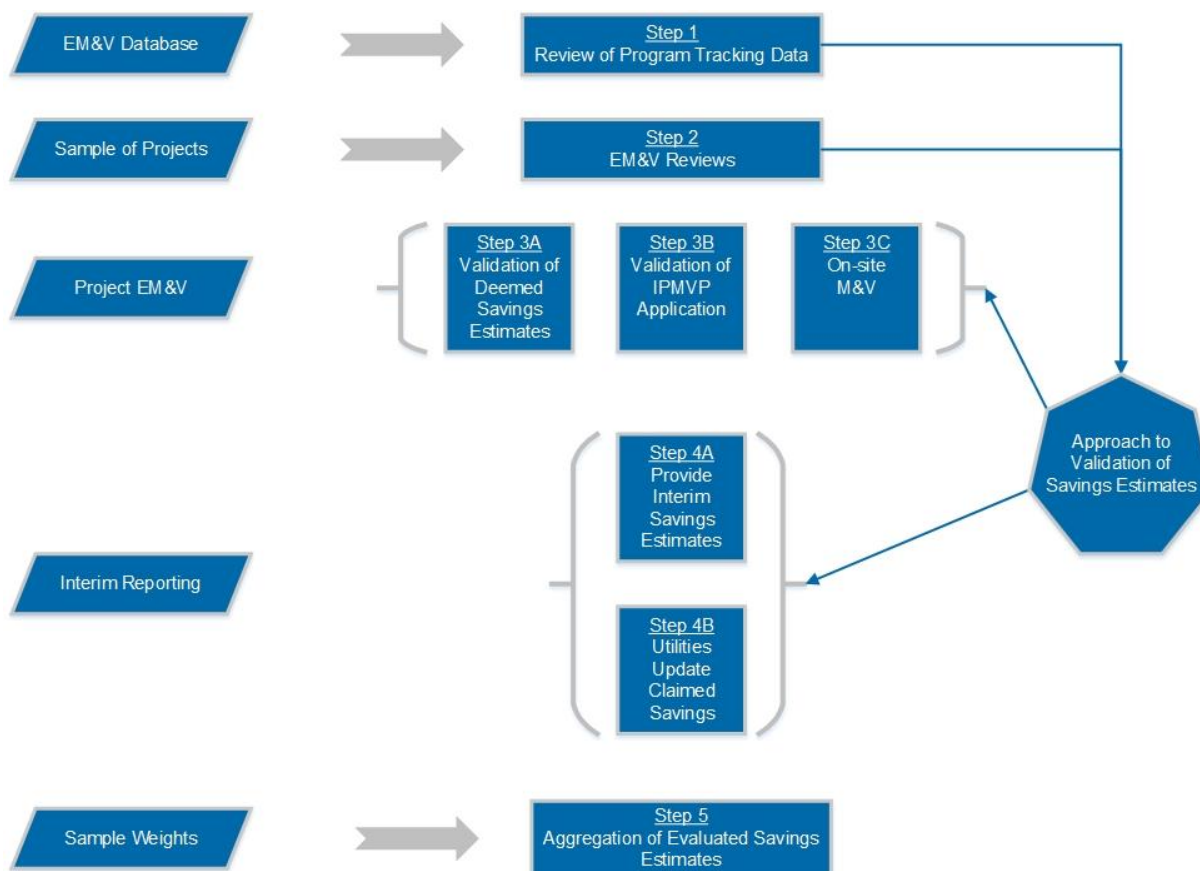
For sampled projects across each utility portfolio, the EM&V team conducted on-site M&V. The on-site visits had two principal objectives: (1) verify installation and operation of the equipment/systems and (2) verify key assumptions made in calculating claimed savings estimates.

- Installations were verified by collecting data on-site related to the number of measures installed, the location of the systems, equipment nameplate information and a visual inspection to ensure the systems are working as intended. This was a basic inspection audit that took approximately one to two hours to complete.
- Site measurements, spot metering, and/or short (and in some cases) long-term metering were completed 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 1-1.

Figure 1-1. 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:** ≥ 90 percent of sampled projects have sufficient documentation.
- **Fair:** 70 percent–<90 percent of sampled projects have sufficient documentation; the remaining sampled projects had Limited or no documentation. Medium uncertainty was also given to nonresidential programs that had utility M&V results available to verify savings in place of other supporting documentation with the needed equipment quantity and specification information such as equipment cut sheets.
- **Limited:** <70 percent of sampled projects have sufficient documentation; the remaining sampled projects had Limited or no 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, 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 documentation 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 PY2018 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, and the PUCT and utilities. Table 1-1 lists the required inputs to the cost-effectiveness model and the sources of information.

Table 1-1. 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	Measure type	Deemed savings
Effective useful life	Measure type	Deemed savings
Incentive payments	Program	EEPRs
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

The EM&V team conducted PY2018 cost-effectiveness tests separately using claimed gross savings and evaluated gross savings. The model produces results at the portfolio, program category,⁴ and program levels.

All benefits and costs are expressed in program year dollars. Benefits resulting from energy savings occurring in future years are net to program year dollars using the utility's weighted average cost of capital (WACC) as the discount rate.

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.

⁴ Program categories are currently defined as Commercial, Residential, Low Income, Load Management, and Pilots.

When tests were conducted at a more disaggregated level than data was available, that data was allocated proportionate to costs (§ 25.181 (h)(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 program year: (1) Interim 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 Interim 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.

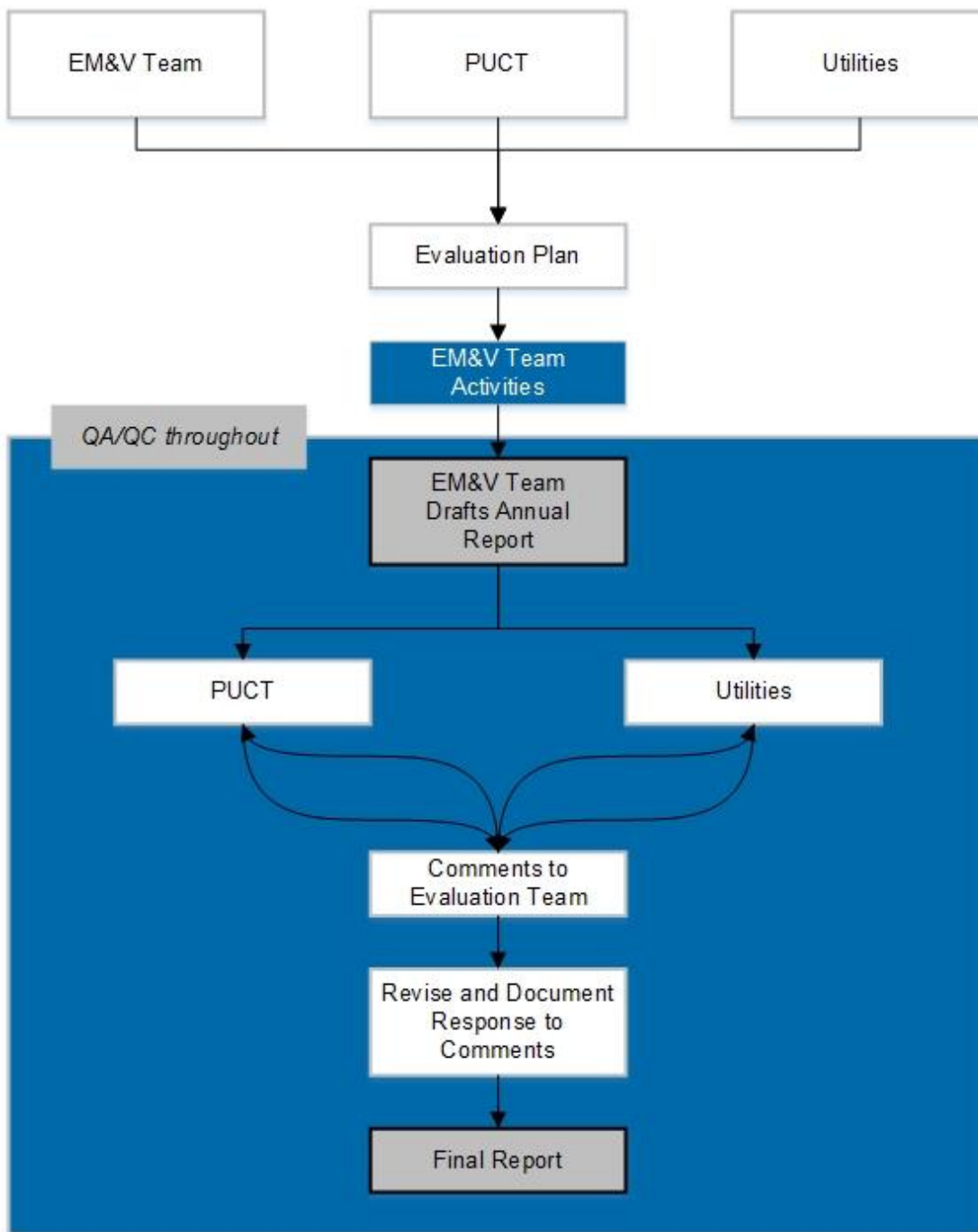
For PY2018, the metrics to be used as the basis for recommendations in the reports are the program's gross savings realization rate and associated program documentation score, tracking system and interval meter data reviews, desk review and on-site M&V findings including site-specific realization rates, 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, and/or sectors. Quality assurance and quality control are conducted to ensure that results being entered into and extracted from the database are accurate. The EM&V team's quality assurance/quality control (QA/QC) plan for the reported evaluated savings is in Appendix C.

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

The flow chart in Figure 1-2 describes the general reporting process flow.

Figure 1-2. Reporting Flow Chart



2.0 AEP TCC IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for AEP TCC's 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

2.1 Key Findings

2.1.1 Evaluated Savings

AEP TCC's evaluated savings for PY2018 were 43,812 in demand (kW) and 62,423,061 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are 100 percent. AEP TCC was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 2-4), which also supported healthy realization rates.

Table 2-1 shows the claimed and evaluated demand savings for AEP TCC's portfolio and broad customer sector/program categories.

Table 2-1. AEP TCC PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	43,812	43,812	100.0%	0.2%
Commercial	19.9%	8,733	8,733	100.0%	0.1%
Residential	24.2%	10,597	10,597	100.0%	0.8%
Low Income	1.8%	805	805	100.0%	n/a
Load Management	54.0%	23,677	23,677	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 resulting level of load curtailment achieved for each event for all participants.

Table 2-2 shows the claimed and evaluated energy savings for AEP TCC's portfolio and broad customer sector/program categories for PY2018.

Table 2-2. AEP TCC PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	62,416,805	62,423,061	100.0%	0.1%
Commercial	64.9%	40,483,377	40,489,770	100.0%	0.1%
Residential	33.0%	20,600,854	20,600,716	100.0%	0.3%
Low Income	2.1%	1,308,897	1,308,897	100.0%	n/a

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Load Management	0.0%	23,677	23,677	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 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. 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–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 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 and/or high savings programs have been identified.

AEP TCC received a Good program documentation score for all of its commercial and residential programs where documentation was reviewed by the evaluation team.

2.1.2 Cost-effectiveness Results

AEP TCC's overall portfolio had a cost-effectiveness of 2.16, or 2.34 excluding low-income programs. (See Table 2-3)

The more cost-effective programs were Commercial Solutions Market Transformation Program (MTP) and SCORE/CitySmart Market Transformation Program (MTP). The less cost-effective programs were CoolSaver A/C Tune-Up Market Transformation Program (MTP) and SMART Source Solar PV Market Transformation Program (MTP).

The lifetime cost of evaluated savings was \$0.010 per kWh and \$22.11 per kW.

Table 2-3. AEP TCC Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.16	2.16	1.95
Total Portfolio excluding low-income programs	2.34	2.34	2.10
Commercial	2.87	2.87	2.59
Commercial Solutions MTP	3.66	3.66	3.29
Commercial SOP	3.35	3.36	3.04
CoolSaver A/C Tune-Up MTP	1.34	1.34	1.07

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Open MTP	1.70	1.70	1.62
SCORE/CitySmart MTP	3.56	3.56	3.20
SMART Source Solar PV MTP	2.03	2.03	2.06
Residential	1.88	1.88	1.65
CoolSaver A/C Tune-Up MTP	1.15	1.15	0.92
High-Performance New Homes MTP	2.04	2.04	1.43
Residential SOP	2.12	2.12	1.88
SMART Source Solar PV MTP	1.22	1.22	1.23
Hard-to-Reach SOP	1.75	1.75	1.75
Low Income*	1.50	1.50	1.50
Targeted Low-Income Energy Efficiency Program*	1.50	1.50	1.50
Load Management	2.18	2.18	2.18
Load Management SOP	2.18	2.18	2.18

* The Low Income sector and Low Income Weatherization program are evaluated using the savings-to-investment ratio (SIR).

2.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project-level based on interim EM&V findings. Table 2-4 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 2-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR⁵ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Commercial Solutions MTP (Com)	1.10	2,566.00
Commercial SOP (Com)	15.70	491,545.00
Open MTP (Com)	-1.20	-6,921.10
SCORE/CitySmart MTP (Com)	15.20	103,782.00
Hard-to-Reach SOP (HTR)	-0.20	-319.50
Residential SOP (Res)	0.10	-218.90
Total	30.70	590,433.50

⁵ Energy Efficiency Cost Recovery

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%	1,083	1,083	100.0%	8.7%	5,459,625	5,458,222	100.0%	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 PY2018 Commercial Solutions MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 5 percent and one project had adjustments greater than 5 percent compared to the original claimed savings. AEP TCC 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 1133394: The energy efficiency project included an early replacement of HVAC equipment, interior lighting retrofits with controls, and exterior lighting retrofits at an office building. During the desk review and on-site M&V visit, the EM&V team adjusted the unit quantity in the HVAC portion of the project (11 units instead of 10 claimed) and corrected the capacity of the baseline equipment from nominal capacity to rated capacity. Because of the nature of the project, a 1-for-1 replacement calculation was not possible. One of the installed units was set to be ineligible by the implementer due to a rule that disqualifies savings for equipment sized outside of 20 percent of the pre-retrofit unit size. This rule was not applied in this specific case because the overall project difference between total cooling capacity of all pre- and post-equipment is minimal, only 1 ton out of 55-tons total, or about 2 percent difference. The cooling capacity was adjusted for six of eight baseline entries based on the Air-conditioning, Heating, and Refrigeration Institute (AHRI) rated cooling capacity. This resulted in a total rated cooling capacity baseline of 655,500 BTU/hr, which is close to the installed rated capacity of the 11 installed units, 643,500 BTU/hr. The reduced baseline capacity reduced the demand and energy savings, but the deemed efficiency values were unaffected. For the lighting and controls portion of the project, post-retrofit equipment inventory in the submitted calculator appeared to be entered erroneously. Therefore, several line items were removed from the final savings calculation. The EM&V team also adjusted the wattage for some interior fixtures using DLC certifications matching the model number listed in the invoice (2GTL4 A12 120 LP840), as the DLC certification provided was from 2015 and did not match the model number exactly. The wattage was adjusted from 39W claimed to 29W. This increased the peak demand and energy savings. Also, the model number of the outdoor wall pack fixture was identified as ANJEET WP-0041, which was claimed to be DLC-certified, but no certification was found for the model number. The EM&V team corrected the qualification from “DLC” to “Non-qualified.” Overall, the adjustments for both portions of the project resulted in an

increase in demand and energy savings and realization rates of 107 percent kW and 104 percent kWh.

Participant ID 1154681: The energy efficiency project included interior lighting retrofits at a non-24-hr supermarket. During the desk review and on-site M&V visit, the EM&V team corrected fixture quantities. The post-retrofit 19W LED fixture quantity was adjusted to match the existing quantity of 27 fixtures, as seven more fixtures were installed per on-site findings. This adjustment slightly decreased the energy and demand savings and resulted in realization rates of 99 percent kW and kWh.

Participant ID 1153005: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team adjusted the LED tube wattage from 10W claimed to 10.5W to match DLC qualified products list since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W). This adjustment resulted in a decrease in energy and demand savings and realization rates of 97 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team 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
7.4%	3,222	3,222	100.0%	29.4%	18,321,586	18,329,302	100.0%	Good

Completed Desk Reviews*	On-Site M&V
13	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 PY2018 Commercial SOP evaluation efforts focused on desk reviews and on-site M&V. The number 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. Three projects had adjustments of less than 5 percent and five projects had adjustments greater than 5 percent compared to the original 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 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1113074: The energy efficiency project included the installation of an Energy Star roof at a retail building. During the desk review and on-site M&V visit, the EM&V team reduced the total roof square footage by approximately 900 square feet based on on-site measurement. This

adjustment reduced demand and energy savings and resulted in realization rates of 95 percent kW and kWh.

Participant ID 1113079: The energy efficiency project included interior lighting retrofits with some controls at an office building. During the desk review and on-site M&V visit, the EM&V team corrected the building type selection for interior lighting from “Service Non-Food” to “Office.” The on-site visit also found that all lighting controls were relay-switch only and did not qualify as automated controls. Therefore, post-retrofit equipment occupancy sensors were adjusted to “None.” In addition, the pre-retrofit fixture code in the elevator was adjusted from 4-lamp to single lamp. The post-retrofit equipment wattage was also adjusted from 20W to 20.5W to match DLC qualified products list since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W). Some flood lighting fixtures were moved from exterior inventory of Participant ID 1113080 to exterior inventory of Participant ID 1113079, as this project focused on the administration building. Overall, these adjustments resulted in a decrease in energy and demand savings and realization rates of 95 percent kW and 97 percent kWh.

Participant ID 1113080: The energy efficiency project included interior lighting retrofits with some controls, and exterior lighting retrofits at a non-food service shop. During the desk review and on-site M&V visit, the EM&V team adjusted the LED wattage for some of the installed interior and exterior fixtures using the DLC qualified products list, from 35W claimed to 28W, from 18W claimed to 21W, and from 80W claimed to 81W. In addition, some flood lighting fixtures were moved from exterior inventory of Participant ID 1113080 to exterior lighting of Participant ID 1113079, as that project focused on the administration building. Overall, the adjustments decreased energy and demand savings and resulted in realization rates of 98 percent kW and kWh.

Participant ID 1139122: The energy efficiency project included interior lighting retrofits at a non-refrigerated warehouse with attached offices. During the desk review and on-site M&V visit, the EM&V team corrected the building type selection from "Non-Refrigerated Warehouse" to "Office" for the deemed portion of the project. The coincidence factor (CF) for both building types is the same, however the annual operating hours (HOU) associated with office buildings is 3,737 hours more than a non-refrigerated warehouse, 3,501 hours, which slightly increased the savings. The EM&V team also adjusted the wattage of the 300W LED fixtures to 302W using the DLC qualified products list, which slightly decreased the evaluated savings. Overall, the adjustments resulted in realization rates of 100 percent kW and 101 percent kWh.

Participant ID 1141283: The energy efficiency project included interior lighting retrofits at a non-refrigerated warehouse. During the desk review and on-site M&V visit, the EM&V team adjusted the air conditioning type from “Air-Conditioned” to “None” and the pre- and post-install controls were corrected from “DL-On/Off” to “None.” Overall, the adjustments resulted in a significant increase in energy and demand savings and realization rates of 126 percent kW and 132 percent kWh.

Participant ID 1139123: The energy efficiency project included interior lighting retrofits at an enclosed mall retail building. During the desk review and on-site M&V visit, the EM&V team adjusted the LED wattage for some of the installed fixtures using the DLC qualified products list, from 43W claimed to 26W, and from 13W claimed to 13.5W. The latter adjustment was a result of using version 2018.5 of the LSF calculator, which allows for wattages in 0.5 increments (up to 25W). In addition, some of the fixture qualifications were corrected from “Non-qualified” to “DLC.” Overall, the adjustments increased demand and energy savings and resulted in realization rates of 106 percent kW and kWh.

Participant ID 1183625: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team corrected the building type selection for interior lighting from “Retail (Other)” to “Retail/Supermarket 24-hr.” This adjustment resulted in a significant increase in energy savings and realization rates of 106 percent kW and 188 percent kWh.

Participant ID 1183900: The energy efficiency project included interior and exterior lighting retrofits at a school. During the desk review, the EM&V team adjusted the LED wattage for some of the installed fixtures from 28W claimed to 29W using the DLC qualified products list. This adjustment resulted in a negligible decrease 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. However, partial documentation was provided for one lighting project. The final ex-ante calculator was missing for the project, but the EM&V team was able to complete the evaluation using other documentation such as invoices. Since sufficient documentation was provided for all projects, 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
1.9%	844	844	100.0%	5.7%	3,536,803	3,536,884	100.0%	Good

Completed Desk Reviews*	On-Site M&V
10	5

*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 PY2018 Open MTP evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The evaluated savings differed from the original claimed savings for eight projects. Two projects had adjustments of less than 5 percent and six projects had adjustments greater than 5 percent compared to the original 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 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1131941: The energy efficiency project included interior lighting retrofits at a day care building. During the desk review and on-site M&V visit, the EM&V team adjusted the fixture

quantity for some LED tubes; 10 fewer 18W LED tubes were found in the interior spaces. This correction resulted in an increase in demand and energy savings and realization rates of 106 percent kW and kWh.

Participant ID 1133107: The energy efficiency project included interior lighting retrofits at a strip mall retail store. During the desk review, the EM&V team adjusted the LED fixture wattage using the DLC qualified products list. All 114 LED tubes were adjusted from 18W claimed to 21W. This correction decreased demand and energy savings and resulted in realization rates of 92 percent kW and kWh.

Participant ID 1133549: 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 adjusted fixture wattages, fixture codes, and fixture quantities. Wattages were adjusted from 10W and 20W to 9.5W and 20.5W respectively since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. In addition, the pre-retrofit fixture code of the compact fluorescent bulbs was adjusted from I30/1 to CF30/1-SCRW. This shifted savings from LED to Integrated Ballast LED. The baseline fixture counts were also adjusted from 112 to 116 per on-site findings. The installed LED tube count was adjusted from 124 to 132, as the project was a 2-lamp per fixture retrofit, and no additional indoor fixtures were added to existing inventory. Overall, the corrections resulted in a slight increase in demand and energy savings and realization rates of 102 percent kW and kWh.

Participant ID 1153229: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team adjusted the LED wattage for some of the installed fixtures from 18W claimed to 21W using the DLC qualified products list. This adjustment decreased demand and energy savings and resulted in realization rates of 92 percent kW and kWh.

Participant ID 1154642: The energy efficiency project included interior lighting retrofits at a strip mall retail store. During the desk review and on-site M&V visit, the EM&V team found slight differences in fixture quantities and minor corrections to fixture wattages to coincide with the site verified lighting model number installed and using the DLC qualified products list. The primary adjustment was the wattage of LED tubes, which was adjusted from 18W claimed to 21W. Overall, the corrections resulted in a decrease in demand and energy savings and realization rates of 88 percent kW and kWh.

Participant ID 1156862: The energy efficiency project included interior and exterior lighting retrofits at a strip mall retail store. During the desk review, the EM&V team corrected some of the fixtures from exterior to interior lighting. Twelve incandescent lamps were replaced with 12 LED lamps and were claimed as exterior lighting. However, the post-inspection photos indicated that the lamps were located inside the store. This adjustment increased demand and energy savings and resulted in realization rates of 108 percent kW and 101 percent kWh.

Participant ID 1156875: The energy efficiency project included interior lighting retrofits at a health out-patient building. During the desk review and on-site M&V visit, the EM&V team adjusted fixture wattages. Lighting tube wattages were adjusted from 15W and 17W to 14.5W and 17.5W respectively since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W). In addition, the wattage of the existing halogen bulbs was adjusted from 35W to 38W based on the provided photo. Overall, the corrections resulted in a slight increase in demand and energy savings and realization rates of 102 percent kW and kWh.

Participant ID 1131889: The energy efficiency project included interior and exterior lighting retrofits at a non-food service building. During the desk review and on-site M&V visit, the EM&V team

adjusted fixture quantities and wattages. Several interior and exterior fixtures were removed from claimed savings per on-site findings. In addition, the EM&V team found that the existing wall pack fixture that was meant to be replaced was inoperable. The wattage of some interior LED fixtures was also adjusted from 120 to 116 using DLC qualified products list. The total quantity of this corn cob style LED fixture was adjusted from 29 to 27 per on-site findings. Overall, the corrections decreased demand and energy savings and resulted in realization rates of 97 percent kW and 95 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, 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
4.1%	1,796	1,796	100.0%	14.3%	8,924,060	8,924,060	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 PY2018 SCORE/CitySmart MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 one project. The project had adjustments greater than 5 percent compared to the original claimed savings. AEP TCC 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 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1154607: The energy efficiency project included interior and exterior lighting retrofits at a school. During the desk review and on-site M&V visit, the EM&V team adjusted fixture wattages, fixture codes, and fixture quantities. For the interior lighting portion of the project, some pre-retrofit fixture codes were adjusted from F44T12 to F42T12, and the quantities for post-retrofit 18W LED fixtures were corrected from 204 claimed to 192, from 1,764 claimed to 1,756, and from 1,356 claimed to 1,362 per on-site findings. For the exterior lighting portion of the project, the EM&V team adjusted the post-retrofit wattage for some fixtures from 50W to 48W using DLC qualified products list. Qualification was also adjusted for three LED fixtures (LED048, LED152, and LED030) from “Non-Qualified” to “DLC” and “ENERGY STAR[®]” respectively. The quantities of

these fixtures were installed one for one. Overall, the corrections significantly increased demand and energy savings and resulted in realization rates of 131 percent kW and 137 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

2.4 Detailed Findings—Residential (High/Medium Evaluation Priority)

2.4.1 High Performance New Homes 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
2.4%	1,035	1,035	100.0%	4.6%	2,842,771	2,842,771	100.0%	Good

Completed Desk Reviews*	On-Site M&V
9	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 PY2018 impact evaluation efforts focused on desk reviews. The number of sampled and completed desk reviews for this program is listed above.

The EM&V team focused on reviewing documentation for program homes. This program relies on a proprietary energy model; however, that model is built on DOE-2 energy modeling software that is listed as an acceptable savings estimation method in the TRM.

We received two types of documentation from the program: REM/Rate files that provided the inputs that fed into the energy models and detailed output files that provided the results of the energy model analysis. We reviewed the REM/Rate files to ensure that all homes met stated program requirements, and that the files contained all inputs required by the DOE-2-based model. We compared the results of the model to the claimed savings in the tracking database and found that all of the model output files matched the claimed savings in the tracking data. We did not recommend any adjustments for this program.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., energy model inputs and detailed model outputs). Because sufficient documentation was provided for all the reviewed projects, the EM&V team assigned a program documentation score of Good.

2.4.2 Residential Standard Offer Program (SOP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
14.5%	6,373	6,373	100.0%	17.0%	10,617,931	10,617,891	100.0%	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of sampled and completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for five projects. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for 12 projects and resulted in desk review realization rates of 100.2 percent and 98.7 percent for demand and energy savings, respectively. There were minor differences between ex-ante and ex post savings for LEDs due to rounding. On-site M&V was completed for six projects and resulted in on-site realization rates of 99.8 percent and 96.1 percent for demand and energy savings, respectively. Further details for the projects where adjustments were made, including the EM&V findings, are provided below.

Participant ID 1113650: The energy efficiency project included implementation of air infiltration, duct sealing, and LED measures. The EM&V team's on-site testing resulted in a substantially higher reduction in air infiltration and duct sealing than what was documented by the program. Using a threshold of +/- 10 percent, the EM&V team's blower door test and duct blaster test results were quite a bit lower than the results found in the tracking data. Additionally, minor adjustments were made to the LED measure. Overall, the adjustments resulted in project level realization rates of 136.7 percent and 135.1 percent for demand and energy savings, respectively.

Participant ID 1113709: The energy efficiency project included implementation of air infiltration and duct sealing. The EM&V team verified that the results found in the tracking system data matched the results found in the documentation. The EM&V team initially calculated savings using the information in the tracking data and documentation but was unable to replicate the reported savings. The EM&V team then worked to replicate reported savings using alternative inputs for heating, cooling, or climate zone, but was unable to do so. As a result, the EM&V team adjusted savings based on the results found in the documentation package received for this project ID. Overall, the adjustments resulted in project level realization rates of 110.6 percent and 107.8 percent for demand and energy savings, respectively.

Participant ID 1114318: The energy efficiency project included implementation of duct sealing, low flow shower heads, low flow faucet aerators, and LED measures. Through the on-site visit, the

EM&V team found that the low flow showerhead had been uninstalled and replaced with a showerhead equivalent to the baseline. The EM&V team also measured the flow rate of the installed low flow faucet aerator and determined it was 1.0 gallons per minute and not 0.5 gallons per minute, per the tracking data. As a result, the EM&V team zeroed out savings for the low flow showerhead and adjusted the low flow faucet aerator savings accordingly. Overall, the adjustments resulted in project level realization rates of 68.0 percent and 71.8 percent for demand and energy savings, respectively.

Participant ID 1114684: The energy efficiency project included implementation of air infiltration, duct sealing, and LED measures. The EM&V team’s on-site testing resulted in a substantially lower reduction in duct leakage than what was documented by the program. Using a threshold of +/- 10 percent, the EM&V team’s duct blaster test results were still quite a bit higher than the results found in the tracking data. Overall, the adjustments resulted in project level realization rates of 82.6 percent and 82.9 percent for demand and energy savings, respectively.

Participant ID 1115659: The energy efficiency project included implementation of air infiltration, low flow shower heads, low flow faucet aerators, and LED measures. Through the on-site visit, the EM&V team found that the low flow showerhead had been uninstalled and replaced with a showerhead equivalent to the baseline. As a result, the EM&V team zeroed out savings for the low flow showerhead and adjusted accordingly. Overall, the adjustments resulted in project level realization rates of 89.0 percent and 80.1 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration and duct efficiency. There was limited documentation for direct installs such as LEDs, low flow showerheads, and low flow faucet aerators. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

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

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
4.8%	2,113	2,113	100.0%	5.8%	3,592,816	3,592,719	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of sampled and completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for one project. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for eight projects and resulted in desk review realization rates of 99.8 percent and 96.7 percent for demand and energy savings, respectively. On-site M&V was completed for four projects and resulted in on-site realization rates of 99.8 percent and 95.1 percent for demand and energy savings, respectively. Further details for the single project where adjustments were made, including the EM&V findings, are provided below.

Participant ID 1117483: The energy efficiency project included implementation of air infiltration and duct sealing. The EM&V team’s on-site testing resulted in a substantially lower reduction in air infiltration than what was documented by the program. Using a threshold of +/- 10 percent, the EM&V team’s blower door test results were quite a bit higher than the results found in the tracking data. The EM&V team noted that the HVAC closet ceiling had been cut away to make room for the gas furnace exhaust piping. Per the homeowner, they had the HVAC unit replaced after the initial project was implemented. The area cut away exposed a hole into the attic that likely contributed to the additional infiltration. Overall, the adjustments resulted in project level realization rates of 67.3 percent and 69.5 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration and duct efficiency. There was limited documentation for direct installs such as LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

2.5 Detailed Findings—Load Management (High Evaluation Priority)

2.5.1 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
54.0%	23,677	23,677	100.0%	0.0%	23,677	23,677	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 resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the AEP TCC Commercial Load Management Program 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 occurred on the following dates and times:

- May 31, 2018, from 4:00 p.m. to 5:00 p.m. (scheduled)

- August 10, 2018, from 1:00 p.m.to 2:00 p.m. (scheduled)

The EM&V team received the interval meter data and a spreadsheet detailing the AEP TCC calculated event level savings for each ESI ID enrolled in the program. All ESI IDs participated in only one of the two scheduled events. The EM&V team found that all savings calculated by AEP TCC matched those of the EM&V Team. As such, no adjustments were made to the program savings.

Evaluated savings for the AEP TCC Load Management program are 23,677 kW and 23,677 kWh. The realization rate for both kW and kWh is 100.0 percent.

2.6 Summary of Low Priority Evaluation Programs

Table 2-5 provides a summary of claimed savings for AEP TCC's PY2018 low evaluation priority programs, which includes each program's overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2018 tracking data provided to the EM&V team for the EM&V database.

Table 2-5. PY2018 Claimed Savings Low Evaluation Priority Programs

Program	Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)
CoolSaver A/C Tune-Up MTP	3.6%	1,573	1,573	100.0%	5.7%	3,541,794	3,541,794	100.0%
SMART Source Solar PV MTP	0.5%	215	215	100.0%	1.1%	699,508	699,508	100.0%
CoolSaver A/C Tune-Up MTP	2.1%	940	940	100.0%	4.9%	3,088,081	3,088,081	100.0%
SMART Source Solar PV MTP	0.3%	136	136	100.0%	0.7%	459,255	459,255	100.0%
Targeted Low-Income Energy Efficiency Program	1.8%	805	805	100.0%	2.1%	1,308,897	1,308,897	100.0%

3.0 AEP TNC IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for AEP TNC's 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

3.1 Key Findings

3.1.1 Evaluated Savings

AEP TNC's evaluated savings for PY2018 were 8,948 in demand (kW) and 12,669,221 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 3-4), which also supported healthy realization rates.

Table 3-1 shows the claimed and evaluated demand savings for AEP TNC's portfolio and broad customer sector/program categories.

Table 3-1. AEP TNC PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	8,948	8,948	100.0%	0.5%
Commercial	19.8%	1,773	1,773	100.0%	0.1%
Residential	23.5%	2,104	2,105	100.0%	2.2%
Low Income	1.2%	107	107	100.0%	n/a
Load Management	55.5%	4,963	4,963	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 resulting level of load curtailment achieved for each event for all participants.

Table 3-2 shows the claimed and evaluated energy savings for AEP TNC's portfolio and broad customer sector/program categories for PY2018.

Table 3-2. AEP TNC PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	12,669,276	12,669,221	100.0%	0.5%
Commercial	72.4%	9,171,126	9,170,588	100.0%	0.1%
Residential	26.1%	3,304,568	3,305,049	100.0%	1.9%
Low Income	1.5%	188,620	188,620	100.0%	n/a

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Load Management*	0.0%	4,963	4,963	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 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. 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–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 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 and/or high savings programs have been identified.

AEP TNC received Good documentation scores for all of its residential and load management programs, and a majority of its commercial programs. Its Commercial SOP received a Fair documentation score, driven by a lack of key project notes and calculations within one project's files.

3.1.2 Cost-effectiveness Results

AEP TNC's overall portfolio had a cost-effectiveness of 2.05, or 2.26 excluding low-income programs. (See Table 3-3.)

The more cost-effective programs were Commercial SOP and Load Management SOP. The less cost-effective programs were the Targeted Low Income Energy Efficiency program and SMART Source Solar PV MTP. The Low Income program is falling slightly short of 1.0 using the savings-to-investment ratio test, as is standard for this program.

The lifetime cost of evaluated savings was \$0.010 per kWh and \$22.55 per kW.

Table 3-3. AEP TNC Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.36	2.36	2.18
Total Portfolio excluding low-income programs	2.61	2.61	2.41
Commercial	2.74	2.74	2.50
Commercial Solutions MTP	3.45	3.45	3.10
Commercial SOP	3.78	3.78	3.42

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Open MTP	1.59	1.59	1.51
SCORE/CitySmart MTP	2.80	2.80	2.51
SMART Source Solar PV MTP	1.34	1.34	1.36
Residential	2.35	2.35	2.18
Residential SOP	2.67	2.67	2.36
SMART Source Solar PV MTP	1.55	1.55	1.57
Hard-to-Reach SOP	2.08	2.09	2.09
Low Income*	0.94	0.94	0.94
Targeted Low Income Energy Efficiency Program*	0.94	0.94	0.94
Load Management	3.55	3.55	3.55
Load Management SOP	3.55	3.55	3.55

* The Low Income sector and Low Income Weatherization program are evaluated using the savings-to-investment ratio (SIR).

3.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project level based on interim EM&V findings. Table 3-4 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 3-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR⁶ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Commercial SOP (Com)	0.90	6,065.00
Open MTP (Com)	-1.70	-53,012.40
Hard-to-Reach SOP (HTR)	-1.80	-3,035.10
Total	-2.60	-49,982.50

⁶ Energy Efficiency Cost Recovery

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
7.5%	673	673	100.0%	29.2%	3,695,280	3,695,280	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 PY2018 Commercial Solutions MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

3.3.2 Commercial Standard Offer Program (SOP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
5.0%	445	445	100.0%	19.7%	2,490,444	2,489,631	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 PY2018 Commercial SOP evaluation efforts focused on desk reviews and on-site M&V. The number 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 four projects. Three projects had adjustments of less than 5 percent and one project had adjustments greater than 5 percent compared to the original

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 1117493: The energy efficiency project included interior and exterior lighting retrofits at a retail building. During the desk review, the EM&V team corrected fixture wattages, quantities, lighting controls, and lighting qualification. For the interior lighting portion of the project, the post-retrofit wattages were adjusted for all fixtures from 53W claimed to 54W, and from 26W and 39W claimed to 15W using the DLC and ENERGY STAR® qualified products list. The quantities were corrected to reflect number of lamps replaced per fixture, and total number of LED lamps installed was confirmed with the provided invoice. In addition, the fixture code was adjusted from “SCRW” to “FIXT,” which shifted savings from the measure “Integrated Ballast LED” to the measure “LED.” Occupancy sensor controls were also added to pre- and post-fixtures per post-inspection notes findings. For the exterior lighting portion of the project, recessed fixtures (interior type) were determined to be eligible fixtures based on TRM allowances because it was on the ENERGY STAR qualified products list. Overall, the adjustments for both portions of the project increased demand and energy savings and resulted in realization rates of 126 percent kW and 132 percent kWh.

Participant ID 1117494: 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 the quantity of some outdoor fixtures from 17 claimed to 19 per on-site visit findings. This adjustment resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1140631: The energy efficiency project included exterior lighting retrofits at a retail building. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of some fixtures from 37W claimed to 38W using DLC qualified products list and corrected the quantity of installed canopy LED fixtures located on the south canopy from 6 to 4 per on-site visit findings. These adjustments resulted in a negligible increase in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1140628: The energy efficiency project included interior and exterior lighting retrofits at a retail building. During the desk review, the EM&V team adjusted the quantities for several fixtures to match 1 for 1 LED tubes per T8 replaced and the metal halide fixtures replacement with 6 LED tubes. The total quantity of pre- and post-retrofit equipment for the project remained the same. The EM&V team also adjusted the wattage of some LED tubes from 18W claimed to 18.5W to match DLC qualified products list since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W). Overall, these adjustments slightly decreased demand and energy savings and resulted in realization rates of 99 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

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
4.0%	357	357	100.0%	12.2%	1,544,383	1,544,477	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 PY2018 Open MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 four projects. Three projects had adjustments of less than 5 percent and one project had adjustments greater than 5 percent compared to the original 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 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1133186: The energy efficiency project included exterior lighting retrofits at a retail building. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage of some fixtures from 130W claimed to 128W and from 162W claimed to 163W using DLC qualified products list and photos. In addition, the fixture code was corrected from “SCRW” to “FIXT” for a 500W pre-retrofit equipment, which shifted savings from the measure “Integrated Ballast LED” to the measure “LED.” Overall, these adjustments resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1133629: The energy efficiency project included exterior lighting retrofits at a retail building. During the desk review, the EM&V team used the 2018.5 LSF calculator, which adjusted the annual operating hours (HOU) and coincidence factor (CF) to match the Texas TRM 5.0. (Earlier versions of the 2018 LSF calculator had wrong HOU and CF values for retail buildings.) In addition, the EM&V team adjusted the bulb wattage from 9W claimed to 9.5W since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W). Overall, these adjustments slightly decreased demand and energy savings and resulted in realization rates of 98 percent kW and 99 percent kWh.

Participant ID 1133630: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team noticed some of the cells in the submitted calculator described custom adjustments, which were not supported by documentation. The corrections slightly increased demand and energy and resulted in realization rates of 101 percent kW and kWh.

Participant ID 1153125: 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 building type from “Manufacturing 3-shift” to “Manufacturing 1-shift” based on on-site visit findings confirming that one shift is the normal operation of the facility. This significantly reduced the energy savings (kWh). The air conditioning type was also adjusted to “none” for the shop areas in the facility because they were not air conditioned. In addition, the EM&V team corrected

fixture wattages and lighting controls type. The wattage for 11 outdoor wall packs was adjusted from 66W claimed to 65W; the wattage for 40 high bay linear LED fixtures in the manufacturing area was adjusted from 166W claimed to 158W using the DLC qualified products list; and photocell controls were added to outdoor lighting controls, as the project claimed ODL savings (with ex-ante calculator showing no pre/post ODL controls). Overall, these corrections resulted in a significant decrease in demand and energy savings and realizations rates of 89 percent kW and 53 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, 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
2.7%	245	245	100.0%	10.2%	1,289,705	1,289,887	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 PY2018 SCORE/CitySmart MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 one project. The project had adjustments of less than 5 percent compared to the original claimed savings and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1131808: 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 adjusted the wattage of 93 fixtures from 11.5W claimed to 12W using the DLC qualified products list. This adjustment resulted in a negligible increase in demand and energy savings and resulted in 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

3.4 Detailed Findings—Residential (Medium Evaluation Priority)

3.4.1 Residential Standard Offer Program (SOP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
15.2%	1,360	1,360	100.0%	16.3%	2,065,028	2,065,028	100.0%	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for six projects and resulted in desk review realization rates of 100 percent and 100 percent for demand and energy savings, respectively. On-site M&V was completed for three projects and resulted in on-site realization rates of 100 percent and 100 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition) for central air conditioners and air infiltration. There was limited documentation for direct installs such as low flow showerheads and LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

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

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
7.5%	669	670	100.1%	7.8%	993,767	994,248	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for one project. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for six projects and resulted in desk review realization rates of 99.8 percent and 96.7 percent for demand and energy savings, respectively. On-site M&V was completed for four projects and resulted in on-site realization rates of 106.2 percent and 105.4 percent for demand and energy savings, respectively. Further details for the single project where adjustments were made, including the EM&V findings, are provided below.

Participant ID 1140930: The energy efficiency project included implementation of the ceiling insulation and duct sealing measures. TRM 5.0 Volume 2 contains an eligibility requirement for the ceiling insulation measure, the application of which led to a difference in claimed and evaluated savings for this project. TRM 5.0 Volume 2 states for any reported pre-retrofit R-value that falls below R-5, all contractors are required to provide sufficient evidence including two pictures: 1) a picture showing the entire attic floor, and 2) a close-up picture of a ruler that shows the measurement of the depth of the insulation. In the absence of evidence demonstrating pre-retrofit ceiling insulation below R-5, the lowest level of pre-retrofit ceiling insulation that can be claimed is the R-5 to R-8 range. The baseline reported was less than R-5 level insulation and the EM&V team determined the documentation provided did not meet the TRM 5.0 Volume 2 requirement and, as a result, adjusted the baseline to R-5. Overall, the adjustment resulted in project level realization rates of 40.7 percent and 38.3 percent for demand and energy savings, respectively.

Additionally, the overall realization rates were influenced by five measures within four projects that fell within the 5 percent project-level adjustment threshold. Of these four projects, one project contained both air infiltration and duct sealing measures. Per protocol, the Texas IOUs are not required to make savings modifications for project-level adjustments within the 5 percent threshold, and as such, AEP

TNC elected to not adjust these projects. In summary, high-level findings for these four projects includes:

- Using a threshold of +/-10 percent, the EM&V team’s on-site testing for one air infiltration project and one duct sealing project yielded substantially higher reduction than what was reported by the program.
- The EM&V team’s on-site testing also found substantially lower reduction for three duct sealing projects and one air infiltration project.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration and duct efficiency. There was limited documentation for direct installs such as LEDs, low flow shower heads, and low flow faucet aerators as well as the single ceiling insulation measure. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

3.5 Detailed Findings—Load Management (High/Medium Evaluation Priority)

3.5.1 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
55.5%	4,963	4,963	100.0%	0.0%	4,963	4,963	100.0%	Good

Completed Desk Reviews*	On-Site M&V
NA	NA

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

The EM&V team evaluated the AEP TNC Commercial Load Management Program 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. A single load management event occurred on May 29, 2018, from 4:00 p.m. to 5:00 p.m.

The EM&V team received the interval meter data and a spreadsheet detailing the AEP TNC calculated event level savings for each ESI ID enrolled in the program. All ESI IDs participated in only one of the two scheduled events. The EM&V team found that all savings calculated by AEP TNC matched those of the EM&V team. As such, no adjustments were made to the program savings.

Evaluated savings for the AEP TNC Load Management program are 4,963 kW and 4,963 kWh. The realization rate for both kW and kWh is 100.0 percent.

3.6 Summary of Low Priority Evaluation Programs

Table 3-5 provides a summary of claimed savings for AEP TNC's low evaluation priority programs in PY2018, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2018 tracking data provided to the EM&V team for the EM&V database.

Table 3-5. PY2018 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 (Commercial)	0.6%	52	52	100.0%	1.2%	151,314	151,314	100.0%
SMART Source Solar PV MTP (Residential)	0.8%	75	75	100.0%	1.9%	245,773	245,773	100.0%
Targeted Low Income Energy Efficiency Program	1.2%	107	107	100.0%	1.5%	188,620	188,620	100.0%

4.0 CENTERPOINT IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for CenterPoint’s 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

4.1 Key Findings

4.1.1 Evaluated Savings

CenterPoint’s evaluated savings for PY2018 were 176,346 in demand (kW) and 162,355,222 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are 100 percent. CenterPoint was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 4-4), which also supported healthy realization rates.

Table 4-1 shows the claimed and evaluated demand savings for CenterPoint’s portfolio and broad customer sector/program categories.

Table 4-1. CenterPoint PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	176,346	176,346	100.0%	0.0%
Commercial	8.4%	14,799	14,799	100.0%	0.0%
Residential	15.5%	27,266	27,266	100.0%	0.0%
Low Income	2.4%	4,174	4,174	100.0%	n/a
Load Management	73.8%	130,107	130,107	100.0%	0.0%
Pilot	0.0%	0	0		n/a

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

Table 4-2 shows the claimed and evaluated energy savings for CenterPoint’s portfolio and broad customer sector/program categories for PY2018.

Table 4-2. CenterPoint PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	162,355,214	162,355,222	100.0%	0.0%
Commercial	52.7%	85,487,606	85,487,614	100.0%	0.0%
Residential	42.5%	68,951,860	68,951,860	100.0%	0.0%
Low Income	4.2%	6,745,990	6,745,990	100.0%	n/a

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Load Management	0.5%	781,166	781,166	100.0%	0.0%
Pilot	0.2%	388,592	388,592	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 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. 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 scores 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 and/or high savings programs have been identified.

Commercial Program Documentation: CenterPoint received a documentation score of “Good” for its Large Commercial SOP, while it received a “Fair” score for its Commercial MTP due to partial documentation available within three of its 14 project desk reviews. It received a score of “Limited” within its Retro-commissioning MTP. The evaluation team awarded this score due several factors, including lack of proof of purchase documentation, missing project photos, and limited project reports, which only included information about measured, target, and energy savings but did not include engineering plans and/or calculation methodologies.

Residential Program Documentation: Nearly all of CenterPoint’s high or medium evaluation priority Residential programs received a documentation score of “Good.” The exception was its Multifamily HTR MTP, which received a score of “Fair,” as the team was unable to verify key post-condition inputs and assumptions during this program’s desk reviews.

4.1.2 Cost-effectiveness Results

CenterPoint’s overall portfolio had a cost-effectiveness of 2.36, or 2.54 excluding low income programs. (See Table 4-3.)

The more cost-effective programs were Advanced Lighting and High Efficiency Homes MTP. The less cost-effective programs were Smart Thermostat Program (Pilot) and REP (CoolSaver & Efficiency Connection), neither of which passed cost-effectiveness. Pilots in their first year of operation are not required to pass cost-effectiveness.

The lifetime cost of evaluated savings was \$0.009 per kWh and \$19.30 per kW.

Table 4-3. CenterPoint Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.36	2.36	2.06
Total Portfolio excluding low-income programs	2.54	2.54	2.20
Commercial	2.19	2.19	1.97
Large Commercial SOP	2.63	2.63	2.38
Commercial MTP (SCORE, Healthcare , Data Center)	2.08	2.08	1.87
Retro-Commissioning MTP	0.99	0.99	0.89
REP (Commercial CoolSaver)	0.87	0.87	0.70
Advanced Lighting Commercial	7.24	7.24	6.52
Residential	3.34	3.34	2.70
CenterPoint Energy High Efficiency Homes MTP	3.93	3.93	2.75
REP (CoolSaver & Efficiency Connection)	1.01	1.01	0.91
Residential & SC SOP	1.70	1.70	1.51
Advanced Lighting Residential	9.86	9.86	8.87
Residential Pool Pump & A/C Distributor MTP	1.94	1.94	1.63
Multi-Family MTP	2.57	2.57	2.05
Hard-to-Reach SOP	1.13	1.13	1.13
Multi-Family MTP (HTR)	1.50	1.50	1.50
Low Income*	2.79	2.79	2.79
Targeted Low Income MTP (Agencies in Action)*	2.79	2.79	2.79
Load Management	1.71	1.71	1.71
Large Commercial Load Management SOP	1.83	1.83	1.83
Residential Demand Response Program	1.23	1.23	1.23
Pilot	0.41	0.41	0.35
Smart Thermostat Program (Pilot)	0.41	0.41	0.35

* The Low Income sector and Low Income Weatherization program are evaluated using the savings-to-investment ratio (SIR).

4.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project level based on interim EM&V findings. Table 4-4 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume the following adjustments will be included in CenterPoint’s May 1 filing.

Table 4-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR⁷ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Commercial MTP (SCORE, Healthcare, Data Center) (Com)	-152.10	-879,206.20
Large Commercial SOP (Com)	-1.10	-2,814.00
Retro-Commissioning MTP (Com)	-703.10	-1,404,332.80
Residential Pool Pump & A/C Distributor MTP (Res)	-6.00	-9,850.10
Total	-862.30	-2,296,203.10

4.3 Detailed Findings—Commercial (Medium Evaluation Priority)

4.3.1 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
3.7%	6,554	6,554	100.0%	24.9%	40,416,097	40,416,105	100.0%	Good

Completed Desk Reviews*	On-Site M&V
16	8

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

The PY2018 Large Commercial SOP evaluation efforts focused on desk reviews and on-site M&V. The number 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 nine projects. Seven projects had adjustments of less than 5 percent and two projects had adjustments greater than 5 percent compared to the original claimed savings. CenterPoint accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with adjustments and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1137685: The energy efficiency project included exterior lighting retrofits at a parking garage. During the desk review and on-site M&V visit, the EM&V team adjusted the pre- and post-retrofit lighting quantities per on-site visit findings. Since the site contact confirmed that the project was a one-for-one retrofit without any additional fixtures added, the baseline quantities were adjusted to match the final post-retrofit quantities. The fixture quantity in the stairwells was adjusted from 20 to 22 fixtures and the quantity in the parking area was adjusted from 155 to 156

⁷ Energy Efficiency Cost Recovery

fixtures. The minor adjustments negligibly decreased the energy savings, but the demand savings were unaffected, and resulted in realization rates of 100 percent kW and kWh.

Participant ID 1137692: The energy efficiency project included the new construction of interior and exterior lighting fixtures at a non-refrigerated warehouse. During the desk review, the EM&V team adjusted the operating hours and Coincidence Factor (CF) to match the Texas TRM 5.0 since the submitted savings calculation for exterior lighting was set up to use a custom calculation for savings at 7,380 operating hours and CF of 83 percent, which is much higher than the value recommended by the TRM (3,996 operating hours and CF of 61 percent). The correction resulted in a decrease in demand and energy savings and realization rates of 98 percent kW and 97 percent kWh.

Participant ID 1137695: 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 wattage of the 28W fixtures to 26W using the DLC qualified products list. This adjustment resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1137713: The energy efficiency project included an early replacement of HVAC equipment at a public assembly-type building. During the desk review and on-site M&V visit, the EM&V team found that two of the 6-ton units were different from what had been reported. The capacity and efficiency were adjusted per literature and AHRI testing, which increased the energy savings and resulted in realization rates of 100 percent kW and 110 percent kWh.

Participant ID 1137687: The energy efficiency project included exterior lighting retrofits at a 24-hr supermarket. During the desk review, the EM&V team corrected the quantities of several LED fixtures. The quantity was adjusted for the 175W fixtures from 19 to 15, for the 43W fixtures from 19 to 8, for the 511W fixtures from 14 to 16, and for the 453W fixtures from 8 to 4. In addition, the wattage of the wall pack fixtures was corrected from 42.5W claimed to 43W because the 0.5 increment was only allowable to a maximum of 25W. Overall, these adjustments resulted in an increase in demand and energy savings and realization rates of 112 percent kW and kWh.

Participant ID 1137696: The energy efficiency project included exterior lighting retrofits at a retail building. During the desk review, the EM&V team adjusted the quantity of the 4-head pole light fixtures installed from 19 to 17 per post inspection notes and invoice. This correction slightly increased the demand and energy savings and resulted in realization rates of 101 percent kW and kWh.

Participant ID 1137709: The energy efficiency project included the new construction of interior lighting at a non-refrigerated warehouse. During the desk review and on-site M&V visit, the EM&V team corrected the LED fixture wattages using the DLC qualified products list for the fixtures in the pump room from 29W claimed to 26W, and for the fixtures in the stairway from 29W claimed to 43W. In addition, the quantities of fixtures in two office rooms were adjusted from 77 to 78 and from 21 to 22 respectively per on-site visit findings. Overall, these corrections resulted in a slight decrease in demand and energy savings and realization rates of 99 percent kW and 100 percent kWh.

Participant ID 1161420: 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 quantities of fixtures in two parking levels from 17 to 18 and from 42 to 47 respectively and corrected the lighting controls for another parking level from "OS" to "None" per on-site visit findings. Overall, these adjustments decreased the demand and energy savings and resulted in realization rates of 97 percent kW and kWh.

Participant ID 1164261: 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 the wattages using the DLC qualified products list for some fixtures from 503W claimed to 516W. This correction resulted in a slight decrease in demand and energy savings and realization rates of 99 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

4.3.2 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%	769	769	100.0%	2.5%	4,067,882	4,067,882	100.0%	Limited

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 PY2018 Retro-commissioning MTP evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team reviewed four projects but adjusted the claimed savings for six projects. The two additional projects were similar to two of the four projects reviewed by the EM&V team and therefore received similar adjustments as described below. All six projects had adjustments greater than 5 percent compared to the original claimed savings. CenterPoint accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with adjustments and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1133756: The energy efficiency project included the retro-commissioning of existing HVAC equipment at a school. During the desk review and on-site M&V visit, the EM&V team made an adjustment to one implemented measure. For the M1.2 measure, the parameter “Diversity F” for the building load points was adjusted from 100 percent to 90 percent at an outside air temperature of 98 degrees F. This was done to match calculations completed for the measures M2.1 and M2.4, which used a diversity factor of 90 percent at the same facility. This was assumed to be a more typical and conservative way of estimating HVAC design load. Overall, the correction decreased the demand and energy savings and resulted in realizations rates of 99 percent kW and 91 percent kWh.

Participant ID 1133757: The energy efficiency project included the retro-commissioning of existing HVAC equipment at a school. During the desk review, the EM&V team made adjustments to four implemented measures. For measure M1.1, the parameter “Diversity F” for the building load points was corrected from 100 percent to 90 percent at an outdoor air temperature of 98 degrees F. This was done to match other measures that used a diversity factor of 90 percent at the same facility and was assumed to be a more typical and conservative way of estimating HVAC design load. For measure M2.1, the EM&V team adjusted the reduction in cooling energy (enthalpy) percentage based on proposed increased indoor air temperatures and adjusted the total hours of cooling in different temperature intervals in the calculator. Reported savings used the reduction in cooling enthalpy percentage difference between hour 1 temperature and baseline temperature, between hour 2 temperature and hour 1 temperature, and between hour 3 temperature and hour 2 temperature. The EM&V team adjusted this so that each hour's temperature reduction enthalpy was compared directly to the baseline enthalpy because each hour should be directly compared to the baseline enthalpy. For reported savings, total number of hours of different outdoor temperature intervals were recorded on the "PIVOT TABLE INFO" sheet in the calculator, which showed a school schedule of unoccupied time in 1-hour increments (3-4 p.m., 4-5 p.m., 5-6 p.m.). Each 1-hour time period showed total interval hours of 406 hours, which is not possible. School generally runs August through part of June, about 200 school days so, at most, planned setbacks during unoccupied time periods (3-4 p.m., 4-5 p.m., 5-6 p.m.) could not exceed approximately 200 hours in each time group. The EM&V team divided total number of hours in each temperature interval by 2 to estimate hours in each interval. For measure M2.4, the reported savings used incorrect enthalpy of reported current indoor air conditions. The reported conditions were 73 DB and 60 percent RH = 29.92 btu/lb dry air. The enthalpy at these conditions, however, is 28.92 btu/lb of dry air, which was adjusted accordingly. For measure M3.1, incorrect enthalpy was used for two summer peak probability hours. The enthalpy used for Month 8, Day12, hours ending 16 and 17 were 32.52 btu/lb and 31.57 btu/lb respectively. The calculator file noted that these values should be approximately 39 and 41 btu/lb. The EM&V team changed these values to the approximate values identified in the calculator notes. Overall, the corrections to the four measures increased the demand savings but reduced the energy savings and resulted in realization rates of 112 percent kW and 94 percent kWh.

Participant IDs 1158686, 1159635, 1162300 and 1166219: The energy efficiency projects included the implementation of several retro-commissioning measures at large office buildings. Two desk reviews were completed, with one including an on-site M&V visit. This review found that the projects claimed savings based upon calculations, but custom M&V process should have been used. This finding was applied to the additional similar projects, which were completed by the same team at different buildings on the office building campus. The EM&V team adjusted the savings to 40 percent of the calculated savings for all four projects. The remainder of the energy savings can be claimed in 2019 based upon the actual M&V at the properties. This is consistent with other utilities that claim a maximum of 40 percent in the implementation year with the remainder claimed when M&V is complete and actual data has been collected to confirm the savings calculations.

Documentation Score

The EM&V team was not able to verify key inputs and assumptions for most of the projects that had desk reviews completed, because partial documentation was provided for the sites. For two projects, limited information was provided about the engineering plan or how the measurement/calculation method was done on the site; the reports only covered measured, target, and final energy savings. For the rest of the projects, documentation lacked onsite M&V information. In addition, documentation did not include any proof of purchase or installation of some equipment and photographs. Complete documentation enhances the accuracy and transparency of project savings and the ease of evaluation.

Since sufficient documentation was not provided for most of the projects, the EM&V team assigned a program documentation score of Limited.

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

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
3.9%	6,837	6,837	100.0%	24.0%	38,977,944	38,977,944	100.0%	Fair

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 PY2018 Commercial MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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. Three projects had adjustments of less than 5 percent and two projects had adjustments greater than 5 percent compared to the original claimed savings. CenterPoint accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with adjustments and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1132953: The energy efficiency project included an early replacement of HVAC equipment at a school. During the desk review, the chiller efficiencies were slightly adjusted based on the manufacturer's product literature, which claims to be Air-conditioning, Heating, and Refrigeration institute (AHRI) certified based on AHRI 550/590 standard rating conditions. The AHRI certificate provided in the supporting documentation was for a smaller capacity chiller (210 series vs. 225 series), which has different capacity and efficiencies. The reported chiller specified a unit with options that were not included in the actual chiller installed. Installed equipment capacity and efficiencies were corrected in the ACE calculator based on the manufacturer's product data (AHRI 550/590): capacity was adjusted from 206.2 to 206.1 tons; the energy efficiency ratio (EER) was adjusted from 9.771 to 9.80; and the integrated energy efficiency ratio (IEER) was adjusted from 16.42 to 16.40. These adjustments slightly increased the demand savings and reduced the energy savings and resulted in realization rates of 102 percent kW and 100 percent kWh.

Participant ID 1133529: The energy efficiency project included interior lighting retrofits at an office. During the desk review and on-site M&V visit, the EM&V team found that the fixtures in one of the office rooms were not retrofitted. In addition, the quantity of post-retrofit fixtures in another room was also corrected from 20 claimed to 25 per on-site visit findings. Overall, these adjustments resulted in a negligible increase in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1133530: The energy efficiency project included interior lighting retrofits and early replacement of a chiller at a college building. During the desk review and on-site M&V visit, the EM&V team made adjustments to both portions of the project. For the HVAC portion of the

project, the building type was corrected from the reported "Secondary School" to "Education: College." The project documentation indicated that this building was a college and not a secondary high school. This increased the operating hours (HOU) and coincidence factor (CF), which increased the energy and demand savings for this project. For the lighting portion of the project, the EM&V team adjusted the lighting controls for some fixtures to "OS" since the fixtures were installed with integrated occupancy sensors. Changing the post-install retrofit controls resulted in an increase of savings for controls of 10.34 kW and 51,440 kWh, which was outside the scope of the project; however, this reduced the lighting equipment measure savings. Overall, these corrections resulted in realization rates of 101 percent kW and 103 percent kWh.

Participant ID 1159242: The energy efficiency project included the new construction of interior lighting fixtures, high efficiency motors, and building envelope measures (roofing system and window replacement) at a healthcare facility. During the desk review, the EM&V team removed the savings that occurred from the motors measure since it is not eligible for new construction projects. For the lighting portion of the project, the building type was adjusted from "Parking Structure" to "Health: In-Patient," which reduced demand and energy savings. For the window replacement portion of the project, the calculation was augmented from an ENERGY STAR® roof calculator, which accounted for temperature and solar radiation to provide the exterior temperature of the insulation. Since the windows are a single structure, the solar radiation does not impact the U-Value calculation, therefore the exterior temperature was reduced to 100 degrees F from the variable calculation, which included the solar radiation and increased the temperature from 112 to 167 degrees F. This adjustment significantly reduced the impact of the increased U-Value. Overall, these corrections resulted in realization rates of 76 percent kW and 74 percent kWh.

Participant ID 1162381: The energy efficiency project involved several energy savings measures at a data center building including the new construction of HVAC units and interior lighting, and interior lighting and UPS retrofits. During the desk review and on-site M&V visit, the EM&V team corrected the quantity of units for the HVAC portion of the project to 49 based on on-site verification. Six units were planned to be installed, but at the time of the on-site visit, the installations were not completed. For the lighting portion of the project, the building type was adjusted from "Office" to "Data Center" to match the predominant building type for the site. Overall, these corrections resulted in a significant decrease in demand and energy savings and realization rates of 90 percent kW and 90 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions for 11 of the 14 projects that had desk reviews completed because sufficient documentation was provided for the sites. However, partial documentation was provided for the other three projects. For one new construction project, documentation lacked invoices and engineering plans. For another new construction project, documentation lacked key information such as square footage of the site, square footage of exempt areas with non-qualified fixtures, roofing specs, and invoices. Complete documentation enhances the accuracy and transparency of project savings and ease of evaluation. Since sufficient documentation was not provided for all projects, the EM&V team assigned a program documentation score of Fair.

4.4 Detailed Findings—Residential (High/Medium Evaluation Priority)

4.4.1 High Efficiency Homes 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
7.5%	13,148	13,148	100.0%	13.1%	21,247,896	21,247,896	100.0%	Good

Completed Desk Reviews*	On-Site M&V
27	NA

*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 PY2018 impact evaluation efforts focused on desk reviews. The number of sampled and completed desk reviews for this program is listed above.

The EM&V team focused on reviewing documentation for program homes. This program relies on the REM/Rate energy modeling software that is widely used in the home rating industry and is listed in the TRM as an accepted energy model.

The program established at the beginning of the year that savings would be claimed based on the report built into REM/Rate that compares the program home's characteristics with IECC 2015 code. This report aligns with the TRM v5.0 baseline home since the TRM specifications are derived from IECC 2015 code specifications. For all evaluated homes, the program accurately claimed savings based on the REM/Rate report.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., energy model inputs, and detailed model outputs). Because sufficient documentation was provided for all the reviewed projects, the EM&V team assigned a program documentation score of Good.

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

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
0.8%	1,397	1,397	100.0%	1.1%	1,862,128	1,862,128	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for eight projects and resulted in desk review realization rates of 100 percent and 100 percent for demand and energy savings, respectively. On-site M&V was completed for four projects and resulted in on-site realization rates of 100 percent and 100 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition) for ceiling insulation. Because sufficient documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

4.4.3 Residential & Small Commercial (SC) Standard Offer Program (SOP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
0.3%	486	486	100.0%	0.6%	1,030,029	1,030,029	100.0%	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for six projects and resulted in desk review realization rates of 100 percent and 100 percent for demand and energy savings, respectively. On-site M&V was completed for three projects and resulted in on-site realization rates of 100 percent and 100 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-unit capacity) for central air conditioners and central heat pumps. Because sufficient documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

4.4.4 Residential Pool Pump & A/C Distributor 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
1.6%	2,850	2,850	100.0%	4.3%	6,977,204	6,977,204	100.0%	Good

Completed Desk Reviews*	On-Site M&V
4	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 PY2018 evaluation efforts focused on desk reviews. The number completed desk reviews for this program is listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for two projects. 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 data in the tracking system.

Desk reviews were completed for four projects and resulted in desk review realization rates of 56.0 percent and 61.5 percent for demand and energy savings, respectively. Further details for the two projects where adjustments were made, including the EM&V findings, are provided below.

Participant ID 1133813: The energy efficiency project included the early retirement of two central air conditioner units. The reported baseline age was 16 years for both units. After a review of the documentation, the EM&V team found that age of the equipment was 24 years for one unit and 25 years for the other unit. The EM&V team adjusted savings accordingly. Overall, the adjustment resulted in project level realization rates of 52.6 percent and 62.0 percent for demand and energy savings, respectively.

Participant ID 1142790: The energy efficiency project included implementation of one central heat pump system. The reported baseline was a 3.5-ton air conditioner and electric resistance furnace. After a review of the documentation, the EM&V team found that the baseline should be a 3-ton heat pump system. The EM&V team adjusted savings accordingly. Overall, the adjustment resulted in project level realization rates of 13.7 percent and 19.6 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-unit capacity) for central air conditioners and central heat pumps. Because sufficient

documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

4.4.5 Multifamily Market Transformation Program (MTP) (Hard-to-Reach (HTR))

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
0.3%	518	518	100.0%	0.6%	964,203	964,203	100.0%	Fair

Completed Desk Reviews*	On-Site M&V
3	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The single on-site M&V project also had a desk review. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for three projects and resulted in desk review realization rates of 100 percent and 100 percent for demand and energy savings, respectively. On-site M&V was completed for one project and resulted in on-site realization rates of 100 percent and 100 percent for demand and energy savings, respectively.

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 for pre-condition, but they were not available for the post-condition. Because sufficient documentation was provided for some of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Fair.

4.5 Detailed Findings—Load Management (High Evaluation Priority)

4.5.1 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
62.7%	110,626	110,626	100.0%	0.4%	663,756	663,756	100.0%	Good

Completed Desk Reviews*	On-Site M&V
NA	NA

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

The EM&V team evaluated the CenterPoint Large Commercial Load Management program 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 occurred on the following dates and times:

- June 6, 2018, from 2:00 p.m. to 5:00 p.m.
- July 23, 2018, from 2:00 p.m. to 5:00 p.m.

The EM&V team received the interval meter data and spreadsheets detailing the CenterPoint calculated savings results for the event and each ESI ID. The EM&V team was able to calculate savings for each of the participating ESI IDs with the results matching those of the program. As such, no adjustments were made to the program savings.

Evaluated savings for the CenterPoint Large Commercial Load Management program are 110,626 kW and 663,756 kWh. The realization rate for kW and kWh is 100.0 percent.

4.5.2 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
11.0%	19,481	19,481	100.0%	0.1%	117,411	117,411	100.0%	Good

Completed Desk Reviews*	On-Site M&V
NA	NA

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

The EM&V team evaluated the CenterPoint 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:

- June 6, 2018, from 2:00 p.m. to 5:00 p.m.
- July 23, 2018, from 2:00 p.m. to 5:00 p.m.

The EM&V team received the interval meter data and spreadsheets detailing the CenterPoint calculated savings results for the event and each ESI ID. The EM&V team was able to calculate savings for each of the participating ESI IDs with the results matching those of the program. As such, no adjustments were made to the program savings.

Evaluated savings for the CenterPoint Residential Demand Response Program are 19,481 kW and 117,411 kWh. The realization rate for kW and kWh is 100.0 percent.

4.6 Summary of Low Priority Evaluation Programs

Table 4-5 provides a summary of claimed savings for CenterPoint's low evaluation priority programs in PY2018, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2018 tracking data provided to the EM&V team for the EM&V database.

Table 4-5. PY2018 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)
Advanced Lighting Commercial	0.2%	325	325	100.0%	1.0%	1,603,501	1,603,501	100.0%
REP (Commercial CoolSaver)	0.2%	313	313	100.0%	0.3%	422,182	422,182	100.0%
Advanced Lighting Residential	3.5%	6,166	6,166	100.0%	18.7%	30,382,118	30,382,118	100.0%
REP (CoolSaver & Efficiency Connection)	0.9%	1,605	1,605	100.0%	2.8%	4,574,603	4,574,603	100.0%
Multi-Family MTP	0.6%	1,095	1,095	100.0%	1.2%	1,913,679	1,913,679	100.0%
Targeted Low Income MTP (Agencies in Action)	2.4%	4,174	4,174	100.0%	4.2%	6,745,990	6,745,990	100.0%
Smart Thermostat Program (Pilot)	0.0%	0	0		0.2%	388,592	388,592	100.0%

5.0 EL PASO ELECTRIC IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for El Paso Electric’s 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

5.1 Key Findings

5.1.1 Evaluated Savings

El Paso Electric’s evaluated savings for PY2018 were 16,846 in demand (kW) and 20,726,303 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are 100 percent. El Paso Electric was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results, which also supported healthy realization rates.

Table 5-1 shows the claimed and evaluated demand savings for El Paso Electric’s portfolio and broad customer sector/program categories.

Table 5-1. El Paso Electric PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	16,846	16,846	100.0%	0.0%
Commercial	19.5%	3,283	3,283	100.0%	0.0%
Residential	13.0%	2,185	2,185	100.0%	0.0%
Load Management*	57.0%	9,604	9,604	100.0%	0.0%
Pilot	10.5%	1,774	1,774	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 resulting level of load curtailment achieved for each event for all participants.

Table 5-2 shows the claimed and evaluated energy savings for El Paso Electric’s portfolio and broad customer sector/program categories for PY2018.

Table 5-2. El Paso Electric PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	20,726,303	20,726,303	100.0%	0.0%
Commercial	74.6%	15,465,503	15,465,503	100.0%	0.0%
Residential	25.1%	5,193,636	5,193,636	100.0%	0.0%
Load Management*	0.1%	24,591	24,591	100.0%	0.0%
Pilot	0.2%	42,574	42,574	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 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. 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–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 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 and/or high savings programs have been identified.

El Paso Electric received a Good program documentation score for its evaluated Commercial, Load Management and Residential programs, and a Fair documentation score for its Demand Response Pilot program.

5.1.2 Cost-effectiveness Results

El Paso Electric’s overall portfolio had a cost-effectiveness of 2.60. (See Table 5-3.)

The more cost-effective programs were Large C&I Solutions MTP and Small Commercial Solutions MTP. The less cost-effective programs were Demand Response Pilot Program and Texas Appliance Recycling MTP.

The lifetime cost of evaluated savings was \$0.009 per kWh and \$19.99 per kW.

Table 5-3. El Paso Electric Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.60	2.60	2.39
Commercial	3.50	3.50	3.19
Small Commercial Solutions MTP	3.08	3.08	2.93
Large C&I Solutions MTP	4.52	4.52	4.06
Texas SCORE MTP	1.52	1.52	1.41
Residential	1.99	1.99	1.82
Residential Solutions MTP	2.64	2.64	2.35
LivingWise MTP	1.88	1.88	1.50
Texas Appliance Recycling MTP	1.40	1.40	1.40
Hard-to-Reach Solutions MTP	1.69	1.69	1.69
Load Management	1.54	1.54	1.54
Load Management SOP	1.54	1.54	1.54
Pilot	0.58	0.58	0.58
Demand Response Pilot Program	0.58	0.58	0.58

5.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project-level based on interim EM&V findings. Table 2-4 summarizes claimed savings adjustments recommended by the EM&V team. Commercial adjustments through the third quarter were made prior to the Energy Efficiency Plan and Report (EEPR) filing on April 1, 2018. Realization rates assume all adjustments will be included in El Paso Electric's May 1 filing.

Table 5-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR⁸ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Large C&I Solutions MTP (Com)	-2.40	3,942.00
Small Commercial Solutions MTP (Com)	-0.40	-24,076.60
Residential Solutions MTP (Res)	0.00	52.60
Total	-2.80	-20,082.00

⁸ Energy Efficiency Cost Recovery

5.3 Detailed Findings—Commercial (Medium Evaluation Priority)

5.3.1 Large C&I Solutions 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
11.9%	2,011	2,011	100.0%	52.6%	10,901,315	10,901,315	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 PY2018 Large C&I Solutions MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 four projects. One project had adjustments of less than 5 percent and three projects had adjustments greater than 5 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 1130723: The energy efficiency project included interior lighting retrofits at a strip mall retail store. During the desk review, the EM&V team identified a calculation error in the LSF calculator v2018.2 used to estimate claimed savings. The evaluation team used the LSF calculator v2018.5, which had correct deemed equivalent full load hours (EFLH) and coincidence factors (CF) that match the Texas TRM 5.0. Earlier versions of the 2018 LSF calculator had wrong EFLH and CF values for retail building types. This adjustment increased energy savings and realization rates of 100 percent kW and 108 percent kWh.

Participant ID 1133681: The energy efficiency project included an early replacement of HVAC equipment at a retail building. During the desk review and on-site M&V visit, the EM&V team updated the pre-retrofit HVAC cooling capacities from nominal to rated capacities. During the on-site M&V visit, the EM&V team made additional adjustments to the baseline cooling capacity finding that the model number had varied slightly. The capacities were adjusted for two HVAC units from 12.5 tons (150,000 BTU/hour) to 146,000 BTU/hour and for another HVAC unit from 5 tons (60,000 BTU/hour) to 59,500 BTU/hour. All post-retrofit cooling capacities were updated from tons to BTU/hour to coincide with the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) rated capacities. Overall, the corrections reduced peak demand and energy savings significantly and resulted in realization rates of 76 percent kW and 53 percent kWh.

Participant ID 1154675: The energy efficiency project included interior lighting retrofits at an enclosed mall retail store. During the desk review, the EM&V team identified a calculation error in the LSF calculator v2017.1 used to estimate claimed savings. The evaluation team used the LSF calculator v2018.5, which had correct deemed equivalent full load hours (EFLH) and coincidence factors (CF) that match the TRM. The difference in HOU and CF values increased energy and peak demand savings. The EM&V team also adjusted fixture wattages to match DLC certification from 10W to 9.5W and from 7W to 6.5W since version 2018.5 of the LSF calculator allows for

wattages in 0.5 increments (up to 25W) that match the rated wattages. Overall, the adjustments resulted in realization rates of 104 percent kW and 123 percent kWh.

Participant ID 1154729: The energy efficiency project included interior lighting retrofits at an enclosed mall retail store. During the desk review and on-site M&V visit, the EM&V team corrected fixtures quantities. The post-retrofit LED wall pack fixture quantities were adjusted to match the existing quantities, as five fewer wall packs were installed per on-site M&V visit findings. This adjustment slightly increased the energy and demand savings and resulted in realization rates of 101 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. However, partial documentation was provided for one HVAC project. AHRI certification was missing for the project, but the EM&V team was able to obtain the information from the AHRI website. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

5.3.2 Texas SCORE MTP

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
3.0%	507	507	100.0%	4.9%	1,016,120	1,016,120	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 PY2018 Texas SCORE MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or AHRI certifications, pre-and post-inspection notes, the project savings calculators, and photographic documentation of the existing and new equipment, which are significant efforts by the utility to verify equipment conditions and quantities. However, partial documentation was provided for one HVAC project. In this case, the provided AHRI certifications did not match the final equipment inventory, but the EM&V team was able to obtain the correct certifications from the AHRI

website. Complete and accurate documentation enhances the accuracy and transparency of project savings and ease of evaluation. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

5.3.3 Small Commercial Solutions 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
4.5%	765	765	100.0%	17.1%	3,548,068	3,548,068	100.0%	Good

Completed Desk Reviews*	On-Site M&V
10	5

*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 PY2018 Small Commercial Solutions MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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. Two projects had adjustments of less than 5 percent and six projects had adjustments greater than 5 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 1129056: The energy efficiency project included interior and exterior lighting retrofits at a non-24-hr. supermarket. During the desk review and on-site M&V visit, the EM&V team identified a calculation error in the LSF calculator v2018.3 used to estimate claimed savings. The evaluation team used the LSF calculator v2018.5, which had correct deemed equivalent full load hours (EFLH) and coincidence factors (CF) that match the Texas TRM 5.0. Earlier versions of the 2018 LSF calculator had wrong EFLH and CF values for supermarket building types. In addition, the EM&V team verified fixture wattages, qualification and quantities: wattages were adjusted for some fixtures from 150W to 100W (pre-retrofit) and from 30W to 31W (post-retrofit) per DLC certification wattage; the qualification was adjusted for one exterior fixture from “DLC” to “Non-Qualified”; and the installed quantity of 68W LED interior fixtures was adjusted from 1 to 2 per on-site M&V visit findings. Overall, the corrections significantly reduced energy and peak demand savings and resulted in realization rates of 73 percent kW and 71 percent kWh.

Participant ID 1129146: The energy efficiency project involved interior lighting retrofits at a non-food service building. During the desk review and on-site M&V visit, the EM&V team adjusted the air-conditioning type from “Other” to “Air-Conditioned” for the entire building. This adjustment resulted in an increase in energy and peak demand savings and realization rates of 112 percent kW and 105 percent kWh.

Participant ID 1129240: The energy efficiency project included interior and exterior lighting retrofits at a religious building. During the desk review and on-site M&V visit, the EM&V team verified fixture wattages, quantities, and lighting controls. Wattages were adjusted for some fixtures from 12W to 11.5W since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments

(up to 25W) that match the rated wattages. Per on-site M&V visit findings, a 48W LED fixture that replaced a 250W HPS fixture was added to the exterior lighting inventory. Lighting controls were also adjusted for exterior lighting fixtures: from “Timeclock” to “None” for 18W LED tubes, and from “Timeclock” to “Photocell” for wall pack fixtures. Overall, the corrections resulted in a slight increase of energy and peak demand savings and realization rates of 101 percent kW and kWh.

Participant ID 1129285: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review and on-site M&V visit, the EM&V team identified a calculation error in the LSF calculator v2018.3 used to estimate claimed savings. The evaluation team used the LSF calculator v2018.5, which had correct deemed equivalent full load hours (EFLH) and coincidence factors (CF) that match the Texas TRM 5.0. Earlier versions of the 2018 LSF calculator had wrong EFLH and CF values for retail building types. In addition, the EM&V adjusted the qualification of 12W LED tubes from “Non-Qualified” to “DLC.” Overall, the corrections decreased energy and peak demand savings and resulted in realization rates of 97 percent kW and 77 percent kWh.

Participant ID 1130126: The energy efficiency project involved interior and exterior lighting retrofits at a non-24-hr. supermarket. During the desk review, the EM&V team adjusted the air-conditioning type for the walk-in cooler to “Med. Temp. (33-41° F).” This correction slightly increases energy and peak demand savings and resulted in realization rates of 102 percent kW and kWh.

Participant ID 1130514: The energy efficiency project included the installation of an ENERGY STAR® roof at a retail building. During the desk review, the EM&V team was not supplied with the calculations and was not able to identify assumptions in the calculator that would yield the exact results. The EM&V team assumed a gray-colored existing roof surface with an R-value of 15.15. This value may be different from the value used to calculate the claimed savings. This resulted in realization rates of 101 percent kW and 90 percent kWh.

Participant ID 1130555: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team identified a calculation error in the LSF calculator v2018.2 used to estimate claimed savings. The evaluation team used the LSF calculator v2018.5, which had correct deemed equivalent full load hours (EFLH) and coincidence factors (CF) that match the Texas TRM 5.0. Earlier versions of the 2018 LSF calculator had wrong EFLH and CF values for retail building types. This adjustment resulted in realization rates of 97 percent kW and 76 percent kWh.

Participant ID 1152529: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team identified a calculation error in the LSF calculator v2018.4 used to estimate claimed savings. The evaluation team used the LSF calculator v2018.5, which had correct deemed equivalent full load hours (EFLH) and coincidence factors (CF) that match the Texas TRM 5.0. Earlier versions of the 2018 LSF calculator had wrong EFLH and CF values for retail building types. In addition, the EM&V team adjusted the building type from “Retail (Other)” to “Retail Strip Mall.” Overall, the corrections decreased energy and peak demand savings and resulted in realization rates of 97 percent kW and 76 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications) for seven of the 10 projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications, pre-and post-inspection notes, the 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. However, partial documentation was provided for the remaining three projects. For two lighting projects, project documentation lacked post-retrofit photos or the provided post-retrofit photos were not sufficient to verify fixture model numbers. For one ENERGY STAR roof installation project, building specs were not provided. Complete documentation enhances the accuracy and transparency of project savings and ease of evaluation. Since sufficient documentation was provided for most of the projects, the EM&V team assigned a program documentation score of Good.

5.4 Detailed Findings—Residential (Medium Evaluation Priority)

5.4.1 Hard-to-Reach Solutions 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
4.4%	741	741	100.0%	7.9%	1,640,748	1,640,748	100.0%	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are 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 the following two activities:

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

Desk reviews were completed for six projects and resulted in desk review realization rates of 100.0 percent and 100.0 percent for demand and energy savings, respectively. On-site M&V was completed for three projects and resulted in on-site realization rates of 100.0 percent and 100.0 percent for demand and energy savings, respectively.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., pre- and post- condition) for central heat pumps and ceiling insulation. Because sufficient documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

5.4.2 Residential Solutions 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%	809	809	100.0%	7.6%	1,577,535	1,577,535	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for one project. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for four projects and resulted in desk review realization rates of 102.1 percent and 101.9 percent for demand and energy savings, respectively. On-site M&V was completed for two projects and resulted in on-site realization rates of 100.0 percent and 100.0 percent for demand and energy savings, respectively. Further details of the EM&V team's findings for the single project where an adjustment of more than 5 percent to the claimed savings was made is provided below.

Participant ID 1129066: The energy efficiency project included implementation of ENERGY STAR windows. During the desk review, the EM&V team corrected the baseline to a single-pane window from a double-pane window based on the documentation provided. Overall, the adjustments resulted in project level realization rates of 139.8 percent and 134.7 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., window area square footage) for windows. Because sufficient documentation was provided for across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

5.5 Detailed Findings—Load Management (High/Medium Evaluation Priority)

5.5.1 Load Management 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
57.0%	9,604	9,604	100.0%	0.1%	24,591	24,591	100.0%	Good

Completed Desk Reviews*	On-Site M&V
NA	NA

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

The EM&V team evaluated the El Paso Electric Load Management program 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. Load management events occurred on the following dates and times:

- June 15, 2018, from 1 p.m. to 2:30 p.m. (scheduled)
- July 19, 2018, from 4:30 p.m. to 5:30 p.m. (unscheduled)

The EM&V team received the interval meter data and spreadsheets detailing the El Paso Electric calculated baseline load, event load, and savings results for each event and meter. During the review process, the EM&V team collaborated with El Paso Electric to develop savings for a participant on an interruptible tariff that received the interruption request during the unscheduled event. After the EM&V team applied the “high 5 of 10 baseline” calculation method, we found that the evaluated savings matched the savings El Paso Electric provided.

Evaluated savings for the El Paso Electric Load Management program are 9,679 kW and 24,993 kWh. The realization rate for both kW and kWh is 100.0 percent.

5.6 Detailed Findings—Pilot Programs (High Evaluation Priority)

5.6.1 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
10.5%	1,774	1,774	100.0%	0.2%	42,574	42,574	100.0%	Fair

Completed Desk Reviews*	On-Site M&V
NA	NA

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

The EM&V team evaluated the El Paso Electric Demand Response program by applying the deemed savings value seen in Volume Two of TRM version 5.0. The meter data was supplied in 30-minute increments at the meter level. Demand Response events occurred on the following dates and times:

- June 20, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- June 22, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- June 27, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- July 23, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- August 16, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- August 20, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- August 27, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- August 29, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- September 5, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- September 10, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- September 12, 2018, from 3 p.m. to 5 p.m. (unscheduled)
- September 18, 2018, from 3 p.m. to 5 p.m. (unscheduled)

The EM&V team received a list of participants enrolled 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 participant list and summary documentation to apply the deemed savings value from TRM 5.0.

During the initial calculation of program savings, the EM&V team applied the deemed savings value to meters that showed full participation in a per-event basis, which was clearly presented in the summary documentation provided by El Paso Electric. After this first round of calculation was complete, the EM&V team found that the savings calculated were lower than what El Paso Electric was claiming. This difference in savings prompted a discussion between the EM&V team and El Paso Electric. During the discussion, it was found that the language in TRM 5.0 was being interpreted differently by each party. The TRM 5.0 language in question reads, “Event-level savings are calculated by multiplying kW savings per household/device by the participating number of devices on that event, then adding all the groups savings together.” The EM&V team understood this statement to mean that the kW savings per household/device were to be applied to meters that did not op-out of, and otherwise had full participation in, an event, whereas El Paso Electric applied the kW savings per household/device to meters that participated/were enrolled in the program during the 2018 program year, regardless of op-out status at the event level.

After this initial discussion with El Paso Electric, more clarification was needed to understand how the deemed savings value was calculated. At this time, Frontier (who produced the deemed savings value), was brought into the discussion. It was found that the deemed savings value was produced using a sample of 50 homes in the El Paso Electric territory. It was assumed by Frontier that this sample of 50 homes would contain op-out rates similar to those the entire program population would exhibit. Therefore, the effects of op-out meters are accounted for in the deemed savings value.

With an understanding of how the deemed savings value was calculated, the EM&V team agreed with El Paso Electric that the deemed savings value in TRM 5.0 is to be applied to participating meters in the program, regardless of participation at the event level.

Evaluated savings for the El Paso Electric Demand Response program are 1,773.9 kW and 42,573.6 kWh. The realization rate for both kW and kWh is 100.0 percent.

5.7 Summary of Low Priority Evaluation Programs

Table 5-5 provides a summary of claimed savings for El Paso Electric's low evaluation priority programs in PY2018, which includes each program's overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2018 tracking data provided to the EM&V team for the EM&V database.

Table 5-5. PY2018 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)
LivingWise MTP	3.4%	573	573	100.0%	7.1%	1,476,778	1,476,778	100.0%
Texas Appliance Recycling MTP	0.4%	62	62	100.0%	2.4%	498,576	498,576	100.0%

6.0 ENTERGY IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for Entergy's 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.

6.1 Key Findings

6.1.1 Evaluated Savings

Entergy's evaluated savings for PY2018 were 19,665 in demand (kW) and 48,099,849 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are 100 percent. Entergy was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results, which helped support healthy realization rates. (See Table 6-4.)

Table 6-1 shows the claimed and evaluated demand savings for Entergy's portfolio and broad customer sector/program categories.

Table 6-1. Entergy PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	19,665	19,665	100.0%	0.0%
Commercial	36.2%	7,126	7,126	100.0%	0.0%
Residential	34.1%	6,714	6,714	100.0%	0.0%
Load Management*	29.6%	5,825	5,825	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 resulting level of load curtailment achieved for each event for all participants.

Table 6-2 shows the claimed and evaluated energy savings for Entergy's portfolio and broad customer sector/program categories for PY2018.

Table 6-2. Entergy PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	48,099,849	48,099,849	100.0%	0.0%
Commercial	75.2%	36,173,250	36,173,250	100.0%	0.0%
Residential	24.8%	11,906,591	11,906,591	100.0%	0.0%
Load Management*	0.0%	20,008	20,008	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 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. 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–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 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 and/or high savings programs have been identified.

Entergy received Good documentation scores for all of its evaluated programs in PY2018.

6.1.2 Cost-effectiveness Results

Entergy’s overall portfolio had a cost-effectiveness of 2.62. (See Table 6-3.)

The more cost-effective programs were Commercial Solutions MTP and Entergy Solutions High Performance Homes MTP. The less cost-effective programs were A/C Distributor Program, Load Management SOP, and Hard-To-Reach SOP. All of Entergy’s programs passed cost-effectiveness in 2018.

The lifetime cost of PY2018 evaluated savings was \$0.008 per kWh and \$16.59 per kW.

Table 6-3. Entergy Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.62	2.62	2.33
Commercial	3.72	3.72	3.34
Commercial Solutions MTP	3.72	3.72	3.34

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Residential	1.87	1.87	1.63
Residential SOP	1.97	1.97	1.75
Entergy Solutions High Performance Homes MTP	2.57	2.57	1.80
A/C Distributor MTP	1.30	1.30	1.09
Hard-To-Reach SOP	1.53	1.53	1.53
Load Management	1.56	1.56	1.56
Load Management SOP	1.56	1.56	1.56

6.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project-level based on interim EM&V findings. Table 6-4 summarizes claimed savings adjustments recommended by the EM&V team prior to the Energy Efficiency Plan and Report (EEPR) filing on April 1, 2018, which were included in the April 1 EEPR. Realization rates assume the following adjustments will be included in Entergy's May 1 filing.

Table 6-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR⁹ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Commercial Solutions MTP (Com)	174.10	46,996.30
Hard-To-Reach SOP (HTR)	-2.50	-5,129.10
A/C Distributor MTP (Res)	0.00	-8.80
Residential SOP (Res)	0.00	-183.70
Total	171.60	41,674.70

6.3 Detailed Findings—Commercial (Medium Evaluation Priority)

6.3.1 Commercial Solutions MTP¹⁰

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
36.2%	7,126	7,126	100.0%	75.2%	36,173,250	36,173,250	100.0%	Good

⁹ Energy Efficiency Cost Recovery

¹⁰ Commercial Solutions MTP also includes two sub-programs, Commercial Midstream Lighting and Resource Management Services (RMS), which have distinct program design and delivery. These sub-programs were included in the PY2018 EM&V.

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 PY2018 Commercial Solutions MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 5 percent and three projects had adjustments greater than 5 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 1131638: The energy efficiency project included an air compressor retrofit at a manufacturing building. During the desk review and on-site M&V visit, the EM&V team reviewed several parameters used to calculate energy and peak demand savings in the International Performance Measurement and Verification Protocol (IPMVP) Option B methodology. The EM&V team agree with the protocols followed in the calculations and found that energy use values for pre-retrofit equipment were missing in the ex-ante calculator for flow rates above 5500 cubic feet per minute (CFM), leading to a slight understatement of the energy savings. The evaluated calculations incorporated the energy use values of the highest available flow rate interval (5375 CFM - 5499 CFM), which slightly increased the overall kWh savings. In addition, the kW claimed estimate did not reflect the guidance in Volume 1 of the Texas TRM 5.0. The reported savings assumed that the highest flow rate measured in the facility would be sufficient for calculating savings in the peak demand period. However, the EM&V team analyzed the distribution of flow rates and found that they were random across all hours and days of the monitoring period. The savings calculations were adjusted to strictly use the utility's peak demand period, Zone 3 (M-F 4-8 p.m.) and the proportional separation is not relevant. With the flow rate distribution, the kW savings between the pre- and post-measurements were greatly increased from the reported savings. Overall, the corrections resulted in realization rates of 152 percent kW and 101 percent kWh.

Participant ID 1133415: The energy efficiency project is a midstream lighting project that incentivizes select ENERGY STAR-qualified lights sold through the online retailer Bulbs.com. During the desk review, the EM&V team found that most of the difference between claimed and evaluated savings is associated with the 2-foot LED tube measures, where the coincidence factor (CF) was adjusted from 0.0707 to match the Texas TRM 5.0 value of 0.830, and the baseline wattage was adjusted from 15.2W to match the QPL certificate value of 17W. The 4-foot LED tubes and downlight fixture baseline wattages were also rounded to 2 decimals, which adjusted savings slightly. Overall, the corrections resulted in a negligible decrease in energy and peak demand savings and realization rates of 100 percent kW and kWh.

Participant ID 1133422: The energy efficiency project is a midstream lighting project that incentivizes select ENERGY STAR qualified lights sold through the online retailer Bulbs.com. During the desk review, the EM&V team found that most of the difference between claimed and evaluated savings is associated with the 2-foot LED tube measures, where the CF was adjusted from 0.0707 to match the Texas TRM 5.0 value of 0.830, and the baseline wattage was adjusted from 15.2W to match the QPL certificate value of 17W. In addition, the 4-foot LED tubes and downlight fixture baseline wattages were also rounded to 2 decimals, which adjusted savings slightly. The wattage

was also adjusted for a 4-foot LED tube that only consumed 10 watts, although it was not clear from the documentation whether the difference from the claimed savings was attributed to the baseline or other assumptions. Some fixtures categorized as T8 LED tubes were in fact T8 fluorescent tubes; these wattages were adjusted from 24.75 watts to 28 watts. Overall, the corrections resulted in a slight increase in energy and peak demand savings and realization rates of 108 percent kW and 103 percent kWh.

Participant ID 1133565: The energy efficiency project included interior and exterior lighting retrofits at a school. During the desk review and on-site M&V visit, the EM&V team found minor corrections to lighting quantity. Thirteen 15W LED tubes were not found in one of the interior spaces, resulting in a slight increase in peak demand and energy savings and realization rates of 102 percent kW and kWh.

Participant ID 1133644: The energy efficiency project included an early replacement of a chiller at an office. During the desk review, the EM&V team adjusted the existing capacity of the pre-retrofit equipment to match the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) rated capacity. The ex-ante calculation utilized the nominal capacity of the existing HVAC unit. This correction resulted in a significant decrease in peak demand savings and realization rates of 64 percent kW and 88 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. The project documentation included invoices, QPL qualifications, AHRI certifications, pre- and post-inspection notes, the 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. For the midstream lighting projects, however, the tracking system did not include the deemed equivalent full load hours (EFLH), coincidence factor (CF), and baseline and new wattages. Savings calculations for these projects were completed based on some provided documentation and researched manufactured values. Tracking the mentioned values will facilitate evaluation efforts in the future. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of Good.

6.4 Detailed Findings—Residential (High/Medium Evaluation Priority)

6.4.1 Entergy Solutions High Performance Homes 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
4.5%	881	881	100.0%	5.9%	2,840,024	2,840,024	100.0%	Good

Completed Desk Reviews*	On-Site M&V
9	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 PY2018 evaluation efforts focused on desk reviews. The number of completed desk reviews for this program is listed above.

The EM&V team focused on reviewing documentation for program homes. This program relies on a proprietary energy model, however that model is built on DOE-2 energy modeling software that is listed as an acceptable savings estimation method in the TRM.

We received two types of documentation from the program: REM/Rate files that provided the inputs that fed into the energy models and detailed output files that provided the results of the energy model analysis. We reviewed the REM/Rate files to ensure that all homes met stated program requirements, and that the files contained all inputs required by the DOE-2-based model. We compared the results of the model to the claimed savings in the tracking database and found that all of the model output files matched the claimed savings in the tracking data. We did not recommend any adjustments for this program.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., energy model inputs and detailed model outputs). Because sufficient documentation was provided for all the reviewed projects, the EM&V team assigned a program documentation score of Good.

6.4.2 A/C Distributor 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
1.8%	350	350	100.0%	1.8%	857,560	857,560	100.0%	Good

Completed Desk Reviews*	On-Site M&V
4	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 PY2018 evaluation efforts focused on desk reviews. The number of completed desk reviews for this program is listed above.

The EM&V team made minor adjustments to three projects within the 5 percent threshold, and at Entergy’s discretion these adjustments were claimed by Entergy. 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 four projects and resulted in desk review realization rates of 99.9 percent and 99.9 percent for demand and energy savings, respectively. Further details for the projects where adjustments were made, including the EM&V findings, are provided below.

Participant ID 1111140, 1111162, 1111209, 1138476: These energy efficiency projects included implementation of central air conditioner units. There were minor differences between ex-ante and ex post savings for central air conditioners, likely due to rounding within the early retirement calculator.

Each Participant ID yielded realization rates of 99.9 percent and 99.9 percent for demand and energy savings, respectively.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-unit capacity) for central air conditioners. Because sufficient documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

6.4.3 Residential Standard Offer Program

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
19.0%	3,728	3,728	100.0%	11.7%	5,617,383	5,617,383	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for three projects. In addition, the EM&V team made minor adjustments to four projects that fell within the 5 percent threshold, and at Entergy’s discretion these adjustments were claimed by Entergy. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for eight projects and resulted in desk review realization rates of 100.0 percent and 98.7 percent for demand and energy savings, respectively. There were minor differences between ex-ante and ex post savings for LEDs and low flow showerheads due to rounding. All identified variations due to rounding were within 1 kWh and 0.01 kW. On-site M&V was completed for four projects and resulted in on-site realization rates of 100.0 percent and 97.1 percent for demand and energy savings, respectively. Further details for the projects where adjustments were made, including the EM&V findings, are provided below.

Participant ID 1109552: The energy efficiency project included implementation of air infiltration, duct sealing, low flow shower heads, and LED measures. The EM&V team’s on-site testing resulted in a substantially higher reduction in air infiltration and a substantially lower reduction in duct sealing than what was documented by the program. Using a threshold of ±10 percent, the EM&V team’s blower door test results were quite a bit lower and the duct blaster test results were quite a bit higher than the results found in the tracking data. Minor adjustments were made to the LED measure due to rounding. Overall, the adjustments resulted in project level realization rates of 103.3 percent and 90.9 percent for demand and energy savings, respectively.

Participant ID 1109598: The energy efficiency project included implementation of air infiltration, duct sealing, low flow shower heads, and LED measures. The EM&V team’s on-site testing resulted in a substantially lower reduction in air infiltration and duct sealing than what was documented by the program. Using a threshold of ±10 percent, the EM&V team’s blower door and duct blaster test results were quite a bit higher than the results found in the tracking data. The EM&V team noted that the sealing measures around the HVAC equipment had been undone by maintenance staff likely resulting in the increased duct and air infiltration. Minor adjustments were made to the LED measure due to rounding. Overall, the adjustments resulted in project level realization rates of 77.2 percent and 81.0 percent for demand and energy savings, respectively.

Participant ID 1109698: The energy efficiency project included implementation of air infiltration, duct sealing, low flow shower heads, and LED measures. The EM&V team’s on-site testing resulted in a substantially higher reduction in air infiltration and duct sealing than what was documented by the program. Using a threshold of ±10 percent, the EM&V team’s blower door and duct blaster test results were quite a bit lower than the results found in the tracking data. Minor adjustments were made to the LED measure due to rounding. Overall, the adjustments resulted in project level realization rates of 123.1 percent and 113.4 percent for demand and energy savings, respectively.

Participant ID 1110617: The energy efficiency project included implementation of air infiltration, duct sealing, low flow shower heads, and LED measures. The EM&V team’s on-site testing resulted in a substantially higher reduction in duct leakage than what was documented by the program. Using a threshold of ±10 percent, the EM&V team’s duct blaster test results were quite a bit lower than the results found in the tracking data. Minor adjustments were made to the low flow showerhead and LED measures due to rounding. Overall, the adjustments resulted in project level realization rates of 100.6 percent and 100.8 percent for demand and energy savings, respectively.

Participant ID 1109562, 1109589: These energy efficiency projects included implementation of air infiltration, duct sealing, low flow shower heads, and LED measures. Minor adjustments were made to the LED measure due to rounding.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration and duct efficiency. There was limited documentation for direct installs such as LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

6.4.4 Hard-to-Reach Standard Offer Program

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
8.9%	1,755	1,755	100.0%	5.4%	2,591,623	2,591,623	100.0%	Good

Completed Desk Reviews*	On-Site M&V
7	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for three projects. In addition, the EM&V team made minor adjustments to four projects that fell within the 5 percent threshold, and at Entergy's discretion these adjustments were claimed by Entergy. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for seven projects and resulted in desk review realization rates of 80.2 percent and 75.2 percent for demand and energy savings, respectively. There were minor differences between ex-ante and ex post savings for LEDs and low flow showerheads due to rounding. All identified variations due to rounding were within 1 kWh and 0.01 kW. On-site M&V was completed for four projects and resulted in on-site realization rates of 73.1 percent and 67.4 percent for demand and energy savings, respectively. Further details for the projects where adjustments were made, including the EM&V findings, are provided below.

Participant ID 1111137: The energy efficiency project included implementation of air infiltration, duct sealing, low flow shower heads, and LED measures. The EM&V team found considerable leaks in the ducts and the on-site duct blaster test resulted in leakage exceeding the reported pre-condition. As a result, the EM&V team zeroed out savings for this measure. Overall, the adjustments resulted in project level realization rates of 76.7 percent and 68.3 percent for demand and energy savings, respectively.

Participant ID 1111310: The energy efficiency project included implementation of the ceiling insulation measure. TRM 5.0 Volume 2 contains an eligibility requirement for the ceiling insulation measure, the application of which led to a difference in reported and evaluated savings for this Participant ID. TRM 5.0 Volume 2 states for any reported pre-retrofit R-value that falls below R-5, contractors are required to provide sufficient evidence, including two pictures: 1) a picture showing the entire attic floor, and 2) a close-up picture of a ruler that shows the measurement of the depth of the insulation. In the absence of evidence demonstrating pre-retrofit ceiling insulation below R-5, the lowest level of pre-retrofit ceiling insulation that can be claimed is the R-5 to R-8 range. The baseline reported was less than R5 level insulation and the EM&V team determined the documentation provided did not meet the requirement and adjusted the baseline to R5. Overall, the adjustment resulted in project level realization rates of 39.3 percent and 38.7 percent for demand and energy savings, respectively.

Participant ID 1111318: The energy efficiency project included implementation of air infiltration, duct sealing, and ceiling insulation measures. The EM&V team's on-site testing resulted in a substantially higher reduction in air infiltration and duct sealing than what was documented by the program. Using a threshold of ± 10 percent, the EM&V team's blower door and duct blaster test results were quite a bit lower than the results found in the tracking data. The EM&V team assessed the ceiling insulation found on-site to be a R-30 rather than R-36 that was reported and adjusted accordingly. Overall, the adjustments resulted in project level realization rates of 114.6 percent and 109.0 percent for demand and energy savings, respectively.

Participant ID 1111140, 1111162, 1111209, 1138476: These energy efficiency projects included implementation of air infiltration, duct sealing, low flow shower heads, and LED measures. Minor adjustments were made to the LED measure due to rounding.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration and duct efficiency. There was limited documentation for direct installs such as LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

6.5 Detailed Findings—Load Management (High Evaluation Priority)

6.5.1 Load Management Standard Offer Program

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
29.6%	5,825	5,825	100.0%	0.0%	20,008	20,008	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 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 occurred on the following dates and times:

- June 14, 2018, from 1:00 p.m. to 3:00 p.m. (scheduled)
- June 15, 2018, from 1:00 p.m. to 2:00 p.m. (scheduled)
- June 15, 2018, from 3:00 p.m. to 4:00 p.m. (scheduled)
- August 7, 2018, from 3:00 p.m. to 4:00 p.m. (unscheduled).
- September 19, 2018, from 3:30 p.m. to 5:00 p.m. (unscheduled).

The EM&V team received interval meter data and a summary spreadsheet that detailed the Entergy calculated event-level savings results for each event and meter. All participants participated in the unscheduled events on August 7, 2017, and September 19, 2018, with the preceding unscheduled events used as test events for individual participants. The EM&V team replicated all event-level savings for each participant using the TRM calculation methodology, with results matching Entergy’s savings calculations.

Evaluated savings for the Entergy Load Management program are 5,825 kW and 20,008 kWh. The realization rate for both kW and kWh is 100.0 percent.

7.0 ONCOR IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for Oncor's 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

7.1 Key Findings

7.1.1 Evaluated Savings

Oncor's evaluated savings for PY2018 were 172,825 in demand (kW) and 218,340,171 in energy (kWh) savings. The overall kW portfolio realization rates are approximately 100 percent. Oncor was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 7-1 Table 2-1), which also supported healthy realization rates.

Table 7-1 shows the claimed and evaluated demand savings for Oncor's portfolio and broad customer sector/program categories.

Table 7-1. Oncor PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	172,402	172,825	100.2%	1.5%
Commercial	13.2%	22,714	22,717	100.0%	0.5%
Residential	25.7%	44,367	44,371	100.0%	6.6%
Low Income	1.7%	2,908	2,908	100.0%	n/a
Load Management	59.4%	102,413	102,829	100.4%	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 resulting level of load curtailment achieved for each event for all participants.

Table 7-2 shows the claimed and evaluated energy savings for Oncor's portfolio and broad customer sector/program categories for PY2018.

Table 7-2. Oncor PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	218,304,094	218,340,171	100.0%	2.0%
Commercial	54.7%	119,515,758	119,546,300	100.0%	0.4%
Residential	42.7%	93,189,929	93,194,217	100.0%	5.5%
Low Income	2.4%	5,291,167	5,291,167	100.0%	n/a

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Load Management	0.1%	307,239	308,487	100.4%	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 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. 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–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 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 and/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 Small Business MTP, which received a documentation score of Fair.

7.1.2 Cost-effectiveness Results

Oncor’s overall portfolio had a cost-effectiveness of 2.19, or 2.36 excluding low-income programs. (See Table 7-3.)

The more cost-effective programs were Retail Platform MTP and Commercial Standard Offer Program (SOP). The less cost-effective programs were Solar PV SOP and Small Business Direct Install MTP. All of Oncor’s programs were cost-effective in 2018.

The lifetime cost of evaluated savings was \$0.009 per kWh and \$20.78 per kW.

Table 7-3. Oncor Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.19	2.19	2.03
Total Portfolio excluding low-income programs	2.36	2.36	2.19
Commercial	2.40	2.40	2.20
Commercial SOP (Custom)	2.53	2.53	2.29
Commercial SOP (Basic)	2.73	2.73	2.47
Solar PV SOP	1.30	1.30	1.31
Small Business Direct Install MTP	1.34	1.34	1.27
Retail Platform MTP	43.20	43.20	38.88
Residential	2.49	2.49	2.29
Home Energy Efficiency SOP	2.18	2.18	1.94
Solar PV SOP	1.19	1.19	1.21
Retail Platform MTP	7.45	7.45	6.70
Hard-to-Reach SOP	1.86	1.86	1.86
Low Income*	1.81	1.81	1.81
Targeted Weatherization Low-Income SOP*	1.81	1.81	1.81
Load Management	1.56	1.57	1.57
Commercial Load Management SOP	1.64	1.65	1.65
Residential Demand Response SOP	1.43	1.43	1.43

* The Low Income sector and Targeted Weatherization Low-Income SOP are evaluated using the savings-to-investment ratio.

7.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project-level based on interim EM&V findings. Table 7-4 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 7-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR¹¹ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Commercial SOP (Custom) (Com)	11.30	16,319.30
Small Business Direct Install MTP (Com)	-9.90	-126,280.40

¹¹ Energy Efficiency Cost Recovery

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Total	1.40	-109,961.10

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
8.0%	13,766	13,773	100.0%	33.5%	73,230,061	73,258,574	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 PY2018 Basic Commercial SOP evaluation efforts focused on desk reviews and on-site M&V. The number 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 5 percent and one project had adjustments greater than 5 percent compared to the original claimed savings. Oncor 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 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1119480: The energy efficiency project included exterior lighting retrofits at a college. During the desk review, the EM&V team corrected the LED fixture wattage using the DLC qualified products list and inspection notes. Fixtures wattage was adjusted from 155W to 156W, which resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1119500: The energy efficiency project included interior lighting retrofits with controls and exterior retrofits at a non-refrigerated warehouse. During the desk review and on-site M&V visit, the EM&V team adjusted the qualification for several LED fixtures from “Non-Qualified” to “DLC” using the DLC qualified products list and post inspection notes. This correction increased the demand and energy savings and resulted in realization rates of 102 percent kW and kWh.

Participant ID 1152161: The energy efficiency project included the new construction of interior lighting fixtures with some controls and exterior lighting fixtures at a warehouse. During the desk review, occupancy sensors were removed from 17 34W fixtures per inspection report. In addition, the EM&V team corrected the wattage of the 35W fixtures to 34W using the DLC qualified products list. These adjustments resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1168068: The energy efficiency project included new construction of interior and exterior lighting at a non-refrigerated warehouse. During the desk review and on-site M&V visit, the EM&V team adjusted the quantity of the 270W LED fixtures in the exterior parking area from 4 to 1 based on post-inspection findings, which was confirmed during the on-site visit. This adjustment resulted in a negligible increase in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1168089: The energy efficiency project included interior lighting retrofits at a non-food service building. During the desk review, the EM&V team corrected the qualification of the 150W fixtures from “Non-Qualified” to “DLC” using the DLC qualified products list. This adjustment increased the demand and energy savings and resulted in realization rates of 119 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

7.3.2 Custom Commercial Standard Offer Program (SOP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
0.8%	1,428	1,429	100.1%	5.8%	12,588,022	12,596,856	100.1%	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 PY2018 Custom Commercial SOP evaluation efforts focused on desk reviews and on-site M&V. The number 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 5 percent and one project had adjustments greater than 5 percent compared to the original claimed savings. Oncor 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 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1119333: The energy efficiency project included interior lighting retrofits at a public assembly building. During the desk review and on-site M&V visit, the EM&V team adjusted the fixture quantities for two rooms in the building from 7 claimed to 5 and from 18 claimed to 16. This adjustment resulted in a slight increase in demand and energy savings and realization rates of 102 percent kW and kWh.

Participant ID 1119335: The energy efficiency project included exterior lighting retrofits at a college. During the desk review and on-site M&V visit, the EM&V team corrected the LED fixture wattages using the DLC qualified products list for several fixtures: from 18W claimed to 17W, from 21W claimed to 20W, from 34W claimed to 33W, from 26W claimed to 25W, and from 53W claimed to 52W. Overall, these adjustments slightly increased demand and energy savings and resulted in realization rates of 101 percent kW and kWh.

Participant ID 1152090: The energy efficiency project included the new construction of an HVAC system at a school. During the desk review, the EM&V team realized after discussions with Oncor that the ex-ante calculator provided did not sum up the savings for all line items in the calculator. Updating the calculator resulted in an increase in demand and energy savings and realization rates of 117 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

7.3.3 Small Business Direct Install 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
1.5%	2,567	2,562	99.8%	6.5%	14,143,909	14,137,102	100.0%	Fair

Completed Desk Reviews*	On-Site M&V
15	8

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

The PY2018 Small Business Direct Install MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 15 projects. Thirteen projects had adjustments of less than 5 percent and two projects had adjustments greater than 5 percent compared to the original claimed savings. Oncor accepted the evaluated results and matched the claimed savings to those of the evaluations for the two 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 1119570: The energy efficiency project included interior lighting retrofits at a school. During the desk review and on-site M&V visit, the EM&V team adjusted the air conditioning type for all interior LED fixtures from “None” to “Air Conditioned.” In addition, the air conditioning type for 17 80W LED fixtures reported to replace 400W metal halide lights in the parking lot area was

corrected from indoor “Air Conditioned” to outdoor “None.” Overall, these corrections resulted in realization rates of 99 percent kW and 100 percent kWh.

Participant ID 1119573: The energy efficiency project included interior and exterior lighting retrofits at a strip mall retail store. During the desk review and on-site M&V visit, the EM&V team corrected the LED fixture wattages using the DLC qualified products list for several fixtures: from 30W claimed to 27W, from 7W claimed to 6W, from 60 claimed to 58W, from 66W claimed to 65W, and from 180W claimed to 179W. Overall, these adjustments decreased demand savings and increased energy savings and resulted in realization rates of 96 percent kW and 102 percent kWh.

Participant ID 1119580: The energy efficiency project included exterior lighting retrofits at an office building. During the desk review, the EM&V team adjusted the LED fixture wattages to match the DLC qualified products list for several fixtures: from 39W claimed to 42W, from 80W claimed to 81W, and from 155W claimed to 166W. Overall, these corrections resulted in a decrease in demand and energy savings and realization rates of 95 percent kW and 99 percent kWh.

Participant ID 1119583: The energy efficiency project included exterior lighting retrofits at a retail store. During the desk review and on-site M&V visit, the EM&V team corrected the LED fixture wattages using the DLC qualified products list for several fixtures from 235W claimed to 227W, and from 66W claimed to 65W. During the on-site M&V visit, the EM&V team also found that the installed lamps were not photocell-controlled, however, savings were still considered. Overall, these adjustments resulted in a negligible increase in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1119611: The energy efficiency project included interior lighting retrofits with some controls at a non-food service shop. During the desk review, the EM&V team adjusted the LED fixture wattages using the DLC qualified products list for several fixtures: from 35W claimed to 23W, from 29W claimed to 32W, from 135W claimed to 133W, and from 178W to 176W. Overall, these corrections slightly increased the demand and energy savings and resulted in realization rates of 101 percent kW and kWh.

Participant ID 1119615: The energy efficiency project included interior and exterior lighting retrofits at an in-patient healthcare facility. During the desk review and on-site M&V visit, the EM&V team corrected the LED fixture wattages to match the DLC qualified products list for several fixtures: from 7W claimed to 6W, from 13W claimed to 22W, from 30W claimed to 29W, and from 60W claimed to 58W. Overall, these adjustments resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and 99 percent kWh.

Participant ID 1119616: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team adjusted the LED fixture wattages using the DLC qualified products list for several fixtures: from 35W claimed to 23W, from 29W claimed to 32W, and from 20W claimed to 22W. These corrections slightly decreased the demand and energy savings and resulted in realization rates of 99 percent kW and kWh.

Participant ID 1119620: The energy efficiency project included exterior lighting retrofits at a strip mall retail building. During the desk review, the EM&V team corrected the LED fixture wattages for some fixtures from 180W claimed to 179W using the DLC qualified products list, which slightly increased the demand and energy savings. This resulted in realization rates of 100 percent kW and kWh.

Participant ID 1147762: The energy efficiency project included exterior lighting retrofits at a parking lot. During the desk review, the EM&V team adjusted the LED fixture wattages to match the DLC

qualified products list for several fixtures from 180W claimed to 179W, from 20W claimed to 21W, and from 60W claimed to 58W. These corrections resulted in a negligible increase in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1147775: The energy efficiency project included exterior lighting retrofits at a parking lot. During the desk review, the EM&V team corrected the LED fixture wattages using the DLC qualified products list for the pole fixtures from 180W claimed to 179W. In addition, the qualification of the wall pack fixtures was adjusted to “Non-qualified,” which significantly decreased demand and energy savings. Overall, these adjustments resulted in realization rates of 85 percent kW and kWh.

Participant ID 1147780: The energy efficiency project included interior lighting retrofits at a non-refrigerated warehouse. During the desk review, the EM&V team adjusted the wattage for two types of fixtures; from 7W claimed to 6W using the ENERGY STAR[®] qualified products list and from 133W claimed to 135W using the DLC qualified products list. Overall, these adjustments slightly increased the demand and energy savings and resulted in realization rates of 101 percent kW and kWh.

Participant ID 1147785: The energy efficiency project included exterior lighting retrofits at a strip mall parking lot. During the desk review and on-site M&V visit, the EM&V team removed savings for fixtures for seven LED screw-in lamps as these lamps were not installed per on-site visit findings. This adjustment resulted in a decrease in demand and energy savings and realization rates of 98 percent kW and kWh.

Participant ID 1147787: The energy efficiency project included interior lighting retrofits at a manufacturing facility. During the desk review and on-site M&V visit, the EM&V team adjusted the building type from "Manufacturing 2 Shift" to "Manufacturing 1 Shift" since it is the primary space usage per on-site visit findings. The coincidence factor (CF) and the annual operating hours (HOU) decreased, which significantly reduced the demand and energy savings. In addition, the air conditioning type for several areas in the front office portion of the facility was adjusted from “Air Conditioned” to “None” per on-site visit findings. Overall, these corrections resulted in a significant decrease in demand and energy savings and realization rates of 85 percent kW and 52 percent kWh.

Participant ID 1147789: The energy efficiency project included interior lighting retrofits at a strip mall retail store. During the desk review and on-site M&V visit, the EM&V team corrected the wattage for some LED screw-in lamps from 10W claimed to 9.5W to match the ENERGY STAR qualified products list since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W). This adjustment resulted in a negligible increase in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 115722: The energy efficiency project included interior lighting retrofits at a school. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage for 20 LED troffer retrofit fixtures from 20W claimed to 21W to match the DLC qualified products list. During the on-site M&V visit, 10 of the 30 reported LED exit signs could not be found on site. The EM&V team corrected the pre- and post-exit sign quantity from a total of 30 to 20 to reflect these findings. Overall, these adjustments decreased the demand and energy savings and resulted in realization rates of 99 percent kW and kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions for two of the 15 projects that had desk reviews completed because sufficient documentation was provided for the sites. However, partial documentation was provided for the other 12 projects. The project documentation lacked in most cases pre- and post-photographs, or photographs were provided but the model numbers could not be verified. In addition, post-inspection notes, invoices and QPL documentation were not provided for several projects. Complete documentation enhances the accuracy and transparency of project savings and ease of evaluation. Since sufficient documentation was provided for just a few projects, the EM&V team assigned a program documentation score of Fair.

7.4 Detailed Findings—Residential (Medium Evaluation Priority)

7.4.1 Home Energy Efficiency 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
14.1%	24,385	24,386	100.0%	18.7%	40,914,271	40,916,143	100.0%	Good

Completed Desk Reviews*	On-Site M&V
18	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for 18 projects and resulted in desk review realization rates of 103.5 percent and 102.2 percent for demand and energy savings, respectively. On-site M&V was completed for nine projects and resulted in on-site realization rates 106.6 percent and 104.2 percent for demand and energy savings, respectively.

The overall realization rates were influenced by three air infiltration projects that fell within the project-level adjustment threshold. Per protocol, the Texas IOUs are not required to make savings modifications for project-level adjustments that would result in added savings, and as such, Oncor elected to not adjust these projects. In summary, high-level findings for these three projects includes:

- Using a threshold of +/-10 percent, the EM&V team’s on-site testing for the three air infiltration projects yielded substantially higher reduction than what was reported by the program.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration, ceiling insulation, and central air conditioners and heat pumps. Because sufficient documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

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

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
6.5%	11,252	11,255	100.0%	7.2%	15,825,595	15,828,010	100.0%	Good

Completed Desk Reviews*	On-Site M&V
10	5

*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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for 10 projects and resulted in desk review realization rates of 119.3 percent and 118.9 percent for demand and energy savings, respectively. On-site M&V was completed for five projects and resulted in on-site realization rates 143.8 percent and 142.9 percent for demand and energy savings, respectively.

The overall realization rates were influenced by five projects that fell within the project-level adjustment threshold. Per protocol, the Texas IOUs are not required to make savings modifications for project-level adjustments that would result in added savings, and as such, Oncor elected to not adjust these projects. In summary, high-level findings for these five projects includes:

- Using a threshold of +/-10 percent, the EM&V team’s on-site testing for four air infiltration projects yielded substantially higher reduction than what was reported by the program.
- The EM&V team’s documentation review for one ceiling insulation project revealed the installed ceiling insulation R-value was higher than what was reported by the program.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration and ceiling insulation. Because sufficient documentation was provided across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

7.5 Detailed Findings—Load Management (High Evaluation Priority)

7.5.1 Commercial Load Management Standard Offer Program (SOP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
39.2%	67,658	68,074	100.6%	0.1%	202,974	204,222	100.6%	Good

Completed Desk Reviews*	On-Site M&V
NA	NA

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

The EM&V team evaluated the Oncor Commercial Load Management program by applying the TRM calculation methodology to interval meter data. The meter data were supplied in 15-minute increments at the Electric Service Identifier (ESI ID) level. A single load management event occurred on June 13, 2018, from 3:00 p.m. to 6:00 p.m.

The EM&V team received the interval meter data and spreadsheets detailing the Oncor calculated baseline load, event load, and savings results for each event and ESI ID. The EM&V team found that its savings calculations were higher than Oncor’s total initial savings (67,657.89 kW) with a calculated kW savings of 68,073.93 kW. In reviewing individual meter savings differences, it was found that Oncor did not set savings to zero in cases where the calculation methodology produced a negative savings result. Per TRM 5.0, in cases where the savings algorithm produces a negative savings, a savings can be set to zero. The EM&V team informed Oncor that setting negative savings to zero was allowed, however in the end, Oncor chose not to correct the final savings value to match the EM&V team.

Evaluated savings for the Oncor Commercial Load Management program are 68,074 kW and 204,222 kWh. The realization rate for both kW and kWh is 100.6 percent.

7.5.2 Residential Demand Response 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
20.2%	34,755	34,755	100.0%	0.0%	104,265	104,265	100.0%	Good

Completed Desk Reviews*	On-Site M&V
NA	NA

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

The EM&V team evaluated the Oncor Residential Demand Response program by applying the TRM calculation methodology to interval meter data. The meter data were supplied in 15-minute increments

at the Electric Service Identifier (ESI ID) level. A single demand response event occurred on June 28, 2018, from 3:00 p.m. to 6:00 p.m.

The EM&V team received the interval meter data and spreadsheets detailing the Oncor calculated baseline load, event load, and savings results for each event and ESI ID. Additionally, Oncor provided documentation on its treatment of meters that required exceptions. For some ESI IDs, there were cases that were inactive for one event or other, which were dropped from the event-level savings calculation. For others, meter data was unavailable due to meter maintenance or other factors, though operability of the program indicated them as participants. For this second set of cases, which totaled less than 1 percent of the program population, the average savings of the remaining participants was applied to these meters, per the TRM and EM&V guidance. Oncor's presentation and discussion of these exceptions was excellent and the EM&V team was able to confirm that verified savings matched Oncor's savings calculation.

Evaluated savings for the Oncor Residential Demand Response program are 34,755 kW and 104,265 kWh. The realization rate for both kW and kWh is 100.0 percent.

7.6 Summary of Low Priority Evaluation Programs

Table 7-5 provides a summary of claimed savings for Oncor's low evaluation priority programs in PY2018, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2018 tracking data provided to the EM&V team for the EM&V database.

Table 7-5. PY2018 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)
Solar PV SOP	1.5%	2,512	2,512	100.0%	3.8%	8,212,970	8,212,970	100.0%
Retail Platform MTP	1.4%	2,440	2,440	100.0%	5.2%	11,340,797	11,340,797	100.0%
Retail Platform MTP	4.4%	7,618	7,618	100.0%	15.0%	32,719,833	32,719,833	100.0%
Solar PV SOP	0.6%	1,113	1,113	100.0%	1.7%	3,730,231	3,730,231	100.0%
Targeted Weatherization Low-Income SOP	1.7%	2,908	2,908	100.0%	2.4%	5,291,167	5,291,167	100.0%

8.0 SWEPCO IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for SWEPCO's 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

8.1 Key Findings

8.1.1 Evaluated Savings

SWEPCO's evaluated savings for PY2018 were 13,961 in demand (kW) and 17,024,556 in energy (kWh) savings. The overall portfolio realization rates for kW and kWh are 100 percent. SWEPCO was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results, which also supported healthy realization rates. (See Table 8-4.)

Table 8-1 shows the claimed and evaluated demand savings for SWEPCO's portfolio and broad customer sector/program categories.

Table 8-1. SWEPCO PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	13,960	13,961	100.0%	0.1%
Commercial	14.4%	2,008	2,009	100.1%	0.4%
Residential	28.1%	3,919	3,919	100.0%	0.1%
Load Management	57.5%	8,033	8,033	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 resulting level of load curtailment achieved for each event for all participants.

Table 8-2 shows the claimed and evaluated energy savings for SWEPCO's portfolio and broad customer sector/program categories for PY2018.

Table 8-2. SWEPCO PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	17,017,391	17,024,556	100.0%	0.2%
Commercial	63.0%	10,712,718	10,719,932	100.1%	0.4%
Residential	36.4%	6,199,876	6,199,826	100.0%	0.2%
Load Management	0.6%	104,797	104,797	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 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. 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–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 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 and/or high savings programs have been identified.

SWEPCO received a Good program documentation score for all its programs.

8.1.2 Cost-effectiveness Results

SWEPCO’s overall portfolio had a cost-effectiveness of 2.38.

The more cost-effective programs were Commercial Solutions Market Transformation Program (MTP) and Commercial Standard Offer Program (SOP). The less cost-effective programs were Open MTP and Hard-to-Reach SOP. All of SWEPCO’s programs were cost-effective in 2018. (See Table 8-3.)

The lifetime cost of evaluated savings was \$0.009 per kWh and \$18.35 per kW.

Table 8-3. SWEPCO Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.38	2.38	2.19
Commercial	2.64	2.64	2.39
Commercial Solutions MTP	3.01	3.01	2.69
Commercial SOP	2.83	2.83	2.56

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Open MTP	1.60	1.60	1.52
SCORE MTP	2.80	2.80	2.51
Residential	2.20	2.20	2.04
Residential SOP	2.40	2.40	2.12
Hard-to-Reach SOP	1.92	1.92	1.92
Load Management	2.27	2.27	2.27
Load Management SOP	2.27	2.27	2.27

8.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project level based on interim EM&V findings. Table 8-4 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume the following adjustments will be included in SWEPCO's May 1 filing.

Table 8-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR¹² Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Commercial SOP (Com)	4.20	11,941.00
Open MTP (Com)	-1.50	4,345.80
SCORE MTP (Com)	-15.10	-84,287.00
Hard-to-Reach SOP (HTR)	0.70	815.20
Residential SOP (Res)	0.30	338.70
Total	-11.40	-66,846.30

¹² Energy Efficiency Cost Recovery

8.3 Detailed Findings—Commercial (High/Medium Evaluation Priority)

8.3.1 Commercial Standard Offer Program

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
5.7%	790	790	100.0%	25.7%	4,375,933	4,376,334	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 PY2018 CSOP evaluation efforts focused on desk reviews and on-site M&V. The number 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 four projects. Three projects had adjustments of less than 5 percent and one project had an adjustment greater than 5 percent compared to the original claimed savings. SWEPCO accepted the evaluated results and matched the claimed savings to those of the evaluations for the one project with significant adjustment and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1117881: The energy efficiency project included interior lighting retrofits with controls at a manufacturing facility. During the desk review and on-site M&V visit, the EM&V team corrected wattages for several installed fixtures using DLC qualified products list (from 139W claimed to 149W, from 83W claimed to 80W, and from 82W claimed to 74W). The deemed equivalent full load hours (EFLH) and coincidence factor (CF) were also adjusted to match the Texas TRM 5.0 values. During the site visit, the EM&V team identified fixtures in a few of the rooms in the facility that were not replaced as part of the project. In addition, additional occupancy controls were found throughout the facility, which led to a significant increase in evaluated savings. Overall, the adjustments resulted in realization rates of 107 percent kW and 103 percent kWh.

Participant ID 1117885: The energy efficiency project included interior lighting retrofits at a non-food service shop. During the desk review and on-site M&V visit, the EM&V team corrected the LED wattage for all installed fixtures using the DLC qualified products list to 141W from 140W claimed. The wattage adjustment for the project's lights resulted in a negligible decrease in energy and peak demand savings and realization rates of 100 percent kW and kWh.

Participant ID 1117887: The energy efficiency project included interior lighting retrofits at a manufacturing facility. During the desk review and on-site M&V visit, the EM&V team verified the model numbers of the new lighting installed and found one of the lighting fixtures installed at the site to have a rating of 52W compared to 53W claimed per DLC qualified products list. The wattage correction resulted in a negligible increase in energy and peak demand savings and realization rates of 100 percent kW and kWh.

Participant ID 1117901: 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 the

LED wattage for some of the installed exterior fixtures using the DLC qualified products list to 75W from 74W claimed. The wattage adjustment resulted in a negligible decrease in energy and peak demand 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 six of the eight 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, the 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. However, partial documentation was provided for the other two projects. One project documentation lacked inspection notes and the other project documentation lacked pre- and post-install photographic documentation. Since invoices, QPL qualifications and specification sheets were provided for these two projects and sufficient documentation was provided for the rest of the projects, the EM&V team assigned a program documentation score of Good.

8.3.2 Commercial Solutions Market Transformation 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
3.3%	465	465	100.0%	15.6%	2,648,555	2,648,655	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 PY2018 Commercial Solutions MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 one project. The project had an adjustment of less than 5 percent compared to the original claimed savings and therefore the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1133534: The energy efficiency project included interior and exterior lighting retrofits at a manufacturing facility. During the desk review, the EM&V team corrected the LED wattage for some of the installed outdoor fixtures using the DLC qualified products list to 80W from 81W claimed. The wattage adjustment for the project’s lights resulted in a negligible increase in energy and peak demand 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 two of the four 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, the 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. However, partial documentation was provided for the other two

projects. Inspection was not conducted for these two projects and the project documentation lacked photographic documentation of new lighting types. Since invoices, QPL qualifications and specification sheets were provided for these two projects and sufficient documentation was provided for the rest of the projects, the EM&V team assigned a program documentation score of Good.

8.3.3 Open Market Transformation 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
1.8%	253	253	100.0%	6.2%	1,055,006	1,055,502	100.0%	Good

Completed Desk Reviews*	On-Site M&V
10	5

*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 PY2018 Open MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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. Four projects had adjustments of less than 5 percent and four projects had adjustments greater than 5 percent compared to the original claimed savings. SWEPCO accepted the evaluated results and matched the claimed savings to those of the evaluations for the four 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 1131641: 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 adjusted the building type from "Retail strip/enclosed mall" to "Office" based on intended use by the customer and corrected the LED wattage for some of the installed interior and exterior fixtures using the DLC qualified products list: from 13W claimed to 12W and from 40W claimed to 38W. During the on-site visit, no air conditioning was found in the open area of the building. Overall, the corrections resulted in a decrease in energy and peak demand savings and realization rates of 85 percent kW and 94 percent kWh.

Participant ID 1131646: The energy efficiency project involved interior lighting retrofits at a non-food service shop. During the desk review and on-site M&V visit, the EM&V team adjusted the Air Conditioning Type to "None" per on-site visit findings. This adjustment decreased the energy and peak demand savings and resulted in realization rates of 91 percent kW and 95 percent kWh.

Participant IDs 1131647 and 1131991: The energy efficiency projects included interior lighting retrofits at strip mall retail stores. During the desk review and on-site M&V visit, the deemed equivalent full load hours (EFLH) and coincidence factor (CF) were adjusted to match the Texas TRM 5.0 values for the Retail-Strip Mall building type. The EM&V team also corrected the LED wattage for most installed fixtures to 17.5W from 18W claimed since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. For the first project, the adjustments resulted in an increase in energy and peak demand savings and realization rates of 101 percent kW and 110 percent kWh. For the second project, the corrections

increased energy and peak demand savings and resulted in realization rates of 108 percent kW and kWh.

Participant ID 1131806: The energy efficiency project included interior lighting retrofits at a religious building. During the desk review, the EM&V team corrected the fixture quantity of the 9W lamps using the invoice and photographic documentation from five claimed to six. This quantity adjustment resulted in a negligible increase in energy and peak demand savings and realization rates of 101 percent kW and kWh.

Participant ID 1133409: The energy efficiency project included interior lighting retrofits at a non-food service shop. During the desk review, the EM&V team corrected the LED wattages for two types of installed fixture to match DLC certification, from 9W to 9.5W (screw-in bulbs) and from 15W to 14.5W and 15.5W (LED tubes) since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. The wattage adjustment for the project's lights resulted in a negligible decrease in energy and peak demand savings and realization rates of 99 percent kW and kWh.

Participant ID 1133641: The energy efficiency project involved interior and exterior lighting retrofits at a manufacturing facility. During the desk review, the EM&V team adjusted the baseline wattage for non-operating fixtures by applying a 10 percent cap per TRM recommendation. The TRM states that "the number of non-operating fixtures will be limited to 10 percent of the total fixture count per facility." However, the ex-ante calculator applied the 10 percent cap per tracked line item. The EM&V team corrected the savings calculation to reflect the TRM by applying the cap on the basis of the entire facility fixture count, which reduced all interior baseline wattage. This adjustment resulted in a negligible decrease in energy and peak demand savings and realization rates of 95 percent kW and 96 percent kWh.

Participant ID 1133649: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review and on-site M&V visit, the EM&V team verified the quantities and model numbers of the new lighting installed and found two lighting fixtures types at the site to have a rating of 10W compared to 18W claimed and 100W compared to 105W claimed. In addition, the on-site verification noted several quantity variations: the lamp quantity in the main sales area was short by 3 lamps (339 total), the 100W fixture quantity in the outbuildings was short by 3 (2 total), the 19W LED tubes quantity was short by 4 (10 total) in the second outbuilding, and quantity of fixtures in the office was short by 6 fixtures (34 total). Overall, the adjustments increased energy and peak demand savings and resulted in realization rates of 103 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, the 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. In some cases, however, discrepancies between the invoices and the photographic documentation (e.g., in fixture model numbers or fixtures quantities) limited the verification process. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of Good.

8.3.4 SCORE Market Transformation 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
3.6%	500	501	100.2%	15.5%	2,633,224	2,639,442	100.2%	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 PY2018 SCORE MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 5 percent and one project had an adjustment greater than 5 percent compared to the original claimed savings. SWEPCO accepted the evaluated results and matched the claimed savings to those of the evaluations for the project with significant adjustment and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1154499: The energy efficiency project included interior retrofits with some controls and exterior lighting retrofits at a school. During the desk review and on-site M&V visit, the EM&V team adjusted the LED wattage for installed fixtures using the DLC qualified products list to 15W from 15.5W claimed. The largest impact, however, was due to a correction to the Air Conditioning Type. The ex-ante calculator did not have savings associated with the retrofit in one of the line items because the air conditioning type was not selected. The EM&V team selected “Air Conditioning” and savings for these retrofits were generated and included in the project total savings. Overall, the adjustments increased energy and peak demand savings and resulted in realization rates of 105 percent kW and kWh.

Participant ID 1154508: The energy efficiency project included interior retrofits with some controls and exterior lighting retrofits at a school. During the desk review, the EM&V team found incorrect entries of installed LED tube quantities in the ex-ante calculator. The quantities were entered in the wrong column; thus, the energy savings were calculated as if the baseline linear fluorescent T8 fixtures were replaced with nothing. This is also reflected in the unusually low controls savings claimed despite having occupancy sensors installed in various locations throughout the building. Overall, the adjustments resulted in a significant decrease in energy and peak demand savings and realization rates of 74 percent kW and 75 percent kWh.

Participant ID 1154509: The energy efficiency project included interior lighting retrofits with some controls and exterior lighting retrofits at a school. During the desk review, the EM&V team corrected the LED wattage for installed fixtures using the QPL qualified products list to 10W from 9.5W claimed (ENERGY STAR certified) and to 15W from 15.5W claimed (DLC certified). The wattage adjustment for the project’s lights resulted in a negligible increase in energy and peak demand 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, the 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.

8.4 Detailed Findings—Residential (Medium Evaluation Priority)

8.4.1 Residential Standard Offer Program

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
17.5%	2,439	2,439	100.0%	23.1%	3,928,310	3,928,310	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of over 5 percent to the claimed savings for one project based on the on-site findings. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for eight projects and resulted in desk review realization rates of 103.0 percent and 102.2 percent for demand and energy savings, respectively. There were minor differences between ex-ante and ex post savings for LEDs due to rounding. All identified variations due to rounding were within 1 kWh and 0.01 kW.

On-site M&V was completed for four projects and resulted in on-site realization rates of 106.9 percent and 105.8 percent for demand and energy savings, respectively. These overall on-site realization rates for the four projects were driven by the following project:

Participant ID 1118499: The energy efficiency project included implementation of air infiltration and LED measures. The EM&V team's on-site testing resulted in a substantially higher reduction in air infiltration than what was documented by the program. Using a threshold of +/-10 percent, the EM&V

team’s blower door test results were quite a bit lower than the results found in the tracking data resulting in an increase in savings. Overall, the adjustments resulted in project level realization rates of 129.2 percent and 128.6 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration, duct efficiency, and ceiling insulation. There was limited documentation for direct installs such as LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

8.4.2 Hard-to-Reach Standard Offer Program

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
10.6%	1,480	1,480	100.0%	13.3%	2,271,566	2,271,516	100.0%	Good

Completed Desk Reviews*	On-Site M&V
7	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for one project. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for seven projects and resulted in desk review realization rates of 107.4 percent and 105.5 percent for demand and energy savings, respectively. There were minor differences between ex-ante and ex post savings for LEDs due to rounding. All identified variations due to rounding were within 1 kWh and 0.01 kW.

On-site M&V was completed for four projects and resulted in on-site realization rates of 112.8 percent and 109.0 percent for demand and energy savings, respectively. These overall on-site realization rates for the four projects were driven by the following project:

Participant ID 1118746: The energy efficiency project included implementation of air infiltration and LED measures. The EM&V team’s on-site testing resulted in a substantially higher reduction in air infiltration than what was documented by the program. Using a threshold of +/- 10percent, the EM&V team’s blower door test results were quite a bit lower than the results found in the tracking data

resulting in an increase in savings. Overall, the adjustments resulted in project level realization rates of 132.8 percent and 131.9 percent for demand and energy savings, respectively.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration, duct efficiency, and ceiling insulation. There was limited documentation for direct installs such as LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

8.5 Detailed Findings—Load Management (High Evaluation Priority)

8.5.1 Load Management Standard Offer Program

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
57.5%	8,033	8,033	100.0%	0.6%	104,797	104,797	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 resulting level of load curtailment achieved for each event for all participants.

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

- May 18, 2018, between 2:30 p.m. and 3:30 p.m. (scheduled)
- May 23, 2018, between 1:00 p.m. and 2:00 p.m. (scheduled)
- May 29, 2018, between 1:00 p.m. and 2:00 p.m. (scheduled)
- May 30, 2018, between 1:00 p.m. and 2:00 p.m. (scheduled)
- May 30, 2018, between 1:30 p.m. and 2:30 p.m. (scheduled)
- June 6, 2018, between 2:00 p.m. and 3:00 p.m. (scheduled)
- June 27, 2018, between 2:00 p.m. and 6:00 p.m. (unscheduled)
- July 20, 2018, between 2:00 p.m. and 6:00 p.m. (unscheduled)
- July 26, 2018, between 2:00 p.m. and 6:00 p.m. (unscheduled)

The EM&V team received the interval meter data and a summary spreadsheet that detailed the SWEPCO calculated event-level savings results for each event and meter. All participants participated in the unscheduled events on June 27, July 20, and July 26, 2018, with the preceding scheduled events used as test events for individual participants. The EM&V team replicated all event-level savings for

each participant using the TRM calculation methodology, with results matching that of SWEPCO's savings calculations.

Evaluated savings for the SWEPCO Load Management program are 8,033 kW and 104,797 kWh. The realization rate for both kW and kWh is 100.0 percent.

8.6 Summary of Low Priority Evaluation Programs

All of SWEPCO's programs were categorized as either high or medium priority for PY2018 evaluation.

9.0 TNMP IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for TNMP's 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

9.1 Key Findings

9.1.1 Evaluated Savings

TNMP's evaluated savings for PY2018 were 13,763 in demand (kW) and 17,204,465 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are 100 percent. TNMP was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results (see Table 9-4), which also supported healthy realization rates.

Table 9-1 shows the claimed and evaluated demand savings for TNMP's portfolio and broad customer sector/program categories.

Table 9-1. TNMP PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	13,763	13,763	100.0%	0.0%
Commercial	12.2%	1,681	1,681	100.0%	0.0%
Residential	31.5%	4,333	4,333	100.0%	0.0%
Low Income	3.5%	479	479	100.0%	n/a
Load Management	52.1%	7,176	7,176	100.0%	0.0%
Pilot	0.7%	94	94	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 resulting level of load curtailment achieved for each event for all participants.

Table 9-2 shows the claimed and evaluated energy savings for TNMP's portfolio and broad customer sector/program categories for PY2018.

Table 9-2. TNMP PY2017 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	17,204,465	17,204,465	100.0%	0.0%
Commercial	46.8%	8,049,347	8,049,347	100.0%	0.0%
Residential	47.3%	8,133,957	8,133,957	100.0%	0.0%

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Low Income	4.4%	757,417	757,417	100.0%	n/a
Load Management	0.0%	7,176	7,176	100.0%	0.0%
Pilot	1.5%	256,568	256,568	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 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. 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–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 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 and/or high savings programs have been identified.

TNMP received a Good program documentation score for its Residential Standard Offer and High-Performance Homes programs. It also received Good documentation scores for its Commercial SOPs and Commercial Solutions MTPs. For the Small Business, Open MTPs and SCORE/CitySmart programs, TNMP received a Fair documentation score as the EM&V team found partial documentation for some projects within each of these programs.

9.1.2 Cost-effectiveness Results

TNMP's overall portfolio had a cost-effectiveness of 1.76, or 1.90 excluding low-income programs. (See Table 9-3.)

The more cost-effective programs were Residential SOP and High-Performance Homes MTP. The less cost-effective programs were Open for Small Business MTP and REP Pilot MTP. The REP Pilot MTP was in its first year of a redesigned pilot to try to be cost-effective, but it still was not.

The lifetime cost of evaluated savings was \$0.009 per kWh and \$19.12 per kW.

Table 9-3. TNMP Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	1.76	1.76	1.57
Total Portfolio excluding low-income programs	1.90	1.90	1.69
Commercial	1.73	1.73	1.57
Open for Small Business MTP	1.25	1.25	1.19
SCORE/CitySmart MTP	1.91	1.91	1.72
Commercial Solutions MTP	1.95	1.95	1.75
Residential	2.14	2.14	1.85
High-Performance Homes MTP	2.22	2.22	1.55
Residential SOP	2.31	2.31	2.05
Hard-to-Reach SOP	1.47	1.47	1.47
Low Income*	2.19	2.19	2.19
Low Income Weatherization*	2.19	2.19	2.19
Load Management	1.58	1.58	1.58
Load Management SOP	1.58	1.58	1.58
Pilot	0.52	0.52	0.43
REP Pilot MTP	0.52	0.52	0.43

** The Low Income sector and Low Income Weatherization program are evaluated using the savings-to-investment ratio.

9.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project-level based on interim EM&V findings. Table 9-4 summarizes claimed savings adjustments recommended by the EM&V team. Realization rates assume all of the following adjustments will be included in TNMP's June 1 filing.

Table 9-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR¹³ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Commercial Solutions MTP (Com)	-6.10	-28,267.00
Open for Small Business MTP (Com)	-3.40	-8,926.60
SCORE/CitySmart MTP (Com)	1.90	43,580.00
Total	-7.60	6,386.40

¹³ Energy Efficiency Cost Recovery

9.3 Detailed Findings—Commercial (Medium Evaluation Priority)

9.3.1 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
5.3%	724	724	100.0%	22.1%	3,806,319	3,806,319	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 PY2018 Commercial MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 5 percent and one project had adjustments greater than 5 percent compared to the original claimed savings. TNMP accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with adjustments and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1179526: The energy efficiency project included the new construction of interior lighting with controls at an office building and a non-refrigerated warehouse. During the desk review, the EM&V team adjusted the qualification of the 12-foot fixtures from “DLC” to “Non-qualified” since they were not on the DLC qualified products list. The wattage was also corrected for two types of fixtures: from 17W claimed to 18W using the ENERGY STAR® qualified products list and from 34W claimed to 47W using the DLC qualified products list. Overall, these adjustments decreased the demand and energy savings and resulted in realization rates of 93 percent kW and kWh.

Participant ID 1179530: The energy efficiency project included interior lighting retrofits with controls and an early replacement of an HVAC system at an office building. During the desk review and on-site M&V visit, a slight difference was noted as a result of a clerical switch of 6 and 9 in the kWh savings for the HVAC portion of the project (208,996 instead of the correct value 208,966). This adjustment resulted in a negligible decrease 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

9.3.2 Open for Small Business 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
2.9%	405	405	100.0%	10.2%	1,751,067	1,751,067	100.0%	Fair

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 PY2018 Open for Small Business MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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. Four projects had adjustments of less than 5 percent and four projects had adjustments greater than 5 percent compared to the original claimed savings. TNMP accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with adjustments and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1131513: The energy efficiency project included interior lighting retrofits at a strip mall retail store. During the desk review and on-site M&V visit, the EM&V team adjusted the building type from "Retail Strip Mall" to "Public Assembly" since that is the primary space usage per on-site visit findings. The coincidence factor (CF) and the annual operating hours (HOU) associated with public assembly buildings are lower than retail buildings, which reduced the demand and energy savings. This correction resulted in realization rates of 71 percent kW and 83 percent kWh.

Participant ID 1132676: The energy efficiency project included interior and exterior lighting retrofits at a non-food service store. During the desk review and on-site M&V visit, the EM&V team adjusted the quantity of some interior fixtures from 15 claimed to 14 and corrected the air conditioning type to "None" for the basement and shop areas per on-site visit findings. For the exterior lighting portion of the project, the EM&V team noted that there was no photocell present, and although the LSF defaults to zero savings, the lighting wattage reduction still provides energy reduction. Therefore, the exterior fixtures were modeled with the photocell controls. Overall, these adjustments resulted in a decrease in demand and energy savings and realization rates of 95 percent kW and 98 percent kWh.

Participant ID 1132944: The energy efficiency project included interior and exterior lighting retrofits at a retail store. During the desk review, the EM&V team adjusted the wattage for several lamps from 8W claimed to 8.5W to match DLC qualified products list since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W). In addition, the HOU and CF was corrected to match the Texas TRM 5.0 values. Overall, these adjustments slightly increased demand and energy savings and resulted in realization rates of 102 percent kW and kWh.

Participant ID 1133116: The energy efficiency project included interior lighting retrofits at a strip mall retail building. During the desk review, the EM&V team adjusted the building type from "Retail Strip Mall" to "Manufacturing 1 Shift." The CF and HOU values associated with retail buildings are

lower than 1-shift manufacturing facilities, which reduced the demand and energy savings. In addition, the EM&V team corrected the wattage of all fixtures from 166W claimed to 164W using the DLC qualified products list and adjusted the air conditioning type for the room where the fixtures were installed to “None.” Overall, these corrections resulted in a significant decrease in demand and energy savings and realization rates of 80 percent kW and 67 percent kWh.

Participant ID 1133120: 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 the building type from “Retail Strip Mall” to “Retail Other” and removed “Air Conditioning” from the space and added it to the office baths. Overall, these corrections resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1152763: The energy efficiency project included exterior lighting retrofits at a non-refrigerated warehouse. During the desk review and on-site M&V visit, the EM&V team adjusted the wattage for several fixtures from 22W claimed to 21W and from 166W claimed to 158W using the DLC qualified products list. In addition, the air conditioning type was corrected to “None” for the shop and storage areas per on-site visit findings. Overall, these adjustments decreased the demand and energy savings and resulted in realization rates of 96 percent kW and 99 percent kWh.

Participant ID 1180238: The energy efficiency project included interior lighting retrofits at a retail building. During the desk review, the EM&V team corrected the wattage for several fixtures from 18W claimed to 19W and from 40W claimed to 41W using the DLC qualified products list. In addition, the fixture code was adjusted for the installed 41W lamp retrofit kit from “LED041-FIXT” to “LED041-TUBE.” Overall, these adjustments resulted in a slight decrease in demand and energy savings and realization rates of 99 percent kW and kWh.

Participant ID 1180266: The energy efficiency project included interior lighting retrofits at a non-food service building. During the desk review, the EM&V team adjusted the building type from “Service (Non-Food)” to “Religious.” The CF and HOU values associated with religious buildings are much lower than service buildings, which significantly reduced the demand and energy savings. This adjustment resulted in realization rates of 58 percent kW and 54 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions for five of the eight projects that had desk reviews completed because sufficient documentation was provided for the sites. However, partial documentation was provided for the other three projects. The project documentation lacked spec sheets and, in some cases, photographs. In addition, post-inspection notes, invoices and QPL documentation were not provided for all projects. Complete documentation enhances the accuracy and transparency of project savings and ease of evaluation. Since sufficient documentation was provided for some of the projects, the EM&V team assigned a program documentation score of Fair.

9.3.3 SCORE/CitySmart Market Transformation Program (MTP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
4.0%	553	553	100.0%	14.5%	2,491,961	2,491,961	100.0%	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 PY2018 SCORE/CitySmart MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 four projects. Two projects had adjustments less than 5 percent compared to the original claimed savings percent and two projects had adjustments greater than 5 percent compared to the original claimed savings. TNMP accepted the evaluated results and matched the claimed savings to those of the evaluations for all projects with adjustments and therefore the final program realization rate is 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1133381: The energy efficiency project included interior lighting retrofits at a school. During the desk review and on-site M&V visit, the EM&V team removed savings for fixtures for one of the school rooms as the room did not have LED retrofits completed per on-site visit findings. In addition, 10 additional fixtures were found in one of the school rooms. Overall, these corrections decreased demand and energy savings and resulted in realization rates of 97 percent kW and kWh.

Participant ID 1153176: The energy efficiency project included the new construction installation of HVAC equipment and interior and exterior lighting fixtures with some controls at a school. During the desk review, the EM&V team made adjustments to the HVAC portion of the project. The quantity of units with model number LGH048H4E installed was adjusted from 18 claimed to 17, per final review comments and HVAC equipment schedule. In addition, replication of the ACE inventory using the 2017.2 version (to match the lighting calculator since the project started in 2017) significantly increased the HVAC energy savings and slightly decreased the demand savings. This is due to the difference in baseline minimum efficiency required by IECC 2009 compared to 2015 requirements between the 2017 and 2018 TRM calculations. Overall, these corrections resulted in realization rates of 99 percent kW and 112 percent kWh.

Participant ID 1178724: The energy efficiency project included interior and exterior lighting retrofits with controls at a school. During the desk review, the EM&V team corrected the fixtures qualification, wattage and quantity for the main school building. Non-qualified 3-foot LED fixtures were adjusted back to DLC qualified, as the lamps were qualified less than 4 months after the completion of the project. The 3-foot LED fixtures' wattage was also adjusted from 14W claimed to 12W using the DLC qualified products list. In addition, the post-retrofit quantity of the 3-foot fixtures was increased to match the number of 3-foot T8 tubes removed since the entire project was a one-for-one tube replacement. For the multipurpose arena portion of the project, the ex-ante savings calculator inventory seemed to be entered incorrectly based upon photographic documentation and descriptions. Fixture types, wattage, and quantity were adjusted based on a one-for-one, like-for-like lamp replacement, where screw-in compact fluorescent fixtures were retrofitted with a 9W LED screw-in lamp, and linear fluorescent T8 fixtures were retrofitted with T8 LED tubes matching the number of existing T8 lamps. Overall, these adjustments resulted in a negligible decrease in demand and energy savings and realization rates of 100 percent kW and kWh.

Participant ID 1179319: The energy efficiency project included the new construction of interior and exterior lighting at a parking structure. During the desk review and on-site M&V visit, the EM&V

team adjusted the gross lighted floor area and reduced the building square footage by 37,388 square feet, as the 7th floor of the parking garage is uncovered parking. For the interior portion of the project, the pole light “cobra head” LED fixtures with the fixture code GP2 were removed, as these fixtures were only installed on the 7th floor (top) of the garage building, which is uncovered. In addition, the qualification for nine LED fixtures was adjusted from “Non-Qualified” to “Lgt Facts.” For the exterior portion of the project, the fixture quantity was adjusted from 4 claimed to 8, as onsite inspection photos showed 8 total cobra heads on 4 poles (2 each). Overall, these corrections increased demand and energy savings and resulted in realization rates of 119 percent kW and 120 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 all projects that had desk reviews completed because sufficient documentation was provided for the sites. Project documentation included invoices, QPL qualifications and/or 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. Since sufficient documentation was provided for all projects, the EM&V team assigned a program documentation score of Good.

9.4 Detailed Findings—Residential (High/Medium Evaluation Priority)

9.4.1 High-Performance Homes 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%	667	667	100.0%	12.4%	2,131,048	2,131,048	100.0%	Good

Completed Desk Reviews*	On-Site M&V
9	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 PY2018 evaluation efforts focused on desk reviews. The number of completed desk reviews for this program is listed above.

The EM&V team focused on reviewing documentation for program homes. This program relies on a proprietary energy model, however that model is built on DOE-2 energy modeling software that is listed as an acceptable savings estimation method in the TRM.

We received two types of documentation from the program: REM/Rate files that provided the inputs that fed into the energy models, and detailed output files that provided the results of the energy model analysis. We reviewed the REM/Rate files to ensure that all homes met stated program requirements, and that the files contained all inputs required by the DOE-2 based model. We compared the results of the model to the claimed savings in the tracking database, and all of the model output files matched the claimed savings in the tracking data. We did not recommend any adjustments for this program.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., energy model inputs and detailed model outputs). Because sufficient documentation was provided for all the reviewed projects, the EM&V team assigned a program documentation score of Good.

9.4.2 Residential Standard Offer Program (SOP)

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
22.4%	3,078	3,078	100.0%	29.7%	5,105,021	5,105,021	100.0%	Good

Completed Desk Reviews*	On-Site M&V
10	5

*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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for 10 projects and resulted in desk review realization rates of 100 percent and 100 percent for demand and energy savings, respectively. On-site M&V was completed for five projects and resulted in on-site realization rates of 100 percent and 100 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition) for ceiling insulation (the primary measure reviewed). There was limited documentation for direct installs such as low flow showerheads. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

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

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
4.3%	588	588	100.0%	5.2%	897,887	897,887	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. All on-site M&V projects also had desk reviews. The number of completed desk reviews and on-site M&V projects for this program are listed in the table 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 the following two activities:

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

Desk reviews were completed for four projects and resulted in desk review realization rates of 100 percent and 100 percent for demand and energy savings, respectively. On-site M&V was completed for two projects and resulted in on-site realization rates of 100 percent and 100 percent for demand and energy savings, respectively.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition) for ceiling insulation (the primary measure reviewed). There was limited documentation for direct installs such as low flow showerheads and LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

9.5 Detailed Findings—Load Management (High Evaluation Priority)

9.5.1 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
52.1%	7,176	7,176	100.0%	0.0%	7,176	7,176	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 resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the TNMP Commercial Load Management program 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. A single load management event occurred on June 20, 2018, from 3 p.m. to 4p.m.

The EM&V team received the interval meter data and spreadsheets detailing the TNMP calculated savings results for the event and each ESI ID. The EM&V team was able to calculate savings for each of the participating ESI IDs with the results matching those of the program. As such, no adjustments were made to the program savings.

Evaluated savings for the TNMP Commercial Load Management program are 7,176 kW and 7,176 kWh. The realization rate for both kW and kWh is 100.0 percent.

9.6 Summary of Low Priority Evaluation Programs

Table 9-5 provides a summary of claimed savings for TNMP's low evaluation priority programs in PY2018, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2018 tracking data provided to the EM&V team for the EM&V database.

Table 9-5. PY2018 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)
Low Income Weatherization	3.5%	479	479	100.0%	4.4%	757,417	757,417	100.0%
REP Pilot MTP	0.7%	94	94	100.0%	1.5%	256,568	256,568	100.0%

10.0 XCEL SPS IMPACT EVALUATION RESULTS

This section presents the evaluated savings and cost-effectiveness results for Xcel SPS's 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, we include a list of the low evaluation priority programs for which claimed savings were verified through the EM&V database.

10.1 Key Findings

10.1.1 Evaluated Savings

Xcel SPS's evaluated savings for PY2018 were 9,568 in demand (kW) and 18,877,468 in energy (kWh) savings. The overall kW and kWh portfolio realization rates are 100 percent. Xcel SPS was responsive to all EM&V recommendations to adjust claimed savings based on EM&V results, which also supported healthy realization rates. (See Table 10-4.)

Table 10-1 shows the claimed and evaluated demand savings for Xcel SPS's portfolio and broad customer sector/program categories.

Table 10-1. Xcel SPS PY2018 Claimed and Evaluated Demand Savings

Level of Analysis	Percent Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Total Portfolio	100.0%	9,574	9,568	99.9%	0.2%
Commercial	21.5%	2,054	2,048	99.7%	0.9%
Residential	28.1%	2,694	2,694	100.0%	0.0%
Low Income	2.9%	282	282	100.0%	n/a
Load Management*	47.5%	4,544	4,544	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 resulting level of load curtailment achieved for each event for all participants.

Table 10-2 shows the claimed and evaluated energy savings for Xcel SPS's portfolio and broad customer sector/program categories for PY2018.

Table 10-2. Xcel SPS PY2018 Claimed and Evaluated Energy Savings

Level of Analysis	Percent Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Total Portfolio	100.0%	18,906,158	18,877,468	99.8%	0.4%
Commercial	57.5%	10,869,988	10,841,305	99.7%	0.6%
Residential	38.2%	7,217,822	7,217,816	100.0%	0.0%
Low Income	4.2%	800,172	800,172	100.0%	n/a
Load Management*	0.1%	18,176	18,176	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 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. 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–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 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 and/or high savings programs have been identified.

Xcel SPS received a Good program documentation score for the Retro-commissioning MTP and the Residential SOP, and it received Fair documentation scores for the Commercial SOP, Small Commercial MTP, and Residential Hard-to-Reach program. While a Fair documentation score indicates a reasonable level of documentation, it also indicates some room for improvement. Details about what documentation the evaluation team found and reviewed are listed within each program-specific section.

10.1.2 Cost-effectiveness Results

Xcel SPS's overall portfolio had a cost-effectiveness of 2.31, or 2.48 excluding low-income programs. (See Table 10-3.)

The more cost-effective programs were Home Lighting MTP and Commercial SOP. The less cost-effective programs were Small Commercial MTP and Load Management SOP. The Commercial Home Lighting MTP result stands out at 26.20, but this is a result of the way this program is reported. Five percent of the program bulbs and budget are allocated to the commercial sector, but commercial applications generate disproportionate savings that distort the cost-effectiveness results.

The lifetime cost of evaluated savings was \$0.009 per kWh and \$19.51 per kW.

Table 10-3. Xcel SPS Cost-effectiveness Results

Level of Analysis	Claimed Savings Results	Evaluated Savings Results	Net Savings Results
Total Portfolio	2.32	2.31	2.13
Total Portfolio excluding low-income programs	2.48	2.48	2.28
Commercial	2.67	2.66	2.41
Commercial SOP	4.84	4.82	4.36
Retro-Commissioning MTP	2.29	2.28	2.05
Small Commercial MTP	1.18	1.18	1.12
Home Lighting MTP	26.20	26.20	23.58
Residential	2.48	2.48	2.30
Residential SOP	2.25	2.25	2.01
Home Lighting MTP	4.10	4.10	3.69
Hard-to-Reach SOP	2.03	2.03	2.03
Low Income*	2.76	2.76	2.76
Low-Income Weatherization*	2.76	2.76	2.76
Load Management	1.27	1.27	1.27
Load Management SOP	1.27	1.27	1.27

* The Low-Income sector and Low Income Weatherization program are evaluated using the savings-to-investment ratio (SIR).

10.2 Claimed Savings Adjustments

Utilities are provided the opportunity to adjust savings at the project-level based on interim EM&V findings. Realization rates assume the following adjustments will be included in Xcel SPS's May 1 filing.

Table 10-4. EM&V Claimed Savings Adjustments by Program (Prior to EECR¹⁴ Filing)

Program	EM&V Demand Claimed Savings Adjustments (kW)	EM&V Energy Claimed Savings Adjustments (kWh)
Small Commercial MTP (Com)	0.40	13,140.00
Hard-to-Reach SOP (HTR)	-0.30	-1,028.10
Total	0.10	12,111.90

10.3 Detailed Findings—Commercial (High/Medium Evaluation Priority)

10.3.1 Retro-commissioning 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
9.5%	907	902	99.5%	26.2%	4,950,639	4,940,604	99.8%	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 PY2018 Retro-commissioning MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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 four projects. All four projects had adjustments of less than 5 percent compared to the original claimed savings and therefore the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1129020: The energy efficiency project involved interior lighting retrofits at a manufacturing facility. During the desk review and on-site M&V visit, the EM&V team adjusted the air-conditioning type from “Air-Conditioned” to “None” for two buildings in the facility. This correction slightly decreased energy and peak demand savings and resulted in realization rates of 99 percent kW and kWh.

Participant ID 1129021: The energy efficiency project included an early replacement of HVAC equipment and interior lighting retrofits at an office building. During the desk review, the EM&V team made adjustments to the lighting savings and did not adjust the HVAC savings. For the lighting portion of the project, the EM&V team corrected the fixture wattages from 31W claimed to 30W and from 26W claimed to 25W since wattages were rounded up instead of rounded to the nearest wattages. This adjustment resulted in a slight increase of energy and peak demand savings and realization rates of 101 percent kW and kWh.

¹⁴ Energy Efficiency Cost Recovery

Participant ID 1156861: The energy efficiency project included interior lighting retrofits at a warehouse (refrigerated and non-refrigerated) with associated offices and VFD installation for a refrigeration system. During the desk review, the EM&V team made adjustments to the lighting savings and did not adjust the refrigeration savings. For the lighting portion of the project, the EM&V team corrected the fixture wattages for the non-refrigerated warehouse from 183W claimed to 182W per DLC certification listing. This adjustment resulted in a negligible increase of energy and peak demand savings and realization rates of 100 percent kW and kWh.

Participant ID 1181195: The energy efficiency project included interior and exterior lighting retrofits at an airport. During the desk review and on-site M&V visit, the EM&V team corrected the deemed annual operating hours, fixtures quantities and wattages. The claimed interior annual hours at the airport were 24/7 although self-reported hours are from 4:00 a.m. to 11:00 p.m. from Sunday to Friday, and 4:40 a.m. to 11 p.m. on Saturday. This equates to approximately 146.3 hours weekly or 7,600 hours annually. The custom annual operating hours were therefore adjusted from 8,760 to 7,600. A slight difference in savings was attributed to adjustment in wattages for the exterior fixtures from 21W claimed to 20W per DLC certification listing. Interior fixture quantities were also corrected from 11 claimed to 10 50W-LED fixtures and from 21 claimed to 22 36W LED fixtures per on-site M&V visit findings. Overall, the adjustments slightly impacted the energy and peak demand savings and resulted in realization rates of 100 percent kW and 99 percent kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions (e.g., equipment quantity, equipment capacity, QPL qualifications) for two of the four projects that had desk reviews completed because sufficient documentation was provided for the sites. The project documentation included post-inspection notes and the project savings calculators. However, partial documentation was provided for two lighting projects. For one project, project documentation lacked inspection notes and pre- and post-install photographic documentation, and for the other project, the provided post-retrofit photos were not sufficient to verify fixture model numbers or confirm claimed delamping. Since sufficient documentation was provided for the rest of the projects, the EM&V team assigned a program documentation score of Good.

10.3.2 Commercial SOP

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
6.8%	652	651	99.8%	19.3%	3,655,048	3,636,196	99.5%	Fair

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 PY2018 Commercial SOP evaluation efforts focused on desk reviews and on-site M&V. The number 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. All seven projects had adjustments of less than 5 percent compared to the original claimed savings and therefore the final program realization rate is nearly 100 percent. Further details of the EM&V findings are provided below.

Participant ID 1112688: The energy efficiency project included interior and exterior lighting retrofits at a retail strip mall building. During the desk review and on-site M&V visit, the EM&V team adjusted the fixture quantity for one of the interior rooms from 1,458 claimed to 1,362 and corrected the exterior fixture wattages from 110W claimed to 150W and from 78W claimed to 77W per DLC certification listings. Overall, the adjustments slightly increased the peak demand savings and resulted in realization rates of 102 percent kW and 100 percent kWh.

Participant ID 1112692: The energy efficiency project included interior and exterior lighting retrofits at a manufacturing facility. During the desk review, the EM&V team adjusted wattages for some of the interior fixtures from 125W claimed to 132W and from 185W claimed to 187W per DLC certification listings. This correction resulted in a slight decrease in energy and peak demand savings and realization rates of 99 percent kW and kWh.

Participant ID 1112696: The energy efficiency project included interior and exterior lighting retrofits at a non-24-hr. supermarket. During the desk review and on-site M&V visit, the EM&V team corrected the building type from “Custom” to “Supermarket Non-24 Hours” with no impact on the savings (annual operating hours and coincidence factor (CF) remained the same). Wattages were also adjusted for some interior fixtures from 16W claimed to 9W per ENERGY STAR® certification listings, and from 16W claimed to 15.5W since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. Some exterior fixture wattages were also corrected from 43W claimed to 41W per DLC certification listing. During the on-site M&V visit, two fewer 9W bulbs were found in one of the interior spaces. Overall, the adjustments resulted in a slight decrease of energy and peak demand savings and realization rates of 98 percent kW and kWh.

Participant ID 1112697: The energy efficiency project included interior and exterior lighting retrofits at a non-24-hr. supermarket. During the desk review, the EM&V team corrected the building type from “Custom” to “Supermarket Non-24 Hours” with no impact on the savings (annual operating hours and coincidence factor (CF) remained the same). The EM&V team also adjusted wattages for some interior fixtures from 16W claimed to 15.5W since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. A few exterior fixture wattages were also corrected from 145W claimed to 150W per DLC certification listing. Overall, the adjustments resulted in a slight decrease of energy and peak demand savings and realization rates of 98 percent kW and kWh.

Participant ID 1112700: The energy efficiency project included interior and exterior lighting retrofits at a non-24-hr. supermarket. During the desk review and on-site M&V visit, the EM&V team adjusted wattages for some of the exterior fixtures from 84W claimed to 78W per DLC certification listing. This correction resulted in a negligible increase in energy and peak demand savings and realization rates of 100 percent kW and kWh.

Participant ID 1183653: The energy efficiency project included interior and exterior lighting retrofits at a school. During the desk review, the EM&V team removed pre- and post-retrofit fixtures for one of the interior rooms based on post-inspection documentation. In addition, wattages for some exterior fixtures were adjusted from 16W claimed to 15.5W since version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. Overall, the corrections decreased energy and peak demand savings and resulted in realization rates of 96 percent kW and kWh.

Participant ID 1183655: The energy efficiency project included interior and exterior lighting retrofits at a custom building. During the desk review and M&V visit, the EM&V team adjusted the building type from “Custom” to “Retail/Supermarket 24-hr.” This correction decreased energy and demand savings as the deemed annual operating hours assumption was decreased from 7,280 to 6,900 hours per year. The coincidence factor (CF) slightly increased from 0.9 to 0.95. In addition, wattages for all exterior and some interior fixtures were corrected per QPL qualifications: from 150W claimed to 149W, from 43W claimed to 41W, 145W claimed to 150W, 84W claimed to 79W, and from 16W claimed to 15.5W. The latter wattage adjustment occurred because version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. Overall, the corrections resulted in realization rates of 103 percent kW and 97 percent kWh.

Documentation Score

Partial documentation was provided for all eight lighting projects. Pre- and post-photographic documentation was not provided for all projects and one project documentation lacked the final savings calculator. In addition, post-inspection notes, invoices, manufacturer’s specification sheets, and QPL documentation were not provided for some of the projects. Three of the eight projects with partial documentation were projects in which custom hours of operation were claimed, however, no details were provided to support the custom attribution. Complete documentation enhances the accuracy and transparency of project savings and ease of evaluation. Therefore, the EM&V team assigned a program documentation score of Fair.

10.3.3 Small Commercial 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
2.8%	268	268	100.0%	6.4%	1,212,389	1,212,593	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 PY2018 Small Commercial MTP evaluation efforts focused on desk reviews and on-site M&V. The number 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. One project had adjustments of less than 5 percent and two projects had adjustments greater than 5 percent compared to the original claimed savings. Xcel SPS accepted the evaluated results and matched the claimed savings to those of the evaluations for the two 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 1112712: The energy efficiency project included interior and exterior lighting retrofits at a religious facility. During the desk review and on-site M&V visit, the EM&V team adjusted the building type from “Religious” to “Public Assembly” since the arena where the lighting fixtures were installed is owned by a church but rented out, therefore making the building type different from religious. This correction significantly increased energy and demand savings as the deemed

annual operating hours and coincidence factor (CF) assumptions were increased from 1,824 to 2,638 hours per year and from 0.53 to 0.56 respectively. Wattages were also corrected for some fixtures from 195W claimed to 150W per DLC certification listing. Pre- and post-retrofit controls for the interior lighting was also adjusted to “None” from “Occupancy Sensor” per on-site M&V visit findings. Overall, the corrections resulted in an increase of energy and peak demand savings and realization rates of 111 percent kW and 118 percent kWh.

Participant ID 1112722: 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 the building type selection from “Retail Other” to “Warehouse Non-Refrigerated” since that represents the majority of the building area. This correction significantly decreased energy and demand savings as the deemed annual operating hours and coincidence factor (CF) assumptions were decreased from 3,668 to 3,501 hours per year and from 0.9 to 0.77 respectively. In addition, the wattage for some interior LED lamps was adjusted from 16W claimed to 15W and from 7W claimed to 7.5W per certification listings. The latter wattage adjustment occurred because version 2018.5 of the LSF calculator allows for wattages in 0.5 increments (up to 25W) that match the rated wattages. The quantity of 4-foot linear fluorescent T8 fixtures installed in the warehouse was also adjusted from 75 to 72 per on-site M&V visit findings. Overall, the corrections decreased energy and peak demand savings and realization rates of 83 percent kW and 93 percent kWh.

Participant ID 1112731: The energy efficiency project included interior lighting retrofits at a single-shift manufacturing facility. During the desk review, the EM&V team adjusted fixture wattages from 120W claimed to 116W per DLC certification listing. This correction resulted in a slight increase in energy and peak demand savings and realization rates of 101 percent kW and kWh.

Documentation Score

The EM&V team was able to verify key inputs and assumptions for two of the four projects that had desk reviews completed because sufficient documentation was provided for the sites. However, partial documentation was provided for the other two projects. The project documentation lacked pre- and post-retrofit photographic documentation. In addition, post-inspection notes, invoices and QPL documentation were not provided for all projects. Complete documentation enhances the accuracy and transparency of project savings and ease of evaluation. Therefore, the EM&V team assigned a program documentation score of Fair.

10.4 Detailed Findings—Residential (Medium Evaluation Priority)

10.4.1 Residential 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
9.9%	945	945	100.0%	11.3%	2,135,877	2,135,878	100.0%	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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are 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 the following two activities:

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

Desk reviews were completed for six projects and resulted in desk review realization rates of 100 percent and 100 percent for demand and energy savings, respectively. On-site M&V was completed for three projects and resulted in on-site realization rates of 100 percent and 100 percent for demand and energy savings, respectively. There were minor differences between ex-ante and ex post savings for LEDs due to rounding. All identified variations due to rounding were within 1 kWh and 0.01 kW.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition) for heat pumps and ceiling insulation. There was limited documentation for direct installs such as low flow showerheads and LEDs. Because sufficient documentation was provided for most of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Good.

10.4.2 Hard-to-Reach 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%	681	681	100.0%	8.2%	1,550,943	1,550,935	100.0%	Fair

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 PY2018 evaluation efforts focused on desk reviews and on-site M&V. The number of completed desk reviews and on-site M&V projects for this program are listed above.

The EM&V team made an adjustment of more than 5 percent to the claimed savings for four projects. Overall, the EM&V team assessed ex-ante claimed energy and demand savings across the following two activities:

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

Desk reviews were completed for six projects and resulted in desk review realization rates of 97.6 percent and 97.1 percent for demand and energy savings, respectively. On-site M&V was completed for three projects and resulted in on-site realization rates of 119.1 percent and 115.2 percent for demand and energy savings, respectively. Differences between evaluated savings and claimed savings were driven by the following projects.

Participant ID 1112954: The energy efficiency project included implementation of the ceiling insulation and duct sealing measures. TRM 5.0 Volume 2 contains an eligibility requirement for the ceiling insulation measure, the application of which led to a difference in claimed and evaluated savings for this project. TRM 5.0 Volume 2 states for any reported pre-retrofit R-value that falls below R-5, all contractors are required to provide sufficient evidence including two pictures: 1) a picture showing the entire attic floor, and 2) a close-up picture of a ruler that shows the measurement of the depth of the insulation. In the absence of evidence demonstrating pre-retrofit ceiling insulation below R-5, the lowest level of pre-retrofit ceiling insulation that can be claimed is the R-5 to R-8 range. The baseline reported was less than R-5 level insulation and the EM&V team determined the documentation provided did not meet the requirement and adjusted the baseline to R-5. Overall, the adjustment resulted in project level realization rates of 37.6 percent and 59.2 percent for demand and energy savings, respectively.

Participant ID 1139114: The energy efficiency project included implementation of the ceiling insulation and duct sealing measures. TRM 5.0 Volume 2 contains an eligibility requirement for the ceiling insulation measure, the application of which led to a difference in claimed and evaluated savings for this project. TRM 5.0 Volume 2 states for any reported pre-retrofit R-value that falls below R-5, all contractors are required to provide sufficient evidence including two pictures: 1) a picture showing the entire attic floor, and 2) a close-up picture of a ruler that shows the measurement of the depth of the insulation. In the absence of evidence demonstrating pre-retrofit ceiling insulation below R-5, the lowest

level of pre-retrofit ceiling insulation that can be claimed is the R-5 to R-8 range. The baseline reported was less than R-5 level insulation and the EM&V team determined the documentation provided did not meet the requirement and adjusted the baseline to R-5. Overall, the adjustment resulted in project level realization rates of 57.0 percent and 53.7 percent for demand and energy savings, respectively.

Participant ID 1113029: The energy efficiency project included implementation of air infiltration, duct sealing, and LED measures. The EM&V team’s on-site testing resulted in a substantially higher reduction in air infiltration than what was documented by the program. Using a threshold of +/-10 percent, the EM&V team’s blower door test results were quite a bit lower than the results found in the tracking data resulting in an increase in savings. Overall, the adjustments resulted in project level realization rates of 136.4 percent and 130.7 percent for demand and energy savings, respectively.

Participant ID 1113032: The energy efficiency project included implementation of air infiltration, duct sealing, and LED measures. The EM&V team’s on-site testing resulted in a substantially higher reduction in air infiltration and substantially lower reduction in duct sealing than what was documented by the program. Using a threshold of +/-10 percent, the EM&V team’s blower door test results were quite a bit lower and the duct blaster test results were quite a bit higher than the results found in the tracking data resulting in an increase in savings. Overall, the adjustments resulted in project level realization rates of 130.3 percent and 123.4 percent for demand and energy savings, respectively. In addition, there were minor differences between ex-ante and ex post savings for LEDs due to rounding. All identified variations due to rounding were within 1 kWh and 0.01 kW.

Documentation Score

For all sampled projects, the EM&V team was able to verify key inputs and assumptions (e.g., pre- and post-condition test results) for air infiltration and duct efficiency. There was limited documentation for ceiling insulation and direct installs such as LEDs and low flow showerheads. Because sufficient documentation was provided for some, but not all, of the measures across all the reviewed projects, the EM&V team assigned a program documentation score of Fair.

10.5 Detailed Findings—Load Management (High Evaluation Priority)

10.5.1 Load Management SOP

Program Contribution to Portfolio Savings (kW)	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Program Contribution to Portfolio Savings (kWh)	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Program Documentation Score
47.5%	4,544	4,544	100.0%	0.1%	18,176	18,176	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 resulting level of load curtailment achieved for each event for all participants.

The EM&V team evaluated the Xcel SPS Load Management program by applying the TRM calculation methodology to interval meter data. The meter data was supplied in 15-minute increments at the meter level. A single scheduled load management event occurred on July 20, 2018, from 2:00 p.m. to 4:00 p.m.

The EM&V team received the interval meter data and a spreadsheet that summarized the event-level savings for each participant. The EM&V team was able to calculate savings with the data that Xcel SPS provided, with the results matching for each participant and in total.

Evaluated savings for the Xcel SPS Load Management program are 4,544 kW and 18,176 kWh. The realization rate for both kW and kWh is 100.0 percent.

10.6 Summary of Low Priority Evaluation Programs

Table 10-5 provides a summary of claimed savings for Xcel SPS' low evaluation priority programs in PY2018, including programs' overall contribution to portfolio savings. Low priority programs' claimed savings were verified against the final PY2018 tracking data provided to the EM&V team for the EM&V database.

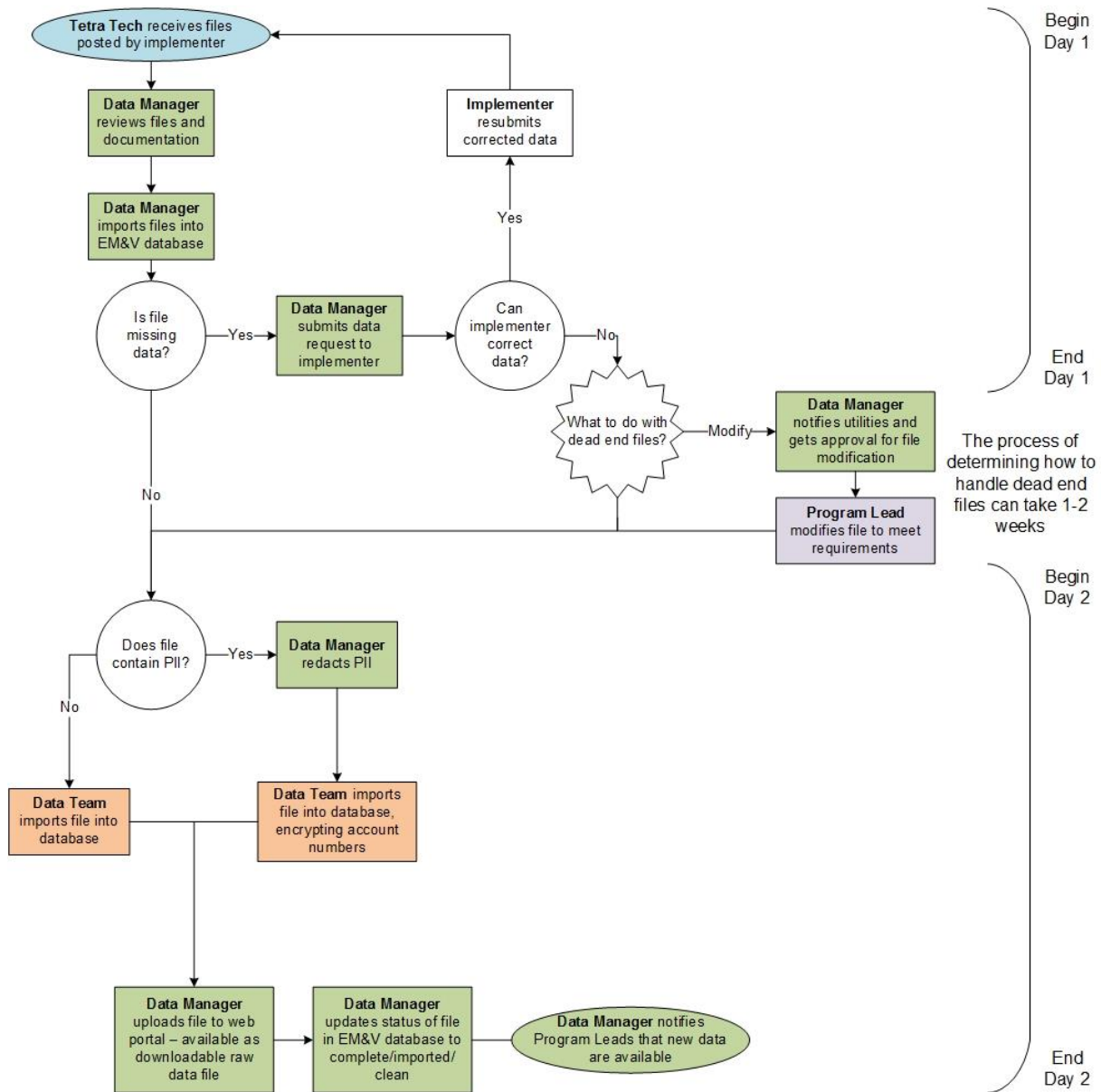
Table 10-5. PY2018 Claimed Savings Low Evaluation Priority Programs

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)
Home Lighting MTP (Com)	2.4%	227	227	100.0%	5.6%	1,051,912	1,051,912	100.0%
Home Lighting MTP (Res)	11.2%	1,068	1,068	100.0%	18.7%	3,531,002	3,531,002	100.0%
Low-Income Weatherization	2.9%	282	282	100.0%	4.2%	800,172	800,172	100.0%

APPENDIX A: DATA MANAGEMENT PROCESS

Figure A-1 details the data management process.

Figure A-1. Data Management Process



APPENDIX B: COST-EFFECTIVENESS CALCULATIONS

This appendix describes the calculations used for modeling cost-effectiveness. This approach provides the PUCT with a consistent methodology for evaluating cost-effectiveness across the utilities.

B.1 APPROACH

The approach to the EM&V team's benefit-cost testing is based on P.U.C. SUBST. R. 25.181, where costs and benefits are defined in section (d):

“The cost of a program includes the cost of incentives, measurement and verification, any shareholder bonus awarded to the utility, and actual or allocated research and development and administrative costs. The benefits of the program consist of the value of the demand reductions and energy savings, measured in accordance with the avoided costs prescribed in this subsection. The present value of the program benefits shall be calculated over the projected life of the measures installed or implemented under the program.”

This description is consistent with the PACT. Based on this definition, we collected the costs reported in the utilities' 2016 EEPs, filed on April 1, 2017.¹⁵ The program benefits must be calculated at a measure level in order to apply individual effective useful lives. Therefore, the savings were derived from the EM&V database, which is a comprehensive, centralized source of the utilities' program tracking data.

The present value of the benefits is calculated separately for energy and demand as follows:

$$PV = \frac{AC}{WACC - E} \left[1 - \left(\frac{1 + E}{1 + WACC} \right)^n \right]$$

Where:

AC is the avoided cost of the benefit (energy or demand)

The discount rate, *WACC*, is the utility's weighted average cost of capital

E is the escalation rate

n is the effective useful life of the measure.

This calculation was modified from the original evaluation plan in order to allow for including an escalation rate. The EM&V team has provided results for benefit-cost calculation using an escalation rate of 2 percent and without an escalation rate.

¹⁵ PUCT filing number 44480.

The benefit-cost ratio is calculated as:

$$BC = \frac{PV_e + PV_d}{C}$$

Where:

PV_e is the present value of the avoided energy costs

PV_d is the present value of the avoided demand costs

C is the total program cost, including incentives, administrative, evaluation, measurement and verification, shareholder bonus, and research and development costs.

Some costs are reported by the utilities at the portfolio level, such as research and development and shareholder bonus costs. These costs are attributed to individual programs based on each program's incentive costs as a percentage of the portfolio. EM&V costs were previously distributed among utility programs by the EM&V team based on programs' share of energy savings and evaluation priority.

B.1.1 Savings-to-Investment Ratio

Targeted low-income energy efficiency programs are run by all unbundled transmission and distribution utilities. These programs are evaluated using the SIR rather than the PACT described above.

The SIR is significantly different in both the benefits and costs included. The benefits are comprised of the customer's avoided energy costs. This means that the retail electric rate is used rather than the utility's avoided cost, and there is no cost associated with avoided demand. Rather than the WACC, the SIR uses a societal discount rate of 3 percent. The only costs included are the incentives paid to the weatherization agencies.

Table B-1 lists the average retail rates paid by customers. These rates are based on data collected by Frontier Associates through weatherization agencies.

Table B-1. Average Energy Cost by Utility

Utility	Average kWh Rate
AEP TCC	\$0.12
AEP TNC	\$0.11
CenterPoint	\$0.12
Oncor	\$0.13
TNMP	\$0.11
Xcel Energy	\$0.12

B.1.1 Net-to-Gross Ratios

The following NTG ratios were used to calculate cost-effectiveness based on net savings. The EM&V team determined the NTG ratios through primary research in the PY2013 and PY2014 scope, and the majority of these were updated during the PY2017 scope.

Table B-2. Net-to-Gross Ratios

Program	kWh NTG	kW NTG
Commercial		
Retro-Commissioning MTP	0.90	0.90
REP (Commercial CoolSaver)	0.80	0.80
Advanced Lighting Commercial	0.90	0.90
Large Commercial SOP	0.91	0.89
Commercial MTP (SCORE, Healthcare , Data Center)	0.86	0.99
Residential		
CenterPoint Energy High Efficiency Homes MTP	0.70	0.70
REP (CoolSaver & Efficiency Connection)	0.90	0.90
Residential & SC SOP	0.92	0.86
Advanced Lighting Residential	0.90	0.90
Residential Pool Pump & A/C Distributor MTP	0.84	0.84
Multi-Family MTP	0.80	0.80
Hard-to-Reach SOP	1.00	1.00
Multi-Family MTP (HTR)	1.00	1.00
Low Income		
Targeted Low Income MTP (Agencies in Action)	1.00	1.00
Load Management		
Residential Demand Response Program	1.00	1.00
Large Commercial Load Management SOP	1.00	1.00
Pilot		
Smart Thermostat Program (Pilot)	0.84	0.84