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

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

The EM&V team adjusted the claimed savings for one project. Xcel SPS accepted the evaluated results and matched the claimed savings for the projects with significant adjustments; therefore, the final program realization rate is 100 percent. Further details of the EM&V findings and adjustments are provided below.

Participant ID 16799: The energy efficiency project included the implementation of *air infiltration* and *duct sealing*. During the desk review, the EM&V team found the ex-ante savings for *duct sealing* were calculated using the *duct testing methodology*, and the CFM was capped at 35 percent of total fan flow for a *3-ton HVAC system*. However, the EM&V team found the *HVAC* system was a *3.5-ton system*, which increased the CFM cap, resulting in an increase in savings. Overall, the adjustments resulted in project-level realization rates of 111.7 percent and 110.1 percent for demand and energy savings, respectively.

Documentation Score

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

9.5 DETAILED FINDINGS—LOW-INCOME

9.5.1 Low-Income Weatherization 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
4.1%	348	348	100.0%	5.5%	1,042,850	1,042,850	100.0%	Good

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

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

The PY2022 Low-Income Weatherization program evaluation efforts focused on desk reviews and on-site M&V. The number of sampled and completed desk reviews and site visits for this program are listed above.

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

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

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

Documentation Score

The EM&V team was able to verify some key inputs and assumptions, including the project scope, HVAC equipment specifications, and income eligibility verification forms for all sampled projects that had desk reviews. Project documentation included customer agreements, nameplate photos, and AHRI certifications. Overall, the EM&V team was satisfied with the project documentation provided and assigned a program documentation score of *good*.

9.6 DETAILED FINDINGS—LOAD MANAGEMENT (MEDIUM EVALUATION PRIORITY)

9.6.1 Load Management Standard Offer Program (SOP)

Program contribution to portfolio savings (kW)	Claimed demand savings (kW)	Evaluated demand savings (kW)	Realization rate (kW)	Program contribution to portfolio savings (kWh)	Claimed energy savings (kWh)	Evaluated energy savings (kWh)	Realization rate (kWh)	Program documentation score
38.9%	3,282	3,283	100.0%	0.0%	3,282	3,283	100.0%	Good

Completed desk reviews*
N/A

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

The EM&V team evaluated the commercial Xcel SPS Load Management SOP by applying the TRM calculation methodology to interval meter data. The meter data were supplied in 15-minute increments. In PY2022, only one load management event occurred on September 8, 2022, from 4:00 p.m. to 5:00 p.m. (scheduled). There were no unscheduled events in PY2022.

The EM&V team received the interval meter data and a spreadsheet that summarized the event-level savings for the seven sponsors across 15 sites. Three sites did not have any load data associated with them for the event. All sponsors but one had at least one site that curtailed during the event.

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

The table above shows both the EM&V team (evaluated) and Xcel SPS's (claimed) calculated kilowatt and kilowatt-hour savings. No adjustments were made to the program savings; however, a negligible difference in kilowatt and kilowatt-hour was a result of different rounding practices during calculations. Evaluated savings for the commercial Xcel SPS Load Management SOP are 3,283 for kW and kWh. The realization rate for both kilowatt and kilowatt-hour is 100 percent, with a documentation score of *good*.

9.7 SUMMARY OF TRACKING-SYSTEM-ONLY EVALUATED PROGRAMS

Table 40 summarizes claimed savings for Xcel SPS's programs in PY2022 that only received a tracking system review for program impacts. The programs' claimed savings were verified against the final PY2022 tracking data provided to the EM&V team for the EM&V database.
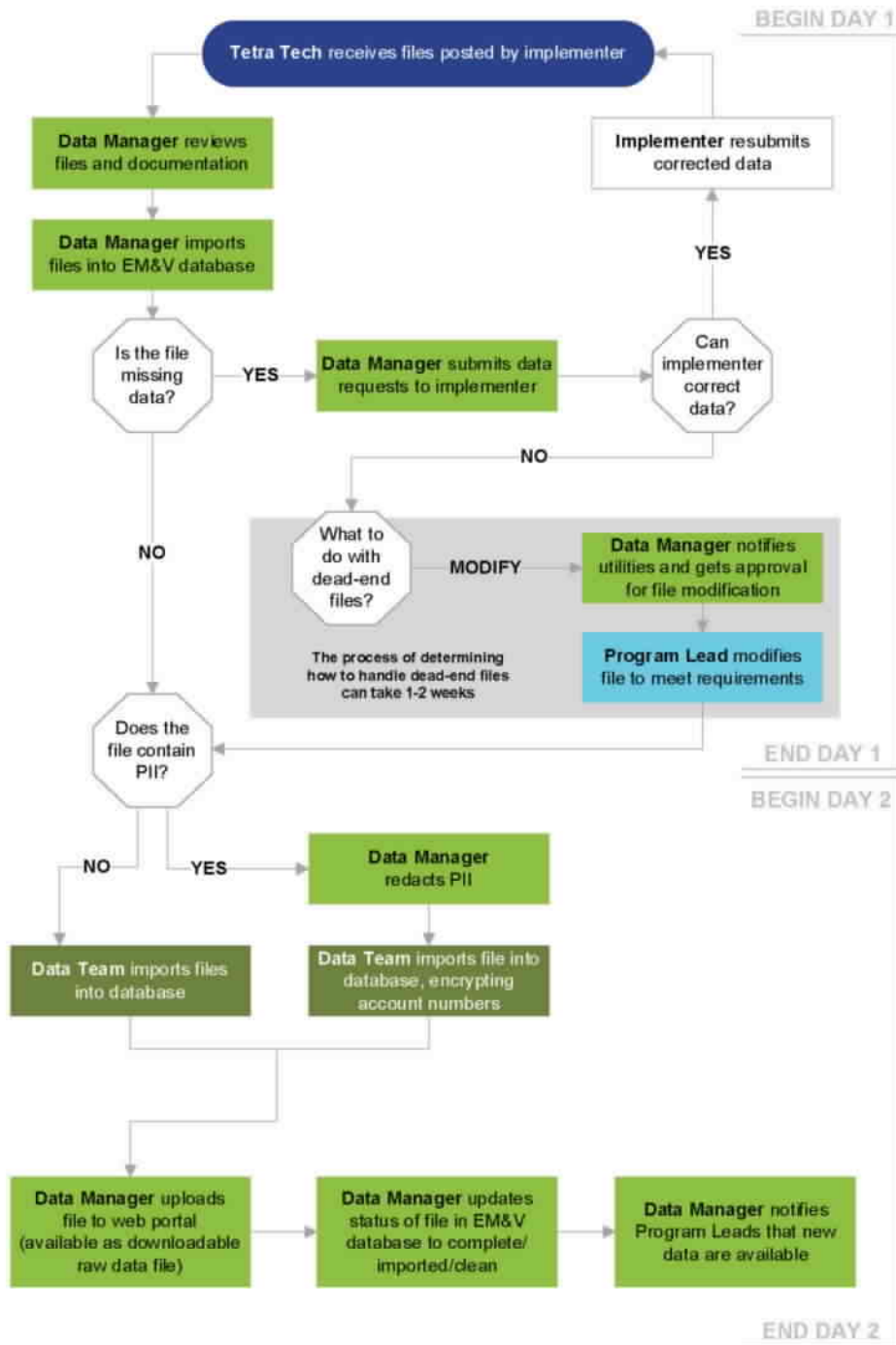
Table 40. PY2022 Claimed Savings (Tracking-System-Only Evaluated Programs)

Program	Contribution to 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)
Commercial Home Lighting MTP	4.4%	370	370	100.0%	10.0%	1,883,644	1,883,644	100.0%
Small Commercial MTP	1.5%	124	124	100.0%	2.9%	551,973	551,973	100.0%
Residential Home Lighting MTP	22.0%	1858	1858	100.0%	33.3%	6,281,114	6,281,114	100.0%
Refrigerator Recycling MTP	0.1%	11	11	100.0%	0.5%	86,596	86,596	100.0%
Smart Thermostat MTP Pilot	0.0%	0	0	0.0%	1.3%	240,284	240,284	100.0%

APPENDIX A: DATA MANAGEMENT PROCESS

Figure 3 details the data management process.

Figure 3. Data Management Process

BEGIN DAY 1

Tetra Tech receives files posted by implementer

Data Manager reviews files and documentation

Data Manager imports files into EM&V database

Is the file missing data? — **YES** → **Data Manager** submits data requests to implementer → Can implementer correct data? — **YES** → Implementer resubmits corrected data

Is the file missing data? — **NO**

Can implementer correct data? — **NO**

What to do with dead-end files? — **MODIFY** → **Data Manager** notifies utilities and gets approval for file modification → **Program Lead** modifies file to meet requirements

The process of determining how to handle dead-end files can take 1-2 weeks

END DAY 1

Does the file contain PII?

BEGIN DAY 2

Does the file contain PII? — **NO** → **Data Team** imports files into database

Does the file contain PII? — **YES** → **Data Manager** redacts PII → **Data Team** imports file into database, encrypting account numbers

Data Manager uploads file to web portal (available as downloadable raw data file) → **Data Manager** updates status of file in EM&V database to complete/imported/clean → **Data Manager** notifies Program Leads that new data are available

END DAY 2

APPENDIX B: COST-EFFECTIVENESS CALCULATIONS

This appendix describes the calculations used for modeling cost-effectiveness. This approach provides the Public Utility Commission of Texas (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 16 Tex. Admin. Code § 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' 2020 Energy Efficiency Plan and Reports, filed on April 1, 2020.[11] 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 two percent and without an escalation rate.

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[11] PUCT filing number 50666.

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, EM&V, shareholder bonus, and research and development (R&D) costs.

Some costs are reported by the utilities at the portfolio level, such as R&D 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 the programs' share of energy savings and evaluation priority.

B.2   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 savings-to-investment ratio (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 which 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 three percent. The only costs included are the incentives paid to the weatherization agencies.

Table 41 lists the average retail rates paid by customers. These rates are based on data collected by Frontier Energy through weatherization agencies. The rates are updated annually based on data from the Energy Information Administration, the Bureau of Labor Statistics, and the PUCT.

Table 41. Average Energy Cost by Utility

Utility	Average kWh rate
AEP Texas	$0.16
CenterPoint	$0.17
Oncor	$0.17
TNMP	$0.17
Xcel SPS	$0.13

B.3 NET-TO-GROSS RATIOS

The following net-to-gross (NTG) ratios were used to calculate cost-effectiveness based on net savings. The EM&V team determines the NTG ratios through primary research periodically (approximately every four to five years), as indicated in the table below. NTG ratios were updated for the Residential SOP, Commercial SOP, and Commercial MTP programs in 2022.

Table 42. Net-to-Gross Ratios Used to Calculate Cost-Effectiveness

Program	kWh NTG	kW NTG	Research year
Commercial			
Commercial SOP	1.00	0.99	2022
Commercial MTP (including SCORE/CitySmart MTP)	1.00	1.00	2022
Solar PV SOP	1.01	1.01	2019
Small Business	0.95	0.95	2019
Upstream Lighting	0.90	0.90	2020
Retro-Commissioning	0.90	0.90	2019
Residential			
Residential SOP, non-HVAC measures	0.90	0.90	2022
Residential SOP, HVAC measures	0.94	0.95	2022
Residential SOP, overall	0.91	0.93	2022
Solar PV SOP	0.96	0.95	2018
New Homes	0.70	0.70	2020
Upstream Lighting	0.90	0.90	2020
A/C Tune-Up/Residential MTP	0.80	0.80	2019
Hard-to-Reach SOP	1.00	1.00	N/A—industry standard is to set at 1.0
Midstream MTP	0.84	0.84	2019
Appliance Recycling	0.79	0.79	2018
Low-income			
Targeted Low-Income	1.00	1.00	N/A—industry standard is to set at 1.0
Load management			
Commercial Load Management SOP	1.00	1.00	N/A—industry standard is to set at 1.0
Residential Load Management SOP	1.00	1.00	N/A—industry standard is to set at 1.0

This appendix documents the quality assurance/quality control (QA/QC) protocols established for the PUCT Evaluation, Measurement, and Verification (EM&V) team for reporting claimed and evaluated impacts. Although quality control is a function of all evaluation stages (e.g., populating the EM&V database, sampling, analysis), this appendix focuses on the QA/QC processes within the reporting stage. A QA/QC team, which will be led by the Tetra Tech reporting lead, will be developed and accountable for ensuring all QA/QC protocols are being followed.

Below we summarize the specific activities that will be subject to QA/QC processes. Note that these QA/QC processes focus on the accuracy of data; this section does not address methodological issues.

Accuracy of ex-ante program data. The EM&V team is housing data, analysis, and reporting functions within the EM&V database. Data will be provided by program implementers, read into the database in raw form, and organized for analysis. The database centrally stores the claimed (ex-ante) savings, which will be used for sampling and reporting those claimed savings. Data will be provided to the EM&V team quarterly. The EM&V team will characterize the data received in terms of energy and demand savings and participants served and report the information within the detailed research plans; these detailed research plans will be delivered to the utilities for review and confirmation that the population data is accurate. Inaccurate population data may indicate missing data, errors in the data importation process, or misunderstanding of the data fields.

- Responsibility: program leads
- Accountability: QA/QC team
- Consulted: utility staff, implementation contractors, and EM&V project manager

Application of verification rates and net-to-gross (NTG) ratios. The impacts will be generated in the EM&V database. The database will categorize measure-level information in the format it was provided to the EM&V team per the data acquisition process. Although projects may be sampled and verified at the measure level, the EM&V team will conduct impact evaluations to obtain and report verification and NTG estimates at the utility and program type level, which will then be aggregated and reported at the program group level.

These impact estimates will be provided by the program leads and stored in two locations. First, the program leads will enter the impact results within an Excel tracking sheet stored on the SharePoint site. The Excel tracking sheet will include the following fields—program year (PY), utility, program group, program type, measure group, program lead, verification rate, NTG ratio, report source of verification rate, report source of NTG ratio, and modification date. Only one sheet will maintain current impact information. Should data be updated throughout the process, the outdated records will be moved to a separate worksheet within that file. Doing so will ensure one sheet will maintain the correct rates and that any modifications are documented, including the reason for the modification.

Second, the EM&V database will include an interface where program leads will directly enter their impact results. These results will then be stored and applied against the claimed savings to calculate the evaluated gross and evaluated net results for the annual reporting.

By creating a two-stage impact reporting process, the EM&V team builds a point of verification of the data into the process. The evaluated and net savings results will be directly calculated out of the EM&V database using the rates supplied within the web interface. The EM&V team will then verify that the results are as expected using the values documented within the Excel impact reporting file. Should the results differ, the QA/QC team will be able to refer to the original source to verify the results.

- Responsibility: program leads
- Accountability: QA/QC team
- Consulted: impact leads, EM&V data lead, and project manager

Accuracy of reported savings. As documented in the report outline, program impacts will be aggregated and reported in various ways. At the most aggregate level, the data will be reported by program group overall and then by utility. At the most granular level, the data will be reported by program group for each utility. The annual report will, therefore, represent impacts in over 100 tables. It will be critical to spend considerable time conducting QA/QC against those reported values.

The EM&V database will calculate the full year claimed savings by utility, program type, and program group. Although claimed savings will be documented in quarterly detailed research plans, adjustments made in claimed savings are likely to occur throughout the year. Therefore, it will be necessary to calculate the full PY claimed savings and verify our results against the utility claimed data, which will be reported to the PUCT. The EM&V team will request that the utilities provide their draft claimed savings to verify against the reported claimed savings within the EM&V database. Any differences in the evaluation and utility claimed savings would be clearly documented within the report.

All results tables will be cross-referenced to ensure the results true up and are consistent with each other. For example, the sum of all residential MTPs evaluated net savings documented within the utility-specific sections should equal the residential MTP results captured in Technical Reference Manual (TRM) Volume 1. The QA/QC team will develop a checklist of tables to be cross-checked against which sources and will systematically go through this checklist throughout the report-proofing process.

Although not a specific QA/QC function, the team's development of these reporting functions with the overarching goal of ensuring transparency will inherently allow for ad hoc QA/QC checks by the PUCT, utilities, implementation contractors, or other interested parties. For example, the EM&V database can export results and resulting calculations within easy-to-use Excel files. In addition, impact-related reports will tie back to results clearly for a secondary review.

- Responsibility: utilities (for providing claimed savings) and program leads (for verifying claimed impacts provided)
- Accountability: QA/QC team (for final review and cross-checks of impact tables)
- Consulted: impact leads, EM&V data lead, utilities, and EM&V project manager