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Received - 2021-09-28 10:17:54 AM
Control Number - 38578
ItemNumber - 36

Public Utility Commission of Texas

TO: Interested Parties

FROM: Therese Harris, Infrastructure Division

DATE: September 29, 2021

RE: Project No. 38578 – Statewide Energy Efficiency Portfolio Report Program Year 2020

Attached is the Statewide Energy Efficiency Portfolio Report Program Year 2020, Volume 1, and Volume 2 for review at the Energy Efficiency Implementation Project meeting to be held on Wednesday, October 13, 2021.

At this time, an in-person and virtual participation option are planned. The in-person option is planned for 9:30 AM to 3:00 PM in the Commissioners' Hearing Room located on the 7th floor of the William B. Travis Building. A detailed agenda will be filed in this project by October 1, 2021.

Public Utility Commission of Texas

Volume 1. Statewide Energy Efficiency Portfolio Report Program Year 2020

TETRA TECH

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July 30, 2021

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ACKNOWLEDGEMENTS

We would like to acknowledge the many individuals who contributed to the evaluation, measurement, and verification (EM&V) of program year 2020. This evaluation effort would not have been possible without their assistance and support.

Public Utility Commission of Texas and electric utility staff provided input throughout the evaluation processes. The following individuals participated in ongoing evaluation deliverable reviews and discussions, attended multiple meetings, and responded to follow-up questions and program data and documentation requests:

- Public Utility Commission of Texas (PUCT): Therese Harris, Keith Rogas, and Pai Liu;
- American Electric Power Texas (AEP Texas): Russell Bego, Robert Cavazos, and Pam Osterloh;
- CenterPoint Energy: Tim Griffin, Shea Richardson, and Andrew Scatizzi;
- El Paso Electric: Crystal Enoch, Araceli Perea, and Susanne Stone;
- Entergy: Kelley Carson, Mark Delavan, Corrin Barrow;
- Oncor: Carl Brown, Prachi Gupta, Garry Jones, and Joseph Nixon;
- Southwestern Electric Power Company (SWEPCO): Debra Miller and Steve Mutiso;
- Texas-New Mexico Power (TNMP): Stefani Case and Morgan Nielsen; and
- Xcel Southwestern Public Service (SPS): Jeremy Lovelady, Derek Shockley, and Bryan Whitson.

We also wish to thank the staff at the following utility consulting firms who provided program data and documentation and insight into program implementation: CLEAResult, Ecova, Frontier Energy, ICF International, Lockheed Martin, Nexant, and Willdan Energy Solutions.

Tetra Tech's EM&V team primary report contributors include:

Contributor	Role
Lark Lee	Overall project director and reporting lead
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Jessica Thompson	Data lead and commercial consumption analysis
Tina Yoder	Technical reference manual lead
Theresa Holmes and Jessi Russell	Data analysts

Please send any questions or comments on the report to Therese Harris (therese.harris@puc.texas.gov) and Lark Lee (lark.lee@tetratech.com).

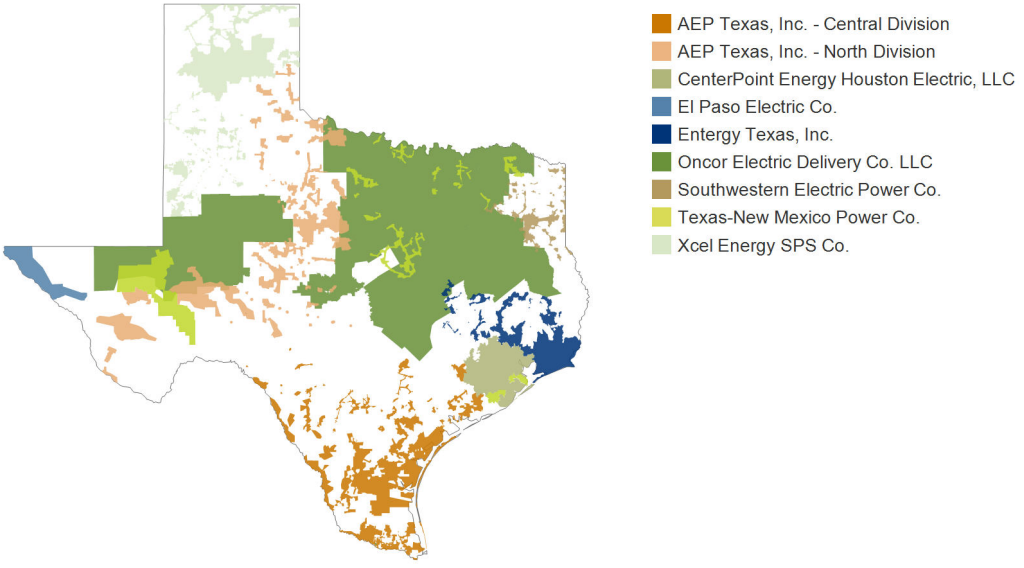
ACRONYMS

AEP TCC	American Electric Power Texas Central Division
AEP TNC	American Electric Power Texas North Division
C&I	Commercial and industrial
CNP	CenterPoint Energy Houston Electric, LLC
CSOP	Commercial standard offer program
DI	Direct install
EEIP	Energy efficiency implementation project
EEPR	Energy efficiency plan and report
EESP	Energy efficiency service provider
EM&V	Evaluation, measurement, and verification
Entergy	Entergy Texas, Inc.
EPE	El Paso Electric Company
EUL	Estimated useful life
HTR	Hard-to-reach
kW	Kilowatt
kWh	Kilowatt-hour
LI	Low-income
LM	Load management
M&V	Measurement and verification
mcf	1,000 cubic feet
MTP	Market transformation program
NTG	Net-to-gross
PUCT	Public Utility Commission of Texas
PV	Photovoltaic
PY	Program year
QA/QC	Quality assurance/quality control
Recommissioning	RCx
RFP	Request for proposals
RSOP	Residential standard offer program
SOP	Standard offer program
SWEPCO	Southwestern Electric Power Company
TEESI	Texas Energy Engineering Services, Inc.
TNMP	Texas-New Mexico Power Company
TRM	Technical Reference Manual
Xcel Energy SPS	Xcel Energy Southwest Public Service, Inc.

1.0 EXECUTIVE SUMMARY

The Public Utility Commission of Texas (PUCT) oversees the energy efficiency programs delivered by the state's investor-owned electric utilities: AEP Texas, Inc.[1] (AEP Texas), CenterPoint Energy Houston Electric, LLC (CenterPoint), Entergy Texas, Inc. (Entergy), El Paso Electric Company (El Paso Electric), Oncor Electric Delivery, LLC (Oncor), Southwestern Electric Power Company (SWEPCO), Southwestern Public Service Company (Xcel SPS), and Texas-New Mexico Power Company (TNMP). The utilities' service territories are shown in Figure 1.

Figure 1. Territories of Regulated Electric Utilities in Texas



The Texas electric utilities administer a variety of programs that improve the energy efficiency of residential and commercial customers' homes and businesses. Standard offer programs (SOP) develop the infrastructure of service providers (e.g., contractors, distributors) and provide financial incentives to deliver higher efficiency products and services. Utilities select implementation firms to run market transformation programs (MTP). MTPs provide additional outreach, technical assistance, and education to customers in harder-to-serve markets (e.g., small business, health care, data centers, and local governments) and for select technologies (e.g., recommissioning, air conditioner (AC) tune-ups, pool pumps). All utilities provide energy efficiency offerings to low-income customers through hard-to-reach (HTR) programs that are delivered similarly to the residential SOPs. The utilities that are part of the Electric Reliability Council of Texas (ERCOT) also offer targeted low-income programs that coordinate with the existing federal weatherization program. Finally, the utilities manage load management

[1] The PUCT approved the application for AEP Texas Central Company (AEP TCC), AEP Texas North Company (AEP TNC), and AEP Utilities, Inc. to merge AEP TCC and AEP TNC into AEP Utilities, and then rename that corporate entity AEP Texas, Inc. AEP Texas reported 2020 energy efficiency programs by the legacy AEP TCC and AEP TNC territories, which are now referred to as AEP Texas Central Division and AEP Texas North Division.

programs, which are designed to reduce summer peak demand.

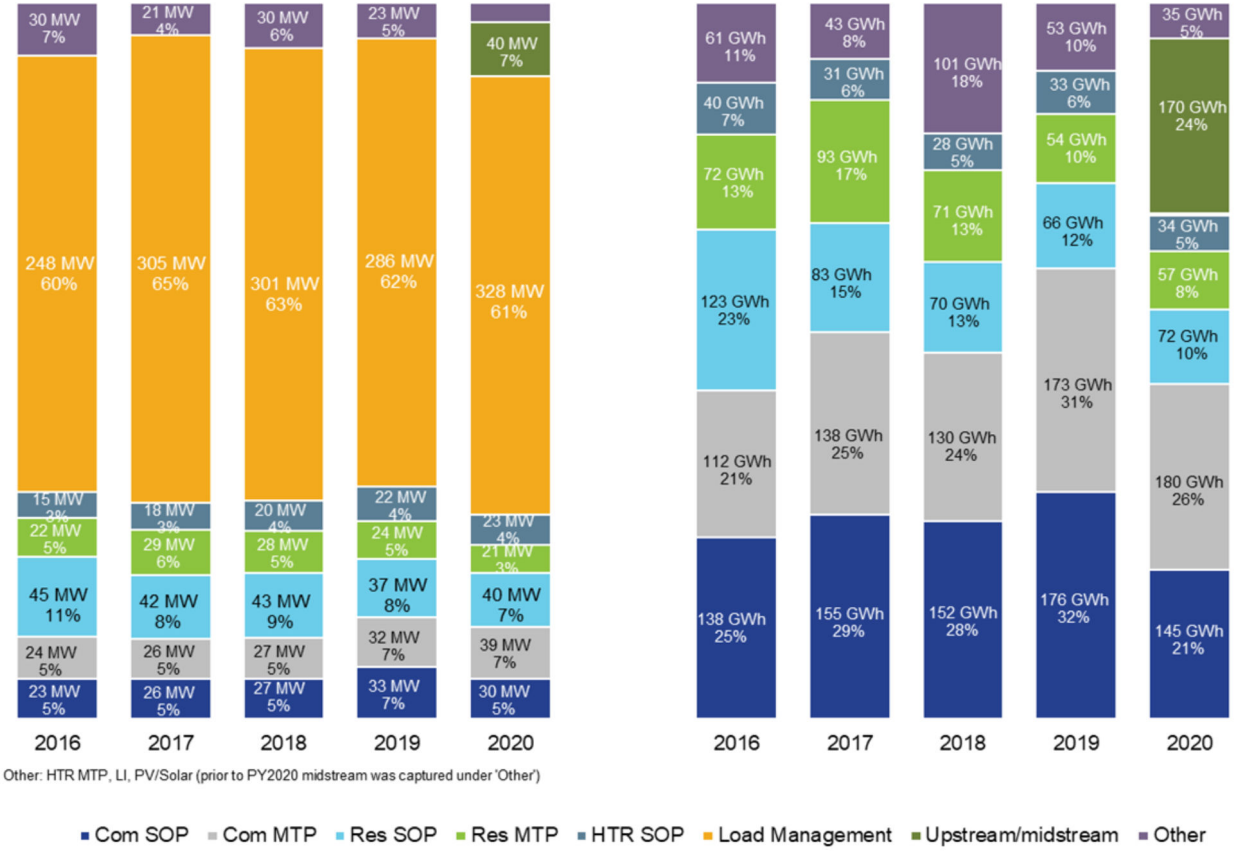
1.1 PY2020 ENERGY EFFICIENCY SUMMARY RESULTS

In program year (PY) 2020, the Texas electric utilities achieved statewide demand reductions of 536,770 kilowatts (kW) at a lifetime savings cost of $11.56 per kW. The utilities achieved statewide energy savings of 695,012,552 kilowatt-hours (kWh) at a lifetime savings cost of $0.02 per kWh.

1.1.1 Savings

As shown in Figure 2, load management programs consistently account for the majority of the statewide demand reductions (MW). In the past, the 'Other' category included HTR MTP, LI, upstream/midstream, and PV/solar programs. Due to the growth in the upstream/midstream programs, we present it as a separate category in PY2020, as it is now the second-largest contributor to statewide energy savings, slightly behind commercial MTPs.

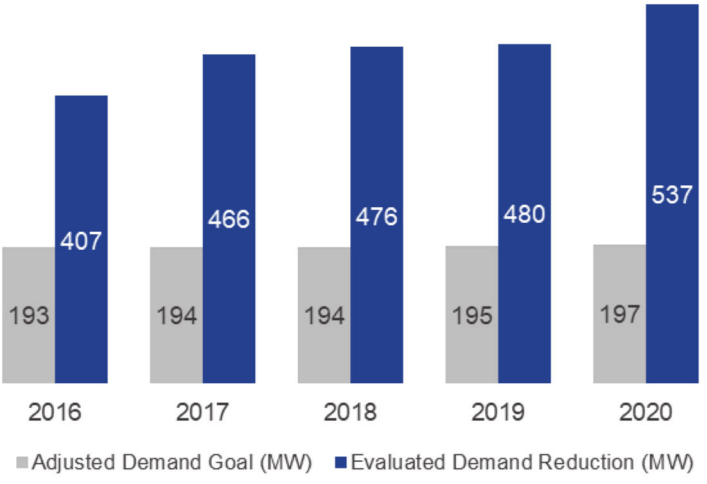
Figure 2. Evaluated Gross Demand Reduction and Energy Savings by Program Type[2]



[2] Values less than four percent have been suppressed for visualization purposes.

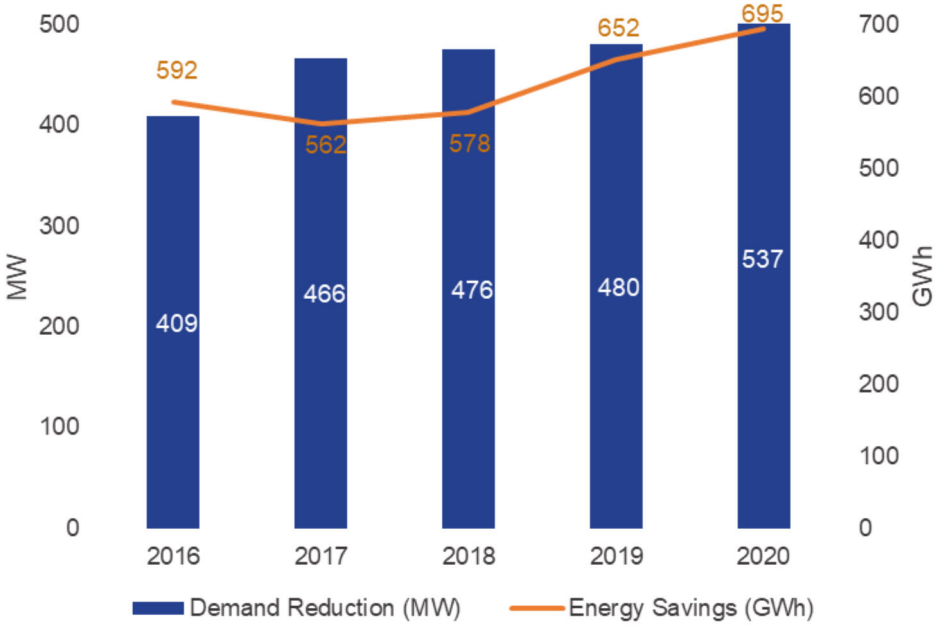
As shown in Figure 3, the utilities continue to significantly exceed their legislated demand reduction goals; this is in large part due to the load management programs.

Figure 3. PY2016–PY2020 Legislated Goals and Actual Demand Reduction



PY2020 saw the largest demand reductions and energy savings in the last five years (Figure 4).

Figure 4. Total Statewide Portfolio: Evaluated Gross Demand Reduction and Energy Savings by Program Year



Energy savings and demand reductions from the energy efficiency programs persist beyond the program year. The duration of savings is based on the type of energy efficiency improvement made and how long it typically lasts. The cumulative savings the utilities had achieved since PY2012—when the PUCT evaluation, measurement, and verification (EM&V) effort began—are shown in Figure 5 (demand reduction) and Figure 6 (energy savings). Demand reductions and energy savings are expected to continue through 2040.

Figure 5. PY2012–PY2048 Lifecycle Demand Reduction by Sector (MW)

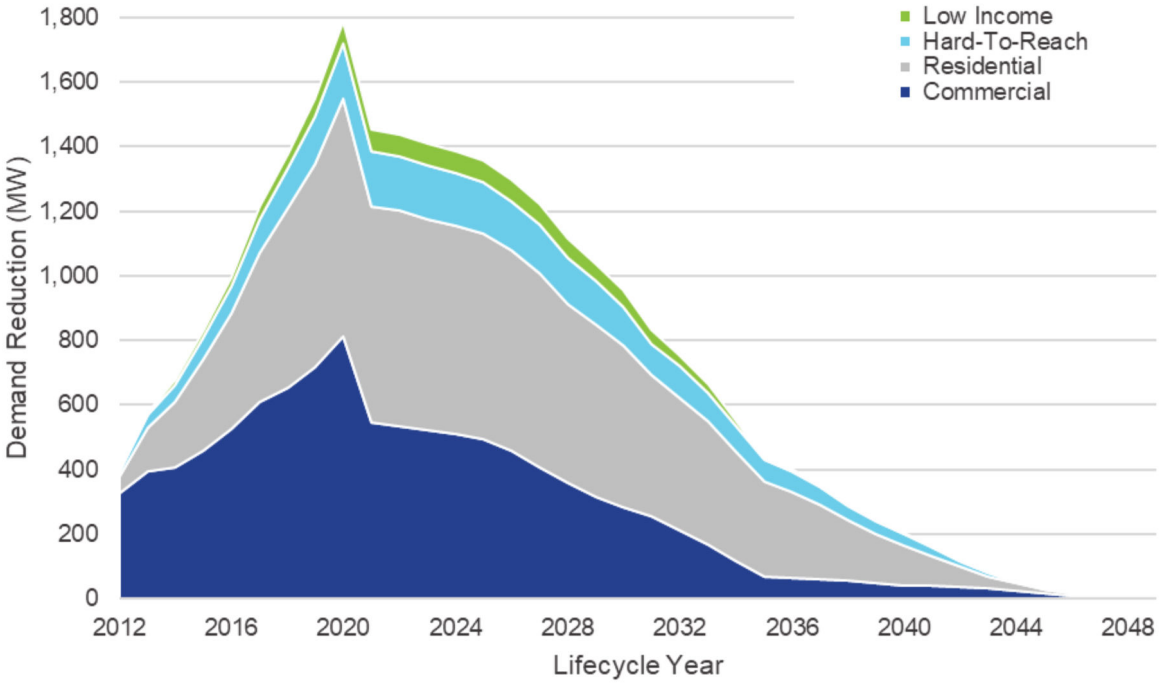


Figure 6. PY2012–PY2048 Lifecycle Energy Savings by Sector (GWh)

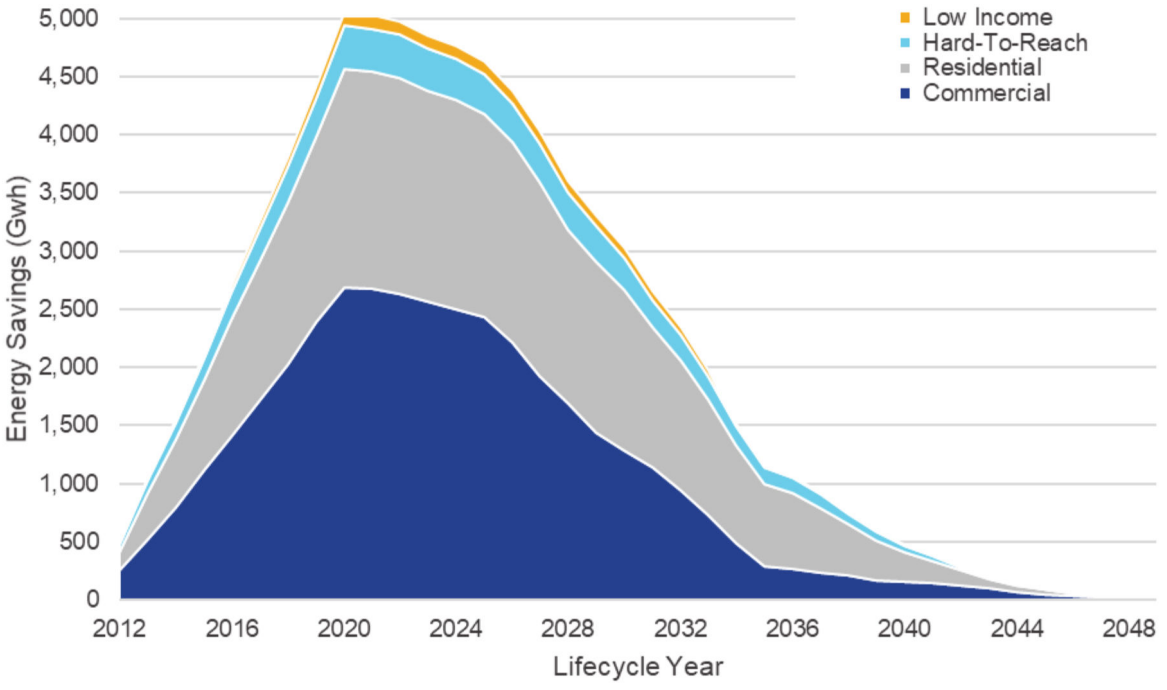


Figure 7 and Figure 8 show the types of measures the programs installed and how they contribute to lifecycle savings. Lighting, HVAC, and building shell improvements are delivering the most savings over time. Load Management delivers demand reductions only in the program year and accounts for the spike and drop-off after 2020.

Figure 7. PY2012–PY2048 Lifecycle Demand Reduction by Measure Category (MW)

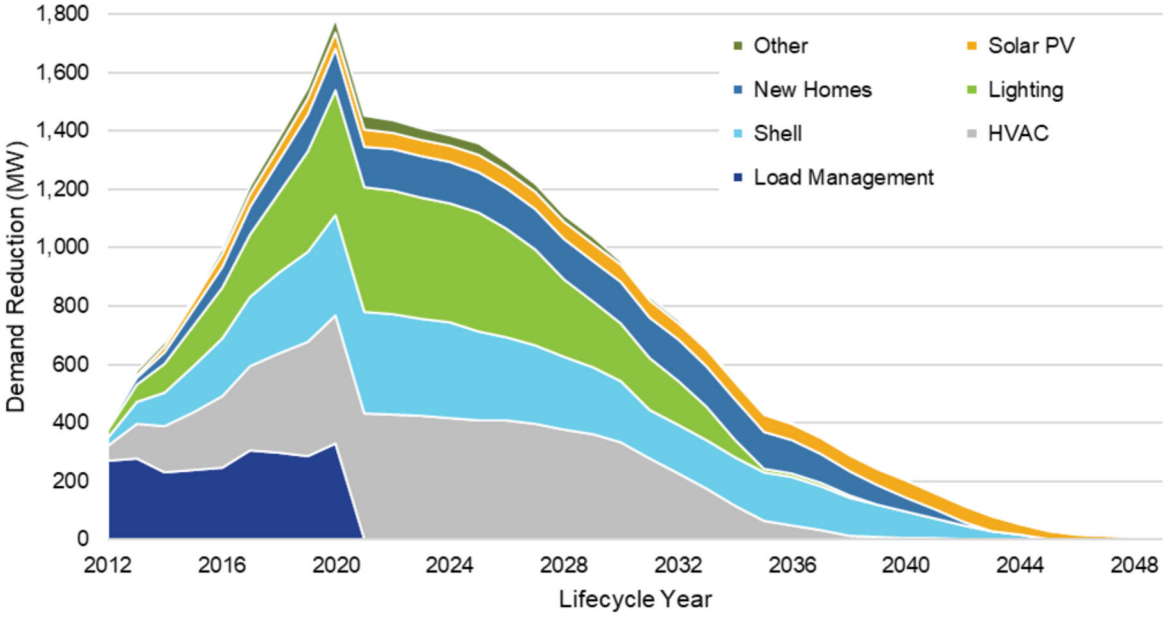
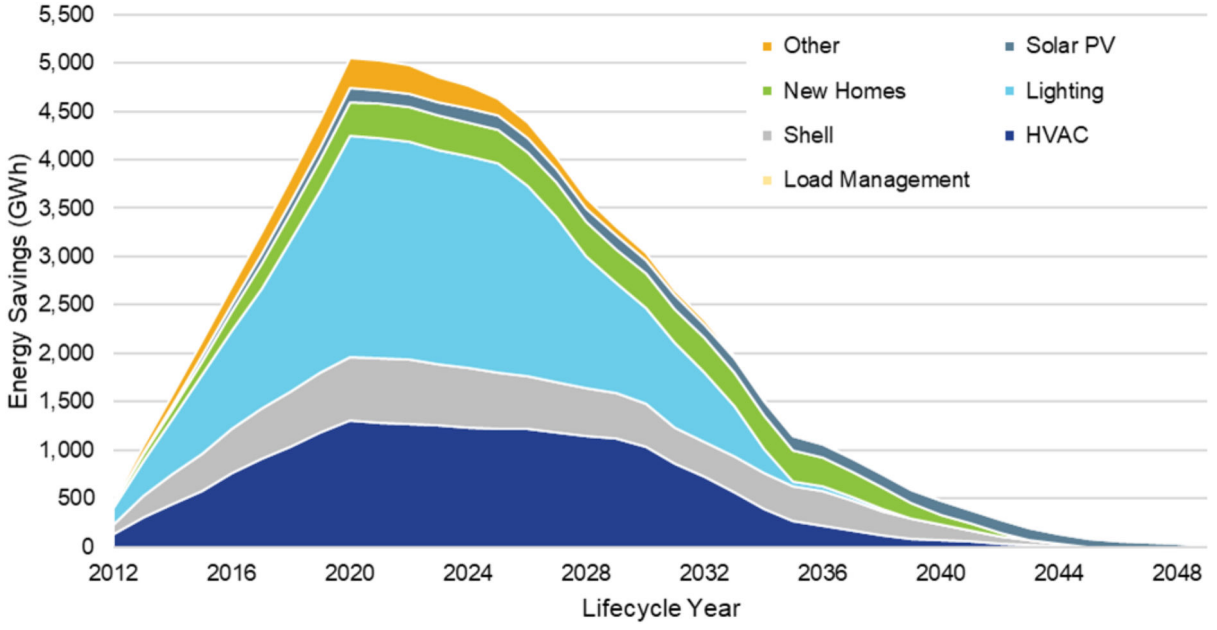


Figure 8. PY2012–PY2048 Lifecycle Energy Savings by Measure Category (GWh)



1.1.2 Cost-Effectiveness

Figure 9 overviews the avoided costs and statewide cost-effectiveness ratios over the last five years (PY2016 to PY2020). The statewide cost-effectiveness has consistently remained above the 2.0 ratio using the program administrator cost test (benefits divided by costs). Cost-effectiveness increased to 4.0 in PY2020. The increase in cost-effectiveness is largely due to the avoided cost of energy almost doubling for PY2020 compared to prior avoided costs. Another driver of the increased cost-effectiveness is the expanded upstream/midstream programs discussed earlier; they were the most cost-effective programs across the utility portfolios.

Figure 9. Statewide Evaluated Gross Cost-Benefit Ratio and Avoided Cost by Program Year

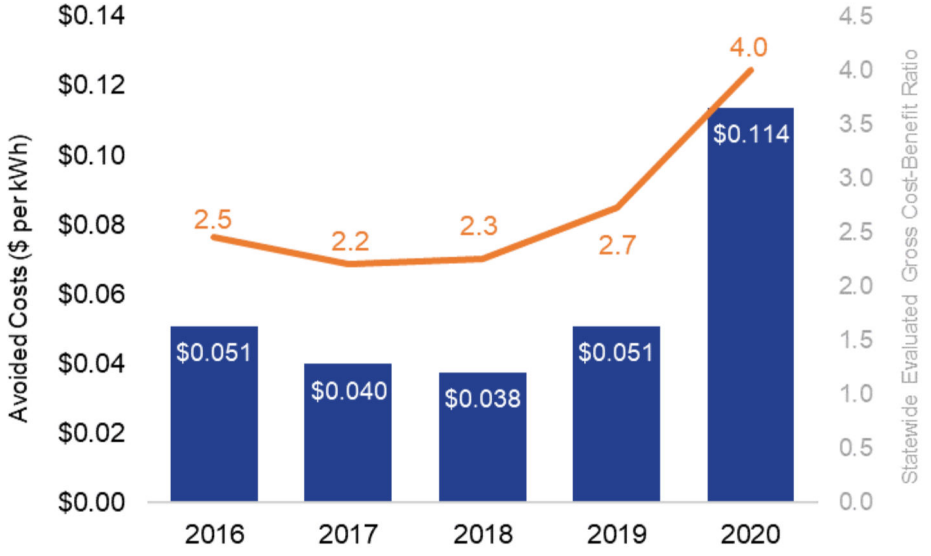
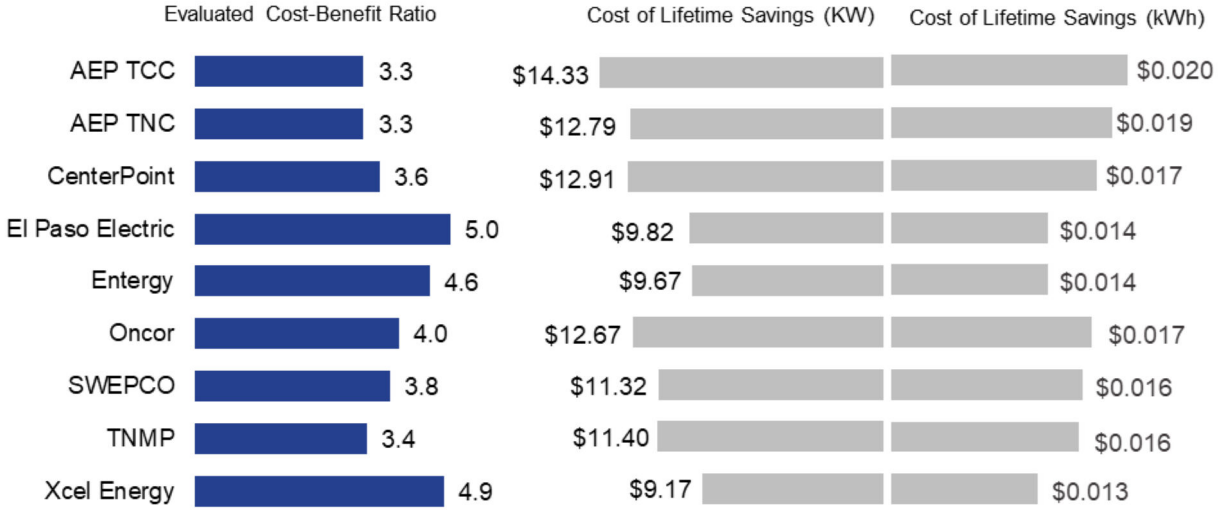


Figure 10 summarizes the cost-effectiveness of each utility's energy efficiency portfolio. All portfolios were cost-effective, with ratios ranging from 3.3 to 5.0. The lifetime cost per kW ranged from $9.17 to $14.33 across utility portfolios. The lifetime cost per kWh ranged from $0.013 to $0.020. These lifetime costs provide an alternate way of describing the cost-effectiveness of a portfolio of programs. Portfolios with a higher cost-effectiveness ratio will have a lower cost to acquire savings and vice versa.

Figure 10. PY2020 Evaluated Savings Cost-Benefit Ratio and Cost of Lifetime Savings



1.2 EVALUATION, MEASUREMENT, AND VERIFICATION OVERVIEW

In 2011, the Texas Legislature enacted Senate Bill (SB) 1125, which required the PUCT to develop an EM&V framework that promotes effective program design and consistent and streamlined reporting. The EM&V framework is embodied in the PUCT's substantive rule § 25.181, relating to the energy efficiency goal.

The PUCT selected an independent, third-party EM&V contractor for the PY2020–PY2023 programs through the Request for Proposals 473-20-0002, Project No. 51021. The selected EM&V team is led by Tetra Tech and includes Texas Energy Engineering Services, Inc. (TEESI) and Energy Bees.

The objectives of the EM&V effort are to:

- document gross and net energy and demand impacts of utilities' individual energy efficiency and load management portfolios;
- determine program cost-effectiveness;
- provide feedback to the PUCT, utilities, and other stakeholders on program portfolio performance; and
- prepare and maintain a statewide technical reference manual (TRM).[3]

This Statewide Energy Efficiency Report presents the PY2020 EM&V findings and recommendations, looking across all eight electric utility portfolios. The report (1) addresses gross and net energy and demand impacts, program cost-effectiveness; and (2) provides feedback on program portfolio performance. The EM&V findings and recommendations inform annual updates to the TRM.

The PUCT's EM&V independently verifies utility claimed savings across all programs through program tracking data. Additional EM&V activities (engineering desk reviews, on-site measurement and verification (M&V), interval meter data analysis, consumption analysis, participant surveys, and in-depth interviews) are conducted based on an evaluation prioritization of *high*, *medium*, or *low* by program type. The PUCT staff and the EM&V team revisit the prioritization each year based on considerations such as magnitude and uncertainty of savings, stage of the program, importance to future portfolio performance, PUCT and Texas utilities' priorities, prior EM&V results, and changes in the markets in which the programs operate.

1.3 KEY FINDINGS AND RECOMMENDATIONS

1.3.1 Adjustment Summary by Utility

The utilities have demonstrated a willingness to work with PUCT Staff and the EM&V team to improve the accuracy of claimed savings. This includes (1) adjusting claimed savings in response to EM&V findings, (2) requesting M&V reviews or additional technical assistance throughout the program year, and (3) implementing TRM or program changes. Utilities fully responded to all PY2020 EM&V recommended savings adjustments to claimed savings as identified in Table 1.

[3] The maintenance of the TRM is informed by the EM&V research and coordinated with the utilities and PUCT staff through the TRM Working Group. Public input prior to filing is solicited through the Energy Efficiency Implementation Project (EEIP) at multiple stages in the update process.

Table 1. PY2020 Recommended EM&V Savings Adjustments to Utility Claimed Savings

Utility	kW	kWh
AEP TCC	-28	5,986
AEP TNC	12	17,539
CenterPoint	-310	-1,337,233
El Paso Electric	-3	34,526
Entergy	-212	-8
Oncor	5	18,316
SWEPCO	-26	-166,991
TNMP	3	9,508
Xcel Energy	-16	-21,305
Overall	**-577**	**-1,439,663**

1.3.2 Recommendations

The PUCT's EM&V recommendations are to facilitate more accurate, transparent, and consistent savings calculations and program reporting across the Texas energy efficiency programs and provide feedback that can lead to improved program design and delivery.[4] PUCT staff and the EM&V team work with the utilities to agree on utilities' responses to recommendations, referred to as *action plans*. Action plans are also vetted with the EEIP (the statewide collaborative group). Utilities then use these action plans to respond to program savings, design, and implementation recommendations within the next program year consistent with § 25.181(q)(9). Recommendations made based on PY2018 evaluation research, which was completed in 2019, were expected to be implemented in PY2020. Likewise, recommendations resulting from the PY2020 EM&V completed in 2021 are expected to be implemented in PY2022. First, we report on utility progress in meeting recommendations that were to be implemented in PY2020. Then we summarize recommendations from the PY2020 EM&V research to be implemented in PY2022.

[4] The EM&V team recognizes that there may be a trade-off between the objectives of the recommendations, program administration costs, and program participation barriers. The EM&V team strives to recognize these trade-offs by making feasible recommendations and working with the utilities to agree upon reasonable action plans in response to recommendations.

1.3.3 Prior EM&V Recommendations

Table 2 through Table 5 summarize the status of 43 PY2018 EM&V recommendations that utilities were to implement in PY2020. While utilities have been responsive to recommendations, over half of recommendations (26 of the 43) are noted as *in progress*. Utility quality assurance and quality control (QA/QC), program tracking, and project documentation recommendations are generally *in progress*. Several other recommendations are *in progress* as they will be assessed in future evaluation years as the applicable program was a *low* evaluation priority in PY2020. For load management programs, many recommendations are *in progress* as they are applicable to future discussions on the role of the programs.

Commercial recommendations addressed TRM updates and utility QA/QC practices. QA/QC practices are noted as *in progress* since some minor discrepancies were found in the PY2020 EM&V, or the TRM update is still being refined.

Table 2. Commercial Program Recommendations for PY2020 Implementation

Category	Key finding and recommendation	PY2020 implementation	Status
Project timing	The commercial programs' historical pattern of the timing of projects and savings across the program year sees the lowest energy savings claimed in the first quarter. Subsequent quarters have increasing savings. While this pattern is typical for commercial programs, the disparity across quarters has increased in recent years.	Utilities considered strategies to smooth participation throughout the program year, including activities and communications to support the increase in projects in the first quarter to minimize a first-quarter slowdown. Some utilities reported that having a strong first quarter in 2020 helped them achieve goals during the COVID-19 pandemic.	 Complete
HVAC projects	Evaporative cooling system projects claimed the *space conditioning type* as *other*, which follows the TRM. The *other* category provides no interactive effects benefit associated with cooling interior space and therefore is a conservative estimate of energy savings.	*Evaporative cooler space conditioning* was added in the TRM to capture the HVAC energy interactive effects.	 Complete

Category	Key finding and recommendation	PY2020 implementation	Status
Lighting projects	The TRM requires that the number of non-operable fixtures be limited to ten percent of the total facility fixture count. If the non-operable fixture count is greater than ten percent, the baseline wattage cannot be adjusted to include the non-operational fixtures.	Utilities confirmed lighting calculators utilize the TRM process for non-operable fixtures. The calculation process, when the total non-operable baseline lighting fixtures exceeded ten percent, has improved.	 Complete
	The EM&V on-site verification found sensors installed for control of lighting fixtures in several cases. The sensors appear to be installed without an incentive. This finding indicates customer interest in this measure that could be integrated into projects more often.	Utilities and the EM&V team discussed providing information to service providers on the benefits of sensor controls on interior and exterior lighting.	 In progress
	Lighting calculations use variable baseline fixture wattages between utility territories. Calculators provide baseline fixture wattages—and some calculations used the TRM-listed fixture baseline wattages—while others used the marketplace available wattages. This inconsistency is especially relevant to two types of fixtures: screw-in light bulbs and fluorescent lighting fixtures.	The EM&V team updated the PY2020 TRM lighting wattage table.	 Complete
	Manufacturer's rated lighting wattages were typically used instead of third-party rated wattages of the fixtures or lamps as previously recommended. Many evaluated projects required that the installed wattages for an individual line item be adjusted to match Design Lighting Consortium (DLC)- or ENERGY STAR®-listed wattages in their qualified listing.	While the utilities have improved internal QA/QC to use the third-party qualification agencies published lighting wattages, the EM&V team still found measures that needed to be adjusted in the PY2020 EM&V.	 In progress

Category	Key finding and recommendation	PY2020 implementation	Status
Building type selection	Commercial lighting and HVAC project analysis require proper building type selection as guided by the TRM. In some cases, facilities can have multiple building types at the same location, but the savings calculation requires selecting one building type per calculator. The building type should match the predominant building type based on the surface area.	Program manuals and utilities' service provider training clarified that the predominant building type for surface area and operations should be used to calculate energy savings. Utilities have also reached out to the EM&V team for guidance, when needed, on selecting the appropriate building type.	 Complete
New construction projects	New construction buildings are primarily claiming only HVAC and lighting improvements in the programs. The buildings that attempted to claim envelope, controls, or other improvements, necessitated a custom calculation.	The EM&V team is working with interested utilities on new construction M&V approaches, as applicable. It continues as a discussion item in the TRM Working Group.	 In progress
	The *lighting new construction* limit of ten percent non-qualifying fixtures or total wattages is augmenting energy savings. The PY2018 TRM 5.0 process to claim lighting savings for a new construction project has a process to handle lighting equipment that is not qualified for the program to be incorporated into the design.	The EM&V team eliminated the ten percent non-qualifying limit for new construction projects but kept the multiplier in place for the PY2020 TRM 7.0, which is appropriately reflected in savings calculators.	 Complete
	The date of new construction projects varies from standard retrofit projects. It is allowable to use all energy efficiency calculators that were in use on the date of the building permit for new construction projects.	Utilities are using the date of the building permit for new construction to select the correct version of energy-efficiency savings calculation tools.	 Complete

Category	Key finding and recommendation	PY2020 implementation	Status
Custom assumptions	A small number of custom assumptions were made regarding commercial and industrial building operation, which is acceptable. The assumptions, however, lacked documentation to confirm custom assumptions, and therefore the evaluation team generally found that the project should have used a TRM standard assumption.	Utilities will check that service providers using custom assumptions have the required documentation of the operation profile if it varies from the Texas TRM standard assumptions. One *custom* building type without documentation was adjusted in the PY2020 EM&V,.	In progress
Midstream programs	The midstream lighting programs are given limited guidance. These projects provided an incentive at the distribution point to the installing contractor with the intention of installing the equipment for a commercial or industrial eligible customer. Within the midstream program, the post-install wattage for the projects is known, but the pre-install equipment and the building type are unknown.	The EM&V team updated the TRM to include a method for developing the savings calculation for commercial midstream lighting programs. The TRM Working Group will refine further for the PY2022 TRM.	In progress
Retro-commissioning (RCx) projects	The retro-commissioning TRM M&V protocol follows Option C of the International Performance Measurement and Verification Protocol (IPMVP) framework, which requires significant effort. RCx projects range in size and scope. Small projects are unduly burdened by the rigorous IPMVP Option C method. A simpler process for small projects would increase the opportunity to improve existing building operations with low-cost measures.	The EM&V team worked with utilities to review a spreadsheet model of energy savings for small projects. Evaluated projects appeared to work, and the EM&V team had minimal adjustments to the calculated savings. The EM&V team will revise the TRM RCx M&V protocol to approve the simplified calculation-based method for projects with limited scope, size, and energy savings.	Complete

Category	Key finding and recommendation	PY2020 implementation	Status
Small business programs	The date to determine eligibility for specifications was not consistent across small business projects. It is acceptable that the date to measure against third-party certification for equipment is the customer acceptance signature date on the project scope.	The EM&V team updated the TRM to provide guidance that the date of the customer acceptance of the small business projects can be used for lighting qualification equipment eligibility.	Complete
	The EM&V team found that the building type for small business customers was less accurate than other commercial projects. The implementation teams should provide additional training or quality control inspections to confirm building type and provide continuous education to the installation trade allies.	Utilities should update QA/QC processes to ensure the building type is verified prior to the final energy savings calculation; this will be assessed in the PY2021 EM&V when small business programs have a *medium* priority.	In progress

Residential recommendations focused on documentation requirements, TRM updates and utility QA/QC practices (Table 3). Several recommendations are noted as *in progress* since the PY2019 consumption analysis resulted in additional recommendations to improve deemed savings estimates starting with the PY2021 TRM. New homes and AC Distributor recommendations are noted *in progress* as these programs were a low evaluation priority for PY2020, but will receive a high evaluation priority in the PY2022 EM&V.

Table 3. Residential Program Recommendations for PY2020 Implementation

Category	Recommendation	PY2020 implementation	Status
Ceiling insulation projects	Determining the effective R-value of ceiling insulation considers several factors, including square footage. However, the TRM lacks guidance on how to accurately determine the effective R-value in attics where varying levels of existing insulation can be found across multiple areas.	The EM&V team updated the PY2020 TRM to clarify how to estimate savings using the area-weighted U-factor methodology.	Complete
Attic encapsulation projects	There was very low usage of the *attic encapsulation* measure across residential programs, as the TRM savings resulted in substantially lower savings than should be expected from this measure.	The EM&V team provided a guidance memo to use the *ceiling insulation* measure savings for attic encapsulation and updated the PY2020 TRM.	Complete

Category	Recommendation	PY2020 implementation	Status
HVAC capacity bins	Historically, the *central air conditioner* and *heat pump* measures had reported capacity based on nominal tonnage.	The EM&V team provided a guidance memo with updated capacity ranges and updated the PY2020 TRM.	 Complete
Duct sealing education	During on-site M&V, the EM&V team found several completed duct sealing projects where the measures had been undone by maintenance staff. In some cases, the mastic tape used to seal joints was removed or damaged and not replaced, resulting in increased duct leakage. In one case, gaps were left between the wall and air handler unit resulting in a loss in pressure and increasing air infiltration and duct leakage.	Utilities should consider developing education materials to leave with homeowners on the upkeep of duct sealing improvements. Due to additional findings from the PY2020 EM&V, the improved implementation of this measure is in progress.	 In progress
HVAC project participation	In response to a PY2016 EM&V recommendation, utilities have successfully increased residential HVAC projects. The PY2018 net-to-gross (NTG) research with HVAC contractors found the majority of these projects were completed due to the programs.	Utilities should continue to encourage efficient HVAC adoption as a component of their portfolios. The percentage of residential HVAC projects still varies considerably by utility program.	 In progress
New homes	Energy models estimate energy usage for the program homes, and the utilities provided either the energy model configuration or pre-configured reports that showed energy model inputs. In some cases, the EM&V team had to make follow-up requests to receive sufficient detail.	Utilities should review the documentation section of the *new homes* measure characterization in the TRM and ensure they continue collecting the required documentation, which will be assessed in the PY2022 EM&V.	 In progress
	Required tracking fields for new homes include the date the home was permitted and the energy code version under which it was permitted. While most homes were constructed under IECC 2015, a few were still permitted under IECC 2009. Although the TRM specifies a statewide code based on IECC 2015, local jurisdictions may decide not to adopt and enforce that code.	Utilities should continue to work with builders to improve the efficiency of homes, even in jurisdictions that have not adopted the latest state energy code. The EM&V team will assess this in PY2022.	 In progress

Category	Recommendation	PY2020 implementation	Status
AC distributor program	The EM&V team found several discrepancies in the baselines for projects, which reduced savings. One was a discrepancy in the age of equipment reported in the tracking data compared to what was found in the documentation. The second was in the type of baseline equipment reported. In both cases, the desk review identified these discrepancies through a review of the photo documentation provided.	Utilities offering AC distributor programs should review documentation to ensure that all necessary information input into tracking data aligns with the photo documentation and field checklist.	 In progress
	Interviews with A/C distributors identified (1) program paperwork and processes and (2) delays in receiving incentives as areas for program improvement.	Utilities may want to review participation and incentive processes to respond to participating distributor feedback.	 In progress

The PY2018 EM&V placed a *high* evaluation priority on the load management programs, resulting in several recommendations to improve the programs (see Table 4). Several recommendations are noted as *in progress* as applicable to future rule-making discussions regarding the role of these programs in utilities' portfolios and the Texas energy resource mix.

Table 4. Load Management Program Recommendations for Future Implementation

Category	Recommendation	Future implementation	Status
Overarching	The percentage of total statewide kilowatt reductions provided through load management averages around two-thirds; this ranges by utility from about one-third of kilowatt reductions to about three-quarters of kilowatt reductions.	The percentage of kilowatts that should be met from load management should be considered in the context of the needs of Texas' grid.	 In progress
	All ERCOT utilities report the primary objective of the programs is to serve as an ERCOT Tier 2 emergency resource before outages during summer peak periods. All ERCOT utilities' program participation requirements also reserve the right for the utility to call curtailment events for its own system needs.	More diversified uses of the load management programs should be considered.	 In progress

Category	Recommendation	Future implementation	Status
	Several utilities reported that the clarity introduced by having consistent TRM methodologies is positively supportive, and the flexibility of the TRM baseline can still allow customers to participate, even if they experience a weather-related outage. One utility felt the interval meter data analysis needed for the TRM residential calculation was data intensive.	Utilities interested in developing a residential demand-response deemed savings value from their program's M&V data should work with the EM&V team to pursue this option. Only one utility has pursued this option to date.	 In progress
	The transmission and distribution utilities coordinate with ERCOT on their programs but differ in the levels of communication.	Utilities, PUCT staff, the EM&V team, and ERCOT discussed consistent guidelines on timing and frequency of utility and ERCOT communications and protocols for verifying there is no duplicate participation between utility and ERCOT programs.	 Complete
	Commercial direct load-control and residential smart thermostats are an increasing resource for load management.	Utilities interested in developing a *small commercial thermostat* measure were encouraged to work with the EM&V team to pursue this option. No utilities have pursued this option to date.	 In progress
	Utilities demonstrated strong capabilities to apply the TRM calculation method to savings.	Utilities have continued to actively communicate with the EM&V team to resolve calculation differences. New rounding guidance was included in the PY2021 TRM.	 Complete
Commercial	Programs are generally retaining commercial load participants effectively. Programs had retained about 600 commercial participants for several years but have increased in the last two programs years to approximately 700 participants.	Utilities should collect information from customers or aggregators annually on how they curtail load if they do not already do so.	 In progress
	All Texas utilities have program websites with clear directions on how to enroll. Program manuals are available for download on their respective websites as well. However, some of them are not up to date with the current program year.	Utilities should update program manuals annually even if program requirements and overall documentation do not change.	 In progress

Category	Recommendation	Future implementation	Status
Residential	While residential programs with smart thermostats are very popular with customers, utilities are seeing a need to modify incentive levels, program administration, and participation limits.	For utilities offering or considering offering residential load management, the percentage of kilowatts that can be met from load management should be considered comprehensively across residential and commercial offerings.	In progress
	PY2018 was the first year in which one utility could calculate savings using a deemed saving approach. There was confusion regarding what qualifies as a participant, since customers can opt out of events.	The EM&V team worked with the utility to update the PY2020 TRM to quantify savings to clearly define participation status.	Complete
	Utilities offering residential programs refer to them as *demand response* in program filings; *load management* is the term defined in the Energy Efficiency Rule 16 TAC § 25.181.	Utilities refer to applicable residential programs as *load management* instead of *demand response*, starting with 2020 filings.	Complete

Portfolio recommendations included program tracking and project documentation (see Table 5). While improvements were made, most recommendations have an *in progress* status. The EM&V team either identified additional opportunities for improvement or will assess progress in the PY2021 EM&V.

Table 5. Portfolio Recommendations for PY2020 Implementation

Category	Recommendation	PY2020 implementation	Status
Program tracking	The EM&V team previously recommended that utilities should clearly associate tracking data and records with subprograms; they are also to report savings and budgets for distinct subprograms.	Utilities combining subprograms into one umbrella program should ensure that program tracking is transparent at the subprogram level. Utilities should track and report subprogram budgets separately to the best of the utility's ability. Transparency of umbrella programs has been an ongoing challenge, and the PY2021 data request clarified the need for this information.	In progress
	Utilities' methodology for rounding data was unclear and differed between tracking data provided to the EM&V team and in utility reporting.	Utilities should round energy savings in the final program tracking data consistently with regulatory reporting and document how rounding occurs.	In progress

Category	Recommendation	PY2020 implementation	Status
	Many measure lines in the tracking data for several small business programs included zero savings and no additional information.	Utilities with small business programs will eliminate unnecessary measure lines in the tracking data; this will be assessed in the PY2021 EM&V.	 In progress
	Participant information for the load management and demand response programs was not always available when a utility uses a third-party service provider.	Utilities will require third-party service providers to collect and provide participant information for load management programs. This requirement will be discussed with other load management program improvements for future implementation summarized above.	 In progress
Project documentation	Small business projects included a simplified calculator and documentation of baseline equipment, building type, location of installation, and proposed equipment. However, what was not always included were post-install verifications, photos of baseline or installed equipment, invoices, or spec sheets and certifications.	The utilities offering small business programs will discuss with the EM&V team the information that could be collected in the current process to better align the documentation needed to verify savings and create a more streamlined program delivery for this sector. This documentation will be assessed in the PY2021 EM&V.	 In progress
	The EM&V team recommended when sampling for site inspections from a large group of similar commercial projects, utilities should verify the projects' business type and size for a more representative sample. Savings calculations were done properly for the sampled projects; however, it was difficult to identify the project documentation to review.	Utilities provided documentation for all projects covered with the sampled inspection. Each project had its own folder, and navigation was easily determined for relevant projects.	 Complete
	There was limited documentation available for residential direct install measures. Some utilities had already started to respond to this recommendation, such as including photos in the documentation collected for residential direct install measures.	Utilities will continue to improve documentation for residential direct install measures. This documentation will be assessed in the PY2021 EM&V	 In progress

1.3.4 PY2020 Key Findings and Recommendations

Based on findings from the PY2020 EM&V conducted across all the utilities, the EM&V team has provided key findings and recommendations for the commercial, residential, and load management programs. Issues that affect both residential and commercial sector programs are summarized in a cross-sector table.

1.3.4.1 Commercial Programs

Commercial key findings and recommendations are summarized in Table 6 using the following categories:

- custom projects,
- measurement and verification (M&V) projects,
- recommissioning (RCx) projects,
- lighting projects, and
- consumption analysis.

Table 6. Commercial Program Recommendations and Action Plans

Category	Key finding and recommendation	Action plan
Custom projects	Claimed peak demand calculations inconsistently use the *top 20 hours* method. The Texas TRM has developed a peak demand calculation based on the identification of utility peak demand periods for summer and winter peaks for five different climate zones.	Increase education for implementers and participants regarding the peak demand calculation method in the TRM.
	Custom calculation documentation lacks detail to understand assumptions and operating conditions. The EM&V team found that while the custom calculation methods were technically sufficient, the documentation of operating conditions and other assumptions in the equation was limited.	Include a project description document to clarify assumptions and identify measured values within the custom calculators or project files.
M&V projects	Savings calculated from metered pre-install and post-install energy consumption should be adjusted for COVID-19 pandemic-related operating changes. The COVID-19 pandemic created a long period of adjusted operating conditions for many businesses. While there are multiple ways to handle this adjustment, a simplified way is to develop an independent variable for all readings after the initial adjustment for the COVID-19 pandemic. The approach to the adjustment should be documented in the M&V plan or similar project description document.	Adjust savings calculated from metered pre-install and post-install energy consumption for COVID-19 pandemic-related operating changes and include specifics in the project documentation.
	M&V analysis could enhance the accuracy of energy savings calculations. The method requires custom decisions and assumptions for the modeling of each project. The EM&V team found that a range of assumptions and modeling could be improved.	Update the PY2022 TRM to increase the consistency of the calculation process, and the accuracy of savings for M&V claimed savings.

Category	Key finding and recommendation	Action plan
RCx	Interactive effects of RCx activities are not always considered when calculating savings. RCx projects include multiple energy-saving adjustments to control HVAC and other systems within a facility. Each potential action has an estimated energy savings value calculated from the existing baseline. When implemented together, the actions interact. If a whole facility M&V is completed, the interactive effects are accounted for, but alternate savings methods do not inherently account for interactive effects.	Include interactive effects adjustments to RCx savings calculations if a whole facility M&V is not completed.
	RCx requires adjustment of controls, or *tag-out/lock-out*, to claim energy savings. These actions tend to save a lot of electricity; however, the electricity saved can only be claimed if the removed equipment is disconnected from the grid operations. Equipment that is turned off with a switch that can be inadvertently turned on in the future is not acceptable for post-install energy efficiency savings, which applies to any project that is claiming energy savings from the non-operation of existing equipment.	Clarify in PY2022 TRM 9.0 Volume 3 and Volume 4 that existing equipment must be demolished, removed, disconnected, or included in the control infrastructure to claim energy efficiency savings for non-operation.
Lighting projects	LED lighting certification does not include all the installation options. The manufacture of LED lighting is continuing to become more flexible and customizable; some lighting can be cut to custom lengths during installation. Updating the TRM to allow qualified custom length products will keep the TRM current to existing technology.	Update the PY2022 TRM ***9.0*** to provide guidance on energy savings calculations for qualified LED products to allow for custom lengths.
	The lighting savings calculations continue to have a significant number of wattage adjustments for installed lighting equipment. The adjustments had two primary reasons: (1) the LED lighting manufacturer wattages were used instead of third-party verified wattages as previously recommended, and (2) the half-watt denominations in the TRM were not utilized.	Increase QA/QC of the post-install wattage to ensure the use of third-party verified wattages for installed equipment and half-watt increment rounding.
Consumption analysis	The first year of the consumption analysis had limited conclusive findings due to a number of factors. The factors include (1) no more than 27 months of available meter data, which limited insight into operating profiles of participants, past participants, and the control group; and (2) a reduction in the total size of the participant group. The COVID-19 pandemic changed operating profiles and limited the business types that could be included.	Conduct additional research as part of the PY2021 EM&V scope to improve the commercial consumption analysis findings, including (1) requesting additional data from the same meters as well as additional participant meters and (2) surveying the participants to collect data to improve statistical representation.

1.3.4.3 Residential Programs

Residential key findings and recommendations are summarized in Table 7 using the following categories:

- residential deemed savings,
- HTR/low-income programs process assessment, and
- smart thermostats.

Table 7. Residential Program Recommendations and Action Plans

Category	Key finding and recommendation	Action plan
Residential deemed savings	The envelope measures include an allowance for customers participating in HTR/LI programs to claim reduced cooling savings for homes cooled by room air conditioner(s) by applying an adjustment to deemed savings. The EM&V team found that, in some cases, this adjustment factor was not applied consistently.	Incorporate guidance to clarify how to apply the adjustment factors in the PY2022 TRM.
HTR/low-income programs process assessment	Expanding the list of other qualifying low-income programs and services that qualify for the energy efficiency HTR/LI programs could provide more opportunities for streamlined participation.	Expand the list of qualifying programs and services in the PY2022 TRM HTR/LI program eligibility forms.
	Only individually metered multifamily units have been eligible since master-metered units are in a commercial rate class. The programs can increase their reach to low-income customers by including master-metered multifamily units with qualifying residents.	Remove the individual meter requirement in the PY2022 TRM HTR/LI program eligibility forms.
	Geographic location information such as Housing and Urban Development (HUD) low-income-qualified census tracts could provide streamlined participation and improve outreach to HTR/LI customers.	Add a *geographic location qualifier* category in the PY2022 TRM HTR/LI program eligibility forms.
	Many community action agencies and social services organizations throughout Texas are already experienced in qualifying low-income households for programs and services.	Include a section for a community action agency or social service organization to verify program eligibility in the PY2022 TRM HTR/LI program eligibility forms.
	Without verification of self-reported income for those who chose to qualify for the program through this option, there is the potential for program services to go to non-low-income customers.	Develop a process that verifies income eligibility prior to participation for customers who use self-reported income. This process can vary by utility, program, and customer type (single-family/multifamily).

Category	Key finding and recommendation	Action plan
Smart thermostats	The review of store invoices, aggregate customer data, quantity purchased, and model numbers found sufficient program tracking and documentation.	Continue internal processes as they are working well in producing verifiable results and correct input parameters.
	The EM&V team has provided guidance on calculating and allocating savings at the sector level for upstream lighting to account for the cross-over between small commercial and residential applications. As upstream programs expand to more offerings such as smart thermostats, this guidance may be applicable.	Discuss within the TRM Working Group expanding the sector allocation guidance to all measures sold through upstream and midstream programs where the installation location is unknown.
	The upstream/midstream delivery model used for smart thermostats is highly cost-effective. The EM&V team calculated results for these programs between 6.2 and 12.1 ratios for the residential sector and higher on the commercial sector.	Explore additional measure offerings for upstream and midstream programs.

1.3.4.4 Load Management Programs

Key findings and recommendations are presented in Table 8 for load management programs overall, followed by commercial and residential programs.

Table 8. Load Management Program Recommendations and Action Plans

Category	Key finding and recommendation	Action plan
Overall	Load management programs have grown in recent years, with PY2020 representing both the largest number of participants and the amount of available demand reduction. Under the current energy efficiency rule § 25.181, curtailment events may only be called during summer peak periods.	Explore opportunities to increase the value of the peak load relief available through the programs year-round in future rule-making discussions.
Commercial	The annual test event is important to gauge program processes and available load relief. Of the 807 participants enrolled in the PY2020 programs, only 711 were able to curtail. Many customers were not able to participate because of the COVID-19 pandemic, including some customers who needed to operate at full capacity (e.g., hospitals).	Update the PY2022 TRM participant eligibility requirements to non-critical load customers and consider using the results of the annual test event to modify program-contract estimates of available demand reduction.

Category	Key finding and recommendation	Action plan
Residential	For the *deemed savings* method, there was some confusion on how to claim savings for smart thermostat devices sold through an online marketplace and enrolled in the Residential Load Management program.	Update guidance on claiming load management savings for smart thermostat devices delivered through another program in the PY2022 TRM.
	While not specific to the utility programs, recent news articles have called into question residential customers' awareness of participating in a load management program. The PY2018 EM&V survey of residential load management participants found about a third (36%) of participants were unaware of when curtailment events are called.	Consider opportunities to increase customer understanding of program participation including the annual participation renewal process.

1.3.4.5 Cross-Sector

Cross-sector key findings and recommendations are summarized in Table 9 for the following:

- program tracking data,
- meter data,
- project documentation,
- solar PV, and
- COVID-19 QA/QC response.

Table 9. Cross-Sector Measure Recommendations and Action Plans

Category	Key finding and recommendation	Action plan
Program tracking data	Several prior program tracking recommendations are noted as *in progress*.	Review prior *in progress* recommendations to implement them in PY2021.
	The EM&V team found several fields across multiple utility programs that were not provided to support TRM savings calculations for several measures.	Increase the internal QA/QC of tracking data to ensure all key parameters for calculating savings are provided as specified in the *program tracking data and evaluation requirements* section for each measure in the TRM.
Meter data	AMI meter data transfers can be more complicated than program tracking data transfers.	Expand the meter consumption data-request contact list to include a meter data specialist for the EM&V team and the utilities.
	Twenty-four months of meter consumption data limited the scope and applicability of the commercial consumption analysis.	Review the data collection time period with program and meter data specialist contacts to discuss the potential to expand the time period of metered data beyond 24 months.

Category	Key finding and recommendation	Action plan
Project documentation	Programs are using application programming interfaces (API) to access external calculators and databases. The streamlined process does not create standard documentation because it eliminates the intermediate step of downloading information to be entered into the tracking database.	Update the s*olar PV* TRM entries to allow API access to PV wattages to determine calculated energy production values and provide sufficient documentation for quality assurance.
Solar PV	Post-install inspection results were not consistently used to update claimed energy savings. This finding was identified in the last evaluation of the solar PV programs in the PY2017 evaluation.	Implement a process to ensure claimed ex-ante savings represent the system installed.
COVID-19 QA/QC response	Transitioning quickly to some form of virtual or desk audit option was necessary for utilities to meet monthly QA/QC inspection targets. Many utilities identified early communication with the EM&V team as critical to the success of the virtual adaptation of the QA/QC process.	Consider incorporating business continuity planning that addresses unforeseen long-term interruptions (i.e., severe weather events) to normal program implementation.
	In general, challenges to in-person inspections impacted residential programs more than commercial programs. Although technology allowed business activities to adapt and resume, most utilities stated that technology could not fully replace in-person interactions; rather, it enhanced the flexibility for employees, customers, and trade allies to get the job done.	Consider continuing some remote QA/QC practices from the COVID-19 pandemic adaptation, such as documentation, pictures, and geotagging apps.
	For most utilities, remote inspections helped streamline the QA/QC workflow timeline and reduced costs associated with travel expenses.	Explore the option of a hybrid in-person/virtual inspection for interested utilities.

2.0 INTRODUCTION AND PORTFOLIO RESULTS

This Statewide Energy Efficiency Report presents the PY2020 evaluation, measurement, and verification (EM&V) findings and recommendations, looking across all eight electric utilities' portfolios. The report addresses gross and net energy and demand impacts, program cost-effectiveness, and program portfolio performance feedback. It includes findings and recommendations to inform updates to the PY2021 Technical Reference Manual (TRM) and the PY2021 program design and delivery.

First, we overview the EM&V methodology in PY2020, followed by portfolio-level results related to program tracking and documentation. Section 3.0 through Section 6.0 present the commercial, residential, cross-sector, and load management program results. A separate Volume 2 of this report details PY2020 impact results for each utility's portfolio.

2.1 EVALUATION, MEASUREMENT, AND VERIFICATION METHODOLOGY

2.1.1 Overview

The EM&V methodology is based on the prioritization for the EM&V effort that includes both PY2020 and the four-year contract period. The EM&V team identified program types across utilities with similar program design, delivery, and target markets. We reviewed each program type and prioritized (*high*, *medium*, *low*) based on the following considerations:

- the magnitude of savings—the percentage of contribution to the portfolio of programs' impacts,
- level of relative uncertainty in estimated savings,
- stage of program or programmatic component (e.g., pilot, early implementation, mature),
- importance to future portfolio performance and PUCT and Texas utilities' priorities
- prior EM&V results, and
- known and anticipated changes in the markets in which the programs operate.

We conduct a streamlined EM&V effort that couples broad due diligence verification of savings for all programs with targeted in-depth activities. These activities include engineering desk reviews, on-site measurement and verification (M&V), interval meter data analysis, benchmarking research and interviews, and consumption analyses based on the prioritization of the programs.

We carefully developed PY2020–PY2023 EM&V scopes across the four-year contract period that prioritize EM&V activities where they provide the greatest value. To continue the significant progress that the PUCT staff, utilities, and EM&V team have made while working together to improve programs and the TRM, we implement targeted in-depth impact evaluations for particular programs and end-uses, as summarized in Table 10 through Table 13 We couple this with tracking system verification of claimed savings across all programs. This approach maximizes both the cost-effectiveness and the value of the proposed EM&V activities. We have prioritized evaluation efforts regarding the level of effort they may receive as *high*, *medium*, or *low* for utility programs each year.

Residential. We have categorized the residential standard offer programs (RSOP), hard-to-reach (HTR), and low-income programs as *high* evaluation priorities in PY2021 and PY2023. These programs comprised a substantial percentage of overall statewide portfolio savings in the last five years; they will be responding to TRM updates to the *heat pump* and *envelope* measures in PY2021. The programs will be evaluated via desk reviews, on-sites, a targeted consumption analysis for PY2021, and a complete consumption analysis in PY2023. We will conduct RSOP participant surveys to update net-to-gross (NTG) information, collect key process information, and confirm measure installation in PY2021. The HTR and low-income programs will be implementing new eligibility processes in PY2022; therefore, these programs will be a *medium* priority as participant surveys are conducted to collect process information on the new eligibility process. Residential new construction programs are a *high* evaluation priority in PY2022 as these programs will need to continue to push the market in future program years. Residential upstream and midstream programs are expected to grow in utility portfolios and are given a *high* evaluation priority in PY2023 to update NTG information. In addition, high-impact measures (i.e., *air conditioners*, *heat pumps*) delivered through midstream programs may also be included in the PY2023 consumption analysis.

Commercial. Commercial standard offer programs (CSOP) and the largest savers of the market transformation programs (MTP) are at least a *medium* priority for the four-year contract. These programs represent the largest percentage of statewide savings and plan to explore new customer segments and technologies. While prior EM&V generally found evaluated savings similar to the utilities' claimed savings, it also resulted in several recommendations for changes to reported claimed savings and recommendations. Therefore, we believe that at least a *medium* priority is justifiable for the next four program years due to the savings contributions, heterogeneity of projects and customer type, and the associated levels of uncertainty in savings. For PY2020, we placed a *high* priority on the largest commercial savers to conduct targeted consumption analyses to gauge the effectiveness of the TRM for prioritized high-impact measures for key building types. Prioritized consumption analyses will then be repeated annually, expanding to include additional measures and building types. The CSOPs and largest commercial MTPs are a *high* priority again in PY2021 to update the NTG information and collect key information identified in the PY2020 consumption analysis through participant surveys. Small business programs are designated a *medium* priority twice in the next four years (PY2021 and PY2023). While these programs are not significant contributors to statewide savings, small businesses are recognized as an important sector to serve. This sector traditionally faces more barriers to energy efficiency program participation than other commercial sectors, and utilities have been trying to expand the range of measures offered.

Load Management and Cross-Sector. Load management programs are designated a *medium* priority throughout the next four program years due to their significant contribution to capacity (kW) savings. AC tune-ups and PV are designated as a *medium* priority at least once in the next contract period as the last EM&V cycle established new M&V protocols for these measures in the TRM—which are being done correctly, with some opportunity for improvement.

Other *medium*-priority programs are pilot programs in their second or third year of implementation. We will provide feedback about whether pilots are viable options for full programs. All other program types are *low* priorities for evaluation for three out of the four program years because they are minor contributors to portfolio savings, have little uncertainty in savings, and have homogenous projects. However, each program will be designated as a *medium* evaluation priority once in the four-year evaluation cycle.

2.1.2 Prioritization tables

The tables below summarize prioritization and EM&V level of effort by program type over the four-year EM&V contract period.

Table 10. Evaluation Prioritization Summary—Commercial Sector

Summary	Program type			
	Commercial SOP	Commercial MTPs, excluding small business	Small business MTPs	Other MTPs, pilots
Percentage of PY savings statewide (kW/kWh)	7 percent of statewide demand reductions and 27 percent of statewide energy savings	6 percent of statewide demand reductions and 23 percent of statewide energy savings	1 percent of statewide demand reductions and 3 percent of statewide energy savings	Medium/TBD
PY2020 evaluation priority and activity	High: desk reviews and targeted consumption analyses		Low: tracking system review and verification	
PY2021 evaluation priority and activity	High: desk reviews, on-site M&V, targeted consumption analyses continue, telephone verification of measures, process and NTG participant surveys		Medium: desk reviews and on-site M&V	
PY2022 evaluation priority and activity	Medium: desk reviews, on-site M&V, targeted consumption analyses continue		Low: tracking system review and verification	
PY2023 evaluation priority and activity	Medium: desk reviews, on-site M&V, targeted consumption analyses continue		Medium: desk reviews and on-site M&V	

Table 11. Evaluation Prioritization Summary—Residential Sector

Summary	Program type		
	Residential SOP	HTR/low-income	New homes MTP
Percentage of PY savings statewide (kW/kWh)	8 percent of statewide demand reductions and 10 percent of statewide energy savings	7 percent of statewide demand reductions and 8 percent of statewide energy savings	4 percent of statewide demand reductions and 6 percent of statewide energy savings
PY2020 evaluation priority and activity	Low: tracking system review	Medium: eligibility process improvement	Medium: eligibility process improvement
PY2021 evaluation priority and activity	High: desk reviews and on-site M&V, targeted consumption analyses of updated measures, and RSOP process and NTG participant surveys		Low: tracking system review and verification
PY2022 evaluation priority and activity	Medium: desk reviews and on-site M&V, HTR/low-income process participant surveys		High: builder and rater interviews
PY2023 evaluation priority and activity	High: consumption analyses[1] of updated measures		Medium: desk reviews

Table 12. Evaluation Prioritization and Summary—Upstream, Midstream, Pilots, Other

Summary	Program type	
	Upstream or midstream MTPs	Other MTPs, pilots
Percentage of PY savings statewide (kW/kWh)	6 percent of statewide demand reductions and 16 percent of statewide energy savings	1 percent of statewide demand reductions and 1 percent of statewide energy savings
PY2020 evaluation priority and activity	Low: tracking system review	Low or medium/TBD
PY2021 evaluation priority and activity	Low: tracking system review	Low or medium/TBD
PY2022 evaluation priority and activity	Low: tracking system review	Low or medium/TBD
PY2023 evaluation priority and activity	High: in-depth interviews, benchmarking research, consumption analyses for high-impact measures	Low or medium/TBD

Table 13. Evaluation Prioritization and Summary—Load Management and Cross-Sector

Summary	Program type		
	Load management programs (residential and nonresidential)	AC tune-ups (residential and nonresidential)	PV
Percentage of PY savings statewide (kW/kWh)	60 percent of statewide demand reductions and <1 percent of statewide energy savings	2 percent of statewide demand reductions and 3 percent of statewide energy savings	<1 percent of statewide demand reductions and 2 percent of statewide energy savings
PY2020 evaluation priority and activity	Medium: census interval meter-data analysis	Low: tracking system review and verification	Medium: M&V calculation review
PY2021 evaluation priority and activity	Medium: census interval meter-data analysis	Low: tracking system review and verification	Low: tracking system review
PY2022 evaluation priority and activity	Medium: census interval meter-data analysis	Medium: census review of M&V data and desk reviews	Low: tracking system review
PY2023 evaluation priority and activity	Medium: census interval meter-data analysis	Low: tracking system review and verification	Medium: M&V calculation review

*The percentage of PY savings in Table 10 through Table 13 may not sum to 100 percent due to rounding.

2.1.3 PY2020 Activities

EM&V activities:

- confirm that the measures installed are consistent with those listed in the tracking system;
- verify that the claimed savings estimates in the tracking system are consistent with the savings calculated in the deemed calculation tools or tables in accordance with the PY2020 TRM 7.0 or M&V methods used to estimate project savings;
- review savings assumptions and, when available, utility M&V reports gathered through the supplemental data request for sampled projects and EM&V team on-site M&V;
- recommend updates to project-level claimed savings if EM&V results indicate a variation in savings of at least ±5 percent; and
- inform updates for the PY2022 TRM 9.0.

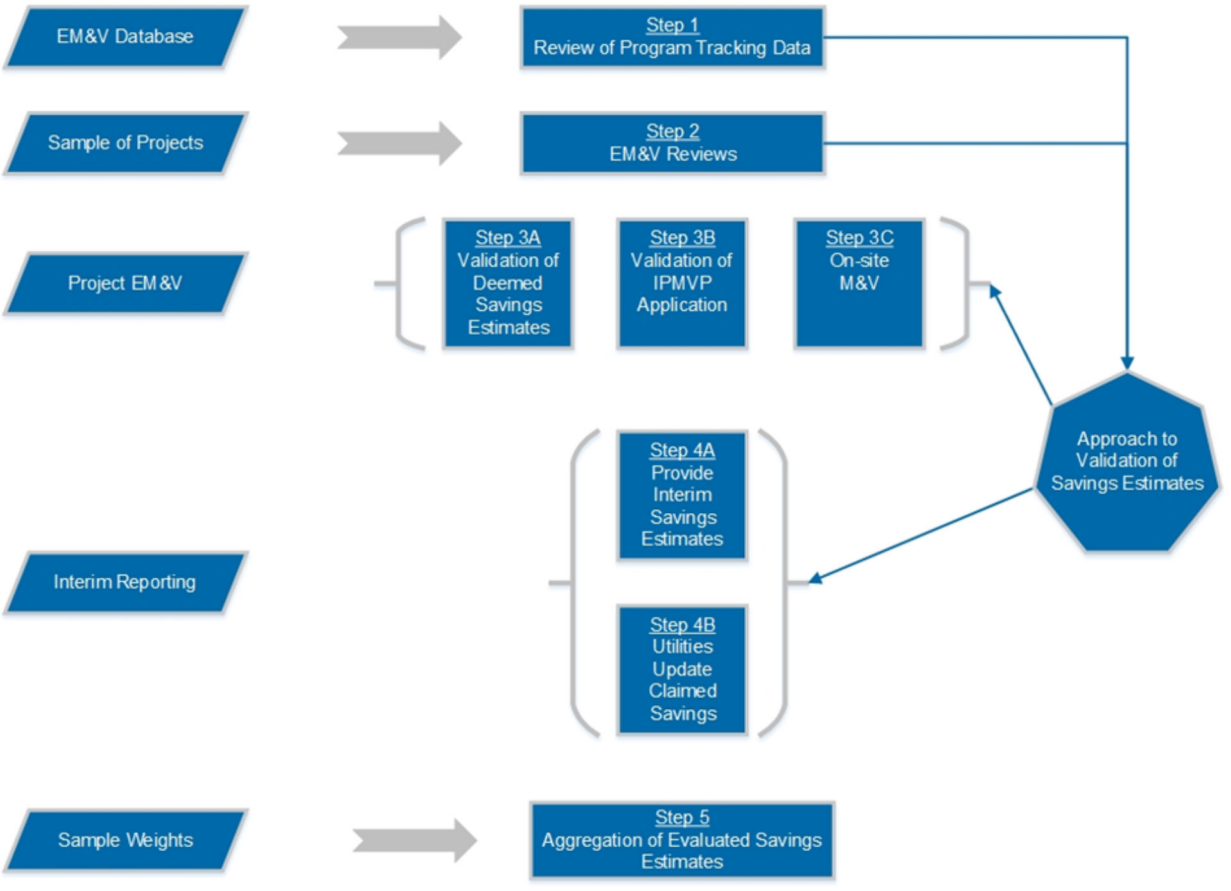
Table 14 shows the EM&V activities completed by program type and evaluation priority.

Table 14. PY2020 Evaluation, Measurement, and Verification Priorities and Activities

Program type	Evaluation priority	Claimed savings verification approach	Project desk reviews	Interval meter/ consumption data analysis
Commercial SOPs, Large commercial MTPs, retro-commissioning (RCx)	High	Sampled (see desk reviews)	91	Sampled business types for lighting participants and nonparticipants
Solar PV	Medium	Sampled (see desk reviews)	9	N/A
Commercial load management	Medium	Census	N/A	Census
Residential load management	Medium	Census	N/A	Census
Residential SOPs, HTR, low-income	Medium	Census	N/A	N/A
Residential MTPs—smart thermostats	Medium	Census	18	N/A
All other programs	Low	Census	N/A	N/A

The evaluated savings are based on project-level realization rate calculations weighted to represent program-, sector-, and portfolio-level realization rates. These realization rates incorporate any adjustments for the incorrect application of deemed savings values and any equipment details determined through the tracking system reviews, desk reviews, and primary data collected by the EM&V team. For example, baseline assumptions for hours of use may be corrected through the evaluation review and thus affect the realization rates. A flow chart of the realization rate calculations is illustrated in Figure 11. Realization rates for utility portfolios and utility programs may be found in Volume 2 of this report.

Figure 11. Realization Rate Flowchart



A complementary component of the realization rate is the sufficiency of program documentation provided to estimate evaluated savings—this was used to determine an overall program documentation score for each program with a *medium* or *high* evaluation priority in a utility's portfolio.

The EM&V team conducted cost-effectiveness testing using the program administrator cost test for claimed and evaluated results. Low-income programs were calculated using the savings-to-investment ratio.

2.2 PROGRAM TRACKING

Tetra Tech collected, compiled, and reviewed program tracking data for all programs in PY2020. We used the data to support evaluation activities, including sampling, deemed savings reviews, and reporting. During these activities, we identified several issues relating to program tracking data. In the *Executive Summary*, the PY2018 EM&V program tracking recommendations that were to be implemented in PY2020 were noted as *in progress*. The EM&V team will continue to work with utilities on these prior recommendations to complete the prior program tracking recommendations in PY2021. In addition, the PY2020 EM&V of residential deemed savings found the following key finding and resulting recommendation:

Key Finding #1: Tracking data and documentation requirements for each measure are outlined in the *program tracking data and evaluation requirements* section of each measure in the PY2020 TRM 7.0. The EM&V team found several fields across multiple utility programs that were not provided to support TRM savings calculations for several measures.

Recommendation #1: Consider increasing the internal quality assurance/quality control (QA/QC) process on tracking data to ensure all key parameters for calculating savings are provided in the tracking data.

2.2.1 Meter Data

The consumption analysis requires interval meter data from the advanced meter infrastructure (AMI). Tetra Tech collected, compiled, and reviewed the readings similar to the program tracking data, although the source and volume of the information required a different process. The PY2020 EM&V commercial consumption analysis found the following key finding and resulting recommendation:

Key Finding #1: AMI meter data transfers can be more complicated than program tracking data transfers.

In PY2020, the meter consumption data request was completed through the same communication channels and data storage locations as the program tracking data request. However, the size and complexity of the data set may be best handled by utility meter data specialists from the utility and the EM&V team with support from the program tracking data contacts who understand the goals of the data request and programs. For example, direct communications between the EM&V team and utility meter data specialists could cover the structure and size of the data to more easily understand how to organize and store the data and quality assurance processes to ensure complete and secure data transmission. These types of communications are expected to unlock efficiencies in meter consumption data collections, transferring, and understanding.

Recommendation #1: Expand the contact list for the meter consumption data request to include a data professional from the EM&V team and the utilities.

Key Finding #2: Twenty-four months of meter consumption data limited the scope and applicability of the consumption analysis.

In PY2020, the meter consumption data was limited to a maximum of 24 months of data on individual meters. This limitation impacted the scope and findings of the consumption analysis when cross-referenced with the program participants to identify the participant group of the consumption analysis. Ultimately, the size of the participant group was the limiting factor in the applicability of the consumption analysis.

Increasing the length of meter data available for consumption analysis will increase the potential size of the participant group and allow the analysis to better handle weather anomalies or other independent variables. The EM&V team understands that the increased time period creates complexities for the utility meter data collection, creating an unnecessary burden for utility staff; however, doing so will increase the understanding of participant activity and the energy savings levels for individual measures.

Recommendation #2: Review the data collection time period with program and data specialist contacts to discuss the potential to expand the time period of metered data beyond 24 months.

2.3 PROGRAM DOCUMENTATION

Tetra Tech collected and reviewed project documentation from individual sampled projects for programs with *high* and *medium* evaluation priorities in PY2020. The review is completed to review the completeness of documentation, identify discrepancies between the tracking system and the installed project, and review the energy savings calculations for compliance with the TRM. Based on this work, the EM&V team offers the following key findings and recommendations:

Key Finding #1: Programs use application programming interfaces (API) to access external calculators and databases.

The API allows two computer program interfaces to talk without operators. Program implementers have used API processes to access third-party calculators (i.e., PV wattages and external databases, such as qualified product lists) and enter the results into the tracking system. The streamlined process does not create standard documentation because it eliminates the intermediate step of downloading information to enter the tracking database. Therefore programs no longer have documentation files or screenshots to confirm the tracking system. The streamlined process eliminates the risk factor of data entry between files and increases the risk that an error in the API can impact tracked data without visibility to the implementer and the EM&V team.

PY2021 TRM 8.0 requires that a documentation file is accessible to confirm the tracked data from the API. In order to meet this requirement, the program must manually access the information that the API has streamlined.

Recommendation #1: Update the solar PV TRM entries to allow API access to PV wattages to determine calculated energy production values and provide sufficient documentation for quality assurance.

Key Finding #2: Documentation for commercial midstream projects was inconsistent.

The EM&V team found that documentation was overall good; however, midstream and upstream projects did not consistently provide documentation of the model number of purchased equipment, itemized quantities per model number, or energy savings calculations. The documentation was promptly provided when requested by the EM&V team; however, it was not part of the standard documentation.

The implementation practices may be providing a sufficient level of quality assurance for the midstream and upstream programs, but it was not apparent in the documentation initially received.

Recommendation #2: Provide complete documentation packages that provide transparency to independent EM&V review.

2.4 REMOTE QA/QC PROCESS ASSESSMENT

This section summarizes the key findings and recommendations relating to COVID-19 effects on the utilities' QA/QC process for energy efficiency programs.

The primary source of the key findings and recommendations are EM&V in-depth interviews conducted with seven of the eight (scheduling conflicts kept one utility from being interviewed) electric utilities[5]. The objective of the interviews was to characterize how utilities responded to COVID-19 and the impacts on their QA/QC practices. Energy Bees, members of the EM&V team, conducted the interviews between May 17 and June 14. The interviews were semi-structured; in other words, the interviewer followed an interview guide touching on key areas while not asking questions verbatim, following the flow of the conversation with interviewees. Interviews were approximately 30 minutes in length. The seven key areas of focus were:

1. Programs
2. Process
3. Technology
4. Data Quality/Integrity
5. Budget
6. Communication/Change Management
7. Stakeholder Experiences

2.4.1 Background

In March of 2020, COVID-19 was declared a global pandemic by the World Health Organization. Texas responded first locally with stay home/work safety policies at the city- and county-level, followed by Governor Abbot issuing statewide orders. Texas' stay home/work safely order expired April 30, 2020, and Texas began a phased reopening to minimize the spread of COVID-19 while opening the economy.

The situation continued to evolve dynamically as the state monitored reopening activities, active cases, and hospitalization rates. Following the Memorial Day holiday, a spike of COVID-19 cases persisted through Summer 2020. Starting June 23, 2020, Governor Abbot began issuing several orders that slowed the reopening process to contain the spread of COVID-19. These orders included expanding the ability of mayors and county judges to impose restrictions on particular outdoor gatherings of over 100 people and a mask mandate for counties experiencing 20 or more positive cases. Limits on restaurant capacities were in place through the end of 2020 for most counties.[6]

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[5] Interviews were recorded and notes journaled directly following each interview. Although meetings were recorded, these recording were only used by interviewers to reference during final recommendation and report writing. No detailed information will be included from the utility interviews beyond what is characterized in the key findings and recommendations. All utility participants were notified and asked permission to record the meetings; all utilities provided their consent.

[6] Texas Executive Orders & Public Health Disaster Declarations. https://www.dshs.texas.gov/coronavirus/execorders.aspx

In July 2020, the EM&V director interviewed all eight utilities to characterize how they responded to COVID-19 within their energy efficiency portfolios. One of the emerging key findings was the innovation of new ways of conducting QA/QC tasks that could prove beneficial to program delivery beyond the COVID-19 pandemic. It was recommended to explore the QA/QC assessment process during the 2020 EM&V program year to document any new emerging procedures that could be implemented moving forward.

Energy Bees conducted research during May and June 2021 to provide the expanded context of the impacts of the COVID-19 pandemic on the QA/QC assessments for energy efficiency programs. Energy Bees interviewed utility program managers, QA/QC inspectors, and directors to characterize how utilities responded to the COVID-19 pandemic restrictions posed by state and local officials, along with utility protocols inhibiting in-person inspections to verify work completed.

2.4.2 Key Findings and Recommendations

Drawing from utility interviews, the EM&V team offers the following key findings and recommendations:

Key Finding #1: The need for business continuity planning was highlighted by the COVID-19 pandemic.

Utilities reported that many businesses were in limbo during the March–April 2020 timeframe, waiting for the mandates to lift and for pre-pandemic business operations to resume. Utility employees adapted to work-from-home conditions, learning to use new technology tools like virtual meeting platforms. In addition, they did their best to communicate with customers and service providers (service providers include contractors, project sponsors, and installers) on new processes moving forward. By April 2020, all utilities put in-person inspections on hold.

Identifying a path forward for handling inspections varied by utility; some utilities created immediate task forces to meet, brainstorm, and investigate alternatives to in-person inspections; others transitioned quickly to phone inspections (audio only). For some utilities, delaying the decision process made it more to gather the necessary personal protection equipment (PPE) than what was typically required. This delay caused pain points once some in-person inspections were allowed. Transitioning quickly to some form of virtual or desk audit option was necessary to meet monthly inspection targets.

Many utilities identified early communication with the EM&V team as critical to the success of adapting QA/QC protocols to ensure data integrity was maintained throughout the virtual adaptation of the QA/QC process.

Recommendation #1: Utilities may want to consider incorporating business continuity planning that addresses unforeseen long-term interruptions to routine program implementation. Planning could include task force creation protocols, technology review, available training resources, and service provider communication channels, helping establish a structured approach to earlier decision-making, communication, and adjustments to QA/QC processes.

Key Finding #2: In general, challenges to in-person inspections impacted residential programs more than commercial programs.

For most utilities, in-person home inspections were completely halted from mid-March through June 2020 (some utilities had not resumed in-person home inspections as of June 2021, when this report was written). During that time, many utility employees were adjusting to their work-from-home environments while predicting just how long the federal, state, local, and utility safety protocols would be in place. Between April and June 2020, utilities were actively planning for, or already pivoting to, virtual inspection processes.
More specifically, multifamily, HTR/low-income, and school kit programs proved the most difficult to pivot. For multifamily and low-income, the biggest challenges were (1) the volume of projects to inspect, (2) documenting and communicating a new process for virtual inspections, and (3) ensuring reporting was accurate promptly to issue incentives. With schools running virtually, it was not easy to distribute the school kits and obtain the post-installation surveys needed to validate the installation.

Although commercial programs faced some challenges, the QA/QC process seemed easier to adapt. Utilities reported the ability of service providers to use virtual inspections for pre- and post-installation was easier. For some utilities, in-person inspections returned in Summer 2020, especially for those measures that were installed outdoors. Many of their employees were working from home for commercial customers, so the building's occupancy was decreased, making indoor inspections possible while adhering to appropriate PPE protocols. Commercial customers in the health care sector like hospitals and doctor's offices were hardest to manage as they were high occupancy and high risk.

Recommendation #2: Utilities may consider including a program portfolio review process that groups programs based on in-person QA/QC requirements versus virtual experiences. During an unforeseen event, efforts to ramp up program participation may quickly adapt to a virtual experience. Conversely, suppose there is a long-term interruption to a particular technology platform used; in that case, the business continuity plan will help a program portfolio shift to programs capable of in-person or manual adaptations.

Key Finding #3: Technology played a significant role in helping navigate QA/QC process changes.

Utilities reported that the use of remote meetings was advantageous. Virtual meetings were not widely used pre-pandemic despite being readily available. Collaborative meeting software like Microsoft Teams, Google Meets, Zoom, and WebEx was used in new ways in place of traditional conference calls. For the first time, many utilities used screen sharing functions and virtual calls using cameras to achieve face-to-face communications. Ultimately, these technologies were used to work remotely with colleagues, customers, and trade allies.

In addition to virtual meetings, cell phones using video chats were extremely popular in virtual inspections. Software like Facetime and Google Duo allowed program staff to directly interact with homeowners and service providers to obtain the correct documentation, whether in real-time, video, or picture format. Most utilities increased the number of pictures required for desk audits, but geotagging became particularly useful for a couple of utilities. Geotagging

applications like GPS Map Stamp (Android) and GPS Photo (Apple) provided additional certainty of the location, date, and time the pictures were taken.

Utilities reported homeowners' and service providers' access to quality Wi-Fi or mobile connections and technology proficiency varied. For instance, real-time videos did not work in every location due to internet or mobile network connections. The need to adapt processes to include flexible options like recorded video uploads, pictures, audio-only phone calls, and real-time videos was necessary.

Although technology allowed business activities to adapt and resume, most utilities stated that technology could not fully replace in-person interactions; instead, it enhanced the flexibility for employees, customers, and trade allies to get the job done.

Recommendation #3: Utilities may consider continuing the same level of picture documentation currently in place due to pandemic adaptation. Service providers have been trained to provide this level of documentation and are accustomed to these expectations; this may increase the data quality of the QA/QC process while also fostering flexibility should in-person inspection processes be interrupted. If not already doing so, utilities may consider investigating geotagging Apps like GPS Map Stamp (Android) and GPS Photo (Apple) that customers and service providers can use for pictures submitted during the QA/QC process.

Key Finding #4: For most utilities, remote inspections helped streamline the QA/QC workflow timeline and reduced costs associated with travel expenses.

Most utilities reported a streamlined QA/QC process timeline that provided an opportunity to increase satisfaction for customers and service providers. Many utilities in Texas have a large service territory; scheduling in-person inspections require the inspector, customer, and sometimes trade allies' calendars to align, travel costs, time to and from the inspection site, final documentation review, and process time. One utility reported preliminary estimates of QA/QC workflow timeline reductions of 30 percent for commercial programs.

With the new virtual inspection processes, utilities have increased the documentation required, and customers and service providers have adapted. Utilities report that several measures benefited from desk review processes, including non-lighting measures like HVAC, which may be permanently transferred to this new QA/QC review method. Some utilities reported lighting measures would continue to require additional picture documentation, 100 percent in-person inspections for larger projects, and random inspections for all other projects.

Recommendation #4: Utilities may consider exploring the option of a hybrid in-person/virtual inspection rather than 100 percent in-person inspections. Virtual inspections and desk audits decreased workflow timelines, travel costs, and time associated with in-person audits.

Key Finding #5: A hybrid in-person/virtual QA/QC process provides more options for customers and flexibility for utilities.

Most utilities agreed that the virtual QA/QC process does provide more flexibility and options to the customer experience. However, not all utilities agree that a virtual experience provides the same customer service experience as an in-person process. For some utilities, getting back into

the field with customers is not going away as their customers prefer face-to-face interactions. At the same time, one utility reported that many customers enjoyed the phone/virtual inspections as it allowed customers to relax behind the veil of technology. In return, this heightens brand awareness for the utility. The virtual experience provided more time to interact rather than the normal process of scheduling an inspection, gaining access to the site, independently gathering data, and leaving.

For many utilities, having the option to conduct virtual inspections provides a new level of flexibility. In the event of a shortage of personnel due to vacant positions, maternity/paternity leaves, or major weather events causing employees to transition to storm duty responsibilities for a couple of days or weeks, using virtual audits can streamline workflow. This flexibility also provides a way to catch up and manage inspection goals during unforeseen events.

Recommendation #5: If not already doing so, utilities may consider polling customers and service providers about the QA/QC process updates; understanding their perspectives could help incorporate the best components from the newly adapted QA/QC processes. Transitioning from a 100 percent in-person audit approach to a hybrid approach may provide options and flexibility for all stakeholders while maintaining a high level of data integrity. Virtual audits may serve a new purpose when business continuity is interrupted by natural weather events; some utility program personnel have storm duty requirements that take them away from inspection duties for extended periods. Exploring options for virtual audit "catch-ups" should be investigated.

3.0 COMMERCIAL ENERGY EFFICIENCY PROGRAMS

This section summarizes the key findings and recommendations from the PY2020 evaluation of commercial energy efficiency projects. All commercial energy efficiency programs except small business MTPs were a *high* or *medium* evaluation priority in PY2020. The recommendations are to be considered by the utilities for PY2022 implementation and will also be incorporated into the PY2022 Texas Technical Reference Manual (TRM) 9.0 as appropriate.

The EM&V team conducted a streamlined EM&V effort that couples broad due diligence verification of savings for the commercial programs with targeted in-depth activities, including engineering desk reviews and interval meter data analysis based on the prioritization of the programs. While on-site measurement and verification (M&V) is typically done, it was not included in the PY2020 scope due to the COVID-19 pandemic.

3.1 PROGRAMS OVERVIEW

The EM&V team evaluated the commercial energy efficiency programs described below. There are two types of programs: standard offer programs (SOP) and market transformation programs (MTP). An SOP is a program under which a utility administers standard offer contracts between the utility and energy efficiency service providers. These contracts specify standard payments based upon the amount of energy and peak demand savings achieved through energy efficiency measures, M&V protocols, and other terms and conditions. An MTP is a strategic program intended to induce lasting structural or behavioral changes in the market, resulting in increased adoption of energy-efficient technologies, services, and practices.[7] SOP and MTP programs continue to represent the most significant percentage of statewide savings.

Commercial SOP: The Commercial SOP provides new construction and retrofit installation incentives for a wide range of measures that reduce demand and save energy in nonresidential facilities. Incentives are paid to energy efficiency service providers (EESP) (project sponsors) based on deemed savings or verified demand and energy savings at eligible commercial customers' facilities. The utility has a limited group of participating project sponsors, which are determined through a selection process. This selection process is based on meeting minimum eligibility criteria, complying with all program rules and procedures, submitting documentation describing their projects, and entering into a standard agreement with the investor-owned utility.

Commercial Solutions MTP: The Commercial Solutions MTP targets commercial customers that do not have the in-house expertise to (1) identify, evaluate, and undertake energy efficiency improvements; (2) properly evaluate energy efficiency proposals from vendors; or (3) understand how to leverage their energy savings to finance projects. Assistance from the program includes communications support and technical assistance to identify, assess, and implement energy efficiency measures. Financial incentives are provided for eligible energy efficiency measures installed in new or retrofit applications and result in verifiable demand and energy savings. Commercial Solutions MTPs can include midstream programs that provide incentives at the distribution point to installation contractors who intend to install the equipment for eligible commercial or industrial customers.

[7] PUCT Order, Chapter 25: Substantive Rules Applicable to Electric Service Providers.

SCORE MTP: The SCORE MTP helps educational facilities (public and private schools, K-12, and higher education) and local government institutions to lower their energy use; this is done by providing education and assistance with integrating energy efficiency into their short- and long-term planning, budgeting, and operational practices. Lowering energy use is also completed through energy master planning workshops; energy performance benchmarking; and identifying, assessing, and implementing energy efficiency measures. Energy efficiency improvements include capital-intensive projects and implementing operational and maintenance practices and procedures. Financial incentives are provided for energy efficiency measures that reduce peak electricity demand.

Recommissioning MTP: The Recommissioning MTP offers commercial customers the opportunity to make operational performance improvements in their facilities based on low-cost/no-cost measures identified by engineering analysis. Financial incentives are provided to facility owners and retro-commissioning (RCx) agents to implement energy efficiency measures and projects completed by approved project deadlines.

Small Business MTP: The Small Business MTP is designed to assist small business customers with identifying and implementing cost-effective energy efficiency solutions for their workplace. Small business customers are defined as business customers that do not have the in-house capacity or expertise to (1) identify, evaluate, and undertake energy efficiency improvements; (2) properly evaluate energy efficiency proposals from vendors; or (3) understand how to leverage their energy savings to finance projects.

3.2 SUMMARY RESULTS

This section presents statewide summary results, followed by key findings and recommendations from all relevant EM&V activities.

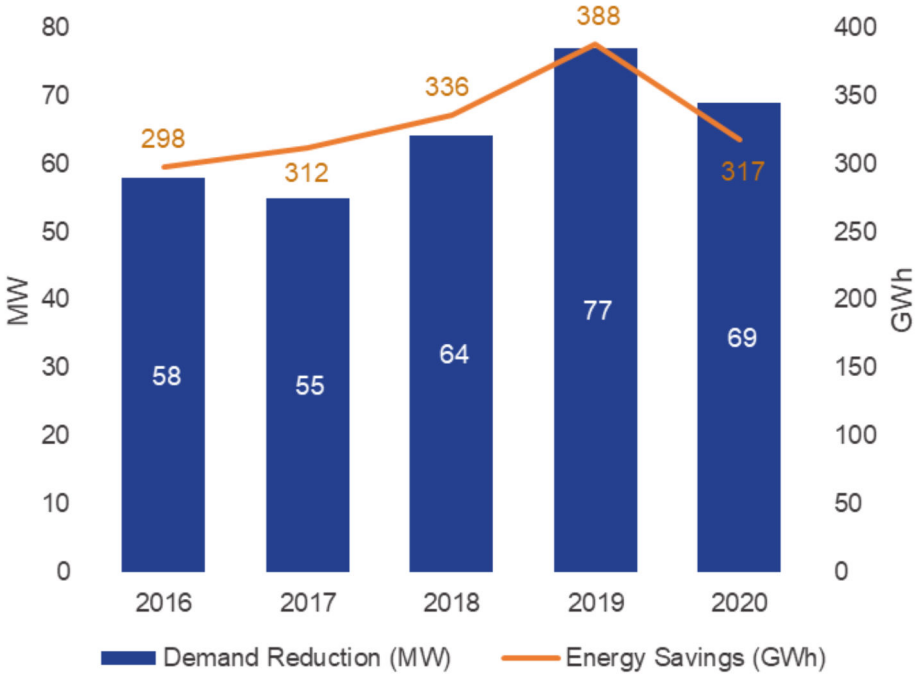
3.2.1 Savings

The statewide PY2020 evaluated gross savings from commercial sector programs were:

- 75,119 kW (demand reduction), and
- 332,236,805 kWh (energy savings).

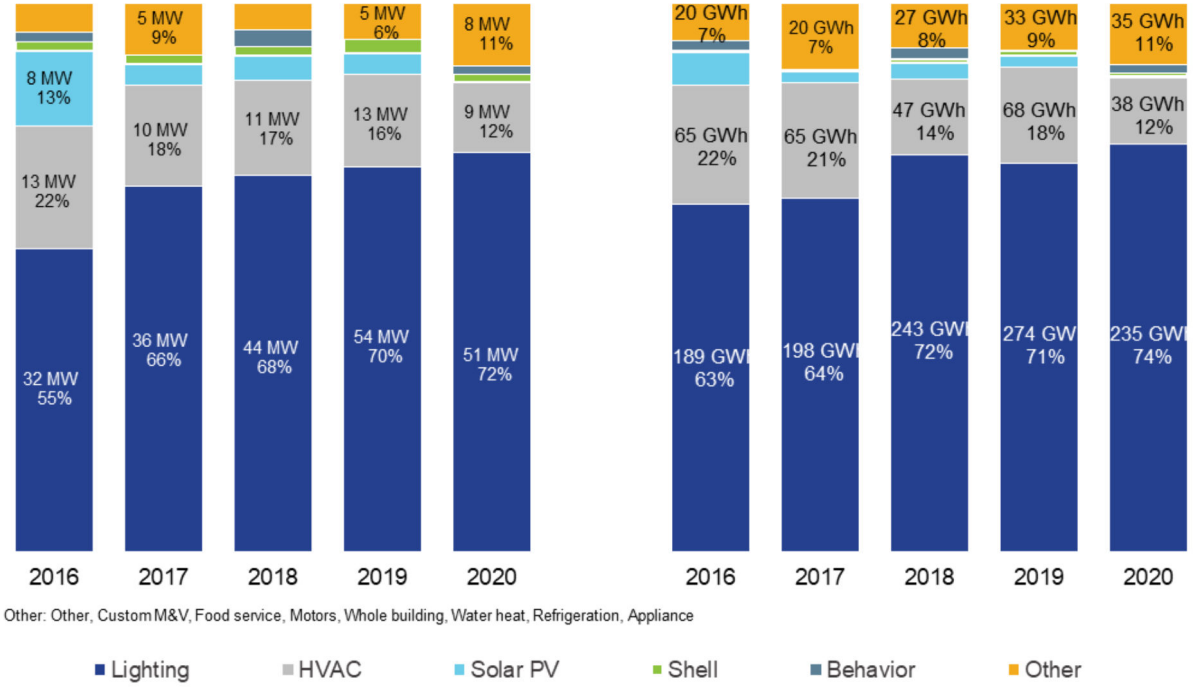
As shown in Figure 12, demand reduction results reflect a decrease from PY2019 (77 MW to 69 MW, respectively). Commercial sector energy savings saw a more considerable decrease from PY2019 (388 GWh to 317 GWh, respectively).

Figure 12. Total Statewide Evaluated Demand Reduction and Energy Savings by Program Year—Commercial Programs PY2016–PY2020



As indicated in Figure 13, lighting measures still account for the majority of the energy savings (72 percent) and demand reduction (74 percent). PY2020 saw HVAC and lighting measures making up approximately 84 percent and 86 percent of demand reduction and energy savings, respectively.

Figure 13. Distribution of Statewide Evaluated Gross Demand Reduction and Evaluated Gross Energy Savings by Measure Category—Commercial Programs Excluding Load Management PY2016–PY2020

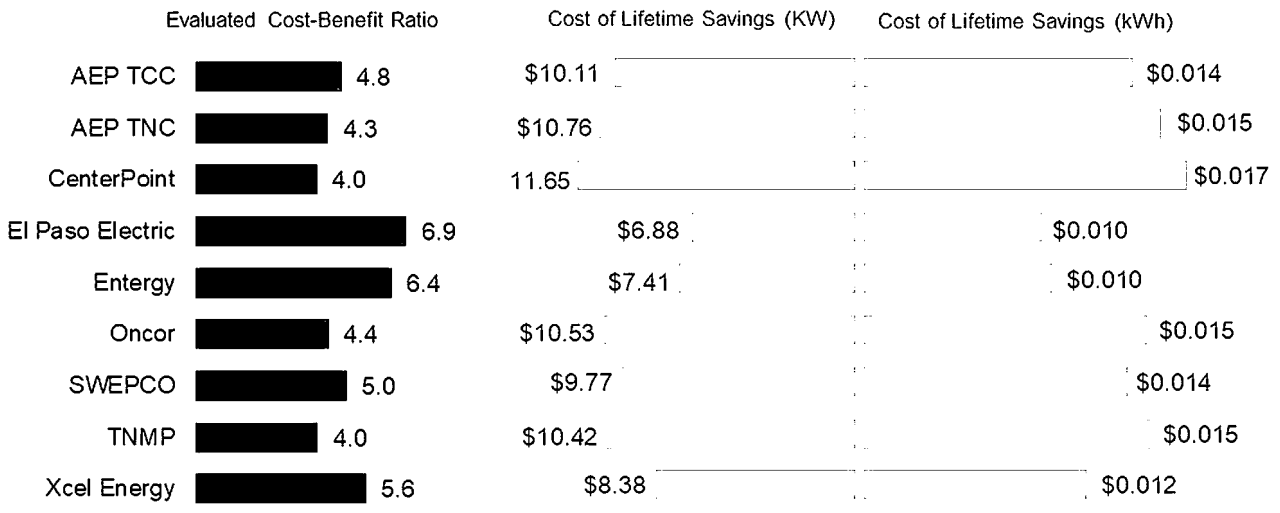


3.2.2 Cost-Effectiveness

Figure 14 summarizes the cost-effectiveness of each utility's commercial energy efficiency portfolio. Commercial sector programs were the most cost-effective, with overall cost-effectiveness of 5.0 statewide based on evaluated savings and 4.5 based on net savings. Utilities' results ranged from 4.0 to 6.9 based on evaluated gross savings and 3.6 to 6.1 based on evaluated net savings. There is variation in the utilities' results in the commercial sector because of the diversity of program designs offered by the utilities.

Figure 14 also summarizes the cost of lifetime kWh and kW for each utility's commercial sector programs. The cost per kWh ranges from $0.010 to $0.017, and the cost per kW ranges from $6.88 to $11.65. These costs provide an alternate way of describing the cost-effectiveness of a portfolio of commercial programs. Those portfolios with a higher cost-effectiveness ratio will have a lower cost to acquire savings and vice versa.

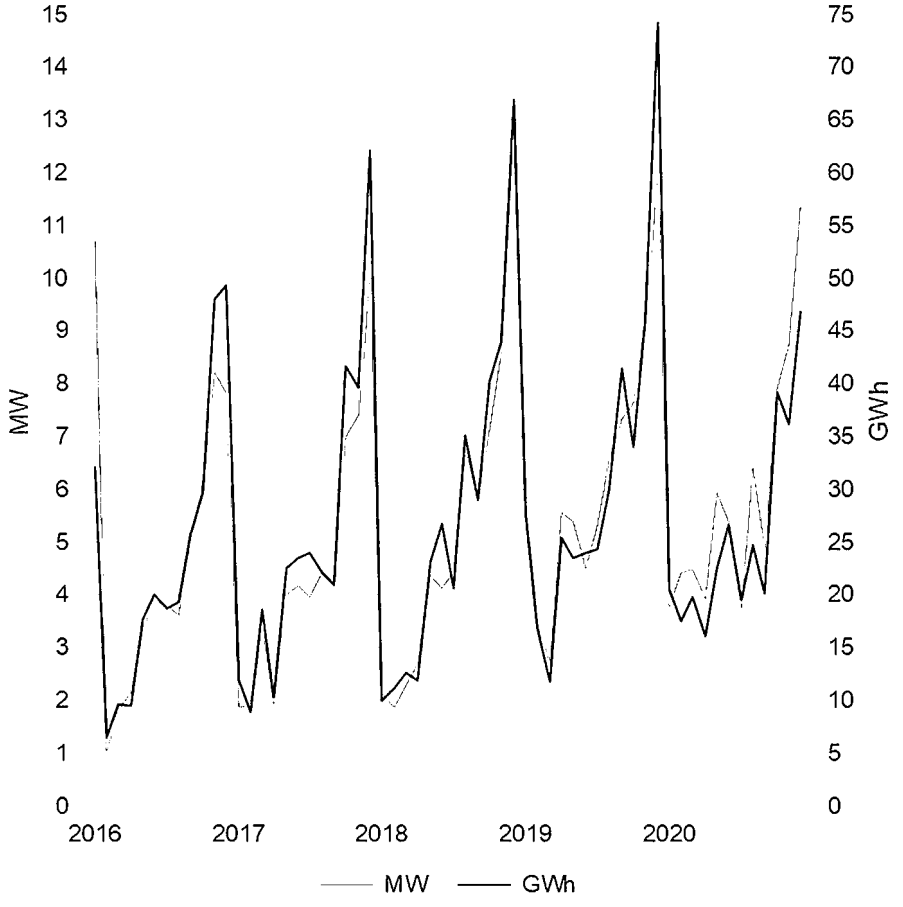
Figure 14. Evaluated Cost-Benefit Ratio and Cost of Lifetime Savings—Commercial Programs PY2020



3.2.3 Timing of Project Completion

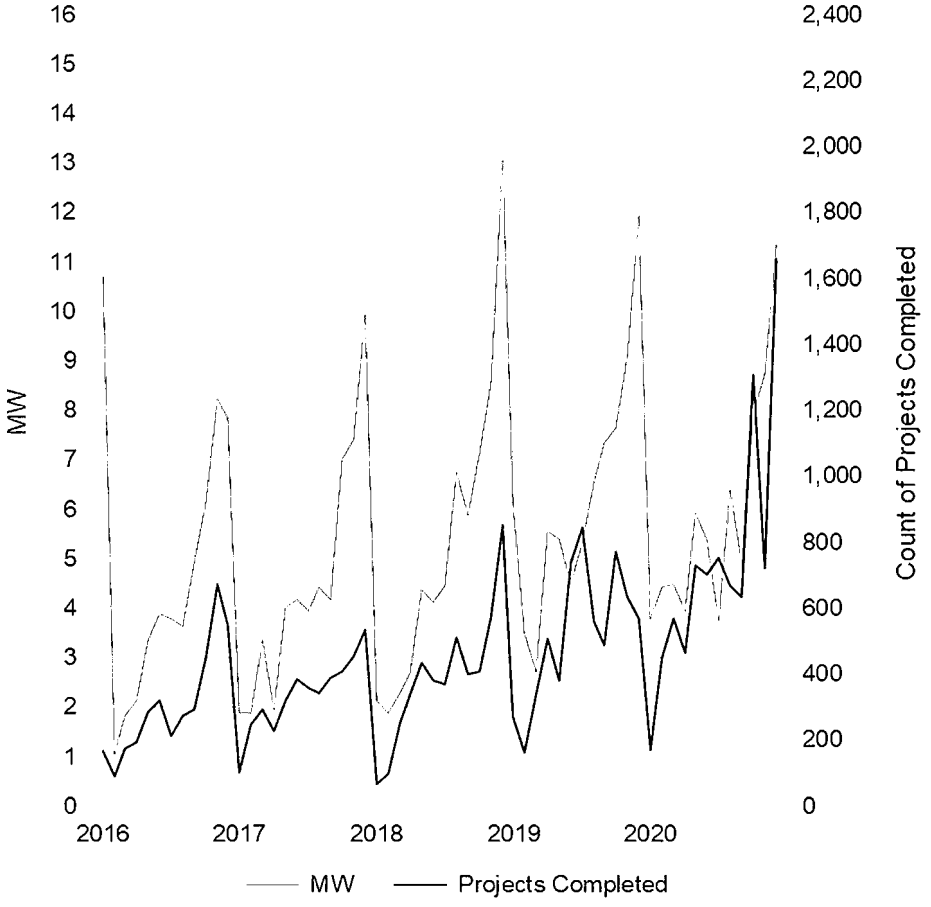
The commercial programs have a historical pattern that kW and kWh savings are closely linked and that the savings increase monthly as the year progresses, as shown in Figure 15. Historically, the first quarter has lower claimed energy savings as the programs launch the new initiatives. However, the first quarter of PY2020 was 30 percent higher than the average first quarter of the previous four years. A previous EM&V recommendation stated to attempt to increase first-quarter projects, and utilities had success. The increase in first-quarter projects was fortuitous as the COVID-19 pandemic started to impact projects at the beginning of the second quarter by accelerating, delaying, or canceling projects. Ultimately, it appears that the savings claimed in the second quarter continued relatively on track. The third quarter started to see canceled projects or delayed start of construction because of the COVID-19 pandemic-related market conditions; as a result, savings claimed dropped. The fourth quarter started to see a rebound in savings claimed with demand reduction reaching equivalent levels to PY2019. The electric consumption reduction did not respond to similar levels.

Figure 15. Monthly Evaluated Gross Demand and Energy Savings Over Time—Commercial Programs PY2016–2020



Historically, the number of projects increased throughout the year. In PY2019, the number of projects completed per month started to be more consistent. PY2020 continued the trend with increased projects in the first quarter, and that level carried through the third quarter. The fourth quarter showed a large increase in projects completion, although the energy savings did not increase at the same rate, showing that the average project size was smaller. The level of increased activity and savings mirrored a larger pattern of returning to normal operations at this time.

Figure 16. Monthly Number of Projects and Evaluated Gross Demand Savings Over Time—Commercial Programs PY2016–2020



PY2020 was not a typical year; the strong first quarter helped alleviate some program pressure due to the COVID-19 pandemic. The savings claimed were impacted through the end of the year because the average project size decreased. Still, the increased number of projects in the fourth quarter helped programs finish the year strong and prepare for delivery in PY2021.

3.3 COMMERCIAL MARKET TRANSFORMATION PROGRAMS

This section presents the Commercial Solutions and SCORE program results that were a *high* evaluation priority and the Retro-Commissioning program that was a *medium* evaluation priority in PY2020[8].

3.3.1 EM&V Overview

The EM&V team conducted desk reviews for a sample of projects from the *high-* and *medium-*priority commercial MTP programs. For the desk reviews, the EM&V team applied the method prescribed in the PY2020 TRM 7.0 to verify energy savings and demand reduction for each project sampled. Comparing the evaluated savings to the utility-claimed savings showed agreement in most cases; however, some individual projects reviewed had more extensive adjustments when evaluated but do not adjust the overall program realization rates. Table 15 presents the range of evaluated project adjusted savings for MTP projects when comparing evaluated ex-post savings to ex-ante savings. The range identifies the variability in evaluated results for various MTP programs and provides additional context for the key findings and recommendations.

Table 15. Range of Evaluated Adjusted Savings for Market Transformation Program

Program	Evaluated Adjusted Savings Comparison (kW)	Evaluated Adjusted Savings Comparison (kWh)
Commercial Solutions MTP	80.6%–102.4%	77.1%–103.5%
SCORE MTP	91.7%–100.7%	99.4%–100.3%
Retro-Commissioning MTP	77.5%–99.9%	98.4%–100.0%

Based on the evaluation results, the EM&V team has outlined key findings and corresponding recommendations described below.

3.3.2 Key Findings and Recommendations

All key findings and recommendations outlined for the Large Commercial MTPs (Commercial Solutions and SCORE) are equally relevant to the SOP programs. The SOP programs include many of the same deemed and prescriptive calculations as the MTP programs; the SOP programs also use custom calculations and M&V methodology to claim savings for projects. These are the calculation methods discussed in the Large Commercial and Retro-Commissioning Findings and Recommendations (Section 3.3.2.1 and Section 3.3.2.2, respectively).

[8] Solar photovoltaic (PV) programs were a medium evaluation priority and projects are located in MTP and SOP programs. The result of the solar PV project evaluations are included in Section 5.0 Cross-Sector.

3.3.2.1 Large Commercial Market Transformation Programs (Commercial Solutions and SCORE)

Key Finding #1: The claimed peak demand calculation inconsistently uses the peak demand probability factor (PDPF) *top 20 hours* method for custom savings calculations.

The Texas TRM has developed a peak demand calculation based on identifying utility peak demand periods for summer and winter peaks for five different climate zones. The peak demand hours, along with the associated temperature and likelihood of occurrence, are listed in the peak probability analysis (PPA) tables in Volume 1 of the TRM. The PDPF *top 20 hours* calculation method for peak demand reduction estimates the difference in energy consumption for the equivalent of the highest 20 hours of utility demand in winter or summer. Section 4.3 of PY2021 TRM 8.0 explains how the PPA tables are used to calculate peak demand.

Custom calculated energy savings should use the PDPF *top 20 hours* calculation method to determine peak demand reduction. The documentation review found that projects did not consistently use the PDPF *top 20 hours* calculation method; some projects used the average peak demand savings calculation for June through September. These two calculation methods sometimes create similar results, although the calculations are fundamentally different and may drastically different energy savings.

While using the PDPF *top 20 hours* peak-demand calculation method, the most common submittal uses the PPA tables for the peak day and hour for the summer peak (Tables 10–14 in Texas PY2020 TRM 8.0 Volume 1). The listing below is a summary of improvements from various submittals.

- Include the winter peak hours calculations (Tables 15–19 in Texas PY2020 TRM 8.0 Volume 1).
- Use the peak hour temperature from the PPA tables in the M&V regression equations.
- Use the PPA Tables 20–39 for loads that only vary by hour of the day and not day of the week or temperature.

The calculation of the peak demand reduction using the PDPF *top 20 hours* calculation method estimates the peak demand reduction at the most critical times for the electric grid. Projects that use the PDPF *top 20 hours* method in calculation from the beginning can adjust equipment or controls to increase peak demand reduction without reducing participant comfort.

Recommendation #1: Increase outreach to implementers and participants who complete custom calculations regarding the peak demand calculation method in the TRM.

Key Finding #2: Custom calculation documentation lacks detail to understand assumptions and operating conditions.

Custom calculated energy savings are acceptable when the prescriptive or deemed measures do not apply. The EM&V team found that the custom calculation methods for kilowatt-hour ex-ante savings were technically sufficient to calculate energy savings. However, the documentation of operating conditions and other assumptions in the equation was limited in many custom calculators. Typical documentation of values used in the calculations include:

- equipment operating hours and control schedules,
- pre-install operating conditions and equipment,

- assumption of pre-install equipment efficiency,
- interactive effects on other systems,
- non-routine or COVID-19 pandemic related adjustments, and
- maximum and minimum expected load equipment operating electric consumption.

Recommendation #2: Custom calculations should include a project description document to clarify assumptions and identify measured values within the custom calculators.

Key Finding #3: Savings calculated from metered pre- and post-install energy consumption should be adjusted for COVID-19 pandemic-related operating changes.

The COVID-19 pandemic created a long period of adjusted operating conditions for many businesses. The pre- and post-install measurement periods for projects will be impacted differently by the operating conditions. There are multiple ways to handle this adjustment; a simplified way to account for this adjustment is to develop an independent variable for all readings after the initial adjustment for the COVID-19 pandemic. This variable used in the International Performance Measurement and Verification Protocol (IPMVP) regression analysis will adjust the baseline to account for the general baseline adjustment.

The approach to the adjustment should be documented in the M&V plan or similar project description document.

Recommendation #3: Savings calculated from metered pre- and post-install energy consumption should be adjusted for COVID-19 pandemic-related operating changes.

3.3.2.2 Retro-Commissioning Market Transformation Program

The MTP findings and recommendations above apply to the RCx program in addition to the following findings specific to the RCx process where energy savings is claimed through the M&V methodology or detailed custom calculations.

The M&V methodology is used to claim energy savings for RCx, behavioral, operational, controls, or custom energy savings. The M&V methods provide a framework for providing high-quality verified savings for projects that cannot be readily isolated through engineering equations or modeling and provide significant energy savings. This process opens energy efficiency programs to identify and claim savings from more complicated projects where the interactive effects or operation protocols do not match those described in the TRM. Improvements in M&V equipment and techniques are allowing this energy efficiency claiming type to be used more frequently, which can create more accurate claimed savings.

The projects include the M&V plan and results to determine a normalized baseline from previous consumption records and an improved normalized consumption based on consumption records after the improvement. The protocol, described inPY2020 TRM 8.0 Volume 4, requires comprehensive projects to comply with IPMVP Option C and expect savings greater than ten percent of utility bill (or sub-metered) energy use. The analysis should have a coefficient of determination (R^2) equal to or above 75 percent. The process includes tools for the M&V expert to help manage the data to support a clean and relevant equation to develop a normalized energy consumption.

The detailed custom calculations for RCx are not a new process for Texas, although using them for RCx is expanding. The approach to calculating custom energy saving from an RCx project is complicated. Based on the evaluation results, the EM&V team has outlined key findings and corresponding recommendations described below.

Key Finding #1: M&V claimed savings modeling could be improved to enhance the accuracy of energy savings calculations.

The M&V methodology creates energy savings claimed for commercial and industrial (C&I) projects based on actual operations and can be very accurate. But, in the calculation process, the method requires custom decisions and assumptions for the modeling of each project. The EM&V team found that assumptions and modeling could be improved to increase the accuracy of the savings calculated, although there was no consistent, identifiable decision that could be improved. Detailed below are the individual modeling assumptions and processes identified by the EM&V team that should inform modeling improvements in the future.

- **Electric consumption billing data detail.** The ideal electric consumption billing data measurement frequency is hourly or shorter to create a robust model of the facility operations. For C&I projects with consistent daily or monthly profiles throughout the year, the daily and monthly measurement frequencies can produce consumption models of equal quality. However, for C&I projects with non-consistent variables, such as weather or occupancy, the daily and monthly measurement frequencies can produce consumption models with variable accuracy.

  Furthermore, the peak demand calculation method relies upon electricity consumption during a critical hour. Daily or monthly data do not provide the detail necessary to measure demand reduction. When the detailed data (hourly or shorter) is not available, the M&V analysis requires an engineering judgment calculation to correlate the peak demand at the top 20 hours, introducing risk for both the baseline and improved peak demand values.

- **Peak demand calculation from M&V projects requires relevant data for the top 20 peak demand hours.** Regression models identify statistically relevant energy consumption trends. This process eliminates the outlier data points, so they do not augment overall consumption, ideal for determining annual consumption (kWh). However, the TRM definition of peak demand requires an analysis of the consumption during times considered outliers. The M&V analysis for the winter and summer peak demand (kW) is different from the annual consumption analysis (kWh). It is necessary to understand the impact of the peak hour operation when calculating energy savings to ensure it matches with actual operation.

- **Adjustments for COVID-19 pandemic-related changes must be accounted for.** The COVID-19 pandemic adjusted each C&I participant's operations in different ways. The modeling of the M&V-claimed savings must recognize the adjustment in the modeling, until the COVID-19 pandemic adjustment period is no longer in the measurement periods.

- **Balance point temperature at the edge of the acceptable range should be tested.** When completing a regression analysis, the balance point temperature for heating and cooling is tested across a range of up to 50 degrees to determine which value optimizes the regression equation. In an ideal HVAC system, it is within a few degrees of the interior temperature setpoint. Still, many other factors impact the value of a whole-

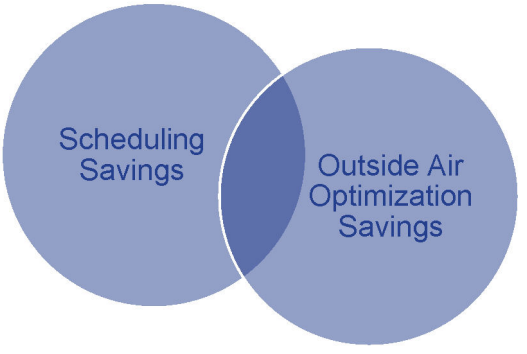
building analysis. When the balance point temperature is near the edge of the acceptable range, the analysis should try to identify an additional independent variable beyond the temperature that is impacting the energy consumption. The M&V report should document the additional variables tested and selected.

Recommendation #1: Update the PY2021 TRM 9.0 (Volume 4, Section 2.4, M&V Miscellaneous) to increase the consistency of the calculation process, and the accuracy of savings for M&V claimed energy savings.

Key Finding #2: Interactive effects of RCx activities are not always considered when calculating savings.

RCx projects include multiple energy-saving adjustments to the control of HVAC and other systems within a facility operation. Each potential action has an estimated energy savings value calculated from the existing baseline. When implemented, the actions interact and adjust the energy savings following each subsequent action. If a whole facility M&V (IPMVP Option C) is completed, the interactive effects are accounted for. Alternate modeling or metering savings determination methods do not inherently account for the interactive effects when energy savings are determined. The RCx calculations must carry over the results of previously calculated energy savings adjustments to the following successive action to account for the facility's energy savings.

The diagram to the right shows the savings association between adjustments for scheduling and outside air optimization. The size of each is representative of the energy savings for each measure from the existing baseline. However, if both projects are implemented, a portion of the energy savings is saved by one, but not both. The interactive effect is the overlap between the measures. It was not documented and calculated when measure savings was determined separately.



Recommendation #2: Include interactive effects adjustments to RCx savings calculations.

Key Finding #3: RCx adjustments require an adjustment of controls or tag-out/lock-out to claim energy savings.

RCx adjusts controls and equipment operation to be more efficient throughout various operating conditions. Sometimes this includes removing equipment from operation because it is redundant or unnecessary. These actions tend to save a lot of electricity; however, the electricity saved can only be claimed if the removed equipment is disconnected from the grid operations. Disconnection can be completed by removing the equipment, disconnecting the electric feed, installing a tag-out/lock-out on the breaker switch, or another action requiring a contractor to complete work before it is switched back on. Equipment that is turned off with a switch that can be inadvertently turned on in the future is not acceptable for post-install energy efficiency savings. Equipment connected to a central operating control system that operates it to only *turn on* in emergency situations is acceptable.

Recommendation #3: Update the PY2021 TRM 9.0 Volume 4 to indicate that equipment must be demolished, removed, disconnected, or included in the control infrastructure to claim energy efficiency savings for non-operation. Equipment that is *turned off* locally is not eligible to claim energy savings.

3.4 COMMERCIAL STANDARD OFFER PROGRAMS

3.4.1 EM&V Overview

Commercial SOP programs were *high* evaluation priorities in PY2020. These programs continue to be a substantial percentage of the overall statewide portfolio savings. The EM&V team conducted desk reviews for a sample of projects from these programs.

For the desk reviews, the EM&V team applied the method prescribed in the PY2020 TRM 7.0 to verify energy savings and demand reduction for each project sampled. Comparing the evaluated savings to the utility claimed savings showed agreement in most cases. The average realization rates across all SOP programs were 99.3 percent and 99.0 percent for demand and energy savings, respectively.[9] Based on the evaluation results, the EM&V team has outlined key findings and corresponding recommendations described below.

3.4.2 Key Findings and Recommendations

Key Finding #1: LED lighting certification for non-standard lengths of qualified products does not include all the installation options.

LED lighting is becoming more flexible and customizable, and some lighting can be cut to custom lengths during installation. The DesignLights Consortium (DLC)-qualified product list (QPL) lists these products in four-foot or other specific length increments and does not state the impact of adjusting the length from the certified length. The current TRM measure does not include qualifying the product in any other length than the one on the QPL. Updating the TRM to allow qualified custom length products to be installed and generate savings for energy-efficient lighting will keep the TRM current to existing technology.

Recommendation #1: Update thePY2021 TRM 9.0, Volume 3, Lighting Measures to provide guidance on energy savings calculations for qualified LED products manufactured to allow for custom lengths.

Key Finding #2: LED lighting wattage continues to need small adjustments to match DLC or ENERGY STAR® QPLs.

The lighting savings calculations continue to have a significant amount of wattage adjustments for installed lighting equipment. The adjustments had two primary reasons: (1) the LED lighting manufacturer wattages were used instead of wattages from the DLC or ENERGY STAR QPLs, and (2) the half-watt denominations allowed by the TRM were not utilized. The half-watt adjustment was introduced in PY2018 affecting fixtures under 25 watts and extended in PY2020 to include all wattages for more accurate savings calculations and increased consistency. The use of the manufacturer wattage in the energy savings calculation should be corrected to match

[9] These are realization rates prior to utilities adjusting savings based solely on evaluated results.

QPL-listed wattage. Most projects included documentation of the equipment, which lists the QPL wattage.

Recommendation #2: Update the post-install wattage quality assurance to ensure the use of QPL-listed wattages for installed equipment and continue to implement half-watt increment rounding.

Key Finding #3: Equipment that remains in place post-installation and is disconnected by an accessible switch is assumed to be active in post-install energy calculations.

The TRM energy efficiency calculations assume that the equipment replaced by the energy-efficient equipment is demolished and removed from the participant location. However, there are times where the original equipment will remain in place. The energy efficiency calculations in this situation require the original equipment is disconnected from the grid; this can be completed by (1) disconnecting the electric feed, (2) installing a tag-out/lock-out on the breaker switch, or (3) another action that requires a contractor to complete work before it is switched back on. Equipment turned off with a switch that can be inadvertently turned on in the future is not acceptable for post-install energy efficiency savings. Equipment connected to a central operating control system that operates it to only turn on in emergencies is acceptable.

Recommendation #3: Update the PY2021 TRM olume 3 measures to indicate that original equipment in an energy-efficient retrofit must be demolished, removed, disconnected, or off in the control infrastructure to claim energy efficiency savings for removal. Equipment that is turned off locally should be included in the post-install inventory.

3.5 CONSUMPTION ANALYSIS

This section outlines the observation of the consumption analysis process completed on lighting measures for the SOP and MTP program measures. The consumption analysis limited the scope to lighting measures for select participant building types.

The results and overview of the consumption activities are included in the Technical Appendix. However, the first year of the consumption analysis had limited conclusive findings due to several factors. The following observation and next steps inform additional research to take place as part of the PY2021 EM&V scope to improve the commercial consumption analysis findings.

3.5.1 Observations and Next Steps

Observation #1: Twenty-seven months of data limited the applicability of the findings.

The consumption analysis requested data from January 2019 through December 2020 and January 2021 through March 2021. Traditionally, a consumption analysis will use 12 months of pre-install data and 12 months of post-install data to estimate consumption patterns. Following this pattern, the pre-install period would be January 2019 to December 2019, and the post-install period would be April 2020 to March 2021. The resulting traditional participant group includes completed projects in the first quarter of 2021. This period is historically the period of lowest participation in Texas programs. The consumption analysis reduced the pre-install and post-install measurement period to eight months, which increased the participant group to include projects completed between 9/1/19 and 5/30/20. The trade-off limited the statistical significance of the findings, and therefore the applicability.

Requesting additional data on these meters will increase the participant group and increase the statistical significance of the findings. A data request will be provided in January 2022 to request information from the discreet set of meters included in the participant and control groups of the PY2021 consumption analysis. This data request will be in addition to the data request for new meters for the PY2022 consumption analysis.

Next Step #1: Request data from the same meters for the period from 4/1/2021 to 12/31/2021.

Observation #2: The participant group size limited the statistical representation of the findings.

As mentioned in Observation #1, the participant group size was limited by the amount of data available. However, when stratified by business type, the participant group has few participants in any given period compared to the total number of meters for the business type. The impact of the small participant group limits the statistical significance of the results. To increase the statistical significance, Tetra Tech will survey the consumption analysis businesses in the upcoming participant survey to confirm operating conditions and better characterize the participant group. The information will be included in the consumption analysis variables to increase statistical significance.

Next Step #2: Survey the participant group to confirm patterns and collect data to increase statistical representation.

4.0 RESIDENTIAL ENERGY EFFICIENCY PROGRAMS

This section summarizes the key findings and recommendations from the PY2020 evaluation of residential energy efficiency projects. The residential standard offer programs (SOP), hard-to-reach (HTR), and low-income programs were *medium* evaluation priorities along with the *smart thermostat* measure. The recommendations are to be considered by the utilities for PY2022 implementation and will also be incorporated into the PY2022 Texas Technical Reference Manual (TRM) 9.0 as appropriate.

4.1 PROGRAMS OVERVIEW

The EM&V team evaluated the residential energy efficiency programs described below. Like the commercial energy efficiency programs, there are residential SOPs and market transformation programs (MTP). The residential SOPs provided by the Texas utilities offer standard incentives for a wide range of measures that are bundled together as a project to reduce system peak demand, energy consumption, and energy costs. The residential MTPs offered in Texas are designed as a strategic effort to make lasting changes in the market that result in increased adoption of energy-efficient technologies, services, and practices. MTPs are designed to overcome specific market barriers that prevent energy-efficient technologies from being accepted. HTR and low-income programs are also offered to provide comprehensive energy efficiency retrofits for single-family and multifamily customers who meet the program's income guidelines on the residential side.

Residential SOP: The Residential SOP provides incentives to project sponsors for a wide range of retrofit measures that reduce demand and save energy, targeting retrofit measures for residential customers in single-family and multifamily buildings. Incentives are paid to project sponsors for qualifying measures that provide verifiable demand and energy savings. The program is open to all qualifying energy efficiency measures, including but not limited to *air conditioning*, *duct sealing*, *weatherization*, *ceiling insulation*, and *water-saving* measures, and ENERGY STAR® windows.

Hard-to-Reach SOP: The Hard-to-Reach SOP provides incentives to project sponsors for a wide range of retrofit measures that reduce demand and save energy in residential buildings. This program is available to customers whose annual total household income is at or below 200 percent of current federal poverty guidelines. Incentives are paid to project sponsors for qualifying installed measures such as air conditioning, air conditioner tune-ups, *duct sealing*, *weatherization*, *ceiling insulation*, *water-saving measures*, and ENERGY STAR windows.

Residential Solutions MTP: The Residential Solutions MTP provides incentives to customers—through participating contractors—for a wide range of retrofit and new construction measures that reduce demand and save energy in residential buildings. The program also provides technical assistance and education on energy efficiency measures. This program is operated by one utility and is included in this section as it operates similarly to a residential SOP.

Residential New Construction MTP: The Residential New Construction MTP provides incentives to builders to increase the efficiency of new homes above minimum code efficiency. The programs partner with raters, who inspect homes and provide energy models to describe the program-sponsored homes. The utilities compare these energy models with code to estimate energy savings.

Residential Upstream/Midstream MTP: The Upstream and Midstream MTPs provide incentives to residential and small commercial customers through in-store discounts at participating retailers and distributors or through an online marketplace for qualifying high-efficacy LED lighting, smart thermostats, energy-efficient appliances, and other efficient equipment. Measure offerings and delivery vary by utility.

Hard-to-Reach Solutions MTP: The Hard-to-Reach Solutions MTP provides incentives to customers—through participating contractors—whose annual total household income is at or below 200 percent of current federal poverty guidelines. Incentives are provided for a wide range of retrofit and new construction measures that reduce demand and save energy in residential buildings. The program also provides technical assistance and education on energy efficiency measures. This program is operated by one utility and is included in this section as it operates similarly to an HTR SOP.

Targeted Low-Income Solutions: The Targeted Low-Income Solutions program offers an energy audit to qualified low-income residents of Texas. Alternatively, the program offers a review of the home's energy efficiency and installation of weatherization measures to increase the energy efficiency of their home. A household qualifies if the income is at or below 200 percent of the federal poverty guidelines, and their home must be able to benefit from being weatherized. Then, after the audit is completed, the program gives financial and installation assistance to improve the home's energy efficiency.

4.2 SUMMARY RESULTS

This section presents statewide summary results, followed by key findings and recommendations from all relevant EM&V activities.

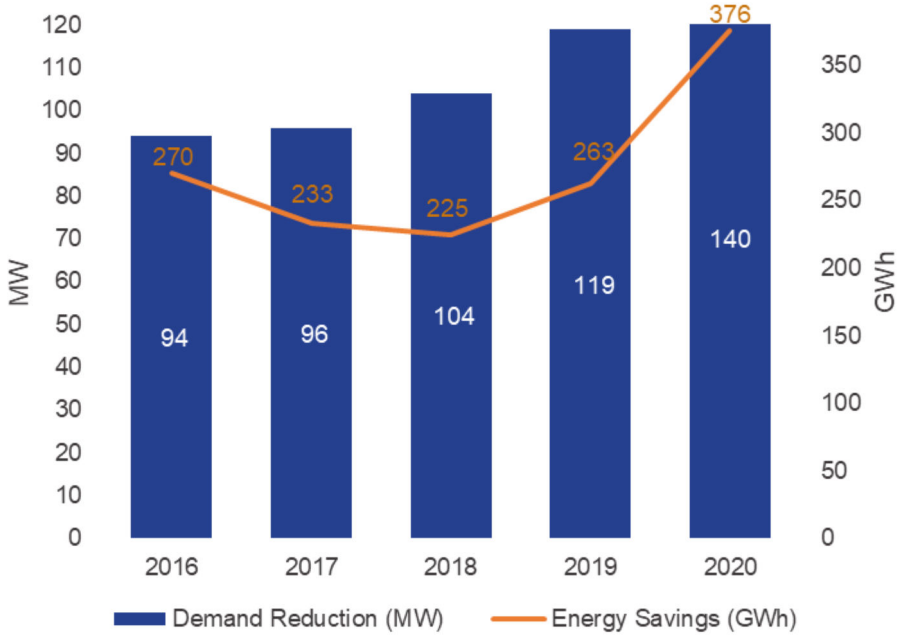
4.2.1 Savings

The statewide PY2020 evaluated gross savings from residential sector programs was:

- 133,822 kW (demand reduction); and
- 360,524,189 kWh (energy savings).

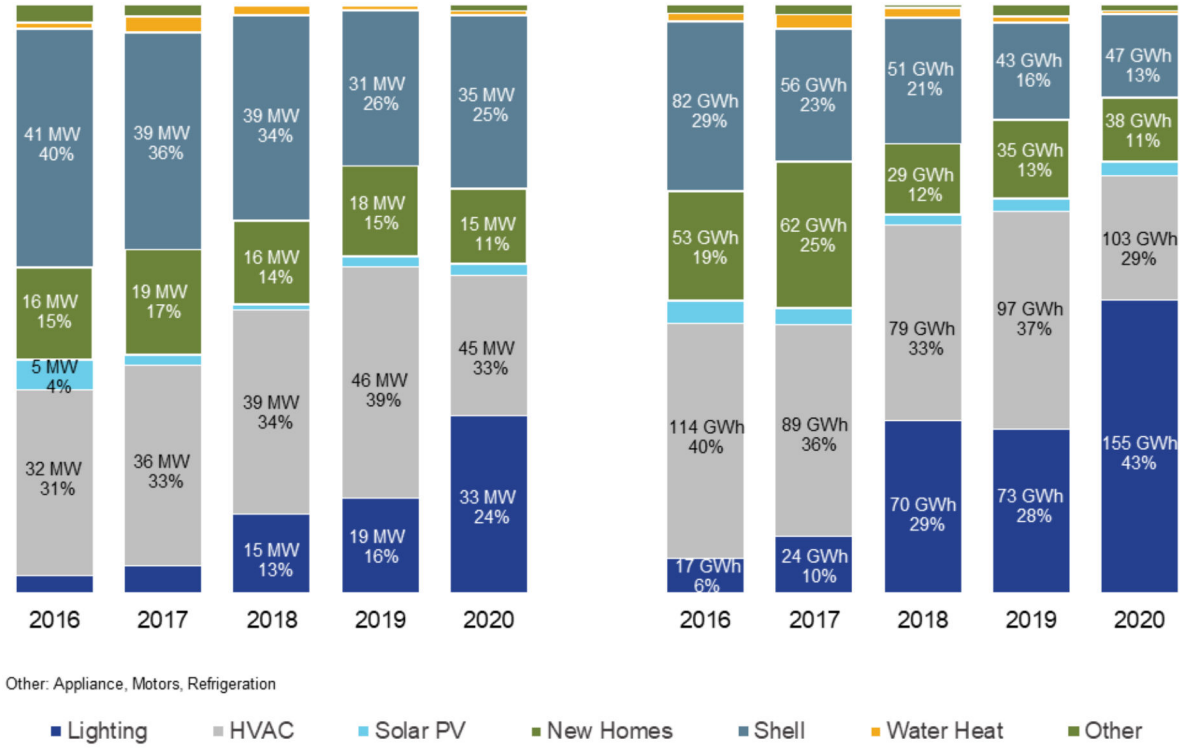
As seen in Figure 17, the demand reduction achieved in PY2020 continues to increase each year. Energy savings were also higher in PY2020 than in recent years, primarily driven by upstream lighting increases.

Figure 17. Total Statewide Evaluated Gross Demand Reduction and Energy Savings by Program Year—Residential Programs PY2016–PY2020



For PY2020, most residential demand savings (excluding load management) were derived from lighting and shell measures. The majority of energy savings achieved has shifted from HVAC in PY2019 (39 percent) to lighting in PY2020 (43 percent). Figure 18 presents the breakdown of savings by measure category and demonstrates that the utilities have successfully diversified their measure mix for residential savings.

Figure 18. Distribution of Statewide Evaluated Gross Demand Reduction and Gross Energy Savings by Measure Category—Residential Programs PY2016–PY2020[10]



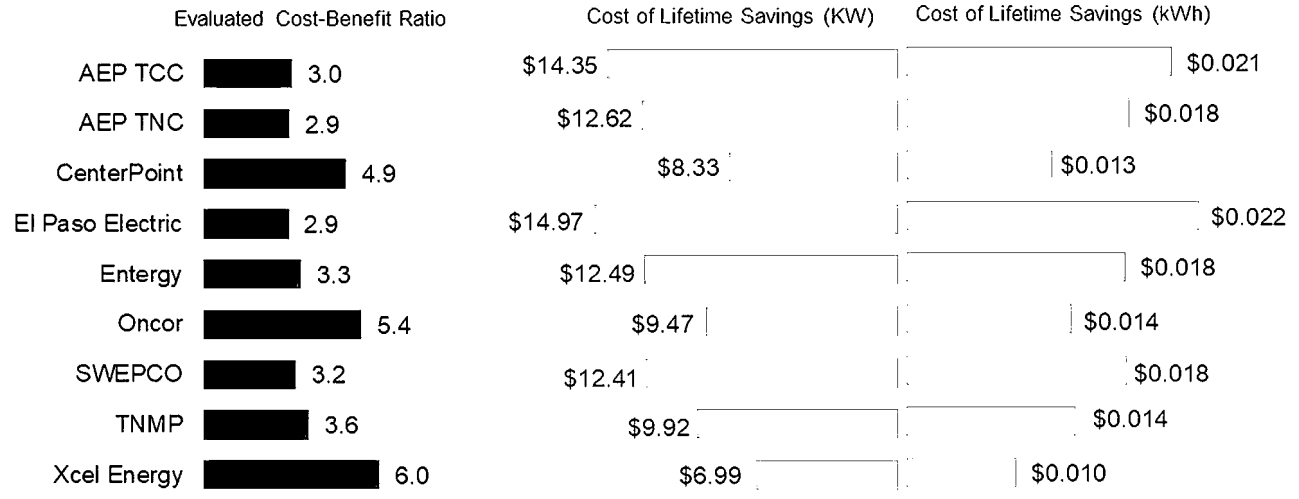
4.2.2 Cost-Effectiveness

Residential sector programs' cost-effectiveness statewide is 3.9 based on evaluated gross savings and 3.3 based on evaluated net savings. Like the commercial sector, the residential sector cost-effectiveness varied among utilities, with evaluated gross savings results ranging from 2.6 to 6.0 and evaluated net savings results ranging from 2.7 to 5.5. As with the commercial sector, this is partly due to the differences in the types of programs offered by different utilities.

Figure 19 summarizes the cost-effectiveness of each utility's residential energy efficiency portfolio and the cost of lifetime kilowatt-hours and kilowatts for each utility's residential sector programs. The cost per kilowatt-hour ranges from $0.010 to $0.022, and the cost per kilowatt ranges from $6.99 to $14.97. These costs provide an alternative way of describing the cost-effectiveness of a portfolio of residential programs. Those portfolios with a higher cost-effectiveness ratio will have a lower cost to acquire savings and vice versa.

[10] Values less than four percent have been suppressed for visualization purposes.

Figure 19. Evaluated Cost-Benefit Ratio and Cost of Lifetime Savings—Residential Programs PY2020



4.3 RESIDENTIAL STANDARD OFFER, HARD-TO-REACH, AND LOW-INCOME PROGRAMS

4.3.1 Impact Key Findings and Recommendations

Key Finding #1: The PY2020 TRM 7.0 includes an envelope measure allowance for customers participating in HTR or low-income programs to claim reduced cooling savings for homes cooled by one or more room air conditioners. This allowance is made by applying an adjustment to deemed savings specified for homes with refrigerated air. The EM&V team found that, in some cases, this adjustment factor was not applied consistently.

Recommendation #1: Update the PY2022 TRM 9.0 to incorporate guidance to clarify how to apply the adjustment factors.

4.3.2 Deemed Savings Verification

The EM&V team conducted census reviews for all *medium* and *high*-priority residential programs. Tracking system reviews assess whether the tracking data requirements outlined in PY2020 TRM 7.0 are met and if claimed savings can be replicated. The EM&V team also checked for consistency with reported savings in annual utility reports. Tracking system reviews provide an overarching look at program data and help identify systematic errors in the data or measure calculations. The EM&V team identified discrepancies in the data among several utility programs and worked with implementors and utilities to remedy the discrepancies.

4.3.3 Low-Income Verification Process Assessment

This section summarizes and compares program eligibility certification processes for energy efficiency programs that serve low-income households across the Texas electric utilities and other utilities' low-income programs as well as the PUCT's low-income telephone assistance program, Lifeline.

4.3.3.1 Background

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

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

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

4.3.3.2 Process Key Findings and Recommendations

Interviews with the utilities and comparing current practices with other low-income programs indicate an opportunity to increase the confidence level that the program services are going to the intended low-income recipients through additional eligibility certification requirements. At the same time, increased requirements should be as streamlined as possible to avoid negatively affecting participation.

The key findings and recommendations aimed to address the objectives of the process assessment, which is to "*Revise low-income/hard-to-reach eligibility verification to increase the confidence program services are going to intended customers, improve program outreach and address participation barriers, and develop efficient administration processes*[11]."

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

[11] This objective was agreed to by PUCT staff, the EM&V team and utilities in February 2021. The objective was then discussed at the March 2021 Energy Efficiency Implementation Project (EEIP) meeting.

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

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

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

Key Finding #3: An option to streamline participation requirements would be to allow participants to qualify via geographic location such as through a US Housing and Urban Development (HUD) low-income qualified census tract.

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

Recommendation #4: Add a Category 1C community action agency or other social service agency certification.

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

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

4.3.3.3 EM&V Research

PUCT staff and the EM&V project manager interviewed each of the eight Texas utilities to understand current eligibility certification practices, the mix of customers qualified through Category 1 and Category 2, and the pros and cons of the current and alternate certification approaches. PUCT staff and the EM&V project manager also interviewed the PUCT staff that oversee the Lifeline telephone assistance program.

In addition, we conducted secondary research for low-income programs offered by the following benchmarked utilities[12]:

- CPS Energy
- Detroit Edison (DTE)
- Kansas City Power and Light (KCP&L)
- FirstEnergy (Ohio and Pennsylvania territories)
- ComEd
- Energize Connecticut (CT)

The EM&V project manager conducted follow-up interviews with CPS Energy and Dollar Energy, the implementer of the FirstEnergy programs, to learn more about their eligibility certification processes. Finally, the EM&V project manager, in conjunction with either Oncor or CenterPoint Energy, interviewed four property managers of prior participating multifamily facilities

4.3.3.4 Results

The mix of participants qualified through Category 1 or Category 2 in the Texas programs varied by utility. For single-family, most think it is a mix of Category 1 and 2. In general, utilities with smaller budgets tend to qualify multifamily units through Category 1; utilities with larger budgets tend to qualify multifamily units through Category 2. Benchmarked programs also offer a qualification option through participation in another low-income program or reported income similar to the Category 1 and Category 2 options. All but one utility program had a range of other qualifying low-income programs except for FirstEnergy Pennsylvania. Their customers must participate in a specific low-income energy assistance program before receiving energy efficiency services. There was consensus across all interviewees that identifying as many other qualifying low-income programs as possible would be helpful in qualifying low-income customers. There was a discussion of working with organizations that serve low-income households to help identify qualified participants through Category 1; Dollar Energy is employing this method successfully on behalf of utilities. At the same time, it was recognized that some low-income households will not want to participate in other programs but should still have the opportunity to receive energy efficiency services through an income-qualifying option.

Currently, in Texas, program service providers are responsible for working with customers to complete the eligibility certification forms. The service providers then submit the forms to the utilities. It was widely agreed amongst the utilities that most customers will not be comfortable submitting personally identifiable information (PII) to service providers if additional

[12] Utilities of the same parent company of Texas electric utilities are not included in this review as we have requested information gathering within their own companies regarding income verification processes and opportunities.

documentation requirements are added to the forms. Therefore, a change in the current process would be needed. While some of the utilities recognized additional requirements could ensure services are going to the intended low-income customers, utilities also voiced concern that additional requirements would be a barrier to program participation that could be difficult to overcome. CPS Energy echoed this sentiment as they recently changed from documentation requirements to allow customers to self-certify to increase low-income program participation. Dollar Energy said in their experience the amount of time to receive approval is more of a barrier to participation than the actual documentation. To address this, they have developed processes internally to approve applications and documentation within 24–48 hours. They said this could be longer for customers who do not fully complete the application or submit the correct documents, which is not uncommon.

Interviewed property managers were very complimentary of the energy efficiency programs in which they participated. Most learned of the program from a service provider or had repeat participation across multiple facilities. The interviewed multifamily properties all qualified through Category 2 as they collect income information as part of the approval process for residents' applications. They report keeping income information on file and report they could not share copies of this information directly with a utility or third-party auditor without first obtaining the resident's written consent. They said some residents, mainly the elderly, would not share income information with another party. However, when asked by the utility, the property managers did seem open to having an auditor verify income information in their files, which would not require additional customer consent as long as no documentation was taken of the confidential information.

The past 30 days or four weeks of income for all occupants over 18 is typically used to qualify customers based on income. The PUCT Lifeline program, however, uses the past 60 days of income.Both federal poverty level and area median income were used for income eligibility for benchmarked programs. Eligible incomes used were either up to 150 percent of the federal poverty level (FPL), 200 of the FPL, or 80 percent of the area median income. There was some discussion that area median income may be a better qualifier to more appropriately serve low-income customers in higher-cost living areas of the state.

Table 16 categorizes the income verification approaches of the benchmarked programs and compares them to the current Texas energy efficiency program processes.

Table 16. Income Verification Summary

Income verification approach	Approach description	Applicable utility/program administrator	Comparison to Texas energy efficiency programs
Customers apply to the program and provide proof of other eligible program participation or prior two months of income	Customers can apply and submit required documentation either online or via mail to a third-party firm that the PUCT hires.	• PUCT Lifeline	Service providers, as opposed to customers, initiate the program application.

Income verification approach	Approach description	Applicable utility/program administrator	Comparison to Texas energy efficiency programs
Multifamily subsidized housing property	Includes federal agency certification of whole properties (HUD), but also others such as USDA or local tax abatement programs.	• CPS Energy • DTE • KCP&L	Multifamily Category 1 options allow participation based on certifications and require documentation. The current process fully meets this approach.
Individual subsidized housing	Individual certification or award letter of federal (HUD), state, county, or city program that requires income certification.	• CPS Energy • DTE • KCP&L • CT	Property managers report income under Category 2 income verification. It is not clear how they know individual incomes. Interviews with property managers are needed to clarify.
Program administrator leads documentation collection	Documentation is collected by the utility, implementation contractor, other third party, or installer. Acceptable documentation varied by utility but includes paycheck stubs, annuity letters, 1099 forms, pension letters, social security award letters, bank statements, and unemployment benefit letters.	• CPS Energy • DTE • KCP&L • CT	Service providers submit forms to utilities, but backup documentation is only requested for multifamily Category 1 qualified housing. There was consensus on utility interviews that service providers should not collect customer documentation with PII.
Self-declaration of income	Notarization or signed affidavit of income is required of the participant.	• CPS Energy • CT	Individual income self-certification requires a signature under penalty of perjury, similar to the current approach.
Required application or participation in another program	Required online application and third-party that provides services and verifies income.	• FirstEnergy	Category 1 qualifies through participation in other services but does not request proof of other services for single-family.

Income verification approach	Approach description	Applicable utility/program administrator	Comparison to Texas energy efficiency programs
Services delivered through an agency that income qualifies for numerous programs	The utility works with an agency that serves the low-income sector and has already income-qualified participants for other services.	• ComEd	Utilities work with low-income agencies with access to Low-Income Home Energy Assistance Program (LIHEAP) lists as part of the targeted low-income weatherization program.
Qualified census tract	All properties located in a HUD-defined "qualified census tract" are eligible. HUD determines these tracts annually and uses an interactive map on the HUD website.	• DTE	Not currently done; however, Oncor has shared similar looks they have done by zip code.

4.4 MARKET TRANSFORMATION PROGRAMS

The EM&V team reviewed residential smart thermostat programs with midstream or upstream delivery as part of the PY2020 program evaluation. The evaluation for these programs focused on a documentation review. There were no savings adjustments made for this program.

Smart thermostats were offered as part of the Smart Thermostat or Retail MTPs and were implemented through an upstream delivery. These programs provide incentives to residential and small commercial customers through in-store discounts for qualifying ENERGY STAR-connected thermostats. The programs partner with retailers or the third-party internet marketplace to apply a discount for smart thermostats at the point of sale to qualifying customers.

4.4.1 Key Findings and Recommendations

Key Finding #1: Due to the nature of the upstream or midstream program delivery, documentation requirements differ from that of an SOP. The EM&V team reviewed monthly store invoices, aggregate customer data, quantity purchased, and model numbers of purchased measures and determined sufficient documentation was provided for all programs and savings were verifiable.

Recommendation #1: Continue internal quality control and quality assurance processes, as they appear to be working well in producing verifiable results and correctly inputting parameters.

Key Finding #2: The EM&V team provided guidance on calculating and allocating savings at the sector level for upstream and midstream lighting programs to account for the cross-over between small commercial and residential applications. As these programs expand to more measure offerings, the 95 percent residential and five percent commercial cost and benefit allocation assumptions should carry over to the additional measures beyond lighting.

Recommendation #2: Update the TRM to expand the allocation guidance outlined in the *Upstream/Midstream Program Cross-Sector Savings* EM&V guidance memo to all measures sold through participating upstream and midstream programs where the installation location is unknown.

Key Finding #3: The upstream and midstream delivery is highly cost-effective. The EM&V team calculated results for these programs between 6.2 and 12.1 for the residential sector and higher for the commercial sector. The commercial sector applies higher savings assumptions, resulting in higher cost-effectiveness results. Incorporating guidance for upstream delivery of additional measures and extending to commercial applications would benefit utility programs.

Recommendation #3: Explore additional measures for upstream and midstream programs and consider extending to commercial measures where applicable. .

5.0 CROSS-SECTOR PROGRAMS OR MEASURES

This section summarizes the key findings and recommendations from the PY2020 evaluation of cross-sector projects. Solar photovoltaic (PV) programs were a *medium* evaluation priority, and the CoolSaver AC Tune-Up Market Transformation Program (MTP) was a *low* priority in PY2020. The recommendations are to be considered by the utilities for PY2022 implementation and will also be incorporated into the PY2022 Texas Technical Reference Manual (TRM) 9.0 as appropriate. Results from the evaluation of the load management programs are described in Section 6.0.

5.1 PROGRAMS OVERVIEW

CoolSaver AC Tune-Up MTP: The CoolSaver AC Tune-Up MTP is designed to overcome market barriers that prevent residential and commercial customers from receiving high-performance AC system tune-ups. The program works through local AC distributor networks to offer key program components, including (1) training and certifying AC technicians on protocols and tune-up and airflow correction services, and (2) paying incentives to AC contactors for the successful implementation of AC tune-up and airflow correction services. Contractors who wish to participate in the program enter into a contractor partnering agreement that specifies the program requirements. Contractors are trained on the AC tune-up process and given incentives and discounts for the cost of field equipment designed to diagnose and quantify energy savings opportunities. Energy savings are captured through the correction of AC system inefficiencies identified during the tune-up activities.

Solar Photovoltaic MTP: The Solar PV MTP offers financial incentives for installing eligible distributed solar energy generation equipment on the premises of customers served by the utilities. These programs are available to utility customers, including residential customers, businesses, and schools. The utility has a limited group of energy efficiency service providers determined through a selection process based on meeting minimum eligibility criteria, complying with all program rules and procedures, and submitting documentation describing their projects.

5.2 SUMMARY RESULTS FOR SOLAR PV

This section presents results for (1) the Solar PV SOP and SMART Source Solar PV MTP that were *medium* evaluation priorities in PY2020, and (2) solar PV measures included in other MTP programs.

5.2.1 Evaluation, Measurement, and Verification Overview

The EM&V team conducted desk reviews for a sample of projects from the *high* and *medium* priority commercial SOP and MTP programs that included solar PV measures. For the desk reviews, the EM&V team applied the method prescribed in Texas PY2020 TRM 7.0 to verify energy savings and demand reduction for each project sampled. Comparing the evaluated savings to the utility-claimed savings showed agreement in most cases. The average realization rates across all solar PV measures were 101.8 percent and 101.2 percent for demand and

energy savings, respectively.[13] Based on the evaluation results, the EM&V team has outlined key findings and corresponding recommendations described below.

5.2.2 Key Findings and Recommendations

All key findings and recommendations outlined for the SOP programs in Section 3.4 are equally relevant to the large commercial MTPs (Commercial Solutions and SCORE). They include many of the same deemed and prescriptive calculations and use custom calculations and measurement and verification (M&V) methodology to claim savings for projects. These are the calculation methods that are discussed in the Large Commercial and Retro-Commissioning Findings and Recommendations sections (Section 3.3.2.1 and Section 3.3.2.2, respectively).

5.2.3 Program Overview

Solar PV project calculations are based on the installation contractor's application data and documentation or updated documentation following a utility's quality assurance/quality control (QA/QC) site visit. The documentation included technical specifications of the proposed equipment, system design parameters, and an estimation of the electricity production. The utilities used the system design and technical specifications to estimate the electricity production using the National Renewable Energy Laboratory (NREL) calculator, PV Watts®. The peak demand reduction (kilowatt) was determined using deemed savings factors provided in lookup tables in the TRM for various weather zones in Texas. In some cases, the documentation also included a shading study and QA/QC post-installation inspection findings. See Section 2.3, *Program Documentation*, for a discussion of the documentation provided for Solar PV measures.

In the PY2020 evaluation, the EM&V team noted that the utilities followed the calculation approach as described in the TRM. All solar PV projects sampled for evaluation review used the fixed deemed savings factors provided in the TRM for the relevant weather zone. The EM&V team also found that several solar PV projects deviated from the original application, potentially due to change in field conditions or equipment availability at the time of installation. In several cases, the project savings calculations were not updated to reflect the final project outcome.

Key findings and applicable recommendations are presented below based on the information gathered in reviews of solar PV projects for both commercial and residential applications.

5.2.4 Key Findings and Recommendations

Key Finding #1: Post-install inspection results were not consistently used to update claimed energy savings.

During the review of several solar PV measures, the EM&V team found that the post-install QA/QC findings completed by the utility were not reflected in the energy savings claimed. It is common for solar PV installations to vary from the project plan, and the utilities have documented the installed equipment. It appears that the preliminary ex-ante savings estimate was not updated with the installed ex-ante savings estimate.

[13] These are realization rates prior to utilities adjusting savings based solely on evaluated results.

This finding was identified in the last evaluation of the solar PV programs in the PY2017 evaluation.

Recommendation #1: Implement a process to ensure claimed ex-ante savings represent the system installed.

6.0 LOAD MANAGEMENT PROGRAMS

This section summarizes the key findings and recommendations from the PY2020 evaluation of commercial and residential load management programs. Load management programs were designated as *medium* evaluation priorities in PY2020 due to their significant contribution to capacity (kilowatt) savings. . The recommendations are to be considered by the utilities for PY2022 implementation and will also be incorporated into the PY2022 Texas Technical Reference Manual (TRM) 9.0 as appropriate.

6.1 PROGRAMS OVERVIEW

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

While each utility operates a unique load management program, there are many similarities among them. In general, a dispatch event may be called at the utility's discretion 30 to 60 minutes in advance of a curtailment event, which generally lasts one to four hours. In most cases, the utility reserves the right to call a certain number of curtailment events per season, ranging from 5 to 15, based on utility. Customers must meet several eligibility requirements, including but not limited to (1) taking service at the distribution level, (2) meeting minimum demand requirements, and (3) being equipped with interval data recorder metering. Customers cannot participate in other load management programs using the same curtailable loads simultaneously (i.e., *double-dipping*).

Participants can either curtail their contracted load during a load control event or opt-out if they wish not to participate. Participants receive an incentive based on the kilowatts that they curtail during the event. Savings for kilowatt and kilowatt-hours are calculated by following the methodology described in PY2020 TRM 7.0, and an incentive is given to a participant based on the amount of kilowatts saved. This incentive amount is specified in an agreement with the utility when enrolling in the program and ranges from $15 to $50 per kilowatt saved.

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

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

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

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

6.2 OVERALL

This section presents statewide summary results, followed by key findings and recommendations from all relevant EM&V activities.

6.2.1 Key Findings and Recommendations

Key Finding #1: Utilities Load management programs have grown in recent years, with PY2020 representing both the largest number of participants and the amount of available demand reduction. Under the current energy efficiency rule § 25.181, curtailment events may only be called during summer peak periods.

Recommendation #1: Explore opportunities to increase the value of the peak load relief available through the programs year-round in future rule-making discussions.

Key Finding #2: Utilities continue to demonstrate strong capabilities to apply the TRM calculation method to savings.

PY2020 is the fifth year in which utilities and the EM&V team have applied the demand savings algorithm for commercial load management programs. Overall, the utilities applied the *high 5 of 10* method correctly to savings and matched the EM&V team's evaluated savings. Similarly, the two utilities that applied the *high 3 of 5* method to savings to their residential programs did so correctly and matched the EM&V team's evaluated savings.

Recommendation #2: Continue implementing the demand savings algorithm described in the TRM and keep active communications with the EM&V team to resolve minor discrepancies in savings calculations to ensure consistency across utilities and enhance overall accuracy and transparency.

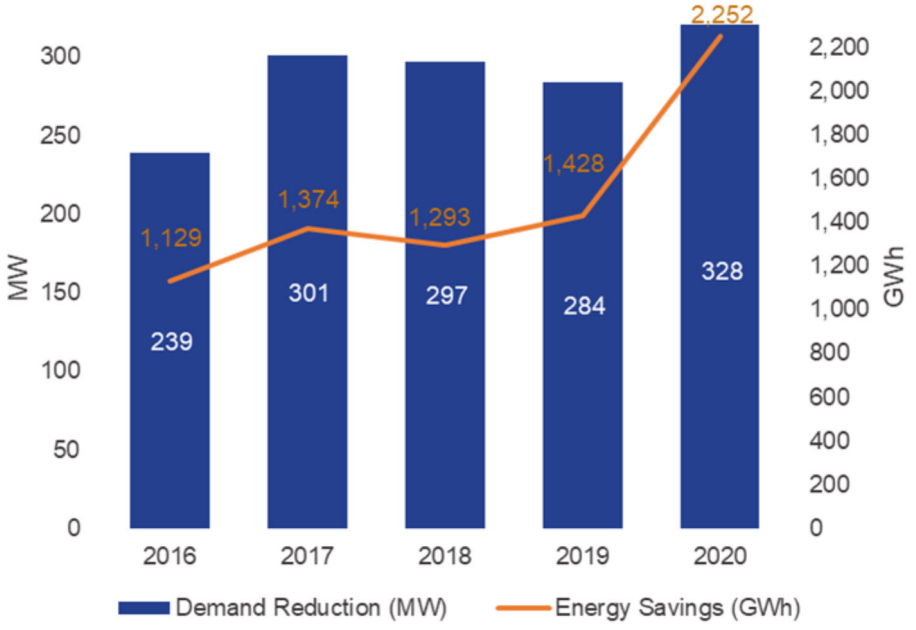
6.2.2 Savings

The total evaluated gross savings of the programs were:

- 327,829 kW (demand reduction), and
- 2,251,558 kWh (energy savings).

These results show a significant increase compared to PY2019, by roughly 44 MW (44,000 kW). Figure 20 summarizes evaluated megawatt and megawatt hour savings of all load management programs from PY2015 to PY2020.

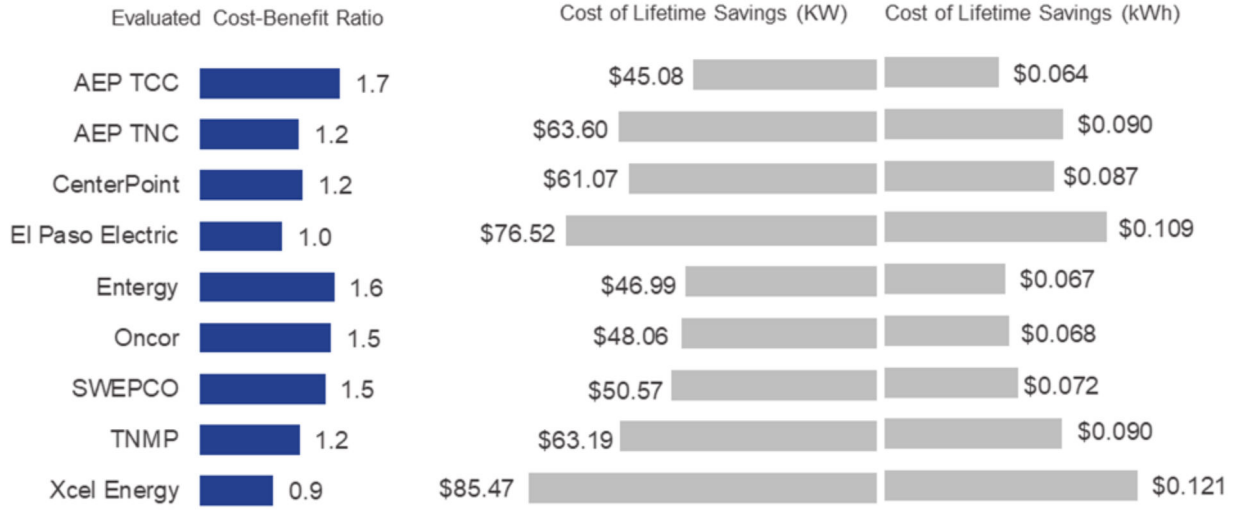
Figure 20. Total Statewide Evaluated Gross Demand Reduction and Energy Savings by Program Year—Load Management Programs PY2016–PY2020



6.2.3 Cost-Effectiveness

Figure 21 summarizes the cost-effectiveness of each utility's energy efficiency portfolio based on evaluated savings of all load management programs in PY2020. Most portfolios were cost-effective, ranging from 0.9 to 1.7. The cost per kW ranged from $45.08 to $85.47, and the cost per kilowatt-hour ranged from $0.064 to $0.121. These costs provide an alternate way of describing the cost-effectiveness of a portfolio of programs. Those portfolios with a higher cost-effectiveness ratio will have a lower cost to acquire savings and vice versa.

Figure 21. Evaluated Cost-Benefit Ratio and Cost of Lifetime Savings—Load Management Programs PY2020



6.3 COMMERCIAL

This section summarizes the key findings and recommendations from the PY2020 evaluation of the commercial load management programs offered by the nine Texas utilities.

The EM&V team applied the savings calculation methodology prescribed in PY2020 TRM 7.0 on a census of records to calculate energy savings and demand reductions from interval meter data.

6.3.1 Key Findings and Recommendations

Key Finding #1: Texas commercial load management programs effectively increase commercial load participants despite lower participation in PY2020 because of the COVID-19 pandemic.

As measured by the number of customers, participation has fluctuated annually in the past years but remained relatively stable, with about 600 commercial participants until PY2018. In the past two years, participation increased to about 750 in PY2019 and 711 in PY2020, resulting in higher savings. Although 807 participants enrolled in the programs in PY2020, only 711 were able to curtail their electric load during the curtailment events. Many customers could not participate because of the COVID-19 pandemic,' and a few customers were not called because they needed to operate at full capacity (e.g., hospitals).

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

Recommendation #1b: Consider using the results of the annual test event to modify program-contract estimates of available demand reduction.

Key Finding #2: Minor discrepancies in savings calculation results continue due to different rounding practices.

The EM&V team provided new guidance on rounding practices in the PY2021 TRM 8.0 Volume 5 to avoid minor discrepancies in savings calculations. While rounding differences create only minor discrepancies in calculations, the differences have the potential to sum to a level that creates confusion or doubt. Applying a standard practice, or documenting differences, will reduce the burden on the utilities and EM&V team (as discrepancies are investigated after initial calculations are developed). This recommendation is a repeat from PY2019 and is included again as a reminder for PY2021.

Recommendation #2: Starting PY2021, follow the new guidance in PY 2020 TRM 8.0 Volume 5 to improve the consistency and transparency of savings calculations going forward.

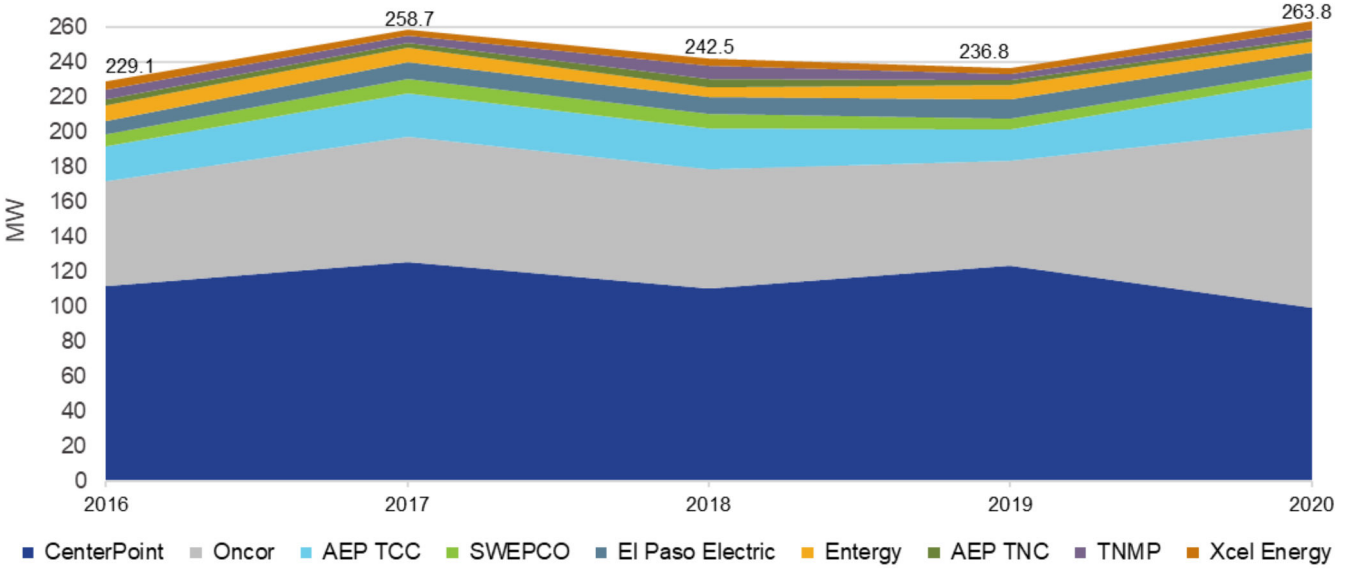
6.3.2 Impact Results

The total PY2020 evaluated savings of all nine commercial load management programs were:

- 263,790 (demand reduction) kW, and
- 1,560,020 (energy savings) kWh.

The PY2020 evaluated savings show a significant increase compared to PY2019, by roughly 27 MW. CenterPoint has the most significant savings among the utilities' commercial load management programs, followed by Oncor. Figure 22 shows total kW savings from commercial load management programs by program year.

Figure 22. Evaluated Demand Savings of Commercial Load Management Programs PY2016–2020



Demand savings calculations from each utility were mainly calculated the same as the evaluation calculations. There were no cases in which adjustments had to be made to individual meter savings calculations. This result supports the fact that both the EM&V team and the implementer and utilities follow the TRM algorithm for savings calculation the same way. While the TRM methodology was followed correctly by all utilities, the realization rates for commercial load management programs were not 100 percent in PY2020. The reason for this discrepancy is that, when comparing individual meter savings for one of the commercial load management programs, it was found that the utility was following a conservative approach by not setting savings to zero in cases where the calculation methodology produced negative savings. Per PY2019 TRM 6.0, in cases where the savings algorithm produces negative savings, the negative savings can be set to zero. As a result, commercial load management programs received a realization rate of 101 percent for kilowatts and kilowatt-hours.

6.4 RESIDENTIAL

This section summarizes the key findings and recommendations from the PY2020 evaluation of three Texas utilities' residential load management programs (Oncor, CenterPoint Energy, and El Paso Electric). Other utilities did not offer a residential load management program.

Two utilities calculated savings using interval meter data following the *high 3 of 5* method; the third utility used *deemed savings* method from PY2020 TRM 7.0.

6.4.1 Key Findings and Recommendations

Key Finding #1: Confusion surrounding language in the PY2019 TRM 6.0 on applying the *deemed savings* method has been resolved, although documentation for participating thermostat devices may be improved.

TRM language related to the *deemed savings* method has been worked through in the last couple of years, and there is now a mutual understanding of the approach. The utility, implementer, and EM&V team agreed on final demand savings calculations, although documentation for participating thermostat devices may be improved. Since the peak event files differ for each smart thermostat manufacturer, a clear description of the different data fields for each file accompanied with the calculation approach will facilitate the evaluation process.

Recommendation #1: The files provided to identify participating smart thermostat devices for the *deemed savings* method should include a description of the data fields and the calculation approach.

Key Finding #2: For the *deemed savings* method, there was some confusion in PY2020 on how to claim savings for smart thermostat devices sold through an online marketplace and enrolled in the residential load management program at the point of purchase.

Recommendation #2a: Savings for smart thermostat devices that did not participate in the curtailment events should be claimed through the smart thermostat or retail MTPs.

Recommendation #2b: Update the TRM to provide more guidance claiming savings for smart thermostats in such situations to avoid double-counting and enhance overall accuracy and transparency.

Key Finding #3: Minor discrepancies in savings calculation results continue due to different rounding practices.

The EM&V team provided new guidance on rounding practices in the PY2021 TRM 8.0 Volume 5 to avoid minor discrepancies in savings calculations. While rounding differences create only minor discrepancies in calculations, the differences have the potential to sum to a level that creates confusion or doubt. Applying a standard practice or documenting differences will reduce the burden on the utilities and EM&V team (as discrepancies are investigated after initial calculations are developed). This recommendation is a repeat from PY2019 and is included again as a reminder for PY2021.

Recommendation #3: Starting PY2020, follow the new guidance in the PY2021 TRM 8.0 Volume 5 to improve the consistency and transparency of savings calculations going forward.

6.4.2 Impact Results

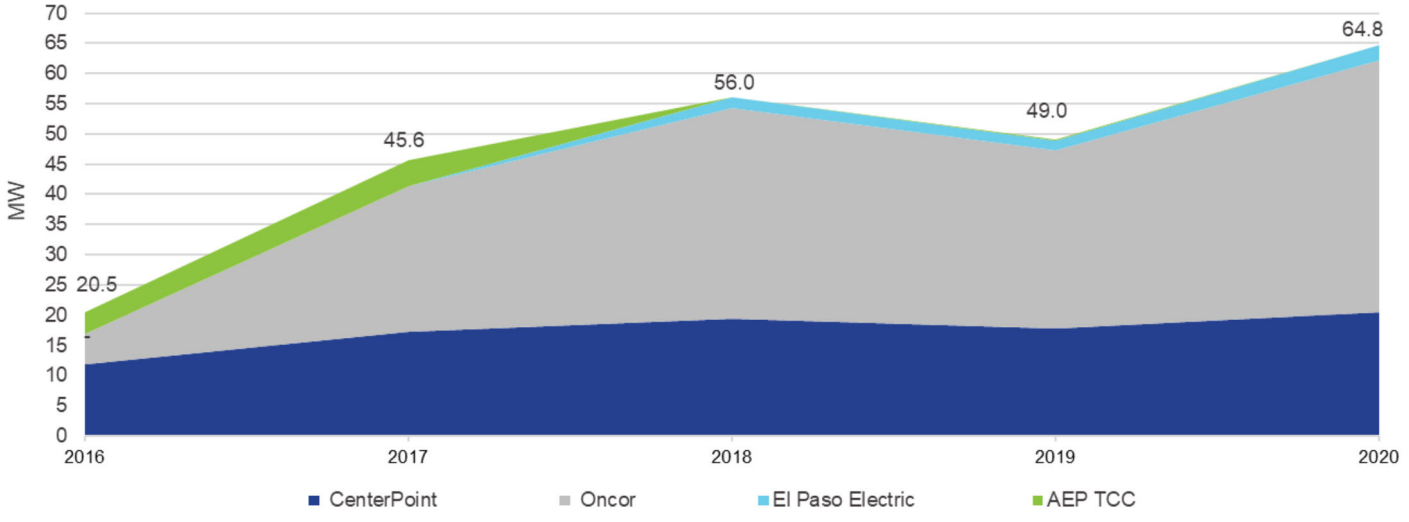
The total PY2020 evaluated savings for the three utilities (Oncor, CenterPoint Energy, and El Paso Electric) were:

- 64,779 kW (demand reduction), and
- 3,452,621 (energy savings) kWh.

These results show a significant increase in savings compared to PY2019, roughly 64.5 MW (64,779 kW). Figure 23 shows total kW savings from residential load management programs by program year. Note that AEP TCC offered a residential load management program for only two years (PY2016 and PY2017).

Oncor's and CenterPoint's programs have continuously operated over the past five years, while PY2020 was El Paso Electric's third year of implementation. Figure 23 shows total kilowatt savings from residential demand response programs by program year. Oncor has the most significant savings amongst the utilities' residential programs, followed by CenterPoint.

Figure 23. Evaluated Demand Savings of Residential Load Management Programs PY2016–2020



Public Utility Commission of Texas

Volume 2. Utility-Specific Energy Efficiency Portfolio Report Program Year 2020

TETRA TECH

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GLOSSARY: ACRONYMS/ABBREVIATIONS/DEFINITIONS

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

Acronym	Description
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
QPL	Qualified Products List
RCx	Retro-commissioning
RFP	Request for proposal
RMTP	Residential market transformation program
ROB	Replace-on-burnout
RSOP	Residential standard offer program
SIR	Savings-to-investment ratio
SOP	Standard offer program
SRA	Self-report approach
SWEPCO	Southwestern Electric Power Company
TMY	Typical meteorological year
TEESI	Texas Energy Engineering Services, Inc.
TNMP	Texas-New Mexico Power Company
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) 2020. It is a companion document to Volume 1 of the Statewide Energy Efficiency Portfolio Report. A summary report, *2020 Energy Efficiency Accomplishments*, is also available at www.puc.texas.gov.

PY2020 is the ninth program year evaluated as part of the statewide EM&V effort. The PY2020 scope is targeted impact evaluations for the savings areas of the highest uncertainty identified in the prior EM&V results or changes in programs or technologies. The targeted impact evaluations are concentrated on particular commercial and residential programs and end-uses. At the same time, a combination of interval meter data analysis and tracking system reviews provides a due diligence review of claimed savings for each utility portfolio.

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

The PY2020 EM&V plans[1] are based on the prioritization for the EM&V effort. To briefly summarize, the EM&V team identified program types across utilities that have similar program design, delivery, and target markets. We reviewed each program type and prioritized (*high*, *medium*, *low*) based on the following considerations:

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

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

1.1 REPORT ORGANIZATION

Section 1.2 summarizes the evaluation approach; Sections 2.0 through 10.0 detail the EM&V results for each utility's portfolio.

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

Detailed desk reviews are provided to utilities in separate documents.

1.2 EVALUATION APPROACH

This section discusses the PY2020 EM&V methodology. The foundation of the evaluation process was to create a statewide EM&V database with a streamlined data request process and a secure retrieval system. Complete PY2020 program data was requested from utilities and integrated into the database. A visual representation of the EM&V database import, review, and validation process can be found in Appendix A.

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

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

Next, the impact evaluation approach is summarized.

1.2.1 Implementing Impact Evaluations

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

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

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

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

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

1.2.1.1 Tracking System and Desk Reviews

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

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

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

1.2.1.2 Realization Rates

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