Public Utility Commission of Texas

Volume 1. Investor Owned Utilities (IOUs) Energy Efficiency Report Program Year 2023

TETRA TECH

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ACRONYMS

AEP	American Electric Power
C&I	Commercial and industrial
CNP	CenterPoint Energy Houston Electric, LLC
CSOP	Commercial standard offer program
DI	Direct install
EEIP	Energy efficiency implementation project
EECRF	Energy efficiency cost recovery factor
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.

EXECUTIVE SUMMARY

OVERVIEW

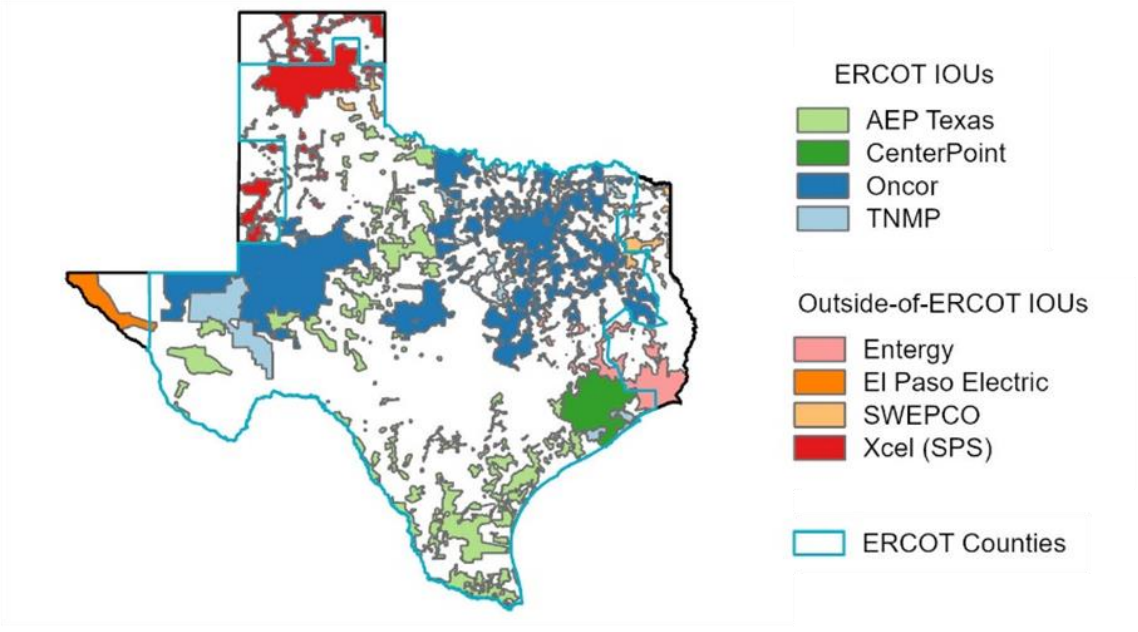
Texas has one of the longest histories in energy efficiency in the country, having established long-term demand reduction goals for investor-owned electric utilities ("IOUs" or "utilities") in Public Utility Regulatory Act (PURA) § 39.905 as part of its deregulation of the electricity market in 1999. Since 2013, legislated demand reduction goals for the IOUs have been at least 30 percent of annual demand growth. Further, once an IOU's 30 percent goal is equal to four-tenths of one percent of their summer weather-adjusted peak demand[1], the utility's demand reduction achievements must meet or exceed that goal in subsequent years.

The Public Utility Commission of Texas (PUCT) oversees the energy efficiency goals for the eight IOUs in Texas. The boundaries of the utilities' respective service territories are shown in Figure 1.

Four of the utilities operate within the Electric Reliability Council of Texas (ERCOT)[2] region: American Electric Power Texas, Inc. (AEP Texas), CenterPoint Energy Houston Electric, LLC (CenterPoint), Oncor Electric Delivery, LLC (Oncor), and Texas-New Mexico Power Company (TNMP). In this report, these four utilities are collectively referred to as the "ERCOT IOUs."

The other four utilities are vertically integrated and operate outside of the ERCOT region: Entergy Texas, Inc. (Entergy); El Paso Electric Company (EPE); Southwestern Electric Power Company (SWEPCO); and Southwestern Public Service Company (Xcel SPS). In this report, these four utilities are collectively referred to as the "outside-of-ERCOT IOUs."

Figure 1. Texas IOU Territories



[1] This higher demand goal is now required of AEP Texas, CenterPoint, and Oncor.
[2] ERCOT is the grid operator for about 90 percent of the Texas power load, www.ercot.com.

All IOUs operating in Texas administer the following programs to improve the energy efficiency of homes and businesses and reduce annual electric use and demand on the electric grid[3].

Standard offer programs (SOPs) deliver high-efficiency products and services to customers through financial incentives by utilities developing and working with the contractor infrastructure, such as insulation and HVAC contractors.

Market transformation programs (MTPs) provide outreach, technical assistance, and education to customers in harder-to-serve markets (e.g., small business, education, health care, data centers, and local governments), or for select technologies (e.g., recommissioning, air conditioner (AC) tune-ups, pool pumps). SOPs and MTPs are executed by IOU-selected implementation contractors. Two common MTP delivery models are 'midstream' and 'upstream,' where programs work directly with distributors and retailers to increase inventory of energy-efficient equipment while reducing additional efficiency-related costs.

All IOUs are required to provide energy-efficiency products and services to hard-to-reach (HTR) customers[4] through **HTR programs[5].** HTR programs have similar delivery models to residential SOPs.

The ERCOT IOUs are also required to offer **targeted low-income (LI) programs** that coordinate with the existing federal weatherization program[6].

Finally, all IOUs offer **load management programs**, which are designed to reduce peak demand for a specified duration—typically, two to four hours—if needed for either grid or local IOU system reliability. In program year (PY) 2023 (PY2023), all IOUs offered summer commercial load management programs as part of their energy efficiency portfolios, and the ERCOT IOUs additionally offered winter commercial load management programs.

Further, two ERCOT IOUs—CenterPoint and Oncor—and two outside-of-ERCOT IOUs—EPE and Entergy—offered residential summer load management programs.

[3] Industrial customers at distribution level voltage may also be served by IOU programs if they do not submit an identification notice to opt-out under 16 TAC §25.181(u).

[4] HTR customers are defined under 16 TAC §25.181(c)(27) as "residential customers with an annual household income at or below 200 percent of the federal poverty guidelines."

[5] Under 16 TAC § 25.181(e)(3)(F), all IOUs are required to achieve no less than five percent of their total demand reduction goal through programs serving HTR customers.

[6] Under 16 TAC § 25.181(r), ERCOT utilities are required to spend no less than ten percent of each program year's energy efficiency budget on targeted LI efficiency programs Outside-of-ERCOT utilities may offer targeted LI programs, but are not required to in PURA §39.905.

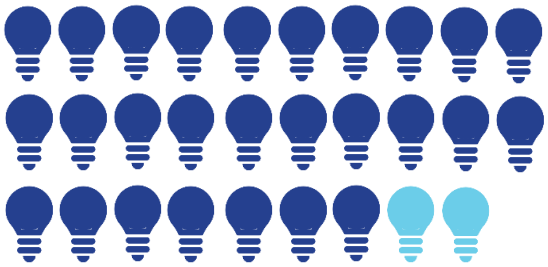
PROGRAM PARTICIPATION AND PERFORMANCE

In PY2023, **more than 141,788 residential households**[7] and **more than 30,811 commercial customers** participated in IOU energy efficiency programs. Program participation breakdowns are shown below by sector, program type, and ERCOT or outside-of-ERCOT region.

RESIDENTIAL PROGRAMS

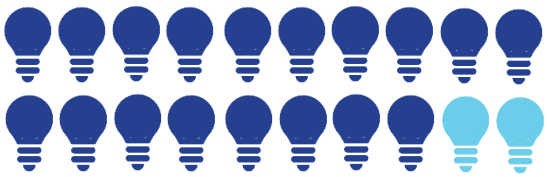
141,788+
PARTICIPATING RESIDENTIAL HOUSEHOLDS

ERCOT IOUs



- **27** energy efficiency programs
- **2** summer smart thermostat load management programs

OUTSIDE-of-ERCOT IOUs

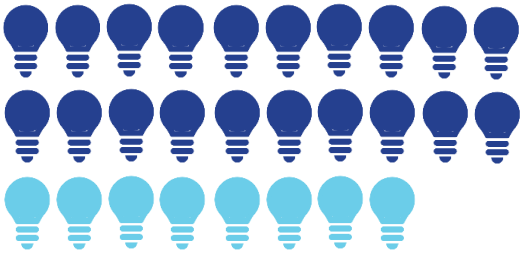


- **18** energy efficiency programs
- **2** summer smart thermostat load management programs[8]

COMMERCIAL PROGRAMS

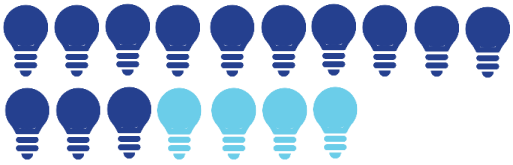
30,811+
PARTICIPATING COMMERCIAL CUSTOMERS

ERCOT IOUs



- **20** energy efficiency programs
- **8** load management programs (4 summer, 4 winter)

OUTSIDE-of-ERCOT IOUs



- **13** energy efficiency programs
- **4** load management programs (summer)

[7] Participation counts do not include energy efficiency measures delivered through retailer point-of-purchase discounts.

[8] While not a stand-alone program, Entergy piloted a load management component in its PY2023 Residential MTP.

PY2023 DEMAND REDUCTIONS

In PY2023, the eight IOUs reported total demand reductions of 580.6 megawatts (MW). These demand reductions were achieved at a lifetime cost of $15.54 per kilowatt for energy efficiency programs and $49.25 per kilowatt for load management programs.[9] Energy efficiency program savings have a longer estimated useful life (e.g., 15 years for an efficient HVAC), whereas load management program savings are based on annual participation, which increases the cost per kW for the load management programs.

DEMAND REDUCTIONS

580.596 MW

520.105 MW
delivered through ERCOT IOU programs

60.491 MW
delivered through outside-of-ERCOT IOU programs

DEMAND REDUCTIONS

$15.54/kW
achieved lifetime cost for energy efficiency

$49.25/kW
achieved lifetime cost for load management

Table 1 below shows the top five performing programs in terms of demand reductions (*Top MW savers*) for both ERCOT and outside-of-ERCOT IOU programs.

Table 1. Top Performers by Megawatt—ERCOT and Outside-of-ERCOT IOU Programs

ERCOT IOU programs	Outside-of-ERCOT IOU programs
Top MW savers	**Top MW savers**
CenterPoint Commercial Load Management	**EPE** Residential Load Management MTP
Oncor Commercial Load Management SOP	**Entergy** Commercial Load Management SOP
AEP Texas Load Management SOP	**Entergy** Commercial Solutions MTP
CenterPoint Residential Load Management	**EPE** Commercial Load Management SOP
Oncor Residential Load Management	**SWEPCO** Commercial Load Management SOP

[9] Lifetime cost per kilowatt and kilowatt-hour is calculated by the EM&V team as a representation of program cost-effectiveness. See Section 2.0 of the full report for more information.

PY2023 ENERGY SAVINGS

In PY2023, the IOUs reported energy savings of 604.222 gigawatt-hours (GWh) at a lifetime cost of $0.018 per kWh for the ERCOT IOUs and $0.017 for the outside-of-ERCOT IOUs.

ELECTRICITY SAVINGS

604.2 GWh

506.6 GWh
delivered through ERCOT IOU programs

97.7 GWh
delivered through outside-of-ERCOT IOU programs

KILOWATT-HOUR REDUCTIONS

$0.018/kWh
achieved lifetime cost through ERCOT IOUs

$0.017/kWh
achieved lifetime cost through outside-of-ERCOT IOUs

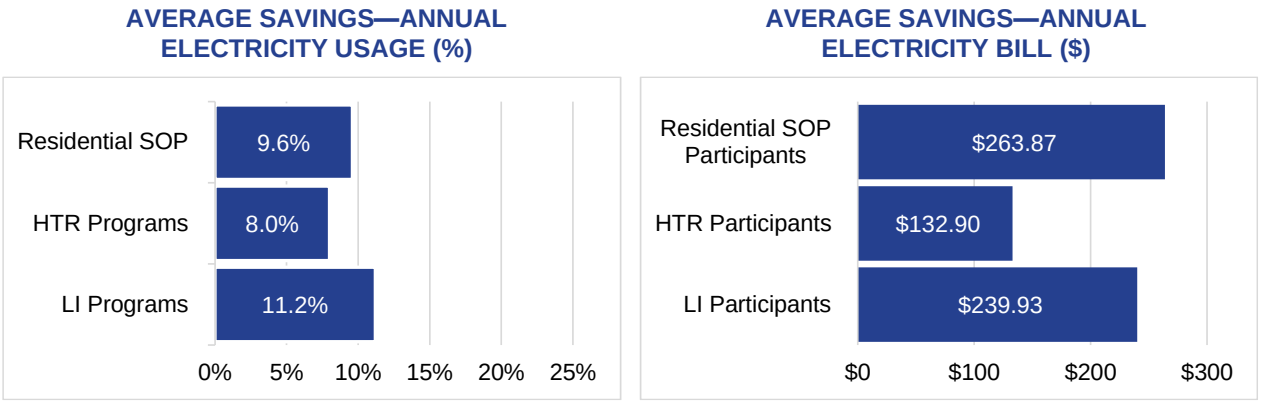
Table 2 below shows the top five performing programs in terms of energy savings (*Top MWh savers*) for both ERCOT and outside-of-ERCOT IOU programs.

Table 2. Top Performers by Megawatt-Hour Saved—ERCOT and Outside-of-ERCOT IOU Programs

ERCOT IOU programs	Outside-of-ERCOT IOU programs
Top MWh savers	**Top MWh savers**
Oncor Retail Products MTP (residential)	**Entergy** Commercial Solutions MTP
CenterPoint Commercial SOP	**EPE** Large Commercial Solutions MTP
Oncor Commercial SOP	**Xcel** Home Lighting MTP (residential)
CenterPoint Commercial MTP (SCORE, Healthcare, Data Center)	**EPE** Texas SCORE MTP
CenterPoint High-Efficiency Home MTP	**Entergy** Residential Solutions MTP

The EM&V team conducted a consumption analysis of program participants' advanced meter infrastructure (AMI) data[10] from 12 months pre- and post-program participation and found that IOU residential retrofit programs are reducing energy usage and producing customer energy bill savings[11] (Figure 2).

Figure 2. AMI-Measured Average Annual Energy Savings for Residential Retrofit Programs



SERVING LOW-INCOME CUSTOMERS

All IOUs **met or exceeded** LI and HTR program goals

22,166
participating households served

34.890 MW reductions and
59,205.040 MWh savings delivered

11%
average annual reduction of LI household electricity use through ERCOT utilities' targeted LI programs

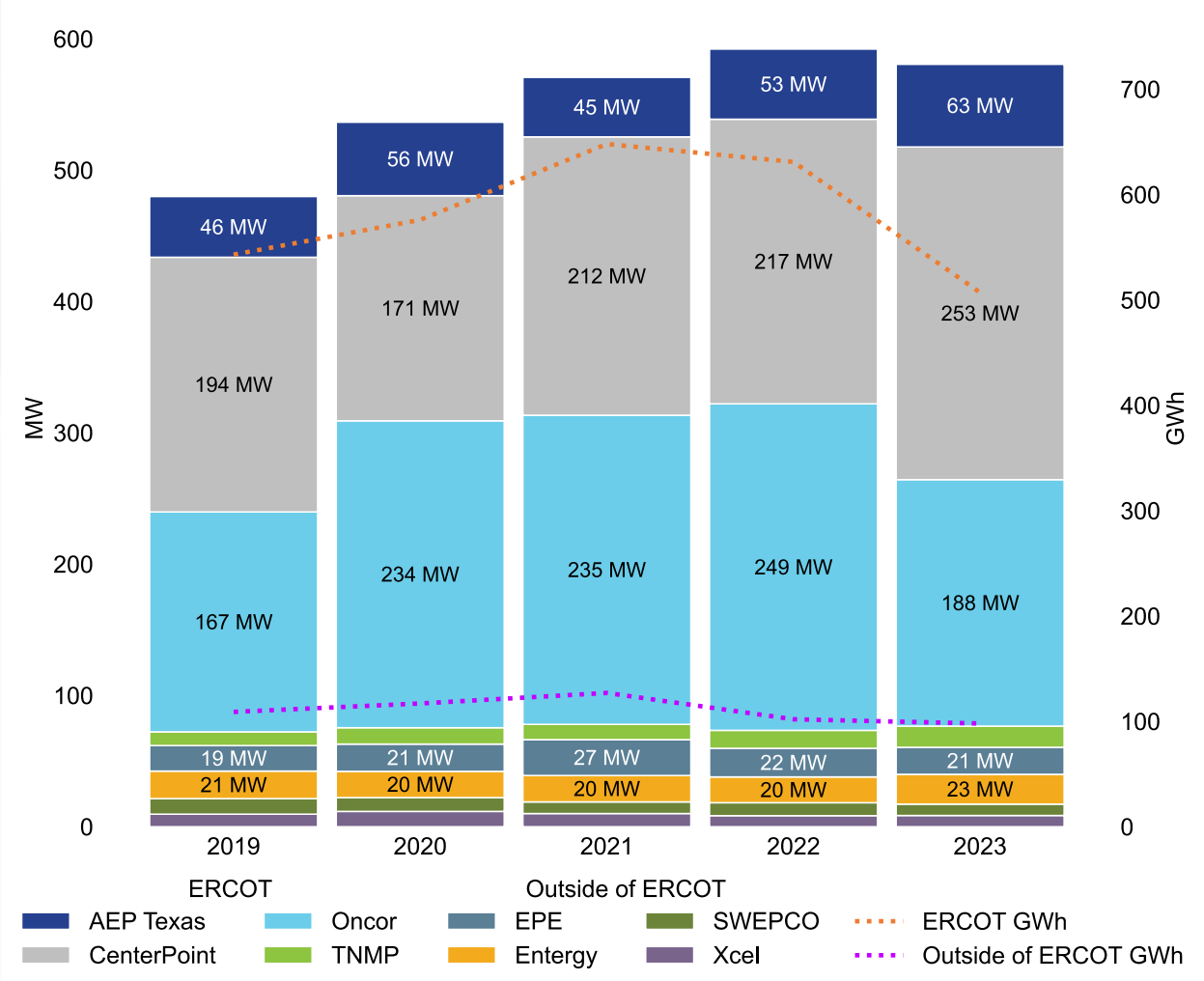
[10] The AMI analysis included PY2022 and PY2023 IOU residential retrofit programs. Five IOUs had residential AMI data to contribute for this time period: AEP Texas, CenterPoint, Entergy, Oncor, and TNMP. See Section 4 and Appendix A for details.

[11] Based on the average Texas electric retail rate of 9.14 cents/kWh, https://www.eia.gov/electricity/state/.

PY2019–PY2023

PY2023 saw a slight decrease in total demand reductions and energy savings across all portfolios, although this differed by IOU (Figure 3). Within ERCOT, both AEP Texas and CenterPoint had increased demand reductions, while Oncor's demand reductions decreased. Outside of ERCOT, Entergy had increased demand reductions while EPE's demand reductions decreased.

Figure 3. Total Texas IOU Portfolios—Demand Reductions and Energy Savings by IOU and Program Year, PY2019-PY2023[12]

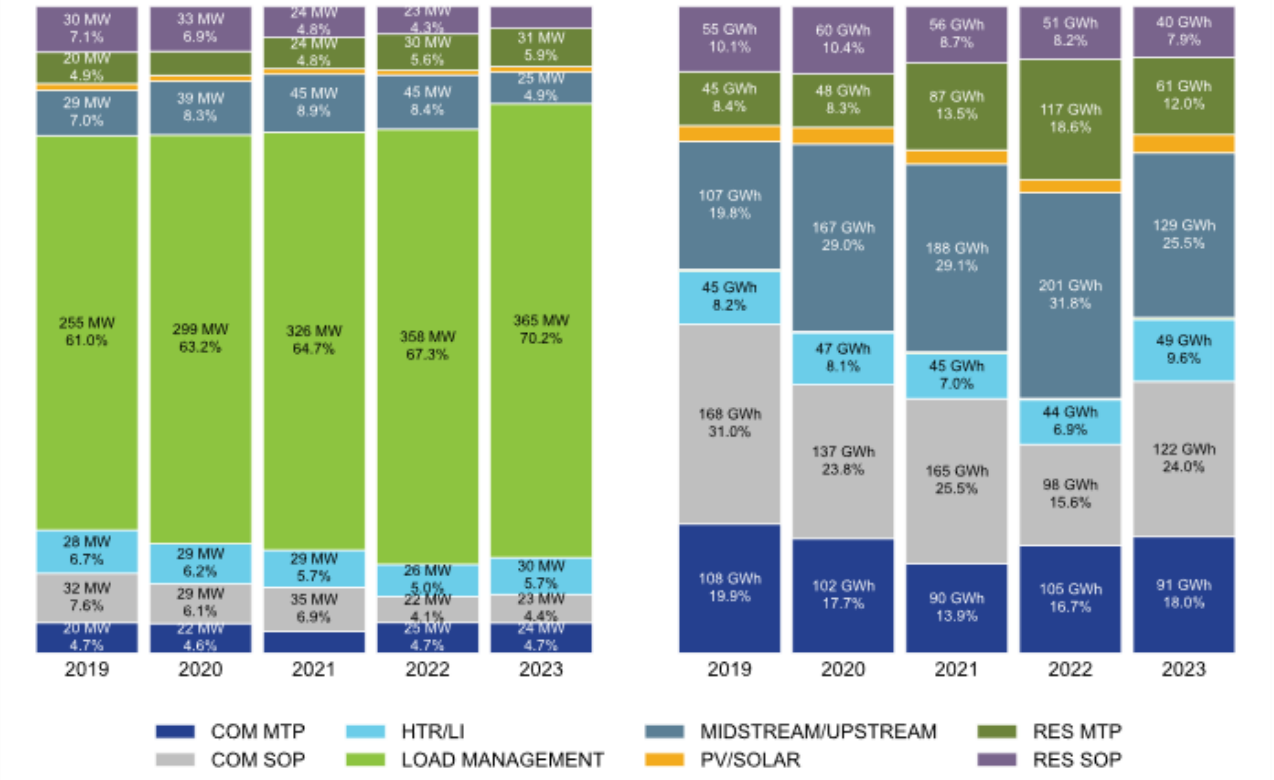


[12] PY2019-PY2023 demand reduction values not shown for TNMP, SWEPCO and Xcel due to size: TNMP achieved 10.43, 12.47, 11.63, 13.69 and 16.15 MW; SWEPCO achieved 11.83, 10.52, 8.857, 9.868, and 8.681 MW; and Xcel achieved 9.572, 11.67, 10.05, 8.431, and 8.558 MW.

In PY2023, ERCOT IOUs achieved 70 percent of demand reduction goals through load management programs, with the addition of winter load management programs as the main driver of the increased percentage from prior years (Figure 4).[13]

In terms of energy savings (Figure 4), upstream and midstream programs—in which residential customers are primarily served through retailers and commercial customers are primarily served through product distributors—have been increasingly attributable to ERCOT IOU portfolio savings in recent years. While these program types decreased to one-quarter of total ERCOT IOU portfolio savings in PY2023, this is primarily a result of changes to federal standards for residential lighting. In PY2023, Commercial SOPs accounted for approximately another one-quarter of total ERCOT IOU portfolio savings—similar to prior years except for PY2022, which saw a decreased percentage of savings from Commercial SOPs.

Figure 4. ERCOT IOU Programs – Demand Reductions and Energy Savings by Program Type, PY2019-PY2023[14]

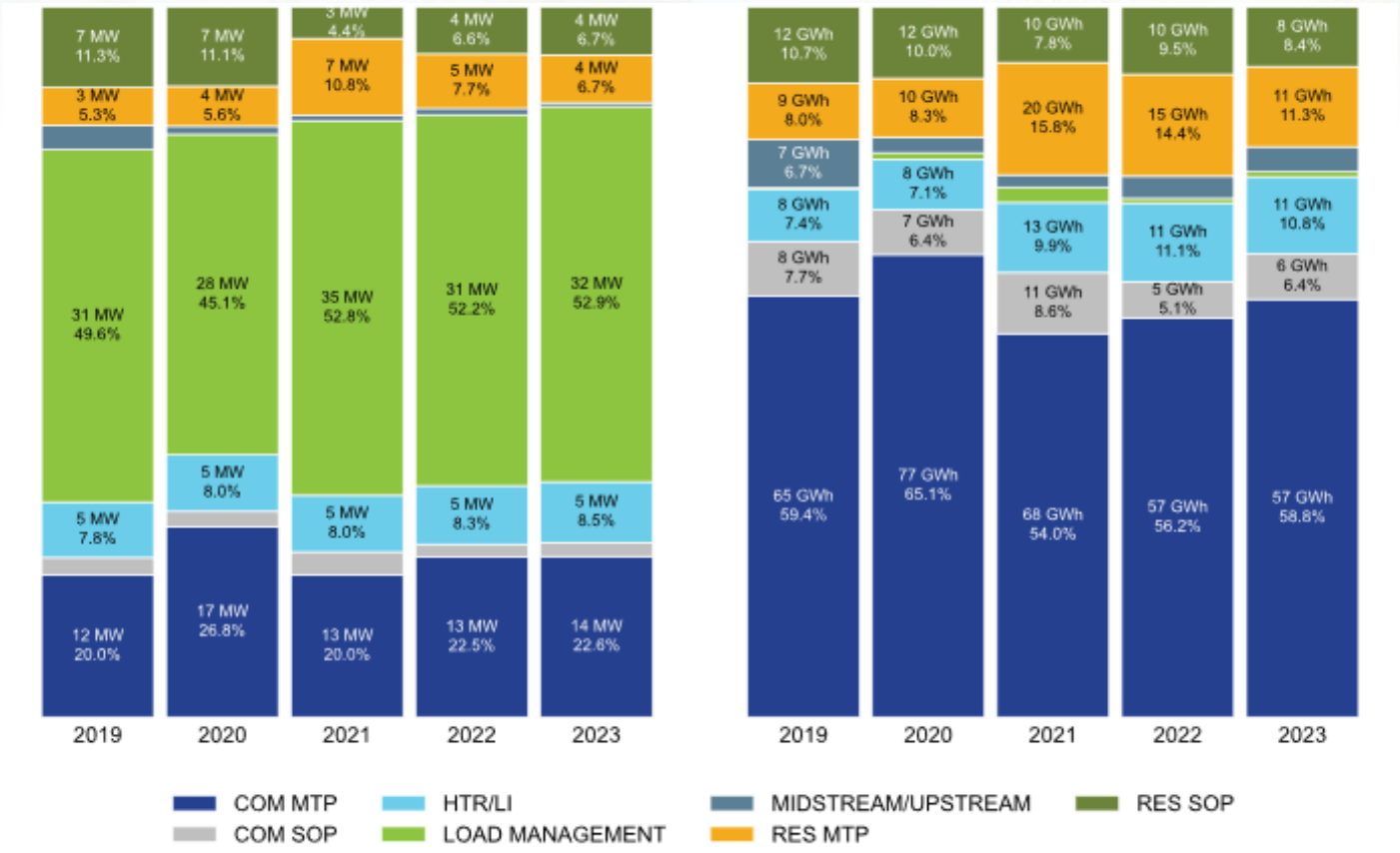


Just over one-half of demand reductions from outside-of-ERCOT IOU program were from load management programs in PY2023, followed by almost one-quarter of demand reductions from Commercial MTPs, which also had the largest percentage of savings for outside-of-ERCOT IOU programs (Figure 5).

[13] AEP Texas, CenterPoint, and TNMP added winter load management programs to their energy efficiency portfolios in PY2023. Oncor added winter load management programs starting in PY2022.

[14] Due to the magnitude of savings, demand reductions are reported in megawatts and energy savings are reported in gigawatt-hours.

Figure 5. Outside-of-ERCOT IOU Programs – Demand Reductions and Energy Savings by Program Type, PY2019-PY2023



PROGRAM BUDGETS AND COST-EFFECTIVENESS

In PY2023, IOU programs distributed a total of $121,968,130 in financial incentives to support the implementation of energy efficiency projects through technical assistance, project cost savings, and increased inventory and sales practices[15].

$121,968,130

IN FINANCIAL INCENTIVES

$102,680,963
through ERCOT IOU programs

$19,287,167
through outside-of-ERCOT programs

The IOU program cost-effectiveness test compares the benefits of a program to the costs, with a ratio over 1.0 representing a cost-effective program. Figure 6 overviews the avoided costs and cost-effectiveness ratios for all IOUs over the last five years—PY2019 to PY2023. Using this program administrator cost test (benefits divided by costs), the overall cost-effectiveness ratio has consistently remained above 2.0 for all IOUs. While PY2020 saw a high of 4.0, the cumulative cost-effectiveness of IOU programs remains healthy at 3.2 in PY2023. The higher cost-effectiveness ratios over the last four years have been largely due to the higher avoided costs of energy; avoided costs were slightly higher in PY2023 than in PY2022 but still less than PY2020 and PY2021.

Figure 6. IOU Portfolios Gross Benefit-Cost Ratio and Avoided Cost by Program Year, PY2019-PY2023

[15] Not including administration and other program costs. See Appendix C of the full report for detailed IOU program budgets.

Figure 7 summarizes the cost-effectiveness of each IOU's energy efficiency portfolio. All portfolios were cost-effective, with ratios ranging from 2.7 (TNMP) to 4. 1 (EPE). The lifetime cost per kilowatt ranged from $13.45 to $16.95 across utility portfolios, and the lifetime cost per kilowatt-hour ranged from $0.015 to $0.019. 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 7. PY2023 Savings Benefit-Cost Ratio and Cost of Lifetime Reductions and Savings

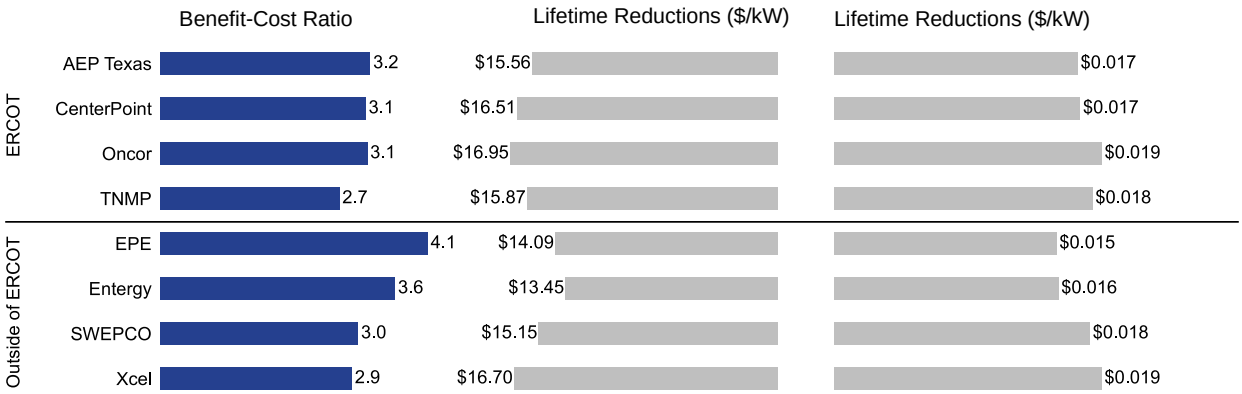


Table 3 below shows the top five performing programs across the IOUs in terms of cost-effectiveness for residential, LI, commercial, and load management programs.

Table 3. Most Cost-Effective Programs by Sector and Program Type

Residential programs	LI programs[16]	Commercial programs	Load management programs
Xcel Smart Thermostat MTP	**Oncor** Low-Income MF Smart Thermostat Direct Install (Pilot)	**Oncor** Retail Products MTP	**TNMP** Winter Load Management SOP
Oncor Retail Products MTP	**Oncor** Low-Income HVAC Tune-Up Program	**Xcel** Home Lighting MTP	**Entergy** Load Management SOP
Xcel Hard-to-Reach Food Bank	**TNMP** Low-Income Weatherization	**CenterPoint** Retail Products and Services Commercial MTP	**CenterPoint** Load Management SOP
CenterPoint Residential & Small Commercial SOP	**CenterPoint** Targeted Low-Income MTP (Agencies in Action)	**EPE** Texas SCORE MTP	**SWEPCO** Load Management SOP
AEP Texas SMART Sources Solar PV MTP	**Xcel** Low-Income Weatherization SOP	**EPE** Large C&I Solutions MTP	**AEP Texas** Load Management SOP

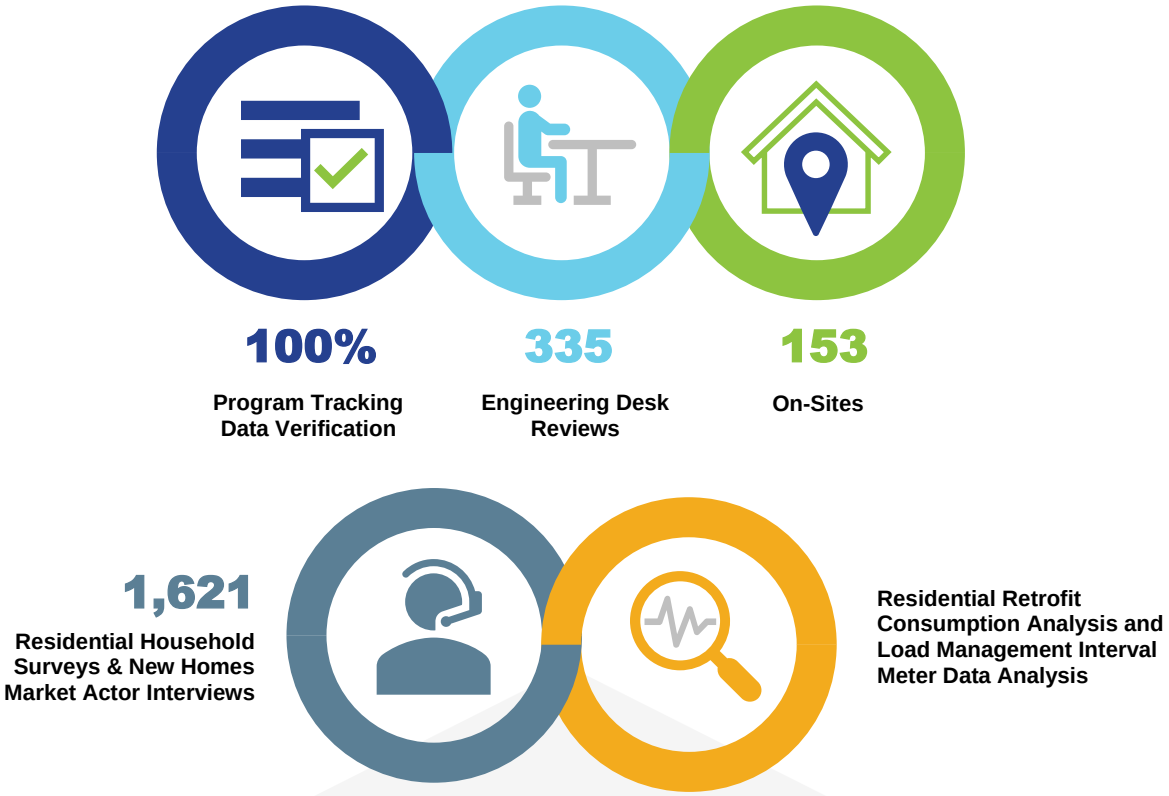
[16] This includes targeted LI programs where cost-effectiveness is calculated according to a savings-to-investment ratio (SIR). HTR programs also serve LI households, but cost-effectiveness is calculated through the program administrator cost test (PACT) and therefore are included in the residential programs column.

EVALUATION, MEASUREMENT, AND VERIFICATION OVERVIEW

The PUCT's EM&V contractor independently verifies utility-claimed savings across all programs through program tracking data. As summarized in Figure 8, 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. Additional activities are based on annual evaluation prioritization of *high*, *medium*, or *low* by program type, which is informed by the magnitude and uncertainty of savings, importance to future portfolio performance, and changes in the markets in which programs operate.

This IOU Energy Efficiency Portfolio Report presents the PY2023 EM&V findings and recommendations for all eight Texas IOU energy efficiency portfolios[17]. Additionally, this report addresses gross and net demand reductions and energy savings, program cost-effectiveness, provides feedback on program and portfolio performance, and informs annual updates to the Texas Technical Reference Manual (TRM).

Figure 8. PY2023 Evaluation, Measurement, and Verification Activities



[17] The EM&V framework is embodied in 16 TAC §25.181, relating to the Energy Efficiency Goal. During the 82nd Legislative Session in 2011, the Texas Legislature enacted Senate Bill 1125, which required the PUCT to develop an EM&V framework that promotes effective energy efficiency program design and consistent and streamlined reporting. Through the Request for Proposals 473-20-0002, Project No. 51021, the PUCT selected an independent, third-party EM&V contractor led by Tetra Tech that includes Texas Energy Engineering Services, Inc. and Energy Bees.

EM&V KEY FINDINGS

The IOU programs achieved many new and continued successes in PY2023. Broad program achievements include:

- successfully adjusting to decreased availability of lighting measure savings due to the new federal standards for general service lamps;
- increasing HVAC measures in multifamily and HTR sectors through new and expanded program efforts;
- increasing the quantity and quality of custom energy efficiency project analysis;
- doubling the number of smart thermostats incentivized through the programs; and
- employing new delivery models to serve diverse commercial sectors, such as the food service industry, through midstream offerings.

ERCOT IOUs included winter programs in their portfolios for the first time in PY2023[18], and both CenterPoint and Oncor expanded their load management offerings to accommodate deployment 24 hours/7 days a week.

Finally, IOU and stakeholder engagement in the PUCT-administered, EM&V team-facilitated Heat Pump Working Group identified both barriers and solutions for the next TRM update to encourage the widespread implementation of variable speed heat pump technologies through IOU programs (Figure 9).

Overall, the PY2023 EM&V that found utilities had improved program quality assurance/quality control (QA/QC) and training efforts, and the consumption analysis confirmed that prior updates to the TRM have resulted in more accurate deemed savings for residential retrofit measures.

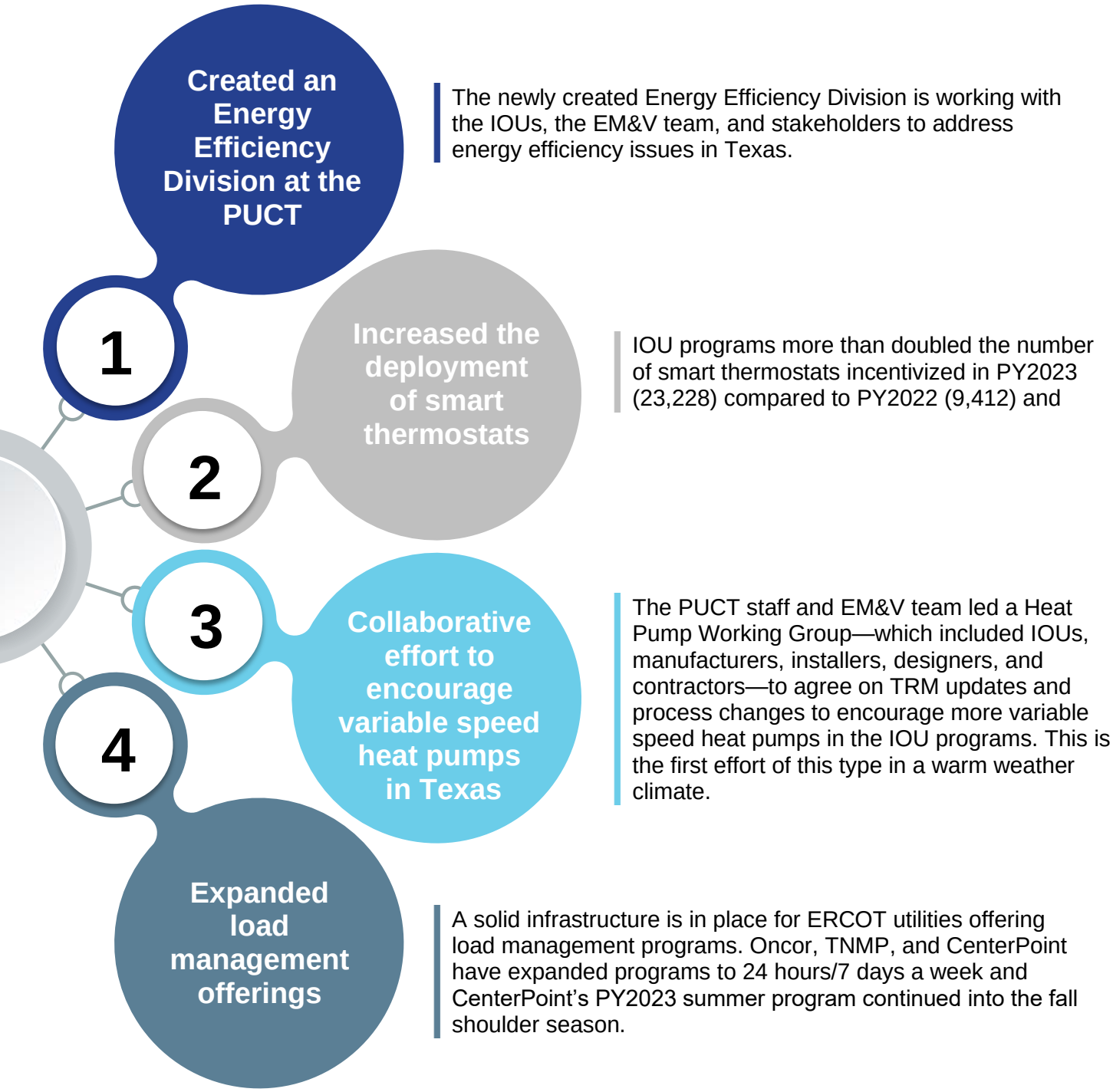
In addition to continued efforts by the EM&V team, the PUCT Energy Efficiency Division filed questions for stakeholder comment[19] regarding potential changes to current energy efficiency rules and practices. In response to stakeholder recommendations:

- the EM&V team added a low-income metrics section to this report, and
- the TRM Working Group is assessing the probability analysis of on-peak demand reductions for each hour of the day to determine if updates can better reflect the value of when energy efficiency savings occur.

[18] Oncor included a winter load management program in its PY2022 energy efficiency portfolio, with AEP Texas, CenterPoint and TNMP including winter programs in their portfolios starting in PY2023.

[19] Project No. 56517, Questions for Comment on Energy Efficiency, http://interchange/Document/List?controlNumber=56517.

Figure 9. Key Energy Efficiency Accomplishments



2.0 EM&V KEY FINDINGS AND RECOMMENDATIONS

This Investor-Owned-Utilities (IOU) Energy Efficiency Portfolio Report presents the program year (PY) 2023 (PY2023) evaluation, measurement, and verification (EM&V) key findings and recommendations, looking across all eight electric utilities' portfolios. The report addresses gross and net demand reductions and energy savings, program cost-effectiveness, and provides performance feedback. It includes findings and recommendations that inform the PY2025 Texas Technical Reference Manual (TRM) update process and PY2025 program design and delivery.

First, we overview the EM&V methodology and PY2023 activities. This is followed by PY2023 key findings and recommendations that are to be implemented in PY2025. Section 3 of this report discusses portfolio-level and cross-sector results, while Sections 4 through 6 of the report present the commercial, residential, and load management program results. Appendices provide detailed information referenced in Sections 1 through 6. Volumes 2 and 3 of this report detail PY2023 results for each utility's portfolio, with Volume 2 addressing ERCOT IOUs and Volume 3 addressing the outside-of-ERCOT IOUs.

2.1 EVALUATION, MEASUREMENT, AND VERIFICATION

The objectives of the EM&V effort are to:

- document gross and net demand reductions and energy savings of the utilities' energy efficiency portfolios;
- determine program cost-effectiveness;
- provide feedback to the PUCT, utilities, and other stakeholders on program and portfolio performance; and
- prepare and maintain a TRM.

The EM&V methodology is based on the prioritization for the EM&V effort that includes both PY2023 and the four-year EM&V contract period[20]. 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 the program or programmatic component (e.g., pilot, early implementation, mature);
- importance to future portfolio performance and priority to PUCT and Texas utilities,
- prior EM&V results; and
- known and anticipated changes in the markets in which the programs operate.

We conducted a streamlined EM&V effort that coupled broad due diligence verification of savings for all programs with targeted in-depth activities. These activities included 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.

[20] Appendix E contains the four-year EM&V contract period prioritization tables.

We carefully developed PY2020–PY2023 EM&V scopes across the four-year contract period to prioritize EM&V activities where they provided the greatest value. We implemented targeted in-depth impact evaluations for particular programs and end-uses. We coupled 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 prioritized evaluation efforts regarding the level of effort for utility programs each year and have summarized this prioritization by sector and program type below (see Appendix E for detailed prioritization tables).

Commercial.

The commercial sector has the largest savings programs; commercial standard offer programs (CSOP) and commercial market transformation programs (CMTP) are at least a *medium* priority across the four program years. These programs represent the largest percentage of IOU 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, a *medium* priority is justifiable across the four program years due to the savings contributions, the heterogeneity of projects and customer types, and the associated levels of uncertainty in savings. For PY2020 and PY2021, we placed a *high* priority on the largest commercial savers to conduct consumption analyses. The consumption analyses gauged the effectiveness of the TRM for *lighting* for key building types. The CSOPs and largest CMTPs were also a *high* priority in PY2021 to update the net-to-gross (NTG) information and collect key information identified in the PY2020 consumption analysis through participant surveys. Small business programs were designated a *medium* priority twice in the four years (PY2021 and PY2023). While these programs are not large contributors to IOU 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.

Residential.

We have categorized the residential standard offer programs (RSOP), hard-to-reach (HTR), and low-income (LI) programs as *high* evaluation priorities in PY2021 and PY2023.

These programs comprised a substantial percentage of residential sector portfolio savings in the last five years and responded to TRM updates to the *heat pump* (HP) and *envelope* measures in PY2021. The programs were evaluated via desk reviews, on-sites, a targeted consumption analysis for PY2021, and a full consumption analysis in PY2023, along with a residential household survey completed in 2024 for the PY2023 consumption analysis. We conducted RSOP participant surveys to update NTG information, collect key process information, and confirm measure installation in PY2021. The HTR and LI programs implemented new eligibility processes in PY2022; therefore, these programs were also a *high* priority in PY2022 to support this process improvement.

Residential new construction programs were a *medium* evaluation priority in PY2022 and a *high* evaluation priority in PY2023 with builder and rater interviews and an updated NTG ratio. With rising baselines, these programs will need to continue to push the market in future program years.

Upstream, Midstream, and Pilot MTPS.

Upstream and midstream programs are a growing part of utility portfolios and were designated a *high* priority in PY2023. The evaluation activities to be conducted included desk reviews for high-impact measures depending on the level of participation in each of these MTPs.

In PY2022, the Strategic Energy Management (SEM) pilot was a *medium* priority, but due to the complexity of this program and the size of projects, we designated it as a *medium* priority again in PY2023. Any other pilot programs in their second or third year of implementation are designated a *medium* priority to provide feedback about whether these pilots are viable options for full programs.

All other MTP program types are *low* priorities for evaluation because they are small contributors to portfolio savings, have little uncertainty in savings, have homogenous projects, and have already been designated as a *medium* evaluation priority once in the four-year evaluation cycle.

Cross-Sector.

Load management programs are designated a *medium* priority in most years due to their significant contribution to capacity demand reductions. In PY2023, the load management programs were designated a *medium* priority after being a *high* priority in PY2022.

In PY2023, residential air conditioner (AC) tune-ups were a *medium* priority. Comparatively, in PY2022, commercial AC tune-ups and photovoltaic (PV) programs were a *medium* priority. The PY2023 EM&V results include cross-sector AC tune-up results, given the methodology applies across sectors.

2.1.1 PY2023 EM&V Activities

Table 4 shows the EM&V activities completed by program type and evaluation priority. EM&V activities:

- verify that the measures and their associated savings are in program tracking systems;
- check 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 PY2023 TRM 10.0 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 project savings of at least ±5 percent;
- inform updates for the PY2025 TRM 12.0;
- provide performance feedback to improve program design, delivery, and reporting; and
- conduct cost-effectiveness testing using the *program administrator cost test* for savings results from all programs except targeted low-income (LI), which are calculated using the *savings-to-investment ratio*.

Table 4. PY2023 Evaluation, Measurement, and Verification Priorities and Activities

Program type	Evaluation priority	Claimed savings verification approach	Cost-effectiveness testing	Project desk reviews	On-sites	Surveys	Interval meter/ consumption data analysis
Commercial SOPs, commercial MTPs, and SCORE MTPs	Medium	Sampled (see desk reviews)	✓	154	74	N/A	Completed on individual sampled projects
Commercial pilots and retro-commissioning (RCx)	Medium	Sampled (see desk reviews)	✓	20	12	N/A	Completed on individual sampled projects
HVAC tune-ups	Medium	Sampled (see desk reviews)	✓	16	0	N/A	N/A
Solar PV	Medium	Sampled (see desk reviews)	✓	9	4	N/A	N/A
Commercial load management	Medium	Census	✓	N/A	N/A	N/A	Census
Residential load management	Medium	Census	✓	N/A	N/A	N/A	Census
Residential SOPs, LI, Hard-to-Reach (HTR)	High	Census	✓	N/A	N/A	1,609	Participant consumption analysis
Residential New Homes MTPs	High	Sampled (see desk reviews)	✓	24	N/A	12	N/A
Residential upstream/midstream MTPs	High	Sampled (see desk reviews)	✓	38	N/A	N/A	N/A
All other programs	Low	Census	✓	N/A	N/A	N/A	N/A

2.2 KEY FINDINGS AND RECOMMENDATIONS OVERVIEW

The utilities have demonstrated a willingness to work with PUCT staff and the EM&V team to improve the accuracy of claimed savings. Examples include utilities:

- adjusting claimed savings in response to EM&V findings;
- requesting M&V reviews or additional technical assistance throughout the program year; and
- implementing TRM or program changes.

Utilities responded to all PY2023 EM&V recommended savings adjustments to claimed savings, as identified in Table 5 below.

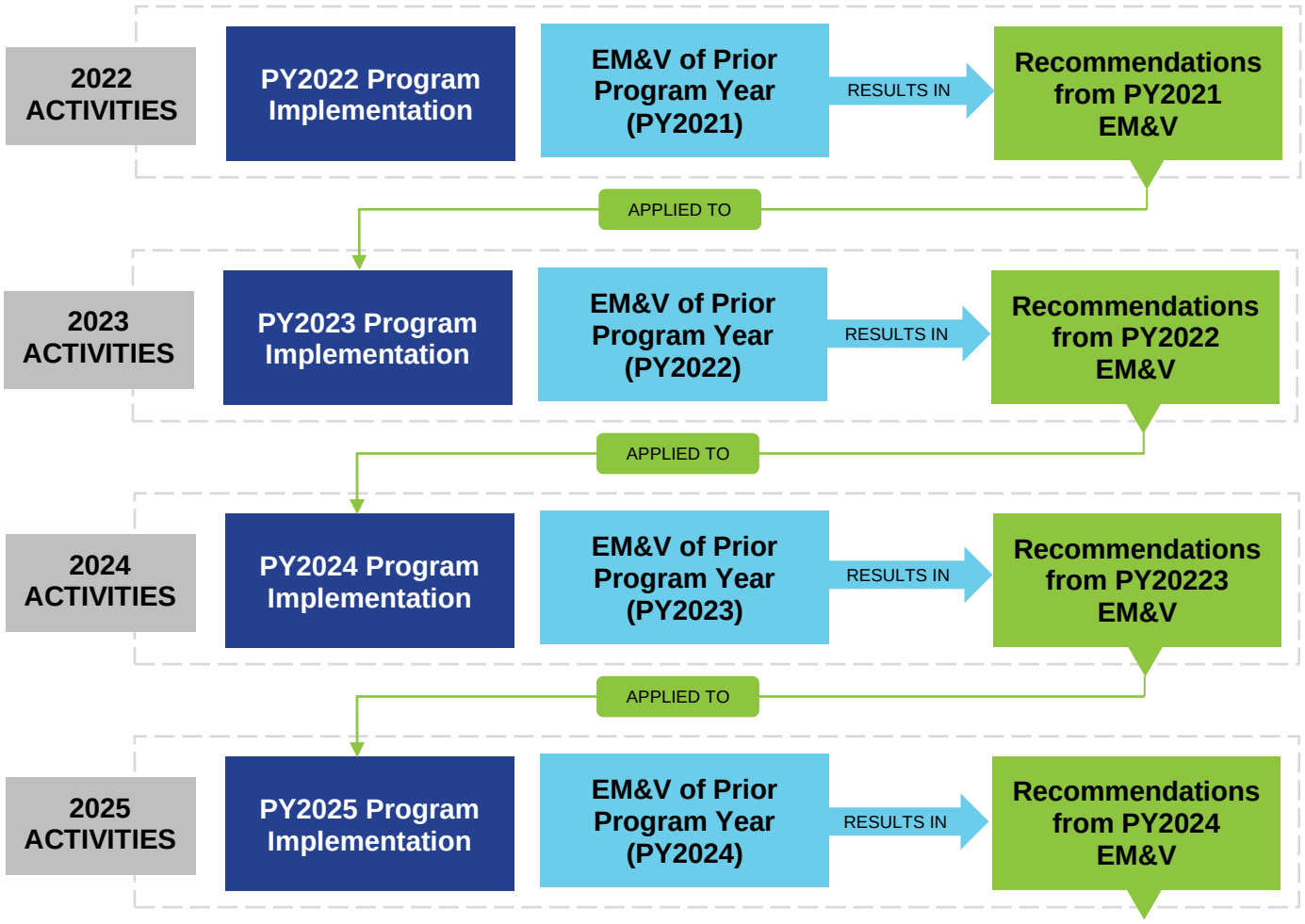
Table 5. PY2023 EM&V Savings Adjustments to Utility Claimed Savings

Utility	kW		kWh	
ERCOT IOU programs				
AEP Texas	↓	-47	↓	-92,187
CenterPoint	↑	448	↑	743,895
Oncor	↑	17	↑	46,359
TNMP	↓	-30	↓	-93,873
Total	↑	388	↑	604,194
Outside-of-ERCOT IOU programs				
El Paso Electric	↑	110	↑	87,943
Entergy	↓	-32	↓	-13,417
SWEPCO	↓	-24	↓	-89,772
Xcel Energy	↓	-114	↓	-649,276
Total	↓	**-60**	↓	**-664,522**

The EM&V team's recommendations are to facilitate more accurate, transparent, and consistent savings calculations and program reporting across the Texas IOU energy efficiency programs and provide feedback that can lead to improved program design and delivery.[21] PUCT staff and the EM&V team discuss with the utilities to agree on responses to recommendations; these are referred to as *action plans*. Recommendations and action plans are also vetted through the Energy Efficiency Implementation Project (EEIP), the PUCT's collaborative group on energy efficiency. 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 PY2021 evaluation research—completed in 2022—were expected to be implemented in PY2023 and their status ("complete" or "in progress") is included in this PY2023 report (Appendix D). Similarly, recommendations resulting from the PY2023 EM&V completed in 2024 are expected to be implemented in PY2025 (see Figure 10).

[21] 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.

Figure 10. Recommendations Timeline



2.3 PY2023 RECOMMENDATIONS AND ACTION PLANS

The EM&V team details PY2023 key findings and recommendations in Sections 3 through 6 of this report; Section 3 discusses findings and recommendations at the portfolio- and cross-sector-levels, while Sections 4-6 discuss the same for commercial, residential, and load management programs. Below, we summarize these key findings and recommendations based on the party responsible for responding to the EM&V recommendations by implementing an action plan. The responsible parties, in order, are the IOUs, the TRM Working Group, the EM&V team, and the PUCT Energy Efficiency Division.

2.3.1 IOU Action Plans

The PY2023 EM&V resulted in 25 recommendations for IOU response – five at the portfolio- and cross-sector level, eight for commercial programs, ten for residential programs, and two for load management programs.

Table 6. PY2023 EM&V Recommendations and IOU Action Plans

Category	Topic	Key finding and recommendation	Action plan
Portfolio-level	Cost cap analysis	Individual IOU cost cap information in EECRFs can be difficult to find and is not generally included in EEPRs.	Work with the PUCT to standardize EEPR reporting—followed by EECRF—for consistency across utilities. Starting with 2025 filings, include a summary of sector projected program budgets as a percentage of sector cost cap in annual EEPRs; include actual program budgets as a percentage of sector cost cap in annual EECRFs.
		The percentage of actual budgets as a percentage of the IOU cost cap varied across IOUs and sectors.	Assess internal opportunities for cost-effective expansion of energy efficiency when program budgets are substantially under cost caps.
	Program tracking	While program tracking data communication has improved, there is still an opportunity to improve the quality of the data collected and reported on through (1) unique participant identifiers (except for upstream programs), (2) measure IDs, and (3) not including load management offerings in umbrella energy efficiency programs.	Include unique participant identifiers for all programs other than upstream and unique measure identifiers for all programs. Load management programs should be tracked and reported as separate programs from energy efficiency.
	Program documentation	New implementers appeared to have documentation available for evaluation but did not provide it for the documentation request.	Discuss EM&V documentation expectations with new implementers prior to the documentation request.
	AC/HP tune-up	Greater transparency and confidence are needed in the AC/HP tune-up savings approach. The field-collected values had discrepancies with the documentation.	Implement the increased requirement of the *Program Tracking Data and Evaluation Requirements* section of the TRM measure and improve QA/QC processes for tracking data to ensure consistency with invoice dates, incentive amounts, unit capacities, building types, addresses, temperatures, and other data collected.

Category	Topic	Key finding and recommendation	Action plan
Commercial	Lighting	Many implemented programs did not identify non-operating lighting fixtures in the energy savings calculations.	Include the count of fully non-operational lighting fixtures in the calculation to verify the quantity does not exceed the limit in the TRM.
		New construction exterior lighting can include multiple exterior lighting types, such as parking lots, loading docks, and pedestrian walkways, which can detail the exterior lighting allowable baseline wattage. Evaluated projects consistently used only one exterior lighting type. The use of multiple exterior lighting zones tended to have one zone that did not meet the code without trading wattages.	Calculate exterior lighting savings using multiple exterior lighting zones and eliminate the code compliance verification in the calculation.
		New construction projects require measurement of both interior and exterior areas. This area is estimated at the time of the initial application and is not consistently updated at project closeout.	Incorporate QA checks to verify interior and exterior areas at project closeout.
	HVAC	PY2023 included the rollout of an efficiency rating system for HVAC equipment with a different baseline than the old rating system. The air conditioning and HP baseline efficiencies did not align with the efficiency rating of the installed equipment in the calculation.	Institute a QA check on the energy savings calculation to ensure the efficiency rating of HVAC equipment matches the baseline and installed equipment.
	Foodservices & refrigeration	The midstream foodservice programs did not provide documentation regarding the measure assumptions and the savings calculation to the evaluator.	Document the claimed savings assumptions per measure in available program documentation or the tracking system.
		The midstream foodservice and refrigeration implementation did not consistently match the equipment specifications to the deemed measure savings.	Document the equipment specifications of the program's accepted midstream measures and use them to select assumptions in the energy savings calculations. Alternately, use a documented conservative assumption for all equipment included in the program.

Category	Topic	Key finding and recommendation	Action plan
	Segment opportunities	Smart thermostats in small commercial operations have an opportunity to save energy with existing HVAC equipment.	Assess program opportunities to offer smart thermostats to small commercial customers.
		Product distributors in the foodservice and refrigeration markets have responded well to the newly implemented midstream delivery model.	Assess program opportunities to increase energy efficiency projects in foodservice and refrigeration through midstream delivery channels.
Residential	New homes programs	Financial incentives are helpful in reducing the costs of building higher-efficiency homes; however, customers may be largely unaware of the utility incentive and are resistant to paying for more efficiency. Several of the IOU programs offer tiered incentive levels that increase as both the efficiency above ENERGY STAR® and HVAC equipment efficiency increase. These tiered incentive levels appear to be the most effective in pushing standard building practices based on the interviews.	Continue to offer tiered incentive levels for building above ENERGY STAR® up to Net Zero and higher efficiency HVAC equipment and assess program materials for effectiveness in conveying the benefits of more efficient homes to customers.
		Builders would appreciate increased communication tools with IOU programs. A recurring theme in builder feedback was the lack of reporting on incentive status, leading to frustration and uncertainty about when they would receive their incentives.	Assess the timeliness of program incentive payments and consider an online program portal.
		Increased program training and outreach would be beneficial to trade allies, especially HVAC contractors.	Consider training and outreach events specifically geared toward HVAC contractors and other trade allies that work with builders and raters to construct more efficient homes.
		Some projects claimed alternative baselines or deemed savings for additional prescriptive measures along with the modeled new home savings. However, documentation and tracking data for these measures were not consistent with the requirements in the prescriptive Residential TRM 9.0, Volume 2.	Ensure all measures and savings are tracked individually, and documentation for additional prescriptive measures follows the *Program Tracking Data and Evaluation Requirements* Section in TRM Volume 2 under each measure. If reported savings differ from the modeled savings report, ensure calculations for reported savings are transparent.

Category	Topic	Key finding and recommendation	Action plan
		For hybrid programs where prescriptive measure savings from TRM 9.0 Volume 2 are claimed along with modeled savings using parameters for the reference home from TRM 9.0 Volume 4, in some instances, the EM&V team found that the modeled home included claimed prescriptive measures potentially double-counting savings.	Ensure all prescriptive measures are excluded from the modeled home and documented. Savings should be tracked individually for each prescriptive measure claimed, and the modeled home should be tracked as one measure. Documentation for hybrid programs should include reference home and modeled home characteristics for comparison to ensure prescriptive measures are claimed appropriately.
	Household survey	Survey respondents have low adoption of solar and electric vehicle technologies within the last year across all utilities.	Consider opportunities to include or expand solar projects in residential programs.
		Survey respondents seem disinterested or uninformed about the benefits of thermostat setbacks in terms of saving energy without sacrificing comfort.	Consider including more customer education in programs around the benefits of thermostat setbacks for heating and cooling and the use of smart thermostats.
		Almost all survey respondent participants (97 percent) across all the utilities reported that their comfort level remained the same (49 percent) or improved (48 percent) after installing energy-efficient HVAC equipment or tuning up their existing equipment.	Utilities may consider utilizing these data results as a means of further promoting energy-efficient HVAC equipment and incentives in their program marketing materials.
		Survey respondents are concerned with electricity rates and reliability (33 percent) coupled with compliments of the IOU energy efficiency programs (33 percent), with some customers expressing frustration with the program equipment or contractors (10 percent) and some (10 percent) looking for additional energy efficiency information or rebates.	As energy costs and grid reliability are top of mind for residential customers, IOU programs may want to consider education, highlighting how energy efficiency is part of the toolbox to address these issues.
	Retrofit programs consumption analysis	Residential retrofit program savings measured through weather-normalized AMI data showed variation in performance across IOUs RSOP, HTR, and LI programs, PY2022 and PY2023, and measures.	Investigate drivers of high and low performance across programs and measures; develop program strategies to address low performance and maintain high performance.

Category	Topic	Key finding and recommendation	Action plan
Load management	Commercial	Participants increased (1,884 participants in PY2023 compared to 1,348 in PY2022; 40 percent increase) while the average level of cooperation with curtailment events has continued to decrease (74 percent in PY2023, 81 percent in PY2022, 90 percent in PY2021). This decrease is driven by Oncor; participants through an aggregator accounted for many of the nonparticipating sites. AEP Texas had the highest cooperation rate (94 percent), followed by CenterPoint (93 percent), Entergy (86 percent), and Xcel (85 percent). The ERCOT winter load management programs had an average level of cooperation of 82 percent.	Continue to follow up with participants who underperform during curtailment events to determine if future program participation or program-contract estimates of available demand reductions need to be revised.
		Utilities continue to demonstrate strong capabilities to apply the TRM calculation method to demand reductions.	Continue implementing the demand reductions algorithm described in the TRM and keep active communications with the EM&V team to resolve minor discrepancies in savings calculations. These recommendations will ensure consistency across utilities and enhance overall accuracy and transparency.

2.3.2 TRM Working Group Action Plans

The PY2023 EM&V resulted in 12 recommendations for TRM Working Group response: two at the cross-sector level, five for commercial programs, four for residential programs, and one for load management programs.

Table 7. PY2023 EM&V Recommendations and TRM Working Group Action Plans

Category	Topic	Key finding and recommendation	Action plan
Cross-sector	AC/HP tune-up	Improved transparency and confidence are needed in the AC/HP tune-up savings approach. A multi-step process is recommended, starting with PY2025 M&V updates and a future consumption analysis.	Adjust the calculation process to deem the atmospheric pressure (which is currently calculated from the elevation and altitude).

Category	Topic	Key finding and recommendation	Action plan
		The efficiency loss calculation includes three methods of determining airflow measurements. There is a significant variation in efficiency loss values between the three methods.	The sampled tune-ups for the efficiency loss factor determination should use direct air measurement (airflow method 1). Airflow methods 2 and 3 should not be used in the determination of the efficiency loss factor.
Commercial	Lighting	Lighting savings calculations were inconsistently completed across utilities when the baseline fixtures included occupancy sensors or other control devices.	Update the TRM measure for lighting equipment and lighting controls to specify calculations when baseline fixtures have lighting controls.
	HVAC	The HVAC energy savings calculation reduced energy savings when the installed equipment capacity exceeded the replaced equipment capacity. Current technology allows upsized equipment to match load better than historical and should not result in reduced savings.	Adjust the TRM savings calculation to determine savings from building HVAC loads instead of equipment capacity.
	M&V and custom	New implementers of custom projects needed support to claim peak kilowatt savings with the PDPF *top 20-hours* method and for regression analysis of peak kilowatt.	Update the TRM to clarify the use of the PDPF *top 20-hours* method in Volume 1.
		The regression analysis of hourly kilowatts for M&V projects regularly requires waivers to the statistical metrics in the TRM.	Update TRM Volume 4 to adjust the statistical metrics for the regression analysis of peak kilowatt demand reduction for summer and winter peak calculations.
	Envelope	The measurement of door seals for the *entrance and exit door air infiltration* measure was inconsistent with the detail of the TRM calculation.	Adjust the TRM calculation to account for the whole door measurement of door seals instead of door seal length.

Category	Topic	Key finding and recommendation	Action plan
Residential	New homes	Residential new construction standard practice has moved to or near ENERGY STAR® standards. Approximately one-half of the builders said they build to these standards, often independent of program incentives. Many local jurisdictions across IOU territories have adopted higher local codes.	Update the PY2025 TRM new homes baseline in Volume 4 to reflect both market baselines and local codes across the IOU territories.
	Upstream/midstream measures	New federal standards for ACs and HPs went into effect on January 1, 2024. The standard applied to ACs in the southern region at the installation date and HPs at the manufactured date. This distinction caused confusion as to which methodology and efficiency rating to apply for savings calculations.	Discuss if the PY2024 TRM update to one methodology for both ACs and HPs effectively addressed this issue or if clarifications are still needed in the PY2025 TRM update.
	Retrofit program consumption analysis	The consumption analysis of RSOP, HTR, and LI participants from PY2022 to PY2023 demonstrates that the PY2021 TRM updates informed by the consumption analysis completed in 2020 have aligned savings seen in AMI meter data with TRM deemed savings estimates.	Discuss expanding the *air infiltration* measure to residential customers in the PY2025 TRM update along with implementation requirements to ensure tangible savings continue to result from this measure as found in the PY2023 consumption analysis, but not previous analysis.
		HP AMI-measured cooling savings are in-line with the TRM, similar to central AC, but heating baselines can impact how the heating savings are seen in the AMI meter data compared to TRM deemed savings estimates given that pre-program heating sources vary.	Continue to adhere to the TRM requirement introduced in PY2024 to capture existing and planned baseline equipment for heat pumps.
Load Management	Residential	A deemed savings value for EPE and a statewide residential summer smart thermostat deemed value have been available in the TRM for utilities without AMI meters fully deployed for residential customers.	EPE is still deploying AMI meters in its territory in 2025 and therefore the deemed value may continue to be used for those without AMI meters. EPE should work with the EM&V team in PY2025 to begin AMI meter data analysis.

2.3.3 EM&V Team Action Plans

The PY2023 EM&V resulted in four recommendations for EM&V team response: two at the cross-sector level and two for residential programs.

Table 8. PY2023 EM&V Recommendations and EM&V Team Action Plans

Category	Topic	Key finding and recommendation	Action plan
Cross-sector	HVAC tune-ups	The amount of claimed savings delivered by this measure across IOUs requires a more detailed evaluation to ensure the accuracy of the energy savings.	Future evaluations should have high prioritization on the *tune-up* measures—for both residential and commercial—that includes consumption analyses and other efforts to support increased accuracy of the claimed savings.
	Heat pumps	The Heat Pump Working Group has developed a new algorithm for variable speed heat pumps starting with the PY2025 TRM. In addition, new existing equipment baseline documentation requirements for all heat pumps came into effect in PY2024.	Assess the standard heat pump and the variable speed heat pump algorithm developed through the Heat Pump Working Group in a future analysis (PY2025 at the earliest, possibly PY2026 depending on variable speed heat pump uptake).
Residential	New homes	Program attribution for the new homes programs has decreased slightly from 70 percent to 60 percent as builders' standard practices have become more efficient. More efficient HVAC equipment remains a barrier; all IOU new homes programs incentivized more efficient HVAC equipment through the programs in PY2023.	Reassess the NTG ratio for new homes programs as the IOU programs gain more participation at the higher-tiered incentive levels and/or as the TRM savings baseline is updated.
	Retrofit programs consumption analysis	Residential retrofit program savings measured through weather-normalized AMI data showed variation in performance across IOUs RSOP, HTR and LI programs, PY2022 and PY2023, and measures.	Work with IOUs to understand their consumption analysis results, including drivers of high and low performance across programs and measures; assess program changes to address low performance and maintain high performance in a future consumption analysis.

2.3.4 Energy Efficiency Division Action Plans

The PY2023 EM&V resulted in four recommendations for the PUCT Energy Efficiency Division's response: three at the portfolio level and one for load management.

Table 9. PY2023 EM&V Recommendations and Energy Efficiency Division Action Plans

Category	Topic	Key finding and recommendation	Action plan
Portfolio-level	Cost cap analysis	Individual IOU cost cap information in EECRFs can be difficult to locate, and, at times, not included in EEPRs.	Work with IOUs to develop EEPR and EECRF standardized templates that include a summary of planned sector program budgets as a percentage of sector cost cap in annual EEPRs, and provide feedback on utility plans and budgets.
		The percentage of actual budgets as a percentage of the IOU cost cap varied across IOUs and sectors; outside-of-ERCOT utilities are generally more constrained by cost cap maximums than ERCOT utilities.	Future rulemaking should address customer cost caps and assess cost caps based on IOU territory characteristics.
	LI and HTR program performance again goals	While all utilities met their LI and HTR goals, all but one of the IOUs met HTR goals with HTR programs alone—CenterPoint utilized savings from both their LI and HTR programs to meet their HTR goal. It is unclear if programs can overlap to meet both goals.	LI and HTR should be addressed holistically in future rulemaking.
Load management	Residential	Due to budget and participation limits, utilities' PY2023 plans for load management and participants slightly decreased similarly to PY2022. The average level of cooperation remained about the same; 77 percent in PY2023 compared to 75 percent in PY2022.	Address load management program design and requirements with a larger scope of bulk power system requirements and local utility system needs.

3.0 PORTFOLIO AND CROSS-SECTOR FINDINGS

This section presents portfolio trends that include energy efficiency cost-cap analysis and program performance against low-income (LI) and hard-to-reach (HTR) goals; this is followed by cross-sector results regarding program tracking, project documentation, and air conditioner (AC) tune-ups.

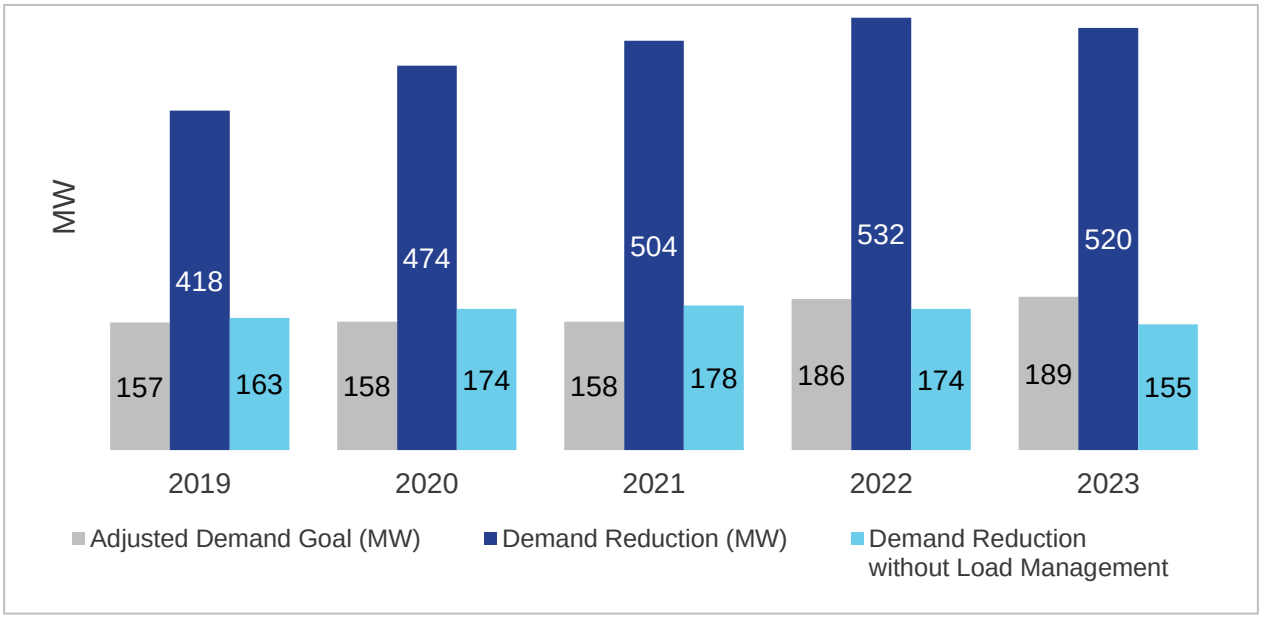
3.1 PORTFOLIO TRENDS

First, investor-owned utilities (IOU) trends in meeting their legislated demand reduction goals over the past five years are presented. This is followed by analysis of their energy efficiency cost recovery factors (EECRFs) by customer rate class (referred to as *cost caps*) for the past three years. Next, IOU program performance against LI and HTR goals for the past three years is summarized.

3.1.1 Demand Reduction Goal Performance

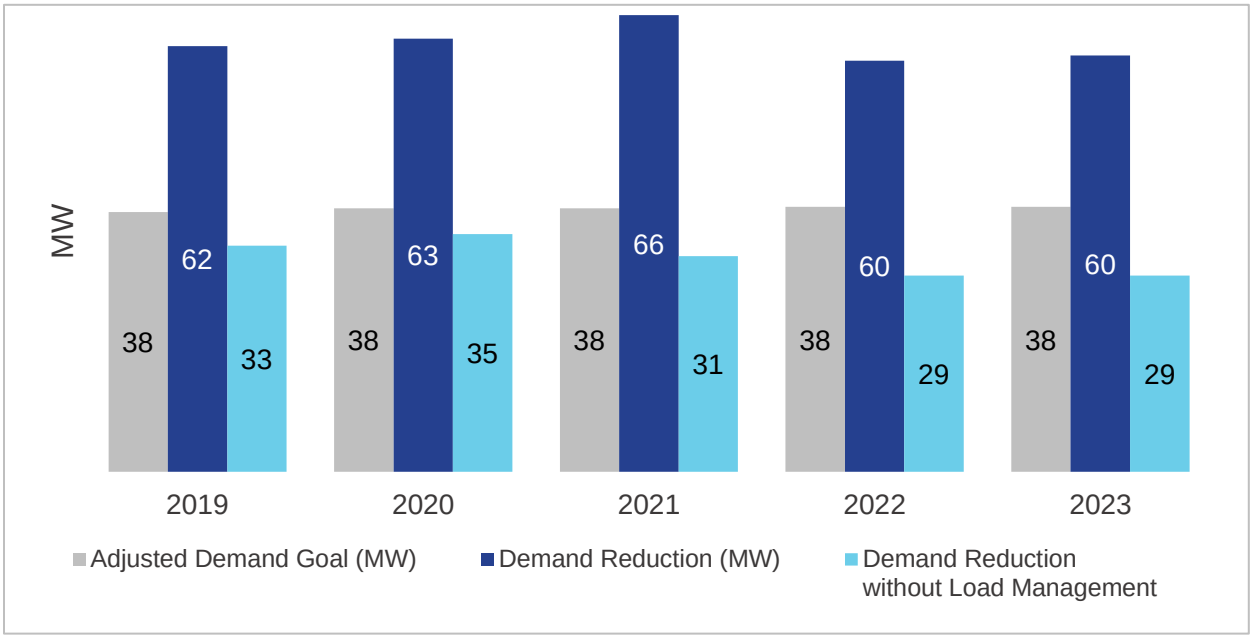
As shown in Figure 11 and Figure 12, the IOUs are significantly exceeding their legislated demand reduction goals, but this is primarily due to their load management programs. In PY2023, the ERCOT IOUs would not have met their demand reduction goals without their load management programs, although they were able to do so in previous years. Over the last five years, as shown below, three ERCOT IOUs moved to the higher demand reduction goal of four-tenths of one percent of summer weather-adjusted peak demand instead of the previous "floor" of 30 percent of demand growth.

Figure 11. Legislated Goals and Demand Reductions—ERCOT IOU Programs, PY2019-PY2023



The outside-of-ERCOT IOUs also require load management programs to meet their legislated demand reduction goals, even though just over one-half of their portfolios' demand reductions have been from load management.

Figure 12. Legislated Goals and Demand Reduction—Outside-of-ERCOT IOU Programs, PY2019-PY2023



3.1.2 Cost Cap Analysis

The Energy Efficiency Cost Recovery Factor (EECRF) is an electric tariff provision compliant with 16 TAC §25.182, which ensures timely and reasonable cost recovery for utility expenditures that satisfy the goals of PURA §39.905, which provides for a portfolio of cost-effective energy efficiency programs.

Annually, each electric utility is required to provide a portfolio of energy efficiency programs with incentives sufficient for residential and commercial customers, retail electric providers, and energy efficiency service providers to acquire additional cost-effective energy efficiency, which are subject to its residential and commercial EECRF cost caps, also known as the *EECRF not-to-exceed amount*, established according to 16 TAC §25.182(d)(7).

Per 16 TAC §25.182(d)(7)(C), for PY2019 and thereafter, the residential and commercial EECRF cost caps must be calculated by increasing or decreasing the prior period's cost caps by a rate equal to the most recently available calendar year's percentage change in the south urban consumer price index (CPI), as determined by the Federal Bureau of Labor Statistics.

The EECRF not-to-exceed amount[22] is established on a per-kilowatt-hour basis and excludes EM&V costs, municipal EECRF proceeding expenses, and any interest amounts applied to over- or under-recoveries from the previous program year. Actual EECRF costs must not exceed the EECRF not-to-exceed amounts unless a good cause exception filed under 16 TAC §25.181(e)(2) was granted.

[22] The EECRF not-to-exceed amount is calculated by multiplying the appropriate billing determinants for each customer rate class times the approved EECRF.

Figures 13 through 16 show each ERCOT and outside-of-ERCOT IOUs' percentage of actual commercial and residential EECRF costs compared to the approved EECRF cost cap for PY2021−PY2023[23]. Over the three years (2021−2023), no utilities' actual EECRF costs exceeded the EECRF not-to-exceed amount unless a good cause exception was filed.

Overall, the ERCOT utilities tend to have more room to grow budgets under their cost caps than outside-of-ERCOT utilities. Amongst the ERCOT utilities, CenterPoint is closest to its commercial cost cap, and TNMP is closest to its residential cost cap.

In order to maintain their current levels of energy efficiency programs and customer benefits, several of the outside-of-ERCOT utilities—EPE, Entergy, and SWEPCO—have requested and received a good cause exception for at least one of the EECRF cost caps from PY2021 to PY2023 as allowed by 16 TAC § 25.181(e)(2) and 25.182(d)(7). EPE has received a good cause exception for its commercial EECRF cost cap each year that cost caps have been in effect, except for 2018. Entergy received a good cause exception for its commercial EECRF cost cap in 2022 and SWEPCO received a good cause exception for their residential and commercial cost caps in PY2022 and PY2023. Based on program design and delivery, the primary drivers of why outside-of-ERCOT IOUs are more likely to exceed, or at least be more constrained by, their cost caps than the ERCOT IOUs include:

- Outside-of-ERCOT IOUs tend to have more rural and less urban territories, making it more expensive to reach and deliver energy efficiency to their customers;
- Outside-of-ERCOT IOUs tend to be smaller in size, and there are economies in the scale of program design and delivery; and
- Outside-of-ERCOT IOU portfolios tend to have more Market Transformation Programs (MTPs) than Standard Offer Programs (SOPs), and implementation firms are more expensive. As compared to the ERCOT IOUs, the existing contractor/trade ally infrastructure is less developed for the outside-of-ERCOT IOUs to tap into, which is one reason why MTPs comprise more of their portfolio than SOPs. Another reason is that they generally have less utility energy efficiency staff to manage programs.

[23] Additional details related to each program's actual EECRF costs are located in *Section VIII: Program Funding Calendar Year* of each utility's Energy Efficiency Plan and Report, included in their PY2024 EECRF Application filing.

Figure 13. Actual EECRF Cost Compared to EECRF Not-to-Exceed Cost for ERCOT IOU Commercial Programs, PY2021-PY2023

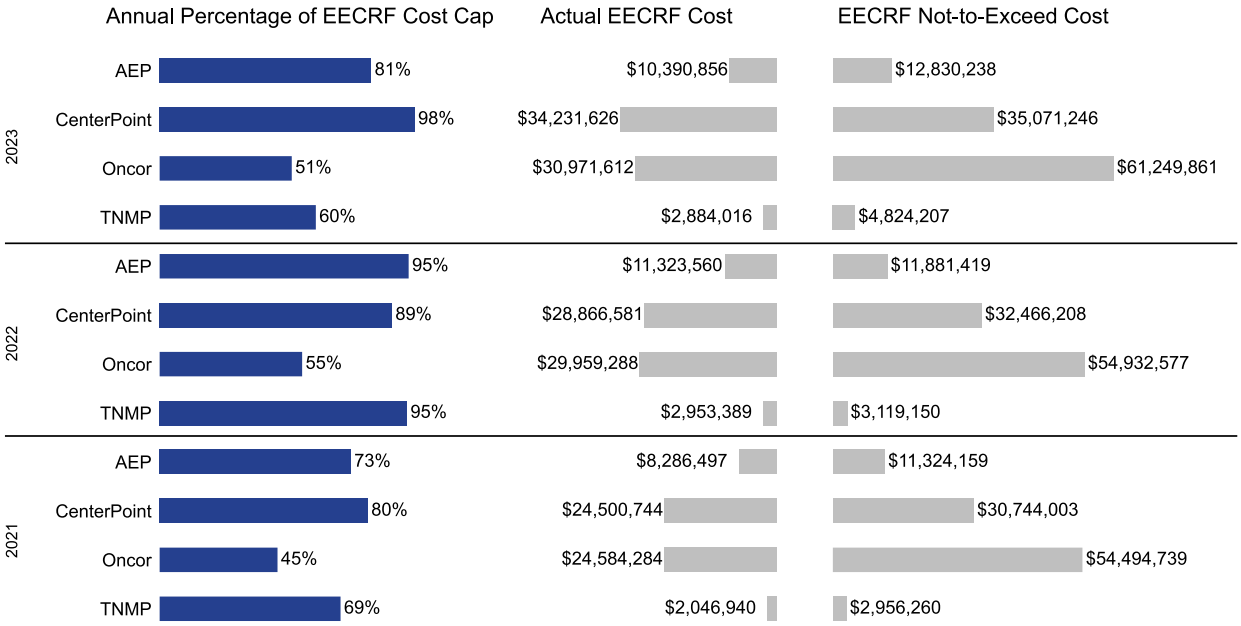
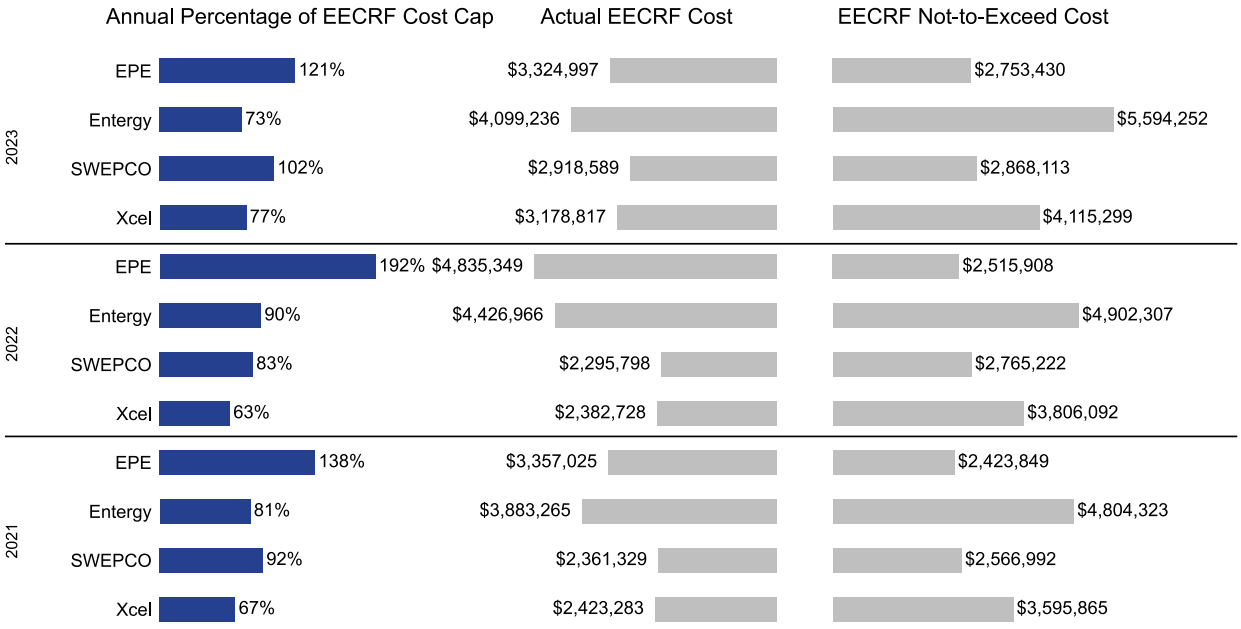


Figure 14. Actual EECRF Cost Compared to EECRF Not-to-Exceed Cost for Outside-of-ERCOT IOU Commercial Programs, PY2021-PY2023



*Good cause exception approved for EPE's commercial EECRF cost cap each year shown.

**Good cause exception approved for Entergy's commercial EECRF cost cap in PY2022.

***Good cause exception was filed and approved for SWEPCO in PY2022 and PY2023.

Figure 15. Actual EECRF Cost Compared to EECRF Not-to-Exceed Cost for ERCOT IOU Residential Programs, PY2021-PY2023

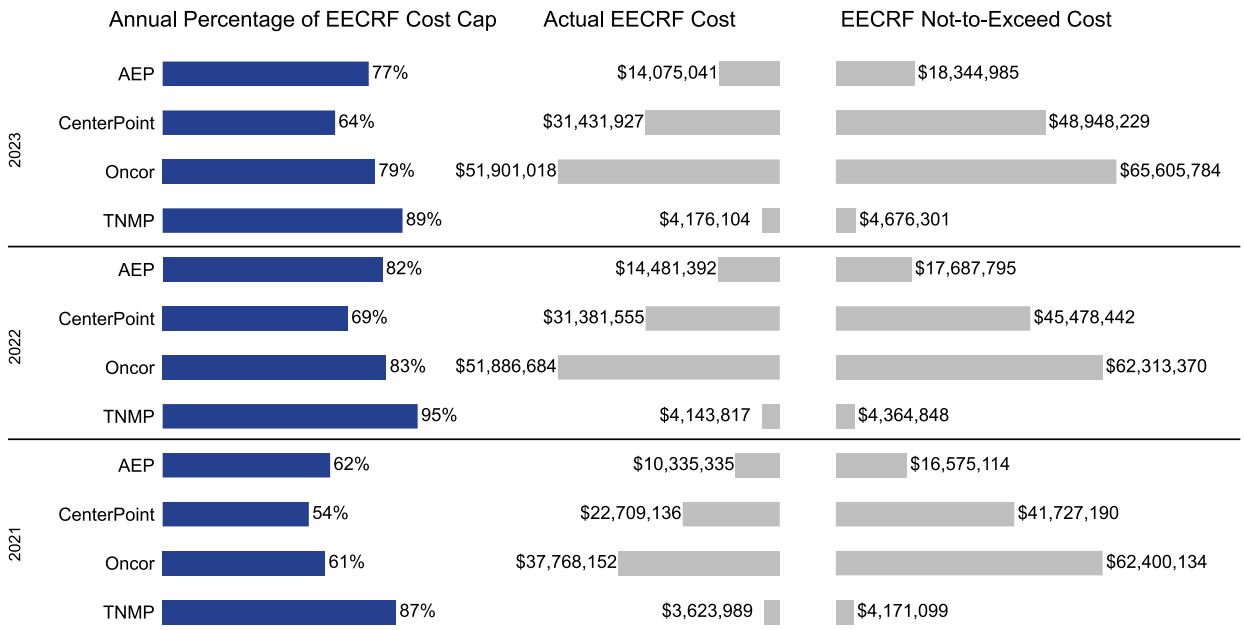
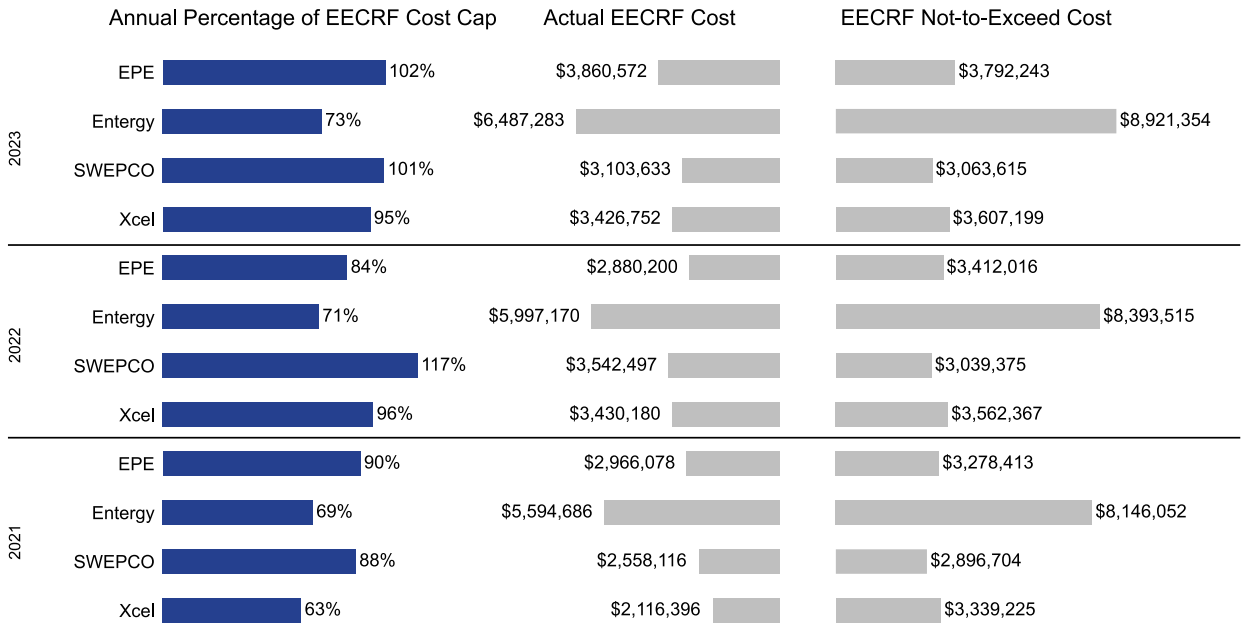


Figure 16. Actual EECRF Cost compared to EECRF Not-to-Exceed Cost for Outside-of-ERCOT IOU Residential Programs, PY2021-PY2023



* PY2022 was the first year that EPE requested and was granted a good cause exception for their residential EECRF cost cap.

**SWEPCO requested and was granted a good cause exception in PY2022 and PY2023.

Key Finding #1: Individual IOU cost cap information in EECRFs can be difficult for general audiences to find and understand.

The EM&V team found cost cap information detailed differently across the IOU EECRF filings, which necessitated a greater level of time and effort to find and understand the information presented. In addition, some IOUs had the information marked as *confidential,* requiring the EM&V team to ask for the information. Utility budgets in relation to cost caps have been a repeated question from stakeholders at Energy Efficiency Implementation Project (EEIP) meetings.

Recommendation #1: IOUS should include a summary of program sector budgets as a percentage of sector cost caps in their annual Energy Efficiency Plans and Reports (EEPRs) starting in 2025.

Key Finding #2: The percentage of actual budgets as a percentage of the IOU cost cap varied across IOUs and sectors, with outside-of-ERCOT utilities generally more constrained by cost cap maximums than ERCOT utilities.

Recognizing that actual and projected program budgets and some 'headroom' between budgets and cost cap maximums can ensure utilities do not have to request a good cause exception to cost caps. IOUs that consistently have program budgets set at less than 70 percent of a sector cost cap may want to consider cost-effective ways to deliver more energy efficiency for that sector. In addition, given the performance differences across IOUs, a future PUCT rulemaking may want to consider if different cost caps based on IOU size, geography, or being part of ERCOT are appropriate.

Recommendation #2a: IOUs should assess internal opportunities for cost-effective expansion of energy efficiency when program budgets are substantially under cost caps.

Recommendation #2b: If a future rulemaking covers EECRF cost caps, the PUCT should assess if tailoring cost caps based on IOU territory characteristics will deliver more value to ratepayers.

3.1.3 Low-Income and Hard-to-Reach Goal Performance

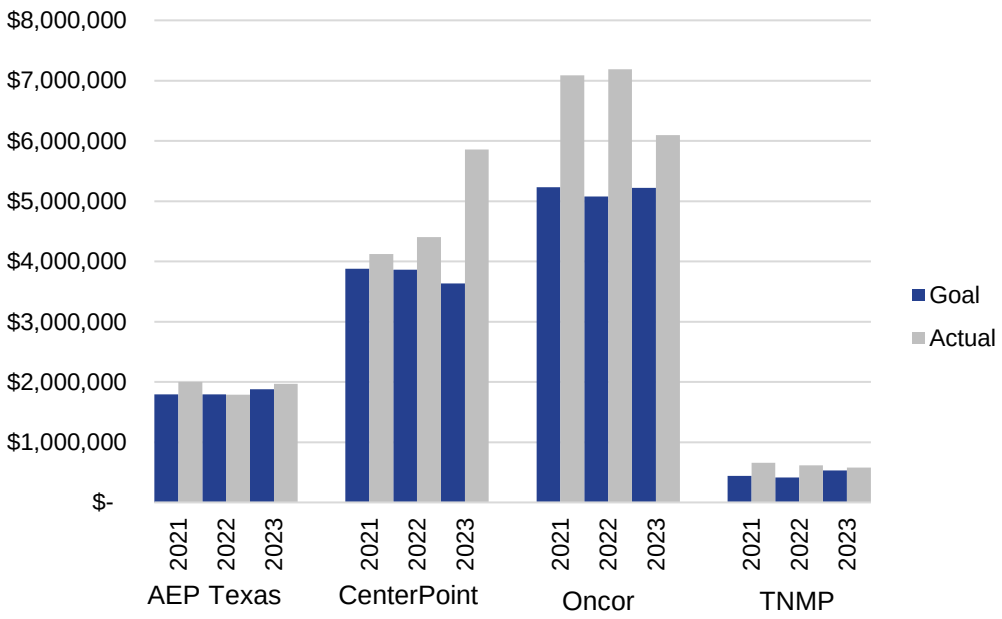
Texas utilities provide energy efficiency services to LI customers through a combination of HTR and LI programs as specified in 16 TAC § 25.181, relating to the Energy Efficiency Goal. Under 16 TAC §25.181(e)(3)(F), all Texas IOUs are required to achieve no less than five percent of their total demand reduction goal through programs serving HTR customers. In addition, the ERCOT utilities are required to spend no less than ten percent of each program year's energy efficiency budget on a targeted LI energy efficiency program under 16 TAC § 25.181(r). The qualifying household income level—200 percent of the federal poverty level—is the same for HTR and LI programs, though the programs are implemented differently.

3.1.3.1 Low-Income Budget Goals

Figure 17 shows the four ERCOT IOU's performance against their required low-income goals of no less than ten percent of the annual energy efficiency budget. All ERCOT IOUs met the LI program budget goals for PY2023. In PY2023, Oncor saw a slight decrease in spending but still exceeded their goal by nearly two percent. Oncor far exceeded its LI spending goal by $1.9 million and $2.1 million for PY2021 and PY2022, respectively. In PY2023, CenterPoint increased its spending substantially compared to previous years, jumping from 10.6 and 11.4 percent of the portfolio budget in PY2021 and PY2022, respectively, to 16.1 percent in PY2023.

AEP Texas did not meet its goal in PY2022 based on actual spending. In PY2022, ten percent of the total budget for AEP Texas was $1,795,902, based on the projected budget of $17,959,017. AEP Texas spent $1,790,210, just short of the goal by $5,692. However, in PY2022, AEP Texas' actual spending for the portfolio was less than the projected budget by four percent, $17,220,700. When comparing actual funds expended, AEP Texas spent 10.4 percent of its total portfolio on targeted LI. In PY2021 and PY2022, TNMP spent nearly 15 percent of its total portfolio budget on its LI weatherization program. However, while still achieving goals, TNMP's spending in PY2023 decreased to about 11 percent of total portfolio spending.

Figure 17. ERCOT IOU Low-Income Budgetary Goal Performance, PY2021−PY2023



3.1.3.2 Hard-to-Reach Demand Goals

Figure 18 shows the ERCOT IOU's performance against their required HTR goal of no less than five percent of demand reductions, followed by the outside-of-ERCOT IOU's performance against their HTR demand goals in Figure 19. From PY2021 to PY2023, all IOUs met or exceeded the HTR demand reduction goal of five percent of their total demand reduction goal with just their HTR programs, except CenterPoint, which is discussed more below.

Figure 18. ERCOT IOU HTR Demand Reduction Goals Compared to Actual Demand Reductions, PY2021−PY2023

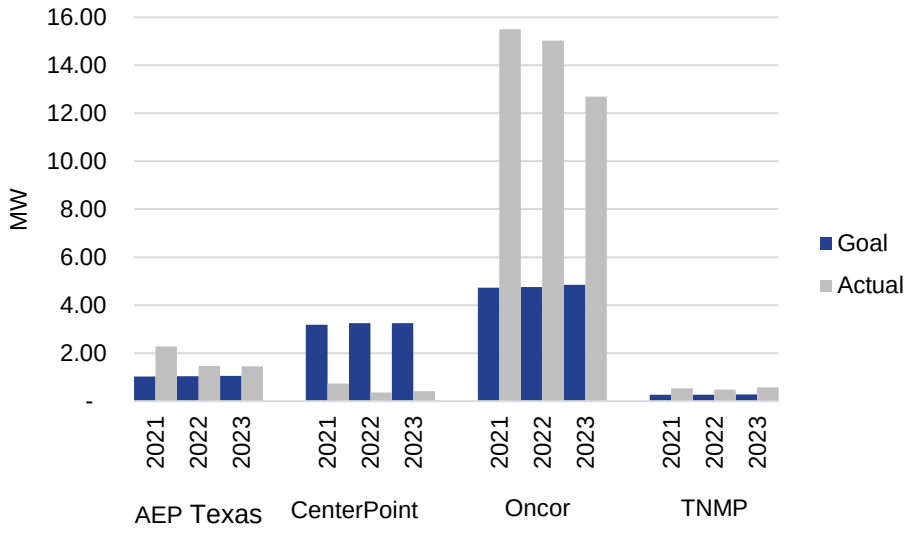
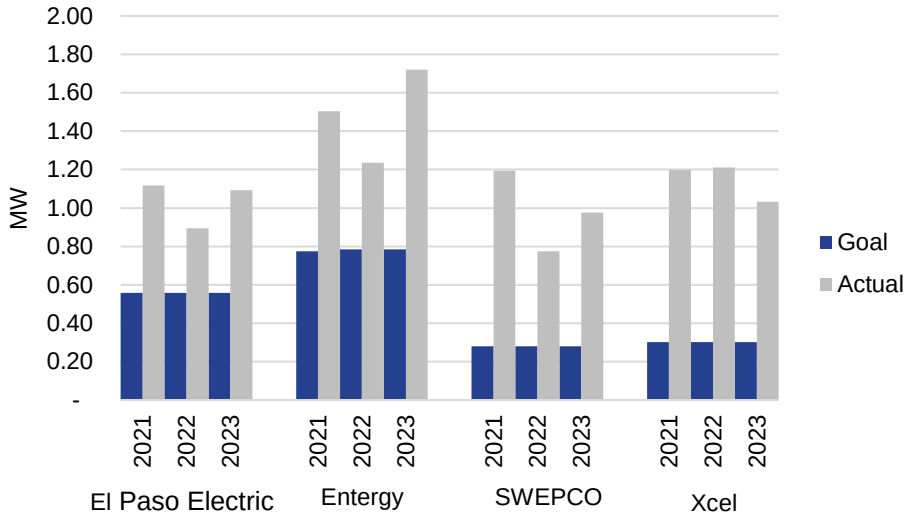
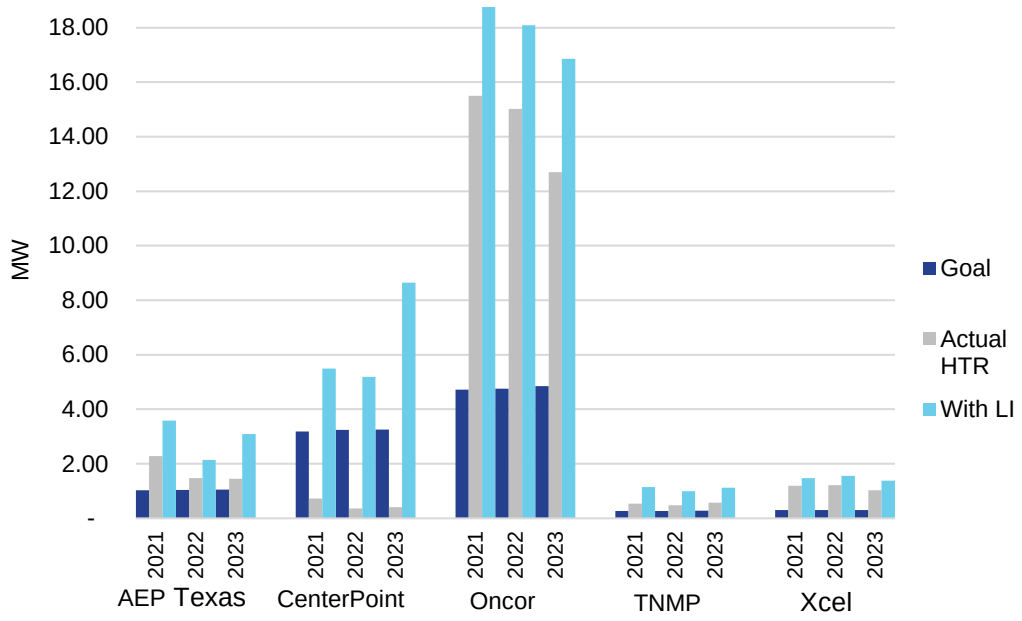


Figure 19. Outside-of-ERCOT IOU HTR Demand Reduction Goal Compared to Actual Demand Reductions, PY2021-PY2023



As seen in Figure 20, CenterPoint exceeded their HTR goal when the demand reductions from their Targeted Low-Income program were included. The outside-of-ERCOT IOUs and Oncor far exceeded their HTR goals, while the remaining ERCOT IOUs slightly exceeded goals. The ERCOT IOUs also serve HTR customers through their targeted LI programs and often split resources between the HTR and LI programs. The outside-of-ERCOT IOUs are not required to offer targeted LI programs; however, Xcel offers a targeted LI program in addition to their HTR program. Figure 20 shows the demand reductions achieved through programs serving HTR customers, including the targeted LI programs, compared to the HTR goals for the ERCOT IOUs and Xcel.

Figure 20. IOU HTR Demand Reduction Compared to Goal with Low-Income, PY2021-PY2023



3.1.4 Program Tracking

Tetra Tech received all the energy efficiency program tracking data from the utilities and uploaded the harmonized program tracking data in an automated fashion to a centralized database. The team's key findings during the data harmonization process resulted in the development of recommendations for the data providers to improve the process:

Key Finding #1: The documentation and clarity of program tracking data have greatly improved, especially for umbrella programs with subprograms, but there are still opportunities for improvement.

The EM&V team appreciates the improved communication with the utilities and their tracking system providers; this improved communication has improved the verification of all claimed savings with program tracking data. However, there are still some areas in need of consistency across utilities to keep improving the value of the information provided through the program tracking data.

Recommendation #1: IOUs should include a definition of "participant" when providing the tracking data. For ERCOT utilities, each participant should have their own unique identifier, "ESIID." For outside-of-ERCOT utilities, a unique identifier like a meter number or account number should be provided for each qualified participant in the tracking data, along with the measure description. Also, we recommend storing the ESIID or the unique identifier in string/text format instead of in a number format.

Recommendation #2: Having detailed information on the load management program data is helpful; however, it should be separated from the other energy efficiency program data. For example, Entergy provided the load management information along with the other residential energy efficiency programs this year, but the load management savings cannot be claimed with the other energy efficiency programs.

Recommendation #3: Data providers should include a unique measure ID, not only the name and description, for each specific measure. The data providers should provide a way to uniquely identify the measure in the respective programs, as there are measures with the same name and description. Without providing a measure ID by the data providers, the process of tracking the actual measures is complicated and adds difficulties to the evaluation and verification process.

Recommendation #4: A unique ID assigned to each tracking record should be provided throughout the year. Due to the lack of a unique ID, connecting the data from quarter to quarter is sometimes hard and may impede the evaluation process.

3.1.5 Program Documentation

Tetra Tech collected and reviewed project documentation from individual sampled projects for programs with *high* and *medium* evaluation priorities in PY2023. The review evaluates the overall documentation's completeness, identifies discrepancies between the tracking system and the installed measure, and reviews the energy savings calculations for compliance with the technical reference manual (TRM). Based on this work, the EM&V team offers the following key findings and recommendations:

Key Finding #1: New implementers appeared to have documentation available for evaluation but did not provide it for the evaluation request.

Several new third-party implementation teams and staff were leading programs that were evaluated this year. The EM&V team provided the documentation request for all utility programs, and while all participants could upload documentation to SharePoint, the files uploaded by first-time program managers and new implementation teams were minimal and did not match the TRM requirements for documentation. Upon further discussion, many of the first-time project managers had the documentation available; however, it was not uploaded or easily accessible for the EM&V team review. Many first-time implementation teams reached out to the EM&V team before the evaluation period to request technical assistance for projects to verify consistency with EM&V expectations, so the impact of the missing documentation was limited. Most utilities and implementers accepted the lower documentation score and engaged in discussions of what would be improved next program year.

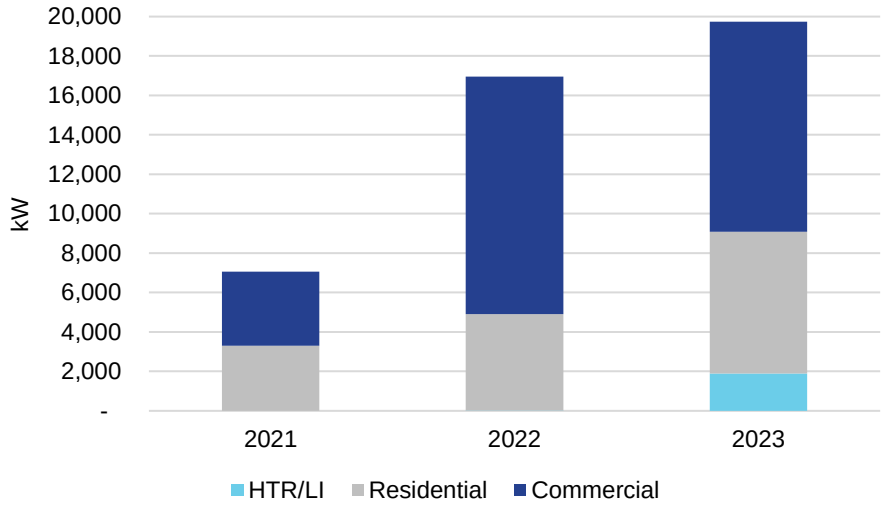
Recommendation #1: The EM&V team should discuss documentation expectations with new implementers and program managers before the documentation request is issued.

3.2 CROSS-SECTOR RESULTS

3.2.1 AC/HP Tune-Up

Texas energy efficiency has seen a large growth in the savings generated by AC and heat pump (HP) tune-ups in the previous three years. There has been a steady increase of over 30 percent for the residential tune-ups, including the addition of LI and HTR participant-specific programs. Commercial tune-ups were first introduced in 2021 and fully adopted in 2022. The AC and HP tune-up measures claimed over 19 MW of demand reductions in PY2023.

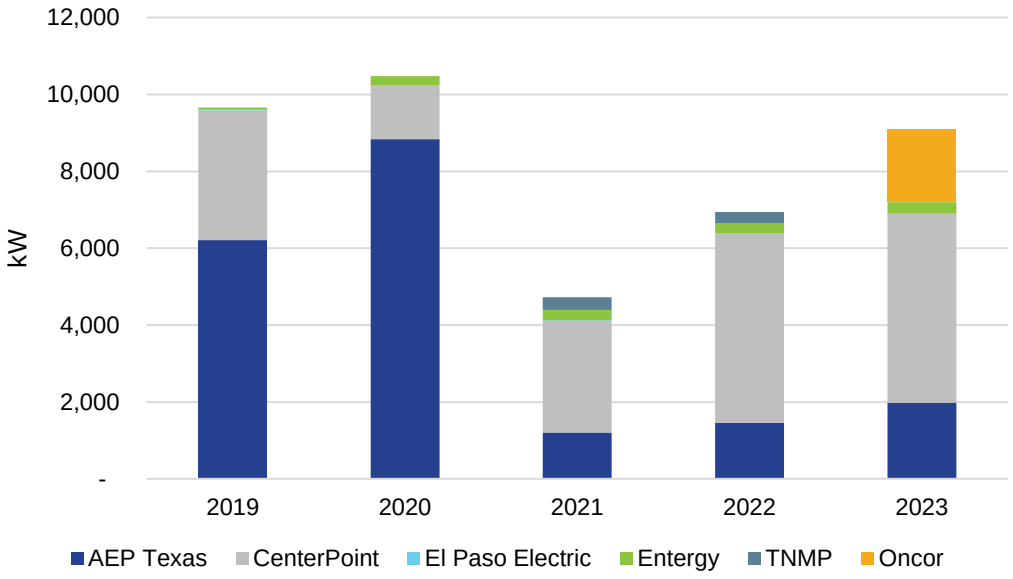
Figure 21. AC/HP Tune-Up Claimed Savings by Sector, PY2021-PY2023



3.2.1.1 Residential Trend Analysis

In PY2023, six utilities implemented residential tune-up measures and claimed 9 MW of demand reductions. Starting in PY2019 and PY2020, demand reductions were primarily driven by AEP Texas and CenterPoint's programs; however, PY2021 saw a noticeable decline in total megawatt savings. The COVID-19 pandemic likely influenced the drop in demand reductions, and after that point, AEP Texas had a much smaller program. Over the past three years, demand reductions have steadily increased as more utilities have delivered tune-ups and as each utility has increased the volume year after year. Combined, the demand reductions in PY2023 nearly reached the levels of PY2019 and PY2020. Included in this growth is Oncor's implementation of a program specifically for LI participants.

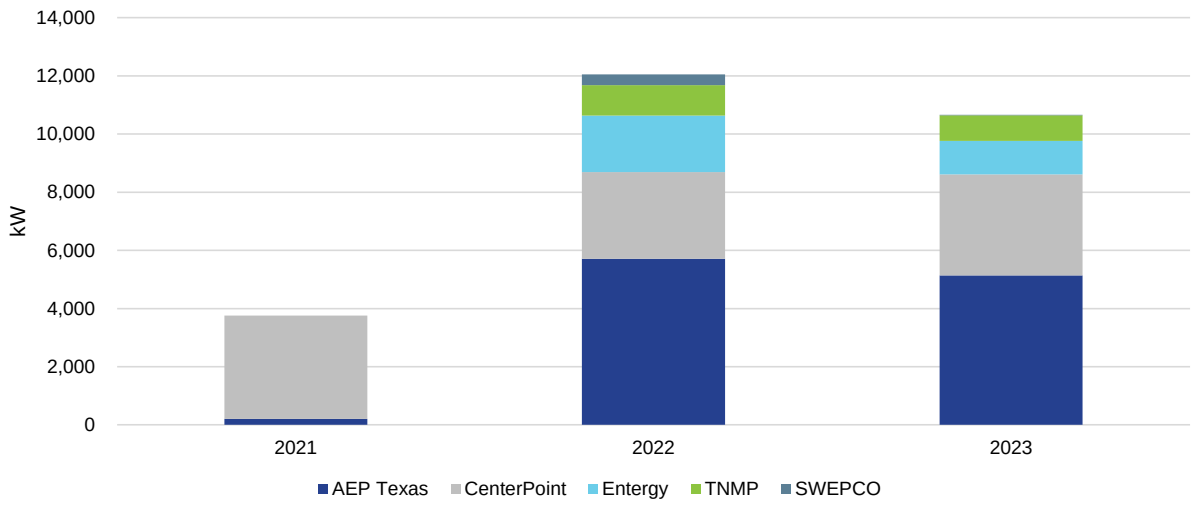
Figure 22. Residential Tune-Up Measure Trend by Utility, PY2019-PY2023



3.2.1.2 Commercial Trend Analysis

In PY2023, five utilities implemented commercial tune-up measures and claimed 10.6 MW of demand reductions. Commercial tune-ups were started in PY2021 by AEP Texas and CenterPoint; in PY2022, five utilities started delivering commercial tune-ups and nearly tripled the amount of claimed demand reductions. In PY2023, the combined demand reductions from all utilities remained at a similar level, with CenterPoint, reducing the volume slightly.

Figure 23. Commercial Tune-Up Measure Trend by Utility, PY2019-PY2023



3.2.1.3 Tune-Up Evaluation Findings

The number of residential and commercial tune-ups are predicted to continue to grow as more utility programs are launched and local contractors become more efficient at delivering the service with existing utilities. These programs continue to provide value to participants, and with the recent expansion of the tune-up measure, the EM&V team has several findings for the implementation and calculation of savings.

Most of the tune-up measure savings are being calculated using Measure 2.1.1 in Volume 4 of the TRM. This measure defines a measurement process and sampling, which is used to estimate savings based on the post-tune-up measurements for the remaining tune-ups implemented. A series of pre-tune-up measurements and post-tune-up measurements are provided for all sampled units serviced. The variation between the pre-service and post-service measurements is used to estimate the sampled unit's efficiency improvement through a conversion of the measurements to estimated energy consumption. The sampled units are used to develop an efficiency loss factor, which is applied to each post-tune-up measurement to determine program savings. The efficiency loss factor is an average of the previous three years' values because of the high level of variability, but nearly all the units show improvement in the performance characteristics.

The PY2023 EM&V completed desk reviews of residential tune-ups, a review of the pre-tune-up and post-tune-up sampled measurements, and a review of the calculation process to convert the measurements into estimated energy consumption. The key findings and recommendations below apply to all AC and HP tune-up measures implemented as part of IOU programs in Texas. The goal is to (1) provide a program that meets the high QA levels expected by the TRM measure to continue to use the sampling procedure of pre-service measurements, and (2) simplify the energy savings calculation from those measurements.

Key Finding #1: Greater transparency and confidence are needed in the AC/HP tune-up savings approach. Field-collected values had discrepancies with the documentation:

- The *estimated project completion date*, *submitted date*, and *invoice date* had discrepancies, indicating the process was not followed;
- The building type (single-family vs. multifamily) did not consistently match the actual building type. In PY2022, the evaluation found that the commercial building type did not consistently match the actual building type;
- The capacity of the serviced unit in the documentation did not match the tracking system consistently. In the PY2022, the evaluation found the unit capacity did not consistently match the actual capacity of the units;
- One unit was identified as an AC unit, which was actually an HP;
- Invoices:
    - Two projects had missing invoices in the documentation;
    - One project address on the invoice did not match the tracking data; and
    - Incentive amounts between invoices and tracking data varied.
- The reported elevation and altitude for projects were not consistent with the addresses of the tune-ups; and
- The reported ambient temperature did not consistently match the recorded airport weather data nearest to the project site.

Based on similar findings in the PY2022 evaluation, the PY2023 evaluation resulted in recommendations to increase the QA of the tracking system data prior to the calculation of savings. As part of the follow-up from that recommendation, Measure 2.1.1 in Volume 4 of the TRM Version 11.0 (for PY2024 implementation) was updated to increase the *Program Tracking Data and Evaluation Requirements* components to provide increased clarity of the implemented process for each project.

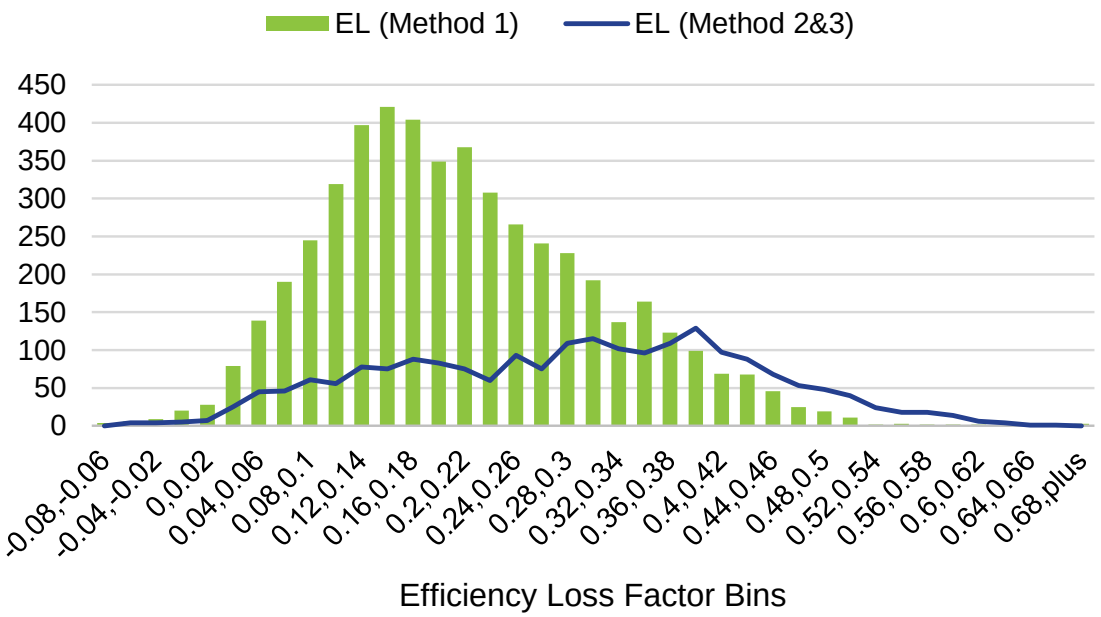
Recommendation #1A: IOUs should implement the increased requirement of the *Program Tracking Data and Evaluation Requirements* in the TRM measure and improve QA/QC processes for tracking data to ensure consistency with invoice dates, incentive amounts, unit capacities, building types, addresses, temperatures, and other data collected.

Recommendation #1B: Adjust the calculation process to deem the atmospheric pressure (which is currently calculated from the elevation and altitude).

Key Finding #2: The efficiency loss calculation includes three methods of determining airflow measurements. There is a significant variation in efficiency loss values between the three methods.

Airflow methods 2 (generic fan charts) and 3 (manufacturer fan charts) resulted in higher efficiency loss values compared to airflow method 1 (direct air measurement) over the past three years; this is likely because of the difficulty of locating an operating point on a fan curve, and the assumptions associated with that effort appear to be increasing the efficiency improvement values. Figure 24 shows the histogram of the number of projects by the efficiency loss factor bin. Although the number of method 2 and 3 projects is much lower than the number of method 1 projects, the different distribution of efficiency loss factors impacts the overall efficiency loss factor determination.

Figure 24. Histogram of PY2021−PY2023 Projects in Efficiency Loss Factor Bins by Airflow Method



In addition, the evaluation found that manufacturer fan charts were not collected, and generic fan charts were used for all projects reported as using airflow methods 2 or 3. The generic fan chart that was used provided a straight line between estimated operating points, which does not reflect the detail of actual fan charts measuring power from static pressure and airflow.

The update to Volume 4 in TRM 11.0 requires the provision of marked-up manufacturer fan charts and will exclude generic fan charts in TRM 12.0.

Recommendation #2: The sampled tune-ups for the efficiency loss factor calculation should use direct air measurement (airflow method 1). Airflow methods 2 and 3 should not be used in the determination of the efficiency loss factor.

Key Finding #3: The amount of savings delivered by this measure across Texas requires a more detailed evaluation to ensure the accuracy of the energy savings.

Both the residential and commercial trend analysis of this measure indicate a more detailed level of evaluation is required over multiple years. Prior to the PY2025 implementation, recommendation #2 should be implemented on the previous three years of sampled tune-ups to determine the efficiency loss factor for use by implementers. Dialog should continue during the evaluation to coordinate additional QA improvements, ensuring the tracking values match the actual conditions. The TRM measure should be updated to eliminate complexity, reduce specific equipment restrictions, and develop a pathway for implementation when a three-year history of projects is not available. In 2025, a multi-year EM&V plan for the specific measure should be completed and presented in the evaluation planning process. The EM&V team recommends that the plan include a consumption analysis, contractor interviews, participant surveys, and site visits.

Recommendation #3: Future evaluations should put high prioritization on tune-up measures for both residential and commercial sector programs by conducting consumption analyses and other efforts to support increased accuracy of the claimed savings.

4.0 COMMERCIAL ENERGY EFFICIENCY PROGRAMS

4.1 SUMMARY RESULTS

This section presents investor-owned utility (IOU) summary results, followed by key findings and recommendations from all relevant evaluation, measurement, and verification (EM&V) activities.

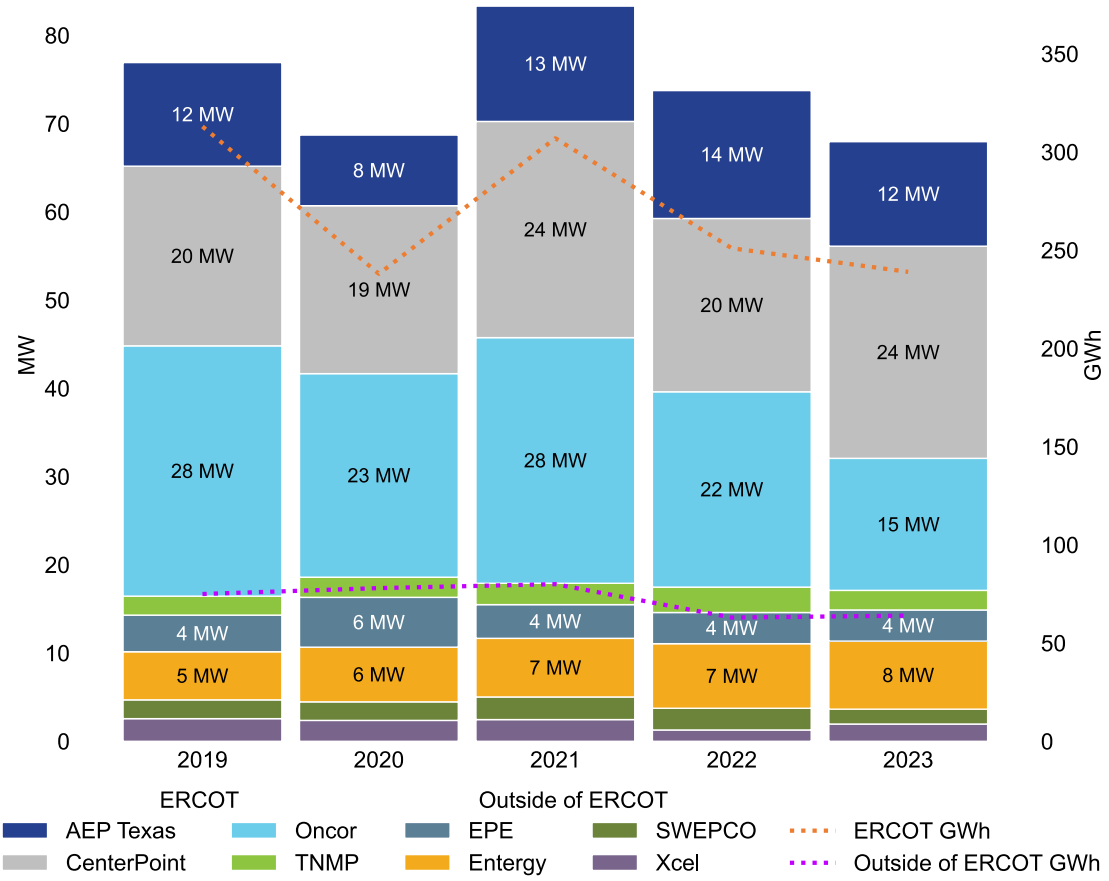
4.1.1 Savings

The IOU program year (PY) 2023 (PY2023) gross savings from commercial sector programs, excluding load management, were:

- 67,951 kilowatts (kW) of demand reductions; and
- 302,421,596 kilowatt-hours (kWh) of energy savings.

As shown in Figure 25, the total demand reductions across IOU programs, excluding load management, decreased from PY2019 to PY2020—77 megawatts (MW) to 69 MW, respectively—but rebounded in PY2021 to 83 MW. Similarly, energy savings decreased from PY2019 to PY2020—388 gigawatt-hours (GWh) to 317 GWh, respectively—but increased from 317 GWh in PY2020 to 385 GWh in PY2021. PY2021 and PY2022 saw demand reductions decrease from 83 MW to 74 MW, with energy savings also decreasing from 385 GWh to 314 GWh. Demand reductions and energy savings continued to decrease from PY2022 to PY2023, with demand reductions falling from 74 MW to 68 MW, and energy savings falling from 314 GWh to 302 GWh.

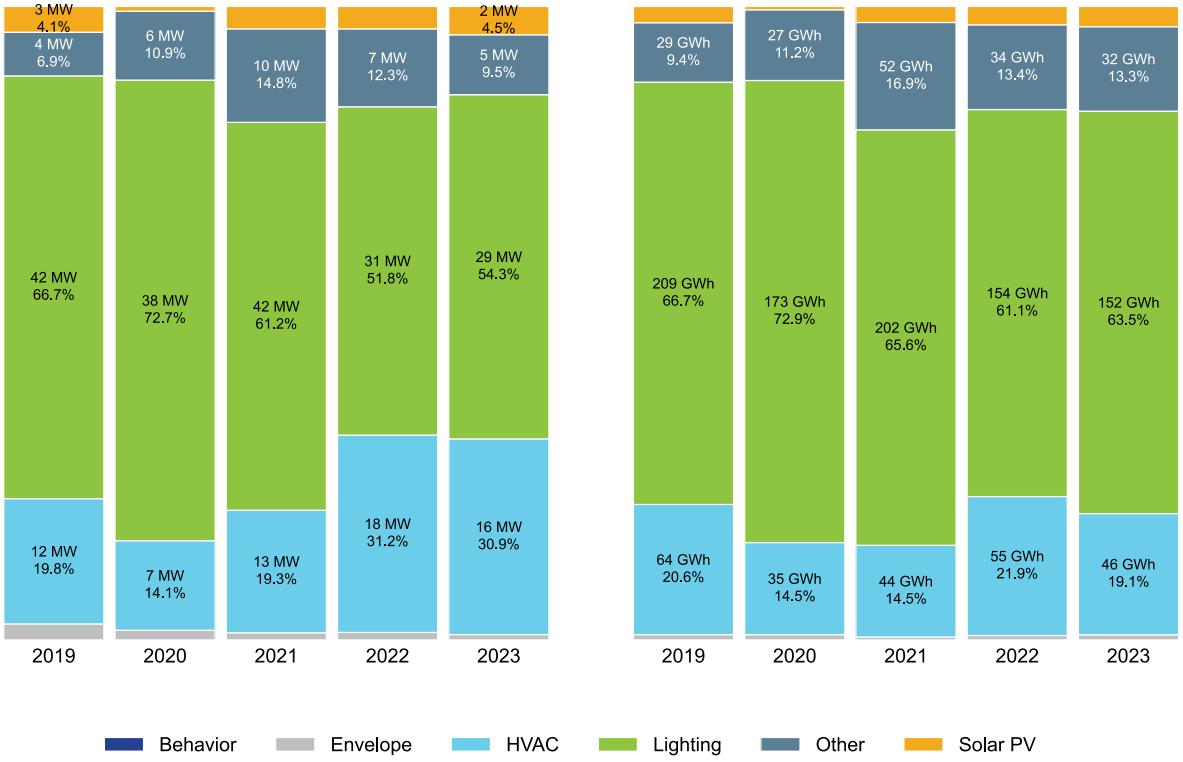
Figure 25. Total IOU Demand Reduction and Energy Savings by Program Year—Commercial Programs Excluding Load Management, PY2019–PY2023[24]



Lighting measures, while still accounting for over one-half of the demand reductions and energy savings from ERCOT IOU commercial programs—54 percent and 64 percent, respectively—have decreased over the past five years. The ERCOT IOU programs have substantially increased commercial *HVAC* measures in PY2022 and PY2023 to approximately 30 percent of demand reductions and 19 percent of energy savings, almost double compared to prior years (Figure 26).

[24] Due to limited space, the MW savings values for TNMP, SWEPCO, and Xcel from PY2019 to PY2023 were unable to make it on the graph: TNMP: PY2019, 2.150 MW; PY2020, 2.282 MW; PY2021, 2.420 MW; PY2022, 2.877 MW; PY2023, 2.221 MW. SWEPCO: PY2019, 2.131 MW; PY2020, 2.102 MW; PY2021, 2.564 MW; PY2022, 2.459 MW; PY2023, 1.684 MW. Xcel: PY2019, 2.567 MW; PY2020, 2.369 MW; PY2021, 2.462 MW; PY2022, 1.285 MW; PY2023, 1.958 MW.

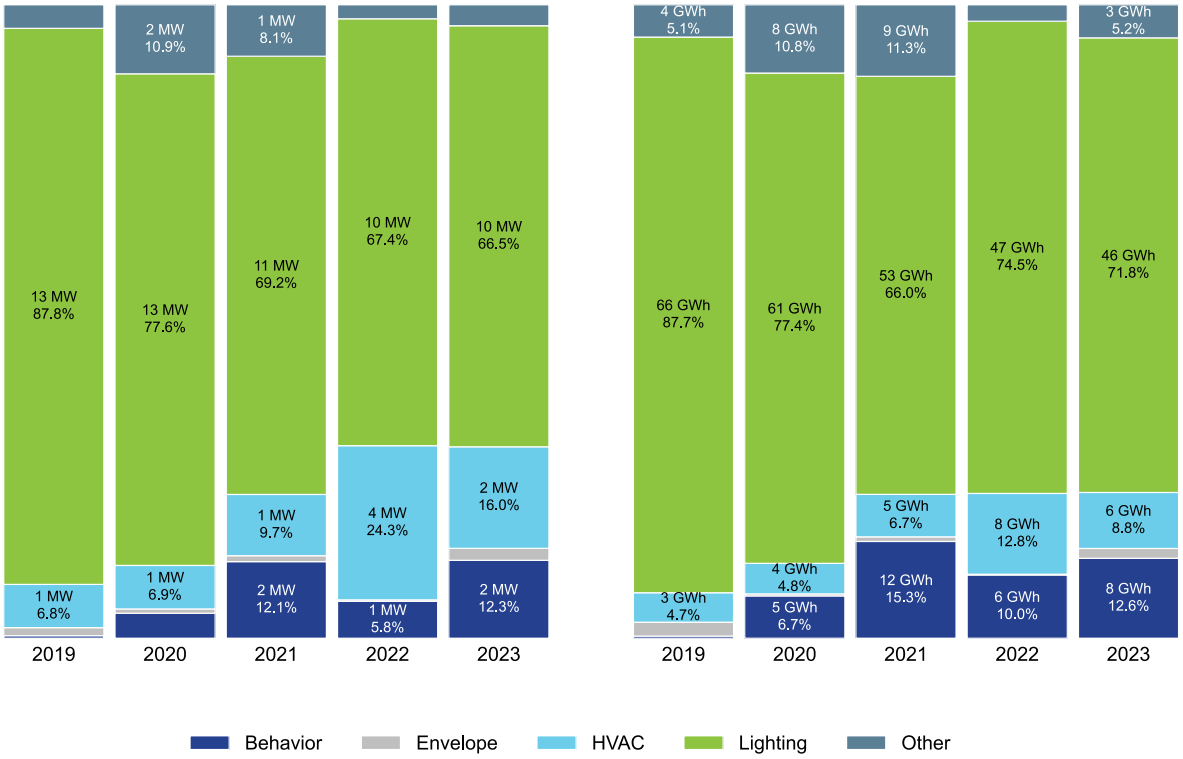
Figure 26. ERCOT IOU Demand Reductions and Energy Savings by Measure Category—Commercial Programs, Excluding Load Management, PY2019–PY2023[25]



While *lighting* measures still account for the majority of demand reductions and energy savings from outside-of-ERCOT IOU's commercial programs—67 percent and 72 percent, respectively—the last three years have seen *HVAC* and *behavioral* measures account for approximately a quarter of demand reductions and energy savings, which is an increase from prior years (Figure 27).

[25] Values less than five percent have been suppressed for visualization purposes.

Figure 27. Outside-of-ERCOT IOU Demand Reduction and Energy Savings by Measure Category—Commercial Programs, Excluding Load Management, PY2019–PY2023[26]



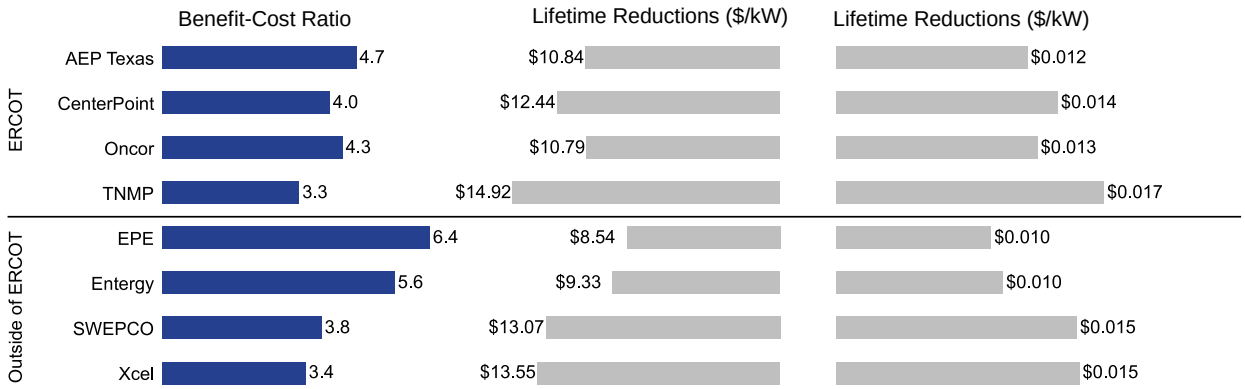
4.1.2 Cost-Effectiveness

Figure 28 summarizes the cost-effectiveness of each utility's commercial sector programs. Collectively, commercial sector programs were the most cost-effective programs in IOU portfolios, with an overall cost-effectiveness of over 4.0. Due to the diversity in IOU program designs, there is variation in each utility's commercial sector cost-effectiveness results.

Figure 28 summarizes the lifetime costs of demand reductions and energy savings for each utility's commercial sector programs. The cost per kilowatt-hour ranges from $0.010 to $0.017, and the cost per kilowatt ranges from $8.54 to $14.92. Lifetime costs of demand reductions and energy savings provide an alternate way of assessing the cost-effectiveness of an IOU's commercial sector programs; lower lifetime costs associated with IOU commercial sector programs generally indicate a higher sector-level cost-effectiveness ratio and result in lower costs to acquire savings and vice versa.

[26] Values less than five percent have been suppressed for visualization purposes.

Figure 28. Benefit-Cost Ratios and Cost of Lifetime Reductions and Savings—Commercial Programs, PY2023



4.2 COMMERCIAL PROGRAMS

4.2.1 Program Overviews

This section summarizes the key findings and recommendations from the PY2023 evaluation of IOU commercial sector programs. In PY2023, all commercial sector programs—and the Strategic Energy Management (SEM) pilot—were a *medium* evaluation priority. The utilities will consider the recommendations for PY2025 implementation and incorporate them into the PY2025 Texas TRM 12.0, as appropriate.

The EM&V team conducted a streamlined EM&V effort that couples broad due diligence verification of savings for commercial programs with targeted in-depth activities, including engineering desk reviews, on-site verification, and interval meter data analysis based on the prioritization of the programs.

The EM&V team evaluated the commercial programs described below. There are two program types: standard offer programs (SOPs) and market transformation programs (MTPs). An SOP is a program under which a utility administers standard offer contracts between the utility and energy efficiency service providers (EESPs). These contracts specify standard payments based on energy savings and demand reductions achieved through energy efficiency measures, measurement and verification (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.[27] SOP and MTP programs continue to represent the most significant percentage of IOU savings.

Commercial SOP: The Commercial SOP provides new construction and retrofit installation incentives for various measures that produce demand reductions and energy savings in nonresidential facilities. Incentives are paid to EESPs (project sponsors) based on deemed savings or verified demand reductions and energy savings at eligible commercial customers' facilities. The utility has a limited group of participating project sponsors, 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 IOU.

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

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 demand reductions and 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, resulting in verifiable demand reductions and energy savings. Commercial Solutions MTPs can include midstream programs that offer incentives at the distribution point to installation contractors who intend to install the equipment for eligible commercial or industrial customers. Specialty midstream programs are implemented using the Commercial Solutions MTP framework but are operated separately within utilities.

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 electricity demand and usage.

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 complete projects by approved project deadlines. This program is evaluated as part of the M&V and custom energy savings.

Strategic Energy Management MTP: The Strategic Energy Management (SEM) MTP is a pilot program offering commercial and industrial participants technical support to make operational adjustments, equipment adjustments, or maintenance improvements to reduce the energy consumption of existing activities. Technical support and financial incentives are provided to facility owners to implement energy efficiency measures and projects completed by approved project deadlines. This program is evaluated as part of the M&V and custom energy savings.

Commercial High-Efficiency Food Service MTP: The Commercial High-Efficiency Food Service MTP provides midstream financial incentives through food equipment dealers. The incentives reduce the initial cost of ENERGY STAR®-certified commercially rated equipment purchased by restaurants and other commercial kitchens. This program is evaluated as part of the food service and refrigeration energy savings.

HVAC Tune-Up MTP: The HVAC Tune-Up MTPs are dedicated programs that directly implement HVAC system tune-ups. The program typically serves residential and commercial participants through the same service network. The programs have various names and are often included under the MTP programs.

Solar Photovoltaic (PV) MTP and SOP: The Solar PV programs are both MTP- and SOP-type programs, depending on the utility. These dedicated programs provide financial incentives for commercial customers to install solar PV on-site power generation systems and use the electricity to offset electricity consumption on the electrical grid. The programs have various names, and solar PV projects are also included under either MTPs or SOPs.

Small Business MTP: The Small Business MTP is sometimes referred to as the Open MTP by Texas utilities. It is designed to assist small business customers with identifying and implementing cost-effective energy efficiency solutions at their workplace. The program typically offers limited measures that are applicable to most small businesses. 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.

4.2.2 Commercial Market Transformation Programs

This section presents the Commercial Solutions MTP and SCORE MTP program results, which were a *medium* evaluation priority. The MTP programs also include the small business, midstream, and custom savings programs, which were also designated as *medium* evaluation priority in PY2023.

Some utilities have dedicated midstream, small business, and custom savings programs, while others roll those services into their standard MTP programs. Therefore, commercial measures are implemented through a variety of programs. The findings are identified by the type of measure and may apply to all implementation methods or a subset of methods.

The EM&V team conducted desk reviews and on-site verification visits for a sample of projects from the *medium*-priority commercial MTP programs. For the desk reviews, the EM&V team applied the method prescribed in the PY2023 TRM 10.0 to verify energy savings and demand reductions for each project sampled. Comparing the evaluated savings to the original utility-claimed savings (ex-ante) showed agreement in about one-half of the projects. The results of the PY2023 evaluation found that fewer project adjustments and the range of savings adjustment decreased over the previous year. Although some individual projects had extensive adjustments when evaluated, nearly two-thirds of the projects were within five percent of the claimed savings. Table 10 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 10. Range of Evaluated Adjusted Reductions and Savings for Market Transformation Programs

Program	Evaluated adjusted demand reductions comparison (kW)	Evaluated adjusted energy savings comparison (kWh)
Commercial Solutions MTP	52%-143%	65%–279%
SCORE MTP	78%–159%	83%–146%
Small Commercial MTP	27%-134%	33%–131%
M&V and Custom MTP	9%–134%	47%–126%
Midstream MTP	62%-113%	54%–106%

4.2.3 Commercial Standard Offer Program

The Commercial SOP programs were a *medium* evaluation priority in PY2023. These programs included the prescriptive and deemed savings measures also delivered in the MTPs.

The EM&V team conducted desk reviews and on-site verification visits for a sample of projects from the *medium*-priority Commercial SOP program. For the desk reviews, the EM&V team applied the method prescribed in PY2023 TRM 10.0 to verify energy savings and demand reductions for each project sampled. Comparing the evaluated savings to the utility-claimed savings showed agreement in about one-half of the projects; this is nearly equivalent to last year's evaluation. However, many adjustments resulted from a transition in HVAC efficiency ratings, which caused market-wide confusion and should be resolved naturally in the coming year. There were still measures and projects that had extensive adjustments, including one that reduced the savings to zero because the new construction area was incorrectly measured. Table 11 presents the range of evaluated project-adjusted savings for SOP projects when comparing evaluated ex-post savings to ex-ante savings, excluding the project that eliminated savings. The range identifies the variability in evaluated results for various SOP programs and provides additional context for the key findings and recommendations.

Table 11. Range of Evaluated Adjusted Reductions and Savings for Standard Offer Programs

Program	Evaluated adjusted demand reductions comparison (kW)	Evaluated adjusted energy savings comparison (kWh)
Commercial SOP[28]	53%-166%	52%–230%

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

4.2.4 Key Findings and Recommendations

All key findings and recommendations outlined apply to the measures for multiple implementation types of commercial MTP and SOP programs. Across utilities, programs include many of the same deemed and prescriptive calculations. In addition, many programs include custom calculations and M&V methodology to claim project savings.

4.2.4.1 Lighting Energy Savings

This section presents the lighting measures in various MTP and SOP programs. These programs and measures were a *medium* evaluation priority in PY2023.

The EM&V team conducted desk reviews and on-site verification visits for a sample of projects from the *medium*-priority lighting measures. For the desk reviews, the EM&V team applied the method prescribed in the PY2023 TRM 10.0 to verify energy savings and demand reduction for each project sampled. Comparing the evaluated savings to the utility-claimed savings showed agreement in slightly more than one-half of the cases. The lighting projects were implemented by many different programs and utilities, leading to a varied realization of 16 percent to 229 percent.

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

[28] Range of adjusted reductions and savings excludes the project which received zero savings.

Key Finding #1: Lighting savings calculations were inconsistently completed across utilities when the baseline fixtures included occupancy sensors or other control devices.

The lighting savings calculations apply a reduction to installed lighting wattage, which translates to consistent savings when lighting controls are installed on a project that previously did not have lighting controls. However, the TRM does not indicate how to apply this factor when lighting controls are on the retrofitted lighting equipment. The uncertainty in the TRM created variability across utility program calculations.

Recommendation #1: Update the TRM measure for lighting equipment and lighting controls to specify calculations when baseline fixtures have lighting controls.

Key Finding #2: Many implemented programs did not identify non-operating lighting fixtures in the energy savings calculations.

The TRM applies an adjustment to the lighting calculations if the number of non-operating fixtures exceeds ten percent of the lighting equipment retrofit. Many programs did not appear to count and log non-operating fixtures to verify that the ten percent limit was not met. The evaluation could not apply a comprehensive value because the photograph documentation of the baseline condition captures limited fixtures.

Recommendation #2: Include the count of fully non-operational lighting fixtures in the calculation to verify the quantity does not exceed the limit in the TRM.

Key Finding #3: New construction exterior lighting can include multiple exterior lighting types, such as parking lots, loading docks, and pedestrian walkways, which can detail the exterior lighting allowable baseline wattage.

The exterior lighting savings calculation develops a baseline allowable lighting wattage from the area and an applied lighting wattage density based on area type. Evaluated projects consistently used only one exterior lighting area type – the parking and drive area. However, this simplification tends to underestimate the allowable wattage, which decreases demand reductions and energy savings.

The baseline development is based on code compliance, although the simplified calculation can create subareas that appear to not meet code. Some lighting calculators eliminate exterior lighting savings in this condition, which is not the intention of the TRM calculation.

Recommendation #3: Calculate exterior lighting savings using multiple exterior lighting zones and eliminate the code compliance verification in the calculation.

Key Finding #4: New construction projects require measurement of both interior and exterior areas. This area is estimated at the time of the initial application and is not consistently updated at project closeout.

The lighting baseline for new construction multiplies the allowable lighting wattage density by the area. The evaluation found that the area claimed in the calculation did not consistently match the area of the new construction facilities. The EM&V team understands the difficulty of claiming the area before the construction. However, the final QA verification of the projects should incorporate a review of the interior and exterior area of the construction to verify that it matches the constructed facilities.

Recommendation #4: Incorporate QA checks to verify interior and exterior areas at project closeout.

4.2.4.2 HVAC Energy Savings

This section presents the HVAC measures in various MTP and SOP programs. These programs and measures were a *medium* evaluation priority in PY2023.

The EM&V team conducted desk reviews and on-site verification visits for a sample of projects from the *medium*-priority HVAC measures. For the desk reviews, the EM&V team applied the method prescribed in the PY2023 TRM 10.0 to verify energy savings and demand reductions for each project sampled. Comparing the evaluated savings to the utility-claimed savings showed agreement in slightly more than one-half of the cases. Many different implementers supplied the HVAC projects, leading to a varied realization of 37 percent to 279 percent.

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

Key Finding #1: PY2023 included the rollout of an efficiency rating system for HVAC equipment with a different baseline than the old rating system. The AC and HP baseline efficiencies did not align with the efficiency rating of the installed equipment in the calculation.

The market conditions in PY2023 created a transitional situation where equipment could have one of two different efficiency-rated values. The different values had differing baselines, so confirming that the calculation had the proper baseline for each HVAC equipment item was complicated. Since this was a transitional year, the indication of which rating baseline to use was misapplied in many projects reviewed; this slightly adjusted the claimed savings value in both positive and negative directions.

Recommendation #1: Institute a QA check on the energy savings calculation to ensure the efficiency rating of HVAC equipment matches between the baseline and installed equipment.

Key Finding #2: The HVAC energy savings calculation reduced energy savings when the installed equipment capacity exceeded the replaced equipment capacity. Current technology allows upsized equipment to match load better than historical and should not result in reduced savings.

Technological advances in HVAC equipment made the condition where the new technology had a larger capacity than the replaced units more common. The result of this adjustment in the calculation was to reduce the energy savings for the equipment replacement, although the technology included would not result in the calculated reduction in energy savings. The reason for this variation between calculated savings and expected actual savings is that the TRM calculation assumes the capacity of the equipment is matched to the load of the building. Although this is a prevalent situation, it was not always the actual situation. Adjusting the calculation to the estimated building load will eliminate the penalty when advanced equipment with a larger capacity is installed.

Recommendation #2: Adjust the TRM savings calculation to determine savings from building HVAC loads instead of equipment capacity.

4.2.4.3 M&V Methodology and Custom Energy Savings

The M&V methodology claims energy savings for RCx, behavioral, operational, controls, and an expanding collection of custom energy efficiency projects. In addition, custom energy savings calculations can determine the energy savings from projects with defined scopes and outputs. The M&V methods provide a framework for high-quality verified savings for projects that cannot be readily isolated through engineering equations or modeling and provide significant energy savings. The M&V methodology identifies and claims savings from more complicated projects. Custom engineering calculations are used to determine energy savings associated with projects. The custom calculation is used where projects are easily defined, do not require long-term monitoring to identify savings, and do not meet prescriptive measure conditions in the TRM. The calculation determines the energy savings and the demand reductions separately, with demand reductions being determined using the PDPF *top 20-hours* method outlined in Volume 1 of the TRM. Overall, the evaluation found that the M&V and custom-calculated projects had agreement with the original utility claimed (ex-ante) savings for about two-thirds of the projects. The projects using the M&V methodology and the custom calculation for energy claimed energy savings were supplied by many different implementers, leading to a variation of 46 percent to 134 percent.

Key Finding #1: New implementers of custom projects needed support to claim demand reductions with the PDPF *top 20-hours* method and for regression analysis of the achieved demand reductions.

Programs with implementers that consistently submit custom and M&V project savings use the PDPF *top 20 hours* method in response to comments from previous evaluations and accessing technical assistance. However, staff and third-party implementers have recently started to complete these calculations and tend to use demand reductions calculations that do not match the Texas TRM. The PDPF *top 20 hours* method is unique to the Texas TRM, and staff that has not previously implemented a custom calculated energy efficiency measure should be notified that the demand reduction calculation is different. Utilities and the EM&V team have resources to support implementers in completing their first custom or M&V calculations and analysis.

Recommendation #1: Update the TRM to clarify using the PDPF *top 20-hours* method in Volume 1.

Key Finding #2: The regression analysis of hourly demand reductions for M&V projects regularly requires waivers to the statistical metrics in the TRM.

The M&V analysis requires a regression analysis of the hourly energy consumption, which can be applied to identify the annual energy savings. The hourly regression analysis tends to smooth out the consumption in each hour so that the overall year consumption represents the annual consumption. Volume 4 of the TRM identifies the statistical metrics required for this type of analysis to be valid without special approval. The implementers have had to create separate models that can be used for calculating demand reductions using the PDPF *top 20 hours* method. However, those models still smooth out the consumption during the peak periods that are being measured.

The EM&V team has been providing specific technical assistance to implementers calculating demand reductions to ensure that the demand reduction calculation is acceptable because it infrequently meets the statistical metrics analyzed. The EM&V team recognizes that the metrics identified in the TRM are unobtainable for the demand reduction calculation for most projects.

Recommendation #2: Update TRM Volume 4 to adjust the statistical metrics for peak kilowatt demand reduction regression analysis in both summer and winter peak calculations.

4.2.4.4 Foodservice and Refrigeration Energy Savings

This section presents the food service and refrigeration measures in either the Commercial High-Efficiency Food Service MTPs or other generalized MTPs. These programs and measures were a *medium* evaluation priority in PY2023.

The EM&V team conducted desk reviews and on-site verification visits for a sample of projects from the *medium*-priority food service and refrigeration MTPs. For the desk reviews, the EM&V team applied the method prescribed in the PY2023 TRM 10.0 to verify energy savings and demand reductions for each project sampled. Comparing the evaluated savings to the utility-claimed savings showed agreement in about one-third of the cases. Nearly all of the food service and refrigeration measures were implemented through a midstream delivery model using streamlined assumptions, leading to a project-level realization rate between 38 percent and 113 percent.

The key findings and recommendations of the food service and refrigeration MTPs do not restate the key findings and recommendations for other programs. However, since measures and program delivery occur across the programs, the findings and recommendations from the Commercial High-Efficiency Food Service MTP also apply to *food service* and *refrigeration* measures in other commercial programs.

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

Key Finding #1: The midstream food service programs did not provide the evaluator with documentation regarding the measure assumptions and savings calculation.

The midstream implementation for food service and refrigeration equipment included a set of standard assumptions about equipment. The documentation provided did not indicate the assumptions made, and the EM&V team was not able to recreate the savings value. Documenting the standard assumptions for equipment in midstream programs increases the transparency of the savings.

Recommendation #1: Utilities should ensure that their program implementers document claimed savings assumptions per measure in available program documentation or the tracking system.

Key Finding #2: The midstream food service and refrigeration implementation did not consistently match the equipment specifications to the deemed measure savings.

The midstream implementation provided a system to ensure that equipment that received an incentive qualified per the requirements of the associated TRM measure. However, the documentation of the equipment did not track or utilize the individual equipment specifications to detail assumptions in the energy savings calculation from the TRM measure. Documenting the individual make and model specifications and using them to select the assumptions in the energy savings calculation will increase the accuracy of the program's claimed energy savings.

Recommendation #2: Utilities should ensure that they maintain documentation for the equipment specifications of the program's accepted midstream measures and use them to select assumptions in the energy savings calculations. Alternatively, utilities should use a documented conservative assumption for all equipment included in the program and inform the EM&V team of their methodology.

4.2.4.5 Envelope Energy Savings

This section presents the envelope measures in generalized MTPs. These programs and measures were a *medium* evaluation priority in PY2023.

The EM&V team conducted desk reviews and on-site verification visits for a sample of envelope projects from the *medium*-priority Small Business and SCORE MTPs. For the desk reviews, the EM&V team applied the method prescribed in the PY2023 TRM 10.0 to verify energy savings and demand reductions for each project sampled. Comparing the evaluated savings to the utility-claimed savings showed agreement for all projects except one with a project-level realization rate of 60 percent.

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

Key Finding #1: The measurement of door seals for the *entrance and exit door air infiltration* measure was inconsistent with the detail of the TRM calculation.

The *door seal* measure was the only envelope measure with a finding from the EM&V team. The measure was well implemented and met the objective of the TRM requirement; however, it underestimated the value of the existing door seals replaced. The project had many doors and provided good documentation of pre- and post-installation conditions. The EM&V team estimated that the pre-installation door seals were still 40 percent effective as a conservative assumption. A conservative assumption should be standard in the deemed savings values to streamline the measure implementation and savings claimed.

Recommendation #1: Adjust the TRM calculation to account for a whole-door measurement of door seals instead of door seal length.

4.3 MEASURE OPPORTUNITY ANALYSIS

Several measures have an opportunity to expand the number of commercial installations incentivized by the programs. Both the *smart thermostats* and *food service and refrigeration* measures are ideal for retrofit opportunities with implementation-type adjustments.

4.3.1 Smart Thermostats

Nearly one-half of commercial buildings in Texas were between 1,001 and 5,000 square feet, and approximately 75 percent of the floor area had space heating and cooling, according to the CBECS Survey[29]. Typical equipment used for HVAC is packaged heating and AC units controlled by a thermostat or a more comprehensive control system. In the CBECS Survey, only nine percent of the existing building stock identified using a smart thermostat to control the HVAC systems. Since 2018, smart thermostats and more comprehensive control systems in these spaces have significantly increased in new construction and major retrofits. However, smart thermostats can provide immediate savings from existing equipment without replacing HVAC equipment.

[29] Commercial Buildings Energy Consumption Survey (CBECS) 2018.

In PY2024, the Texas TRM developed an estimate of energy savings for small commercial buildings that upgraded from a standard programmable thermostat to a smart thermostat in Measure 2.2.11 in TRM 11.0. The measure estimates heating and cooling savings of ten percent and eight percent of the estimated HVAC energy consumption, respectively. To identify the savings, the data collected to implement the measure includes the building type, HVAC equipment type, and HVAC capacity. Implementation of the measure can be completed as a midstream program. However, it will still require that the program collects the size and capacity of the equipment controlled in addition to the smart thermostat specification. Measure 2.2.2 for HVAC equipment sets out the baseline assumptions for midstream implementation for the assumptions associated with building type and climate zone that a midstream implementation of smart thermostats can utilize.

Utilities in Texas incentivized an average of 4,000 smart thermostats over the last three years. There is a significant opportunity to increase the number of small commercial participants by implementing this measure, which can lead to savings with existing equipment.

4.3.2 Food Service and Refrigeration Midstream Implementation

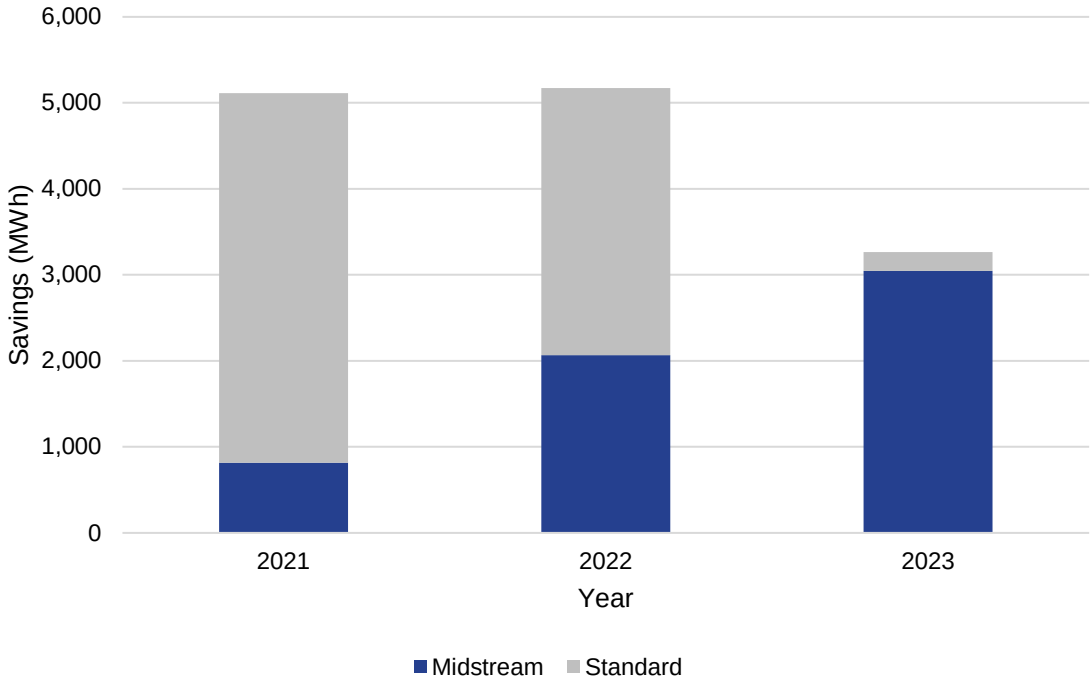
In Texas, foodservice buildings accounted for 5.3 percent of the total commercial buildings (around 40,000) and 1.7 percent of the total commercial floor space (193 million square feet)[30]. In addition to the traditional food service industry building, the 2018 CBECS Survey identified that refrigeration and food service equipment were widely used across many additional commercial buildings. Specifically, 71,000 buildings had walk-in units, 112,000 had refrigerated cases or cabinets, 11,000 had large cold storage areas, 125,000 had commercial ice makers, 450,000 had residential-type or compact units, and over 150,000 had food preparation or serving areas in non-food-service buildings. These figures highlight the extensive use of energy-intensive equipment throughout the commercial sector, presenting significant opportunities for energy savings through adopting more efficient technologies and spreading participant contacts across many different markets.

Expanding the *food service* and *refrigeration* measures is important because the commercial buildings that include this equipment have significantly increased energy consumption per square foot because of the food preparation and associated ventilation equipment. ENERGY STAR® provides certification of this equipment to provide businesses with an indication of which equipment will impact energy consumption least when installed. However, a 2020 market study completed by ENERGY STAR® found that about 25 percent of commercial food service equipment sold in the US was ENERGY STAR®-certified[31]. For the programs to succeed, the benefits of ENERGY STAR® equipment must be apparent to the equipment-purchasing individuals from the various building types.

[30] Commercial Buildings Energy Consumption Survey (CBECS) 2018.
[31] https://www.energystar.gov/sites/default/files/asset/document/2020%20USD%20Summary%20Report_Lighting%20%20EVSE%20Update_0.pdf.

CenterPoint piloted a midstream program in 2021 and has since converted it to an MTP[32]. This program provides incentives for energy-efficient food service and refrigeration equipment at the distributor level; therefore, it can reach all commercial buildings that include food service and refrigeration equipment in all building types. In the past three years, this midstream program consistently increased savings while the remainder of the standard programs implemented have seen decreased savings each year. Figure 29 shows the growth of the midstream implementation from about 16 percent of the savings for *food service* and *refrigeration* measures. The program has expanded by about an additional 1,000 MWh per year for the past two years. The implementation through a midstream program is an opportunity for utilities to reach all participants who have food service equipment.

Figure 29. Claimed Energy Savings from Food Service and Refrigeration Measures, PY2021-PY2023



The TRM currently includes electric energy efficient measures for refrigerators, freezers, ice makers, dishwashers, ovens, griddles, fryers, steamers, and demand-controlled ventilation. Beyond these measures, the utilities have provided research and propose to expand the TRM to include rack ovens, conveyor ovens and toasters, rotisseries, induction cooktops, electric deck ovens, hand wrap machines, ultra-low-temperature freezers, refrigerated chef bases, steam tables, and induction soup wells. In addition to the electric energy savings, food service equipment that saves natural gas can also be identified by the ENERGY STAR® rating. Combining the energy-efficient commercial kitchen equipment can save a restaurant around $5,300 per year on energy bills. Expanding the measure availability and increasing the ability for incentives to support the purchase of energy-efficient equipment for all market sectors is an opportunity available across Texas.

[32] Center Point Commercial High-Efficiency Foodservice (CHEF) program.

5.0 RESIDENTIAL ENERGY EFFICIENCY PROGRAMS

5.1 SUMMARY RESULTS

This section presents the portfolio summary results for the investor-owned utilities' (IOU), residential programs, followed by key findings and recommendations from all relevant evaluation, measurement, and verification (EM&V) activities.

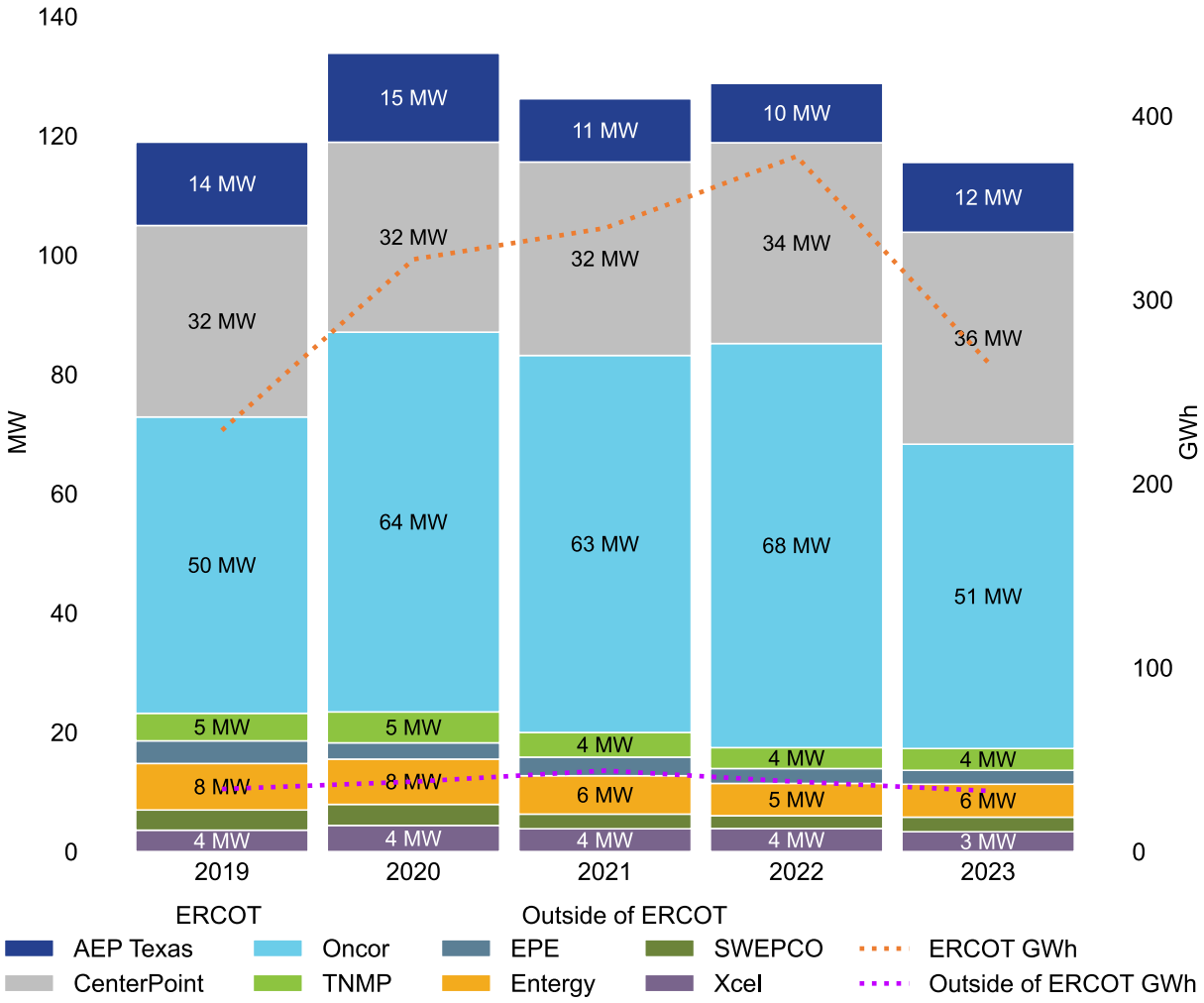
5.1.1 Savings

The IOU program year (PY) 2023 (PY2023) gross savings from residential sector programs, excluding load management, were:

- 115,509 kilowatts (kW) of demand reduction; and
- 299,659,010 kilowatt-hours (kWh) of energy savings.

As seen in Figure 30, the residential demand reductions achieved in PY2023 were the lowest in the last five years, with energy savings at the second lowest. One driver of this decrease is the updates to the TRM in PY2021 in response to results from the residential consumption analysis completed in 2020. The 2020 residential consumption analysis found that the residential deemed savings were overestimating savings found in the AMI meter data; therefore, several changes to the TRM were made to address these differences. This consumption analysis was updated as part of the PY2023 EM&V and will be discussed later in this section. In addition, PY2022 was the last year of residential lighting savings not affected by the Energy Independence and Security Act (EISA) backstop. Energy savings and demand reductions from residential lighting were expected to decrease significantly in PY2023, which did occur across all IOU portfolios with the largest impact on Oncor's residential savings.

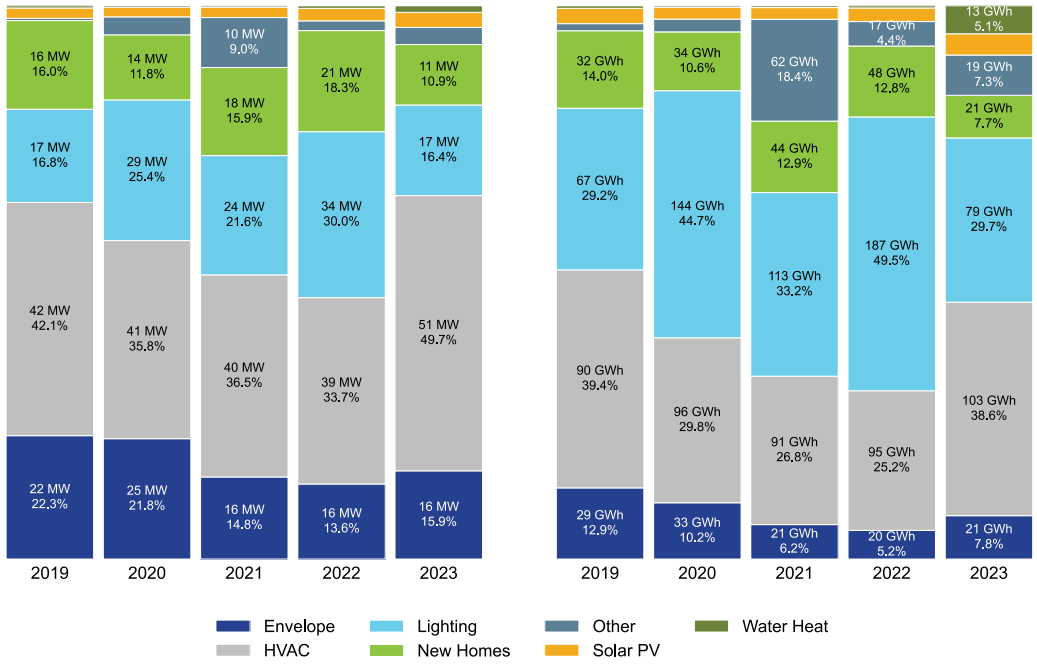
Figure 30. Total IOU Demand Reduction and Energy Savings by Program Year—Residential Programs, Excluding Load Management, PY2019–PY2023[33]



In PY2023, ERCOT IOU residential demand reductions (excluding load management) and energy savings were primarily derived from *HVAC* measures representing almost one-half of kilowatts and over one-third of kilowatt-hours. Figure 31 presents the breakdown of savings by measure category and demonstrates that the ERCOT IOUs have successfully increased *HVAC* measures in their residential portfolios. While *lighting* has decreased substantially as a percentage of impacts, it is still the second highest contributor to demand reductions and energy savings, although *envelope* measures are a close third for demand reductions at 16 percent.

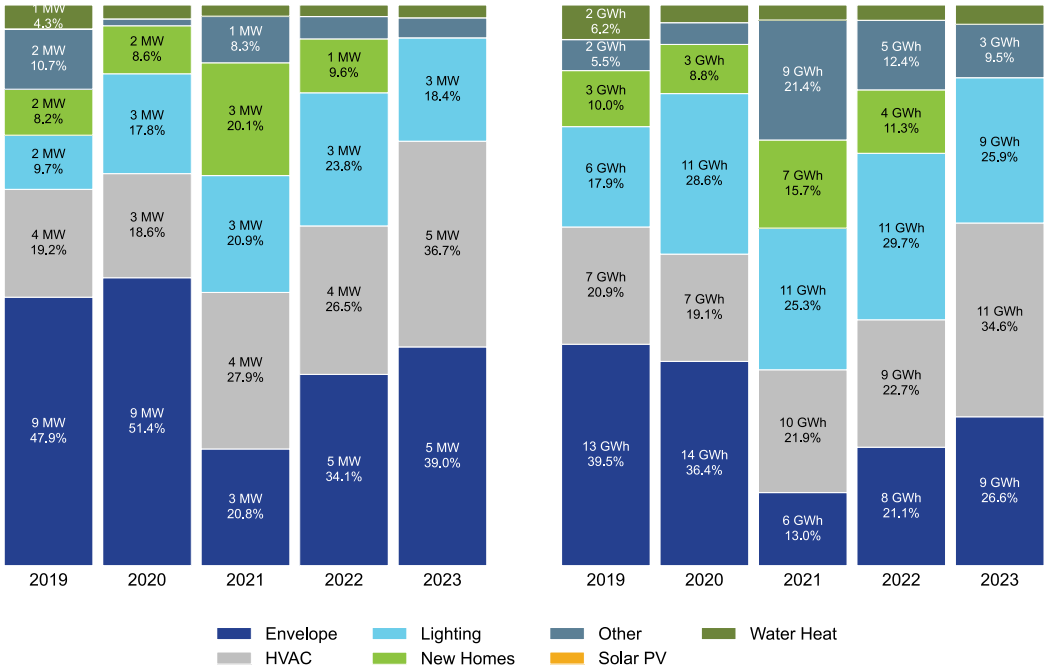
[33] The following data points consist of the MW savings values that were unable to make it on the graph due to limited space. TNMP: PY2019, 4.615 MW; PY2020, 5.183 MW; PY2021, 4.133 MW; PY2022, 3.506 MW; PY2023, 3.653 MW. EPE: PY2019, 3.798 MW; PY2020, 2.728 MW; PY2021, 3.118 MW; PY2022, 2.496 MW; PY2023, 2.334 MW. SWEPCO: PY2019, 3.382 MW; PY2020, 3.528 MW; PY2021, 2.457 MW; PY2022, 2.149 MW; PY2023, 2.442 MW. Xcel: PY2019, 3.588 MW; PY2020, 4.381 MW; PY2021, 3.820 MW; PY2022, 3.864 MW; PY2023, 3.325 MW.

Figure 31. Distribution of IOU Demand Reduction and Energy Savings by Measure Category—Residential ERCOT Programs, Excluding Load Management, PY2019–PY2023[34]



Outside-of-ERCOT IOU portfolios also saw an increase in *HVAC* measures as PY2023 programs achieved over one-third of demand reductions and energy savings from HVAC. *Envelope* measures are similar contributors to portfolio demand reductions and energy savings (Figure 32).

Figure 32. Distribution of IOU Demand Reduction and Energy Savings by Measure Category—Residential Outside-of-ERCOT Programs, Excluding Load Management, PY2019–PY2023[35]



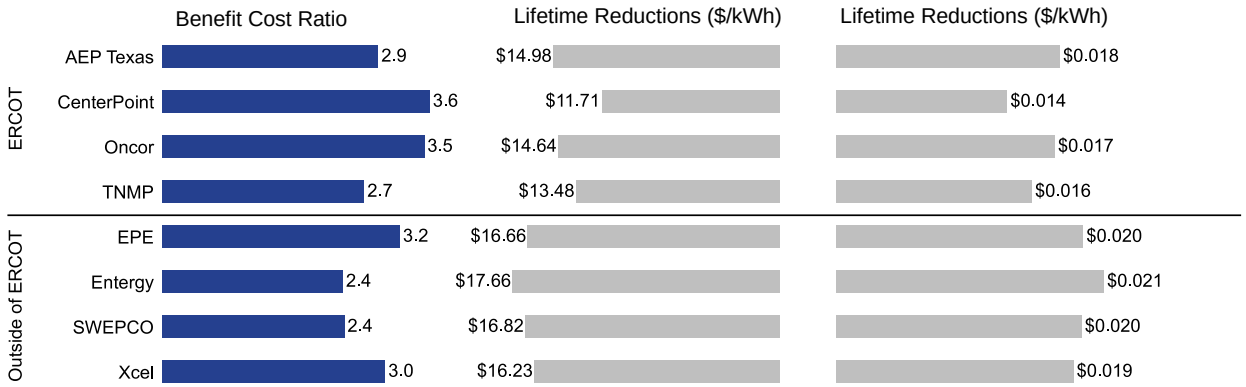
[34] Values less than four percent have been suppressed for visualization purposes.
[35] Values less than four percent have been suppressed for visualization purposes.

5.1.2 Cost-Effectiveness

Based on gross claimed savings, the cost-effectiveness of residential sector programs across all IOUs was 3.0. Like the commercial sector, the residential sector's cost-effectiveness varied among utilities, ranging from 2.4 to 3.6; similarly, this is partly due to the differences in the types of programs offered by different utilities.

Figure 33 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 $0.014 to $0.021, and the cost per kilowatt ranges from $11.71 to $17.66. 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 reductions and savings and vice versa.

Figure 33. Benefit-Cost Ratio and Cost of Lifetime Reductions and Savings—Residential Programs, Excluding Load Management, PY2023



5.2 RESIDENTIAL PROGRAMS

5.2.1 Program Overviews

This section summarizes the key findings and recommendations from the PY2023 evaluation of residential energy efficiency projects. The residential standard offer programs (SOPs), hard-to-reach (HTR), low-income (LI) programs, and certain residential market transformation programs (MTPs) were *high* or *medium* evaluation priorities. The recommendations are to be considered by the utilities for PY2025 implementation and will also be incorporated into the PY2025 Texas TRM 12.0 as appropriate.

The EM&V team evaluated the residential energy efficiency programs described below. Like the commercial energy efficiency programs, there are residential SOPs and MTPs. The residential SOPs provided by the Texas utilities offer standard incentives for a wide range of measures that are bundled together as a program to reduce system 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 by increasing the 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 LI programs are also offered to provide comprehensive energy efficiency retrofits for single-family and multifamily customers who meet the program's residential income guidelines.

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 reductions 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 the current federal poverty level (FPL). Incentives are paid to project sponsors for qualifying installed measures such as *air conditioning*, *air conditioner tune-ups*, *duct sealing*, *weatherization*, *ceiling insulation* and *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 utilities partner with raters on this program, 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-efficiency *LED lighting*, *smart thermostats*, *energy-efficient appliances*, and *other efficient equipment*. Offering 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 FPL. Incentives are provided for a wide range of retrofits 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 LI residents of Texas. Alternatively, the program offers a review of the home's energy efficiency and the installation of weatherization measures to increase the home's energy efficiency. A household qualifies if the income is at or below 200 percent of the FPL, 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.

5.2.2 Residential New Homes and Upstream/Midstream Key Findings and Recommendations

Key findings and recommendations are presented first for New Homes programs and upstream/midstream measures. This is then followed by the detailed research that supports the key findings and recommendations.

5.2.2.1 New Homes

Key Finding #1: Residential new construction standard practice has moved to or near ENERGY STAR® standards.

Most interviewed builders report they already build to ENERGY STAR® standards or beyond. Many say they build to International Energy Conservation Code (IECC) 2018 or 2021, which some jurisdictions in the IOU territories have adopted as the local code. Approximately one-half of the builders said they build to these standards, often independent of program incentives. Several builders also reported that customers expect energy efficiency as a standard feature of new homes, which also influences them to exceed the requirements of energy codes. Similarly, raters report working with multiple builders and programs, ensuring homes meet or exceed these standards.

Recommendation #1: Consider updates to the PY2025 TRM 12.0new homes baseline in Volume 4 that reflects both market baselines and local codes across the IOU territories**.**

Key Finding #2: Program attribution for the new homes programs has decreased slightly from 70 percent to 60 percent as builders' standard practices have become more efficient.

The last net-to-gross research was conducted in 2020 as part of the PY2019 EM&V. In 2020, the State Energy Conservation Office (SECO) recently adopted IECC 2015 as the IOU code, and builders were adjusting to increased ENERGY STAR® levels, which are defined as 10 percent more efficient than code. The same research also found that HVAC equipment was an opportunity to gain efficiency levels beyond standard practice. The same series of net-to-gross (NTG) questions asked of builders in 2024 indicate a 50 percent NTG based on standard building practices. However, more efficient HVAC equipment remains a barrier in new homes; builders reported incentives were still needed to coordinate with HVAC contractors to install more efficient equipment. The EM&V team's review of IOU new homes programs found that all programs incentivized more efficient HVAC equipment through the programs, resulting in the EM&V team increasing the NTG by 10 percent to 60 percent. The NTG ratio for the Texas IOU programs is used to calculate cost-effectiveness based on net savings; all the programs are still passing at 60 percent.

Recommendation #2: Reassess the NTG ratio for new homes programs as the IOU programs gain more participation at the higher-tiered incentive levels and/or as the TRM savings baseline is updated.

Key Finding #3: Financial incentives are helpful in reducing the costs of building more efficient homes, although customers may be largely unaware of the utility incentive and are resistant to paying for more efficiency.

Builders report they primarily use the incentives to reduce their costs rather than passing the discount to the customer; a minority of builders consistently inform customers about the utility incentives. Some builders and raters reported that the costs of incorporating energy-efficient measures are still high and find the incentive value insufficient compared to the incremental costs of increased efficiency. In addition, builders indicated that despite customers expecting an "efficient new home," customers also frequently question the tangible monthly savings from energy-efficient products, which affects their willingness to pay for more efficiency. Several of the IOU programs offer tiered incentive levels that increase as both the efficiency above ENERGY STAR® and HVAC equipment increase. These tiered incentive levels appear to be the most effective in pushing standard building practices based on the interviews.

Recommendation #3: Continue to offer tiered incentive levels for building above ENERGY STAR® up to Net Zero and higher efficiency HVAC equipment and assess program materials for effectiveness in conveying the benefits of more efficient homes to customers.

Key Finding #4: Builders would appreciate increased communication tools with IOU programs.

Some builders reported dissatisfaction with the clarity of program requirements. A recurring theme in their feedback was the lack of reporting on incentive status, leading to frustration and uncertainty about when they would receive their incentives. Utilities may consider streamlining the process for submitting and tracking incentive applications, such as an online portal where builders can easily check the status of incentives. Providing regular updates could reduce builder frustration and uncertainty. Ensuring timely delivery of incentives and monitoring the disbursement process to address any delays can help maintain builder participation in the program.

Recommendation #4: IOUs should assess the timeliness of program incentive payments and consider an online program portal.

Key Finding #5: Increased program training and outreach would be beneficial to trade allies, especially HVAC contractors.

Additionally, builders and raters highlighted the need for better communication and training from IOU programs for trade allies. Raters specifically mentioned program events geared toward HVAC contractors would be particularly beneficial in successfully promoting and having more efficient HVAC installed through the programs.

Recommendation #5: Consider training and outreach events that are specifically geared toward HVAC contractors and other trade allies that work with builders and raters to construct more efficient homes.

Key Finding #6: Documentation was incomplete or not readily available for all components of the projects.

Some projects claimed alternative baselines or deemed savings for additional prescriptive measures along with the modeled new home savings. However, documentation and tracking data for these measures were not consistent with the requirements in the prescriptive Residential TRM 9.0, Volume 2.

Recommendation #6a: Ensure all measures and savings are tracked individually, and documentation for additional prescriptive measures follows the *Program Tracking Data and Evaluation Requirements* Section in TRM Volume 2 under each measure.

Recommendation #6b: Ensure all savings calculations are readily available for all projects. If reported savings differ from the modeled savings report, ensure calculations for reported savings are transparent.

Key Finding #7: Some double counting of prescriptive savings was found when both prescriptive and modeled home participation paths were available.

For hybrid programs where prescriptive measure savings from TRM 9.0, Volume 2 are claimed along with modeled savings using parameters for the reference home from TRM 9.0, Volume 4, in some instances, the EM&V team found that the modeled home included claimed prescriptive measures potentially double-counting savings.

Recommendation #7: Ensure all prescriptive measures are excluded from the modeled home and documented as such. Savings should be tracked individually for each prescriptive measure claimed, and the modeled home should be tracked as one measure. Documentation for hybrid programs should include characteristics of the reference home and modeled home for comparison to ensure prescriptive measures are claimed appropriately.

5.2.2.2 Upstream/Midstream

Key Finding #1: Updates in federal HVAC standards caused confusion as to how to determine savings.

New federal standards for air conditioners (AC) and heat pumps (HP) went into effect on January 1, 2024, updating the efficiency standards and terminology from SEER/HSPF to SEER2/HSPF2. The standard applied to ACs in the Southern region at the installation date and HPs at the manufactured date. This distinction caused confusion as to which methodology and efficiency rating to apply for savings calculations.

Recommendation #1: For 2024 and beyond, the TRM has been streamlined to one methodology for both ACs and HPs. Both ACs and HPs should use the Air Conditioning, Heating, and Refrigeration Institute or equivalent SEER2/HSPF2 ratings to calculate savings.

5.2.3 New Homes

This section presents the EM&V findings of the new homes programs offered by five Texas IOUs: AEP Texas, CenterPoint, Oncor, and TNMP, in the ERCOT market, and Entergy in the outside-of-ERCOT market[36]. The impact evaluation allowed for an assessment of the accuracy of the gross savings, while the process evaluation included research to understand the effectiveness of the programs and update the NTG value used to calculate net savings. The Residential New Construction MTPs provide incentives to builders to increase the efficiency of new homes above minimum code efficiency. The programs partner with home energy raters, who inspect homes and provide the programs with energy models to describe the program-sponsored homes. The utilities and their implementers compare these energy models with code to estimate energy savings. Table 12 describes the five IOU programs.

[36] SWEPCO also offers a new homes program, but it offers prescriptive rebates only. The focus of this section is programs that have a whole house M&V approach to new homes.

Table 12. New Homes Program Attributes

Utility	Program name	Whole house M&V—incentive levels	Whole house M&V—minimum requirements	Add-on prescriptive incentives	Add-on prescriptive savings
AEP Texas	High-Performance New Homes MTP	2 Tiers: Exceeds Code, ENERGY STAR®-certified with complete foam encapsulation	Savings of at least five percent above the IECC 2015, meet all minimum energy code requirements	Yes	None
CenterPoint	Energy High-Efficiency Home MTP	3 Tiers: Exceeds Code, ENERGY STAR®-certified, DOE Net-Zero-Ready-certified	Savings of at least ten percent above IECC 2015, rated and registered in the RESNET[37] registry	Yes	HVAC equipment, heat pump water heaters, ENERGY STAR® connected thermostats and appliances
Oncor	Residential New Home Construction MTP	2 Tiers: ENERGY STAR®-certified, DOE Net-Zero-Ready-certified	ENERGY STAR® certification	Yes	HVAC equipment, ENERGY STAR® appliances
TNMP	High-Performance Homes MTP	2 Tiers: Exceeds Code, ENERGY STAR®-certified .	Savings of at least five percent above IECC 2015 with HVAC SEER2 ≥15.2	Yes	ENERGY STAR® connected thermostats, electric vehicle supply equipment, right-sizing HVAC bonus
Entergy	Residential Solutions MTP—New Homes MTP	3 Tiers: Exceeds Code, ENERGY STAR®-certified , DOE Net-Zero-Ready-certified.	RESNET HERS rated	Yes	HVAC equipment, domestic hot water equipment, and ENERGY STAR®-connected thermostats, appliances, and electric vehicle supply equipment

[37] RESNET is the Residential Energy Services Network

5.2.3.1 Process Results

The EM&V team gathered feedback from a combination of builders and raters to provide a comprehensive understanding of the New Homes programs' performance and areas for improvement. In addition, the EM&V team reviewed local codes, which are also summarized in this section. The detailed insights below inform the key findings and recommendations presented above.

i. Interview Overview

The EM&V team completed builder and rater (market actors) in-depth interviews for the Texas new homes programs in April and May 2024. The EM&V team also captured process-related information provided by builders and raters, such as:

- program awareness;
- satisfaction with various components of the program(s);
- perceptions of the market and barriers to adoption;
- areas the program is working well and opportunities for improvements; and
- standard building practices.

The EM&V team obtained the market actor sample from the PY2023 program tracking databases provided by IOUs. At a minimum, the market actors' company names and telephone numbers were received. Some market actor data also included an individual contact name, email address, number of projects completed, and associated demand reductions and energy savings.

The EM&V team completed 12 unique market actor interviews—8 builder interviews and 4 rater interviews. Because most of the raters and some builders work with several different utility programs, the 12 unique market actor interviews represent an overall 19 utility-specific, program-level completed interviews. The EM&V team reached out to all the raters and builders on the provided list, contacting them twice via email (if an email address was provided) and twice by phone. Table 13 documents the number of completed interviews by utility and market actor type.

Table 13. Number of Builder- and Rater-Completed Interviews by IOU*

Utility	Number of builder interviews completed (n=8)	Number of rater interviews completed (n=4)
ERCOT		
AEP Texas	4	0
CenterPoint	3	1
Oncor	2	4
TNMP	1	1
Outside-of-ERCOT		
Entergy	2	1
Total	**12**	**7**

*The counts represent the number of market actors working within each IOU. Market actors that serve customers in multiple territories are represented more than once.

Since the number of market actors interviewed for each IOU program is limited, results are qualitative and may not be representative of the entire population of interest. All numeric results (e.g., satisfaction ratings) are presented in responses rather than percentages to reflect the data's qualitative nature. Additionally, the information presented reflects the perception of the market actors, which may or may not accurately reflect the intended program design and delivery.

Next, we present the results of the homebuilder interviews, followed by rater interviews.

ii. Builder Interview Summary

The EM&V team spoke with a mix of builders that work across the five new homes programs in Texas. Organizations included in the study vary by the number of homes built annually (under ten homes to over 1,000 homes) as well as the type of home (primarily *production* but some *custom* homes). Five of the eight builders said that all the homes they build are built in areas that enforce the IECC 2015 energy code and that their rater completes a full rating on all their homes, whether they receive utility incentives or not. In addition to home ratings, raters provide various other key services for builders—they handle utility incentive paperwork and online submittals, as well as provide builders with code change information and training. About one-half of the interviewed builders report that, due to how much raters handle for them, they need less training or technical support provided by the IOU programs; however, the other half of interviewed builders do use program technical assistance.

Most home builders interviewed have been building homes through the Texas IOU programs for two to five years, with some (2 of 8) noting they have been participating for over ten years. The primary way builders interviewed first heard about the program was through HERS raters (3 of 8), followed by another program (2 of 8), with one builder reporting discussions with utility staff and one from another builder/contractor.

Satisfaction

Builders were asked to rate their level of satisfaction with various elements of the program (*very satisfied*, *satisfied*, *somewhat satisfied*, and *not satisfied*). As reflected in Table 14, the majority of builders said they were *very satisfied* or *satisfied* with most of the areas discussed. *Responses to questions and concerns* received the most *very satisfied* ratings, and the *amount of incentive offered* received the most *somewhat satisfied* ratings.

Table 14. Builders Satisfaction with New Homes Programs Components

Program component	Number very satisfied	Number satisfied	Number somewhat satisfied	Number not satisfied	Total responders*
Support received from the utility	3	4	4	0	11
Clarity of program eligibility requirements	3	4	0	4	11
Responses to questions/concerns raised	4	0	3	1	8
Training received	3	6	2	0	11
Amount of incentive offered	1	4	3	4	12

Program component	Number very satisfied	Number satisfied	Number somewhat satisfied	Number not satisfied	Total responders*
Amount of paperwork required	2	3	2	2	9
Utility online program application process	3	1	0	2	6

* n=12 When the number of responders does not equal 12, responses were either *not applicable* or *don't know*.

Use of Incentives and Participation Barriers

Builders stated they use the incentive to reduce their cost of building the home by offsetting the increased cost of more efficient products and practices. No builders reported that the incentive goes directly to the customer. Only one builder mentioned *always* informing customers about the utility's contribution, while others either *sometimes* (2 of 12) or *never* (4 of 12) do so, with 2 of 12 *unsure*.

Builders highlighted *cost* as the most significant barrier to customers purchasing energy-efficient homes, a recurring theme in past findings. This cost barrier manifests in several ways:

- **Market Competitiveness:** The new homes market, especially for production homes, is highly competitive. Some builders noted they couldn't afford substantial energy efficiency upgrades without additional incentives, as it would price them out of the market.

  "As an example, foam was really expensive at the time when the city raised code. About that time when people got involved with foam prices dropping, we jumped on the bandwagon. With the higher cost of this foam—very few people would have been able to afford it without the [utility] incentive."

- **Customer Expectations:** Most builders indicated that consumers expect homes to be energy efficient, leading them to build to ENERGY STAR® standards and transition to IECC 2021 standards in anticipation of code changes. The incentives help offset some of the costs associated with meeting these expectations.

  "We just build that way—we build above code to ENERGY STAR® —the incentives are helpful though."

- **Uncertainty About Savings:** Builders reported that many home buyers are concerned about tangible cost savings. Customers frequently question the real dollar savings per month from using energy-efficient products and worry about balancing the costs of the latest technologies, especially when transitioning to all-electric versus natural gas systems.

  "What does it translate to real dollars. You say you are putting these products in but how much am I saving each month?"

Satisfaction with Incentives and Program Requirements

The two items rated lowest for satisfaction were *the amount of incentive offered by the utility* and *the clarity of the program requirements*. Several reasons contribute to this dissatisfaction:

- **Low Incentive Value:** Builders mentioned that while the incentive is beneficial, its dollar value is low compared to the additional cost of building homes with higher energy-efficient equipment as required by the program.

- **Established Practices:** As indicated above, most respondents stated that they already build homes that meet or exceed program requirements as a standard practice. Many builders have been constructing energy-efficient homes for so long that they wouldn't do otherwise, indicating an increase in free-ridership.

- **Market Influences:** Other program influences, such as ENERGY STAR® and Environments for Living®, compel builders to construct more efficient homes to stay competitive. Some builders believe utility programs should enhance management and training to ease the burden on builders participating in multiple programs.

  ". . . a program with better training and management of the program. Better communication from the management of the program to equip us with more information. We really need more communication. Participating in the program is just one additional thing we are trying to do, and it just shouldn't be this hard to participate. We have even contemplated is this even worth our time to participate?"

- **Communication and Technology Issues:** Builders expressed frustration with the complexity of submitting and reporting program participation. Some are unaware of their incentive status, with some waiting over five to six months and still having no idea where their incentive is.

  "It's complex to determine what to submit and how to submit and that's a barrier - lots of clicks - needs to be a more streamlined process to find data and submit it. Having a place where you can check your rebate status vs what's been submitted - what's the status. I have to call somebody - I want to go online and check where my rebate is – a self-help portal or customer portal would be helpful."

Technical Support, Training, Marketing

Builders were asked if they employ or contract with a home energy rater, and 3 of 12 builders reported employing a rater, whereas 8 of 12 indicated they contract their rater. Additionally, when builders were asked whether the home energy rater completes a full rating for all homes or only for the homes that are incented through the program, 9 of 12 builders responded that the rater completes a full rating for all homes, while the other 3 builders answered they did not know.

The EM&V team also surveyed builders regarding their utilization of training since they started participating in the program. Just over one-half of the 12 respondents utilize training offerings; however, 4 of 12 builders surveyed responded that they do not utilize any training. Builders offered an array of reasons for how training has been applied to their building practices:

"ENERGY STAR® - We go above and beyond code."

"We usually attend the program kick off / annual onboarding."

"We've talked to our program rep a couple times."

"Email out of information on programs - videos and other materials"

"Use of the Program, like how to get started and the requirements when we first started."

Three of 12 builders shared that they utilize technical support when it is offered. However, one-half of the builders we spoke with (6 of 12) do not use technical support. Builders shared these comments regarding the influence of technical support on their building practices and general operations.

"[we used a] Googling the website methodology for how to submit questions [and for] what was actually needed to compile to submit for incentives. Rater was not so great so created challenges for us."

"Influenced a little maybe over the years but we build to ENERGY STAR® as standard practice."

"Somewhat helpful the training and technical support"

Just one builder informed us that they utilize program marketing resources such as signs in the yard, doormats, and brochures. Most builders (10 of 12) do not use any marketing resources.

"We just have verbally communicated that we have upgraded equipment if asked using the program. It would be great if you had lawn signs or something to indicate that this home has participated in the program. We would use them."

"Having social media [content] posts ready to go would also be helpful marketing for us."

5.2.3.2 Raters Interview Summary

The EM&V team spoke with raters working in four of the five new homes programs in Texas. Rater organizations included in the study vary by the number of home ratings annually (hundreds to thousands) and work with multiple builders. Raters reported that 80−90 percent of homes they rate are program-participating homes. All four raters said they anticipate about the same amount of new homes business in 2024. Many of the builders that these raters work with are building to ENERGY STAR® standards or similar types of programs (e.g., Environments for Living®).

All four raters we spoke with work with builders across multiple utility new homes programs.

The interviews probed these raters on differences in program requirements, marketing, program interactions, etc., by utility. Other than a few variations in program responsiveness, raters did not identify differences among the various utilities for this program.

When we asked how many builders work in jurisdictions that have not adopted or are not enforcing the IECC 2015 code, all four raters responded *none*. Likewise, for the builders that work in jurisdictions that have adopted/enforced the IECC 2015 code, raters said all builders they worked with in 2023 had reached compliance, and most are achieving IECC 2018 or above.

Satisfaction

Raters were asked to rate their level of satisfaction with various elements of the program (*very satisfied*, *satisfied*, *somewhat satisfied*, and *not satisfied*). As reflected in Table 15, all raters said they were *very satisfied* or *satisfied* with the areas discussed.

Table 15. Raters Satisfaction with New Homes Programs Components (n=7)

Program component	Number very satisfied	Number satisfied	Number somewhat satisfied	Number not satisfied	Total responders*
Overall program satisfaction	7	0	0	0	7
Ease of filling out and submitting required program documentation	7	0	0	0	7
Responsiveness of program staff to questions	1	6	0	0	7
On-site inspection process	1	5	0	0	6
Technical support	2	5	0	0	7

* n=7 When the number of responders does not equal 7, responses were either *not applicable* or *don't know*.

Program Requirements and Interactions

All raters indicated that communication related to program requirements has continued to be "pretty clear" and is understood. When asked about what program requirements builders or subcontractors find hardest to meet, one rater said:

"ENERGY STAR® is challenging, coordinating that through all the levels of the builder and working with the AC companies, [also] heat pump water heaters but then they couldn't find them for a while so finding the right equipment in the service territory, to have consistency. Same with AC systems, [we] just couldn't find them. SEER change was confusing for everyone.."

When probed for feedback regarding any needed program requirement changes, the same rater suggested:

"ENERGY STAR® is a great program, but at the same time ENERGY STAR® assumes we have more control over what the AC companies do. Bringing in some oversight of the AC companies more than just the raters would help."

Raters indicated that the process for certifying to the IECC 2015 specifications has been fine. One rater said:

". . . we address any problems related to the new specifications by consulting with Purchasing [departments] at the Builders, that's where it starts."

And again, all raters believed and communicated that builder's subcontractors know what is required of the IECC 2015 requirements and that training is not needed as most builders are building to IECC 2018 or higher.

Regarding technical support, two of seven raters indicated they were *very satisfied,* and five of seven) raters were *satisfied* with the level of support. The raters reported that technical support provided by utilities helps them:

- bring on new clients,
- get quick responses for technical issues, and
- get answers to questions about uploading documents.

Considering marketing, just one rater voiced they promote the advantages of newly constructed energy efficiency homes to real estate agents; other groups that raters identified promoting the program to were HVAC companies and builders. Building better homes and informing builders about the rebates were the benefits identified by raters promoting the program to these groups. All the raters confirmed that they didn't know whether realtors understand the benefits of the program or are actively promoting the advantages of energy-efficient homes.

We asked raters how QA/QC is done for files and software review, and one rater told us:

"we use Ekotrope and QA/QC is integrated into the software using an Ekotrope ID."

Another rater said:

"we use Fast Field Forms; it's really changed things and fast tracked it"

They can take pictures and check the boxes on checklists and time-stamp and date files. Internally, the rater uses design review checklists and reports. This same rater may also consider going to third-party QA per the ENERGY STAR® requirements because it may reduce liability. Three of four raters did not know if QA/QC differed by utility however, one rater indicated QA/QC differs for Oncor:

"…where an inspection report and pictures are documented, then they go out into the field, each program has their own process."

Only one rater provided feedback on how QA/QC could be improved, recommending that utilities provide a standard number of projects to QA/QC.

When asked how the program participation process could be improved, raters replied that integrating direct contact with AC companies and the onboarding process could be improved to bring in new builders more rapidly to increase program participation. This comment identified the most critical support the program could provide to raters in the near future.

"Training for AC company, Subcontractor, Raters – on-site meetings to demonstrate what they need to do before they can participate. Offering trainings for builder staff as well."

Raters were unanimous in the type of software they use to model homes, which is Ekotrope, and they do not foresee any major program changes in the past year that will affect the software modeling. No raters had any issues reporting to meet program requirements.

Primary barriers to builder participation in the program included covering the cost of energy efficiency equipment, issues with the different service territories and eligibility, meeting ENERGY STAR® requirements, and getting HVAC companies on board. The biggest challenge for raters participating in the programs is primarily the manual data collection. Plus, all of the raters confirmed there are incremental costs associated with building program-incented homes, and these additional costs are a challenge for their builders. Likewise, there was agreement that the biggest challenge for constructing and/or selling energy-efficient homes going forward is cost; increased rebates were offered as a suggestion to overcome this.

"[Name] is awesome! Involve the AC companies more and look at a second tier receiving incentives that isn't just based off of ENERGY STAR®, Manual J and testing perhaps or a different code."

5.2.3.3 Local Codes

In the past few years, many Texas cities have adopted energy codes that are more advanced than the state residential energy code (IECC 2015). As shown in Table 16 below, 14 of the top 20 largest cities by population have adopted IECC 2021. New homes built in cities that have adopted newer codes must adhere to them during permitting.

Table 16. Local Energy Code Adoption for Top 20 Largest Texas Cities

Rank	City	Local energy code	Effective date of newer code
1	Houston	IECC 2021	January 1, 2024
2	San Antonio	IECC 2021	February 1, 2023
3	Dallas	IECC 2021	May 12, 2023
4	Austin	IECC 2021	September 1, 2021
5	Fort Worth	IECC 2015	Statewide code level
6	El Paso	IECC 2021	October 1, 2023
7	Arlington	IECC 2021	January 1, 2023
8	Corpus Christi	IECC 2015	Statewide code level
9	Plano	IECC 2021	February 1, 2022
10	Lubbock	IECC 2021	June 3, 2024
11	Laredo	IECC 2018	October 4, 2021
12	Irving	IECC 2021	February 13, 2023
13	Garland	IECC 2015	Statewide code level
14	Frisco	IECC 2021	January 1, 2023
15	McKinney	IECC 2021	January 1, 2023
16	Amarillo	IECC 2015	Statewide code level
17	Grand Prairie	IECC 2021	January 1, 2022
18	Brownsville	IECC 2015[38]	Statewide code level
19	Killeen	IECC 2021	March 1, 2022
20	Denton	IECC 2021	June 1, 2022

[38] Brownsville's local code is IECC 2009, but new homes would follow the more stringent state code of IECC 2015.

5.2.3.4 Impact Results

The EM&V team conducted desk reviews for a sample of projects from the residential new homes programs. For the desk reviews, the EM&V team applied the method prescribed in the PY2023 TRM 10.0 to verify energy savings and demand reduction for each project sampled. New homes programs can include modeled whole-home savings as well as prescriptive *HVAC* and *appliance* measures. Table 17 shows the quantity, incentive amount, and reported demand reductions and energy savings by measure and utility for the sampled new homes projects. The desk review findings inform the key findings and recommendations presented in Section 5.2.2 above.

Table 17. New Homes Program Savings by Measure, by Utility

Utility	Measure description	Measure quantity	Incentives	Demand reductions kW	Energy savings kWh
AEP Texas	R-AtticEncapsulation	5	$250.00	0.00	0
	R-HPBonus	1	$200.00	0.00	0
	R-NewHm	5	$1,550.00	15.02	27,897
CenterPoint	ENERGY STAR® Connected Thermostats	3	$45.00	0.00	1,701
	HVAC Unit	5	$600	3.28	2,208
	Rater Bonus	5	$75	0.00	0
	Whole Home	5	$1100	1.52	3,139
Entergy	Fulfillment	2	$30	0.00	0
	R-CentAC	1	$400	0.76	1,362
	R-CentACSeer1	2	$375	1.42	1,058
	R-ESPool	1	$800	0.50	6,015
	R-NewHm	2	$250	0.00	0
	R-SmtTstat	3	$174.98	0.00	3,084
Oncor	Central Air Conditioner	3	$1716.1	2.01	1,980
	Central Heat Pump	2	$669.89	0.95	1,417
	ENERGY STAR® Dishwasher	1	$7.38	0.01	37
	ENERGY STAR® Refrigerator	1	$6.23	0.01	61
	ENERGY STAR® Thermostat	5	$0	0.00	3195
	Whole House-New Homes	5	$1819.98	2.90	5325
TNMP	R-CentACSEER2	1	$50	0.57	463
	R-NewHm	5	$2000	4.52	12364

5.2.4 Upstream/Midstream

The EM&V team conducted desk reviews for a sample of projects from upstream and midstream programs. For the desk reviews, the EM&V team applied the methods prescribed in the PY2023 TRM 10.0 to verify energy savings and demand reductions for each measure for the projects sampled. Sampled measures included *HVAC*, *pool pumps*, *smart thermostats*, and *lighting*.

5.2.4.1 Impact Results

Project savings adjustments were primarily driven by *HVAC* measures responding to changes in federal standards or confusion on how to determine rightsizing savings. The desk review findings inform the key findings and recommendations presented in Section 5.2.2.

5.2.5 Air Conditioner and Heat Pump Tune-Ups

The EM&V team conducted desk reviews for a sample of tune-up measures in residential programs. Tune-ups can be offered under a retrofit program or as a standalone program under the residential sector. Tune-ups were sampled at the measure level across programs. Tune-ups can also be offered under the commercial sector. In PY2023, the evaluation efforts focused on tune-ups in the residential sector, as the commercial sector was evaluated in a prior year. The desk review findings from the residential evaluation in PY2023 and the commercial evaluation in PY2022 inform the key findings and recommendations presented in Section 3.2, where cross-sector results are presented.

5.3 PARTICIPANT HOUSEHOLD TRENDS

This section summarizes the findings from the Texas residential household survey that was completed to inform the retrofit consumption analysis (see Section 5.5). The survey collected input from residential program participants who received an energy efficiency installation in 2022 or the first half of 2023.

5.3.1 Participant Household Trends Key Findings and Recommendations

Finding #1: Survey respondents have low adoption of solar and electric vehicle (EV) technologies within the last year across all utilities.

Recommendation #1: As IOU programs include solar technologies, the responses indicate an opportunity for programs to continue to address the barriers and increase awareness and incentives to help promote greater adoption of solar energy systems.

Finding #2: Survey respondents seem disinterested or uninformed about the benefits of thermostat setbacks in terms of saving energy without sacrificing comfort.

Recommendation #2: IOU programs may consider including more customer education campaigns around the benefits of thermostat setbacks for heating and cooling and the use of smart thermostats in their programs.

Finding #3: Almost all survey respondent participants (97 percent) across all the utilities reported that their comfort level remained the same or improved after installing energy-efficient HVAC equipment or tuning up their existing equipment.

Recommendation #3: Utilities may consider utilizing these data results as a means of further promoting energy-efficient HVAC equipment and incentives in their program marketing materials.

Finding #4: While survey respondents are concerned with electricity rates and reliability, they are also complimentary of the IOU energy efficiency programs, with some respondents expressing frustration while some are looking for additional information about IOU energy efficiency programs or rebates.

Many customers provided feedback unrelated to the program, such as *higher energy bills* or *increased energy rates*, and *outages* or *reliability issues* (33 percent of the total 252 respondents when responding to open-ended/additional comments questions). Another third of the respondents shared positive comments; 16 percent talked about *achieved energy cost reductions and improved comfort*, and another 16 percent *expressed gratitude for the program, utility, or service overall*. Ten percent expressed *frustration with the contractor, equipment, or service in general*, and another ten percent were *looking for additional information about energy efficiency programs or rebates*. The remaining comments with about ten respondents or less included *requests for more incentives and discounts* and *enhanced transparency.*

Recommendation #4: As energy costs and grid reliability are top-of-mind for residential customers, IOU programs may want to consider education, highlighting how energy efficiency and demand response are part of the toolbox to address these issues.

5.3.2 Methodology

The residential household survey collected input from residential program participants who received an energy efficiency installation in 2022 or the first half of 2023. Survey responses supported the Texas residential retrofit consumption analysis described in Section 5.3. The survey focused on the following topics:

- lifestyle changes (i.e., working from home),
- occupancy changes (i.e., number in household),
- equipment changes (i.e., EV),
- behavioral changes (i.e., temperature set-point),
- major renovations, and
- perceived comfort level pre- and post-installation.

In addition, the survey concluded with an open-ended question that allowed respondents to share any other energy efficiency concerns.

The EM&V team administered the survey online, with a link distributed via postcards and emails. First, an invitation postcard was sent to all residential program participants, inviting them to complete the survey online. Email invitations were sent to customers whose email addresses were available. The postcard and email briefly explained the purpose of the study, provided login information, and included a toll-free telephone number and email address for assistance or if the recipient preferred to participate by telephone. Additional postcards and reminder emails were sent to nonrespondents as needed to maximize the online survey completion rate.

The survey was launched in March 2024 and concluded in April 2024, with a total of 1,609 respondents (exceeding the initial target of 1,000 respondents). Customers who completed the survey received a $10 electronic gift card.

To overcome language barriers, the survey was available in English and Spanish, and all communication with the customers (postcards and emails) included a Spanish section.

Table 18 below shows a breakdown of respondents by utility, highlighting the levels of survey participation in various energy efficiency programs.

Program types represented include:

- Hard-to-Reach Standard Offer
- Residential Standard Offer
- Low-Income Weatherization

Table 18. Survey Participant Totals by Utility (n=1609)

Utility	Participant totals
AEP Texas	516
CenterPoint	93
Entergy	155
Oncor	778
TNMP	67
Grand total	**1,609**

Note that the utilities vary in size to their respective respondent base. Thus, in general, the smaller utilities had less participants to survey and, therefore, fewer respondents.

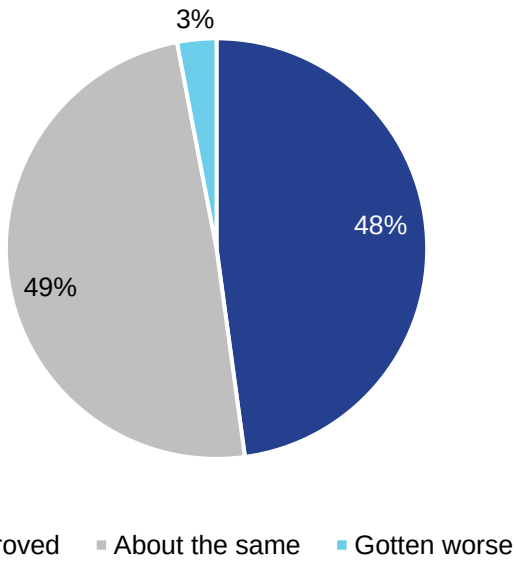
5.3.3 Home Comfort

Respondents were asked to confirm their participation in the utility's energy efficiency program. Those who answered *yes* were asked about their comfort level after equipment installation or tune-up.

5.3.3.1 Perceived Comfort Level Pre- and Post-Installation

Figure 34 shows the response from survey participants in terms of their level of comfort after installing energy-efficient HVAC equipment or having a tune-up of their existing equipment.

Figure 34. Level of Comfort After Energy-Efficient Equipment Installation or Tune-Up (n=1,231)



Almost all participants (97 percent) across the utilities reported that their comfort level remained the same or improved. Only three percent of respondents reported a worsening of comfort.

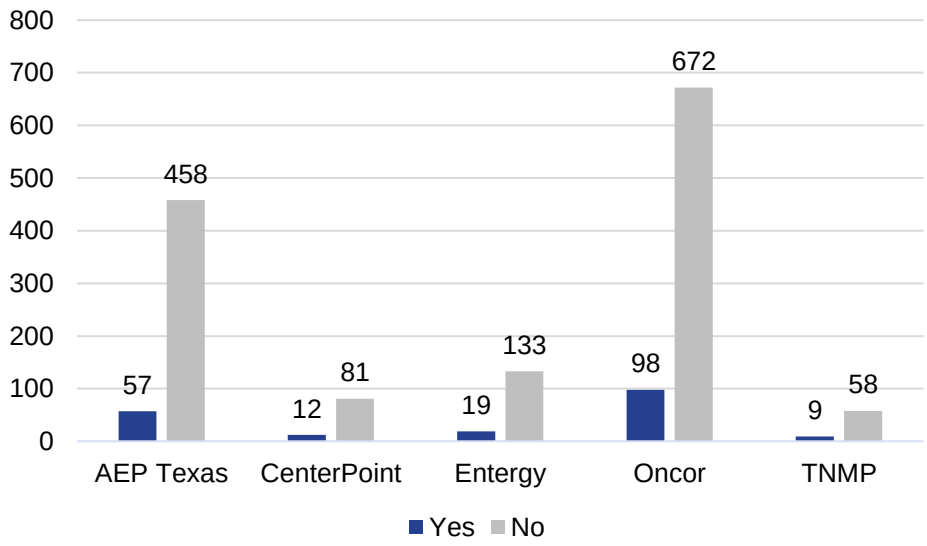
5.3.4 Household Changes

The survey asked about a number of household changes since their participation in the program, which included lifestyle, occupancy, equipment, and behavior questions.

5.3.4.1 Lifestyle Changes

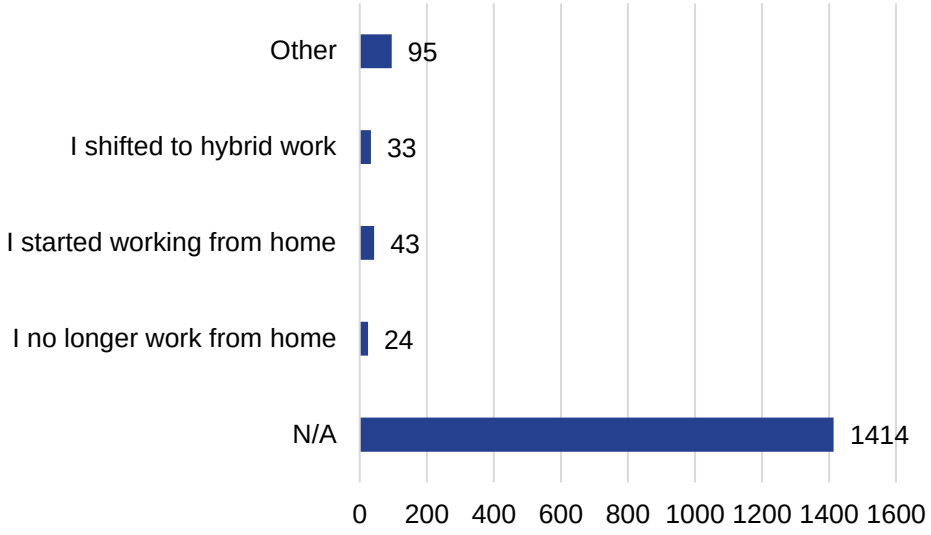
Figure 35 and Figure 36 below inform on whether the respondents had lifestyle changes impacting residence occupancy within the last year along with the descriptions if provided.

Figure 35. Lifestyle Changes in the Last 12 Months (n=1,597)



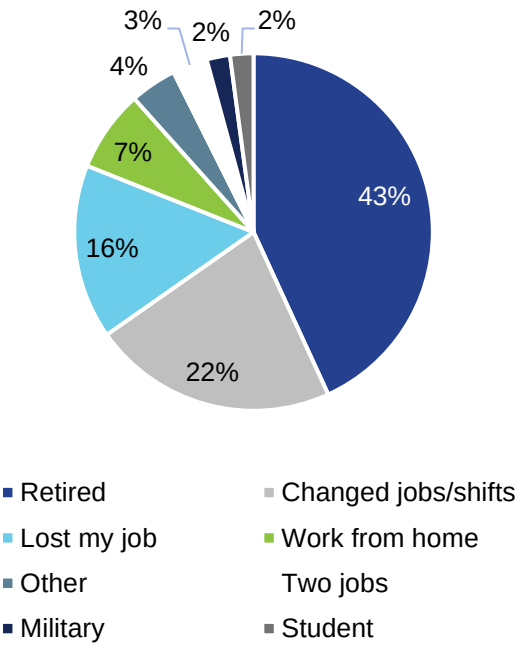
Note: *N/A* responses were not included (n=12)

Figure 36. Lifestyle Change Descriptions in the Last 12 Months (n=1,609)



The survey data revealed that most respondents did not specify their lifestyle changes (indicated by the high ***N/A*** count). Very few respondents noted changes like *shifting to hybrid work, starting to work from home*, or *stopping working from home*. The *other* category, although containing minimal responses, provided further insights into the types of lifestyle changes reported, as indicated in Figure 37.

Figure 37. Specified Lifestyle Changes in *Other* Category (n=95)

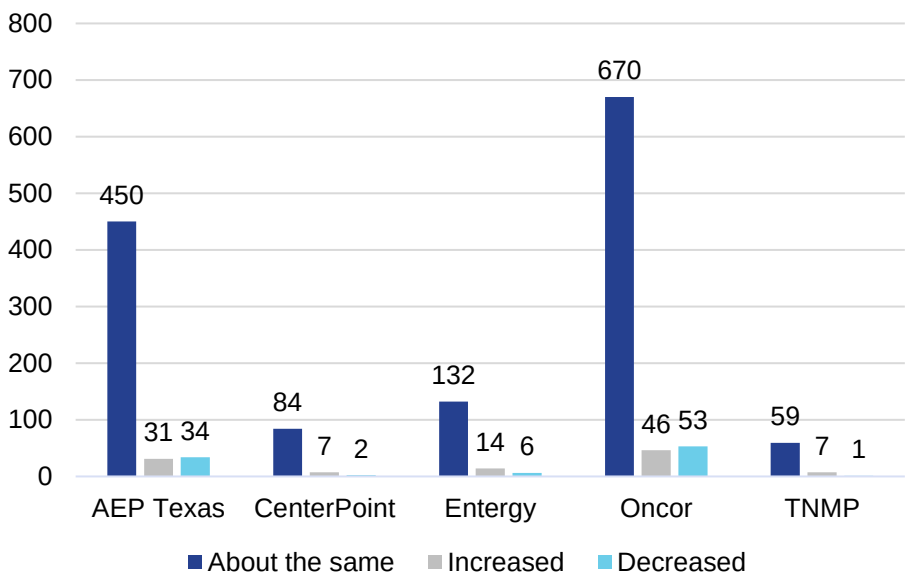


The most common *other* specified lifestyle changes in the last 12 months were *retiring* (43 percent), *changing jobs or shifts at work* (22 percent), and *losing their job* (16 percent).

5.3.4.2 Occupancy Changes—Household Size

Respondents were asked about any changes to their household size in the last 12 months. Figure 38 shows that, across all utilities, most respondents (n=1395) said their household size *stayed about the same*.

Figure 38. Household Size Changes in the Last 12 Months (n=1,596)



Note: *N/A* responses were not included (n=13)

5.3.4.3 Equipment Changes—Solar Installation and Electric Vehicle Purchased

Figure 39 shows whether respondents have installed solar energy systems within the last 12 months by utility. Most respondents (96 percent) indicated that they *had not installed solar energy systems within the previous year*.

Additionally, Figure 40 indicates the number of respondents who *purchased EVs within the last year*, compared to those who did not, across the various utilities. Many respondents across all utilities indicated they *did not purchase EVs in the previous year*, and the overall adoption of EVs was low, with a remarkably high number of respondents (97 percent) indicating no EV purchases. The analysis also shows that of the 45 respondents who indicated purchasing an EV in the last 12 months, nine respondents (or 20 percent) also installed solar panels.

Figure 39. Solar Panels Installed in the Last 12 Months (n=1,609)

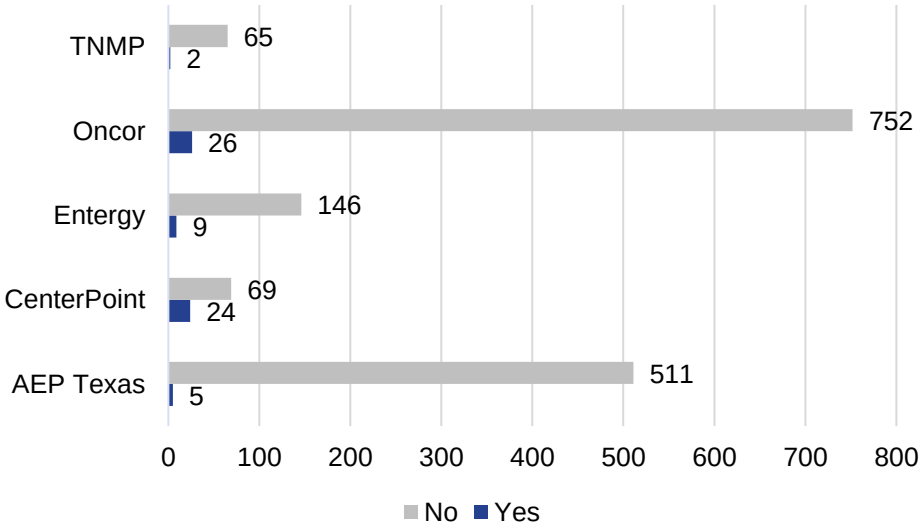
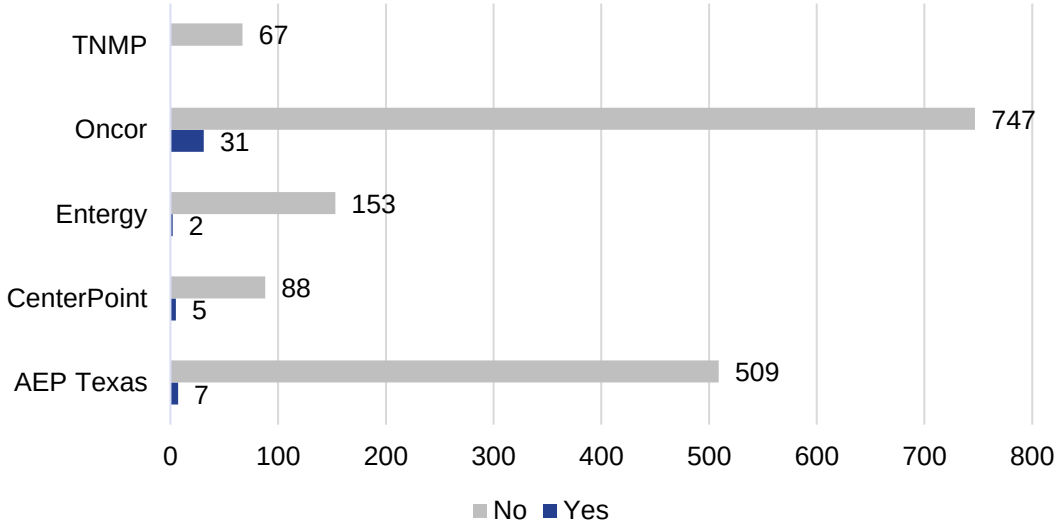


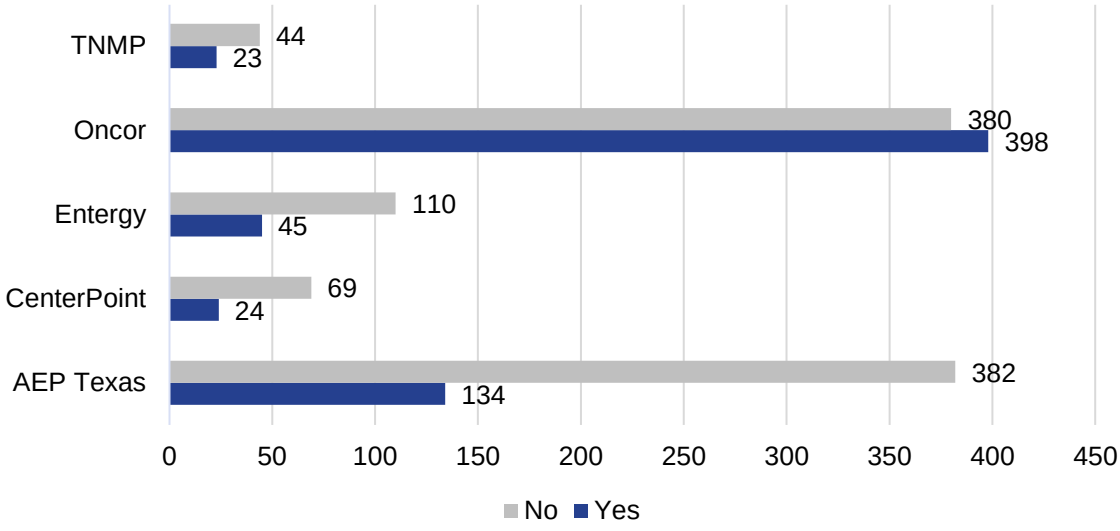
Figure 40. EVs Purchased in the Last 12 Months (n=1,609)



5.3.4.4 Equipment Changes—Addition of Major Energy-Using Equipment

Program participants were asked if they have added major energy-using equipment in their home (other than an EV), such as a *refrigerator*, *freezer*, *washer*, *dryer*, *dishwasher*, or *heating and air conditioning equipment*. Figure 41 shows how many program participants added major energy-using equipment to their homes in the last 12 months. In total, 624 of the 1,609 survey respondents (39 percent) indicated they had added major energy-using equipment to their homes.

Figure 41. Added Major Energy-Using Equipment in the Last 12 Months (n=1,609)



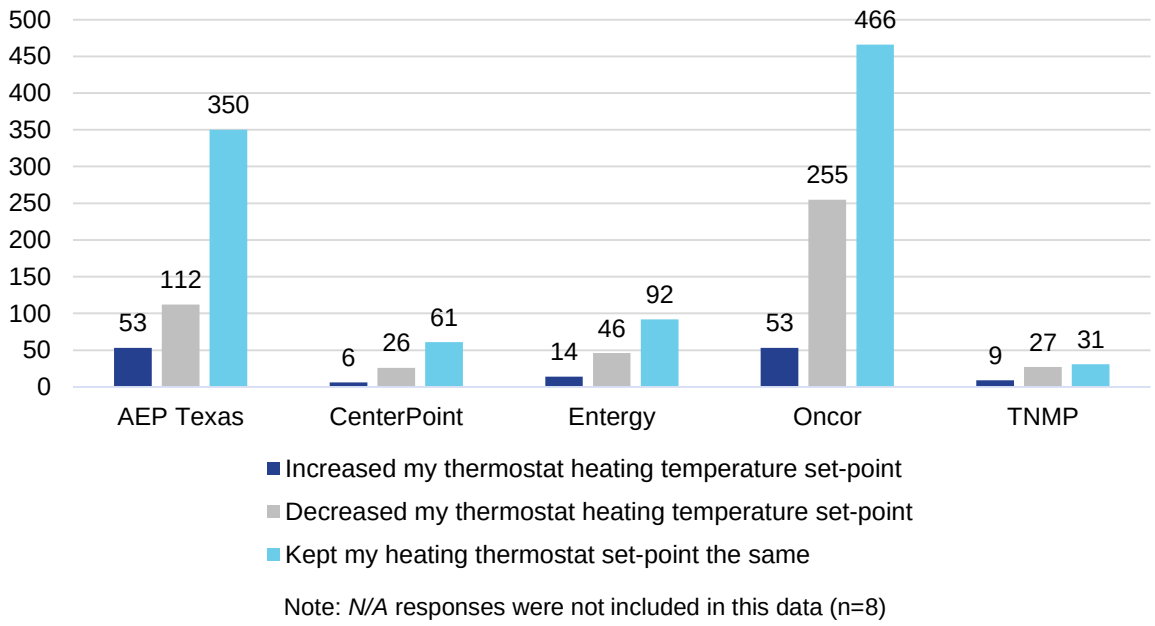
5.3.4.5 Behavioral Changes—Thermostat Settings

Program participants were asked to describe their thermostat settings as it relates to heating and cooling in their home. They were given the following options for both heating and cooling settings:

- I increased my thermostat heating/cooling temperature setpoint
- I decreased my thermostat heating/cooling temperature setpoint
- I kept my heating/cooling temperature set point the same

Figure 42 displays the response to the survey question regarding their thermostat heat settings.

Figure 42. Adjustments to Heating Temperature Setpoints in the Last 12 Months (n=1,601)

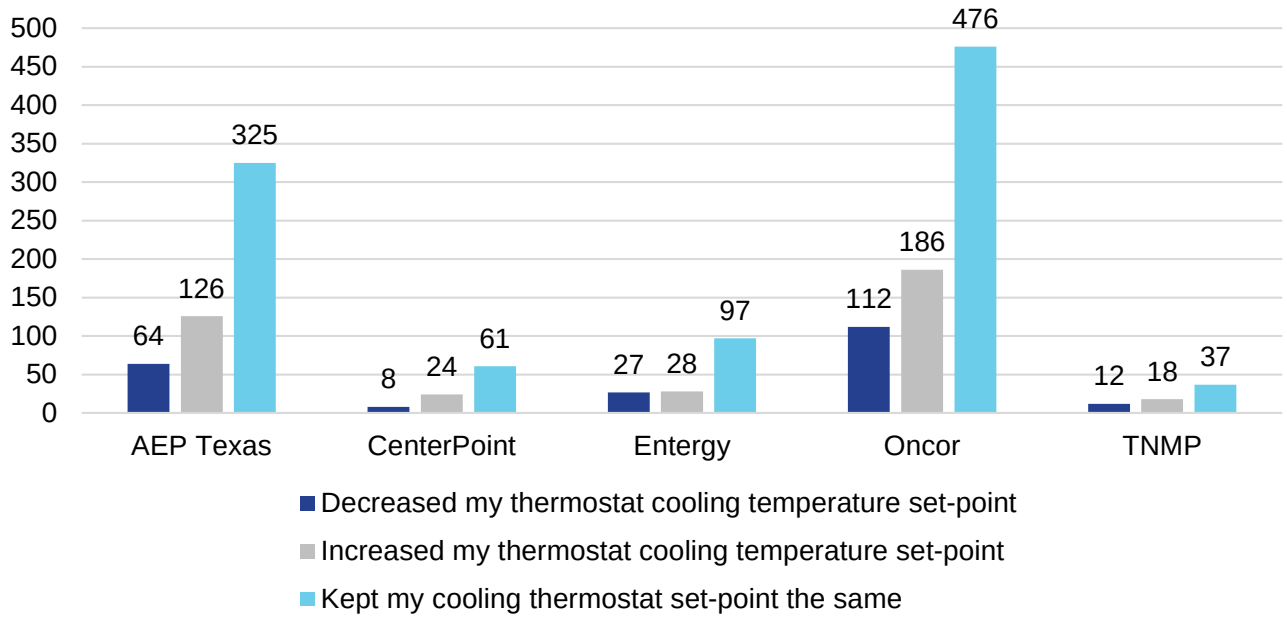


Note: *N/A* responses were not included in this data (n=8)

There is a general trend of respondents preferring to keep their heating thermostat setpoints the same (1,000 respondents). From the remaining survey participants, 466 respondents said they *decreased* their thermostat heating setpoint, and only 135 respondents said they *increased* their heating thermostat setpoint.

Figure 43 provides data on how respondents are adjusting thermostat cooling settings. Like the heating settings, this chart indicates a strong trend of respondents preferring to keep their cooling thermostat setpoints *the same* (996 respondents). From the remaining survey participants, 382 respondents said they *increased* their thermostat cooling setpoint, and 223 respondents said they *decreased* their cooling thermostat setpoint.

Figure 43. Adjustments to Cooling Temperature Setpoints in the Last 12 Months (n=1,601)



Note: *N/A* responses were not included in this data (n=8)

5.3.4.6 Major Renovation

Respondents were asked if they had completed any major renovations, such as adding one or more rooms to their homes. Very few respondents indicated they had completed major home renovations in the last 12 months. Just 47 of 1,609 respondents (three percent) indicated they had a major renovation on their homes last year.

5.3.5 Feedback

Survey participants were asked if they had any additional comments or feedback to share. Most respondents (84 percent) did not provide any responses. Of the remaining 16 percent (252 respondents) who entered a response, 39 provided either off-topic comments or responded *don't know.*

Relevant comments and suggestions (n=213) are outlined in Table 19. Many customers provided feedback unrelated to the IOU energy efficiency programs, such as *higher energy bills, increased energy rates*, and *outages or reliability issues* (33 percent total). Another third of the respondents shared positive comments; 16 percent talked about *achieved energy cost reductions* and *improved comfort*, and another 16 percent *expressed gratitude for the program, utility, or service overall*. Ten percent expressed *frustration with the contractor, equipment, or service in general,* and another ten percent were *looking for additional information about energy efficiency programs or rebates*. The remaining comments with about ten respondents or less included *requests for more incentives and discounts* and *enhanced transparency*.

Table 19. Additional Comments and Feedback from Survey Participants

Energy saving tip	Percentage
Higher energy bills and increased energy rates	25.4%
Energy cost reduction and improved comfort	16.4%
Gratitude for the program, utility, or service overall	16.4%
Problems with contractor, equipment, or service in general	13.1%
Additional actions taken to increase efficiency or reduce energy bill	10.3%
Request for additional information or assistance	10.3%
Outages and reliability issues	7.5%
More incentives/discounts	5.2%
No or minimal improvement in energy cost reduction	1.9%
Enhanced transparency about electric plans	0.5%
Respondents	**213**

5.4 MEASURE OPPORTUNITY ANALYSIS

This section presents trend analysis regarding savings opportunities in heat pumps, smart thermostats and insulation. All three measure savings opportunities expanded in PY2023 though this varied by utility.

5.4.1 Heat Pumps

Key Finding: The *heat pump* measure continues to be a top savings measure in residential programs.

In PY2023, all eight utilities installed *air-source, ground-source,* or *mini-split HPs* under residential retrofit or new construction programs. Program-incentivized *HPs* collectively saved 38 megawatts (MW) and 57,669 megawatt-hours (MWh) in PY2023.

As

Figure 44 and Figure 45 below show, the IOU programs have again increased the demand reductions and savings achieved by HPs. While Oncor has implemented the most HP projects in recent years, CenterPoint achieved the most demand reductions and energy savings from HPs in PY2023 and significantly increased savings from prior years. AEP Texas also saw an increase in reductions and savings from HPs in PY2023 as compared to prior years. Most of the IOUs offered HP measures in their LI and HTR programs. The IOUs target LI and HTR customers who have interest in replacing inefficient electric resistance equipment with high-efficiency HPs. In PY2023, HTR and LI programs made up nearly 38 percent of HP demand reductions.

In 2023, the federal standards for ACs and HPs increased, and efficiency ratings were updated from SEER/HSPF to SEER2/HSPF2. For HPs, the federal standards will go into effect in PY2024 to allow for the market sell-down of the older models in 2023. In 2024, the IOUs will be responding to changes to the minimum efficiency standards affecting baselines.

Figure 44. Demand Reductions (MW) from Residential Heat Pumps, PY2020−PY2023

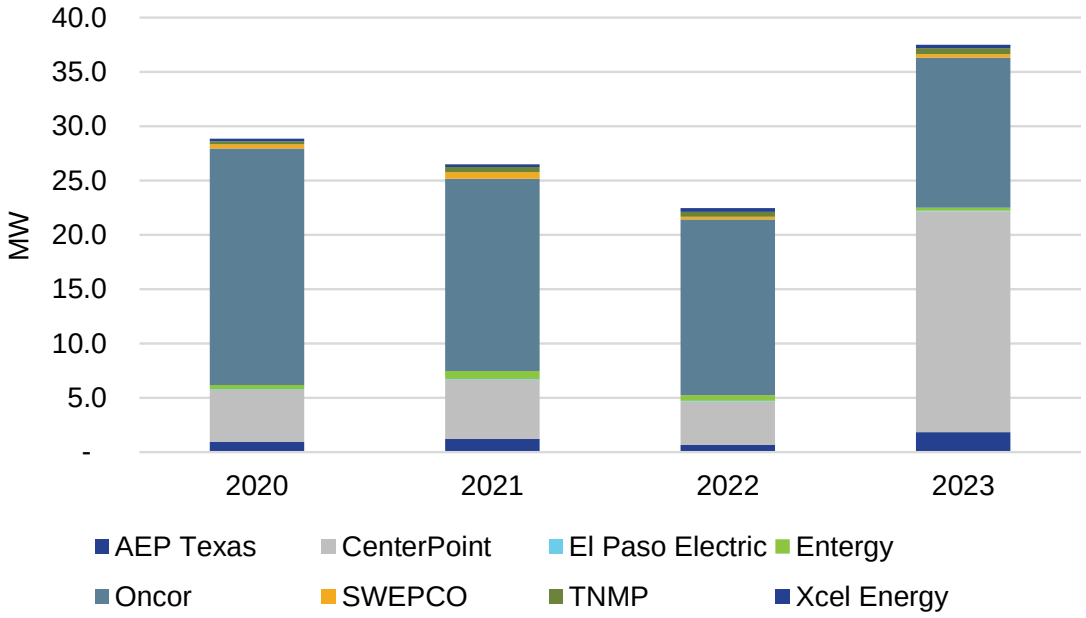
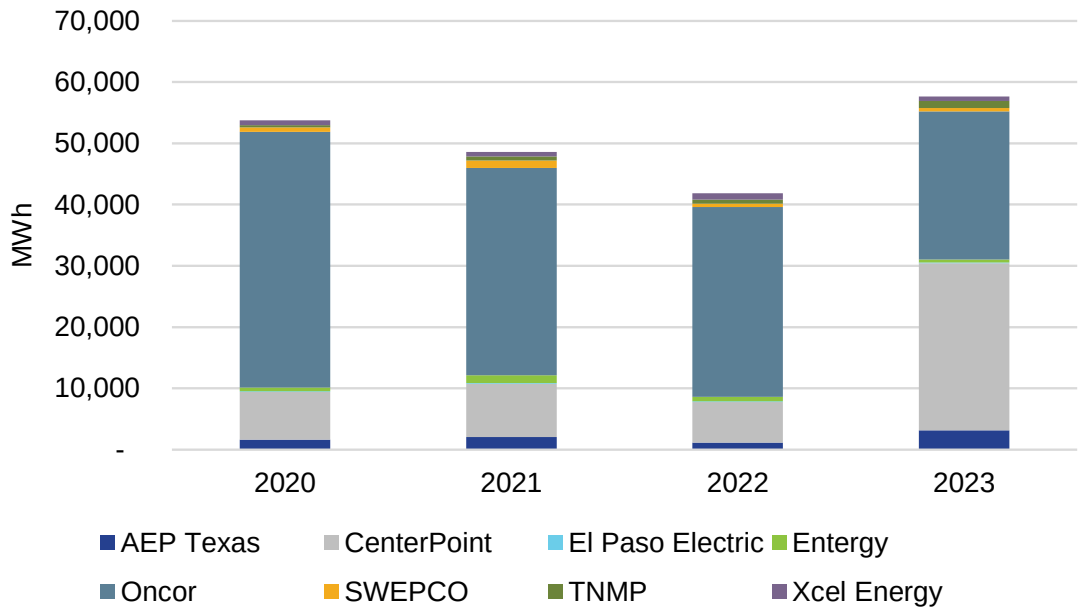


Figure 45. Energy Savings (MWh) from Residential Heat Pumps, PY2020−PY2023



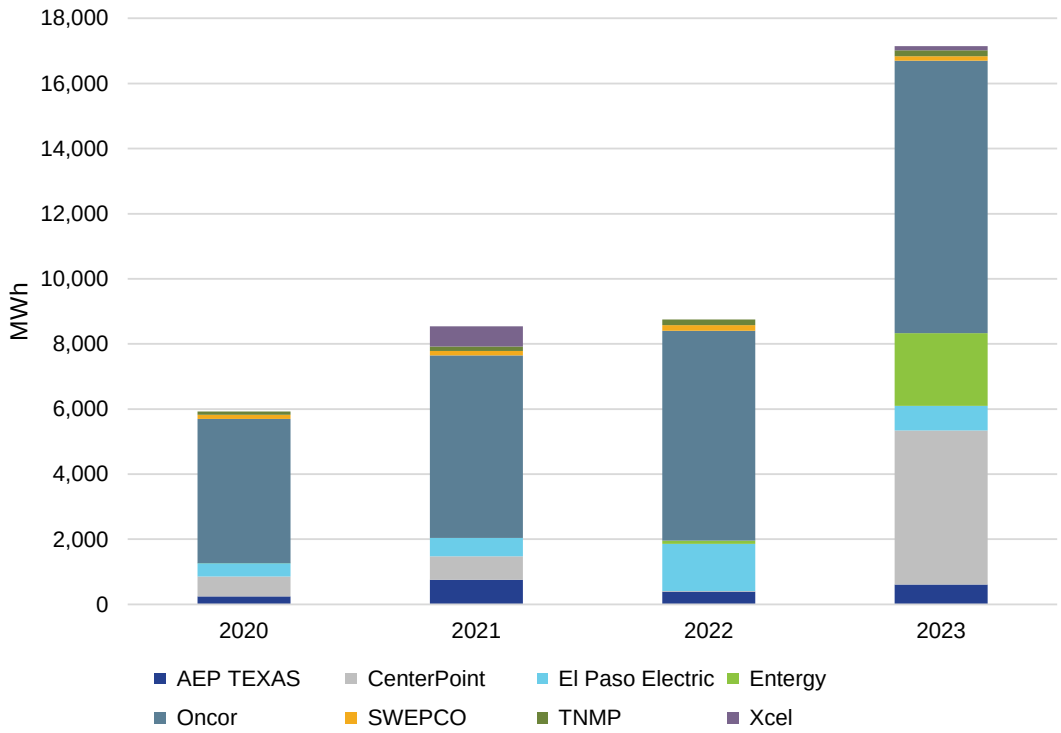
5.4.2 Smart Thermostats

Key Finding: Energy savings from *smart thermostat* measures more than doubled in PY2023 as compared to PY2022.

In PY2023, *smart thermostats* were installed across all utilities utilizing several different program delivery types such as upstream, midstream, online marketplaces, and direct installations. As compared to PY2022, the IOU programs more than doubled the savings from smart thermostats in PY2023 (Figure 46). The IOU programs installed over 23,000 smart thermostats across eight utilities, saving 17,146 MWh. While some utilities have focused on implementing smart thermostat programs, others have incorporated them into their existing retail, retrofit, or new construction programs. In previous years, retail programs have provided the majority of savings; however, PY2023 saw increased smart thermostat participation in direct installation programs. Oncor continues to be the IOU leader in this measure. Oncor piloted three new smart thermostat programs aimed at targeting multifamily, master-meter multifamily[39], and LI multifamily. Both CenterPoint and Entergy, as the second and third largest contributor to smart thermostat savings, also increased their deployment of this measure in PY2023.

The US Energy Information Administration (EIA) conducts the Residential Energy Consumption Survey (RECS) roughly every four years to collect data on residential housing characteristics. In 2020, the RECS data showed that, of the homes in the West-South-Central region, which includes Texas, of respondents indicating *yes* to having a thermostat, only 14 percent of those were smart thermostats[40]. Data collection for 2024 RECS will begin in Fall 2024.

Figure 46. Energy Savings (MWh) from Residential Smart Thermostats, PY2020−PY2023



[39] Multifamily master meter savings are claimed under the commercial sector.
[40] https://www.eia.gov/consumption/residential/data/2020/hc/pdf/HC%206.8.pdf

5.4.3 Insulation

Key Finding: Demand reductions and energy savings from *insulation* measures are trending upwards, despite the dip in PY2020.

In PY2023, *insulation* measures included *wall insulation*, *ceiling* or *attic insulation*, and *floor insulation*. A significant portion of demand reductions and energy savings come from *ceiling* and *attic insulation* each year. *Insulation* measures were installed across all utilities.

As Figure 47 and Figure 48 show, the IOU programs have increased demand reductions and energy savings from *insulation* measures in PY2023 from the levels of PY2021 and PY2022. One driver of the dip in reductions and savings from PY2020 levels is the previously mentioned *TRM update based on the consumption analysis*. Hence, the savings after PY2020 are more accurate than the PY2020 savings. Another driver was the *supply chain issues* that insulation contractors faced because of the pandemic. As the supply chain has normalized over the years, participation in *insulation* measures has increased. In PY2023, Entergy had the most reductions and savings from *insulation* measures, followed by TNMP.

There is an opportunity to increase insulation participation, particularly for *wall* and *floor insulation*. Historically, *wall* and *floor insulation* participation has been low, likely due to barriers such as difficulty insulating existing homes with walls already in place. However, there are now other methods, such as blowing in insulation from the exterior, that are less intrusive to the homeowner. By implementing whole home insulation, the overall HVAC load of the home can be reduced, and replacing HVAC equipment could be a recommended next step. By reducing the load first through whole home insulation, there is greater potential for higher HVAC savings through early retirement and rightsizing of units.

Figure 47. Demand Reductions (MW) from Residential Insulation, PY2020−PY2023

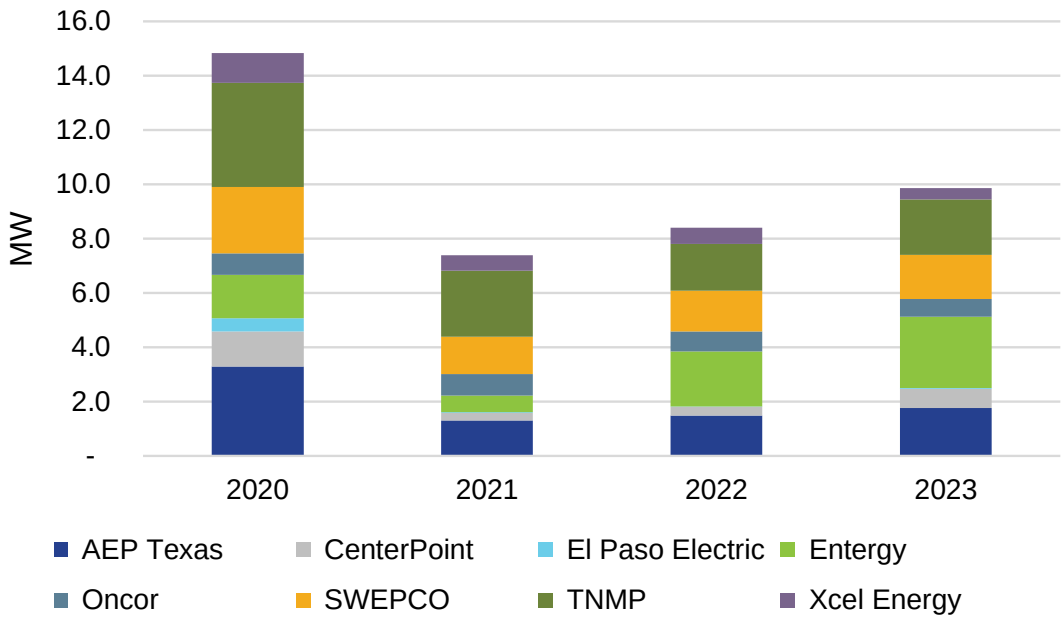
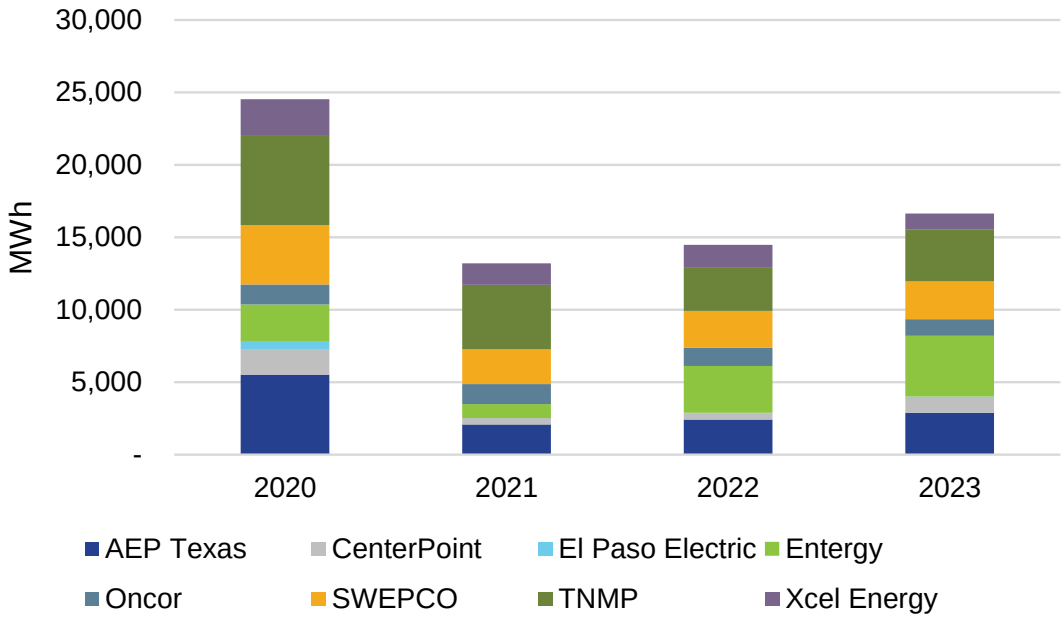


Figure 48. Energy Savings (MWh) from Residential Insulation, PY2020−PY2023



5.5 CONSUMPTION ANALYSIS

For PY2023, the EM&V team conducted a consumption analysis on three kinds of residential retrofit programs offered by IOUs—Residential Standard Offer Programs (RSOP), Hard-to-Reach Standard Offer Programs (HTR SOP), and Low-Income Weatherization (LI) programs.

This consumption analysis was performed to assess:

- if the IOU residential retrofit programs are effectively reducing participants' annual energy usage; and
- how the IOU residential retrofit programs and measures are performing compared to TRM deemed savings.

The EM&V team collected advanced metering infrastructure (AMI) meter data from IOUs offering RSOPs, HTR SOPs, or LI programs to customers to conduct this analysis. During the consumption analysis study period, only five of the eight IOUs had fully deployed AMI meters and were able to submit program participant data for analysis—AEP Texas, CenterPoint, Entergy, Oncor, and TNMP. Across the five IOUs, over 30,000 households with unique AMI meter data participated in at least one of the three programs between January 1, 2022, and June 30, 2023, and were included in the consumption analysis[41].

[41] The data in this analysis reflects a full year of program participation in PY2022 and program participation for the first half of PY2023. Participant meter data were received for a census of the five IOU programs in this time period, totaling 56,566 participants. More than one-half of the participants' data were retained in the analysis after the data cleaning process; details on the data cleaning process and reasons why meters were excluded from the analysis can be found in *Appendix A: Residential Consumption Analysis*.

Using the data provided by IOUs, the EM&V team conducted an analysis of each household's AMI meter data by:

- measuring the data for the year before they participated in a program;
- measuring the data for the year after program participation;
- normalizing the data for the weather; and
- analyzing the data for energy savings (referred to as *measured savings*) attributable to residential retrofit programs they participated in and any installed measures.

The detailed methodology and results of the consumption analysis are discussed in *Appendix A: Residential Consumption Analysis*, which includes summary tables with results by specific program, IOU, measure, and TRM climate zone.

5.5.1 Key Findings and Recommendations

The consumption analysis provided insight into program design and implementation effectiveness at both the program and measure-levels across the IOU programs. The first set of key findings and recommendations focus on program-level performance, while the second set of key findings and recommendations focus on measure-level performance.

5.5.1.1 Program-Level Performance

The key findings, recommendations, and tables below provide measured savings results for each of the three residential retrofit programs (RSOP, HTR SOP, LI programs) offered by the five IOUs included in the PY2023 consumption analysis.

Additionally, the tables below illustrate the program results comparisons of the PY2019 and PY2023 consumption analysis for AEP, CenterPoint, Oncor, and TNMP. In PY2023, Entergy's AMI meters were fully deployed and operational, allowing them to be included in the consumption analysis for the first time.

Key Finding #1: Overall, the residential retrofit programs result in energy savings for participants; however, savings varied across IOUs and program types.

Residential SOP.

In PY2023, RSOP participants saw average savings of 9.6% to their annual energy usage (2,887 kWh)—an increase in average savings as compared to 8.7% for RSOP participants in PY2019.

Table 20 illustrates the change in measured savings for each utility's RSOP from the PY2019 to PY2023 consumption analyses[42].

[42] Entergy did not participate in the PY2019 consumption analysis. Therefore, Entergy is not included in Table 20.

Table 20. RSOP Results by Utility—PY2023 vs PY2019

Utility	PY2023 measured savings (kWh)	PY2019 measured savings (kWh)	Percentage change
AEP Texas	-41	403	-110.2%
CenterPoint	6,402	1,337	378.8%
Oncor	4,306	1,667	158.3%
TNMP	329	575	-42.8%

- Savings for CenterPoint and Oncor's RSOPs increased from PY2019 to PY2023.
- Savings for AEP and TNMP's RSOPs decreased from PY2019 to PY2023.

Table 21 compares the measured savings and performance of each utility's RSOP against the TRM deemed savings.

Table 21. RSOP Results by Utility—Measured Savings vs TRM Deemed Savings

Utility	N	Measured savings (kWh)	Measured savings as a percentage of annual usage	TRM deemed savings (kWh)	Savings as a percentage of TRM
AEP Texas	5,421	-41	-0.1%	966	-4.3%
CenterPoint	523	6,402	20.0%	131	4884.1%
Entergy	594	5,631	13.7%	2,045	275.4%
Oncor	13,329	4,306	13.5%	3,480	123.7%
TNMP	2,420	329	1.7%	1,705	19.3%

- RSOP savings ranged from 0% for AEP to 20% for CenterPoint.
  - CenterPoint, Entergy, and Oncor's RSOPs achieved above-average savings at 20%, 13.7%, and 13.5%, respectively.
  - AEP and TNMP's RSOPs achieved below-average savings of -0.1% and 1.7%, respectively. (Third from left, Table 21).
- CenterPoint, Entergy, and Oncor's RSOPs outperformed the TRM deemed savings estimates (far right, Table 21), while AEP and TNMP's RSOPs underperformed.

Hard-to-Reach SOP.

While HTR SOP participants saw the lowest average savings across the three retrofit programs participants saw an *increase* in average savings from 5.8 percent in PY2019 to of 8.0 percent (1,454 kWh) in PY2023 (see Table 22).

Table 22 illustrates the change in measured savings for each utility's HTR SOP from the PY2019 to PY2023 consumption analyses[43].

Table 22. HTR SOP Results by Utility—PY2023 vs PY2019

Utility	PY2023 measured savings (kWh)	PY2019 measured savings (kWh)	Percentage change
AEP Texas	-89	788	-111.3%
CenterPoint	437	657	-33.5%
Oncor	1,718	712	141.3%
TNMP	834	581	43.5%

- Savings for Oncor and TNMP's HTR SOPs increased from PY2019 to PY2023.
- Savings for AEP and CenterPoint's HTR SOPs decreased from PY2019 to PY2023.

Table 23 compares the measured savings and performance of each utility's HTR SOP against the TRM deemed savings.

Table 23. HTR SOP Results by Utility—Measured Savings vs TRM Deemed Savings

Utility	n	Measured savings (kWh)	Measured savings as a percentage of annual usage	TRM deemed savings (kWh)	Savings as a percentage of TRM
AEP Texas	3,060	-89	-0.3%	993	-9.0%
CenterPoint	221	437	1.9%	1,659	26.4%
Entergy	377	5,072	14.0%	1,540	329.4%
Oncor	5,310	1,718	10.9%	1,544	111.3%
TNMP	767	834	4.9%	1,624	51.4%

- HTR SOP savings ranged from 0 percent for AEP Texas to 14 percent for Entergy.
  - Entergy and Oncor HTR SOPs were above the average IOU savings at 14.0 percent and 13.5 percent, respectively.
  - AEP Texas, CenterPoint, and TNMP were below the average IOU savings at 0 percent, 1.9 percent, and 4.9 percent, respectively (third column from right, Table 23).

- Entergy's and Oncor's HTR SOP savings outperformed the TRM deemed savings estimates, while AEP Texas', CenterPoint's, and TNMP's HTR SOP savings underperformed (far right, Table 23).

[43] Entergy did not participate in the PY2019 consumption analysis. Therefore, Entergy is not included in Table 22.

Low-Income Weatherization Program.

Of the three residential retrofit programs in PY2023, LI program participants saw the highest average savings at 11.2% of their annual energy usage (2,625 kWh). Additionally, from PY2019 to PY2023, LI program participants saw an increase in measured savings from 2,079 kWh in PY2019 to 2,625 kWh in PY2023. However, average savings for LI program participants decreased from 18.5% in PY2019 to 11.2% in PY2023.

Table 24 illustrates the change in measured savings for each utility's LI program from the PY2019 to PY2023 consumption analyses.

Table 24. LI Program Results by Utility—PY2023 vs PY2019

Utility	PY2023 measured savings (kWh)	PY2019 measured savings (kWh)	Percentage change
AEP Texas	2,413	1,932	24.9%
CenterPoint	2,694	2,044	31.8%
Oncor	2,533	2,102	20.5%
TNMP	2,946	1,672	76.2%

- Savings for all four ERCOT utilities' LI programs increased from PY2019 to PY2023[44].

Table 25 compares the measured savings and performance of each utility's LI program against the TRM deemed savings.

Table 25. LI Program Results by Utility—Measured Savings vs TRM Deemed Savings

Utility	n	Measured savings (kWh)	Measured savings as a percentage of annual usage	TRM deemed savings (kWh)	Savings as a percentage of TRM
AEP Texas	611	2,413	12.3%	3,437	70.2%
CenterPoint	1,693	2,694	8.7%	3,303	81.6%
Oncor	1,351	2,533	17.4%	5,164	49.1%
TNMP	339	2,946	15.4%	4,225	69.7%

- LI program savings ranged from 8.7 percent for CenterPoint to 17.4 percent for Oncor.
  - AEP Texas, TNMP, and Oncor LI program savings were above the average IOU savings of 11.2 percent, at 12.3 percent, 15.4 percent, and 17.4 percent, respectively.
  - CenterPoint's LI program achieved below-average savings at 8.7%.
- None of the utilities' LI programs outperformed the TRM deemed savings estimates (far right, Table 25).

[44] Entergy does not offer a low-income weatherization program; therefore, Entergy is not included in this section.

Recommendation #1: With the support of the EM&V team, the utilities should:

- Investigate the high-performance drivers and low-performance drivers across residential retrofit programs.
- Develop strategies to address the low-performing programs and maintain effectiveness of the high-performing programs.
- If applicable, develop action plans for under-performing programs before the end of 2024 to discuss with the PUCT and EM&V team prior to the rollout of PY2025 programs[45].
- Additionally, utilities with high-performing programs are encouraged to share best practices at the first Energy Efficiency Implementation Project (EEIP) meeting in 2025[46].

5.5.1.2 Measure-Level Performance

The key findings and recommendations below provide insight into the effectiveness of the primary measures installed through the three residential retrofit programs. This includes both AMI data measured savings for each primary measure (e.g., air infiltration, central AC) and comparisons to the TRM deemed savings estimates for the primary measures.

Key Finding #2: The PY2023 consumption analysis demonstrates a better alignment of savings between the TRM deemed savings estimates and IOU measured savings for residential retrofit measures than the PY2019 consumption analysis[47]. However, measure-level performance still varies by utility and program.

[45] AEP Texas and TNMP should develop and discuss action plans for improvement in their RSOP and HTR programs for PY2025. CenterPoint should develop and discuss action plans for improvement in their HTR and LI programs for PY2025.

[46] Entergy and Oncor, as having high-performing programs across all three program types, are encouraged to share best practices with other IOUs and present them in the first EEIP meeting of 2025.

[47] The PY2019 consumption analysis was completed in calendar year 2020 and used to inform the TRM update in PY2021.

Table 26 compares the measured savings and performance of each residential retrofit measure against the TRM deemed savings.

Table 26. Measure-Level Results—Measured Savings vs TRM Deemed Savings

Measure	n	Measured savings (kWh)	Measured savings as a percentage of annual usage	TRM deemed savings (kWh)	Savings as a percentage of TRM
Air infiltration	14,247	1,516	8.6%	1,131	134.1%
Ceiling insulation	6,862	1,322	5.2%	1,659	79.7%
Central AC	8,302	4,929	14.1%	2,475	199.1%
Central HP	7,389	3,266	13.8%	5,696	57.3%
Duct sealing	4,274	278	0.9%	703	39.6%
ENERGY STAR® thermostat	2,831	979	6.9%	658	148.9%
Multifamily heat pump	1,286	2,290	15.5%	4,855	47.2%

Across the five IOU residential retrofit programs included in the PY2023 consumption analysis, the following measures are performing better than the TRM deemed savings estimates (see Table 26):

- air infiltration (134.1 percent);
- central AC (199.1 percent); and
- ENERGY STAR® thermostats (148.9 percent).

Other measures have improved performance against the TRM from prior analysis:

- Savings from ceiling insulation measures achieved 79.7% of the TRM deemed savings.
- Savings from duct sealing measures achieved 39.6% of the TRM deemed savings—making duct sealing the lowest performing measure.
- Savings from heat pump measures achieved 57.3% of the TRM deemed savings.

The difference between measured and TRM deemed savings for heat pump measures does not indicate a TRM misalignment, but rather is characteristic of heat pumps replacing another fuel type, such as a natural gas boiler. For example, if the planned retrofits were electric resistance, TRM deemed savings will apply but not be tracked in the AMI measured savings. The PY2024 TRM requires that existing heat pump fuel sources be tracked to utilize deemed savings values; therefore, future analysis will be conducted to characterize the extent to which a change in fuel type drives performance variability.

Table 27 compares each utility's measure-level performance against the TRM deemed savings.

Table 27. Measure-Level Result by Utility—Measured Savings vs TRM Deemed Savings

Measure	n	Measured savings (kWh)	Measured savings as a percentage of annual usage	TRM deemed savings (kWh)	Savings as a percentage of TRM
AEP Texas					
Air infiltration	1,014	131	0.4%	835	15.7%
Ceiling insulation	2,143	953	3.9%	1,742	54.7%
Central AC	399	2,394	7.3%	2,546	94.0%
Central HP	379	3,026	15.3%	5,809	52.1%
Duct sealing	3,556	-731	-2.4%	706	-103.6%
CenterPoint					
Air infiltration	152	3,412	5.8%	215	1586.6%
Ceiling insulation	603	2,612	6.4%	1,153	226.5%
Multifamily heat pump	1,286	2,290	15.5%	4,855	47.2%
Entergy					
Air infiltration	241	4,246	11.3%	446	952.5%
Ceiling insulation	494	5,013	12.2%	2,485	201.8%
Duct sealing	634	5,634	14.3%	657	857.8%
Oncor					
Air infiltration	12,954	1,551	10.0%	1,184	131.0%
Ceiling insulation	1,626	1,638	8.5%	967	169.4%
Central AC	7,949	5,066	14.5%	2,475	204.7%
Central HP	7,046	3,369	13.9%	5,695	59.2%
ENERGY STAR® thermostat	2,835	1,333	9.4%	658	202.7%

Measure	n	Measured savings (kWh)	Measured savings as a percentage of annual usage	TRM deemed savings (kWh)	Savings as a percentage of TRM
TNMP					
Air infiltration	48	236	0.9%	793	29.7%
Ceiling insulation	2,213	281	1.4%	2,136	13.1%
Central AC	91	4,345	12.2%	2,214	196.3%
Central HP	274	3,004	15.9%	5,566	54.0%
Duct sealing	332	1,002	3.7%	722	138.8%

- Ceiling insulation:
  - CenterPoint, Entergy and Oncor's measures are outperforming the TRM deemed savings.
  - AEP and TNMP's measures are underperforming in relation to the TRM deemed savings, thereby decreasing the overall measure-level percentage.
- Duct sealing:
  - Entergy and TNMP's measures are outperforming the TRM deemed savings value.
  - AEP's RSOP and HTR SOP both demonstrated no savings for the duct sealing measure, thereby decreasing the overall measure-level average.

Recommendation #2: Given the differing performances in measure-level savings across IOU programs, the EM&V team provides the following recommendations to inform the TRM Working Group and IOU action plans (see Recommendation #1 above):

- IOU programs with demonstrably high performance in the air infiltration measure[48] can expand to residential customers in the PY2025 TRM update.
- IOU programs showing limited savings in the duct sealing measure[49] should limit the measure to low-income programs starting with PY2025. Similar to air infiltration, the measure could expand back to RSOP once improved implementation can be demonstrated in AMI meter data.
- IOU programs underperforming in ceiling insulation[50] should identify QA/QC improvements and begin implementing these improvements in PY2025. In particular, increased QA/QC of baseline insulation documentation requirements may be helpful in improving measure-level performance.
- In a PY2025 consumption analysis, heat pump baseline documentation and savings should be assessed, and any necessary changes to the heat pump algorithm should be identified.

[48] CenterPoint, Entergy and Oncor are eligible to expand air infiltration to RSOP.
[49] AEP's RSOP and HTR programs both need to improve implementation of duct sealing as measured in the AMI meter data.
[50] AEP and TNMP should include QA/QC improvements for ceiling insulation in their action plans in response to Recommendation #1 above.

6.0 LOAD MANAGEMENT PROGRAMS

6.1 SUMMARY RESULTS

This section presents investor-owned-utility (IOU) summary results, followed by key findings and recommendations from all relevant evaluation, measurement, and verification (EM&V) activities.

6.1.1 Savings

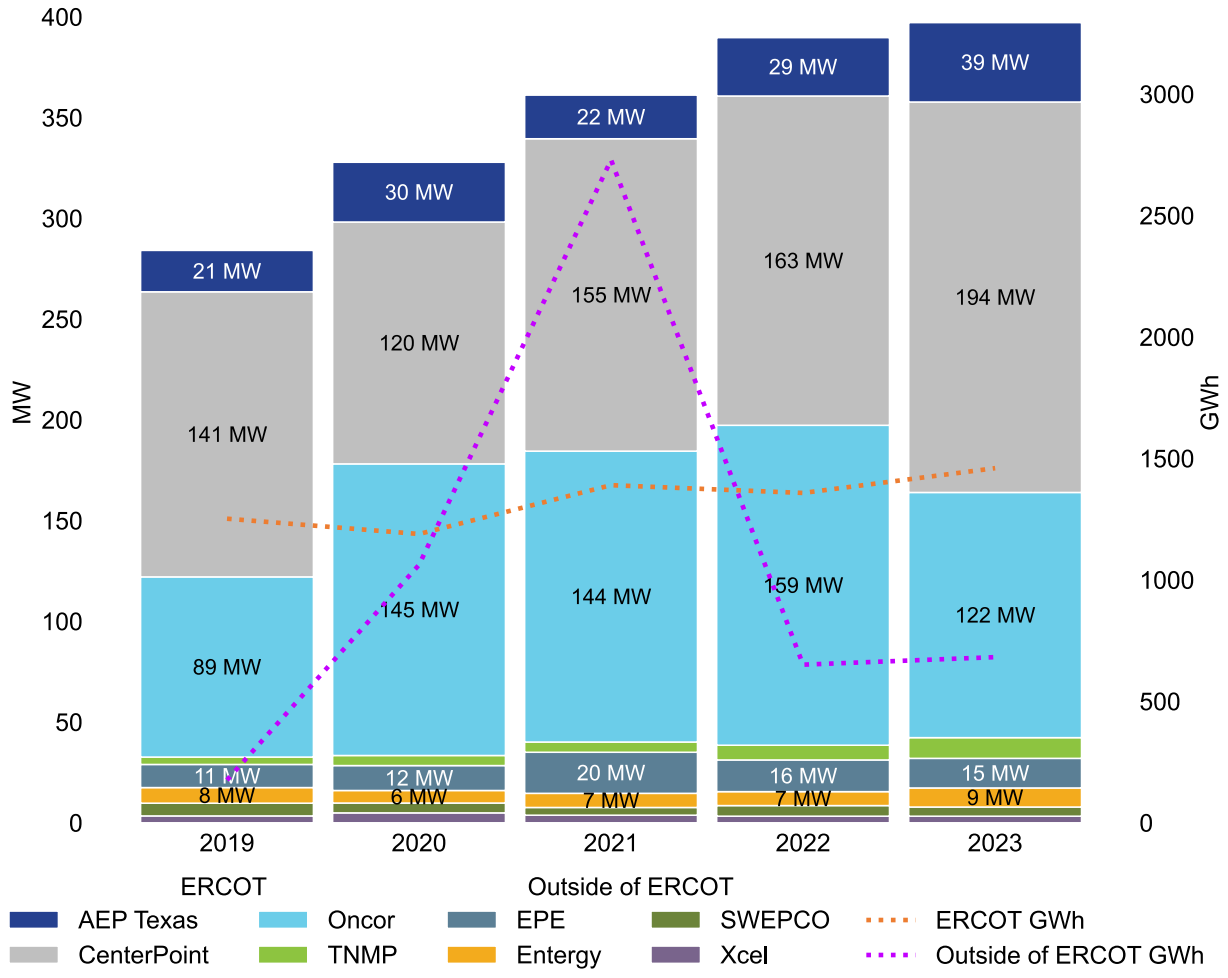
The total savings of the programs were:

- 397,135 kilowatts (kW) of demand reduction; and
- 2,141,731 kilowatt-hours (kWh) of energy savings.

The demand reductions achieved by load management programs increased from program year (PY) 2019 (PY2019) through PY2023. While the programs saw continued growth in PY2023, this is primarily due to the introduction of winter load management programs as opposed to growth in the existing programs as in years prior to PY2022. In response to Senate Bill (SB) 3 passed in the 2021 legislative session (87-R), the ERCOT IOU utilities developed winter load management programs. While Oncor introduced a winter load management program into its energy efficiency portfolio in PY2022, the other three ERCOT utilities introduced winter load management programs into their energy efficiency portfolios in PY2023.

Figure 49 summarizes the demand reductions and energy savings of all load management programs from PY2019 to PY2023, showing fairly consistent growth in demand reductions from year to year. PY2021 saw a peak in energy savings because El Paso Electric claimed savings from incentivized smart thermostats as part of their load management program. In response to SB 1699, passed in the 2023 legislative session (88 R), residential load management programs role are being considered.

Figure 49. Total IOU Demand Reduction and Energy Savings by Program Year—Load Management Programs, PY2019–PY2023[51]

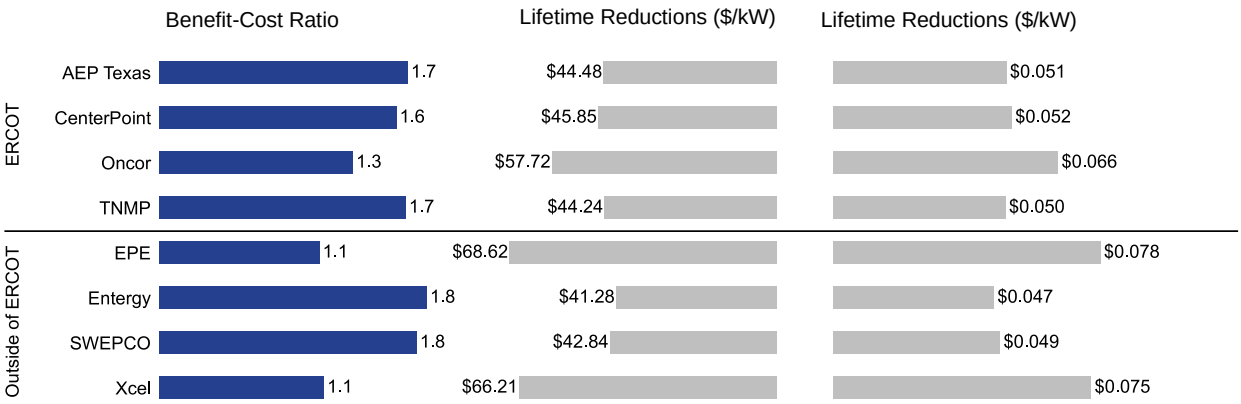


6.1.2 Cost-Effectiveness

Figure 50 summarizes the cost-effectiveness of each utility's load management programs in PY2023. All IOUs load management programs were cost-effective, ranging from 1.1 to 1.8. The cost per kilowatt ranged from $41.28 to $68.62, and the cost per kilowatt-hour ranged from $0.047 to $0.078. These costs provide an alternate way of describing the cost-effectiveness of a group of programs. Programs, or groups of programs, with a higher cost-effectiveness ratio will have a lower cost to acquire savings and vice versa.

[51] The following megawatt savings values were unable to make it on the graph due to limited space: TNMP: PY2019, 3.667 MW; PY2020, 5.004 MW; PY2021, 5.078 MW; PY2022, 7.306 MW; PY2023, 10.278 MW. SWEPCO: PY2019, 6.319 MW; PY2020, 4.889 MW; PY2021, 3.837 MW; PY2022, 5.261 MW; PY2023, 4.555 MW. Xcel: PY2019, 3.417 MW; PY2020, 4.922 MW; PY2021, 3.771 MW; PY2022, 3.282 MW; PY2023, 3.275 MW.

Figure 50. IOU Benefit-Cost Ratio and Cost of Lifetime Reductions and Savings—Load Management Programs, PY2023



6.2 COMMERCIAL LOAD MANAGEMENT

This section summarizes the key findings and recommendations from the PY2023 evaluation of the commercial load management programs offered by the eight Texas utilities.

The EM&V team applied the savings calculation methodology prescribed in PY2023 Technical Reference Manual (TRM) 10.0 on a census of records to calculate energy savings and demand reductions from interval meter data.

6.2.1 Programs Overview

Commercial summer load management programs offered by ERCOT IOU programs are designed to reduce kilowatt usage during summer peak demand periods in case of ERCOT energy emergency alert (EA) level 2 or for system reliability while outside-of-ERCOT programs manage load in response to grid or system reliability issues. These periods are defined in §25.181 as 1:00 p.m. to 7:00 p.m., on weekdays from June 1 through September 30, although some utilities have expanded programs to 24/7. These programs are based on performance and offer incentive payments to participating customers for voluntarily curtailing electrical load on notice.

While each utility operates a unique load management program, there are many similarities among them. In general, a dispatch event may be called at the utility's discretion 30 to 60 minutes in advance of a curtailment event, which generally lasts one to four hours. In most cases, the utility reserves the right to call a certain number of curtailment events per season, ranging from 5 to 12, depending on the utility. In order to participate in a commercial load management program, 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.

Notably, customers cannot simultaneously participate in other load management programs using the same curtailable loads (i.e., *double-dipping*).

Similarly, winter commercial load management programs offered by ERCOT IOU programs are designed to manage kilowatt usage during winter peak demand periods in an emergency condition – specifically at EA2. These periods are defined in § 25.181 as 6:00 a.m. to 10:00 a.m., 6:00 p.m. to 10:00 p.m., but have been expanded by programs to cover 24/7, from December 1 through the end of February.

Commercial customers participating in both summer and winter load management programs 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 amount of kilowatts they curtail during the event; savings for kilowatts and kilowatt-hours are calculated by following the methodology described in PY2023 TRM 10.0. This incentive amount is specified in an agreement between the participant and utility when enrolling in the program. Participating customers can receive up to $50 per kilowatt saved. Commercial customers who meet a utility's eligibility criteria can participate in the load management program directly or through an aggregator or other third party. PY2023 participation is summarized in Table 28 for summer and winter commercial load management programs. For summer programs, the portion of commercial customers participating through an aggregator, or a third party varies by utility. The majority of commercial load management participants in Oncor's programs are through an aggregator, in contrast to Entergy and SWEPCO, where all customers participate directly.

Table 28. PY2023 Commercial Customer Participation Summary by Utility

Utility		Number of Sites- Summer	Number of Sites- Winter
ERCOT	AEP Texas	385	9
	CenterPoint	334	105
	Oncor	882	26
	TNMP	69	35
Non-ERCOT	El Paso Electric	18	-
	Entergy	175	-
	SWEPCO	8	-
	Xcel	13	-
Overall		**1,884**	**175**

6.2.2 Key Findings and Recommendations

Key Finding #1: Participants in the summer commercial load management programs continue to increase year-over-year (1,884 participants in PY2023 compared to 1,348 in PY2022; 40 percent increase). While the average level of cooperation with curtailment events remains relatively high, it did drop from PY2022 to PY2023 (81 percent in PY2022 to 74 percent in PY2023). For the winter commercial load management programs, the cooperation rate was 82 percent.

As measured by the number of customers, participation in summer commercial load management programs has been steadily increasing since PY2018. Of these participants, three-quarters (74 percent) curtailed load when requested for a curtailment event. The PY2023 level of cooperation—ratio of enrolled participants compared to participants that were able to curtail—dropped for a few utilities, resulting in a lower average level of cooperation than PY2022. The EM&V team determines this percentage based on sites with zero or negative savings. In some cases, this may be due to a meter or technical issue as opposed to non-performance. In PY2023, Oncor accounted for much of the decrease; participants through an aggregator accounted for many of the nonparticipating sites. Differently, AEP Texas had the highest PY2023 cooperation rate at 94 percent, followed by CenterPoint at 93 percent, Entergy at 86 percent, and Xcel at 85 percent.

PY2023 was the first year that all ERCOT IOU utilities offered a winter commercial load management program. The programs were successfully implemented with a high average level of cooperation of 82 percent, given that the programs are in their early stages.

Recommendation #1: PUCT and EM&V team to follow up with ERCOT utilities to understand underperformance by load management participants. IOUs should continue to follow up with participants who underperform during curtailment events, including aggregators, to determine if future program participation or program-contract estimates of available demand reduction need to be revised.

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

PY2023 is the eighth year in which utilities and the EM&V team have applied the demand reduction algorithm for summer commercial load management programs described in TRM 10.0, the second year for Oncor's winter commercial load management programs, and the first year for the other three ERCOT IOUs' winter commercial load management programs. There is a mutual understanding of the *high 5 of 10* (summer) and *high 8 of 10* (winter) approaches. The utility companies, implementers, and EM&V team were largely in agreement on final demand reductions calculations.

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

6.2.3 Impact Results

The PY2023 savings of summer and winter commercial load management programs are outlined in Table 29.

Table 29. PY2023 Commercial Load Management Demand Reductions and Energy Savings

Utility type	Summer		Winter		Overall	
	kW (demand reductions)	kWh (energy savings)	kW (demand reductions)	kWh (energy savings)	kW (demand reductions)	kWh (energy savings)
ERCOT total	261,711	1,128,484	42,068	147,531	303,779	1,276,015
Outside-of-ERCOT total	21,867	171,074	N/A	N/A	21,867	171,074
Overall	**283,578**	**1,299,558**	**42,068**	**147,531**	**325,646**	**1,447,089**

The overall demand reductions in PY2023 show a roughly 7.7 MW increase from PY2022 (from 317.9 MW in PY2022 to 325.6 in PY2023). CenterPoint achieved a significant level of demand reductions among the utilities' commercial load management programs; however, the addition of the winter load management program is a main driver of the growth in the total IOU demand reductions from PY2022 to PY2023. When only considering summer load management programs, demand reductions decreased by roughly 9.5 MW from PY2022 to PY2023 (from 293.0 MW in PY2022 to 283.5 in PY2023). Figure 51 and Figure 52 show overall demand reductions from the ERCOT and outside-of-ERCOT IOUs' commercial load management programs by program year, respectively.

Figure 51. Demand Reductions of ERCOT IOU Commercial Load Management Programs, PY2019–PY2023

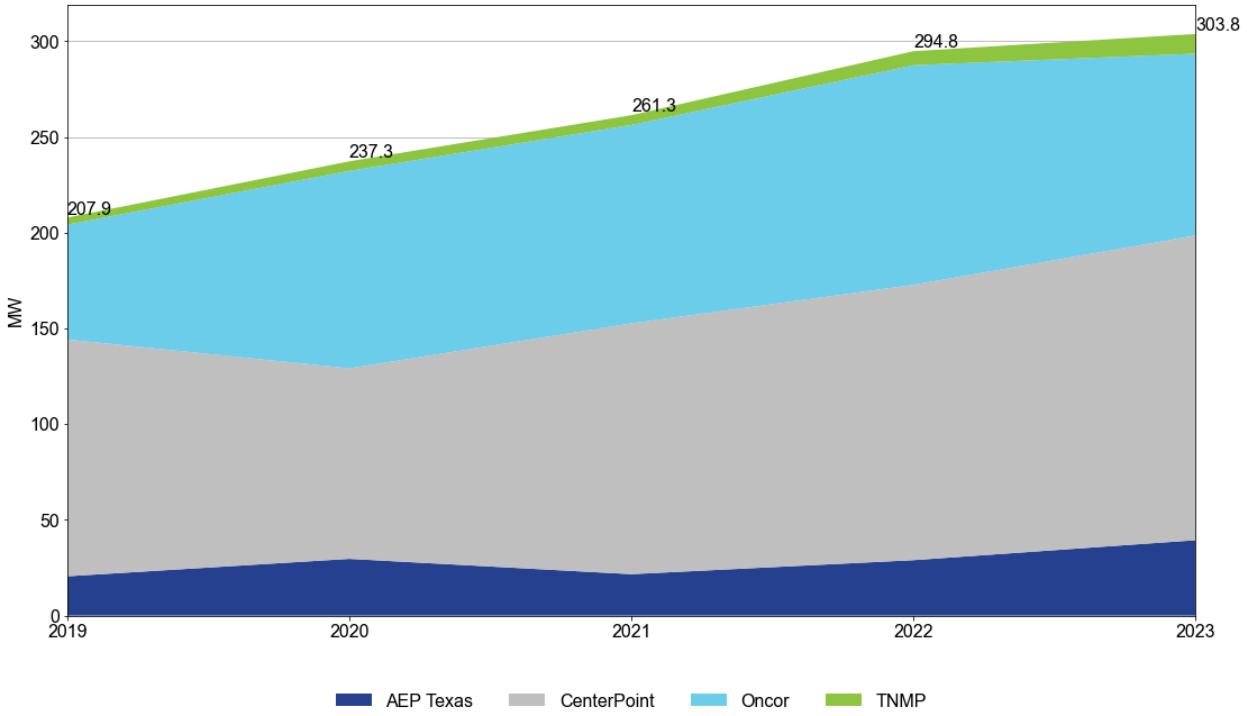
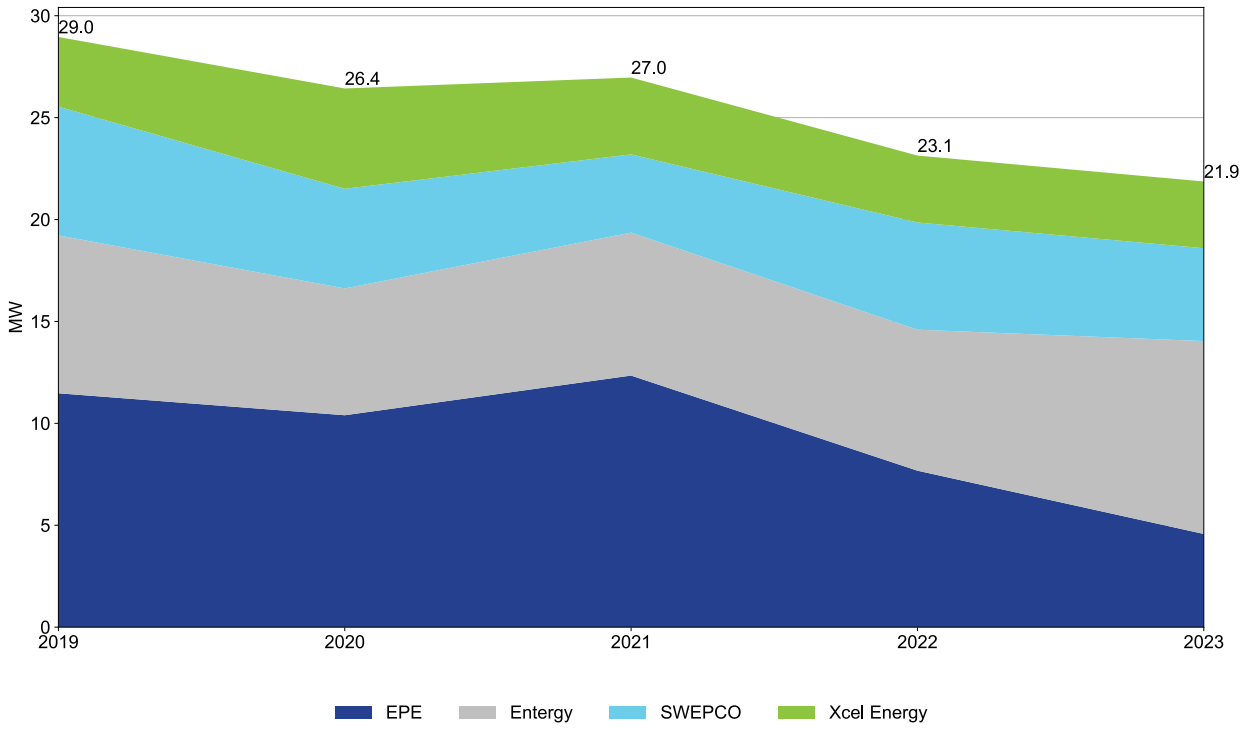


Figure 52. Demand Reductions of Outside-of-ERCOT IOU Commercial Load Management Programs, PY2019–PY2023



Demand reduction calculations for most utilities were calculated the same as the evaluation calculations, indicating that the EM&V team, the implementer, and the utilities follow the TRM algorithm for demand reduction calculations similarly. Four commercial load management programs (offered by three utilities) adjusted their savings to match the evaluated savings. The reason for three of the adjustments is that, when comparing individual meter demand reductions for one of the commercial load management programs, it was found that the utility was following a conservative approach by not setting reductions to zero in cases where the calculation methodology produced negative reductions. Per PY2023 TRM 10.0, in cases where the reduction algorithm produces a negative result, the reductions can be set to zero. The fourth adjustment was due to missing data for one site. The site had partial meter data for one of the events; therefore, reductions for that meter were not considered since limited data were available during the event period. The three utilities accepted the evaluated results and matched the claimed demand reductions to those of the evaluated demand reductions. As a result, commercial load management programs received a realization rate of 100.0 percent for both demand reductions and energy savings.

6.3 RESIDENTIAL LOAD MANAGEMENT

This section summarizes the key findings and recommendations from the PY2023 evaluation of three Texas IOUs' residential load management programs (Oncor, CenterPoint, and EPE). Entergy piloted a residential load management program in PY2023, and TNMP, AEP Texas, and SWEPCO are considering pilot programs. Xcel offers a residential demand response program but does not claim it as part of its energy efficiency portfolio.

Oncor and CenterPoint calculate demand reductions and energy savings using interval meter data following the *high 3 of 5* method; EPE used the *deemed savings* method from PY2023 TRM 10.0 as they are still deploying AMI in their territory.

6.3.1 Program Overviews

Residential load management programs are designed to manage kilowatt usage during summer peak demand periods. In PY2022, three of the eight Texas IOUs offered a residential load management program (CenterPoint, Oncor, and EPE). CenterPoint and Oncor's programs utilize a smart thermostat control strategy, while the EPE program utilizes direct load control devices. Incentives for these programs differ by the utility's service territory; Utilities in the ERCOT region receive an incentive based on the demand reductions achieved during the load control season, while in contrast, EPE pays a flat enrollment incentive and a flat participation incentive per program year. All participants may opt out of a load control event.

Participants in CenterPoint and Oncor's residential load management programs are evaluated individually using the *High 3 of 5 Baseline with Day-of Adjustment* method described in PY2023 TRM Volume 4. In contrast, EPE is evaluated using the deemed savings value measured specifically for the utility (see TRM, Volume 2, Smart Thermostat Load Management). In the past years, the availability of advanced metering infrastructure (AMI) meters has dictated a utility's methodology to calculate demand reductions and energy savings.

The PUCT's substantive rule § 25.181, relating to the Energy Efficiency Goal, defines the summer control period as June 1 to September 30, from 1:00 p.m. to 7:00 p.m. on non-holiday weekdays for ERCOT IOUs and from 2:00 p.m. to 8:00 p.m. on non-holiday weekdays for outside-of-ERCOT IOUs. Although a utility can call events at Energy Emergency Alert level 2 (for ERCOT utilities) or local distribution system reliability needs, the rule currently only counts demand reductions occurring during the defined peak periods towards a utility's demand reduction goal.

Table 30. PY2023 Residential Customer Participation in Load Management Programs, by Utility

Utility		Number of participants (targeted devices)
ERCOT	CenterPoint	25,623
	Oncor	28,173
Outside-of-ERCOT[52]	EPE	9,373
Overall		**63,169**

6.3.2 Key Findings and Recommendations

Key Finding #1: The three residential load management programs saw significant increases in participation until PY2022. Due to budget and participation limits, demand reductions, energy savings, and participation decreased in PY2023. The average level of cooperation remained about the same; it slightly increased from 75 percent in PY2022 to 77 percent in PY2023.

[52] Note that Entergy also piloted a residential load management component in its Residential Solutions program in PY2023, which was not evaluated this year.

As measured by the number of customers, participation in residential load management programs has been steadily increasing since PY2018, reaching 71,680 participants (targeted devices) in PY2022. However, the number decreased by 12 percent in PY2023 (63,169 participants). This decrease is driven by one ERCOT IOU that experienced a 30 percent decrease in participation in PY2023.

Demand reductions, on the other hand, reached a peak in PY2021 (72.8 MW in PY2021 compared to 71.8 in PY2022 and 71.5 in PY2023). Of the PY2023 participants, three-quarters (77 percent) curtailed load during the curtailment event. The level of cooperation (ratio of enrolled participants compared to participants that were able to curtail) in PY2023 increased for two utilities and slightly dropped for another utility, resulting in an average level of cooperation that was slightly higher than PY2022. The EM&V team determines this percentage based on sites with zero or negative savings.

Recommendation #1: Continue to explore cost-effective ways to increase participation and demand reductions for the residential load management programs if needed in the portfolios, including expanding into underserved segments such as multifamily homes, additional devices beyond smart thermostats such as water heaters, and expanded control periods beyond summer as needed for grid or system reliability.

Key Finding #2: Due to the unique aspect of the *deemed savings* method (using runtime data and a deemed savings value instead of interval meter data), the approach used to identify participating thermostat devices is critical. TRM language related to the *deemed savings* method has been improved in the past few years, and there is now a mutual understanding of the approach. The utilities, implementers, and EM&V team agreed on a final demand savings calculation. In PY2023, documentation for participating thermostat devices has been improved, resulting in minor savings adjustments.

Given the increased interest in residential load management programs, the substantial amount of prior program year data available for CenterPoint and Oncor, and the deemed value experience for EPE, the EM&V team conducted a study to determine if a statewide deemed value could be developed to streamline residential participation for use in pilot programs and areas where deployment of AMI meters is ongoing; employing the same participation documentation requirements established for El Paso Electric.

Recommendation #2a: For those interested in a streamlined participation option to offer or participate in a residential summer smart thermostat pilot in PY2024—who do not yet have AMI meters fully deployed—the EM&V team recommends the average statewide demand reduction deemed value per smart thermostat of 1.40 following the Program Tracking Data and Evaluation Requirements outlined in the TRM.

Recommendation #2b: Given that EPE will be completing deploying AMI in its territory, the EM&V team recommends that EPE utilize a smart thermostat control strategy in PY2025 and follow the M&V methodology outlined in the TRM for those with AMI but continue the deemed savings approach who do not yet have AMI.

6.3.3 Impact Results

The PY2023 savings for the three residential load management programs (CenterPoint, Oncor, and EPE) are outlined in Table 31.

Table 31. PY2023 Residential Demand Reductions and Energy Savings

Utility type	Overall	
	kW (demand reductions)	kWh (energy savings)
ERCOT total	61,371	184,114
Outside-of-ERCOT total	10,118	510,588
Overall	**71,489**	**694,702**

While demand reductions started increasing in PY2019, reductions slightly decreased in PY2022 and PY2023 to 71.8 MW and 71.5 MW, respectively. Figure 53 and Figure 54 show the total demand reductions from ERCOT and outside-of-ERCOT IOU residential load management programs by program year. From PY2018 to PY2022, Oncor had the most significant demand reductions amongst the residential IOU programs, followed by CenterPoint. However, in PY2023, the demand reductions from CenterPoint's program increased from approximately 20 MW to 35 MW, which resulted in the highest demand reductions across all residential IOU programs.

Figure 53. Demand Reductions of ERCOT IOU Residential Load Management Programs, PY2019–PY2023

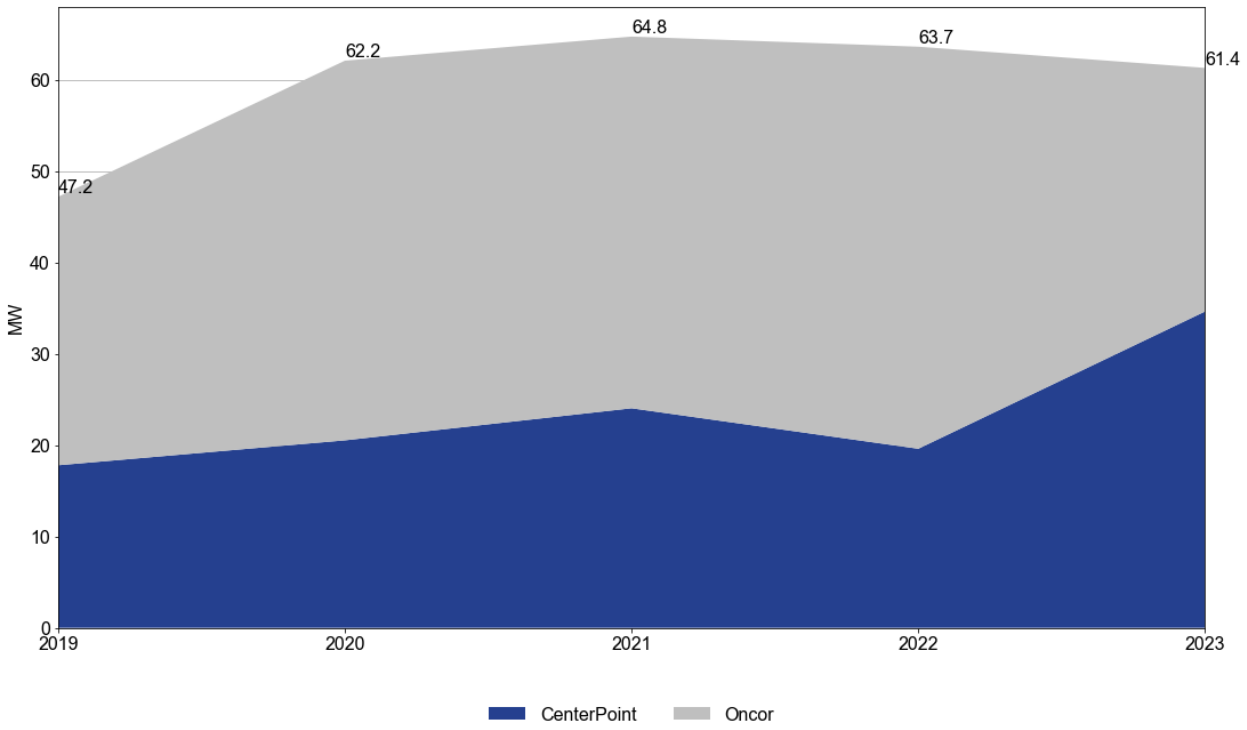
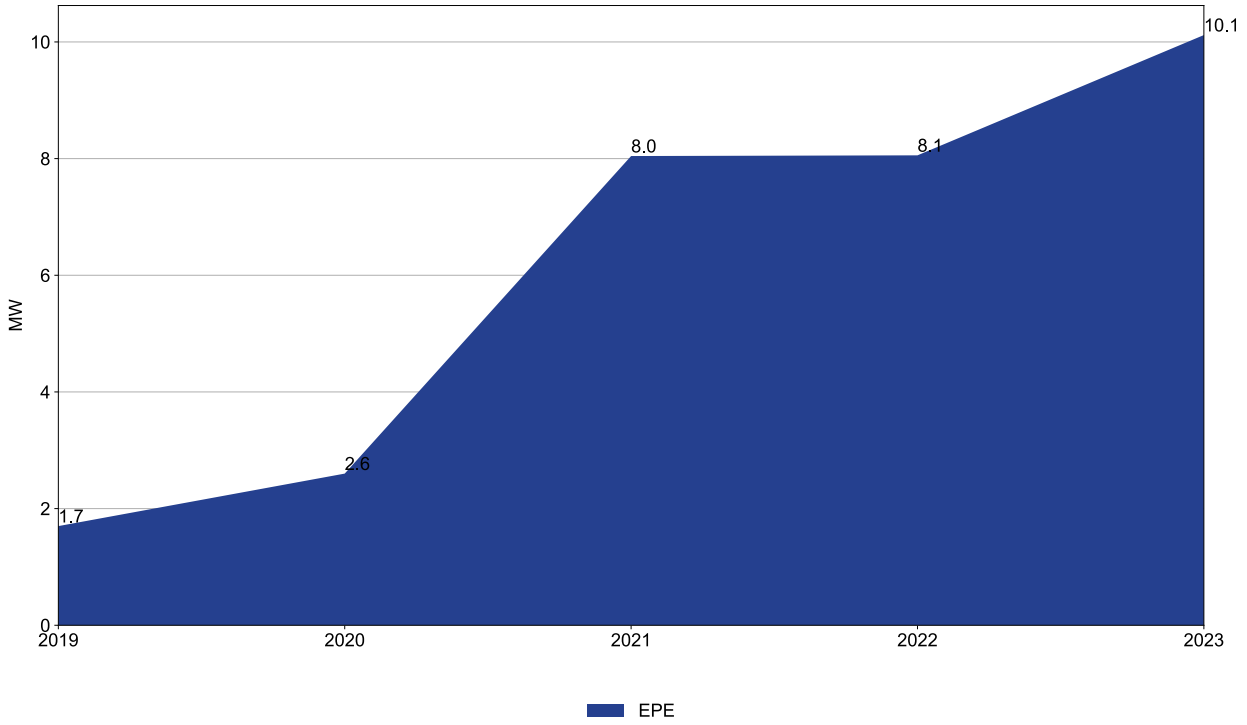


Figure 54. Demand Reductions of Outside-of-ERCOT IOU Residential Load Management Programs, PY2019–PY2023



Demand reduction calculations for most utilities were calculated the same as the evaluation calculations, indicating that the utilities follow the TRM algorithm similarly. Two residential load management programs adjusted their reductions to match the evaluated reductions. The reason for one of the adjustments is minor differences resulting from calculating the demand reductions for meters with partial data[53].The other adjustment was related to the deemed savings approach. The number of participating devices was adjusted for a few events, resulting in a small decrease in demand reductions.

[53] Per the TRM, reductions may still be calculated for less than two percent of meters that fail to record data sufficient to apply the *High 3 of 5* calculation method.

APPENDIX A: RESIDENTIAL CONSUMPTION ANALYSIS

This appendix outlines the methodology and results associated with the residential consumption analysis conducted as part of the PY2023 evaluation, measurement, and verification (EM&V) analysis, expanding on the key findings and recommendations outlined in Section 5.5 of this report. The analysis' goal is to estimate the impact of the Residential Standard Offer Program (RSOP), the Hard-to-Reach Standard Offer Program (HTR SOP), and the Low-Income Weatherization (LI) program at both the program and measure levels. We analyzed customers who participated in these three programs between January 1, 2022, and June 30, 2023, representing a full year of participants in PY2022 and the first half-year of participants in PY2023.

A.1 DATA SOURCES

Data for the consumption analysis came from four sources:

- **Program tracking data:** We received program tracking data that contained account numbers, the program in which the account participated, measure details, installation dates, the address, and reported technical reference manual (TRM) energy savings.

- **Meter/consumption data:** We received 15-minute interval data from five investor-owned utilities (IOUs) – American Electric Power Texas, Inc. (AEP Texas), CenterPoint Energy Houston Electric, LLC (CenterPoint), Oncor Electric Delivery, LLC (Oncor), and Texas-New Mexico Power Company (TNMP). For customers who participated in 2022, we received meter data spanning January 1, 2021, through December 31, 2023. For customers who participated in 2023, the meter data spanned January 1, 2022, through May 30, 2024. This data contained an account number, a timestamp, and kilowatt-hour consumption for each period.

- **Temperature data:** We collected one-hour temperature data from the Automated Surface Observing System (ASOS) network[54]. The temperature data spanned the period of January 1, 2021, through June 30, 2024, and was retrieved from 192 stations covering the state of Texas.

- **Participant survey data:** We conducted a survey of participants in the RSOPs, HTR SOPs, and LI programs that was aimed at collecting information about factors that could impact a household's consumption, such as whether the household installed solar panels or a major appliance during the consumption analysis period.

[54] The Texas weather stations in the ASOS network can be found at https://mesonet.agron.iastate.edu/request/download.phtml?network=TX_ASOS

A.2 METER FILTERING AND EXCLUSIONS

Fifteen-minute advanced metering infrastructure (AMI) meter data is quite reliable, but due to the sheer quantity of data, some accounts have unreliable meter data that could potentially bias results. This could occur for multiple reasons, such as connection issues between the utility and the meter, the residence being vacant for an extended period of time, power outages, and software issues. Due to these reasons, accounts with meter data that could bias results were identified and excluded from the analysis.

An account was excluded from the consumption analysis if it met one of the following criteria:

- the account could not be matched to the tracking data,
- the account had more than 20 percent of its overall meter readings at 0 kWh,
- the account was missing at least one week (10,080 minutes) of continuous meter readings,
- the account had connectivity problems due to the AT&T issues in TNMP's territory,
- the account's annual consumption was higher than 1.5 inter-quartile ranges above the 99th percentile of average consumption and has not been verified by the utility as a high consumer,
- the account lacked sufficient data to construct a fully robust pre- or post-installation period for use in weather normalization, or
- after weather normalization, the account had an annual consumption of less than 500 kWh or larger than the top 0.1 percent of all weather-normalized annual consumption, which was larger than 146,254 kWh.

These criteria were developed in conjunction with the utilities. In particular, we met with the utilities to explain and refine the criteria, and each utility was provided with the accounts identified with potentially high consumption and the accounts with too many zero or missing readings. Oncor verified that the high consumption accounts identified were valid accounts, and so these accounts were retained in the analysis.

In response to our initial data request, each utility provided us with 15-minute AMI meter data for their accounts. The number of meters represented by these data is outlined in Table 32.

Table 32. Meter-Level Data Received

Year Meters Received	AEP Texas	CenterPoint	Entergy	Oncor	TNMP
2022 meters received	5,383	1,976	1,892	21,700	2,164
2023 meters received	4,593	560	1,884	14,521	1,893
Total	**9,976**	**2,536**	**3,776**	**36,221**	**4,057**

The number of accounts that fit each of the above criteria is outlined in Table 33.

Table 33. Accounts Matching Filtering Criteria

Participant Data	AEP Texas	CenterPoint	Entergy	Oncor	TNMP
2022 participants					
Total number of accounts	**5,383**	**1,976**	**1,892**	**21,700**	**2,164**
Reasons for exclusion					
No tracking data	0	0	146	17	0
>20% zero kilowatt-hour readings	360	44	21	234	18
Missing data	806	14	10	59	1,063
Unvalidated high consumption	12	10	4	0 (79*)	0
AT&T issues	0	0	0	0	709
Normalized extreme consumption	35	24	0	101	12
2023 participants					
Total number of accounts	**4,593**	**560**	**1,884**	**14,521**	**1,893**
Reasons for exclusion					
No tracking data	453	0	1,384	6	0
>20% zero kilowatt-hour readings	288	6	64	252	8
Missing data	725	0	9	19	942
Unvalidated high consumption	13	0	4	0 (48*)	8
AT&T issues	0	0	0	0	762
Normalized extreme consumption	31	2	11	17	21

*The 79 and 48 high-consumption accounts identified from Oncor in 2022 and 2023, respectively, were verified by the utility and were subsequently retained in the analysis.

After removing these meters, the total number of accounts that were used in the consumption analysis is outlined by utility in Table 34 and by measure and program in Table 35.

Table 34. Analysis of Meter Counts by Utility

Year	AEP Texas	CenterPoint	Entergy	Oncor	TNMP
2022	**4,256**	**1,916**	**1,716**	**21,215**	**1,090**
% retained	79.1%	97.0%	90.7%	97.8%	50.4%
2023	**3,250**	**493**	**480**	**9,033**	**931**
% retained	70.8%	88.0%	25.5%[55]	62.2%[56]	49.2%

Table 35. Analysis Meter of Counts by Program and Measure

Measure	RSOP	HTR SOP	LI Program
Air infiltration	0	14,245	164
Ceiling insulation	3,183	3,150	752
Central AC	8,339	105	0
Central HP	4,847	1,113	1,739
Duct sealing	2,745	1,686	95
ENERGY STAR® thermostat	1,169	1,258	408
Multifamily heat pump	0	0	1,286
Total	**22,287**	**19,735**	**3,994**

Note: The total number of meters in each program is not the sum of the measures due to accounts having installed multiple measures.

[55] A low percentage of Entergy PY2023 participants were retained in the analysis due to the EM&V team's inability to match meters with program tracking data. This was not an issue for the ERCOT utilities due to the ESIID serving as a unique identifier across data sources. To prevent this in future analyses, a PY2023 EM&V recommendation is for utilities outside of ERCOT is to have a unique identifier for meters to also be used in program tracking data. We would like to note that Entergy did provide a premise number as a unique identifier in the AMI meter data request; however, we were unable to tie this in many cases to program tracking data for PY2023 participants.

[56] A large number of Oncor's 2023 participants lacked sufficient data to construct a full pre-period for use in weather normalization. Due to the compressed timeline for 2023 participants, we could not obtain the missing data before completing the analysis.

A.3 METHODOLOGY

After the meters were filtered, the data were resampled to one-hour intervals, temperature data from the nearest weather station were attached, and then the consumption data were normalized to remove the effect that weather had on consumption. The differences between the normalized consumption in the period pre-installation and the period post-installation were then analyzed at multiple levels to arrive at the results.

A.3.1 Weather Normalization

For each account, the weather station in the ASOS network that was geographically nearest to the address was identified. The temperature from this weather station was attached to the consumption data after cleaning the weather data to ensure that the temperature data had no gaps.

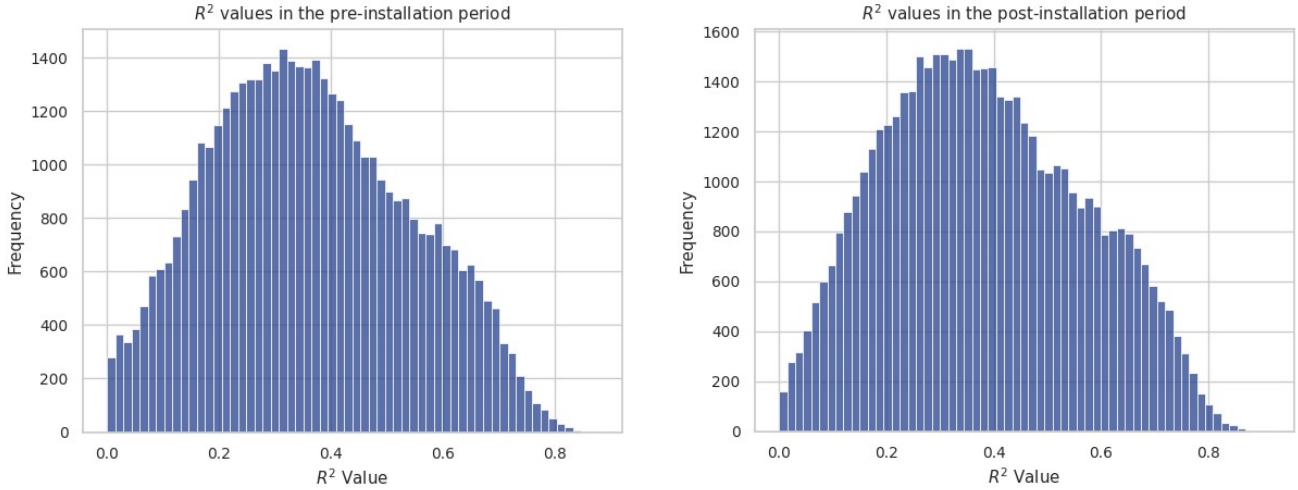
For each meter, the cooling degree hours (CDH) and heating degree hours (HDH) were calculated for multiple setpoints as follows:

- Given a cooling setpoint x, for each hour, the temperature t_h is compared against the setpoint. Then CDH is defined as $CDH_h = t_h - x$ if $t_h - x > 0$, and 0 otherwise. This measures the number of degrees (Fahrenheit) that the outside temperature exceeds the cooling setpoint.
- Given a heating setpoint y, the HDH is defined similarly, with the exception that HDH measures the number of degrees that the outside temperature is below the heating setpoint. So for each hour, $HDH_h = y - t_h$ if $y > t_h$, and 0 otherwise.
- We then set up the following regression for each meter and each combination x and y of potential cooling and heating setpoints:
    - $Consumption_h = \alpha_h + \beta_1 * CDH_{h,x} + \beta_2 * HDH_{h,y} + \sum_i \beta_i * Hour_i + \varepsilon_h$
    - Here, for each hour h, $Consumption_h$ is the hourly consumption of the participant, α_h is the intercept, which corresponds to the average consumption at hour 0. $CDH_{h,x}$ is the CDH assuming a cooling setpoint of x, and $HDH_{h,y}$ is the HDH assuming a heating setpoint of y. Their coefficients, β_1 is the model cooling slope, representing the average change in hourly usage resulting from an increase of one CDH, and β_2 is the model heating slope, representing the average change in hourly usage from an increase of one HDH. Finally, $Hour_i$ is an indicator variable indicating the hour of the day (ranging from 1 to 23), and their coefficients β_i are the average kilowatt-hour baseloads at each hour. The error term, ε_h encapsulates any variance that occurs.
- For each meter, the regression with the best R^2 value was selected and their coefficients and heating and cooling setpoints were recorded.
- Normalization was completed by applying the coefficients and setpoints in the pre- and post-periods to one year of temperature data from the nearest weather station. The year used for all meters was July 1, 2023, through June 30, 2024.

Upon normalization, the average heating setpoint for all individual accounts was 53, and the average cooling setpoint was 71. This was similar to the 2020 consumption analysis, where the average setpoints were 56 and 70, respectively. These averages are consistent when the pre-installation period is compared to the post-installation period, and they are also consistent when the accounts that participated in 2022 are compared against the accounts that participated in 2023.

The individual regressions for normalization have an average R^2 value[57] of 37.2 percent. The average R^2 ranges between 36.2 percent and 38.1 percent when the accounts are separated by year or by pre- and post-installation. The distribution of R^2 values for the pre-installation period and the post-installation period are displayed in Figure 55.

Figure 55. R^2 Distributions in the Pre- and Post-Installation Periods



A.3.2 Regression

In the tracking data that was received from the utilities, each account had between one and four measures installed during the analysis period. For each account and each measure, an indicator variable was created, which was *1* if the account had that measure installed and *0* otherwise. Indicator variables were created for each program (RSOP, HTR SOP, LI) as well. The difference between the normalized annual consumption during the pre-installation and post-installation periods was calculated, then regression equations were used to measure the impact that each program and measure had on the difference between the normalized annual consumption.

[57] The R^2 value for a regression measures the percentage of variation in the modeled variable that the model explains.

a. Program-Level Regression

At the program level, the regression equation used to measure impacts is:

$$\mathrm{NACDiff}_i = \alpha_i + \beta_1 * \mathrm{RSOP}_i + \beta_2 * \mathrm{LowIncome}_i + \varepsilon_i$$

Where:

$\mathrm{NACDiff}_i$	Change in weather normalized consumption for account i as calculated from the normalization method outlined above.
α_1	The model intercept represents the average difference for accounts in the HTR SOP program.
β_1	The deviation from α_1 for accounts in the RSOP program.
RSOP_i	An indicator variable for accounts in the RSOP program, which is *1* if the account was in the RSOP and *0* otherwise.
β_2	The deviation from α_1 for accounts in the LI program.
$\mathrm{LowIncome}_i$	An indicator variable for accounts in the LI program, *1* if the account was in the LI program and *0* otherwise.
ε_i	The error/residual term.

The model has an F statistic[58] of 123, signifying that the model explains a significant amount of the variation in the difference in normalized annual consumption.

[58] The F statistic measures the ratio of the variability between the groups (for instance, how different are RSOP participants to HTR SOP participants?) to the variability within each group (for example, how different are the RSOP participants from other RSOP participants?). In other words, it is the ratio of explained variance (in the model) to unexplained variance. The significance level of the F statistic depends heavily on the degrees of freedom in the model, but a good rule of thumb is that an F statistic larger than 2.5 is likely significant.

b. Measure-Level Regression

At the measure level, the accounts were split into the three programs; measure-level regressions were run for all three. The regression equation for each program is:

$$\text{NACDiff}_i = \alpha_1 + \beta_1 * \text{AirInf}_i + \beta_2 * \text{CeilIns}_i + \beta_3 * \text{CentAC}_i + \beta_4 * \text{CentHP}_i + \beta_5 * \text{DuctSeal}_i + \beta_6 * \text{Therm}_i + \beta_7 * \text{MFHP}_i + \varepsilon_i$$

Where:

NACDiff_i	Change in weather normalized consumption for account i as calculated from the normalization method outlined above.
α_1	The model intercept represents the average difference for all accounts in the program.
β_1	The deviation from α_1 for accounts that received an air infiltration measure.
$AirInf_i$	An indicator variable for accounts, which is *1* if the account received an air infiltration measure and *0* otherwise.
ε_i	The error/residual term.

The other coefficients and indicator variables follow a similar pattern. The F statistics for the models for each of the three programs are shown in Table 36.

Table 36. F Statistics for the Measure-Level Regressions

Program	*F* statistic
RSOP	152.6
HTR SOP	34.0
LI	0.6

The F statistics for the RSOP and the HTR SOP indicate that the measure-level models explain a significant amount of the variation in the normalized consumption. For accounts in the LI program, however, the low F statistic and, the subsequent high p-values[59] at the measure level, means that the results for this program, detailed below, are more qualitative and should be taken as informative only. This will also be evident in the confidence intervals around each measure's estimate, shown in the details below.

[59] The p-value is the probability (between 0 and 1) that chance alone can produce the results, assuming there is no difference between the consumption pre-installation and post-installation. A p-value of larger than 0.1 indicates that we cannot confidently say the difference is not zero.

c. Interaction Between Measures

For some accounts, the participant had more than one measure installed. Table 37 outlines the number of accounts that had another measure installed along with any of the given measures. So, for instance, of the 6,862 accounts that had ceiling installation installed, 1,051 also had the duct sealing measure installed.

Table 37. Installation of Multiple Measures

Measure	Air infiltration	Ceiling insulation	Central AC	Central HP	Duct sealing	ENERGY STAR® thermostat	Multifamily heat pump
Air infiltration	14,247						
Ceiling insulation	968	6,862					
Central AC	3	4	8,302				
Central HP	38	12	16	7,389			
Duct sealing	1,082	1,051	-	8	4,274		
ENERGY STAR® thermostat	38	7	-	1,772	-	2,831	
Multifamily heat pump	-	-	-	-	-	-	1,286

The interaction between the measures for accounts with more than one measure can lead to issues when using the model to predict individual differences in normalized consumption. However, none of the pairwise interactions between the measures had a significant impact on the model. In Table 38, the p-values for the interaction between each pair of measures are recorded. None of the p-values are smaller than 0.05, and very few are less than 0.1. The only interaction that yielded a significant impact was for accounts that installed air infiltration, ceiling insulation, and duct sealing measures. With these, there were only 124 accounts with all three measures, and the impact did not influence the final results.

Table 38. Interaction Between Pairwise Measures—P-Values

Measure	Air infiltration	Ceiling insulation	Central AC	Central HP	Duct sealing	ENERGY STAR® thermostat	Multifamily heat pump
Air infiltration	-						
Ceiling insulation	0.573	-					
Central AC	0.317	0.079	-				
Central HP	0.422	0.282	0.365	-			
Duct sealing	0.652	0.067	0.206	0.301	-		
ENERGY STAR® thermostat	0.422	0.334	-	0.459	-	-	
Multifamily heat pump	-	-	-	-	-	-	-

With the large number of accounts that installed measures in isolation and the fact that the interaction between the measures was not significantly impacting the model, we can confidently attribute the modeled savings to the specified measures.

A.3.3 TRM Savings

The program tracking data included information about more than just the measures modeled above. Certain measures are not reported because the number of participants for them is too low (e.g., ENERGY STAR® refrigerators) or because their inclusion would detract from the focus of the analysis (e.g., low-flow showerheads).

The TRM savings were calculated for each participant using the ex-ante savings in the tracking data. At the program level, the TRM savings for an account is the sum of the ex-ante savings for the account in that program. At the measure level, the TRM savings for an account are only the ex-ante savings for that particular measure.

A.3.4 Lessons Learned

We identified a few quality assurance and procedure improvements for the next time a similar analysis is run. First, ingesting the data from the utilities was a very slow process and involved multiple uploads and downloads. Ultimately, the data needs to be in Microsoft Azure—a data management program—so it would be more efficient to have the data uploaded directly to Microsoft Azure from the start instead of using SharePoint as a staging point. SharePoint was used as the secure data transfer process, which the utilities are familiar with for other data requests. We will discuss the possibility of utilities uploading to Microsoft Azure for future analyses, as we also want to balance the burden of the interval meter data request.

Second, the consumption data is processed through many steps with additional data (i.e., tracking data, weather data) being connected to the consumption data at various stages in the process. At each of these stages, there is the potential for accounts to disappear and for data to join incorrectly. We discovered during the weather-joining process that certain temperatures were not being connected correctly, which can have a large impact on the weather normalization process. This was corrected in this year's analysis, and we successfully implemented more quality control checks in our process to catch instances where issues can occur, which should be implemented in future analyses.

Third, care should be taken at the beginning of the process so that the account identifiers received from the utilities are the same as the identifiers in our tracking data. We had some issues with the IDs, particularly with the 2023 participants in Entergy's territory, where the consumption data we received could not be matched with the tracking data.

Finally, working with the utilities from the beginning kept the process transparent and allowed the utilities to have input into how the exclusion criteria were defined.

A.4 RESULTS

This section presents the evaluated savings estimates for the RSOP, HTR SOP, and LI programs. The results are first presented at the program level, followed by the measure level, and finally at the utility level.

Each table below presents the sample size (n), the average normalized annual consumption in the pre-installation period (PRENAC), the modeled savings in kilowatt-hours, 95 percent confidence intervals[60] around the modeled savings, the average TRM savings in kilowatt-hours, and percentages to help put the results into context. Using the RSOP program displayed in Table 39 and Table 40, here is an example of how to read the results: The average participant in the RSOP program saw a reduction of 2,887 kWh, which represents 9.6 percent of the average normalized annual consumption in the pre-installation period. These participants had an average TRM savings of 5,332 kWh, meaning the modeled savings represented 54.2 percent of the TRM savings. The 95 percent confidence interval shown in Table 40 shows that the average reduction in energy consumption for RSOP participants is very likely between 2,662 kWh and 3,113 kWh.

It is important to note that there are differences between how savings are calculated in this analysis and how savings are calculated in the TRM. The TRM is designed to estimate savings for a given measure in isolation from any other measures. In this analysis, an account may have installed multiple measures. The discussion on how the measures may have interacted can be found in subsection c of section A.3.2. The large number of measures installed in isolation from any others allows us to confidently attribute savings to a particular measure. In addition, these results are aggregate values across the five IOUs (AEP Texas, Centerpoint, Oncor, TNMP, and Entergy); performance both at the program level and compared to the TRM deemed values differed by utility and climate zone.

[60] Note that the EM&V RFP specified that our confidence intervals only need to be at the 90 percent confidence level. We chose to report at the 95 percent level, as is typical for scientific work, although 90 percent confidence levels are still often used in the energy efficiency industry. The difference in confidence level widens the confidence intervals slightly, but it does not affect any of the conclusions.

A.4.1 Results by Program

At the program level, each program showed savings when comparing the normalized annual consumption in the pre-installation period to the post-installation period. In Table 39, the modeled savings are compared to both the average normalized annual consumption in the PRENAC and the TRM savings. When compared to the PRENAC, the programs saved the average participant between 8 and 11.2 percent of their consumption. Additionally, on average, participation in the program realized between 37.9 and 54.2 percent of the claimed TRM savings.

Table 39. Program-Level Results

Measure	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
RSOP	22,287	30,105	2,887	9.6%	5,332	54.2%
HTR	19,735	18,153	1,454	8.0%	3,835	37.9%
LI	3,994	23,403	2,625	11.2%	6,189	42.4%

Table 40. Program-Level Results—Precision and Confidence Intervals

Program	Model savings	Standard error	Lower 95% savings	Upper 95% savings
RSOP	2,887	115	2,662	3,113
HTR	1,454	68	1,322	1,587
LI	2,625	172	2,288	2,963

In the PY2019 consumption analysis, the RSOP savings were 7.6 percent of the PRENAC and 38.6 percent of the TRM savings, which indicates that the savings in PY2023 were higher for both categories. The HTR SOP savings were 4.9 percent of the PRENAC and 30.1 percent of the TRM savings in PY2019, again showing that savings were higher in PY2023 than PY2019. The LI program savings in PY2019 were 15.9 percent of the PRENAC and 38.2 percent of the TRM savings, meaning the comparison to the PRENAC is lower in PY2023, but the comparison to the claimed TRM savings is higher.

A.4.2 Results by Measure

In Table 41 and Table 42, the results are presented at the measure level for all programs combined. In the combined programs, most analyzed measures show significant savings compared to the PRENAC. The exception is duct sealing (or duct efficiency), whose 95 percent confidence interval includes 0, which indicates that the savings demonstrated are not significantly different from 0. Results are separated into their respective programs in the sections that follow.

Table 41. Measure-Level Results—All Programs

Measure	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
Air infiltration	14,247	17,559	1,516	8.6%	1,131	134.1%
Ceiling insulation	6,862	25,310	1,322	5.2%	1,659	79.7%
Central AC	8,302	34,970	4,929	14.1%	2,475	199.1%
Central HP	7,389	23,676	3,266	13.8%	5,696	57.3%
Duct sealing	4,274	30,192	278	0.9%	703	39.6%
ENERGY STAR® thermostat	2,831	14,132	979	6.9%	658	148.9%
Multifamily heat pump	1,286	14,745	2,290	15.5%	4,855	47.2%

Table 42. Measure-Level Results—All Programs—Precision and Confidence Intervals

Measure	Model savings	Standard error	Lower 95% savings	Upper 95% savings
Air infiltration	1,516	165	1,192	1,840
Ceiling insulation	1,322	178	972	1,671
Central AC	4,929	184	4,570	5,289
Central HP	3,266	185	2,903	3,629
Duct sealing	278	191	(96)	652
ENERGY STAR® thermostats	979	224	540	1,419
Multifamily heat pump	2,290	304	1,695	2,885

a. Measure-Level Results for RSOP

In the RSOP, the central AC and HP measures show more than 10 percent savings relative to the normalized annual consumption in the pre-installation period; duct sealing, on the other hand, is showing less than 40 percent of the claimed TRM savings. Looking at the confidence intervals in Table 44, we cannot say that the modeled savings are significantly different from zero.

Table 43. Measure-Level Results—RSOP

Measure	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
Ceiling insulation	3,183	25,189	1,111	4.4%	2,124	52.3%
Central AC	8,339	35,117	4,924	14.0%	2,457	200.4%
Central HP	4,847	28,703	3,473	12.1%	5,515	63.0%
Duct sealing	2,745	32,606	293	0.9%	738	39.7%
ENERGY STAR® thermostat	1,169	13,628	626	4.6%	712	87.9%

Table 44. Measure-Level Results—RSOP—Precision and Confidence Intervals

Measure	Model savings	Standard error	Lower 95% savings	Upper 95% savings
Ceiling insulation	1,111	279	565	1,657
Central AC	4,924	252	4,430	5,417
Central HP	3,473	265	2,953	3,992
Duct sealing	293	286	(267)	853
ENERGY STAR® thermostats	626	357	(73)	1,325

b. Measure-Level Results for HTR SOP

In the HTR SOP, most of the measures show good savings relative to the TRM savings. Similar to the RSOP, duct sealing again shows savings that are not significantly different from zero.

Table 45. Measure-Level Results—HTR SOP

Measure	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
Air infiltration	14,245	16,870	1,475	8.7%	1,150	128.3%
Ceiling insulation	3,150	20,992	944	4.5%	1,421	66.5%
Central AC	105	21,405	5,353	25.0%	1,918	279.1%
Central HP	1,113	15,900	2,605	16.4%	5,627	46.3%
Duct sealing	1,686	30,751	(272)	-0.9%	663	-41.0%
ENERGY STAR® thermostat	1,258	14,852	1,435	9.7%	642	223.4%

Table 46. Measure-Level Results—HTR SOP—Precision and Confidence Intervals

Measure	Model savings	Standard error	Lower 95% savings	Upper 95% savings
Air infiltration	1,475	236	1,012	1,938
Ceiling insulation	944	249	456	1,432
Central AC	5,353	818	3,750	6,955
Central HP	2,605	392	1,836	3,373
Duct sealing	(272)	265	(790)	247
ENERGY STAR® thermostats	1,435	382	687	2,183

c. Measure-Level Results for Low-Income Weatherization

In the LI program, many measures demonstrated savings in the model, particularly when compared against the TRM. Caution should be exercised when applying these results for two reasons: (1) the small sample sizes (in duct sealing and air infiltration in particular), and (2) the large standard errors, which indicate a large variance in the normalized consumption savings for accounts with these measures. In a qualitative sense, the LI program is performing well.

Table 47. Measure Level Results—Low-Income Weatherization

Measure	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
Air infiltration	164	56,749	1,729	3.0%	181	953.7%
Ceiling insulation	752	36,433	3,129	8.6%	900	347.6%
Central HP	1,739	14,982	2,686	17.9%	5,696	47.2%
Duct sealing	95	25,430	2,911	11.4%	387	752.8%
ENERGY STAR® thermostat	408	13,428	2,792	20.8%	549	509.0%
Multifamily heat pump	1,286	14,745	2,290	15.5%	4,855	47.2%

Table 48. Measure-Level Results—Low-Income Weatherization—Precision and Confidence Intervals

Measure	Model savings	Standard error	Lower 95% savings	Upper 95% savings
Air infiltration	1,729	1,017	(265)	3,723
Ceiling insulation	3,129	739	1,681	4,577
Central HP	2,686	703	1,309	4,063
Duct sealing	2,911	1,245	472	5,351
ENERGY STAR® thermostats	2,792	765	1,293	4,292
Multifamily heat pump	2,290	706	905	3,674

A.4.3 Results by Utility

The modeled savings for each utility are presented below, separated at the program- and measure-level. These looks can help the utility isolate which programs and/or measures show savings, and which need further investigation.

a. Program Level Results Separated by Utility

The results for each utility are separated by program in Table 50 with confidence intervals in Table 51. A few programs, including the RSOPs offered by CenterPoint and Entergy, showed large standard errors, which indicate that the sample size is small, the variance among accounts is large, or potentially both. While the results for these programs should be viewed qualitatively, the quantitative data still provides insight into how each utility performed in each program and measure.

The utility and program results are compared to the PY2019 consumption analysis results for the ERCOT utilities in Table 49. The RSOP and HTR SOP offered by Oncor demonstrated over 100 percent increases over the PY2019 results, while the RSOP offered by CenterPoint increased by over 350 percent. For all four ERCOT utilities, the LI programs showed increases between 20.5 percent and 76.2 percent.

Table 49. Program-Level Results—Comparison to PY2019 Results

Program	Model savings (kWh)	PY2019 model savings (kWh)	Percentage change
AEP Texas			
RSOP	(41)	403	-110.2%
HTR SOP	(89)	788	-111.3%
LI	2,413	1,932	24.9%
CenterPoint			
RSOP	6,402	1,337	378.8%
HTR SOP	437	657	-33.5%
LI	2,694	2,044	31.8%
Oncor			
RSOP	4,306	1,667	158.3%
HTR SOP	1,718	712	141.3%
LI	2,533	2,102	20.5%
TNMP			
RSOP	329	575	-42.8%
HTR SOP	834	581	43.5%
LI	2,946	1,672	76.2%

Table 50. Program-Level Results by Utility

Program	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
AEP Texas						
RSOP	5,421	29,446	(41)	-0.1%	966	-4.3%
HTR	3,060	27,771	(89)	-0.3%	993	-9.0%
LI	611	19,595	2,413	12.3%	3,437	70.2%
CenterPoint						
RSOP	523	32,017	6,402	20.0%	131	4884.1%
HTR	221	23,055	437	1.9%	1,659	26.4%
LI	1,693	30,842	2,694	8.7%	3,303	81.6%
Entergy						
RSOP	594	41,041	5,631	13.7%	2,045	275.4%
HTR	377	36,325	5,072	14.0%	1,540	329.4%
Oncor						
RSOP	13,329	31,822	4,306	13.5%	3,480	123.7%
HTR	15,310	15,736	1,718	10.9%	1,544	111.3%
LI	1,351	14,560	2,533	17.4%	5,164	49.1%
TNMP						
RSOP	2,420	19,459	329	1.7%	1,705	19.3%
HTR	767	17,169	834	4.9%	1,624	51.4%
LI	339	19,161	2,946	15.4%	4,225	69.7%

Table 51. Program-Level Results by Utility—Precision and Confidence Intervals

Program	Model savings	Standard error	Lower 95% savings	Upper 95% savings
AEP Texas				
RSOP	(41)	264	(558)	476
HTR SOP	(89)	165	(412)	234
LI	2,413	437	1,556	3,269
CenterPoint				
RSOP	6,402	1,434	3,591	9,213
HTR SOP	437	921	(1,369)	2,243
LI	2,694	1,337	73	5,314
Entergy				
RSOP	5,631	1,100	3,475	7,787
HTR SOP	5,072	865	3,375	6,768
Oncor				
RSOP	4,306	130	4,051	4,562
HTR SOP	1,718	73	1,574	1,861
LI	2,533	268	2,008	3,059
TNMP				
RSOP	329	346	(350)	1,007
HTR SOP	834	228	387	1,281
LI	2,946	471	2,023	3,870

b. Measure-Level Results Separated by Utility

At the measure level, each utility had certain measures that performed better than others. The central AC measure consistently performed well when compared to TRM savings across all utilities, while other measures showed more variability between the different utilities.

Table 52. Measure-Level Results by Utility

Measure	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
AEP Texas						
Air infiltration	1,014	29,862	131	0.4%	835	15.7%
Ceiling insulation	2,143	24,427	953	3.9%	1,742	54.7%
Central AC	399	32,874	2,394	7.3%	2,546	94.0%
Central HP	379	19,798	3,026	15.3%	5,809	52.1%
Duct sealing	3,556	30,820	-731	-2.4%	706	-103.6%
CenterPoint						
Air infiltration	152	59,044	3,412	5.8%	215	1586.6%
Ceiling insulation	603	40,549	2,612	6.4%	1,153	226.5%
Multifamily heat pump	1,286	14,745	2,290	15.5%	4,855	47.2%
Entergy						
Air infiltration	241	37,642	4,246	11.3%	446	952.5%
Ceiling insulation	494	40,933	5,013	12.2%	2,485	201.8%
Duct sealing	634	39,458	5,634	14.3%	657	857.8%
Oncor						
Air infiltration	12,954	15,442	1,551	10.0%	1,184	131.0%
Ceiling insulation	1,626	19,179	1,638	8.5%	967	169.4%
Central AC	7,949	35,042	5,066	14.5%	2,475	204.7%
Central HP	7,046	24,155	3,369	13.9%	5,695	59.2%
ENERGY STAR® thermostat	2,835	14,142	1,333	9.4%	658	202.7%

Measure	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
TNMP						
Air infiltration	48	26,241	236	0.9%	793	29.7%
Ceiling insulation	2,213	20,447	281	1.4%	2,136	13.1%
Central AC	91	35,714	4,345	12.2%	2,214	196.3%
Central HP	274	18,878	3,004	15.9%	5,566	54.0%
Duct sealing	332	27,098	1,002	3.7%	722	138.8%

Table 53. Measure Level Results by Utility—Precision and Confidence Intervals

Measure	Model savings	Standard error	Lower 95% savings	Upper 95% savings
AEP Texas				
Air infiltration	131	357	-569	832
Ceiling insulation	953	277	410	1,495
Central AC	2,394	502	1,410	3,379
Central HP	3,026	513	2,020	4,032
Duct sealing	-731	263	-1,246	-217
CenterPoint				
Air infiltration	3,412	1,265	933	5,891
Ceiling insulation	2,612	848	950	4,273
Multifamily heat pump	2,290	746	827	3,753
Entergy				
Air infiltration	4,246	1,681	952	7,541
Ceiling insulation	5,013	1,736	1,612	8,415
Duct sealing	5,634	1,728	2,247	9,020

Measure	Model savings	Standard error	Lower 95% savings	Upper 95% savings
Oncor				
Air infiltration	1,551	376	815	2,287
Ceiling insulation	1,638	380	893	2,383
Central AC	5,066	387	4,308	5,823
Central HP	3,369	371	2,641	4,097
ENERGY STAR® thermostat	1,333	342	662	2,004
TNMP				
Air infiltration	236	940	-1,607	2,079
Ceiling insulation	281	306	-318	879
Central AC	4,345	711	2,952	5,738
Central HP	3,004	468	2,088	3,921
Duct sealing	1,002	416	187	1,818

A.5 MEASURE-ATTRIBUTE-LEVEL RESULTS

For each core measure, certain attributes were used to break down the results further and determine whether there were specific drivers for them. For air infiltration and duct sealing, the results were broken into quartiles based on the percentage of cubic-feet-per-minute (CFM) reduction. For ACs and HPs, the results were aggregated by seasonal energy efficiency ratios (SEER). For ceiling insulation, results were separated by starting R-values.

A.5.1 Air Infiltration Attribute Results

The detailed air infiltration results are shown in Table 54. The quartiles are defined by the percentage of CFM improvement. The top three quartiles showed savings in the model, but the accounts in the first quartile did not demonstrate any savings.

Table 54. Detailed Measure Level Results—Air Infiltration

Quartile CFM improvement	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
Q1 (4.7%-26.2%)	276	32,064	-1,072	-3.3%	728	-147.3%
Q2 (26.2%-33.8%)	258	30,905	235	0.8%	744	31.6%
Q3 (33.8%-47.9%)	257	29,407	1,326	4.5%	675	196.5%
Q4 (47.9%-77.2%)	277	27,187	508	1.9%	621	81.8%

A.5.2 Duct Sealing Attribute Results

The detailed duct sealing results are shown in Table 55. The accounts are separated into four quartiles based on the percentage of CFM improvement, which ranged between 41.7 percent and 98.4 percent. On average, accounts with at least an 83 percent CFM improvement showed savings, while accounts with less than 83 percent improvement did not demonstrate savings.

Table 55. Detailed Measure Level Results—Duct Sealing

Quartile CFM improvement	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
Q1 (41.7%-74.7%)	981	34,704	-611	-1.8%	707	-86.3%
Q2 (74.7%-78.8%)	999	32,419	-937	-2.9%	782	-119.8%
Q3 (78.8%-83.0%)	980	32,721	-260	-0.8%	821	-31.7%
Q4 (83.0%-98.4%)	987	30,231	1,072	3.5%	760	141.0%

A.5.3 Air Conditioner and Heat Pump Attribute Results

Table 56 and Table 57 respectively, show the detailed results for accounts with the central AC and central HP measures, broken down by SEER. There is not any discernable difference between accounts with different SEER values.

Table 56. Detailed Measure Level Results—Central AC

SEER	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
<16	191	35,003	5,523	15.8%	1,655	333.7%
16	3,679	35,578	5,912	16.6%	2,613	226.2%
17	602	37,267	6,075	16.3%	3,345	181.6%
18+	1,439	41,488	6,060	14.6%	4,465	135.7%

Table 57. Detailed Measure Level Results—Central HP

SEER	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
<16	2,965	19,562	3,260	16.7%	5,672	57.5%
16	2,787	25,479	3,627	14.2%	5,678	63.9%
17	244	34,698	2,685	7.7%	5,846	45.9%
18+	707	36,490	4,262	11.7%	7,150	59.6%

A.6 CLIMATE-ZONE-LEVEL RESULTS

The TRM has developed five climate zones to recognize the energy savings differences for HVAC and envelope measures for different weather conditions. Therefore, measures have different savings claimed depending on the location. The climate zones in the TRM are defined by county and are shown in Figure 56. The accounts we analyzed were distributed among Climate Zone 1 through Climate Zone 4, with no accounts in Climate Zone 5. In this section, results are presented separately by climate zone.

Table 58 shows that only 112 accounts were analyzed in Climate Zone 1. The relatively large standard error in this climate zone indicates that we cannot say the average savings in this climate zone are significantly different from zero. Climate Zone 2 and Climate Zone 3 show good realization rates relative to the TRM savings in the zones. In Climate Zone 4, however, accounts do not show any savings. In fact, on average, the accounts in Climate Zone 4 show higher normalized annual consumption post-installation than in the pre-installation period.

Figure 56. Map of TRM Climate Zones

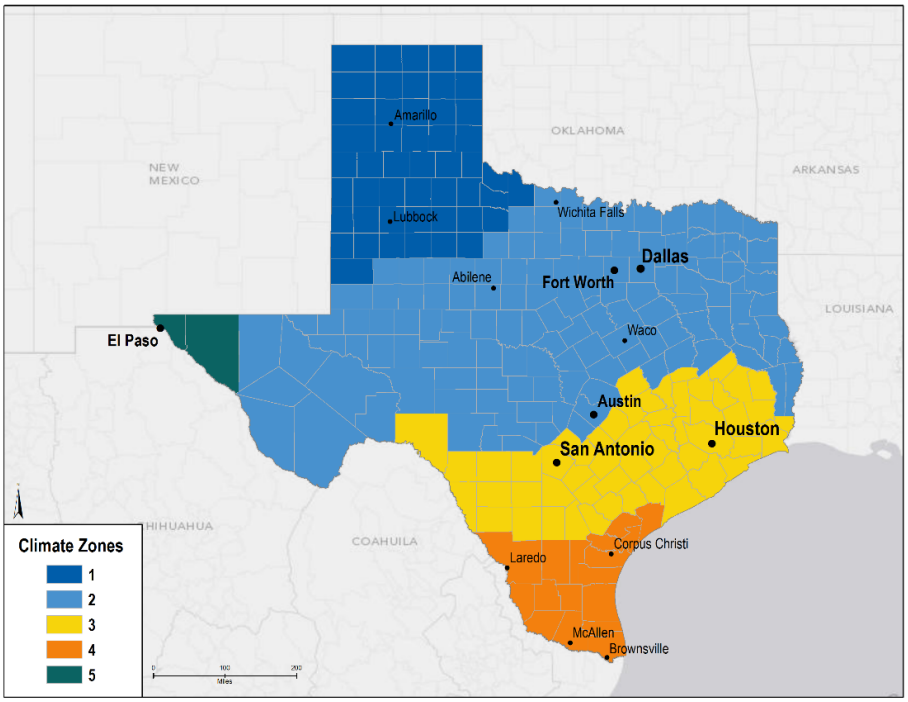


Table 58. Results by Climate Zone

Climate zone	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
1	112	12,534	1,150	9.2%	945	121.7%
2	33,306	22,429	2,686	12.0%	2,517	106.7%
3	5,282	28,812	2,837	9.8%	2,387	118.9%
4	7,181	30,187	-162	-0.5%	799	-20.3%

Table 59. Results by Climate Zone—Precision and Confidence Intervals

Climate zone	Model savings	Standard error	Lower 95% savings	Upper 95% savings
1	1,150	896	-606	2,906
2	2,686	1,268	200	5,172
3	2,837	1,273	341	5,333
4	-162	1,272	-2,655	2,331

A.6.1 Ceiling Insulation Attribute Results

Accounts with a ceiling insulation measure were separated by the starting R-value. The model results are shown in Table 60. Accounts with a starting R-value larger than five demonstrated higher model savings than the TRM savings, while accounts with a starting R-value of four or lower had realization percentages of less than 50 percent.

Table 60. Detailed Measure Level Results—Ceiling Insulation

Starting R-value	n	PRENAC (kWh)	Model savings (kWh)	Savings as a percentage of PRENAC	TRM savings (kWh)	Savings as a percentage of TRM
R0	278	28,275	621	2.2%	1,766	35.2%
R1-R4	3,272	24,744	842	3.4%	2,107	40.0%
R5-R8	1,655	25,378	1,455	5.7%	1,424	102.2%
R9-R14	944	28,903	1,923	6.7%	1,129	170.4%
R15-R22	742	21,360	754	3.5%	558	135.2%

A.7 PARTICIPANT SURVEY RESULTS

Tetra Tech conducted a quantitative survey of residential program participants who received an energy efficiency installation in 2022 or the first half of 2023. The survey focused on the following topics:

- lifestyle changes (i.e., working from home);
- occupancy changes (i.e., number in the household);
- equipment changes (i.e., electric vehicle (EV));
- behavioral changes (i.e., temperature setpoint);
- a major renovation; and
- perceived comfort level pre- and post-installation.

In addition, the survey concluded with an open-ended question that allowed respondents to share any other energy efficiency concerns.

The goal of conducting the survey was to determine factors that would change an account's consumption that may not be captured solely in the tracking data. Even if these factors do not affect the overall results, having this information can increase confidence that the model savings can be attributed to the specified measures.

Tetra Tech sampled 24,145 participants and received 1,590 responses to the survey. The number of responses, separated by utility and by program, are shown in Table 61 and Table 62, respectively.

Table 61. Survey Responses by Utility

Utility	AEP Texas	CenterPoint	Entergy	Oncor	TNMP
Count	496	131	57	693	67

Table 62. Survey Responses by Program

Program	RSOP	HTR SOP	LI
Count	1,094	243	107

The survey responses were used in two ways to determine their impact on the consumption analysis results. First, the individual responses were analyzed to determine whether they could be used to predict a difference in the account's consumption. Second, the respondents who indicated they installed solar panels or had purchased an EV were removed from the consumption analysis to determine if they were having an adverse impact on the results.

A.7.1 Survey Response Analysis

Responses were used as categorical variables in the following model to determine whether the survey responses could be used to predict savings:

$$\mathrm{NACDiff}_i = \alpha_1 + \beta_1 * \mathrm{RSOP}_i + \beta_2 * \mathrm{LowInc}_i + \beta_3 * \mathrm{Solar}_i + \beta_4 * \mathrm{EV}_i + \beta_5 * \mathrm{Equip}_i + \beta_6 * \mathrm{Renov}_i + \beta_7 * \mathrm{Work}_i + \beta_8 * \mathrm{House}_i + \beta_9 * \mathrm{Comfort}_i + \varepsilon_i$$

Where:

$\mathrm{NACDiff}_i$	Change in weather normalized consumption for account i as calculated from the normalization method outlined above.
α_1	The model intercept represents the average difference for accounts in the HTR SOP program who responded negatively to all major changes, did not have a change in household size, and indicated their comfort did not change upon installing the measure.
β_1	The deviation from α_1 for accounts in the RSOP program.
RSOP_i	An indicator variable for accounts in the RSOP program, which is *1* if the account was in the RSOP and *0* otherwise.
β_2	The deviation from α_1 for accounts in the LI program.
$\mathrm{LowIncome}_i$	An indicator variable for accounts in the LI program, *1* if the account was in the LI program and *0* otherwise.
β_k	The coefficient for each survey indicator variable, which represents the deviation from α_1 for respondents who responded positively to the survey question.
Solar_i	An indicator variable, which is *1* if the respondent said they installed solar panels in the past year and *0* otherwise.
ε_i	The error/residual term.

The other indicator variables are defined similarly, with the exception that multiple indicator variables were created for the questions about household size (with three potential responses), work from home (with four potential responses), and comfort level (with three potential responses). The extra variables were repressed from the model shown above for conciseness.

The regression showed that only one of the survey variables was a significant predictor of the difference in consumption: solar panels. Participants who installed solar panels had an average consumption difference of 4,167 kWh larger than those who did not.

For the remainder of the survey variables, the p-values indicate the variables do not significantly impact the program-level estimates; this gives us confidence that the consumption analysis results are not significantly impacted by some of the major factors that the tracking data does not reveal.

A.7.2 Survey Response Interaction with Consumption Results

To emphasize this last point further, participants who indicated they had installed solar panels or purchased an electric vehicle in the past year were removed; this resulted in 100 accounts being removed from the consumption analysis (58 that had installed solar panels, and 42 with EVs). At both the program and measure levels, the removal of these accounts had very little impact on the modeled estimates, with each estimate within five percent of the original estimates.

APPENDIX B: LIFETIME IOU PROGRAM SAVINGS

The demand reductions and energy savings achieved by 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 have achieved since PY2012—when the PUCT evaluation, measurement, and verification (EM&V) effort began—are shown in Figure 57 (demand reductions) and Figure 58 (energy savings). Demand reductions and energy savings are expected to continue through 2051.

Figure 57. Lifecycle Demand Reduction by Sector (MW), PY2012-PY2051

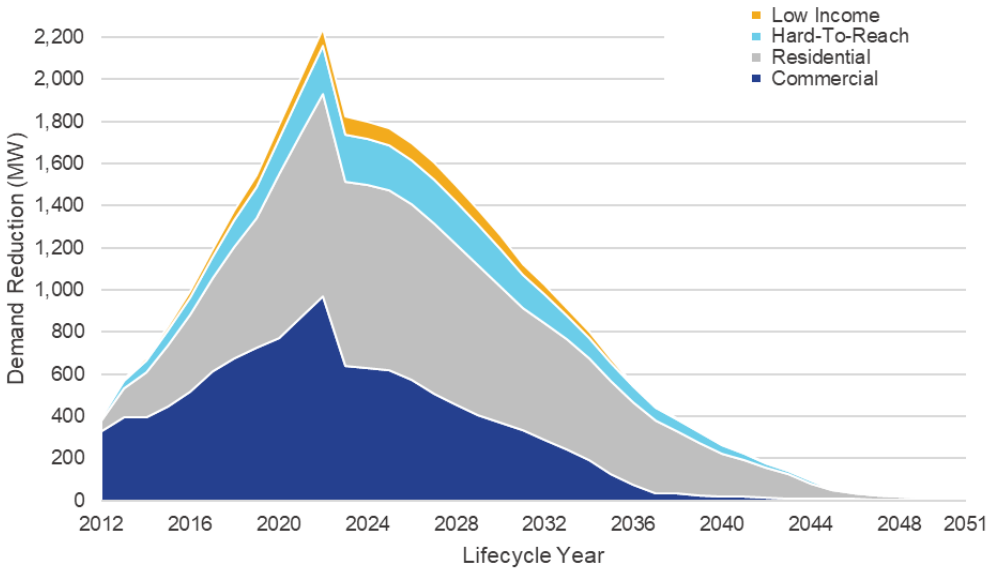


Figure 58. Lifecycle Energy Savings by Sector (GWh), PY2012-PY2051

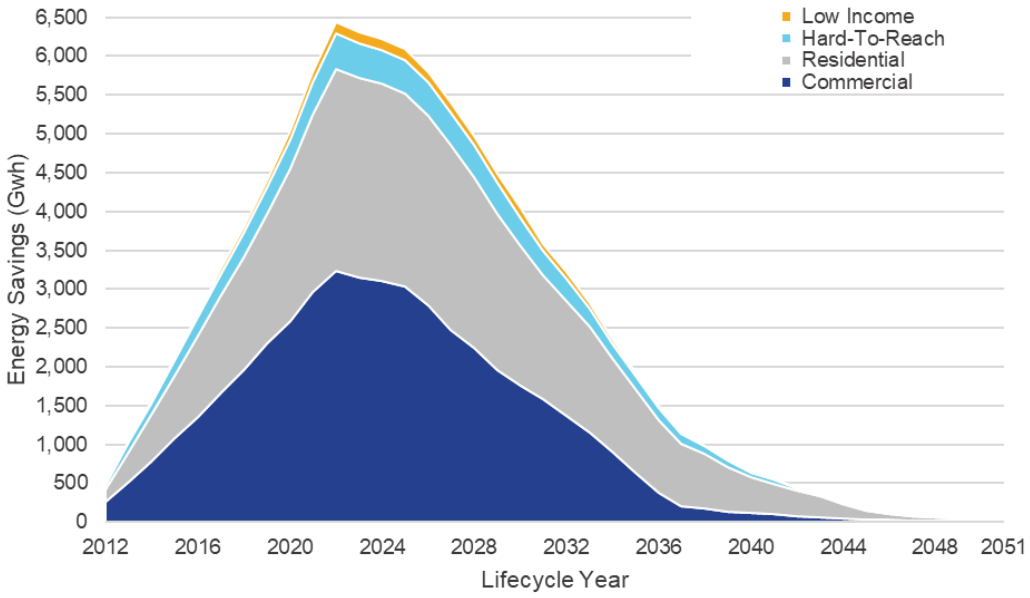


Figure 59 and Figure 60 show the types of measures installed through the programs and how they contribute to lifecycle savings. *Lighting*, *HVAC*, and *building shell* improvements continue to deliver the most savings over time. Load management delivers demand reductions only in the program year and accounts for the spike and drop-off after PY2022.

Figure 59. Lifecycle Demand Reduction by Measure Category (MW), PY2012-PY2051

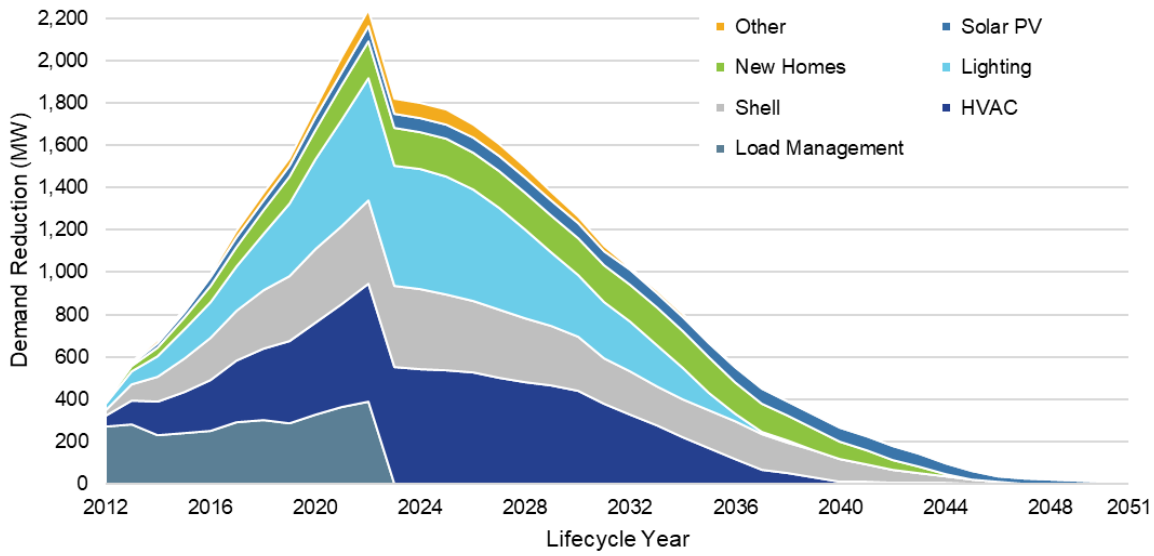
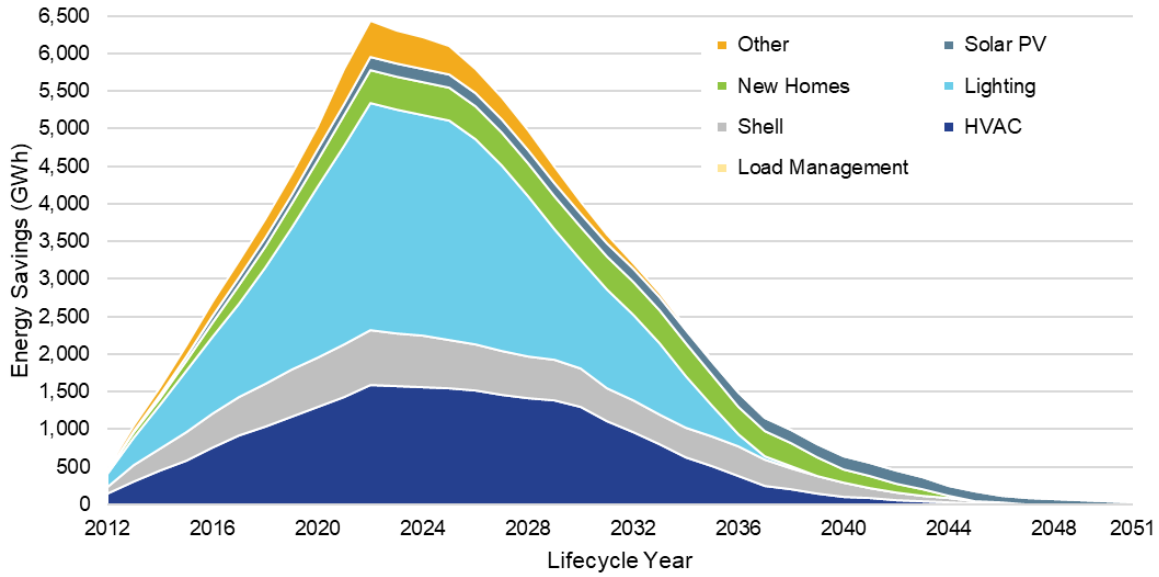


Figure 60. Lifecycle Energy Savings by Measure Category (GWh), PY2012-PY2051



APPENDIX C: IOU PROGRAM COSTS

This appendix shows that energy efficiency program costs during program year (PY) 2023 (PY2023) totaled just under $168 million across the eight investor-owned utilities (IOUs). Almost three-quarters of the costs were program incentives, with the remainder being made up by administrative, research and development, and evaluation, measurement, and verification (EM&V) costs and the performance bonus collected by utilities in PY2023. See Table 63.

Table 63. PY2023 IOU Actual Program Costs

Utility	Incentive amount	Administrative, R&D, and EM&V costs[61]	PY2023 performance bonus collected	Total PY2023 costs
AEP Texas	$15,133,235	$2,141,566	$6,041,869	$23,224,932
CenterPoint	$36,486,498	$3,577,444	$15,032,510	$55,096,452
Entergy	$6,846,112	$696,417	$3,232,686	$10,775,215*
EPE	$4,570,498	$191,350	$1,731,256	$6,493,104
Oncor	$46,711,169	$6,305,330	$16,592,374	$69,608,873
SWEPCO	$3,471,272	$640,514	$1,233,504	$5,345,290*
TNMP	$4,350,061	$844,261	$1,340,102	$6,534,424
Xcel SPS	$4,399,285	$415,859	$1,651,543	$6,466,687
Total	**$121,968,130**	**$14,812,741**	**$46,855,844**	**$167,424,472**

*Good cause exception to customer rate caps granted as established under 16 TAC §25.182(d)(7).

[61] EECRF and other case proceeding expenses are not included.

APPENDIX D: STATUS OF PRIOR EM&V RECOMMENDATIONS

The tables in this appendix summarize the status of the 40 EM&V recommendations from PY2021 that utilities were to implement in PY2023. Utilities have been responsive to the EM&V recommendations, with the majority of recommendations (32 of 40) marked as *complete*. Most of the recommendations were addressed through TRM updates, enhanced utility quality assurance/quality control (QA/QC), and enhanced reporting practices. The eight *in-progress* recommendations relate to M&V, commercial consumption analysis, and residential recommendations not assessed in the PY2023 EM&V due to the consumption analysis and responding to changing markets and baselines.

Commercial program recommendations from PY2021 addressed lighting and new construction projects, M&V, SOPs, Small Business programs, consumption analysis, and program satisfaction and attribution. Twelve recommendations are *complete*, while 12 of the 14 recommendations are noted as *complete* due to improvement seen in the PY2023 EM&V, a completed TRM update, or EM&V activity, and both M&V and consumption analysis information are noted as *in progress*.

Table 64. Commercial Program Recommendations for PY2023 Implementation

Category	Key finding and recommendation	Implementation	Status
Lighting	Lighting calculation assumptions did not consistently match participant conditions or equipment detailed specifications. Utilities should reduce lighting savings calculation adjustments by completing a detailed review of the claimed savings calculations' individual line-item assumptions and specifications.	Utilities increased QA/QC of the factors that led to adjustments resulting in decreased lighting savings adjustments in the PY2023 EM&V.	 Complete
	Lighting savings calculations did not provide consistent results from calculations for lighting equipment that remained in place and lighting equipment that was removed and not replaced.		
New construction	New construction projects can have unpredictable timelines due to market conditions. The energy-efficiency calculations did not consistently match the changing construction timelines.	Utilities increased QA/QC to verify new construction projects between the actual constructed components and the submitted calculations and documentation.	 Complete
	New construction lighting projects require the participant to determine the baseline code compliance based upon a scale from *undeveloped* to *downtown area*. A conservative assumption to determine energy savings for new construction would	The PY2023 TRM 10.0 was updated to clarify the selection of the new construction exterior lighting zones and detail the default.	 Complete

Category	Key finding and recommendation	Implementation	Status
	be to select *Zone 2*; however, *Zone 3* is typically picked.		
M&V	The claimed peak demand calculation inconsistently uses the peak demand probability factor (PDPF) *top 20 hours* method for custom savings calculations. Last year's evaluation identified that the *top 20 hours* method was not consistently used.	Increased education for implementers and participants regarding the peak demand calculation method in the TRM as well as proactively engaging the EM&V team to review upfront have helped address these issues. This is *in progress* as improvement was documented with historical implementers, although new implementers need further support to use the calculation method.	 In progress
	The ideal electric consumption billing-data-measurement frequency is at least hourly. Monthly consumption data is not able to capture the relationship between electricity consumption and independent variables necessary to develop robust models to forecast energy savings.	The TRM Working Group updated Volume 4 of the PY2023 TRM 10.0 to require hourly consumption data and create an alternative path for data with less frequency.	 Complete
	The M&V savings process requires that the actual weather conditions at the site be used to develop consumption models based on weather conditions. The identification of historical weather data files and the normalized weather data files does not always match the site conditions.	The TRM Working Group updated Volume 4 of the PY2023 TRM 10.0 to indicate the preferred historical acquisition process of the weather data file. The clarification also discusses updating the normalized weather data files.	 Complete
SOPs	The EM&V team found that calculation assumptions and documentation did not consistently match participant conditions or equipment specifications.	Utilities increased QA/QC of the factors that led to decreased savings adjustments in the PY2023 EM&V.	 Complete

Category	Key finding and recommendation	Implementation	Status
Small business	The documentation for small business programs is streamlined to allow for quick processing for smaller projects. However, the EM&V team found documentation discrepancies, including the wrong location, wrong name, and incorrectly identified existing lighting fixtures. The streamlined nature must consistently collect the participant's name, location, and baseline equipment to maintain program integrity.	Utilities consistently delivered enhanced small business participant documentation in PY2023.	 Complete
	The predominant building type is not consistently identified; two-thirds of the evaluated building type adjustments involved the use of the *service* building type.	Building type selection is consistent with other program types.	 Complete
	Entry and exit door seals continue to be implemented below the standards of other measures.	The *entry and exit door seal* measure documentation met the TRM requirements.	 Complete
Consumption analysis	Lighting retrofit projects are providing significant savings in participants' facilities, and the TRM is reliably estimating these savings.	The PY2021 EM&V scope included a consumption analysis that concluded the TRM commercial algorithms are estimating savings accurately.	 Complete
	The limited participant group size creates challenges in subdividing various analysis groups. Further complicating the analysis, participants' consumption patterns varied from the comparison group. Data availability is key to understanding the impacts of energy efficiency projects.	Utilities and the EM&V team should analyze opportunities to increase participant group sizes.	 In progress
Program satisfaction and attribution	The programs are generating high satisfaction among participants (average satisfaction is 4.8 on a 5-point scale). In addition, satisfaction increased substantially from the last survey effort (66 percent in the PY2017 survey were *very satisfied* compared with 88 percent in PY2021).	The EM&V team provided the utilities with the detailed participant survey results so that they would be aware of areas of the programs working well and any opportunities for improvement.	 Complete

Category	Key finding and recommendation	Implementation	Status
	Program attribution – the percentage of claimed savings estimated to directly result from the programs – is high (99 percent for CSOP kilowatt and 100 percent for CMTP kilowatt). In other words, the majority of savings are happening because of the program as opposed to other external factors.	Utilities continue to monitor markets and the TRM Working Group continues to update baselines to maximize net savings.	 Complete

Residential program recommendations are categorized by the Energy Independence Security Act (EISA), deemed savings, HTR/LI programs process assessment, and program satisfaction and attribution. Eleven of the twelve recommendations from PY2021 are noted as c*omplete* through TRM updates and the successful implementation of the new low-income eligibility verification; the one *in progress* recommendation is calculating dual baselines correctly, as the PY2023 EM&V did not include desk reviews of this issue because of the residential consumption analysis.

Table 65. PY2021 Residential Program Recommendations for PY2023 Implementation

Category	Key finding and recommendation	Implementation	Status
EISA	New EISA standards will significantly decrease program lighting savings. Based on recent desk reviews and on-sites, a substantial number of halogen and incandescent lamps currently operate in homes. The EM&V team recommends a delayed implementation of the new baseline to allow for the early retirement of existing incandescent and halogen lamps in programs with direct-install delivery.	The TRM Working Group updated Volume 2 of the PY2023 TRM 10.0 to allow for early retirement of incandescent and halogen lamps at the utility's discretion for LI programs with direct-install LED delivery.	 Complete
	For retailers, financial enforcement of the EISA standard phases was between March 1 and August 1, 2023. Feedback indicates retailers are likely to discount inefficient lighting to move their inventory. Prematurely discontinuing or decreasing incentives for efficient bulbs during this transition period could result in increased inefficient bulbs in homes and businesses.	The TRM Working Group updated the new standards in the PY2023 TRM 10.0 to provide an option of a mid-PY2023 implementation date to accommodate the EISA baseline change.	 Complete

Category	Key finding and recommendation	Implementation	Status
Deemed savings	The PY2021 TRM 8.0 includes a weighted methodology to calculate savings for measures with dual baselines. The EM&V team found that, in some cases, this methodology was not applied consistently.	Sum the heating and cooling savings values together prior to weighting rather than only weighting the cooling savings and adding the heating savings after the fact.	In progress
	The PY2021 TRM 8.0 includes an *envelope* measure allowance for customers participating in LI programs to claim reduced heating savings for homes cooled by one or more space heaters. The EM&V team found that, in some cases, this adjustment factor was not applied consistently.	The TRM Working Group updated Volume 2 of the PY2023 TRM 10.0 to incorporate clarifying guidance on how to apply the adjustment factors.	Complete
	The EM&V team found that, in some cases, summer demand reductions were claimed for ACs where the full-load efficiency (EER) requirement of 12 was not met.	Demand reductions should not be claimed for AC systems where the EER is less than the minimum standard. Only winter demand reductions should be claimed for *HP* systems where the EER is less than the minimum standard.[62]	Complete
HTR/LI programs process assessment	Expanding the list of other qualifying LI programs and services that qualify for the energy efficiency HTR/LI programs could provide more opportunities for streamlined participation.	The list of qualifying programs and services in the PY2023 TRM HTR/LI program eligibility forms was expanded.	Complete
	Only individually-metered multifamily units have been eligible for HTR/LI programs since master-metered units are included under the commercial rate class. The programs can increase their reach to LI customers by including master-metered multifamily units with qualifying residents.	The individual meter requirement in the HTR/LI program eligibility forms of the PY2023 TRM 10.0 was removed.	Complete

[62] A new federal standard for *air conditioner* and *heat pump measures* took effect on January 1, 2023, and the PY2023 TRM wias updated with the new minimum standard EER.

Category	Key finding and recommendation	Implementation	Status
	The geographic location information from the Housing and Urban Development (HUD) LI-qualified census tracts provide streamlined participation opportunities and improves outreach to utilities' HTR/LI customers.	A *geographic location qualifier* category was added to the HTR/LI program eligibility forms of the PY2023 TRM 8.0.	Complete
	Many community action agencies and social services organizations throughout Texas are already experienced in qualifying LI households for programs and services.	A section allowing for a community action agency or social service organization to verify program eligibility was added to the HTR/LI program eligibility forms of the PY2023 TRM 8.0.	Complete
	Without verification of self-reported income (for those who chose this program qualification option), there is the potential for HTR/LI program services to go to non-LI customers.	PY2023 processes verified income eligibility prior to participation for customers who self-reported income, although there are very few participants who elected to use this verification option.	Complete
Program satisfaction and attribution	Most respondents said they were *satisfied* or *very satisfied* with the program overall (89 percent), with three-quarters of respondents being *very satisfied* (77 percent). While satisfaction is high, participants did offer some suggestions, with more energy education and program information at the top of the list.	Reviewed detailed participant survey results to be aware of areas of the programs working well and opportunities for improvement.	Complete
	Program attribution – the percentage of claimed savings that is estimated to result from the program intervention – is high (93 percent kilowatt and 91 percent kilowatt-hour NTG). In other words, the vast majority of savings are happening because the program is opposed to other external factors.	Monitor markets and changing baselines to continue to maximize net savings.	Complete

All load management recommendations from PY2021 are marked as *complete*. The PY2021 EM&V had three recommendations for calculating impacts and clarifying program eligibility, all of which were addressed through TRM updates. Two process recommendations were included in the PY2022 EM&V process evaluation of the load management programs.

Table 66. PY2021 Load Management Program Recommendations for PY2023 Implementation

Category	Key finding and recommendation	Implementation	Status
Commercial	Consider using the results of the annual test event to modify program-contract estimates of available demand reductions and the results of the test and actual events to identify any non-performers who should not be allowed to participate in the future.	The EM&V team conducted a process evaluation of the load management programs as part of the PY2022 evaluation that assessed compliance with events.	Complete
	There is considerable stakeholder interest in utility load management programs. Utilities should provide online access to program manuals and update these manuals annually to foster a clear understanding of the program operations.	The EM&V team PY2022 process evaluation found that load management manuals were updated and available online.	Complete
Residential	Load management programs continue to effectively increase demand reductions and rates of participation. While a relatively low number of meters to date have had missing data, the TRM does not address how to handle missing data for baseline or event days.	The TRM Working Group updated the PY2023 TRM 10.0 to clarify how to handle missing data.	Complete
	TRM language related to the deemed savings method has been revised over the past few years, and there is now a mutual understanding of the approach; however, the participation documentation could be improved.	The utility using deemed savings, EPE, provided a file that identified participating smart thermostat devices, including a description of the data fields and the calculation approach.	Complete
	For the deemed savings method, there was some confusion on how to claim savings for smart thermostat devices sold through online marketplaces and smart thermostat devices that were not enrolled in a utility's residential load management program at the point of purchase.	The utility, EPE, is using deemed energy savings for smart thermostat devices that did not enroll during the summer season through the smart thermostat or retail MTPs.	Complete

Portfolio and cross-sector recommendations from PY2021 included market trends, savings opportunities, program tracking data, meter data, and project documentation. Three of the recommendations are noted as *in progress*. This is because the PY2023 EM&V research found opportunities for improvement in responding to changing markets and pursuing new savings opportunities as the programs respond to increased baselines from which to claim savings. For program tracking and project documentation, four recommendations are noted as *complete* due to process improvements put in place, while two are noted as *in progress.*

Table 67. PY2021 Portfolio and Cross-Sector Recommendations for PY2023 Implementation

Category	Key finding and recommendation	Implementation	Status
Market trends	Gains in energy efficiency are expected to be increasingly challenging and expensive to obtain. There are multiple reasons for this, including increased costs due to inflationary pressures, market saturation, code and standard changes, staffing shortages, supply chain issues, and economic uncertainty. Challenges are reported as pronounced in rural territories.	Build on best practices to reach underserved communities, including online offerings, community partnerships, installing multiple measures when on-site, and increased incentives.	 In progress
	Utilities continued to diversify the types of measures delivered through both existing programs and new pilots (i.e., installing efficient HVAC in multifamily and new homes and installing efficient commercial food service equipment). Utilities also continued to expand the types of distribution channels used to reach customers, by working with retailers, distributors, and contractors, as well as adding online offerings.	Adapt programs and measures based on marketplace dynamics and trends, needs of underserved communities, and changes in federal standards and codes.	 In progress
Savings opportunities	The changes to EISA baselines will decrease demand reductions available through IOU programs by about 14 percent, with most decreases coming from the residential sector. Utilities will need to pursue other measures to address the impacts of the baseline changes on demand reductions and continue to meet their legislated goals. These other measures include *smart thermostats*, *lighting controls*, *HP water heaters*, *mini-splits*, *recommissioning*, and *variable refrigerant flow*. Additionally, utilities should explore more programs that utilize AMI data.	Expand existing measure offerings and continue to explore potential new measures, engaging the EM&V team as needed. PY2023 saw decreased kilowatt and kilowatt-hour savings as the programs adjusted to the new standards.	 In progress

Category	Key finding and recommendation	Implementation	Status
Program tracking data	The EM&V team loads tracking data received from utilities each quarter by an automated process. Due to inconsistency in the data format or programs for which data is submitted from quarter to quarter, the development of custom programming was necessary for the data to be loaded.	Consider the development of a standard query that is re-run each quarter to capture updated data for the EM&V team; this will guarantee consistency between data request submittals.	 In progress
	Mapping submitted program data to energy efficiency plans and reports (EEPRs) can be difficult. Any differences in data are likely to go undiscovered until after the last data submission when reconciliation happens.	In PY2023, utilities and the EM&V team successfully mapped all potential data names to EEPR names as part of the first data request, making the final reconciliation of savings numbers more streamlined.	 Complete
	Similar to program mapping, the identification of missing information within the data, such as estimated useful life (EUL) details or too-general roll-ups of measures, may go undiscovered until the end-of-year analysis.	Measure-level documentation and communication have greatly improved, minimizing PY2023 cost-effectiveness calculation issues.	 Complete
Meter data	AMI meter data transfers can be more complicated than program tracking data transfers.	In PY2023, IOUs with AMI meter data and the EM&V team successfully worked through data transfers.	 Complete
Project documentation	The EM&V team found that, in many cases, the documentation verifying residential heating type, particularly electric resistance heating, was limited; this was an important recommendation from the PY2019 consumption analysis and was to be fully implemented in PY2021.	Educate service providers on TRM documentation requirements and check their compliance with heating type, specifically.	 In progress
	Challenges with utility M&V inspections continued in PY2021. Commercial projects were less likely to have inspection notes documented, and when inspection notes were provided, the findings were not consistently incorporated into the final documentation and tracking system.	Inspection notes were provided and incorporated into final findings of demand reductions and energy savings in PY2023.	 Complete

APPENDIX E: PRIORITIZATION TABLES

The tables below summarize prioritization and EM&V level of effort by program type over the four-year EM&V contract period (program year (PY) 2019 (PY2019) to PY2023).

Table 68. Evaluation Prioritization Summary—Commercial Sector Programs

	Program type			
	Commercial SOP	Commercial MTPs, excluding small business	Small business MTPs	Other MTPs, pilots
PY2019 percentage of savings IOU demand reductions and energy savings	7 percent of IOU demand reduction; 27 percent of IOU energy savings	6 percent of IOU demand reduction; 23 percent of IOU energy savings	1 percent of IOU demand reductions; 3 percent of IOU energy savings	
PY2020 evaluation priority and activity	High; desk reviews, telephone verification of measures, process and NTG participant survey (delayed due to winter storms), and targeted consumption analyses		Low: tracking system review and verification	
PY2021 evaluation priority and activity	High; desk reviews and on-site M&V, targeted consumption analyses, and process and NTG participant surveys		Medium: desk reviews and on-site M&V	
PY2022 evaluation priority and activity	Medium; desk reviews and on-site M&V		Low: tracking system review and verification	
PY2023 evaluation priority and activity	Medium; desk reviews, and on-site M&V		Medium: desk reviews and on-site M&V	Low

Table 69. Evaluation Prioritization Summary—Residential Sector Programs

	Program type		
	Residential SOP	**HTR/LI**	**New homes MTP**
PY2019 percentage of savings IOU demand reductions and energy savings	8 percent of IOU demand reductions;10 percent of IOU energy savings	7 percent of IOU demand reductions; 8 percent of IOU energy savings	4 percent of IOU demand reductions; 6 percent of IOU energy savings
PY2020 evaluation priority and activity	Medium; telephone verification on measures, and process and NTG participant surveys (delayed due to winter storms)	Low; tracking system review	Low; tracking system review
PY2021 evaluation priority and activity	High; desk reviews and on-site M&V, targeted consumption analyses of updated measures, residential participant surveys, and LI/HTR process improvement interviews		Low; tracking system review and verification
PY2022 evaluation priority and activity	Medium; desk reviews and on-site M&V	High; desk reviews and on-site M&V, and LI/HTR process improvement interviews	Medium; desk reviews
PY2023 evaluation priority and activity	High; consumption analyses[63] of updated measures and participant surveys		High; desk reviews, and builder and rater interviews

Table 70. Evaluation Prioritization and Summary—Upstream, Midstream, Pilots, and Other Programs

	Program type	
	Upstream or midstream MTPs	**Other MTPs, pilots**
PY2019 percentage of IOU demand reductions and energy savings	6 percent of IOU demand reductions; 16 percent of IOU energy savings	1 percent of IOU demand reductions; 1 percent of IOU energy savings
PY2020 evaluation priority and activity	Low; tracking system review	Low or medium
PY2021 evaluation priority and activity	Low; tracking system review	Low or medium
PY2022 evaluation priority and activity	Low; tracking system review	Low or medium
PY2023 evaluation priority and activity	High; desk reviews for high-impact measures	Low or medium—the Oncor Strategic Energy Management pilot will continue as a *medium* priority

[63] The residential consumption analyses included the following utilities with interval AMI meter data: AEP Texas, CenterPoint, Oncor, TNMP, and Entergy.

Table 71. Evaluation Prioritization and Summary—Load Management and Cross-Sector Programs

	Program type		
	Load management (residential and nonresidential)	**AC tune-ups (residential and nonresidential)**	**Photovoltaic (PV)**
PY2019 percentage of IOU demand reductions and energy savings	60 percent of IOU demand reductions; <1 percent of IOU energy savings	2 percent of IOU demand reductions; 3 percent of IOU energy savings	<1 percent of IOU demand reductions; 2 percent of IOU energy savings
PY2020 evaluation priority and activity	Medium; census interval meter-data analysis	Low; tracking system review and verification	Medium; review of M&V calculations
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	High; census interval meter-data analysis, aggregator interviews, and participant surveys (70 residential and 70 commercial)	Medium; census review of M&V data and desk reviews	Medium; review of M&V data and desk reviews (PV storage change)
PY2023 evaluation priority and activity	Medium; census interval meter-data analysis	High; tracking system review and verification, desk reviews	Low; tracking system review