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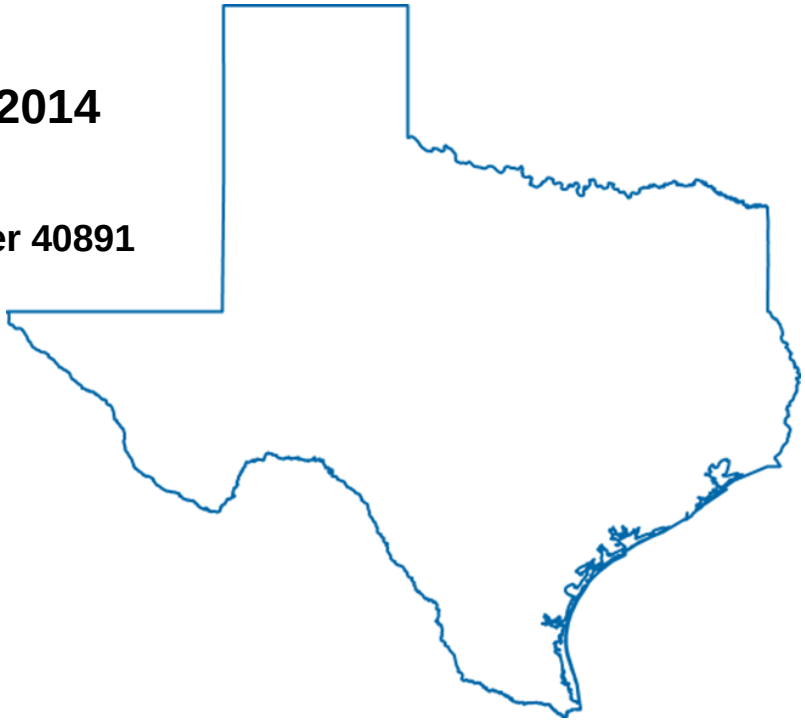
Public Utility Commission of Texas

Annual Statewide Portfolio Report for Program Year 2013—Volume I

October 6, 2014

Project Number 40891



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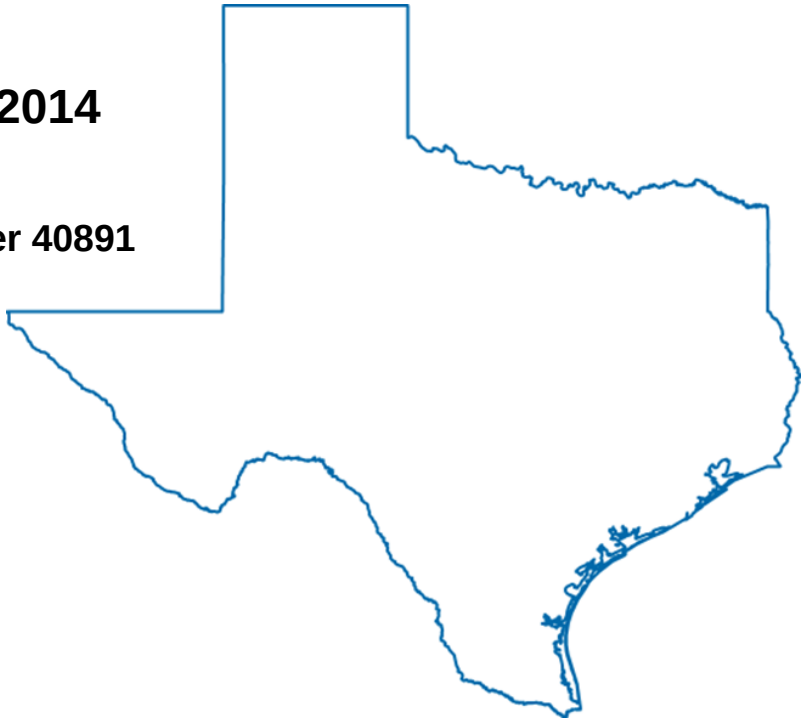

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Acknowledgements

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EM&V team primary report contributors include:

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	Laura Schauer, Jonathan Hoechst, Pam Rathbun, and Scott Wagner	Portfolio/sector roll-ups, precision calculations, QA/QC, technical editing, and net-to-gross
	Dan Belknap	Cost-effectiveness testing
	Sue Hanson	Residential market transformation programs
	Kim Baslock	Nonresidential market transformation programs

Firm	Contributor	Role
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Acronyms

AC	Air conditioner
AEP TCC	American Electric Power Texas Central Company
AEP TNC	American Electric Power Texas North Company
CF	Coincidence factor
C&I	Commercial and industrial
CMTP	Commercial market transformation program
CNP	CenterPoint Energy Houston Electric, LLC
CSOP	Commercial standard offer program
DHP	Ductless heat pump
DI	Direct install
ECM	Energy conservation measure
EECRF	Energy efficiency cost recovery factor
EEIP	Energy efficiency implementation project
EEPR	Energy Efficiency Plan and Report
EESP	Energy efficiency service provider
EISA	Energy Independence and Security Act of 2007
Entergy	Entergy Texas, Inc.
EPE	El Paso Electric Company
ER	Early replacement
ERCOT	Electric Reliability Council of Texas
ERS	Emergency Response Service
ESCO	Energy service company
ESIID	Electric Service Identifier ID
ESNH	ENERGY STAR® New Homes
EM&V	Evaluation, measurement, and verification
EUMMOT	Electric Utility Marketing Managers of Texas
GSHP	Ground-source heat pump
HCIF	Heating/cooling interactive factor
HOU	Hours of use
HPwES	Home Performance with ENERGY STAR®
HTR	Hard-to-reach
HVAC	Heating, ventilation, and air conditioning
IECC	International Energy Conservation Code
IPMVP	International Performance Measurement and Verification Protocol

kW	Kilowatt
kWh	Kilowatt hour
LED	Light emitting diode
LI	Low-income
LI/HTR	Low-income/hard-to-reach
LM	Load management
mcf	1,000 cubic feet
MF	Multifamily
MTP	Market transformation program
M&V	Measurement and verification
NTG	Net-to-gross
PUCT	Public Utility Commission of Texas
PV	Photovoltaics
PY	Program Year
QA/QC	Quality assurance/quality control
RCx	Retro-commissioning
RFP	Request for proposals
RMTP	Residential market transformation program
ROB	Replace-on-burnout
RSOP	Residential standard offer program
Sharyland	Sharyland Utilities, L.P.
SOP	Standard offer program
SRA	Self-report approach
TMY	Typical meteorological year
Xcel SPS	Southwestern Public Service Company (subsidiary of Xcel Energy)
SIR	Savings-to-investment ratio
SWEPCO	Southwestern Electric Power Company
TNMP	Texas New Mexico Power Company
TRM	Technical reference manual
WACC	Weighted average cost of capital

1. EXECUTIVE SUMMARY

Independent evaluation, measurement, and verification (EM&V) was conducted for Texas electric investor-owned utilities' Program Year 2013 (PY2013) energy efficiency portfolios.

In 2011, the Texas Legislature enacted SB 1125, which required the Public Utility Commission of Texas (PUCT) to develop an EM&V framework that promotes effective program design and consistent and streamlined reporting. The EM&V framework is embodied in P.U.C. SUBST. R. 25.181 (§25.181), relating to Energy Efficiency Goal (Project No. 39674).

The PUCT selected through the Request for Proposals (RFP) 473-13-00105, Project No. 40891 a third-party EM&V team. This team is led by Tetra Tech and includes Texas A&M Center for Applied Technology, Texas Energy Engineering Services, Inc. (TEESI), The Cadmus Group, Itron, and Johnson Consulting Group (hereafter, "the EM&V team").

The objectives of the EM&V effort are to:

- Document gross and net energy and demand impacts of utilities' individual energy efficiency and load management portfolios
- Determine program cost-effectiveness
- Provide feedback to the PUCT, utilities, and other stakeholders on program portfolio performance
- Prepare and maintain a statewide Technical Reference Manual (TRM).

This Annual Portfolio Report presents the PY2013 EM&V statewide findings and recommendations looking across all ten electric utilities' portfolios. It addresses gross and net energy and demand impacts, program-cost effectiveness and provides feedback on program portfolio performance. In addition, it includes findings and recommendations related to measure savings to inform the maintenance of the TRM.

1.1 METHODOLOGY OVERVIEW

PY2013 is the second program year evaluated as part of the statewide EM&V effort. The EM&V team conducted program tracking system reviews across all utility programs and desk reviews, customer and market actor surveys, and on-site M&V for sampled projects. Energy efficiency program evaluations routinely employ 90% confidence intervals with ± 10% precision as the industry standard ("90/10"). The sampling process for evaluation activities was designed to achieve a minimum of 90/10 relative precision for evaluated savings estimates at the utility portfolio level[1]. The following EM&V activities were completed statewide:

- 2,806 desk reviews
- 596 on-site M&V

[1] While this precision level was achieved for all utilities for kW savings, for two utilities with smaller participant populations, the precision level was slightly wider for kWh savings.

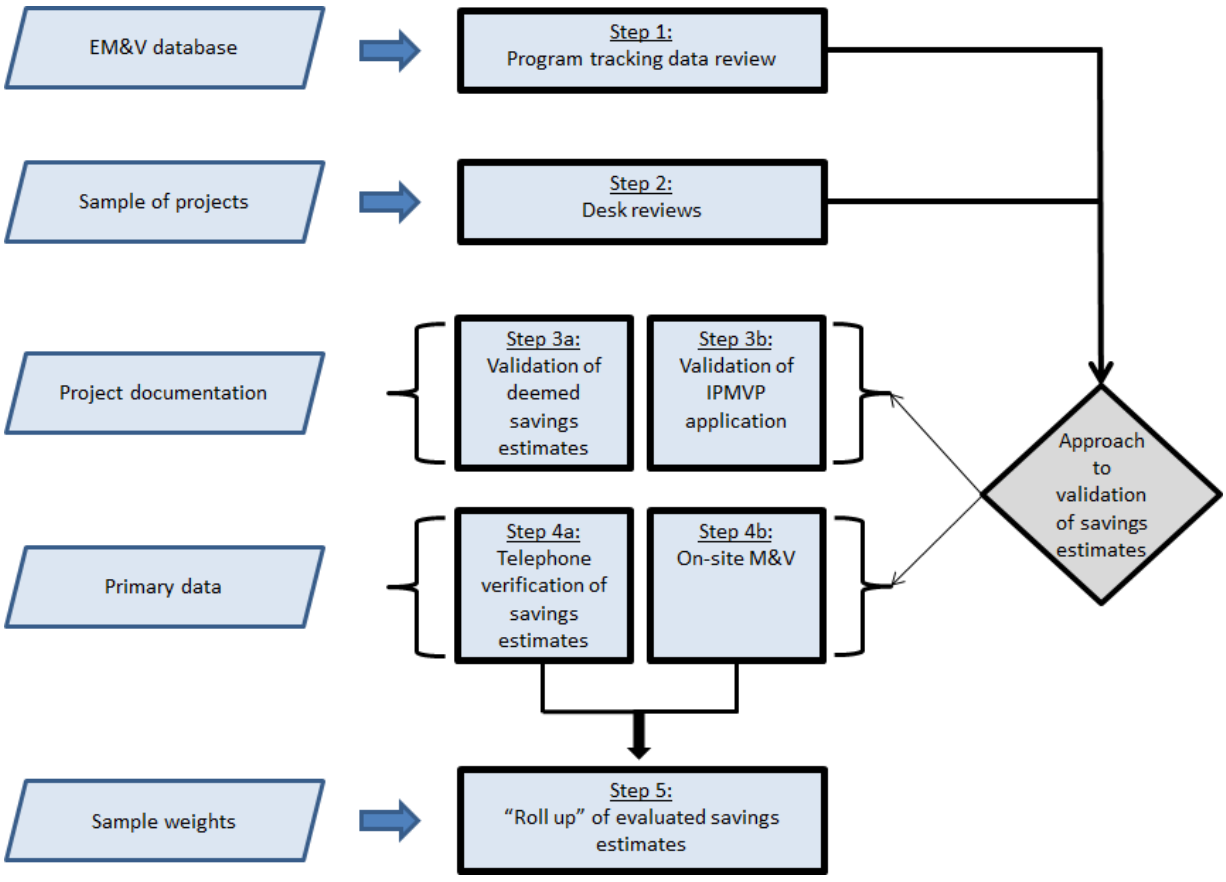
- 888 customer surveys
- 284 market actor surveys.

The EM&V activities:

- Confirmed that the measures installed are consistent with those listed in the tracking system
- Verified that the savings estimates in the tracking system are consistent with the savings calculated in the deemed calculation tools or tables or measurement and verification (M&V) methods used to estimate project savings
- Reviewed 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 and customer survey results.

The evaluated savings are based on project-level realization rate calculations that are then weighted to represent program-level, sector-level, and portfolio-level realization rates. These realization rates incorporate any adjustments for incorrect application of deemed savings values and any equipment details determined through the tracking system and desk reviews and primary data collected by the EM&V team. For example, baseline assumptions or hours of use may be corrected through the evaluation review and thus affect the realization rates. A flow chart of the realization rate calculations is below.

Figure 1-1. Realization Rate Flowchart



A complementary component of the realization rate is the sufficiency of program documentation provided to estimate evaluated savings. This was used to determine an overall program documentation score for each utility.

The EM&V team conducted cost-effectiveness testing using the program administrator cost test for PY2013 claimed and evaluated results. Low-income programs were also calculated using the Savings-to-Investment Ratio (SIR).

1.2 EVALUATED SAVINGS

Evaluated savings results are shown below across all utilities first at the portfolio level, followed by commercial sector, residential sector, load management, and pilot results.

A. Portfolio results

Table 1-1 shows the claimed and evaluated demand savings for each utility's portfolio for PY2013 and the precision levels around the evaluated savings estimates at a 90% confidence interval. Overall, evaluated savings are higher than claimed savings. Statewide,

the demand savings realization rate is 110 percent and the energy savings realization rate is 108 percent.

For PY2013, evaluated annual savings from all ten of the utilities' programs were 577,023,515 kWh (compared to 480,631,457 kWh for PY2012) and 453,489 kW (compared to 402,061 kW in PY2012). As in PY2012, CenterPoint programs contributed the largest percentage of statewide kW savings, and Oncor programs contributed the largest percentage of statewide kWh savings.

The primary driver of the difference in the overall kW portfolio realization rates from 100 percent was the residential programs. For this sector, adjustments were primarily made to the RSOP and HTR SOP programs and were largely changes that accounted for new deemed savings values approved by the PUCT in 2013, including winter peak demand savings.

Across all utilities, savings were adjusted to account for findings from the tracking system, desk review, and on-site data collection activities. First, for all utilities, the initial tracking system review resulted in initial evaluated savings over 100 percent. This increase was primarily driven by adjustments to claimed energy and peak savings to be consistent with TRM 1.0. In particular, the duct sealing measures were not updated using the winter peak demand savings calculation for most utilities.

The savings for the RSOP and HTR SOP programs were also adjusted based on desk reviews and from on-site M&V activities. Air infiltration reduction and duct efficiency improvement measures were most commonly adjusted based on these on-site visits.

The statewide realization rates for the commercial and load management programs were near 100 percent and 106 percent, respectively. Although all utilities saw some level of adjustments for demand savings, one of the large utility's increase in evaluated demand savings for the residential and load management programs drove the statewide results upward.

In addition, the sufficiency of program documentation provided to the EM&V team to complete a third-party due diligence review of evaluated demand savings is indicated as good, fair, or limited. As an example, a majority if the utilities (eight out of ten) received the highest documentation score of "good" for kW savings. This was largely a result of the level of information provided to verify load management programs' savings, including baseline and interval meter data, and these programs' large contribution to overall portfolio kW savings. In fact, PY2013 saw a marked improvement in project documentation; in PY2012, four of the utilities received a program documentation score of "good."

Table 1-1. Program Year 2013 Claimed and Evaluated Demand Savings—Total Portfolio

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence	Program Documentation Score
AEP TCC	8.3%	34,136	34,819	102.0%	4.2%	Good
AEP TNC	1.7%	6,932	6,641	95.8%	5.7%	Good
CenterPoint	46.9%	193,843	193,144	99.6%	1.4%	Good

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence	Program Documentation Score
El Paso Electric	3.4%	14,232	14,831	104.2%	2.4%	Good
Entergy	4.6%	19,141	17,489	91.4%	3.2%	Limited
Oncor	27.3%	112,734	155,940	138.3%	3.8%	Good
Sharyland	0.6%	2,668	2,702	101.3%	2.7%	Good
SWEPCO	3.4%	14,066	13,542	96.3%	4.3%	Good
TNMP	2.5%	10,295	9,787	95.1%	3.9%	Good
Xcel SPS	1.2%	5,105	4,594	90.0%	4.9%	Fair
Total	100%	413,154	453,489	109.8%	1.5%	Good

Table 1-2 shows the claimed and evaluated energy savings for each utility's portfolio for PY2013. Statewide, evaluated savings are higher than claimed savings (108 percent realization rate) with some utilities' results substantially higher. Adjustments were made across all utilities' claimed savings through tracking system and desk reviews and on-site M&V.

The evaluated energy savings are, again, primarily higher due to adjustments made for the residential sector programs, primarily RSOP and HTR SOP. As discussed above, this increase was primarily driven by adjustments to claimed energy and peak savings to be consistent with TRM 1.0, which included new deemed savings values approved by the PUCT in 2013.

In addition, the sufficiency of program documentation provided to the EM&V team to complete a third-party due diligence review of evaluated energy savings is indicated as good, fair or limited. The program documentation rankings varied considerably due to varying levels of program documentation across utilities. Four utilities received the highest program documentation score of "good" for kWh savings. Four utilities received "fair" rankings as documentation was generally sufficient with more targeted areas for improvement identified. And two utilities received a program documentation score of "limited." Note that in the case of Xcel, the limited documentation score is a reflection of the small sample sizes requested for the desk reviews; lacking sufficient documentation for even just a few projects where the sample sizes are small can have a considerable impact on the documentation score. Entergy's program documentation was sufficient for all programs with the exception of RSOP and HTR SOP, which represent a considerable portion of the utility's energy savings. Again, they have made changes in their forms which should be reflected in PY2014's documentation score.

The PY2012 EM&V research was used to provide specific program documentation recommendations to come into effect for PY2014. Therefore, the EM&V team did not expect to see improvement in PY2013 program documentation scores. However, as seen with the demand savings documentation, PY2013 shows a marked improvement to PY2012 where

only one utility had a "good" documentation score and five utilities had a "limited" documentation score.

Table 1-2. Program Year 2013 Claimed and Evaluated Energy Savings—Total Portfolio

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence	Program Documentation Score
AEP TCC	9.1%	48,954,289	56,844,575	116.1%	9.7%	Fair
AEP TNC	1.7%	9,086,796	9,057,235	99.7%	14.1%	Fair
CenterPoint	27.6%	148,039,736	146,766,780	99.1%	8.4%	Good
El Paso Electric	4.5%	23,958,806	25,192,197	105.1%	1.9%	Fair
Entergy	6.9%	36,995,919	40,816,738	110.3%	4.3%	Limited
Oncor	41.9%	224,666,448	251,316,469	111.9%	4.8%	Good
Sharyland	0.2%	1,007,593	1,217,332	120.8%	26.4%	Good
SWEPCO	3.5%	18,774,990	17,750,039	94.5%	15.9%	Fair
TNMP	3.2%	16,980,658	19,079,798	112.4%	9.0%	Good
Xcel SPS	1.5%	7,950,196	8,982,352	113.0%	15.1%	Limited
Total	100%	536,415,431	577,023,515	107.6%	3.2%	Good

B. Commercial sector results

Statewide PY2013 evaluated savings from commercial sector programs were 263,638,864 kWh (compared to 254,241,172 kWh for PY2012) and 58,512 kW (compared to 56,114 kW for PY2012). The majority of commercial kW savings came from load management programs (82 percent). Lighting and HVAC measures accounted for the majority of the kWh savings (68 percent and 16 percent, respectively).

Statewide, realization rates were 101 percent for both energy and demand savings. Demand savings realization rates ranged from 96 percent to 106 percent and energy savings realization rates ranged from 99 percent to 107 percent.

Commercial evaluated savings primarily varied from claimed savings due to on-site M&V findings for issues such as different measure type and/or quantities found on-site from those used for claimed savings. The adjustments, made at the project level, were typically minor and the utilities saw project-level savings both increase and decrease based on the on-site M&V results. As an example, although most adjustments were related to commercial HVAC and lighting measures, the evaluation found realization rates of 101 to 102 percent for those measures.

Table 1-3 shows the claimed and evaluated demand savings for each utility's commercial energy efficiency portfolio for PY2013 and the precision levels around the evaluated savings estimates at a 90% confidence interval.

Table 1-3. Program Year 2013 Claimed and Evaluated Demand Savings—Commercial Sector

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
AEP TCC	10.8%	6,227	6,543	105.1%	8.5%
AEP TNC	2.2%	1,267	1,268	100.0%	24.9%
CenterPoint	28.6%	16,572	15,978	96.4%	16.6%
El Paso Electric	6.4%	3,720	3,717	99.9%	0.0%
Entergy	7.1%	4,086	4,082	99.9%	0.2%
Oncor	37.2%	21,545	22,256	103.3%	15.6%
SWEPCO	3.6%	2,108	2,234	106.0%	10.0%
TNMP	2.5%	1,451	1,444	99.6%	1.7%
Xcel SPS	1.6%	943	989	104.8%	8.3%
Total	**100%**	**57,919**	**58,512**	**101.0%**	**7.5%**

Table 1-4 shows the claimed and evaluated energy savings for each utility's commercial energy efficiency portfolio for PY2013.

Table 1-4. Program Year 2013 Claimed and Evaluated Energy Savings—Commercial Sector

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
AEP TCC	9.2%	23,896,937	23,686,807	99.1%	14.9%
AEP TNC	2.0%	5,253,955	5,254,730	100.0%	22.2%
CenterPoint	34.4%	89,701,845	88,391,052	98.5%	13.9%
El Paso Electric	7.0%	18,190,842	18,326,748	100.7%	0.4%
Entergy	7.4%	19,168,395	19,151,065	99.9%	0.1%
Oncor	33.5%	87,282,732	91,359,609	104.7%	8.4%
SWEPCO	3.1%	7,949,337	8,021,249	100.9%	24.9%
TNMP	2.1%	5,536,892	5,735,047	103.6%	0.6%
Xcel SPS	1.3%	3,462,732	3,712,556	107.2%	11.6%
Total	**100%**	**260,443,667**	**263,638,864**	**101.2%**	**5.7%**

C. Residential sector results

The residential sector claimed energy savings are similar to those reported within the commercial sector (261,855,118 and 260,443,667 kWh, respectively). However, the

evaluated residential savings are higher than the commercial sector (299,604,892 and 263,638,864 kWh, respectively). The difference in the evaluated savings reflects the high energy realization rates made for tracking system adjustments (discussed above).

Similarly, the residential sector reported higher claimed and evaluated demand savings than the commercial sector, excluding load management savings (111,130 evaluated residential demand savings compared with 58,512 evaluated commercial demand savings). This difference is primarily due to a higher percent of seasonal peak demand measures in the residential programs than the nonresidential programs. The majority of residential demand and energy savings came from shell and HVAC measures (42 percent for each measure representing a total 84 percent residential demand and energy savings). Shell measures include duct sealing and air infiltration, which comprised a large percentage of the savings reported by utilities.

While realization rates were high, the EM&V team made adjustments—oftentimes downward—to duct efficiency and air infiltration measures based on testing during on-site visits. Due to the nature of blower door and Duct Blaster tests, natural variation between tracking system and on-site measurements is expected. For duct improvement measures, variation in measured post-retrofit leakage is expected to be within ± 20 percent using a Duct Blaster test; for infiltration measures, variation within ± 10 percent is expected for blower door test results. In some cases, the evaluation found that the M&V measurement was higher than the post-service measurement in the tracking system by a greater percentage than these thresholds, and in some cases at or slightly higher than the pre-service measurement. These findings indicated that in these instances there was some failure in the service received.

Table 1-5 shows the claimed and evaluated demand savings for each utility's residential energy efficiency portfolio for PY2013 and the precision levels around the evaluated savings estimates at a 90% confidence interval. There are four utilities with realization rates at or below 85 percent. There are two issues driving these lower realization rates. First, these utilities had a higher proportion of projects where adjustments were made to air sealing and duct efficiency measures, as described above. But, second, these utilities also tended to have smaller on-site sample sizes (fewer than 15), which increased the magnitude that those adjustments had on the overall results.

Table 1-5. Program Year 2013 Claimed and Evaluated Demand Savings—Residential Sector

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
AEP TCC	10.6%	9,455	9,820	103.9%	13.6%
AEP TNC	1.6%	1,454	1,163	80.0%	18.2%
CenterPoint	23.6%	21,094	20,988	99.5%	3.3%
El Paso Electric	1.3%	1,164	1,800	154.6%	20.1%
Entergy	10.3%	9,164	7,516	82.0%	7.5%
Oncor	40.6%	36,190	60,809	168.0%	7.9%

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
Sharyland	0.4%	351	385	109.6%	18.7%
SWEPCO	4.1%	3,676	3,008	81.8%	17.9%
TNMP	5.4%	4,827	4,325	89.6%	8.7%
Xcel SPS	2.1%	1,872	1,315	70.2%	16.0%
Total	**100.0%**	**89,246**	**111,130**	**124.5%**	**4.6%**

Table 1-6 shows the claimed and evaluated energy savings for each utility's residential energy efficiency portfolio for PY2013. While evaluated savings are similar to claimed savings, minor adjustments were made across all utilities' claimed savings. One utility had an energy realization rate under 90 percent for the same reasons discussed above for demand savings.

Table 1-6. Program Year 2013 Claimed and Evaluated Energy Savings—Residential Sector

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
AEP TCC	9.2%	24,050,327	32,150,742	133.7%	13.1%
AEP TNC	1.3%	3,457,058	3,426,721	99.1%	15.2%
CenterPoint	19.4%	50,687,516	50,725,352	100.1%	1.5%
El Paso Electric	1.8%	4,807,687	6,085,394	126.6%	7.7%
Entergy	6.8%	17,821,558	21,659,707	121.5%	8.1%
Oncor	52.4%	137,158,207	159,731,351	116.5%	5.8%
Sharyland	0.4%	1,002,959	1,212,698	120.9%	26.5%
SWEPCO	3.2%	8,478,843	7,538,643	88.9%	26.5%
TNMP	3.8%	9,928,736	11,829,721	119.1%	14.6%
Xcel SPS	1.7%	4,462,229	5,244,561	117.5%	24.4%
Total	**100.0%**	**261,855,118**	**299,604,892**	**114.4%**	**3.5%**

D. Load management results

Statewide PY2013 evaluated savings from load management programs were 279,172 kW (compared to 276,630 kW for PY2012) and 950,570 kWh (compared to 1,085,549 kWh for PY2012).

Table 1-7 shows the claimed and evaluated demand savings for each utility's load management portfolio for PY2013 and the precision levels around the evaluated savings estimates at a 90% confidence interval. Evaluated savings were the same as claimed savings across all utilities except one utility that capped demand savings at the amount contracted with the customers since only a single scheduled event was called in PY2013.

Table 1-7. Program Year 2013 Claimed and Evaluated Demand Savings—Load Management

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
AEP TCC	7.0%	18,217	18,217	100.0%	0.0%
AEP TNC	1.6%	4,112	4,112	100.0%	0.0%
CenterPoint	58.6%	153,041	153,041	100.0%	0.0%
El Paso Electric	3.5%	9,028	9,028	100.0%	0.0%
Entergy	2.3%	5,891	5,891	100.0%	0.0%
Oncor	21.0%	55,000	72,875	132.5%	0.0%
Sharyland	0.9%	2,317	2,317	100.0%	0.0%
SWEPCO	2.9%	7,698	7,698	100.0%	0.0%
TNMP	1.4%	3,702	3,702	100.0%	0.0%
Xcel SPS	0.9%	2,290	2,290	100.0%	0.0%
Total	**100.0%**	**261,297**	**279,172**	**106.8%**	**0.0%**

Table 1-8 shows the claimed and evaluated energy savings for each utility's load management portfolio for PY2013, which again were the same as claimed savings with the exception of one utility which had slightly higher evaluated kWh than claimed kWh.

Table 1-8. Program Year 2013 Claimed and Evaluated Energy Savings—Load Management

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
AEP TCC	13.3%	126,525	126,525	100.0%	0.0%
AEP TNC	3.9%	37,015	37,015	100.0%	0.0%
CenterPoint	48.4%	459,123	459,123	100.0%	0.0%
El Paso Electric	1.3%	11,957	13,547	113.3%	0.0%
Entergy	0.6%	5,966	5,966	100.0%	0.0%
Oncor	23.8%	225,509	225,509	100.0%	0.0%
Sharyland	0.5%	4,634	4,634	100.0%	0.0%
SWEPCO	4.8%	45,640	45,640	100.0%	0.0%

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
TNMP	0.8%	7,376	7,376	100.0%	0.0%
Xcel SPS	2.7%	25,235	25,235	100.0%	0.0%
Total	**100.0%**	**948,980**	**950,570**	**100.2%**	**0.0%**

E. Pilot results

Statewide PY2013 evaluated savings from pilot programs were 12,829,189 kWh (compared to 4,710,045 kWh for PY2012) and 4,674 kW (compared to 1,710 kW for PY2012). While most utilities saw 100 percent realization rates, adjustments were made to two utilities' pilot programs based on the desk reviews that adjusted savings for weather climate (El Paso Electric) and on-site verification that adjusted lighting savings (SWEPCO).

Table 1-9 shows the claimed and evaluated demand savings for each utility's set of pilot programs for PY2013 and the precision levels around the evaluated savings estimates at a 90% confidence interval.

Table 1-9. Program Year 2013 Claimed and Evaluated Demand Savings—Pilots

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
AEP TCC	5.1%	237	237	100.0%	0.0%
AEP TNC	2.1%	98	98	100.0%	0.0%
CenterPoint	66.9%	3,137	3,137	100.0%	0.0%
El Paso Electric	6.8%	320	285	89.2%	0.0%
SWEPCO	12.5%	585	602	102.9%	1.2%
TNMP	6.7%	315	315	100.0%	0.0%
Total	**100.0%**	**4,692**	**4,674**	**99.6%**	**0.1%**

Table 1-10 shows the claimed and evaluated energy savings for each utility's pilot portfolio for PY2013.

Table 1-10. Program Year 2013 Claimed and Evaluated Energy Savings—Pilots

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
AEP TCC	6.7%	880,501	880,501	100.0%	0.0%

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
AEP TNC	2.6%	338,769	338,769	100.0%	0.0%
CenterPoint	54.6%	7,191,252	7,191,252	100.0%	0.0%
El Paso Electric	7.2%	948,320	766,507	80.8%	1.9%
SWEPCO	17.5%	2,301,170	2,144,506	93.2%	1.7%
TNMP	11.4%	1,507,654	1,507,654	100.0%	0.0%
Total	**100.0%**	**13,167,666**	**12,829,189**	**97.4%**	**0.3%**

1.3 COST-EFFECTIVENESS RESULTS

The EM&V team calculated PY2013 cost-effectiveness based on claimed savings, evaluated savings, and evaluated net savings[2] using the Program Administrator Cost Test (PACT). Overall cost-effectiveness of Texas energy efficiency programs based on evaluated savings was 3.43 including low-income programs and 3.81 excluding low-income programs from the analysis. The cost-effectiveness for claimed savings was lower than evaluated savings, reflecting the overall realization rates over 100 percent. The claimed savings cost-effectiveness ratios were 3.14 including low-income programs and 3.49 excluding low-income programs. Finally, the cost-effectiveness when calculated using net savings is 2.89 including low-income programs and 3.20 excluding low-income programs.

Cost-effectiveness results are shown below across all utilities first at the portfolio level, followed by commercial sector, residential sector, low-income programs, load management, and pilot programs.

A. Portfolio results

Table 1-11 below summarizes the cost-effectiveness of each utility's energy efficiency portfolio both with and without low-income programs. The cost-effectiveness of the utilities' portfolios ranged from 2.99 to 4.65 based on evaluated savings results and from 2.50 to 3.86 based on evaluated net savings results. Cost-effectiveness increases somewhat across all of the utility portfolios that include low-income programs when these programs are excluded from the analysis.[3] Cost-effectiveness without low-income programs ranged from 3.27 to 5.28 based on evaluated savings and from 2.84 to 4.35 based on evaluated net savings.

[2] Evaluated net savings are determined by applying the EM&V team's recommended net-to-gross factor to evaluated savings. The net-to-gross factor measures program attribution including free-riders and spillover as defined in §25.181 (c).

[3] Non-ERCOT utilities are not required to offer low-income programs. Cost-effectiveness results shown with and without low-income programs do not vary for these utilities.

Table 1-11. Program Year 2013 Cost-effectiveness Results—Total Portfolio

Utility	Claimed Savings Results	Evaluated Savings Results	Evaluated Net Savings Results	Claimed Savings Results w/o low-income	Evaluated Savings Results w/o low-income	Evaluated Net Savings Results w/o low-income
AEP TCC	3.10	3.55	3.03	3.40	3.88	3.30
AEP TNC	3.06	2.99	2.61	3.34	3.29	2.86
CenterPoint	3.06	3.03	2.50	3.59	3.54	2.88
El Paso Electric	3.81	4.12	3.64	3.81	4.12	3.64
Entergy	3.44	3.63	3.05	3.44	3.63	3.05
Oncor	3.09	3.63	3.07	3.42	4.02	3.39
Sharyland	3.52	4.11	3.58	3.52	4.11	3.58
SWEPCO	3.23	3.02	2.66	3.50	3.27	2.87
TNMP	2.88	3.09	2.62	3.13	3.37	2.84
Xcel SPS	4.38	4.65	3.86	4.95	5.28	4.35

The cost of PY2013 lifetime evaluated savings statewide was $0.016 per kWh and $12.77 per kW. Table 1-12 below summarizes the cost of lifetime kWh and kW for each utility. The cost per kWh ranges from $0.012 to $0.20, and the cost per kW ranges from $9.35 to $15.86. These costs provide an alternate way of describing the cost-effectiveness of a portfolio of programs. Those portfolios with a higher cost-effectiveness ratio will have a lower cost to acquire savings and vice versa.

Table 1-12. Program Year 2013 Cost-effectiveness Results—Cost of Lifetime Savings

Utility	kWh	kW
AEP TCC	$0.016	$13.06
AEP TNC	$0.020	$15.86
CenterPoint	$0.018	$15.50
El Paso Electric	$0.015	$11.47
Entergy	$0.015	$11.50
Oncor	$0.015	$11.57
Sharyland	$0.013	$11.61
SWEPCO	$0.018	$14.45
TNMP	$0.016	$12.19
Xcel SPS	$0.012	$9.35

B. Commercial sector results

Table 1-13 below summarizes the cost-effectiveness of each utility's commercial energy efficiency portfolio.

Commercial sector programs were the most cost-effective programs with an overall cost-effectiveness of 4.13 statewide based on evaluated savings and 3.49 based on net savings. With the exception of Sharyland, utilities' results ranged from 3.41 to 6.52 based on evaluated savings and 2.87 to 5.37 based on evaluated net savings. There is variation in the utilities' results in the commercial sector because of the diversity of program designs offered by the utilities. Note that Sharyland's cost-effectiveness of 0 reflects some program start-up costs incurred with no savings in PY2013.

Table 1-13. Program Year 2013 Cost-effectiveness Results—Commercial Sector

Utility	Claimed Savings Results	Evaluated Savings Results	Evaluated Net Savings Results
AEP TCC	4.17	4.17	3.61
AEP TNC	3.68	3.68	3.29
CenterPoint	4.99	4.90	4.04
El Paso Electric	6.12	6.16	5.37
Entergy	4.43	4.42	3.87
Oncor	3.26	3.41	2.87
Sharyland	0.00	0.00	0.00
SWEPCO	3.88	3.95	3.35
TNMP	3.74	3.84	3.33
Xcel SPS	6.11	6.52	5.20

C. Residential sector results

Table 1-14 below summarizes the cost-effectiveness of each utility's energy residential efficiency portfolio.

Residential sector programs' cost-effectiveness statewide is 4.22 based on evaluated savings and 3.48 based on evaluated net savings. The residential sector had the widest variability between utilities, with evaluated savings results ranging from 2.98 to 7.40 and net savings results ranging from 2.69 to 6.36. As with the commercial sector, this is in part due to the differences in the types of programs offered by different utilities.

Table 1-14. Program Year 2013 Cost-effectiveness Results—Residential Sector

Utility	Claimed Savings Results	Evaluated Savings Results	Evaluated Net Savings Results
AEP TCC	3.38	4.33	3.61
AEP TNC	4.09	3.95	3.27
CenterPoint	3.84	3.80	2.86
El Paso Electric	2.02	2.98	2.69
Entergy	3.01	3.31	2.69
Oncor	3.73	4.65	3.91
Sharyland	6.25	7.40	6.36
SWEPCO	4.18	3.60	3.19
TNMP	3.18	3.55	2.90
Xcel SPS	4.84	5.16	4.32

D. Low-income results

Table 1-15 below summarizes the cost-effectiveness of each utility's low-income energy efficiency portfolio.[4]

As expected due to the higher program costs associated with serving this residential sector, low-income programs had a statewide cost-effectiveness ratio of 1.29.[5] There are no separately reported net evaluated savings for low-income programs since all savings are assumed to be attributable to the program due to the substantial affordability barriers this sector faces to make energy efficiency improvements.

Table 1-15. Program Year 2013 Cost-effectiveness Results—Low-income Sector

Utility	Claimed Savings Results	Evaluated Savings Results
AEP TCC	1.00	1.34
AEP TNC	1.48	0.91
CenterPoint	1.40	1.47
El Paso Electric	N/A	N/A
Entergy	N/A	N/A

[4] Non-ERCOT utilities are not required to offer low-income programs. These cases are indicated in the table with "N/A."

[5] Unlike other programs that apply the program administrator cost test (PACT), the low-income sector programs are evaluated using the savings-to-investment ratio (SIR). This test excludes administrative and other overhead costs and directly compares the cost of installing the measure with estimated customer energy bill reductions.

Utility	Claimed Savings Results	Evaluated Savings Results
Oncor	0.82	1.10
Sharyland	N/A	N/A
SWEPCO	0.84	0.81
TNMP	1.63	1.58
Xcel SPS	1.56	1.54

E. Load management results

Table 1-16 below summarizes the cost-effectiveness of each utility's load management energy efficiency portfolio.

Load management programs had the lowest cost-effectiveness of non-low-income programs at 1.33 based on evaluated savings. However, load management programs serve a different purpose in the utilities' energy efficiency portfolio as they are a supply-side resource to be used when peak demand reduction is needed due to capacity constraints. There is some variation in the utilities' evaluated savings results, ranging from 0.81 to 1.58. There are no separately reported net evaluated savings for load management programs since the programs require participation in a curtailment event that would not happen without the program.

Table 1-16. Program Year 2013 Cost-effectiveness Results—Load Management Sector

Utility	Claimed Savings Results	Evaluated Savings Results
AEP TCC	0.94	0.94
AEP TNC	0.81	0.81
CenterPoint	1.36	1.36
El Paso Electric	0.97	0.97
Entergy	1.19	1.19
Oncor	1.17	1.55
Sharyland	1.58	1.58
SWEPCO	1.48	1.48
TNMP	1.10	1.10
Xcel SPS	1.17	1.17

F. Pilot results

Table 1-17 below summarizes the cost-effectiveness of each utility's pilot energy efficiency portfolio.

The pilot programs' statewide cost-effectiveness is 1.45 based on evaluated savings and 1.30 based on net evaluated savings. As discussed with PUCT staff, pilots are not required to pass the cost-effectiveness test PACT their first year of implementation to recognize program start-up costs, but are expected to pass during the second year. Allowing time to pass cost-effectiveness is industry standard, as pilot programs serve an important function in energy efficiency portfolios by exploring the feasibility of programs designed to increase market penetration of new technologies, reach underserved customer segments, and/or explore new distribution channels. With that said, all utilities passed cost-effectiveness based on evaluated savings. Sharyland's cost-effectiveness of 0 reflects some start-up costs incurred with no savings in PY2013.

Table 1-17. Program Year 2013 Cost-effectiveness Results—Pilot Sector

Utility	Claimed Savings Results	Evaluated Savings Results	Evaluated Net Savings Results
AEP TCC	1.89	1.89	1.59
AEP TNC	1.77	1.77	1.48
CenterPoint	1.10	1.10	0.96
El Paso Electric	1.86	1.63	1.52
Entergy	N/A	N/A	N/A
Oncor	N/A	N/A	N/A
Sharyland[6]	0.00	0.00	0.00
SWEPCO	1.98	1.87	1.73
TNMP	2.21	2.21	2.10
Xcel SPS	N/A	N/A	N/A

1.4 KEY FINDINGS AND RECOMMENDATIONS

Overall, the PY2013 EM&V research shows the utilities are running cost-effective portfolios with high satisfaction from both participating customers and energy efficiency service providers (EESPs). The healthy realization rates across the portfolios indicate accuracy of claimed savings across the utilities for the commercial and market transformation programs. The relatively higher realization rates for the residential standard offer programs are also indicative of accurate claimed savings, as the high realization rate is a function of the TRM version referred to for the EM&V effort that included newly Commission-approved deemed savings values in 2013. Assuming a similar mix of measures, the residential tracking system reviews completed in PY2014 will likely result in realization rates closer to 100 percent.

The EM&V research also shows that the majority of energy and demand savings would not have happened in the absence of the programs. The Standard Offer programs are working effectively with the EESPs to encourage the adoption of high-efficiency measures, as

[6] Sharyland's cost-effectiveness of 0 reflects minimal costs incurred with no savings in PY2013.

recognized by both participating customers as well as the EESPs themselves. This finding holds true for the majority of Market Transformation programs as well.

Various successes of the programs are documented in this report so utilities can continue to build on effective practices to meet savings goals. Examples include offering programs to all customer classes with targeted offerings for sectors that are less likely to participate in energy efficiency on their own, understanding and reacting to changes in market conditions (including building codes and appliance standards), reviewing and incorporating lessons learned from other jurisdictions, and leveraging national models such as ENERGY STAR®.

Another success recognized in the 2013 EM&V research is the improvement in program documentation. PY2012, being the first year of the formal evaluation, identified a number of issues related to program documentation. The annual report and subsequent discussions with utilities provided guidance on the type of documentation needed to verify savings estimates. Utilities and their implementation contractors made a concerted effort to respond to those recommendations for the PY2013 evaluation, which is apparent when reviewing the improvements in the documentation scores. These improvements were not expected until PY2014.

At the same time, the EM&V research found some improvement opportunities. The EM&V team identified recommendations looking across all of the utilities' portfolios in the following areas: (1) improving savings estimates, (2) measures that are good candidates for deemed savings, (3) maximizing net savings, and (4) opportunities for process improvements. Key findings and recommendations in these areas are summarized below.

In addition, the following statewide process issues were researched: mix of standard offer and market transformation programs in portfolios, utility quality assurance and quality control practices, and defining program participants. These are also summarized below.

The EM&V team discussed recommendations from the PY2013 evaluation with all ten of the utilities during July and August 2014 to agree on "action plans" to respond to recommendations. These action plans are also summarized below along with the recommendations.

1.4.1 Improving savings estimates

Based on findings from evaluation activities, the EM&V team provides recommendations for improving savings estimates for the following commercial measures.

- **Recommendation #1a: LED lighting qualification requirements.** The EM&V team found that several LED lighting fixtures and lamps were not meeting the qualification requirements specified in the TRM. The new LED fixtures and lamps installed as part of the commercial energy efficiency programs should provide proof of certification (specification sheet from the qualifying certification agency) to confirm the eligibility of the LED fixtures and lamps. The qualification requirements are in keeping with national industry practices that protect customers from inferior products and help ensure the energy savings.

  1a Action Plan: Utilities will require certification for all LEDs with a certification category with the Design Light Consortium (DLC) or ENERGY STAR as specified in the TRM. If a LED has been submitted for certification but has not yet been

processed, the utility will check that it is being processed and also request forms LM79 and LM80 to review that the LED meets the required efficiency standards. In cases where a certification category does not address a certain LED usage (i.e., outdoor signage), the utility will inform the EM&V team and discuss a M&V plan and supporting savings information for these LED applications.

- **Recommendation #1b: Lighting projects with mixed building types.** The EM&V team identified the use of multiple building type selections within the same lighting calculator (e.g., Office and Warehouse).

  1b Action Plan: Utilities will use a single building type in a calculator for deemed savings project calculations. If multiple building types are needed, utilities will then use custom calculations.

- **Recommendation #1c: Outdoor lighting retrofit projects.** In 2013, winter peak demand energy savings for outdoor lighting was approved for use. The EM&V team identified inconsistent use and application for the "Outdoor" building type code and winter coincidence factor demand. This could be improved with consistent guidelines for the application of these savings.

  1c Action Plan: Utilities will use the primary building type for outdoor applications where the lighting is attached to the building. Appropriate applications for utilities to use outdoor lighting use include parking lot, security street and walkway lighting, and security lighting.

- **Recommendation #1d: Lighting M&V methods.** The M&V method to calculate lighting hours of use (HOU) and coincidence factors (CF) seems to attempt to capture lighting that is grouped into similar activity areas. Very often, however, the HOU recorded by loggers were found to vary greatly from logger to logger within the same activity area. The EM&V team recommends the utilities implement alternate methods to provide a standardized requirement for calculating the lighting HOU for non-deemed projects as documented within the commercial section.

  1d Action Plan: For custom lighting projects, utilities will conduct M&V by activity area and then apply a weighted average to determine the overall facility HOU and CF or simple average to determine HOU and CF per usage area.

- **Recommendation #1e: Use of part-load efficiencies for HVAC energy savings calculations.** The EM&V team recommends that the utilities consider the use of part-load efficiencies (e.g., IEER and IPLV) for estimating HVAC energy savings. Chiller part-load ratings (IPLVs) were added to TRM V2.0 *for reference only,* but in anticipation of this consideration.

  1e Action Plan: TRM 3.0, which is to be used for PY2016, will include updates to support the implementation of part-load efficiencies to calculate HVAC energy savings. Utilities may choose to accommodate part-load efficiencies calculations in savings tools and begin calculating savings using part-load efficiencies for HVAC energy savings starting in PY2015. Utilities will send calculator tools with part-load efficiencies revisions to the EM&V team to review prior to PY2016.

- **Recommendation #1f: Primary versus secondary school HVAC projects.** The EM&V team identified use of secondary building type selections with the CalcSmart HVAC calculator for primary schools that contain larger capacity HVAC equipment

likely due to the building size and cooling requirements as compared to the smaller, more traditional primary schools. The HVAC calculators distinguish between different school types; however, the calculators do not distinguish between schools that do and do not operate in the summer. Further research is necessary to determine if the building type categories may need adjustment and realignment with those found in the Texas school building population. The EM&V team plans to oversample for HVAC measures in 2014 to provide more sample points to continue analysis in this area.

1f Action Plan: Starting in PY2014, the utilities have begun using new HVAC savings calculators that combines primary and secondary schools. Also in PY2014 the EM&V team will collect hours of use data on schools to determine additional revisions to the savings calculators (these would not come into effect until PY2016).

Additionally, the EM&V team makes the following recommendations related to residential measures. The action plan for all of the below residential measures is the utilities are working with the EM&V team for savings updates for TRM 3.0 that will be used for planning and implementation of PY2016 programs.

- **Recommendation #1g: Add energy and demand savings specific to the Texas TRM's climate zone five (West), when missing.** Several measures are missing energy and demand savings specific to the Texas climate zone five specified in the TRM. Due to the sensitivity of many measures to climate zone, as well as the substantial differences between the western (climate zone 5) and northeastern (climate zone 2) regions, the team recommends that energy and demand savings specific to climate zone five be developed wherever they are not currently available.
- **Recommendation #1h: Update the model parameters/characteristics used in all of the whole-house models for consistency and to increase accuracy.** The whole-house models that were created to derive winter demand savings used recently-updated values as input parameters. The evaluation team recommends updating all old models on which deemed savings have been based to reflect this new set of basic assumptions
- **Recommendation #1i: Adjust the energy and demand savings for the envelope measure category, excluding the air infiltration measure, for homes with evaporative coolers.** The EM&V team recommends revising the deemed savings for envelope measures installed in homes with evaporative coolers, particularly present in the western climate zone (climate zone 5). In addition, utilities should look into the notable variance between the savings generated by the previously-used duct savings calculator and the engineering algorithm approach introduced in Texas TRM v.1.0. The methodology and the assumptions used in the duct savings calculator previously used to determine savings should be compared to those underlying the new engineering algorithm approach in order to explain the significant variance of savings resulting from each methodology, and to ensure that the most accurate methodology has been selected.
- **Recommendation #1j: Introduce a heating/cooling interaction factor (HCIF) to the savings calculation for lighting measures.** Incorporating an HCIF into the energy and demand savings algorithm will more accurately account for the impact on energy and demand from the measure.

- **Recommendation #1k: Collect primary data or use climate zone specific Typical Meteorological Year (TMY3) weather data to estimate the average ambient air temperature for heat pump water heaters located in unconditioned spaces.** The team encourages that residential models be built and calibrated against actual energy consumption data.

- **Recommendation #1l: Update the methodology used to calculate energy and demand savings for ground source heat pumps with desuperheaters.** In the Texas TRM v.2.0, the methodology used to calculate energy and demand savings for ground source heat pumps was updated to rely on an engineering algorithm. The EM&V team recommends revisiting this methodology and finding a way to calculate energy and demand savings for ground source heat pumps with desuperheaters using one unified methodology to increase the accuracy of the predicted savings.

Cross-sector recommendation #1m: In addition, across both sectors, there is a need for consistency in peak demand definitions across all measure types. There is inconsistency in the peak demand definition used to calculate demand savings for different measure types. This issue has already been discussed with the utilities and the Energy Efficiency Implementation Project (EEIP). The Electric Marketing Managers of Texas (EUMMOT) will be presenting consistent definitions to be used at a forthcoming EEIP meeting, which will then be incorporated into TRM 3.0.

1m Action Plan: This issue has been discussed with the utilities and the Energy Efficiency Implementation Project (EEIP). The Electric Marketing Managers of Texas (EUMMOT) will be presenting consistent definitions to be used at a forthcoming EEIP meeting and will submit the definitions and supporting analysis to the EM&V team for review. The objective is to have consistent definitions to be incorporated into TRM 3.0 to be used in measure updates going forward.

1.4.2 Measures that are good candidates for deemed savings

The EM&V team reviewed the current list of measure categories used in Texas to identify those measures that are not deemed that are prevalently installed through the programs and/or were increasingly installed from PY2012 to PY2013. Program manager interviews also identified measures that were newly added or being contemplated for future portfolios.

- **Recommendation #2a:** From PY2012 to PY2013, the mix of deemed and custom measures funded through the commercial sector programs remained fairly consistent. However, the EM&V team recommends considering establishing deemed values for air conditioning tune-ups for both sectors that were part of both program years. Most TRMs do include air conditioning tune-up as a deemed measure.

  2a Action Plan: Utilities are exploring filing a deemed savings petition for air conditioning tune-ups for PY2015 or a standardized M&V approach for the EM&V team's review and incorporation into the TRM.

- **Recommendation #2b:** The EM&V team identified a number of residential measures that could be considered for deemed savings as they are offered in other jurisdictions. These measures include advanced power strips, ENERGY STAR® freezers, ENERGY STAR® pool pumps, shower auto-shutoff thermostatic valves, LED lamps, occupancy sensors, ductless "mini-split" heat pumps, and radiant

barriers. It may also be worthwhile considering ENERGY STAR® dehumidifiers in the future.

2b Action Plan: Utilities are developing LED deemed savings estimates. Some utilities are also looking into offering pool pumps and mini splits through a M&V approach that could then support future deemed savings estimates.

- **Recommendation #2c:** For nonresidential measures, the EM&V team identified that deemed savings values be considered for hot water aerators if they become more prevalent in program offerings. The EM&V team found this measure in a couple of instances in PY2012, but not PY2013.

2c Action Plan: Since utilities are not planning a broader offering of this measure at this time, a M&V approach for claimed savings will be used when it is included in programs. Some utilities are considering deemed savings for other commercial measures in PY2015 such as computer power management and have consulted the EM&V team about measures of interest.

1.4.3 Maximizing net savings

The EM&V research found relatively high net savings (or attribution) for most programs, although recommendations were provided for each program to consider for maximizing program attribution. Overarching recommendations are summarized below.

- **Recommendation #3a:** In addition to the financial incentives, the evaluation research with customers and EESPs found that information provided through the programs is key in influencing energy efficiency projects. The EM&V team recommends utilities continue outreach and targeted education to and through the EESPs.

  3a Action Plan: Utilities will continue workshops and trainings to EESPs to support their effective delivery of SOPs as well as provide direct customer technical assistance through MTPs for areas where there is a defined need.

- **Recommendation #3b:** While overall net savings for Texas programs were high, program designs need to respond to changing marketing conditions to minimize freeridership. The EM&V team recommends utilities monitor market conditions (including evolving codes and standards) to ensure the programs are having the greatest influence on customers' decisions.

  3b Action Plan: Utilities will conduct periodic baseline studies to monitor market conditions and inform program design changes that may be needed in order to continue to push the market through program offerings. At a minimum, a baseline or market assessment study should take place when net-to-gross research indicates a higher level of freeridership may be occurring. In PY2014, the utilities that offer a residential new construction program are undertaking a baseline study for that market in response to the PY2013 net-to-gross research. In addition, utilities will continue to monitor market conditions through periodic qualitative and/or quantitative research with their EESPs.

- **Recommendation #3c:** The EM&V team conducted an in-depth review of the largest saving projects in the commercial market transformation programs to inform project level net-to-gross ratios. This in-depth or "case study" review included

customer surveys, program implementation contractor discussions and review of project documentation. The EM&V team recommends for market transformation programs, and in some cases commercial standard offer programs, that the contractors retain key project documentation related to the decision-making process and assistance provided to customers for the EM&V team to review in considering program influence. This is particularly important for programs where projects take longer to move from initiation to completion.

3c Action Plan: Utilities will consider processes to capture key project documentation related to the customer decision-making process with the objective of collecting this information.

1.4.4 Overall opportunities for process improvements

Based on interviews with customers, market actors, program staff and implementers, and general experience through EM&V activities, the EM&V team provides the following opportunities for process improvements. These improvements cut across programs and/or sectors; additional program-specific process improvements are summarized next and further detailed within each program section.

- **Recommendation #4a: Attend to programs with low or high participation levels.** Some utilities struggle with low participation levels while other programs are perennially oversubscribed. In either case, the ability to anticipate subscription levels and budget accordingly is a challenge for these utilities. Utilities are, with approval, able to move budgets between programs *within customer classes*, but not between years *or customer classes*. Any number of factors could contribute to high or low program participation levels. For example, budgets could be based on overly optimistic forecasts, and/or incentives could be too small to drive participation. Surveys with nonparticipating service providers and customers could help inform actions to address low participation. However, even with better understanding of causes of low participation, administrative budget caps could also limit utilities' ability to mobilize resources to address low participation. Oversubscription of programs is a simpler problem to solve. Budgets can be increased or incentive levels reduced. If allowed to persist, oversubscription should be managed carefully.

  4a Action Plan: While utilities have a number of actions they take to monitor participation and budgets internally, it is also important that participation and budget levels are communicated to stakeholders during the program year. In the case of oversubscription, utilities will continue to keep EESPs informed of budget spends and when funds are expected to be depleted so that EESPs can plan accordingly. In the case of undersubscription that could affect a utility's meeting goal, utilities should communicate this to the PUCT staff overseeing energy efficiency programs along with actions they are taking to increase participation and meet goals. Finally, in PY2014, the EM&V team is assessing administrative cost caps from PY2012–PY2014 and how those have affected the utilities' portfolios.

- **Recommendation #4b:** Consider strategies to engage a diverse group of commercial and residential customers.

  Commercial. Utilities that offer MTP programs have begun to target and reach different building and business types, which has diversified their participant group. For example, historically, the target markets for the CMTP programs have included

educational facilities, government facilities, and larger commercial/industrial facilities. Some examples of new customer segments reached are nonprofits, churches, car lot facilities, and smaller companies such as nail salons and convenience stores. Small schools may also be an opportunity for additional program outreach. A few utilities are starting to focus on smaller schools. These customers are typically overlooked by EESPs and energy service companies (ESCOs), who tend to focus on larger schools.

Residential. The demographic information collected in the EM&V team's residential participant surveys indicate to date the programs have primarily served customers living in single-family dwellings and residents that own their own home. The EM&V team recognizes there are barriers to serving other dwelling types and renters, but utilities may want to explore specific program strategies for these sectors as relevant for their territory. For example, one utility serving an urban area does offer a program targeting multi-family dwellings.

4b Action Plan: Utilities will continue to consider strategies that diversify the group of customers served through the programs in keeping with allocating funding among the classes on an equitable basis ((§25.181 (m) (1)(A)). Strategies discussed with utilities that they are currently employing include program funding "set-asides" for certain customer types underserved such as small schools and customers located in rural areas and program strategies targeting customer types that face substantial barriers to program participation such as small businesses and multi-family rental facilities.

- **Recommendation #4c: Consider reducing the burden of implementation requirements.** For both residential and nonresidential programs, application bureaucracy was a reported barrier to participation according to service providers. This is a commonly reported barrier in evaluation research across the country, since energy efficiency programs require a certain amount of documentation and information to ensure savings. Utilities seemed to be aware of this concern; most named this as the only complaint they were aware of from service providers. Specific system challenges included the amount of time required to complete the application forms, M&V plan requirements for non-deemed projects (particularly commercial), measures that have not been approved by the program (e.g., some LED technologies), and the needs for accredited testing of some products. Some programs are moving toward streamlined electronic application processes.

  4c Action Plan: Several utilities have put in place electronic application forms and other utilities are considering or implementing electronic applications (for some utilities, this is as they are able, given administrative cost caps). While all of the utilities reported assessing areas where they can streamline the application process, it is also important to recognize that in some cases application requirements have increased as a result of the EM&V team's recommendations regarding the documentation that should be collected to support savings. Opportunities to streamline M&V requirements are discussed under Recommendation #5c.

- **Recommendation #4d: Expand and diversify measures**. As in most areas around the US, the majority of commercial savings are resulting from lighting measures. As federal lighting standards become effective, baseline energy consumption will go down and thus reduce the savings associated with existing measures. Residential

savings, though resulting from a more diversified measure mix, are also affected by increased codes and standards.

Some utilities appeared to be actively considering new measures such as LEDs, newer HVAC technologies, and pool pumps as well as new program delivery mechanisms such as codes and standards programs. Additionally, some utilities offering services to small business customers are considering expanding measures beyond lighting in PY2014. However, efforts to diversify and expand the measure mix appear to be fairly limited to date.

Identification of new measures and program delivery mechanisms in the context of rising baselines is a national issue facing energy efficiency programs. We recommend utilities and their contractors work with the EM&V team and PUCT staff to explore the viability of new measures and program design opportunities.

4d Action Plan: Many utilities offer tiered incentives to encourage measures other than lighting and/or incentive strategies that encourage multiple measures. Utilities continue to research new technologies (see Recommendation #2a, b and c). For example, in PY2014, deemed savings were developed and approved for pump off controllers, which utilities report as a good measure for oil and gas customers that may not benefit as much from more traditional energy efficiency measures.

- **Recommendation #4e: Continue to collect sufficient project documentation.** As discussed above, the documentation received for PY2013 evaluation activities was far improved from that received in PY2012; however, there continue to be instances where documentation was limited. This was most often the case for the SOP programs. And although the EM&V team found that project tracking of savings were, for the most part, correctly entered from project savings calculators into tracking databases, the EM&V team was not able to replicate savings calculations for some programs. Savings calculations should have supporting documentation that allows for measure-level verification, especially those key project inputs and parameters that drive a significant portion of calculated savings. Robust and organized program documentation will help improve the accuracy and transparency of estimated savings in future program years. Project activities should be conducted and documented in a way that allows for effective independent review. Sections 3 and 4 provide more detail on the specific documentation and/or data the EM&V team is looking for using the following project types: lighting, HVAC, other end uses, and multi-site customers (commercial customers only).

  4e Action Plan: Utilities will continue to work with the EM&V team on supporting documentation with the goal of improved program documentation scores in PY2014 when compared to PY2012.

- **Recommendation #4f: Improve light level designs.** Improvements in light level designs may provide additional influence on savings beyond the retrofit. With today's lighting technologies and other influences on light level requirements, lighting designs can result in not only improved lighting but also reductions in lighting levels for over lit areas. Making sure lighting levels are appropriate for the space as part of the retrofit may be a component to contribute significantly to energy savings for lighting projects beyond the equipment efficiency savings.

  4f Action Plan: Utilities reported improving light level designs through the market transformation programs where more technical assistance is provided directly to

customers, but reported that this is difficult to do through the commercial standard offer programs given the program's often more limited role during the design stage of new construction projects. The EM&V team acknowledged that it may be difficult to affect light level designs in the commercial standard offer program. This recommendation is retained only to document that this is a best practice when it is feasible to affect light level designs.

- **Recommendation #4g: Consider the need for technical assistance for MTPs.** Several utilities interviewed believed there is a reduction in the need for benchmarking and master planning with some customers. Some utilities also indicated at the same time that they have observed an increased need in walk-through audits. The traditional types of technical assistance for these programs in Texas (e.g., benchmarking and master planning) may have achieved their purpose for some customer segments, such as schools where utilities have developed long-term relationships, but as noted by other utilities, are still needed for several schools where staff turnover is high. As MTPs are in place for a number of years, the role of technical assistance may transition and further research may be necessary to determine future requirements.

  4g Action Plan: Utilities will continue to assess the need for technical assistance as part of their monitoring of market conditions (Recommendation #3b) and considering the role for market transformation programs in their portfolio (Recommendation #5a).

In addition to overarching recommendations, the EM&V team identified program-specific opportunities for process improvements for several CMTPs, solar PV, load management, and residential programs. Other than the cross-cutting issues documented above, no other specific process opportunities are identified for CSOPs or RMTPs.

- **Recommendation #4h Small Commercial/Small Business MTP.** Four utilities introduced new small business programs in PY2013. Overall, the evaluation found that the small commercial/small business programs were operating as intended and, where customer data was collected, the program impacted customers' decisions. The EM&V team identified several opportunities for program staff consideration based on evaluation activities. One opportunity identified was to develop program inspection protocols to guide M&V for this program. Due to the smaller size of projects, 100 percent pre- and post-inspection of projects is unlikely. The electronic format for project application submission also provides an opportunity for contractors to directly upload project documentation. Providing direction for M&V protocols and integration and consolidation of electronic files will also allow for greater transparency and facilitate future data requests. A second opportunity is to increase the measure mix. Only one small business program offered measures beyond lighting in PY2013; however, new measures are being added for PY2014.

  4h Action Plan: Measures beyond lighting have been added to small business programs in 2014. Utilities are working to complete non-lighting projects, but report uptake has been slow. Utilities are sampling projects for M&V due to the small size of the projects.

- **Recommendation #4i: Commercial MTP.** Through the EM&V research it was clear that the technical and other assistance provided through the program is valued and impactful on customers' decisions. One challenge identified is that ESCOs may, at times, compete with program efforts. During the market actor interviews, two ESCOs

mentioned that at times they felt they were competing with MTPs for customers. This was also confirmed in program manager interviews. The EM&V team identified several opportunities for program staff consideration based on evaluation activities. First, small schools may be an opportunity for additional program outreach. A few utilities are starting to focus on smaller schools. These customers are typically overlooked by EESPs and ESCOs who tend to focus on larger schools. This may be an opportunity for MTPs that have not focused on this customer segment in the past.

Second, Commercial Solutions MTPs identified specific strategies to ease the implementation process. Several suggestions include streamlining the application process and improving documentation on using the savings calculations, calculators, and/or program software. Other comments included increased education, particularly related to the software, and inclusion of additional direct install measures.

Last, future impacts to equipment baselines may require alternative program adjustments. One utility reported during program manager interviews that they are introducing a new tiered incentive level to help with impacts from baseline adjustments. As discussed above, most utility programs are focused on increasing measure mixes as a way to combat changes to baselines, especially in lighting, which has been a predominant measure for most MTPs in PY2013. These alternative measure types may also introduce an even larger mix of customer segments that require focused outreach and implementation strategies.

There was limited EM&V activity for the Retro-commissioning MTP due to limited participation. Only two utilities are currently offering a retro-commissioning (RCx) program. In general, the evaluation found that the program was operating well and resulted in high realization rates. There may be an opportunity for other utilities to introduce this program to provide customers with comprehensive versus measure-specific improvements in building performance.

4i Action Plan: The commercial MTP process improvements are addressed in Recommendation #4b, #4c and #4d above.

- **Recommendation #4j Solar PV.** The Solar PV programs generally resulted in high realization rates and were received favorably by customers and market actors interviewed. However, there were several opportunities for process improvements identified. First, continue to clearly inform customers on program requirements and processes. Some market actors and participants voiced complaints about too much paperwork and payment delays. The utilities are already performing some outreach to educate applicants and are undertaking efforts to streamline the application process. Second, consider removing or changing the requirement for PV meters. The programs should consider the value the PV generation meters have for program delivery, as implemented in the current programs. In regards to EM&V, the data collected through the generation meters have little value. In addition, to use these metered data for evaluation, an exact PV turn on date is critical. Many Solar PV contractors currently provide internet based metering as part of their service package. Leveraging these interval data would be much more useful to quantify actual performance.

  4j Action Plan: Some utilities have a PV generation meter requirement for their program to meet the utility needs. For those programs with this requirement, we recommend utilities consider installing a communicating revenue grade meter and a

monitoring service to allow interval data to be collected remotely. The EM&V team recognizes this would have an increased upfront cost, but this would eliminate the need to send someone to read the meter later and would increase the value of the meter requirement.

- **Recommendation 4k: Load management.** The EM&V team proposes the following recommendations based on the findings from discussions with participants and aggregators of load management programs. First, distinguish utility load management programs from ERCOT Emergency Response Service (ERS). Research indicated that some customers had difficulty discerning between load management programs and the ERS offered by ERCOT. Utilities and EESPs could provide more customer education in this regard.

  Second, explore opportunities to standardize load management programs. Program aggregators cited customer confusion resulting from the different load management programs offered by various utilities and asked for more similarity across utility load management programs in regards to notification times (e.g., 30 minutes versus an hour), compensation, and baselines. The standardization of load management programs could reduce customer confusion and streamline marketing.

  4k Action Plan. Utilities agreed to have a load management program manager meeting to identify best practices in the load management programs related to program design and processes.

- **Recommendation 4l: RSOP and HTR.** Initially, the residential and hard-to-reach standard offer programs were designed to meet statewide commission requirements, but most utilities' programs have evolved to better serve identified needs of their specific service territory. RSOP and HTR program managers would benefit from open communication about best practices and lessons learned.

  4l Action Plan. Utilities agreed to have a RSOP and HTR program manager meeting to identify best practices in these programs related to program design and processes.

1.5 STATEWIDE PROCESS EVALUATION RESULTS

The EM&V team identified three additional process areas to be assessed statewide—the mix of SOPs and MTPs in the utility portfolio, optimizing utility QA/QC processes, and definition of participants. The results of each are summarized below.

- **Recommendation #5a: The mix of standard offer/market transformation programs in a utility portfolio.** Standard offer and market transformation programs use different program strategies to achieve energy and demand savings. Standard offer programs use a contract between an EESP and a participating utility where standard payments are made based upon the amount of energy and peak demand savings achieved. Market transformation programs are strategic efforts, including but not limited to, incentives and education designed to reduce market barriers for energy efficiency technologies and practices. (§25.181 (k)). In PY2013, SOPs represented the majority of statewide savings—57 percent of energy savings and 82 percent of demand savings (including load management SOP).

In utility interviews, most of the utilities indicated that they ran the SOPs internally while having an implementation contractor for the MTPs. In general, the larger utilities with an urban base reported a more developed contractor infrastructure, allowing them to have healthy participation in their SOP. Smaller utilities with rural territories tended to report they had limited participation in SOPs, which has led to increased MTPs in their portfolios.

The EM&V team's research indicates the utility programs have been successful in establishing the EESP infrastructure to support the successful delivery of SOPs statewide, as the PY2013 tracking system review reflects a considerable network of EESPs. While EESPs include many large ESCOs, some utilities also reported working to develop the local contractor network, which was substantiated in the tracking system review.

Because MTPs are strategic efforts that are able to include both incentives and education designed to reduce market barriers for energy efficient technologies and practices, these programs can provide value in delivering services that encompass the comprehensive treatment of existing homes and facilities, including Home Performance with ENERGY STAR® and RCx-type programs. In most markets, these particular sectors continue to have an uphill battle to overcome specific market barriers. MTPs, by definition, can address these barriers by providing information and education as well as direct incentives.

MTPs can also play a valuable role for new energy efficiency technologies or services as well as be specifically designed to express support for new codes and standards adoptions or enforcements. Examples of energy efficiency technologies that have recently been promoted through MTPs include solar photovoltaics and air conditioning tune-ups.

The PY2013 EM&V team's research does indicate that for some markets in select utility service territories, MTPs may have largely addressed the barriers they were designed to overcome (e.g., new construction). As a result, it is important that these programs are assessed to determine their ongoing need in the market.

While recognizing the important role of SOPs as market-driven programs, MTPs will continue to play a valuable role in reaching market sectors that traditionally have not been effectively served by the SOPs. Examples include small business customers and retail electric providers.

The EM&V team recommends each utility assess the market barriers each program type is designed to address within their own service territory to determine the right mix of market transformation offerings versus standard offer program offerings. Baseline studies should be conducted periodically to determine the need for market transformation offerings.

5a Action Plan: Utilities will continue to assess the need for market transformation programs within their portfolios to address identified needs. Starting in PY2015, market transformation program manuals will address the specifications in §25.181 (m) (3), which include identifying the market barriers the program is designed to overcome, key intervention strategies to overcome those barriers, and how the program will achieve the transition from extensive market intervention activities toward a largely self-sustaining market. Utilities will also conduct baseline studies as discussed under Recommendation #3b.

- **Recommendation #5b: Optimizing utility Quality Assurance/Quality Control (QA/QC) processes**

  The QA/QC component of a program refers to ongoing planned and systematic activities intended to detect and address programmatic process, technical, and performance issues as soon as possible in order to correct them during program operation. Routine QA/QC helps support better claimed savings estimates and EM&V outcomes by reducing the risk of systematic or repetitive errors, "gaming," or other activities that could negatively affect the programs, utilities, and customers.

  All utilities have established QA/QC processes. While these processes vary by utility, in general they are more rigorous for nonresidential projects with census sampling of contractors or projects and both pre- and post-inspections. Residential processes involve sampling a percentage of projects for post-inspections only, most typically reported as 10 percent.

  While QA/QC is at the discretion of each utility and no specific changes are being required, the appropriate level of QA/QC is an important topic for consideration. At the same time, QA/QC is a very important function for utilities to complete, as it helps ensure the savings are resulting and that program satisfaction remains high. While utilities' QA/QC requirements are addressed in §25.181(p), specific guidelines regarding sampling of projects are not included.

  Below the EM&V team discusses further details of the current Texas QA/QC practices and provides additional information regarding national industry standards for residential and nonresidential projects.

  Residential projects. The standard approach for residential QA/QC issues—identifying error and extrapolating percent savings differential to all project savings within an invoice period—appears to be too sweeping and punitive. There is the potential for effects of random errors (e.g., error of transcription, data entry) to be applied unduly to the bulk of projects within an invoice period. Reviewing around 15 percent of projects by contractor per invoice period may be high; industry practice is around 10 percent. In addition, as the majority of the savings come from duct improvements and infiltration control, verifying the savings through an on-site inspection based on a visual confirmation of the work may be sufficient for some inputs (e.g., heating/cooling system), but not for others (e.g., CFM reduction).

  Utilities should continue performing a similar level of QA/QC of projects but may want to consider reducing sampled contractor projects from 15 percent to 10 percent for contractors with consistently high performance. We also recommend correcting only site-specific errors without extrapolating these savings adjustments across projects within invoice periods.

  Utilities may also want to perform ride-alongs with contractors while the work is being completed. These ride-alongs can be focused on those contractors that are new to the program or for whom there have been quality issues.

  Nonresidential projects. The EM&V team did not find any major issues or recurring errors with the nonresidential QA/QC procedures. However, the one area identified for potential improvement is better documentation of findings from the inspection visits.

Texas utilities' current practice of close to census sampling and often completing both pre- and post-inspections is more rigorous than national industry practice. The EM&V team has found standard practice on the nonresidential side is normally a certain level of sampling (10 to 20 percent) coupled with "triggers" for automatic QA/QC based on rebate and/or savings levels.

The utility site inspectors and engineering assessors should clearly document the findings from the field inspection visits and modifications made during final project reviews. We also recommend that either individual utilities or EUMMOT consider revising QA/QC guidelines for deemed savings projects (not custom projects) that would include a sample of approved applications in the 10 to 20 percent range as well as savings and rebate thresholds for automatic QA/QC review. Rebate level thresholds the EM&V team has seen in other jurisdictions have started in the range of $10,000–$20,000 and a kWh savings threshold starting around 200,000–300,000 kWh.

5b Action Plan: Utilities are aware of the benchmarking research regarding industry standard QA/QC M&V and will determine if they would like to make any changes in their practices or not.

- **Recommendation #5c: Determining consistent definitions of participants.**

  As part of the PY2012 EM&V effort, the EM&V team attempted to calculate the number of participants for each utility program and match this to the numbers reported in the EEPRs. Through this process, it was identified that utilities defined participants differently; therefore, the numbers could not be compared or consistently referenced.

  The EM&V team discussed this finding with both the PUCT and utilities as well as in an EEIP meeting, and it was agreed that establishing a consistent definition of a participant, and how to calculate the number of participants, will provide consistency across the state and allow for comparability. It was agreed that the EM&V team would conduct research with the utilities to provide statewide recommendations for participant definitions in this PY2013 report.

  Half of the utilities in the evaluation define program participants by account number or Electric Service Identifier ID (ESIID) number. While the remaining utilities also define participants primarily at the level of individual meters and account numbers, all employ additional definitions for specific programs. In instances where utilities opt against using individual meters or ESIIDs, customer tax ID numbers are a popular identifier for participants of commercial programs. While this definition succeeds in providing a unique code for each commercial participant, it also has the potential to either duplicate records or fail to create a record for a specific business altogether (e.g., if a business has multiple participating locations.

  Last, larger commercial programs and the residential air conditioning programs often define participants as individual home builders, developers, distribution firms, or contractors—the party ultimately responsible for designing a home or selling an air conditioning unit. Because these contractors are identified as the participant, the tracking systems do not always capture the end user's unique identifier.

  Although the criteria for defining participants may be similar, the ways utilities characterize the number of participants vary somewhat. In some instances, one line

item equaled one participant, meaning that individual sites could be counted more than once. In other instances, the program collapsed the customer, regardless of number of installations, and reported the number of unique sites in the program.

Using ESIID is the ideal method of identifying and tracking participants—it allows for a high level of granularity using a preexisting unique identifier, eliminating the need to create additional tracking methods. For programs using an identifier other than account number or ESIID (such as a commercial tax ID) to define participants, a secondary, more granular method of identifying specific premises attributable to the primary identifier is a prudent step to ensure the participant tracking can be aggregated and disaggregated as necessary. Additionally, it is also valuable to capture the unique customer identifier where the contractor, or EESP, is tracked as the participant. Last, utilities may determine number of customers differently than the implementers. If important for the two parties to have the same information, then it would be beneficial to coordinate with each other to ensure the same identifier is being used to count customers and counting the same items (e.g., number of measures vs. number of unique customers participating).

5c Action Plan: Utilities will use a site-specific identifier such as ESIID or meter number to identify and track participants starting with PY2015. Several utilities were already doing this practice and of those who were not, many have begun this in PY2014.

1.6 CONCLUSION

The EM&V team found that utilities generally have well-established program design and delivery processes, supported by developed program tracking systems, program documentation, and savings tools. This finding is supported by the generally healthy realization rates across utility portfolios.

The objective of the EM&V recommendations is to facilitate more accurate, transparent, and consistent savings calculations and program reporting across the Texas energy efficiency programs as well as provide feedback that can lead to improved program design and delivery. The EM&V team recognizes there may be a trade-off between these objectives and program administration cost and program participation barriers. Several of the recommendations require utility process changes as well as have administrative cost implications.

The EM&V team discussed the recommendations with the PUCT and utilities to develop action plans for the reasonable roll-out of PY2013 recommendations. The recommendations and utility action plans will then be discussed at the next Energy Efficiency Implementation Project (EEIP) meeting on September 18, 2014. Feedback from that meeting will be incorporated into a final set of recommendations and action plans with an expectation that they will be considered for implementation in Program Year 2015 consistent with §25.181(q)(9).

2. INTRODUCTION

This document presents the third-party evaluation, measurement, and verification (EM&V) results for the Texas electric investor-owned utilities' energy efficiency portfolios implemented in Program Year 2013 (PY2013).

For PY2013, the team conducted program tracking system reviews across all utility programs and desk reviews, customer and market actor surveys, and on-site M&V for sampled projects. These activities were designed to achieve a minimum of 90% confidence interval and 10% relative precision for gross evaluated savings estimates at the utility portfolio level.

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

The PY2013 EM&V plans[7] are based on the prioritization for the EM&V effort[8] presented and distributed for comment to the EEIP and approved by PUCT staff. To briefly summarize, the EM&V team identified 24 program types across utilities that have similar program design, delivery, and target markets. We reviewed each program type and prioritized (high, medium, low) based on the following considerations (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (n)):

- Magnitude of savings—percentage of contribution to the portfolio of programs' impacts
- Level of relative uncertainty in estimated savings
- Level and quality of existing quality assurance and verification data from on-site inspections completed by utilities or their contractors
- Stage of program or programmatic component (e.g., pilot, early implementation, mature)
- Importance to future portfolio performance
- PUCT and Texas utilities' priorities.

2.1 REPORT ORGANIZATION

Section 3 summarizes the evaluation approach. Section 4 details the EM&V results for the commercial sector, and Section 5 provides the results for the residential sector. the sector-level sections document the impact results (overall, by measure type, and prospective realization rates for select measures), as well as attribution (net-to-gross) and process findings resulting from customer and market actor surveys. Last, these sector-level sections

[7] *Public Utility Commission of Texas Evaluation, Measurement, and Verification (EM&V) Plans for Texas Utilities' Energy Efficiency and Load Management Portfolios—Program Years 2012 and 2013*, June 12, 2013.

[8] *EM&V Prioritization for Program Years 2012 and 2013* to Katie Rich and Therese Harris, PUCT, from Lark Lee, EM&V project manager, May 1, 2013.

provide recommendations related to improving savings, candidates for deemed savings, maximizing net savings, and opportunities for process improvements (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 5).

Section 6 documents a number of statewide process issues targeted for PY2013. These include a mix of standard offer and market transformation programs in portfolios, utility quality assurance and quality control practices, and program participant definitions.

A separate volume (Volume II) details the EM&V results for each utility's portfolio. Section 13 discusses evaluation recommendations.

3. EVALUATION APPROACH

This section discusses the PY2013 EM&V methodology organized around the following activities:

- Understanding portfolios
- Creating the EM&V database
- Implementing impact evaluations
- Cost-effectiveness testing
- Reporting.

3.1 UNDERSTANDING PORTFOLIOS

One of the first steps in the statewide EM&V effort was to understand the energy efficiency and load management portfolios for each utility and the context in which they operate. This was necessary for the EM&V effort to result in actionable feedback that can be used to improve program performance and reporting accuracy. Information was gathered primarily through meetings, utility staff interviews, program documentation review, and data tracking review. These activities directly informed the evaluation prioritization process and the EM&V plans.

3.1.1 Meetings

Immediately after contract execution, the EM&V team met with PUCT staff to clarify the objectives of the EM&V effort, priorities for the PY2013 evaluations, and use of the EM&V research and results. This initial meeting was followed with informational meetings with utilities and implementation contractors to review program data tracking systems and available data.

A utility EM&V kickoff meeting was then held with staff participating from all ten utilities. The objectives of the utility EM&V kickoff meeting were to confirm the primary objectives of the EM&V effort; reach a common understanding on the technical approach, project deliverables, and timeline; and establish a working relationship with the utilities, including processes for ongoing communication, review of deliverables, and program tracking data requests.

Scheduled biweekly and ad hoc meetings between the EM&V team and PUCT continued throughout the duration of the evaluation. The EM&V team also met with utilities and, when applicable, their implementation contractors, throughout the evaluation period. These meetings included meetings to review and discuss EM&V deliverables as well as monthly EM&V utility status meetings and ad hoc meetings.

To engage a wide range of stakeholders in the EM&V process in both up-front planning and the end results, an EEIP meeting was held to review the EM&V planning documents and another meeting was held to review the PY2012 Annual Portfolio Evaluation Report results. An EEIP meeting will also be held to review the PY2013 Annual Portfolio Evaluation Report results.

3.1.2 Utility staff interviews

All ten utilities completed in-depth interviews with the EM&V team in March 2013. These interviews helped the EM&V team gain knowledge of the utilities' territories; energy efficiency staff roles and responsibilities, and the extent to which outside contractors are used; portfolio history, mix of programs, and performance; and program design and delivery processes. The EM&V team conducted additional utility staff interviews as necessary across the course of the evaluation process.

3.1.3 Program documentation and tracking data review

To gain a broader perspective of the overall programs, the EM&V team reviewed §25.181 relating to Energy Efficiency Goal (Project No. 39674), related legislation and filings, 2012 and 2013 Energy Efficiency Program Plans and Reports, 2012 Energy Efficiency Cost Recovery Factor (EECRF) filings, Electric Utility Marketing Managers of Texas (EUMMOT) annual reports, and other information on the EUMMOT maintained website. The EM&V team collected and cataloged program documentation for each utility's program. Types of program-specific documentation reviewed included operating manuals, service provider applications, customer agreements, memoranda of understanding, sample customer reports (e.g., benchmarking), workshop presentations, and tools (e.g., the duct tool).

In addition, the EM&V team reviewed all utilities' program tracking data. The program tracking data served as the basis for sampling and verifying program impacts. The EM&V team conducted a preliminary tracking data review to understand how claimed savings are tracked and calculated and what data are available to the EM&V team, which fed into creating a statewide EM&V database to support evaluation activities (discussed next).

3.2 CREATING THE EM&V DATABASE

Another critical step in this evaluation process was to create a statewide EM&V Database with a streamlined data request process and secure retrieval system (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (d)). Complete PY2013 program data was requested from utilities and integrated into the database.

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

- Due-diligence review of PY2013 claimed savings
- Program tracking system reviews
- Efficient sampling across utilities and programs.

3.3 IMPLEMENTING IMPACT EVALUATIONS

The impact evaluations are used to calculate realization rates. The realization rate is determined by dividing the evaluated savings by the utility claimed savings (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (h)). Utility claimed savings are the EM&V team's replicated savings in the EM&V Database from the tracking systems. In the majority of cases, utility program-level claimed savings match those reported in each utility's 2014 Energy Efficiency Plan and Report (EEPR). In some cases, the EM&V

team's claimed savings do not match the EEPR. When there is a discrepancy, it is footnoted in this report along with the reason for the discrepancy.

For PY2013, the EM&V team performed a tracking system review and series of desk reviews for an initial assessment of the reasonableness of the claimed savings. Primary data was then collected for sampled projects to further assess the accuracy of the claimed savings.

Demand side management program evaluations routinely employ 90% confidence intervals with ± 10% as the industry standard ("90/10"). The "90%" in the confidence interval represents a level of certainty about the estimate. If we were to repeatedly obtain new estimates using exactly the same procedure (by drawing a new sample, conducting new interviews, calculating new estimates and new confidence intervals), the confidence intervals would contain the average of all the estimates 90 percent of the time.

PY2013 evaluation activities were designed to achieve 90/10 relative precision for gross evaluated savings estimates at the utility portfolio level based on the sampling process used to select a random sample of participants that received desk reviews[9]. The tracking system and desk reviews are discussed next.

3.3.1 Tracking system and desk reviews

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

Our review accomplished two primary objectives. First, it ensured that the measures installed are consistent with those listed in the tracking system. Second, the desk reviews verified that the savings estimates in the tracking system are consistent with the savings calculated in the deemed calculation tools or tables or M&V methods used to estimate project savings (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (f)).

The desk reviews included a review of the assumptions used for the savings assumptions and, when available, utility M&V reports gathered through the supplemental data request for sampled projects (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (j)).

3.3.2 Primary data collection

For sampled projects across each utility portfolio, the EM&V team conducted three different primary data collection activities—participant telephone surveys, market actor interviews, and on-site M&V. Each is discussed below.

- **Participant surveys.** The EM&V team conducted telephone surveys for a sample of PY2013 participants. These surveys were primarily focused on verifying installation of measures and developing estimates of free ridership and spillover to inform the

[9] While this precision level was achieved for all utilities for kW savings, for two utilities with smaller participant populations, the precision level was slightly wider for kWh savings.

net-to-gross (NTG) analysis[10] as well as key process issues such as program awareness and satisfaction. Participant surveys were also used to recruit for on-site verifications.

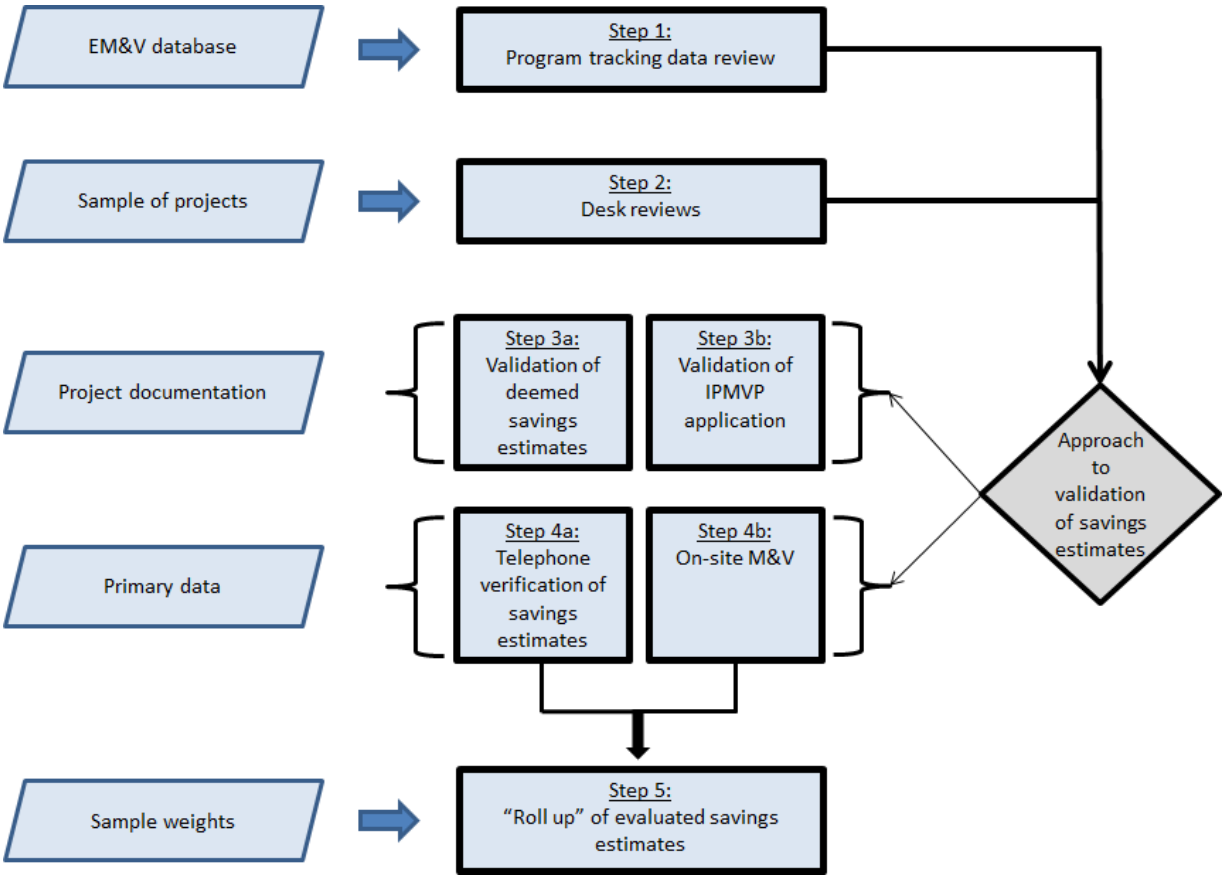
- **Market actor surveys.** The EM&V team interviewed key market actors that were PY2013 participating EESPs to inform NTG and baseline issues. Market actor interviews are particularly critical for Standard Offer Programs that rely on service providers to market and deliver the program to customers.
- **On-site M&V.** The on-site visits had two principal objectives—(1) verify installation and operation of the equipment/systems and (2) verify key assumptions made in calculating claimed savings estimates.
  - Installations were verified by collecting data on-site related to the number of measures installed, the location of the systems, equipment nameplate information, and a visual inspection to ensure the systems are working as intended. This was a basic inspection audit that took approximately one to two hours to complete.
  - Additional data collection such as blower door testing for residential homes and metering for nonresidential facilities also was conducted to develop independent estimates of savings to compare to the utility's claimed savings estimates. This more comprehensive audit verified key input assumptions used to develop ex-ante claimed savings estimates from deemed savings algorithms (or M&V plans for custom projects) such as baseline energy use, operating hours, efficiency performance, and potentially interactive effects. For example, for a home that received a rebate for ceiling insulation, the on-site data collected included square footage of insulated space, depth and type of insulation installed, as well as age of home to substantiate pre-installation conditions. This type of information is primarily used to develop prospective realization rates at the statewide sector and measure level to inform Technical Reference Manual updates and is not included in this report.

3.3.3 Realization rates

The evaluated savings are based on project-level realization rate calculations that are then weighted to represent program-level and then portfolio-level realization rates. These realization rates incorporate any adjustments for incorrect application of deemed savings values and any equipment details determined through the tracking system and desk reviews. For example, baseline assumptions or hours of use may be corrected through the evaluation and thus affect the realization rates. In order to calculate evaluated savings, we apply the realization rate determined from the EM&V sample to the population of projects. A flow chart of the realization rate calculations is below.

[10] The EM&V team is quantifying NTG at the statewide program category level.

Figure 3-1. Realization Rate Flowchart



3.3.4 Uncertainty ranking

The EM&V team assigned an "uncertainty" ranking of low, medium, or high to the evaluated savings estimates based on the level of program documentation provided to complete a third-party, due-diligence review of claimed savings.

Uncertainty rankings were assigned as follows:

- **LOW uncertainty:** >=90 percent of sampled projects have sufficient documentation
- **MEDIUM uncertainty:** 70 percent–<90 percent of sampled projects have sufficient documentation, the remaining sampled projects had limited or no documentation. Medium uncertainty was also given to nonresidential programs that had utility M&V results available to verify savings in place of other supporting documentation with the needed equipment quantity and specification information such as equipment cut sheets.
- **HIGH uncertainty:** <70 percent of sampled projects have sufficient documentation, the remaining sampled projects had limited or no documentation.

Sufficient documentation is defined as the necessary information required to verify savings. For nonresidential programs, this included completed savings calculators, customer invoices, pre- and post-inspection reports, and equipment cut sheets. For residential programs,

documentation provided all inputs needed to replicate the savings calculations based on the deemed savings manual or the approved calculation method as well as supporting materials.

Limited documentation is defined as documentation was provided to verify some, but not all key inputs to savings calculations.

No documentation is defined as only the savings calculator or measure attributes was provided with no supporting materials.

3.4 COST EFFECTIVENESS TESTING

The EM&V team conducted cost-effectiveness testing using the program administrator cost test (PACT, also known as the Utility Cost Test) using PY2013 actual results except for low-income programs as discussed below. Cost-effectiveness tests were run using a uniform model for all utilities. The EM&V team collected required inputs for the model from several sources, including program tracking data, deemed savings, and the PUCT and utilities. Table 3-1 below lists the required inputs to the cost-effectiveness model and the sources of information (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (i)).

Table 3-1. Cost-effectiveness Model Inputs and Sources

Model Input	Measurement Level	Source
Reported Energy/Demand Savings	Measure Type	EM&V Database
Summer/Winter Peak Coincidence Factors	Measure Type	Deemed savings
Effective Useful Life	Measure Type	Deemed savings
Incentive Payments	Program	EEPRs
Administrative and R&D Costs	Program/Portfolio	EEPRs
EM&V Costs[11]	Program/Portfolio	EM&V team budgets
Performance Bonus[12]	Portfolio	EEPRs
Avoided Costs	Statewide	PUCT (Utilities)
Weighted Average Cost of Capital	Utility	Utilities
Line Loss Factor (non-ERCOT utilities only)	Utility	Utilities
Realization Rates	Program	Evaluation results

The EM&V team conducted PY2013 cost-effectiveness tests separately using claimed gross savings and evaluated gross savings. The model produces results at the portfolio, program category,[13] and program levels.

[11] EM&V costs were not known at the time of utilities' original cost-effectiveness analysis.
[12] Performance bonuses as an input into cost-effectiveness testing came into effect in 2013.
[13] Program categories are currently defined as Nonresidential, Residential, Low-Income, Load Management, and Pilots.

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

When tests were conducted at a more disaggregated level than data was available, that data was allocated proportionate to costs (§25.181(h)(6)). For example, the performance bonus was calculated for the overall portfolio and allocated to individual programs proportionate to the programs' costs associated with meeting demand and energy goals. These program costs include program administrative and incentive costs. Portfolio-level costs include the performance bonus, EM&V, administrative, and research and development costs.

Low-income programs were evaluated using the Savings-to-Investment Ratio (SIR). This model only includes net incentive payments under program costs. The SIR methodology is only used when specifically testing the low-income programs.

Portfolio-level cost-effectiveness analyses are based on the PACT and are shown including and excluding low-income and low-income/hard-to-reach customers.

In addition, in 2013 the evaluation team reported the cost per lifetime kWh and kW. This is calculated by attributing costs to energy savings and avoided demand based on their portion of total benefits and applying that proportion to the total program costs.

3.5 NET-TO-GROSS

The EM&V team is tasked with estimating net savings for the Texas energy efficiency programs, which was accomplished by completing NTG research and producing NTG ratios statewide for the different program types offered by the utilities (exclusive of low-income/hard-to-reach and load management programs). The PY2012–PY2013 EM&V plan[14] defines net savings as "those savings that are attributable to the programs, inclusive of free-ridership and spillover" (pg. 2-11) based on the definitions of these terms in 25.181(c).

Free-ridership refers to actions taken by participants through a program that would have occurred in the absence of the program. In other words, a *free rider* is a program participant who would have done some amount of the program-rebated energy efficient improvements if the program had not been offered. The EM&V team drew on research with customers and/or market actors to calculate free-ridership as often both customers and market actors were involved in the decision-making process for the project.

Spillover refers to additional energy-efficient equipment installed or actions taken due to program influences but without any financial or technical assistance from the program. The EM&V team relied on market actor interviews to determine the spillover rate. Experience has shown that customers generally cannot provide enough data about the new equipment they have installed to allow for accurate estimates of the energy savings achieved from the equipment. On the other hand, market actors who have worked with the program are typically more knowledgeable about equipment and are familiar with what is and is not "program-eligible." In addition, spillover takes time to occur. Customer surveys were implemented soon after project completion and therefore we would have expected little to no spillover from

[14] Evaluation, Measurement, and Verification Plans for Texas Utilities' Energy Efficiency and Load Management Portfolios – Program Years 2012 and 2013 (Final June 12, 2013).

PY2013 participants at the time the customer surveys were implemented whereas market actors have generally worked with the programs for a number of years.

With a few exceptions, the EM&V team used a self-report approach (SRA) via customer surveys and market actor interviews to calculate NTG ratios. As program designs and deliveries vary, the NTG methodology also varied. The reader is referred to the PY2012-PY2013 EM&V Plan Appendix B, updated January 23, 2014, which provides more detail on the NTG approach, including an overview of the methods by program type and survey questions and analysis methodologies[15].

For those programs where the SRA approach was used, the final NTG ratio is calculated using the following formula. The ratio can be applied to the population to determine the final net savings value.

NTG Ratio = 1 – (Free-ridership Rate) + (Spillover)

As a simplistic example, if Program A has a free-ridership rate of 20 percent, and a spillover rate of 8 percent, the NTG ratio would then be:

Program A NTG Ratio = 1.00 – 0.20 + 0.08
Program A NTG Ratio = 0.88, or 88%

There are occasions where outliers exist in the data. Outliers are cases that provide responses that extensively deviate from the norm. While important to account for these customers' activities, depending on project size and number and composition of survey completes, these data can significantly swing the results. Within NTG research, the spillover calculation has the potential of capturing large outliers, which could then influence the overall NTG ratio considerably. While it is important to recognize the spillover results for these cases, the EM&V team needs to be careful to manage the results such that NTG is not overstated due to potential self-reporting bias. Therefore, the EM&V team capped the spillover rate calculated for individual market actors at 200 percent.

3.6 REPORTING

There are two EM&V report deliverables per program year—(1) Interim Impact Evaluation Reports, and (2) Annual Portfolio Results. There are also a number of status reports, ad hoc reports, interim memorandums and data collection and sampling deliverables (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (l)).

The Interim Impact Evaluation Reports are delivered separately for each utility and discussed with the PUCT and each utility *prior* to drafting the Annual Portfolio Report. This allows the EM&V team to discuss the impact results with the PUCT and utilities, receive their input, and conduct supplemental analysis if needed prior to the Annual Portfolio Report. The Annual Portfolio Report is a comprehensive report across all utility portfolios.

[15] The updated Appendix B can be found on the Texas PUC EM&V SharePoint site at https://sites.tetratech.com/projects/158-TexasEMV/Annual%20Evaluation%20Plans/Forms/AllItems.aspx.

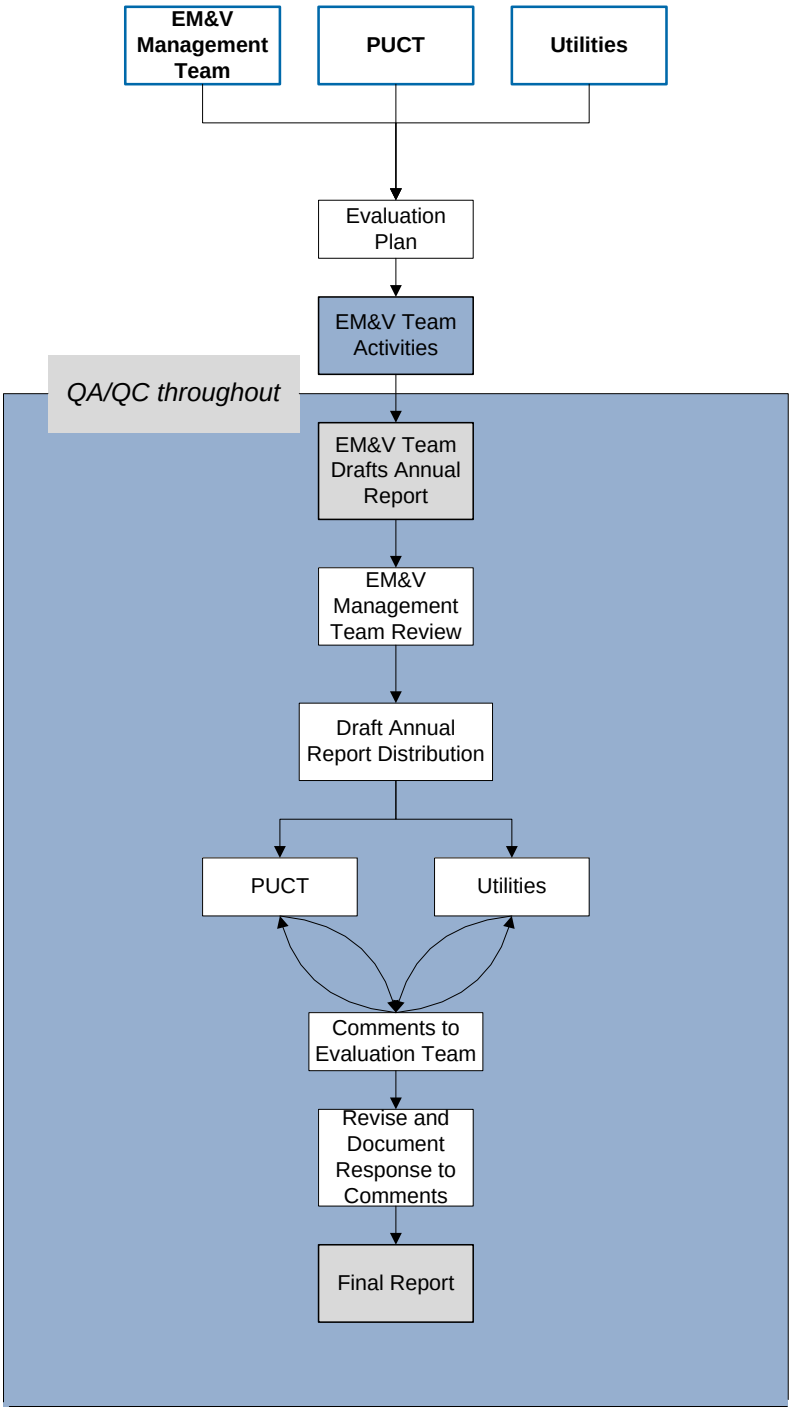
For PY2013, the metrics to be used as the basis for recommendations in the reports (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (m)) is the program's gross savings realization rate and associated uncertainty ranking, customer and market actor survey results, including net-to-gross ratios, on-site M&V findings including site-specific realization rates and prospective realization rates, and programs' cost-effectiveness.

The EM&V Database is at the core of reporting results. It houses the claimed and evaluated savings. The database allows structured queries to provide results by utilities, program categories and types, measure types, and/or sectors. QA/QC is conducted to ensure that results being entered into and extracted from the database are accurate (Request for Proposals 473-13-00105, Project No. 40891, Scope of Work Task 1B (l)).

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

The following flow chart describes the general reporting process flow.

Figure 3-2. Reporting Flow Chart



4. STATEWIDE PORTFOLIO RESULTS—COMMERCIAL SECTOR

This section documents the statewide portfolio results for the commercial sector within the following sub-sections:

- Impact results
  - Overall
  - By measure category
  - Prospective realization rates for select measures
- Program attribution (net-to-gross)
- Customer survey results
- Market actor survey results
- Recommendations
  - Improving savings estimates
  - Measures that are good candidates to use deemed savings
  - Maximizing net savings
  - Opportunities for process improvements.

4.1 IMPACT RESULTS

Statewide PY2013 evaluated savings from commercial sector programs were 263,638,864 kWh (compared to 254,241,172 kWh for PY2012) and 58,512 kW (compared to 56,114 kW for PY2012). The majority of commercial kW savings came from load management programs (82 percent). Lighting and HVAC measures accounted for the majority of the kWh savings (68 percent and 16 percent, respectively).

Statewide, realization rates were 101 percent for both energy and demand savings. Demand savings realization rates ranged from 96 percent to 106 percent and energy savings realization rates ranged from 99 percent to 107 percent.

Commercial evaluated savings primarily varied from claimed savings due to on-site M&V findings for issues such as different measure type and/or quantities found on-site from those used for claimed savings. The adjustments, made at the project level, were typically minor and the utilities saw project-level savings both increase and decrease based on the on-site M&V results. As an example, although most adjustments were related to commercial HVAC and lighting measures, the evaluation found realization rates of 101 to 102 percent for those measures.

Table 4-1 shows the claimed and evaluated demand savings for each utility's commercial energy efficiency portfolio for PY2013 and the precision levels around the evaluated savings estimates at a 90 percent confidence interval.

Table 4-1. Program Year 2013 Claimed and Evaluated Demand Savings—Commercial Sector

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
AEP TCC	10.8%	6,227	6,543	105.1%	8.5%
AEP TNC	2.2%	1,267	1,268	100.0%	24.9%
CenterPoint	28.6%	16,572	15,978	96.4%	16.6%
El Paso Electric	6.4%	3,720	3,717	99.9%	0.0%
Entergy	7.1%	4,086	4,082	99.9%	0.2%
Oncor	37.2%	21,545	22,256	103.3%	15.6%
SWEPCO	3.6%	2,108	2,234	106.0%	10.0%
TNMP	2.5%	1,451	1,444	99.6%	1.7%
Xcel SPS	1.6%	943	989	104.8%	8.3%
Total	**100%**	**57,919**	**58,512**	**101.0%**	**7.5%**

Table 4-2 shows the claimed and evaluated energy savings for each utility's commercial energy efficiency portfolio for PY2013. While evaluated savings are similar to claimed savings, minor adjustments were made across all utilities' claimed savings.

Table 4-2. Program Year 2013 Claimed and Evaluated Energy Savings—Commercial Sector

Utility	Percent Statewide Savings (kWh)	2013 Claimed Energy Savings (kWh)	2013 Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
AEP TCC	9.2%	23,896,937	23,686,807	99.1%	14.9%
AEP TNC	2.0%	5,253,955	5,254,730	100.0%	22.2%
CenterPoint	34.4%	89,701,845	88,391,052	98.5%	13.9%
El Paso Electric	7.0%	18,190,842	18,326,748	100.7%	0.4%
Entergy	7.4%	19,168,395	19,151,065	99.9%	0.1%
Oncor	33.5%	87,282,732	91,359,609	104.7%	8.4%
SWEPCO	3.1%	7,949,337	8,021,249	100.9%	24.9%
TNMP	2.1%	5,536,892	5,735,047	103.6%	0.6%
Xcel SPS	1.3%	3,462,732	3,712,556	107.2%	11.6%
Total	**100%**	**536,415,431**	**577,023,515**	**107.6%**	**3.2%**

4.1.1 Savings summary by measure type

The tracking systems provided by the utilities and their contractors provide measure-level details, which the EM&V team then assigned to a measure category. Table 4-3 documents

the percentage of energy savings by measure category. Not surprisingly, the majority of the commercial programs' savings come from lighting measures, which is in keeping with national results. Lighting is followed distantly by HVAC and other measures. Motors and Solar PV account for about 2 to 3 percent of the statewide commercial savings.

Table 4-3. Energy Savings by Measure Category

Measure Category	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Percent Commercial Savings (kWh)
Lighting	181,214,043	183,589,800	101%	68.0%
HVAC	42,167,743	42,686,317	101%	15.8%
Other	28,295,162	28,066,263	99%	10.4%
Motors	6,827,916	6,672,484	98%	2.5%
Solar PV	5,984,736	6,237,620	104%	2.3%
Roofing	1,090,464	1,155,666	106%	0.4%
Load Management	948,980	950,570	100%	0.4%
Shell	441,130	475,979	108%	0.2%
Windows	229,136	225,188	98%	0.1%
Appliance	2,229	2,229	100%	0.0%
Total	**267,201,539**	**270,062,116**	**101%**	

Note: Totals in this table will not match the sector total, since this table includes pilot programs.

The commercial sector demand savings are largely a result of load management programs. Again, lighting and HVAC measures constitute the next two measures responsible for the commercial programs' demand savings at 9 percent and 6 percent, respectively (Table 4-4).

Table 4-4. Demand Savings by Measure Category

Measure Category	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Percent Commercial Savings (kW)
Load Management	261,297	279,172	107%	82.2%
Lighting	30,625	30,923	101%	9.1%
HVAC	19,169	19,495	102%	5.7%
Other	4,635	4,558	98%	1.3%
Solar PV	3,140	3,152	100%	0.9%
Motors	1,132	1,123	99%	0.3%
Roofing	777	815	105%	0.2%
Windows	246	235	95%	0.1%
Shell	80	86	107%	0.0%

Measure Category	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Percent Commercial Savings (kW)
Appliance	0	0	100%	0.0%
Total	**321,102**	**339,558**	**106%**	

Note: Totals in this table will not match the sector total, since this table includes pilot programs.

4.1.2 Prospective realization rates for select measures

As part of PY13 evaluation activities, the EM&V team conducted analysis to estimate prospective realization rates. The main objective was to provide a qualitative assessment that would identity any potential issues with the deemed values and calculation methods for various measure types.

For the commercial programs (CSOP and CMTP) the EM&V team assessed the prospective realization rates of two measures (lighting and HVAC) as well as Solar PV applications. The prospective realization rates accounted for the accuracy of stipulated hours of use for lighting projects, the baseline selection processes for HVAC projects, and use of PVWatts and incorporation of climate differences for Solar PV projects.

The analysis is based on data collected from participants through on-site M&V surveys as well as tracking system and desk reviews. The EM&V team performed a high level review of stipulated hours of operation and attempted to find any discrepancies that may guide future evaluation research efforts.

Note that the lighting analysis incorporates self-reported use characteristics (e.g., hours of use) obtained via participant interviews while on-site. The EM&V team understands the limitations of the self-reported hours but, barring long-term metering, the self-report hours are the most reliable data source to determine prospective realization rates and opportunities for calculation improvements.

A. Lighting

Prospective realization rates were calculated for lighting measures in the on-site sample. The rates are calculated as the ratio of prospective energy savings to the on-site sample evaluated energy savings.

The prospective realization rates for lighting compared the stipulated hours of use for each building type (specified in PUCT Docket 39146) and the customer self-reported hours of use, based on the building hours. The team only included calculations for energy; the primary variable under review is hours of use, which does not affect the estimation of demand savings.

As shown in Table 4-5 below, a total of 181 projects were analyzed, resulting in an overall Prospective Realization Rate of 96.4 percent.

Table 4-5. Commercial Lighting Measures Prospective Realization Rates

Measure Type	Number of Sample Records	2013 On--site Sample Claimed Energy Savings (MWh)	2013 On--site Sample Evaluated Energy Savings (MWh)	2013 On-site Sample Prospective Energy Savings (MWh)	Evaluated Realization Rate** (MWh)	Prospective Realization Rate** (MWh)
Lighting	**181**	**17,647**	**17,814**	**17,180**	**100.9%**	**96.4%**

i. Comparison of self-reported and stipulated operating hours

This prospective realization rate is primarily driven by the difference in stipulated versus reported lighting hours of use. Table 4-6 provides a comparison of the stipulated and self-reported lighting hours by building type. The table also documents the percentage change and number of sample points included in the analysis. Note that only building types with sample sizes of nine or greater are included.

The self-reported hours per building type were calculated using a straight average of hours by building type. Note that the EM&V team did not sample specifically to inform the prospective analysis; therefore, not all building types had sufficient samples to be represented in the table. For this reason, along with the smaller sample sizes for some building types, the results in this section should be viewed qualitatively and for informational purposes only.

The percent variation between the stipulated and self-reported operating hours ranged from -16 percent to +12 percent. The three building types with most percent variation between the stipulated hours and the self-reported hours are:

- Retail Non-Mall/Strip varied by 16 percent (9 sample points),
- Education K-12, No Summer hours varied by 15 percent (24 sample points) and Education, Summer by 11 percent (23 sample points)
- Manufacturing varied by 14 percent (9 sample points) respectively.

Based on the results and findings, the EM&V team recommends continued research on operating hours in PY2014 to inform if any updates in the stipulated operating hours for certain building types are needed.

Table 4-6. Comparison of Self-Reported and Stipulated Operating Hours by Building Type

Building Type Code	Building Type Description	Stipulated Operating Hours*	Self-Reported Operating Hours	% Variation	Number of Sample Records
Education K-12, no summer	Education (K-12 w/o summer session)	2,777	2,351	-15%	24
Education, summer	Education: college, university, vocational, day care, and K-12 w/ summer session	3,577	3,198	-11%	23
Outdoor (Oncor)*	Outdoor lighting photo-controlled	4,145	4,052	-2%	16
Outdoor*	Outdoor lighting photo-controlled	3,996	3,966	-1%	14
Public assembly	Public assembly	2,638	2,383	-10%	13
Office	Office	3,737	3,551	-5%	12
Parking	Parking structure	7,884	7,374	-6%	12
Public assembly	Public assembly	2,638	2,383	-10%	13
Retail non-mall/strip	Retail (Excl. mall and strip center)	3,668	3,068	-16%	9
Non-24-hour retail	Food Sales – non-24-hour supermarket/retail	4,706	4,985	6%	9
Manufacturing	Manufacturing	5,740	4,949	-14%	9
Non-refrigerated warehouse	Warehouse (non-refrigerated)	3,501	3,907	12%	9

* Oncor calculator lists outdoor lighting as 4,145 hrs. PUCT Docket 39146 lists the hours for Outdoor Lighting as 3,996, which is what all other utilities use. The EM&V team will continue to investigate the difference in hours of use with Oncor.

B. HVAC

For commercial HVAC measures, the main objective of the prospective analysis was to assess the baseline selection process for the HVAC projects. Specifically, the team reviewed HVAC equipment retrofitted through the CSOP and CMTP programs considering Early Retirement (ER) and Replace-on-Burnout (ROB) baselines.

Across the M&V efforts completed for the commercial programs statewide, there were only three instances where the EM&V team adjusted the ER baseline claims to ROB baseline claims. The baseline was adjusted based on the on-site inspection findings that the existing baseline units were severely degraded and would not be able to meet the cooling load requirements of the facilities which indicated a ROB rather than ER situation.

Adjusting the baseline from ER to ROB has the potential of reducing the energy and demand savings considerably. Using the three HVAC projects where we identified this issue via M&V, the energy and demand savings for those projects were reduced by about 60 percent.

As noted above, the incidence of this occurrence was very low with little impact on the overall savings at the measure category level. If this were to become a more pervasive issue, however, then the realization rate could shift downward considerably for this measure category. The EM&V team recommends clearer guidelines on determining when equipment should be ER versus ROB be incorporated into the TRM and used to inform savings calculator tools. The guidelines should address cases where the existing cooling equipment is experiencing performance based issues.

C. Solar PV

The majority of Solar PV projects report deemed savings. These deemed values do not account for climate variation. The prospective evaluated savings from Solar PV are based on PvWatts[16] simulations run in NREL's System Advisor Model (SAM). The PvWatts simulation includes the effects of location (accounting for climate differences) and orientation in PvWatts, which results in different savings than the statewide deemed factors. In addition, PvWatts takes into account a number of other factors that affect Solar PV system performance that are termed de-rates. The prospective realization rate for Solar PV takes this into account as well. This section discusses the effect of including these adjustments.

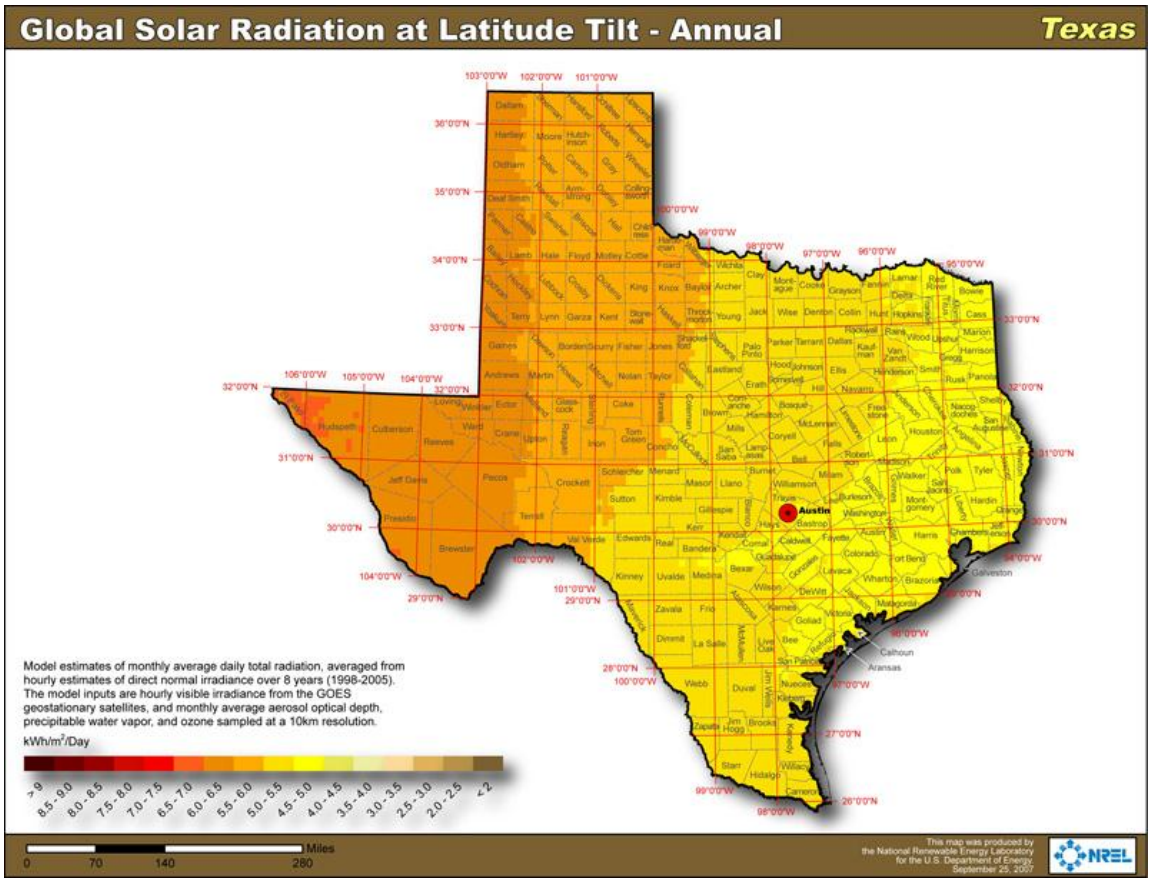
i. Climate zone and orientation

In general, the further projects are from the gulf coast and the closer the panels are to pointing south, the more energy the project will produce because more sunlight will strike the panels. Figure 4-1 shows the relationship between average daily insolation and location.[17]

[16] PvWatts is an NREL developed tool that uses weather data for the selected location to determine the solar radiation incident of the PV array and the PV cell temperature for each hour of the year. The DC energy for each hour is calculated from the PV system DC rating and the incident solar radiation and then corrected for the PV cell temperature. The AC energy for each hour is calculated by multiplying the DC energy by the overall DC-to-AC de-rate factor and adjusting for inverter efficiency as a function of load. Hourly values of AC energy are then summed to calculate monthly and annual AC energy production. http://www.nrel.gov/rredc/pvwatts/.

[17] From the National Renewable Energy Lab (NREL): http://apps1.eere.energy.gov/states/images/maps/map_large_pv_TX.jpg.

Figure 4-1. Average Solar Irradiance per Day in Texas



To provide geographic variation and to maintain consistency with other measures, five climate zones, each with a representative Typical Meteorological Year (TMY3)[18] city, were used for the PvWatts simulations. The TMY city for each climate zone is[19]:

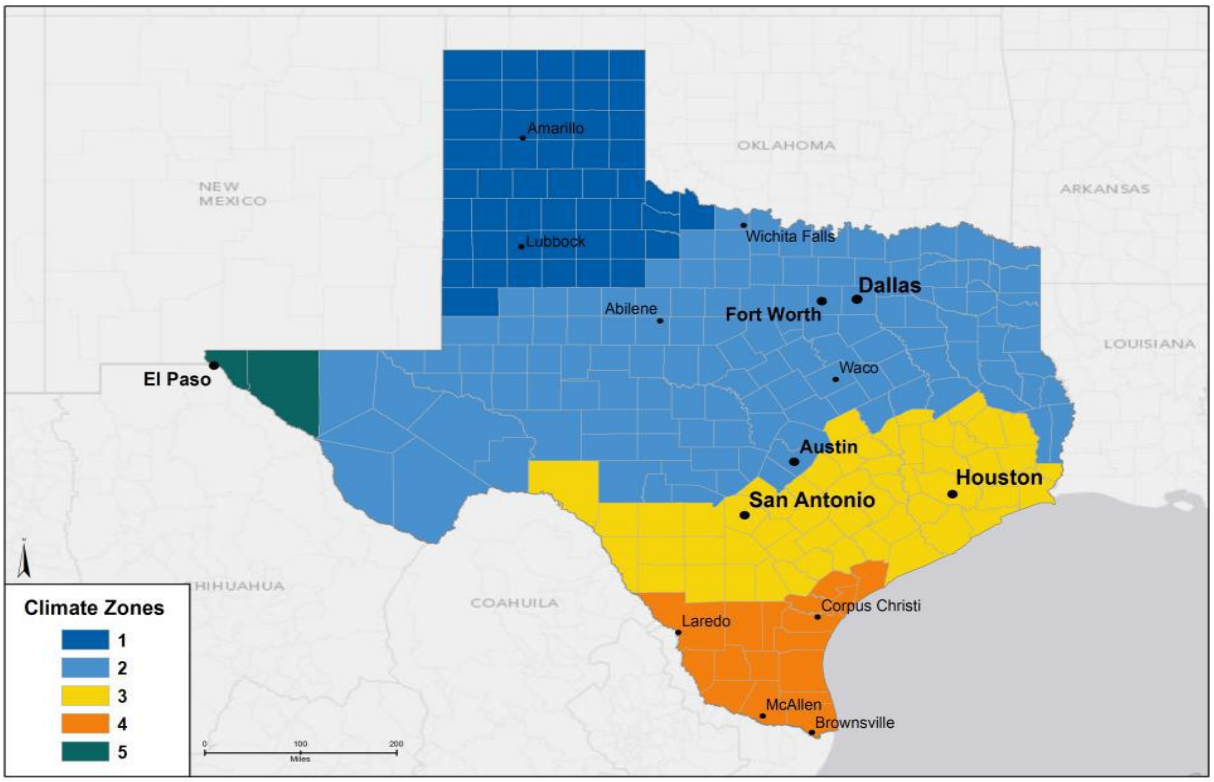
- TRM Climate Zone 1 (Panhandle Region): Amarillo International AP [Canyon UT]
- TRM Climate Zone 2 (North Region): Dallas Fort Worth Intl AP
- TRM Climate Zone 3 (South Region): Houston Bush Intercontinental
- TRM Climate Zone 4 (Valley Region): Corpus Christi International AP
- TRM Climate Zone 5 (West Region): El Paso International AP [UT].

The EM&V team assigned a TMY3 city by the county a project is in and used the climate zones shown in the figure below:

[18] http://rredc.nrel.gov/solar/old_data/nsrdb/1991-2005/tmy3/.

[19] Texas Technical Reference Manual Version 2.0 Volume 1: Overview & User Guide for PY2015 Implementation http://texasefficiency.com/images/documents/RegulatoryFilings/DeemedSavings/trmv2%200%20vol%201%20overview%20%20--%20%20final.pdf.

Figure 4-2. Texas Climate Zones



ii. De-rates

In addition to weather and orientation, PvWatts takes into account a number of other factors that affect Solar PV system performance that are termed de-rates. The de-rates account for:

- Wiring losses—driven largely by:
  - PV module nameplate DC rating adjustments for temperature and actual capacity.
  - Module Mismatch Loss—panels are connected in series to build voltage and are limited by the current of the worst performing panel.
  - AC & DC Wiring Losses—resistive losses in the wires on both the DC side (before the inverter) and AC side (after the inverter) decrease performance.
- Inverter efficiency losses when converting AC to DC power
- Shading—from nearby panels, buildings, or trees
- Soiling—build-up of dirt or other particulates on the panels that block sunlight from reaching the PV cells
- System availability—how often the system is ‘up’ and not offline due to maintenance, failures, etc.
- Equipment degradation over time—PV cells lose efficiency over time at commonly accepted rates of 0.5 percent to 1 percent, primarily due to short circuit current (Isc) losses caused by ultraviolet absorption at or near the top of the silicon surface.

PvWatts will be updated in mid-2014 to v5[20] to better reflect actual system performance and effectively increase simulated energy. The PvWatts v5 model was not yet available for this report. The EM&V team therefore adjusted the default overall de-rate of 0.77 in PvWatts v1/v2 to be 0.825[21] as suggested by NREL to approximate what the PvWatts v5 model will predict.

Table 4-7 shows the prospective savings and realization rates for commercial Solar PV in PY2013 from PvWatts using the climate zones and de-rates described above.

Table 4-7. Commercial Solar PV PY2013 Prospective Savings

Utility	Claimed Demand Savings (kW)	Prospective Demand Savings (kW)	Prospective Demand Realization Rate (kW)	Claimed Energy Savings (kWh)	Prospective Energy Savings (kWh)	Prospective Energy Realization Rate (kWh)
AEP TCC	91	87	0.96	174,592	141,729	81%
AEP TNC	81	85	1.05	156,016	145,840	93%
El Paso Electric	6	6	1.00	10,848	10,760	99%
Oncor	2,836	2,899	1.02	5,391,829	5,412,332	100%
SWEPCO	127	127	1.00	245,192	219,056	89%
Statewide	**3,141**	**3,204**	**1.02**	**5,978,477**	**5,929,717**	**99%**

The approved savings factors largely resulted in realization rates equal to one. Because the PvWatts simulations account for available sunlight and panel orientation, the prospective savings vary from those calculated using the approved deemed savings factors. Prospective energy savings realization rates were 99 percent statewide; however, they varied from a low of 81 percent to 100 percent due to climate. For example, AEP TCC's territory is clustered on the gulf coast so Solar PV performance is slightly lower than other utilities like Oncor or El Paso Energy that are further from the coast.

Prospective demand savings realization rates were 102 percent statewide and varied from 96 percent to 105 percent. Prospective demand savings are currently defined as the maximum hourly output of the systems, so like annual savings, prospective demand savings are driven by the available sunlight that is more abundant further from the gulf coast. The majority of these demand savings occur at noon when the sun is brightest, so if a utility's peak demand period were later in the afternoon, the demand savings could be substantially less as the sun sinks into the west.

[20] https://sam.nrel.gov/sites/sam.nrel.gov/files/content/documents/pdf/pvwattsv5-draft-march-14-2014.pdf.

[21] 0.825 is the value suggested by NREL to approximate V5 results, as described in the draft PvWatts V5 manual (https://sam.nrel.gov/sites/sam.nrel.gov/files/content/documents/pdf/pvwattsv5-draft-march-14-2014.pdf).

Due to the rigor of the analysis underlying the prospective realization rates, the EM&V team recommends the development of deemed savings that replaces the single statewide deemed factors to better represent the variation of solar resources throughout the state. This recommendation is detailed further in Section 4.5.1, "Improving saving estimates."

4.2 PROGRAM ATTRIBUTION

This section describes the program-specific approaches and results for commercial sector program attribution.

4.2.1 CSOP results

The EM&V team used market actor interviews and customer surveys to calculate free-ridership for the CSOP. The free-ridership results from the customer surveys and market actor interviews were averaged to arrive at a final CSOP free-ridership rate (customer responses for self-sponsored participants were not averaged with market actor responses). The EM&V team used market actor interviews alone to calculate CSOP spillover. The team conducted 136 customer participant surveys and 65 market actor interviews to support the CSOP attribution results.

A. Freeridership

Table 4-8 and Table 4-9 report the program level kWh and kW free-ridership rates, respectively, along with the relative precision associated with each estimate, for market actors, customers, and the overall sample.

Table 4-8. Free-ridership results for CSOP (kWh)

Customer kWh free-ridership rate (n=136)	Customer kWh Precision at 90% CI	Market actor kWh free-ridership rate (n=65)	Market actor kWh Precision at 90% CI	Final free-ridership rate (inclusive of customer and market actor results)
23%	16%	41%	7%	30%

Table 4-9. Free-ridership results for CSOP (kW)

Customer kW free-ridership rate (n=136)	Customer kW Precision at 90% CI	Market actor kW free-ridership rate (n=65)	Market actor kW Precision at 90% CI	Final free-ridership rate (inclusive of customer and market actor results)
22%	13%	42%	6%	31%

Only two measures had sufficient sample to report free-ridership rates by measure category— lighting (n=83) and HVAC (n=21). The kWh weighted free-ridership rates for these two measures were similar at 21 percent and 25 percent, respectively.

B. Spillover

The EM&V team calculated the spillover rate for CSOP at 7 percent for kWh savings and 19 percent for kW savings. One market actor reported a spillover rate of 609 percent, which was capped at 200 percent, per the method discussed in the introduction. The market actor interviews did not ask market actors to quantify spillover results at the measure-level. Sample sizes are not sufficient at the individual utility level to be able to reliably estimate utility level spillover.

C. Net-to-gross results

The final CSOP NTG ratio, accounting for free-ridership and spillover, is 78 percent for kWh and 88 percent for kW as reported in Table 4-10.

Table 4-10. Final CSOP Statewide NTG Ratio

Weighting	Freeridership	Spillover	NTG
kWh	30%	7%	78%
kW	31%	19%	88%

D. Comparison to other jurisdictions

The EM&V team compiled more than a dozen NTG studies from other jurisdictions for commercial and industrial programs with similar measure offerings as the CSOP. These studies include commercial and industrial prescriptive and custom programs in New York, Maryland, Maine, Washington, Utah, Pennsylvania, Arizona, Idaho, Oregon, New Mexico, California and Illinois. The program delivery and measures for the programs reviewed are comparable to CSOP. NTG ratios from the studies averaged 72 percent and ranged from 31 percent in Pennsylvania to 99 percent in Arizona. The NTG estimates for the Texas CSOP programs are well within the bounds of these other studies.

4.2.2 CMTP results

The EM&V team used participant survey results as the primary method to calculate free-ridership for the CMTP programs. The EM&V team also used market actor interviews to calculate free-ridership for specific programs and spillover for all CMTPs. Unlike CSOP, which directly integrates the market actor results with the customer results, for the CMTP programs the market actor interview findings are triangulated against and used as a reasonableness check for the participant survey results. We do this under the assumption that either the customer is the primary decision maker, or the customer is working directly with a contracted EESP to specify the project and provide technical assistance previous to any engagement with the market actors. The EM&V team completed a total of 184 customer participant surveys and 52 market actor interviews to support the CMTP attribution results.

In addition to surveying customers and market actors, the EM&V team completed case study reviews of the two highest saving customers from the SCORE/CitySmart and Commercial Solutions participants. The EM&V team requested back-up documentation for these participants and reviewed the information with the implementation contractor. The EM&V team then considered whether adjustments should be made to the free-ridership rates based on the result of those reviews.

As an example, for one case the documentation and discussions with the implementation contractor showed that the primary decision maker with whom the EM&V team spoke as part of the survey effort was not the initial decision maker. That individual had left the organization just prior to project implementation. Subsequently, the individual interviewed did not have the history or did not understand the considerable role the program had in providing the assistance needed to support the approval of the project. This case study review allowed the EM&V team to adjust the free-ridership rate for this case so that it most accurately reflected the program's influence on the project.

A. Freeridership

Table 4-11 and Table 4-12 document the free-ridership results for SCORE/CitySmart and Commercial Solutions. Although there was primary data collected for AC Distributor, CoolSaver, and small commercial programs, those results are not quantified due to small sample sizes. The EM&V team plans to complete additional primary data collection for small commercial programs in 2014; only one utility was included in the PY2013 research, as the other utilities' small business programs were in their first year of implementation.

As discussed above, the results for SCORE/City Smart and Commercial Solutions are based on customer and market actor data. The customer results exclude customers that said they did not receive a final incentive or markdown for the measure *and* were not aware that the services provided by the Energy Efficiency Service Provider were coordinated through a utility program. Few customers were excluded from the analysis based on this logic.

As an information piece, we note the higher market actor free-ridership rates and lower customer free-ridership rates for the SCORE/CitySmart program. Based on interviews with these market actors, as well as program managers, it is our understanding that there is a more concerted effort to educate and train market actors in the Commercial Solutions program and SCORE/CitySmart focuses more on the end-use customer. This is likely the cause of the different free-ridership rates across customers and market actors. It is also interesting to note that Commercial Solutions' market actor results are in line with the CSOP, which similarly target EESPs.

Table 4-11. Free-ridership Rate Results for CMTP Programs with Primary Data (kWh)

Program	Customer Free-ridership Rate	Customer kWh Precision at 90% CI	Market actor free-ridership rate	Market actor kWh Precision at 90% CI
SCORE/CitySmart/ Educational Facilities/ Government Facilities	22% (n=136)	3%	65% (n=11)	15%
Commercial Solutions	28% (n=51)	3%	40% (n=15)	13%

Table 4-12. Free-ridership Rate Results for CMTP Programs with Primary Data (kW)

Program	Customer Free-ridership Rate	Customer kWh Precision at 90% CI	Market actor free-ridership rate	Market actor kWh Precision at 90% CI
SCORE/CitySmart/ Educational Facilities/ Government Facilities	26% (n=136)	2%	65% (n=11)	15%
Commercial Solutions	23% (n=50)	3%	40% (n=15)	13%

B. Spillover

Market actors (n=34) indicated that approximately 45 percent of their sales of program qualifying projects did not go through a utility program in 2013. Almost half of respondents (45 percent) strongly agreed that they would be more likely to recommend energy efficient upgrades because of their experience with the program, if the program were to be discontinued. More than half of customers (52 percent) stated they strongly agreed that they are better able to identify opportunities to improve energy efficiency through projects because of their experience with their program.

Participation in the programs does not always create increased promotion of energy efficiency among market actors. When asked whether they are more likely to discuss energy efficient options and approaches with all of their customers since participation in the program, slightly more than half of respondents (n=17) indicated they agreed with the statement, while the other half disagreed (n=14). However, only 29 percent of respondents strongly or somewhat agreed that their experience providing energy efficiency upgrades through the utility program had little or no effect on their recommendations of energy efficient improvements, showing the program did increase awareness and promotion of energy efficient practices among market actors.

C. Net-to-gross results

NTG results for SCORE/CitySmart and Commercial Solutions were relatively high at 85 percent to 93 percent, respectively.

Table 4-13. CMTP Program-level Results

Program	Customer Free-ridership Rate	Spillover	kWh NTG Ratio
SCORE/CitySmart/Educational Facilities/Government Facilities	22% (n=136)	13% (n=11)	93%
Commercial Solutions	28% (n=51)	14% (n=13)	85%

Due to the small number of completed surveys, or low priority assigned to the program, we recommend stipulating the NTG ratios for the following programs: small business programs, A/C Distributor, CoolSaver, Retro-commissioning, and Commercial Lighting. We discuss the recommended NTG ratios, and rationale for those ratios, for each program below.

Small business programs. We recommend stipulating the NTG for small business programs at 95 percent. Small Commercial Solution and Small Business NTG ratios in other states ranged from 81 to 100 percent. Most other studies report NTG ratios near 100 percent. States with reviewed findings included Massachusetts, Connecticut, Colorado, Oklahoma and Arkansas. A 2010 study in Massachusetts calculated the statewide NTG ratio of five utilities' Small Business programs at 96 percent, while in Connecticut, the statewide NTG ratio for the Small Business Energy Advantage program was calculated at 99 percent in 2011. NTG research Tetra Tech conducted for a Colorado Small Business program found a 99 percent NTG ratio. While a 2012 study found Oklahoma's Small C&I Solutions program to have a NTG ratio of 81 percent, a 2013 Arkansas report calculated a NTG ratio of 100 percent for another small business program.

Additionally, the NTG research we did for this Texas study for the one utility with a full program in operation for more than a year reinforces the higher NTG ratio; our primary data collection indicates high attribution and low free-ridership, as discussed further in this section.

AC Distributor. We recommend stipulating AC Distributor at 80 percent. Reviewing results from several other states, including Nevada, Colorado, Minnesota, and Massachusetts, we found NTG ratios for commercial cooling equipment that ranges from 75 percent to 92 percent. Based on the limited information provided by market actors and customers, we recommend a NTG at the lower end of the range. More details are provided on the market actor responses further discussed in this document.

CoolSaver. We also recommend stipulating CoolSaver at 80 percent. There is more limited information regarding commercial tune-up programs with design elements similar to CoolSaver. We identified NTG results from Minnesota, Colorado, Oklahoma, and Arkansas, with NTG ratios ranging from 69 to 100 percent. Based on this information, and the very limited results from our Texas surveys, we are recommending a stipulated value at 80 percent. However, we recognize that CoolSaver may result in a higher NTG ratio assuming it reaches commercial customers that would not otherwise receive the level of tune-ups offered through the program.

Retro-commissioning. Due to the prioritization process set forth at the beginning of this evaluation, the CMTP Retro-commissioning program did not have any customer or market actor primary data collection completed. Therefore, the NTG value is stipulated based on secondary research review only. Retro-commissioning NTG ratios reported in other jurisdictions (Colorado, Massachusetts, and Nevada) ranged from 78 percent to 97 percent, with most findings reported in the 90 percent range. Based on this information, we stipulated the Retro-commissioning program's NTG ratio at 90 percent.

Commercial Lighting. Again, as this program had low priority via the prioritization process, the NTG is stipulated and based on secondary data review only. Commercial Lighting NTG ratios reported in other jurisdictions (Nevada, Rhode Island, Oklahoma, and Massachusetts) ranged from 81 percent to 96 percent. Based on this information, we stipulated the Advanced Lighting program's NTG ratio at 90 percent.

D. Comparison to other jurisdictions

The statewide NTG ratio of 92.7 percent for SCORE/CitySmart programs is in the high range of the ratios calculated for similar programs throughout the United States, which were found

to range from a low of 72 percent to a high of 99.2 percent across Massachusetts, Rhode Island, Oklahoma and Nevada. A 2011 study of National Grid's (RI) Energy Initiative program found a NTG ratio of 87 percent, while a 2010 study of Cape Light Compact (MA) calculated a NTG ratio of 80 percent for the Compact's Medium and Large Government Retrofit program. A 2012 study calculated a NTG ratio of 72 percent for the Public Service Company of Oklahoma's Smart Schools program. A 2011 study for NV Energy's Schools Program found a NTG of 99.2 percent.

The statewide NTG ratio of 85 percent for Commercial Solutions programs in Texas is in line with ratios calculated for similar programs throughout the United States, which ranged from 81 percent to 91 percent across Massachusetts, Connecticut and Oklahoma. A 2010 study in Massachusetts calculated a NTG ratio of 91 percent for Cape Light Compact's Medium and Large C&I Retrofit program and a NTG ratio of 87 percent for Western Massachusetts Electric Company's Commercial retrofit program.[22] Additionally, a 2011 study calculated a NTG ratio of 89 percent across three utilities' Energy Conscious Blueprint program in Connecticut[23], while a 2012 study determined the NTG ratio of Oklahoma's Large Commercial Solutions program at 81 percent.[24]

4.2.3 Solar PV results

The EM&V team used market actor interviews as the primary method to calculate free-ridership and spillover. The EM&V team also surveyed participating customers to calculate free-ridership. The customer survey results were triangulated against and used as a reasonableness check against the market actor free-ridership results. The evaluation team conducted 11 customer participant surveys and five market actor interviews to support the Solar PV attribution results.

A. Freeridership

Table 4-14 and Table 4-15 document the free-ridership rates for customers and market actors. The customer results exclude customers that said either they did not receive a final incentive or markdown for the measure or they did not know if they received a final incentive or markdown for the measure.

Table 4-14. Free-ridership Results for Solar PV (kWh)

	Customer kWh free-ridership rate	Market actor kWh free-ridership rate	Final kWh free-ridership rate (inclusive of customer and market actor results)
Commercial	14% (n=11)	7% (n=5)	10%

[22] 2010 C&I Electric Programs Free-ridership and Spillover Study. Prepared by Tetra Tech for National Grid, NSTAR, Western Massachusetts Electric Company, Unitil, and Cape Code Light Compact. June 23, 2011.
[23] Connecticut Energy Efficiency Fund 2011 C&I Programs Free-ridership and Spillover Study.
[24] Public Service Company of Oklahoma 2012 Energy Efficiency & Demand Response Programs: Annual Report. Prepared for the Oklahoma Corporation Commission. June 1, 2013.

Table 4-15. Free-ridership Results for Solar PV (kW)

	Customer kW free-ridership rate	Market actor kW free-ridership rate	Final kW free-ridership rate (inclusive of customer and market actor results)
Commercial	14% (n=11)	7% (n=5)	10%

B. Spillover

The EM&V team calculated the spillover rate for solar PV at 12 percent for commercial programs.

C. Net-to-gross results

The final NTG ratio, shown in Table 4-16 and Table 4-17, accounting for free-ridership and spillover, is 101 percent for commercial kWh and kW. Note that the numbers displayed are rounded to the nearest whole percent so the NTG appears slightly off due to rounding of free-ridership and spillover.

Table 4-16. Final Solar PV Statewide kWh NTG Ratio

	Solar PV Free-ridership	Solar PV Spillover	Solar PV NTG
Commercial	10%	12%	101%

Table 4-17. Final Solar PV Statewide kW NTG Ratio

	Solar PV Free-ridership	Solar PV Spillover	Solar PV NTG
Commercial	10%	12%	101%

D. Comparison to other jurisdictions

The EM&V team reviewed a NTG study from the New York State Energy Research and Development Authority (NYSERDA) for similar commercial Solar PV programs. In the NYSERDA study, the NTG ratio was 97.4 percent for nonresidential installations. The Texas utilities' programs display very similar overall NTG results. However, the NYSERDA study found lower rates of free-ridership (3.6 percent) and spillover (0.8 percent).

4.3 CUSTOMER SURVEY RESULTS

4.3.1 Overview

The EM&V team conducted a nonresidential participant telephone survey to inform the evaluation effort. The energy efficiency survey was conducted in two waves; the first wave ran from August to September 2013, and the second wave ran from December 2013, to February 2014. The load management survey was completed in one wave in March 2014. Table 4-18 shows the number of completed surveys by utility and program type.

Table 4-18. Nonresidential Surveys Completed by Utility and Program Type

Utility	MTP	Solar PV	SOP	Load Management	Total
AEP TCC	17	2	8	11	38
AEP TNC	21	0	2	1	24
CenterPoint	12	0	49	24	85
Entergy	23	0	0	4	27
EPE	33	0	0	6	39
Oncor	55	9	53	0*	117
Sharyland	0	0	0	1	1
SWEPCO	11	0	9	4	24
TNMP	14	0	0	1	15
Xcel SPS	0	0	17	1	18
Total	**186**	**11**	**138**	**53**	**388**

*The EM&V team primarily completed interviews with aggregators as part of Oncor's Load Management program.

The following section summarizes key findings from the customer participant survey. This survey asked questions to inform installation and persistence rates, net-to-gross ratios, and customer satisfaction, and it collected information about the participants' organizations. The survey focused on energy-efficiency and renewable programs, including MTPs, (SOPs), and Solar PV programs. Note that there were very few respondents in the Solar PV programs, so their responses should be treated as qualitative information.

4.3.2 Energy efficiency program key findings

Key findings from the survey with energy efficiency program participants are summarized below for program awareness, satisfaction, measure persistence, and firm information.

A. Awareness

The survey asked respondents how they first heard about the energy efficiency program. The most common response was that the energy efficiency service provider (EESP) or contractor told them about the program, followed by the utility. Notably, 16 percent of respondents were familiar with the program because they had participated previously. Participants in SOPs were more likely than other program types to have heard from their EESP or contractor, while MTP participants were more likely to have heard from their utility.

Table 4-19. Sources of Program Familiarity

	Program Type			
	MTP	Solar	SOP	Statewide Total
EESP or contractor	46.7%	36.4%	63.9%	53.7%
Utility	42.0%	0.0%	16.5%	29.7%
Previous experience	18.9%	0.0%	12.8%	15.7%
Website	6.5%	9.1%	6.0%	6.4%
Other business contacts	4.1%	0.0%	9.0%	6.1%
Other	5.9%	36.4%	3.8%	6.1%
Colleague	5.9%	9.1%	4.5%	5.4%
Did research on our own	3.0%	9.1%	6.0%	4.5%
Word of mouth/general industry knowledge	1.8%	9.1%	7.5%	4.5%
Conference/industry trade show	3.0%	0.0%	0.8%	1.9%
Builder/Engineer/Architect/Developer	1.2%	9.1%	0.8%	1.3%
Workshop	0.6%	0.0%	0.8%	0.6%
Trade journal/magazine	1.2%	0.0%	0.0%	0.6%
Retail store	0.6%	0.0%	0.0%	0.3%
Respondents (n)	169	11	133	313

Source: Question $a1, 2013 Nonresidential Participant Survey

Note: Totals will not sum to 100 percent because respondents could select more than one response category

Related to this, the survey asked participants if they were aware that the program services were coordinated by their utility. An overwhelming majority of customers responded that they did know that the utility was involved. Only five percent of customers were unaware. This was slightly higher for SOP participants than MTP participants, but not significantly so. All of the Solar PV participants knew about the utility's involvement with the program.

Table 4-20. Familiarity with Utility Involvement in Energy Efficiency Program

	Program Type			
	MTP	Solar	SOP	Statewide Total
Yes	96.2%	100.0%	93.5%	95.2%
No	3.8%	0.0%	6.5%	4.8%
Respondents (n)	183	11	138	332

Source: Question INC0_1, 2013 Nonresidential Participant Survey
Note: Totals may not sum to 100 percent due to rounding

B. Satisfaction

The survey included a short series of questions to gauge customer satisfaction with their participation experience. The programs are generating very high satisfaction among participants. Respondents rated their satisfaction an average of 9.3 on a scale from 0 to 10, where 0 is very dissatisfied and 10 is very satisfied, and 94 percent of customers gave a rating of 8 or higher.

Table 4-21. Participant Satisfaction with Project

	Program Type			
	MTP	Solar	SOP	Statewide Total
0 - Very dissatisfied	0.5%	0.0%	0.0%	0.3%
4	2.7%	0.0%	0.0%	1.5%
5	1.1%	9.1%	0.0%	0.9%
6	0.5%	0.0%	0.7%	0.6%
7	1.6%	0.0%	5.1%	3.0%
8	13.4%	9.1%	10.9%	12.2%
9	14.5%	54.5%	26.1%	20.6%
10 - Very satisfied	65.6%	27.3%	57.2%	60.9%
Respondents (n)	186	11	138	335
Mean	9.2	8.8	9.3	9.3

Source: Question SA2, 2013 Nonresidential Participant Survey

The highly-satisfied customers brought up a wide range of subjects resulting in their satisfaction, including:

- Positive experience with contractors
- Customer service and communication
- Financial benefits (both rebates and energy bill reductions)
- Quality or performance of new equipment.

Of the less-than-satisfied respondents who gave a rating of five or lower, some mentioned that they had not seen any financial benefit, while others mentioned trouble with the installation or contractor.

C. Measure persistence

Nearly all of the measures implemented through the program are still installed and operating. One percent of respondents reported that the measure was never installed. These respondents were split between MTP and SOP participants. All of the Solar PV equipment was still installed and operating.

D. Firmographics

Finally, the survey included questions regarding the participating organization and the facility where the measure was implemented. The responses to the survey indicate that the programs are reaching a wide variety of business types, buildings, and projects. Given that some MTPs target education and government facilities, these were the most common types of facilities. There were a wide variety of other types of facilities represented, including retail, lodging, offices, and manufacturing. Interestingly, education facilities were among the most commonly-upgraded business type even in commercial SOPs. Some utilities have also begun targeting other sectors, such as healthcare and small commercial customers. The facilities ranged widely in age, from over a century old to new construction projects.

A majority of participating facilities were upgraded directly by the owner; however, over 20 percent of surveyed projects were completed in a facility that is occupied by an organization other than the participant. This is important for nonresidential programs because leased facilities can prove to be a barrier. Facility owners who control the building's equipment may not pay the energy bills, so have a lower incentive to implement efficiency projects.

Table 4-22. Respondent Company's Role at Facility

	Program Type			
	MTP	Solar	SOP	Statewide Total
Company owns and occupies this facility	83.7%	81.8%	72.9%	79.3%
Company owns this facility but it is leased to someone else	7.1%	9.1%	3.1%	5.6%
Company leases this facility	9.2%	9.1%	17.1%	12.3%
Company manages the facility	0.0%	.0%	7.0%	2.8%
Respondents (n)	184	11	129	324

Source: Question F2, 2013 Nonresidential Participant Survey

Note: Totals may not sum to 100 percent due to rounding

4.3.3 Load management key findings

As shown above, the EM&V team completed surveys with 53 single-utility participants and 3 multi-utility participants. The key findings are summarized around program awareness and understanding, satisfaction, curtailment process, firmographics and suggestions for improvement, awareness, and understanding.

Survey results indicate that 64 percent of single-utility respondents learned about the program through a third-party such as an aggregator or an ESCO. And, according to aggregators, the services that they provide are important in spreading program awareness and educating customers on load management programs.

All of the single-utility respondents expressed some level of familiarity with load management programs, and 60 percent said that they were *very familiar* with the programs offered.

However, respondents were less knowledgeable in their understanding of other program details. Specifically, a portion of respondents said they were *not at all familiar* with calculation of incentives (13 percent), determination of baselines (17 percent), and curtailment verification methods (27 percent). Not surprisingly, when asked what aspects of the program merit more education, several single-utility customers indicated that they would like to learn more about the calculations that determine incentives and baseline load.

The three multi-utility customers that responded to the survey, on the other hand, indicated that they were *very familiar* with all aspects of the program. Multi-utility customers, such as a school district mentioned earlier, demonstrated a greater understanding of how baselines and incentives were calculated and did not seek out more education pertaining to these issues.

In most cases customers reported that either utility staff or a third-party aggregator initiated contact and explained the nature of the program. Almost all of these customers indicated that the assistance of utility staff or third-party aggregators was either *somewhat helpful* or *very helpful*.

The survey sought to compare how the experience of self-sponsored customers compared to that of aggregator-sponsored customers, but identified only a few minor differences. For example, aggregator-sponsored customers were more likely to have received assistance with determining curtailment strategies than were self-sponsored customers (91 percent and 75 percent, respectively).

Additionally, all of the self-sponsored single-utility respondents indicated that they intended to continue participation in the following summer, with 27 percent having already signed up. Aggregator-sponsored single-utility respondents were less likely to have reported continuing participation and only 9 percent reported having signed up. The 9 percent of aggregator-sponsored single-utility customers who did not intend to continue participation cited objections such as "*It destroys production*," and "*There is poor reception at the location, so we are not able to commit.*"

All three of the multi-utility customers indicated that they intended to participate in the next season. Aggregators also expected most, if not all, of their 2013 customers to return to the program for the 2014 season.[25]

A. Satisfaction

In general, customers were pleased with the program. Single-utility respondents reported an averaged satisfaction score of 8.7, on a 10-point scale. One customer applauded the program and stated that "*utility staff members were always available to answer our questions and walk us through the process.*" While complaints were few, one dissatisfied customer indicated that participation "*destroyed manufacturing, and caused us to lose more money in lost production than whatever we gained*."

The three multi-utility participants reported a slightly lower satisfaction score. These customers also provided a unique perspective in that they typically participate in programs offered by different utilities. One customer compared two programs offered by different

[25] One aggregator expected only half of its customers to return in 2014 due to the implications of recent environmental policy (RICE-NESHAP) on on-site electricity generation.

utilities in saying, "*I'm extremely satisfied with one utility because they call me to remind me that the application is due, so it feels like they value me as a customer in the program. For the other utility program, it feels like there's more customer demand for the program than there are spots for participants, so you have to apply at just the right time in order to be accepted.*"

As a result of participation, 60 percent of single-utility respondents have recommended the program to others. Such recommendations were reported among retirement villages, offices, and school districts, whereas national and regional chains stated that it was against corporate policy to share recommendations with their competition.

B. Curtailment process

The amount of curtailable load reported by customer and aggregator respondents varied greatly and ranged anywhere from 10 percent to 100 percent of peak load. The customers who were able to curtail the most load were often those with the ability to switch over to back-up generation. Other customers, such as manufacturers, pipeline operators, and facilities that only curtail HVAC loads (e.g., retail stores, schools) were typically only able to reduce load by a small amount.

While 55 percent of single-utility respondents indicated that demand reductions were manually operated, others indicated that such reductions were either fully automated (19 percent) or partially automated (26 percent). For aggregator-sponsored customers, automation capabilities varied depending on the services offered by the aggregator. Most of the aggregators interviewed reported that they offered some form of hardware or software enabling the remote monitoring and control of customer load.

The majority of single-utility respondents (83 percent) experienced one to three curtailment events occurring during the season. Almost half of respondents (49 percent) reported that the number of events was fewer than expected, and 43 percent of respondents indicated that the number of events met expectations.

One aggregator said that customer expectations could be better managed if the reasons for events called at the utility's discretion were more clearly stated in the program manual. Another aggregator intended to instruct customers to expect more events in future seasons, as "*the economy picks up and more coal units are shut down.*"

Customer surveys (as well as aggregator interviews) indicated that the most common means of event notification were phone calls, text messages, and emails sent from the utility or aggregator. The majority of respondents indicated that the notification process was "*very effective*." The length of the dispatch notification period varied by program, as some programs have longer periods of 60 minutes (Oncor, AEP), while other programs have shorter periods of 30 minutes (CenterPoint, TNMP). At least one customer indicated a preference for programs with a longer notification period. This preference was reiterated among a few other customers, one of which stated, "*The manual shut down timeline is very hard to meet, especially because we have so few people spread among several facilities.*"

Few respondents (8 percent) reported not responding to curtailment events, but those who did cited "*system issues*" or the "*inability to respond in time*" as barriers. Just over a quarter of customers (29 percent) said they experienced negative impacts as a result of curtailment. The two most commonly reported issues were discomfort and loss of production.

One self-sponsored customer also indicated that long curtailment events limited their desire for participation. According to the customer, "*We would like to be able to pick our hours of participation, as we don't want to be in a 4-hour or 6-hour curtailment event due to the hot environment and our inability to cut HVAC for long periods of time.*" The customer perceived two-hour curtailment events as more convenient because they allow better business management and the minimization of risk. Several other customers raised similar concerns about long curtailment events and expressed a preference for events of two hours in duration.

C. Firmographics

The sample of single-utility customers was composed of accounts from various businesses, such as manufacturing (21 percent of sponsored respondents[26]), education (13 percent), warehousing (11 percent), wastewater (11 percent) and to a lesser degree, health care, cotton processing, food sales, lodging, nursing, offices, and public safety. The multi-utility participant group was composed of a big-box retail chain, a grocery chain, and a school district.

Most single-utility respondents surveyed operate modern facilities, as 53 percent operated a facility that was built after 1990. Customer buildings varied greatly in size, as 34 percent of respondent facilities were larger than 100,000 square feet, and 30 percent of respondent facilities were smaller than 1,500 square feet.

Approximately one-quarter of single-utility respondents (26 percent) reported undergoing organizational changes in the past year, such as recommissioning, adding floor area, renovating, and implementing energy efficiency protocols. More than half (58 percent) of single-utility respondents indicated that their operation schedule varied according to the season or production cycle. Respondents identified operational changes such as running HVAC equipment in response to extreme summer temperatures and running equipment to meet agricultural or manufacturing cycles. A school district also reported baseline issues stemming from summer school ending in the middle of the summer peak demand period, and suggested the implementation of a more conservative baseline methodology.

D. Suggestions for improvement

Participants were asked for suggestions on how to improve the program. Their comments are summarized below. These suggestions reflect the statements made by participants and are not necessarily recommended by the EM&V team.

More advanced notification. When asked about the aspects of the program that should be changed, more advanced notification was the most common request, particularly among customers with manually controlled demand response. Customers also expressed a preference for notification periods of at least one to two hours in advance of an event and some found 30-minute notification periods to be inconvenient. Agricultural customers asked for even more advanced notification, as they cited their ability to "pre-water" crops up to a day in advance.

[26] The percentage of respondents provided in this memo reflects only the percentage of single-utility participants (self-sponsored and aggregator-sponsored) surveyed. The sample of multi-utility customers and aggregators is not large enough to merit descriptions in terms of percentages.

Shorter curtailment events. Curtailment events may last up to four hours in duration. Customer responses indicated that participation in a curtailment event becomes burdensome after the second hour of participation. This sentiment was most common among schools, and retail/grocery stores, who reported discomfort upon shutting down HVAC load during the hottest part of the day, and the resulting accumulation of heat after two hours.

4.4 MARKET ACTOR RESULTS

4.4.1 Overview

The EM&V team completed market actor surveys for all programs in February and March 2014. Throughout the interviews the EM&V team also captured process-related information provided by these market actors, such as:

- Experience working with the utilities
- 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.

The EM&V team obtained the market actor sample from program year PY2013 program tracking databases, utilities, and/or implementation contractors.

This section highlights key findings identified from interviews with market actors that participate in the CSOP, CMTP, Solar PV and Load Management programs. Note that the results documented within this section are qualitative and may not be representative of the entire population of interest.

4.4.2 CSOP

The EM&V team completed a total of 56 unique market actor interviews for the CSOP.

A. Overarching key findings for the CSOP

The EM&V team spoke with a mix of market actors. The organizations that were interviewed varied in size based on the number of people they employ in Texas. About half of the respondents reported having fewer than ten employees in Texas. The highest number of Texas employees reported was 10,000.

As expected, the two most common products or services sold by these companies were lighting (56/65 respondents) and HVAC (27/65 respondents). Nineteen out of 65 respondents said that they sell equipment and services to customers across multiple service territories. The interviews probed the respondents on differences in program requirements, satisfaction, etc., by utility. Other than a few variations in program satisfaction, the respondents did not report substantial differences between any of the utilities' programs when compared to the others.

The majority of market actors said they were satisfied with the program; however, the amount of paperwork required by the program received the lowest satisfaction of all areas discussed

in the interviews. For example, the application process was described as, "tedious," "cumbersome," and "not worth the time." Another area that had relatively higher rates of reported dissatisfaction was the clarity of the program manual/documentation.

According to market actors, the most prevalent barrier to customers' investment in improved energy efficiency is the upfront cost of the equipment followed by the perception that customers do not believe that the savings will justify the higher cost of energy efficient equipment. These findings indicate opportunities for customer education and training on energy efficiency, from either the market actor or program itself.

Market actors reported that they notify their customers of the incentive and either pass the rebate onto them directly or lower the cost of the project. Only a few (eight) respondents reported that they keep a percentage of the rebate money to compensate for the amount of time they spend completing the application process.

B. Program influence

The majority of market actors interviewed said the program is important in influencing their decision to offer upgraded energy efficiency upgrades to their customers. They also indicated that they would not be as likely to sell program-qualifying equipment to customers if the CSOP had not been available. Over 40 respondents mentioned that they have some customers who would have installed the upgraded equipment regardless of the program but that the rebate made these projects easier to sell since it decreased the payback period, making the project more financially justifiable.

Respondents were asked about the importance of various program offerings in their decisions to recommend equipment upgrades. The most important factors, according to respondents, were the program incentive and their firm's past participation in a rebate or audit program. Thirty-one of the respondents specifically mentioned that the incentive makes projects feasible since it lowers projects' upfront costs, lowers payback periods, and increases customers' return on investment; therefore, the rebate offering makes it more attractive to customers who are looking for a better deal on their projects.

C. CSOP influence on projects outside of the program

Twenty respondents installed projects outside of the program. The reasons for installing projects outside the CSOP included the length of the application process (7/20), not wanting the hassle of submitting an application (3/20), and projects were located outside of the service territories of the utilities that offer the CSOP (3/20).

4.4.3 CMTP

The EM&V team interviewed a sample of EESPs that participated in the following programs: Commercial Solutions, SCORE/CitySmart/Government/Educational, Small Commercial Solutions, Retro-commissioning, CoolSaver A/C Tune-up, and A/C Distributor.

In general, EESPs are satisfied with most aspects of the programs. The most frequently mentioned area that rated lowest in satisfaction is the incentive level, which is a common area of concern for most contractors that participate in energy efficiency programs. The second most frequently noted area of dissatisfaction is the complexity of the program (such as in

SCORE/CitySmart/Government/Education) and/or amount of paperwork required to be completed.

With the exception of the Small Commercial Solutions programs, EESPs have been participating in Texas programs for a considerable period of time (many between five and ten years or over ten years). Not surprisingly, they characterized the upfront investment as the most prevalent barrier to energy efficiency for customers. The incentive provides them with a means to overcome that upfront barrier. They generally attribute customers' decision to install high-efficiency equipment to the program offerings.

The following sub-sections further summarizes the EESP market actor interview results.

A. Commercial Solutions

The EM&V team completed a total of 15 unique market actor interviews for the Commercial Solutions program.

Overall, EESPs that we spoke with were reasonably satisfied with the program(s) they work with. EESPs were asked to rate their level of satisfaction with various elements of the program (very satisfied, satisfied, somewhat satisfied, and not satisfied). Most EESPs said they were very satisfied or satisfied with the areas discussed.

Nearly all EESPs the EM&V team spoke with said they always inform their customers that the service and/or equipment improvements are being incentivized through the utility-sponsored Commercial Solutions program. Most EESPs said they pass the incentive directly onto the customer while others leverage the incentive to mark down the price of their service. Whether their customers were aware of the program was mixed by EESP interviewed.

EESPs agree that costs influence their customers' *investments* in improved energy efficiency: nine stated that the most prevalent barrier to customers' investment in improved energy is lack of investment capital. Other barriers identified included: savings won't justify the higher cost of energy efficient equipment, the customers' lack of knowledge, and the customers' lack of resources to dedicate time and focus to the projects.

While the MTP offers technical assistance and some EESPs feel the program is straight forward, there are still a number of EESPs that indicated that not only do their customers but they themselves feel the programs could be made simpler.

"Customers of ours historically are understaffed in the first place. The last thing they have is adequate staff and/or time to dedicate current resources to try to figure out the overwhelming complexity of these programs." – Commercial Solutions EESP

A portion of those interviewed said they participate in various types of training offered by the utility and/or the implementation contractor. This training is typically in the form a kick-off meeting which provides information on any changes taking place in the new program year. However, many respondents had no response and indicated there was either no training or did not participate. Most of these respondents also noted that the implementer "does it all" indicating there is not necessarily a need for such training.

Most EESPs indicated they are either satisfied or very satisfied with the clarity of program requirements (eligibility requirements, program participation instructions, and program

manual/documentation), the amount of incentive offered for participation, and the amount of paperwork that must be completed for each project.

When asked for opportunities for improvement, the EESPs provided the following suggestions with respect to the current program requirements:

> *"I think they could definitely streamline the application process a little bit, and it would probably make people more encouraged to apply and move forward with the program."* – Commercial Solutions EESP
>
> *"The only one would be to rewrite their software for their mobile"* – Commercial Solutions EESP
>
> *"There was some difficulty in trying to calculate what the energy savings would be or trying to figure out what the rebate would be if we went from packaged equipment to chilled water or vice versa."* – Commercial Solutions EESP
>
> *"I just think make them simpler."* – Commercial Solutions EESP
>
> *"Add more contractor direct incentive measures and/or programs."* – Commercial Solutions EESP
>
> *"Maybe a little more education - some offering to us for working through their software."* – Commercial Solutions EESP
>
> *"More program marketing to commercial customers."* – Commercial Solutions EESP
>
> *One interviewee thought the program had already put in place process improvements.*
>
> *"The program in 2014 has already been streamlined from what it was; I've already seen improvement in it."* – Commercial Solutions EESP

A portion of the respondents said that the programs have changed how they specify equipment and in particular the efficiency levels of equipment. As the types of technologies and efficiency levels change over time, this education at the design level will also need to be reinforced. One respondent mentioned how the programs are helpful in getting customer buy in for what they are trying to teach their customers.

B. SCORE/CitySmart/ Government/Education

The EM&V team completed a total of 11 unique market actor interviews for the SCORE/CitySmart/Government/Education programs. Organizations included in the study vary by number of projects they complete through the program (one to 50) as well as type of end-uses they support (lighting or HVAC only to fully comprehensive and custom measures).

The majority of EESPs interviewed have been working through the Texas programs for five or more years and many of the EESPs operate across multiple territories. The interviews probed these EESPs on differences in program requirements, satisfaction, etc. by utility. The EESPs collectively identified three differences among the various utilities for this program—inconsistency of program incentives, variation of pre- and post-inspection timeframes, and benefits and challenges working with an implementer based program versus directly with a utility.

Overall, EESPs interviewed were reasonably satisfied with the program(s) they work with. The responses to questions/concerns raised and the amount of incentive offered received the lowest satisfaction of all categories. A number of EESPs mentioned that the programs are complicated and would like to see them made more straightforward. More consistency of incentives levels, inspection timeframes, and answers to program questions were also identified as major differences between programs.

EESPs stated that the most prevalent barrier to customers' investment in improved energy efficiency is lack of investment capital. Other barriers identified included: savings won't justify the higher cost of energy efficient equipment, the customers' lack of knowledge, and the customers' lack of resources to dedicate time and focus to understanding the energy savings and benefits. The EESPs indicate that not only do their customers but they themselves feel the programs are complicated.

Most EESPs are satisfied with the support they receive from the utilities. Most respondents also said they are participating in various types of training offered by the utility and/or the implementation contractor and this training is typically in the form of a kick-off.

Most EESPs indicated they are also satisfied with the clarity of program requirements (eligibility requirements, program participation instructions, and program manual/documentation), the amount of incentive offered for participation, and the amount of paperwork that must be completed for each project. There does seem to be a difference in perspectives with regard to the level of complexity with dealing with the incentive programs, though, based on the size of customer served. For example, one EESP indicated a difference in larger versus small types of projects and how that impacts their relationship with the incentive programs.

"Sometimes I think it just depends on the total cost of the project, perhaps customers don't always see the value in the time it takes to do some of it. Once you get into projects that are over $1 million, it's always worth the time, and usually the customers want to make sure it's done." – SCORE/CitySmart/Government/ Education EESP

The EM&V team asked respondents a series of questions related to training and technical assistance, and their relative importance in the EESP's recommendations of measures. Ratings for technical support provided by the utilities and information provided by the utility websites had the lowest ratings with a significant portion of respondents identifying them as either not at all important or just moderate in importance. The importance of training seminars provided by the utilities received mostly moderate importance with an average score of 5.0. Additionally, EESPs provided almost no other comments for this series of questions, indicating few, if any issues, related to training and technical assistance for the programs.

When asked what they think the biggest challenges are for participation in the program, EESPs provided various comments but most of the responses focused on the value proposition for the EESP and end use participant as described above. Additionally, EESPs we spoke to note the perception that participants do not fully recognize the value of the energy efficiency investments. Energy education is needed to change this perception and increase demand for energy efficiency improvements.

In addition, over half the respondents said that the programs have changed how they specify equipment and in particular the efficiency levels of equipment. As the types of technologies

and efficiency levels change over time, this education at the design level will also need to be reinforced.

C. Small Commercial Solutions

The EM&V team completed a total of six market actor interviews for the Small Commercial Solutions program. Organizations included in the study vary by number of projects they complete through the program (one to 92) as well as type of end-uses they support (typically solely lighting or HVAC measures).

Half the EESPs interviewed have been working through the Texas programs since they began. The other half of the EESPs are recently new to the programs in the last two years. Respondents indicated they heard about the program either through the utility (2/6), implementer (1/6) or other vendors familiar with the program (3/6).

Overall, EESPs that we spoke with were satisfied with the program(s) they work with. The only items to receive "somewhat satisfied" rankings were the responses to the amount of incentive offered and the amount of paperwork required.

Nearly all EESPs the EM&V team spoke with said they always inform their customers that the service and/or equipment improvements are being incentivized through the utility-sponsored Small Commercial Solutions program. EESPs agree that costs influence their customers' *investments* in improved energy efficiency. Five stated that the most prevalent barrier to customers' investment in improved energy efficiency is lack of investment capital and three of these also stated concerns about the upfront expenses. Another EESP indicated that most view the improvements as a "win-win" for all parties; however, since they only offer AC tune-ups through the program, they also mentioned the owner-tenant relationship issue.

Most EESPs indicated they are either satisfied or very satisfied with the clarity of program requirements (eligibility requirements, program participation instructions, and program manual/documentation), responses to any questions or concerns, the amount of incentive offered for participation, and the amount of paperwork that must be completed for each project. Only one EESP indicated they were only somewhat satisfied with the amount of incentive offered and the amount of paperwork involved.

When asked if they have any suggestions on how the utilities could improve their Small Commercial programs, two EESPs indicated increasing the incentive offered. In addition, one respondent said that the programs have changed how they specify equipment. This education at the design level will also need to be reinforced. Another respondent mentioned a potential new measure opportunity.

The EM&V team asked respondents a series of questions related to training and technical assistance, and their relative importance in the EESP's recommendations of Small Commercial program measures. The vast majority of respondents rated all training and technical aspects as important. EESPs provided almost no other comments for this series of questions, indicating few, if any issues, related to training and technical assistance for the Small Commercial programs.

D. RCx

The EM&V team only completed two market actor interviews for the RCx program. Both EESPs interviewed have been working through the Texas utilities' energy efficiency programs for ten years. Both EESPs learned about the RCx programs through experience working on projects and other energy efficiency programs offered by the utility prior to introduction of the RCx program in Texas.

When asked about the barriers to customer participation in the program, one EESP indicated that typically, the project is too small to move through the program. They also provided two other examples of projects that did not move forward through the program—one due to not having a building automation system to monitor results and the other due to the complications between owner-tenant responsibilities of the utility bills. Another EESP identified financials and lack of dedicated resources as barriers to participation.

> *"In addition, the customers are required to have a dedicated person participate. This person usually wears lots of hats for the organization and getting their focus can be challenging for many projects."* – RCx EESP

When asked if they have any suggestions on how the utilities could improve their RCx programs, one EESP indicated new contract issues for the RCx Agents for 2014, but that these are still being worked out. Another EESP who works across two service territories said that they have been doing a good job streamlining the programs already and that there are no major differences yet that they've seen between the two utilities that offer the RCx programs at this time.

E. CoolSaver A/C Tune-up (Commercial and Residential)

The EM&V team completed five market actor interviews for the CoolSaver A/C Tune-up program. The CoolSaver programs are designed to help eligible customers increase the performance of their air conditioning and heat pump systems. Program staff works with local air conditioning distributor networks to offer training to contractors on the air conditioning tune-up and air flow correction services and protocols and pay incentives to contractors, resulting in discounts to their customers for the successful implementation of air conditioning tune-up and air flow correction services.

The EM&V team spoke with a mix of EESPs that work across both of the utilities that offer the CoolSaver programs in Texas. Organizations included in the study vary by number of completed projects annually (30 to almost 1,000), and three EESPs completed tune-ups for both the residential and commercial sectors of AEP TCC's program. Organizations vary with regard to the number of employees in Texas as well (from one to 2,500). Three of the five EESPs interviewed started participating in the CoolSaver programs in 2013, one has been in the program since 2012, and the other one since 2011.

EESPs said they were very satisfied or satisfied with all but one of the areas discussed. The item that received a "somewhat satisfied" ranking was the amount of paperwork required. This type of rating for paperwork requirements from EESPs is not uncommon in other similar types of programs across the country, as it is often the case that contractors say program reporting requirements are time consuming.

Four EESPs said they leverage the incentive to mark down the price of their service, and one EESP said they pass the incentive directly on to the customer. EESPs agree that costs influence their customers' investments in improved energy efficiency: four EESPs said that lack of investment capital is a primary barrier, one said concerns over disruption of operations during measure installation is a barrier, and one said just general awareness of the value of energy efficiency is a barrier.

F. A/C Distributor (Commercial and Residential)

The EM&V team completed a total of 16[27] market actor interviews for the A/C Distributor program.

Incentives are paid to A/C distributors who promote and facilitate the installation of high efficiency air conditioning equipment. The EM&V team spoke with a mix of distributors that work across all of the A/C Distributor programs in Texas. Organizations included in the study vary by number of completed projects annually (five to almost 500), and only one distributor we spoke with completed projects across both the residential and commercial sectors. Organizations vary with regard to the number of employees in Texas as well (from 50 to 4,000).

While distributors mentioned that their companies encourage sales of high efficiency equipment—some through "spiffs" to installing contractors and others through financing programs—they also reported that the available incentives through the A/C Distributor program positively affected 2013 company sales of high efficiency equipment, though at varying levels.

> *"We are always going to push the higher efficiency equipment, but the incentive offers us another tool to help us sell this equipment."* – A/C Distributor
>
> *"We have structured our entire business model around these types of programs; working to sell energy efficiency equipment and products. Our goal is to really drive sales of more energy efficient equipment."* – A/C Distributor

The key program element that seemed to affect utility satisfaction ratings was the amount of time it took for participating distributors to receive their incentive checks; those utility programs where this process was more expedited received better satisfaction scores than those utility programs where this process took longer. In some cases, the EM&V team was told this process took months.

The majority (12/15) of distributors said they always inform their customers that the product is being incentivized through the utility-sponsored A/C Distributor program. Nine distributors said they pass the incentive directly onto the customer (e.g., installing contractor), and one distributor said they leverage the incentive to mark down the price of the equipment. Other distributors do not pass the full amount of the incentives along to the EESPs.

[27] Not all distributors the EM&V team spoke with answered all of the questions. Additionally, in some cases satisfaction scores and/or importance varied by utility; because some of the distributors work across multiple utilities, responses may add to more than 16.

Regarding the different barriers to customers' participation in the program, four distributors mentioned that the incentive process is too much hassle. Others mentioned lack of awareness, both from the EESP and end use customer perspectives.

> *"Contractor knowledge; some of them just aren't aware of the program because we have limited funds and haven't educated them all."* – A/C Distributor

4.4.4 Solar PV (Commercial and Residential)

The EM&V team completed nine market actor interviews for the Solar PV Programs. The market actors were randomly sampled from the population of projects and include project sponsors (service providers) who applied for AEP TCC's and Oncor's residential and non-residential programs and AEP TNC's residential program.

Organizations included in the study vary in size based on the number of people they employ in Texas (from two to 100) and the services and products that they sell in Texas. Five respondents reported that they sell solar PV technology exclusively, while the remaining four respondents sell other technology including HVAC, lighting, etc.

The majority of market actors interviewed started selling solar PV equipment and services through the Texas Solar PV Programs in 2013. The market actors reported a variety of ways in which they first heard about the program, including through customers, a discussion with utility staff/program representatives, word of mouth, and training at school.

Respondents were generally satisfied with the Solar PV program. The amount of incentive offered received the lowest satisfaction of all categories. Four of the market actors reported that the overall program rebate funds ran out very quickly, which forced customers to either wait until the following year to apply for a rebate or cancel their projects altogether. Without an incentive, the equipment is often cost-prohibitive or does not meet payback requirements for many customers, particularly residential customers. For this reason, many of the market actors suggested that the utilities increase their programs' budgets to reach more customers, and thereby capture more potential energy savings in the market.

Most market actors were generally satisfied with the program manual and online resources but many mentioned that these resources could be updated to be more user-friendly. Some respondents said that the program manuals lack clarity and should have a better description of the program requirements. A couple of market actors also expressed dissatisfaction about how new construction projects are only program-eligible once a permanent meter is installed. Some customers would like to include the cost of the solar PV installation into their home loan and/or install the equipment during the same time period as the rest of the construction on site, but are currently unable to because they have to wait until a permanent meter is installed to apply to the Solar PV SOP. Utilities are already taking steps to remedy this barrier to including solar PV with new home construction in PY2014.

Many market actors mentioned that it would be difficult for them to sell solar PV projects at full price because high upfront cost is the largest barrier to customer investments in solar technology. Therefore, the participating market actors use the rebate offering to help carve out a more competitive position in the solar market. The majority of market actors use the rebate to mark down the price of the project while the remaining project sponsors send the incentives directly to their customer. When asked about potential barriers for participating in the program in general, the majority of market actors said there were no other barriers to

program participation assuming customers can afford the upfront cost of their solar project. Given this information, it is not surprising that the area rated lowest for satisfaction is the amount of incentive offered by the utility. Most respondents said that their business is dependent on the rebate and that they could reach more customers if the rebate budget was increased.

All project sponsors ranked the importance of the program in influencing their decision to recommend solar PV as important or very important[28], and the majority reported that the likelihood of selling the same equipment without the rebate offering would be low. The majority of respondents said that if the program had not been available, then 15 percent or less of their projects would have been installed with the same equipment. This indicates that the program largely influenced customers' decisions about installing solar.

When asked to rank the level of influence several factors had on their decision to recommend solar PV technology, market actors ranked the program incentive highest overall. The majority of market actors ranked the other factors, including technical support, information provided by the utilities, information provided by the utility website, and their firm's past participation in a rebate program, as being important or very important[29] in their decision to recommend the program to customers. Many respondents said that they did not take advantage of the training seminars, and while the seminars may have been helpful in completing the paperwork or navigating the online resources, they did not find them particularly influential in their decision to recommend solar PV technology.

4.4.5 Load management

The EM&V team completed surveys with eight aggregators. Aggregators interviewed represented a range of customers that included health care, manufacturing, school districts, data centers, manufacturers, food service, cold storage, offices, national chains, and agricultural customers.

A. Program awareness and understanding

All of the aggregators interviewed believed their customers were *somewhat familiar* or *very familiar* with these programs, but described customer awareness as varying among two principal customer types—customers with sophisticated understanding of demand response and customers with a rudimentary understanding of demand response. According to aggregators, customers in the former group make up approximately one-third of their customer base and have likely participated in load management on other occasions. These customers are typically large commercial end users with a history of monitoring their own energy usage. Customers in the latter group are reported to have little knowledge of load

[28] Respondents were asked to rank the importance of the program in influencing their decision to recommend solar PV technology to their customer on a 0 to 10 scale where 0 is "not at all important" and 10 is "very important." All respondents ranked the program as a seven or greater.

[29] Respondents were asked to rank the importance of several program services in influencing their decision to recommend solar PV technology to their customer on a 0 to 10 scale where 0 is "not at all important" and 10 is "very important." Technical support, information provided by the utilities, and information provided by the utility website were all ranked seven or above by the majority of respondents.

management prior to program participation and are typically customers in the small C&I market, specifically restaurants and hotels.

Aggregators also played a role in educating customers on the calculation of incentives and baseline demand profiles. Aggregators cited differences among customers in that there are some customers who want to be familiar with the baseline and incentive calculations and those who do not. On the other hand, some aggregators felt it was their job to educate customers. One aggregator stated that recent revisions to the baseline calculations used in some programs has made participation more onerous for customers, thus making the involvement of aggregators even more important.

Aggregators also reported some confusion among customers regarding the utility load management programs and Emergency Response Service (ERS) offered by the Electric Reliability Council of Texas (ERCOT).[30] One aggregator reported promoting both programs simultaneously: "*We educate customers on a holistic demand response approach, so we make participation easy for them by making ERS and utility load management programs sound similar, but customers could use some education on how these programs are different.*"

Beyond the confusion stemming from the simultaneous promotion of these programs, there is also potential for "double-dipping." (Note that ERCOT checks to ensure that does not happen when they receive bids, although the energy efficiency rule does allow customers to sign up for multiple programs if the contract times differ.) Aggregators also expressed concern that load management programs might syphon participation from the ERCOT ERS program, as they both compete for load reduction during afternoon hours.

Some aggregators perceived load management programs to be somewhat undervalued in the current political environment. One aggregator said, "*It seems that energy efficiency programs are prioritized over load management programs, but they should be treated equally because our customers are under contract for multiple years, and will continue to come back to these programs.*" One multi-utility customer requested greater exposure of load management programs and said, "*We would like to see these programs have a bigger footprint and be spread across Texas, rather than just be limited to a few utility territories.*"

B. The curtailment process

One aggregator said that customer expectations could be better managed if the reasons for events called at the utility's discretion were more clearly stated in the program manual. Another aggregator intended to instruct customers to expect more events in future seasons, as "*the economy picks up and more coal units are shut down.*"

The observations of aggregators regarding notification periods varied. While one aggregator indicated that a 30-minute notification period was a sufficient amount of time for customers to respond, another aggregator stated that customers would be able to curtail more if they had more time to prepare for an event.

[30] The EM&V team also observed that during the course of discussions with customers, there was some confusion between utility load management programs and ERCOT ERS.

C. Customer satisfaction

In general, aggregators said that customers seemed pleased with the program and reported that customers perceived the programs as being fair because incentives are paid according to performance. On the other hand, some aggregators indicated that customers would have reaped more benefits if several of the utilities had called more events.

Another aggregator was pleased with the utility programs, and said that "*The programs do an excellent job communicating and reconciling payment,*" but indicated that one utility is "*trailing far behind in satisfaction because their reconciliation and algorithms are more difficult to understand.*" As a result, the aggregator received "*numerous*" complaints from customers. Another aggregator added the caveat that customers' perception of utility load management programs was also influenced by their experiences with ERCOT ERS.

D. Aggregator suggestions for improvement

Aggregators were asked for suggestions on how to improve the program. Their comments are summarized below. These suggestions reflect the statements made by participants and aggregators and are not necessarily recommended by the EM&V team.

Standardization of load management programs. Some aggregators asked for more standardization across utility load management programs for marketing purposes. Standardization may include notification times (e.g., 30 minutes versus an hour), compensation, and baselines. One aggregator stated, "*It would be convenient if aggregators could offer a more consolidated product across all of Texas, or at least the metro areas.*" As discussed earlier in this memo, utilities are discussing standardization of baseline calculations with the EM&V team for possible future incorporation into the TRM. Doing so will be a step toward standardization.

Relieve enrollment bottlenecks. Several aggregators expressed frustration with the "*first come, first serve*" model of enrollment utilized by some utilities, and cited the inability to register customers and nominated demand due to customer demand outstripping the program's supply. Aggregators reported that one of the utility programs was fully subscribed within the first minute of enrollment. One aggregator stated, "*It's difficult to align all our customers at once and register them, so it's defeating when we aren't able to enter all of our resources because another aggregator clicked the mouse a few moments before us.*" Due to these limits, aggregators indicated that they have little incentive to increase the scope of their outreach efforts. Aggregators asked that utilities seek to increase their load management budget and procure more load for the programs. Respondents also cited a desire for a simpler enrollment process.

Lower eligibility threshold. One aggregator felt that the minimum kW threshold of curtailable load for participation was too high and acted as a barrier to participation. The aggregator observed this circumstance among box store retailers with multiple accounts, who are able to curtail 100 kW of their peak demand of 300 kW, but are ineligible for not meeting the threshold. The aggregator reported that this was especially an issue in the AEP program, which requires a minimum load of 500 kW. This aggregator also expressed disappointment with several utilities that no longer accept small-load end users into their respective programs. As a result of these limitations, the aggregator expects these customers to migrate to ERCOT ERS.

4.5 RECOMMENDATIONS

Below we provide a number of recommendations for the commercial programs in regards to improving savings estimates, identifying measures that are good candidates for deemed savings, maximizing net savings, and opportunities for process improvements.

4.5.1 Improving saving estimates

We first provide options for improving savings estimates for CSOP and CMTP, followed by Solar PV and Load Management programs.

A. CSOP and CMTP

The EM&V team identified opportunities for improving savings estimates within two measure categories—lighting and HVAC. The items identified below apply to both CSOP and CMTP programs.

1) **LED lighting qualification requirements.** The EM&V team that found several LED lighting fixtures and lamps were not meeting the qualification requirements. PUCT Docket 38023 requires that all non-residential LED fixture and lamp products are pre-qualified under either Energy Star® or NEEP Design Light Consortium's Qualified Products Listings. The new LED fixtures and lamps installed as part of the commercial energy efficiency programs should provide proof of certification (specification sheet from the qualifying certification agency) to confirm the eligibility of the LED fixtures and lamps.

2) **Lighting projects with mixed building types**. The EM&V team identified use of multiple building type selections within the same lighting calculator (e.g., Office and Warehouse). A more detailed explanation for appropriate building type selection may be necessary. Use of the stipulated building hours of use and coincidence factors are for whole building use. This means that only one predominant building type should be selected that best represents the building type area for where the retrofit or new construction lighting project is taking place. The stipulated whole-building HOU (hours of use) are designed to accommodate the variation in activity areas and corresponding deviations in HOU for those activity areas. However, allowing multiple building types to be specified within any single calculator allows for unintended variations in HOU to be assigned for any given building type. EM&V team recommends that projects with multiple building type selections should be claimed as Custom projects since HOU are not stipulated by the predominant building type.

3) **Outdoor lighting retrofit projects.** In 2013, winter peak demand energy savings for outdoor lighting was approved for use. The EM&V team identified inconsistent use and application for the "Outdoor" building type code and winter coincidence factor demand. A more detailed explanation for when its use is appropriate may be necessary to improve this consistency. Use of the "Outdoor" building type and Winter coincidence factor should only be used for lighting projects that follow these specifications:
    a. Only retrofitted outdoor lighting fixtures that operate separate from any building operations such as outdoor street and parking lot lighting are eligible.

b. Outdoor lighting fixtures that operate dusk to dawn. Those which turn off during the night are not eligible for this deemed savings building type.

c. New construction outdoor lighting should be calculated with a separate calculator (e.g., LSF) from indoor lighting because the required areas are different.

4) **Lighting M&V methods.** The M&V method to calculate lighting hours of use (HOU) and coincidence factors (CF) seems to attempt to capture lighting that is grouped into similar activity areas. Very often, however, the HOU recorded by those loggers were found to vary greatly from logger to logger within the same activity area. A simple average of logger hours, instead of weighted average, is used across the activity area, which does not account for the variation in HOU from logger to logger. The issue with a simple average is that a logger representing a smaller number of lamps with a significantly different usage pattern will provide the same weight to the total HOU for the activity area. There are two ways that this method may be improved:

   a. Breaking out the activity areas into better-defined areas that are more representative of the differences in HOU. This will result in the use of more activity areas within the savings calculator and ensure better estimation of operating hours.

   b. Providing a weighted average for the HOU, that is weighted by the number of fixtures that are represented by the logger. These can either be on the same circuit as the logger, or possibly reported by the customer to turn on and off at the same time as the logged circuit. To do this, the fixture count that is represented by that logger needs to be recorded.

   EM&V team recommends that one of these methods be utilized across all utilities that implement M&V for their lighting programs. This will provide a standardized requirement for calculating the lighting HOU for non-deemed projects.

5) **Use of part-load efficiencies for HVAC energy savings calculations.** Full-load efficiencies from HVAC equipment are used to determine energy savings in the current HVAC calculators. A review of the savings algorithms used in the TRMs from other states shows that many jurisdictions are moving away from the use of full-load efficiencies towards part-load efficiencies to estimate HVAC savings. Also, standards organizations like International Energy Code Council (IECC) 2012 and ASHRAE 90.1-2010, provide part-load efficiency standards as minimum requirements for new Unitary Air Conditioners and Heat Pumps greater than 65 kBtuh, and for all sizes of chillers. EM&V recommends that the program administrators should consider the use of part-load efficiencies (e.g., IEER and IPLV) for accurate HVAC energy savings estimates and to ensure Texas TRM HVAC energy savings calculation methods are consistent with the standard calculation methods used in TRMs from other states.

6) **Primary versus secondary school HVAC projects.** The EM&V team identified use of secondary building type selections with the CalcSmart HVAC calculator for primary schools that contain larger capacity HVAC equipment (likely due to the building size and cooling requirements as compared to the smaller more traditional primary schools). These findings were not changed during the evaluation as not enough detail about the schools' size (e.g., student population and number of stories) was available. The HVAC calculators distinguish between different school types (i.e., primary, secondary, and college); however, the calculators do not distinguish between schools

that do and do not operate in the summer (similar to lighting calculators). Further research is necessary to determine if the building type categories may need adjustment and realignment with those found in the Texas school building population (i.e., Texas schools may have a larger amount of building area such as air conditioning gyms and other ancillary, but large spaces that are air conditioned compared to schools from other states). The EM&V team plans to oversample for HVAC measures in 2014 to provide more sample points to continue analysis in this area.

B. Solar PV

The approved deemed savings factors provide savings that are relatively close to simulations at the statewide level. However, for individual utilities, these statewide factors can over or underestimate simulated, and likely, actual savings. This variation is due largely to the variation in available sunlight throughout the large state of Texas. A few recommendations to improve these estimates are provided below. Recommendations 1–3 largely apply to the current TRM and practices, and recommendation 4 is focused on potential improvements to the TRM and practices in the future.

1. Utilities already collect additional information that is not entered into the tracking database but could be valuable to EM&V efforts. The following parameters are collected as part of the application process. Adding these parameters to the tracking data would allow for more cost-effective verification and simulation (some utilities are already in the process of implementing this change):
   a. PV Array Tilt
   b. PV Array Azimuth
   c. PV Array Capacity
2. For any system using PvWatts to calculate energy and demand savings, use the soon to be released PvWatts V5 to calculate savings. This newer version should better estimate actual system savings. PvWatts V5 will include a “thin film” option for panel type and this should be appropriate to estimate solar shingle savings.
3. Develop deemed savings that replaces the single statewide deemed factors to better represent the variation of solar resource through the state. The most detailed approach is to replace the statewide deemed factors with site-specific PvWatts V5 simulations. These would use the representative TMY3 city weather by climate zone to match savings methodology used for other measures. This is done in some other states.[31] This would, however, increase the complexity of the incentive process and program administrative costs. It is important to balance the additional fidelity gained by using site-specific simulations with the simpler application of deemed factors. Furthermore, the overall healthy prospective realization rates for Solar PV detailed earlier in this section do not indicate that the additional complexity is needed to improve savings estimates. The alternative to site–specific simulations the EM&V team recommends is to develop and use climate zone specific deemed factors.

[31] http://www.csi-epbb.com/.

C. Load management

The EM&V team recommends investigating possible standardization of baseline calculations. Baselines enable utilities, regulators, and grid operators to measure the performance of load management programs. A well-designed baseline benefits all stakeholders by aligning the incentives, actions, and interests of participants, aggregators, utilities, grid operators, and ratepayers. The standardization of baseline calculations would facilitate an "apples-to-apples" comparison of utility load management programs.

The EM&V team has recommended both here and through the TRM process that a baseline methodology study sponsored by the utilities should be conducted to develop a single uniform method. This customer specific baseline methods study should include the examination of day-of adjustments. The study should use all of the current customers from all of the programs. Similar studies have been conducted by other entities in other regions of the United States.[32, 33, 34] The outcome of the study should be a recommended baseline methodology that is the least biased and most accurate of all and should be used by all Texas load management programs. Federal standards in this area are too general and not specific enough. Ideally, this study would be completed to inform updates to TRM 3.0 that would apply to PY2016. There is currently a discussion with the utilities as part of the TRM process to standardize baseline calculations across utility load management programs and therefore incorporation of this recommendation into TRM 3.0 may be feasible.

4.5.2 Measures that are good candidates to use deemed savings

The EM&V team reviewed the current list of measure categories used in Texas to identify those measures that are not deemed that are prevalently installed through the programs and/or were increasingly installed from PY2012 to PY2013. Program manager interviews also identified measures that were newly added or being contemplated for future portfolios. Through this process, two commercial measures were identified as potential candidates for the development of deemed savings methodologies as further described below.

From PY2012 to PY2013, the mix of deemed and custom measures funded through the commercial sector programs remained fairly consistent. On further review of the custom measures, one measure in particular—air conditioning tune-ups (including packaged AC, packaged heat pump, split AC, and split heat pump)—stood out as having a significant increase in both quantity and savings from PY2012 to PY2013. These measures were introduced to eight new commercial programs across four utilities in PY2013, and as a result, the statewide savings for this measure category surged nearly 5 MWh and 2.5 MW. Additionally, in PY2013 a portion of the air conditioning tune-up measure savings were deemed, while the remaining savings were estimated through an M&V process.

[32] *Analysis and Assessment of Baseline Accuracy – Final Report.* Prepared for the ISO-NE, Holyoke, Massachusetts, by KEMA, August 4, 2011.

[33] *PJM Empirical Analysis of Demand Response Baseline Methods.* Prepared for the PJM Markets Implementation Committee, by KEMA, Inc., April 20, 2011.

[34] Coughlin, K., M.A. Piette, C. Goldman, and S. Kiliccote 2008. *Estimating Demand Response Load Impacts: Evaluation of Baseline Load Models for Non-Residential Buildings in California*. Prepared for the California Energy Commission, by Demand Response Research Center, Ernest Orlando Lawrence Berkeley National Laboratory, LBNL-63728 http://drrc.lbl.gov/system/files/63728.pdf.

During PY2012, two commercial programs across two utilities utilized a direct install approach for installing low flow faucet aerators as part of their Score and Commercial Solutions MTP programs measure mix. In total, this measure contributed over 2.5 MWh and 0.8 MW. The largest contributor was for El Paso Electric's Commercial Solutions MTP in PY2012 which recognized nearly 2 MWh and 0.6 MW in low flow aerator savings. This measure was second only to lighting as the largest contributor to the statewide savings for the Commercial Solutions MTP. Unfortunately, neither program claimed any aerator projects in PY2013, but remains a potential significant measure opportunity for the utilities.

The EM&V team recommends considering establishing deemed values for air conditioning tune-ups and low-flow faucet aerators. Most TRMs do include air conditioning tune-up and low-flow faucet aerators as deemed measures.

4.5.3 Maximizing net savings

A. CSOP

For the CSOP, most customers are aware of the utility incentives that are offered and many (31 out of 138 in the survey sample) projects were self-sponsored – i.e., the customer applied for and received the incentives directly from the utility, rather than through an EESP. Based on the customer survey results, the CSOP incentives were clearly a major factor in their purchase decisions.

The CSOP targets most of its marketing, outreach, and education to EESPs with the end goal of encouraging them to promote higher efficiency equipment to customers. The customer surveys clearly show the importance of the EESP recommendation to install the energy efficient equipment. The market actor interviews indicate the CSOP has influenced EESPs to promote energy efficient technologies that they otherwise would not have, both to CSOP participants, as indicated by the free-ridership results, and to a lesser extent non-participants, as indicated by the spillover results.

While the benchmarked results generally affirmed the reasonableness of the Texas CSOP NTG findings, the Texas CSOP results also tend toward the high end of the benchmarked range. This suggests that Texas utilities are successfully maintaining industry standard levels of program attribution for commercial programs. The EM&V team recommends the utilities continue program strategies that support an EESP infrastructure effectively selling energy efficient equipment through financial incentives and providing recommendations and information to customers regarding the energy efficient equipment.

B. CMTP

The benchmarked results generally affirmed the reasonableness of the Texas CMTP NTG findings with the Texas CMTP results trending toward the higher end of the benchmarked range. This suggests that Texas utilities have generally employed strategies to keep program attribution high. For example, implementation contractors appear to be providing an increased level of assistance throughout the participation process and bringing technical expertise to customers and/or market actors, depending on the program's design. Evidence of this is seen in the lower customer free-ridership score for SCORE/CitySmart, which targets education and technical assistance to customers, and the lower market actor free-ridership score for Commercial Solution, which targets assistances to market actors.

There can be difficulty with effectively measuring program attribution with programs such as SCORE/CitySmart and Commercial Solutions due to the multi-year nature of these programs. For these programs, implementation contractors may establish long-term relationships with customers and project lifecycles are often greater than a year. Therefore, we encourage implementation contractors to maintain background documentation, including emails, on correspondence with customers related to the participation process, especially any technical assistance provided. This documentation can support more accurate NTG ratios when case study reviews are done of NTG findings.

While the Small Business 2013 sample was limited to one utility and the NTG for this sector will be investigated more in 2014, the preliminary research for this sector shows high attribution in Texas. This is consistent with other small business NTG findings across the country. Therefore, utilities may want to consider a specific offering targeted to reaching small business customers as a strategy to minimize free-ridership for their overall commercial portfolio.

4.5.4 CSOP opportunities for process improvements

All of the utilities' CSOPs are built on a common performance-based model requiring some level of pre- and post-monitoring and verification of in situ equipment and program measure installation and performance. While the basic framework of the CSOP is largely unchanged since their launch shortly after deregulation in 1999, utilities have made numerous program revisions. Some revisions have been applied and developed collectively across most or all programs, including for example:

- Changes in eligibility requirements
- Addition or deletion of measures
- Development of deemed measure savings parameters
- Tiered incentives.

Other revisions appear to be made individually, such as:

- Requiring deposits with applications
- Incentive caps (e.g., 50% of project cost)
- Streamlined application process

- Online application process.

The PY2013 evaluation did not find any major overall deficiencies in the CSOP. The CSOP projects are generally well documented. Freeridership is well within the bounds of commercial programs seen elsewhere in the country. Customer and service provider satisfaction with the program was generally high.

Utilities and service providers cited several concerns, however. All of the utilities expressed or acknowledged concerns about burdensome application and approval systems and the dominance of lighting measures in their portfolios. Other common concerns were low or high participation levels, and the burden of conducting pre- and post-inspections for all projects. Individual utilities were taking a variety of actions to address or mitigate these concerns.

A. Low or high participation levels

Some utilities struggle with low participation levels. Some utility programs are perennially oversubscribed. In either case, the ability to anticipate subscription levels and budget accordingly is a challenge for these utilities. Utilities are, with approval, able to move budgets between programs, but not between years.

Any number of factors could contribute to low program participation levels. Budgets could be based on overly optimistic forecasts given current levels of measure saturation. Incentives could be too small to drive the anticipated participation levels. Potential participants and service providers may not be aware of the incentives. They could be deterred by complicated or burdensome application and approval requirements.

Surveys with non-participating service providers and customers could help inform actions to address low participation. If market saturation is the major barrier to participation, then increased participation levels would depend on an expanded suite of measures. If incentives are too small, then utilities would need to make changes to incentive structures or levels. If awareness is the problem, then increased or more effective marketing could be needed. If bureaucratic application and approval requirements are the problem, the additional refinements to those systems could be in order.

However, even with understanding causes of low participation more, administrative budget caps could also limit utilities' ability to mobilize resources to address low participation.

Oversubscription of programs is a simpler problem to solve. Budgets can be increased or incentive levels reduced. If allowed to persist, oversubscription should be managed carefully. Service providers and customer participants may defer projects in anticipation of future incentives. Customers may be aggravated by long waiting periods that may never lead to project approval. Some potential project sponsors are reluctant to go through the initial application process if they previously applied for the program and it sold out; this would reduce participation but increase dissatisfaction with the utility.

Another implication of oversubscription is that more experienced service providers and larger multiple account customers may be advantaged if they are able to navigate the application and approval process. One utility said it gets mostly repeat customers, because new customers don't get in line quickly enough—this repeat business is actually easier for the utilities to manage, since experienced participants understand the application and approval

process. While expedient, this could create some concerns about fairness and access of some customer segments to the programs.

B. Burdensome implementation requirements

Bureaucracy was a major impediment to participation according to service providers. Utilities seemed to be aware of this concern; most named this as the only complaint they were aware of from service providers. Specific system challenges include the amount of time required (especially for first-time users), insurance requirements, M&V plan requirements for non-deemed projects, measures that have not been approved by the program (e.g., some LED technologies), and the need for accredited testing of some products.

Recent utility efforts to streamline the process include master contracts with service providers. Originally the contracts with service providers were on a project by project basis, then went to annual, and are now ongoing contracts as long as the service provider does not have to be removed from the program.

In regards to the utility M&V process for quality assurance/quality control (QA/QC) purposes, several utilities expressed interest in sampling of pre-and post-inspections. Especially in large rural regions of Texas, inspections can be expensive and time consuming so sampling could provide great cost efficiencies. At least one utility cited pre- and post-inspections as a major impediment to increasing the speed of applications and approvals.

There is no established protocol in Texas for sampling of projects for inspection. One of the large utilities conducts pre- and post-inspections on all projects. Another large utility conducts inspections on a sample. The challenge is to ensure that sampling inspections do not open the door to inaccurate savings claims or even fraudulent activity. For programs with larger participant populations, a sampling for QA/QC M&V should be considered. It would be difficult to devise statistically reliable sample plans for programs with only a dozen or so projects each year, but sampling and other ways to reduce the cost of pre- and post-inspection should be explored.

To some extent, complaints arise as a result of misinformed expectations pertaining to the application and approval process. Utilities should, of course, be as clear and transparent about the requirements and expected timelines. Importantly, we heard no complaints about the availability or quality of utility support, so it is not clear that there are gaps that need to be filled with respect to training or technical assistance.

C. Expanding and diversifying measures

As in most areas around the US, the majority of commercial savings are resulting from lighting measures. As federal lighting standards become effective, baseline energy consumption will go down and thus reduce the savings associated with existing measures.

Some utilities appeared to be actively considering new measures such as LEDs, newer HVAC technologies and pool pumps, as well as new program delivery mechanisms such as codes and standards programs. However, efforts to diversify and expand the measure mix appear to be fairly limited to-date. Outdoor lighting measures could become more common in utilities portfolios; the Energy Efficiency Rule 25.181 now recognizes a winter peak so utilities can now offer incentives on outdoor lighting projects as standalone projects.

Identification of new measures and program delivery mechanisms in the context of rising baselines is a national issue facing energy efficiency programs. We recommend utilities and their contractors work with the EM&V team and PUCT staff to explore the viability of new measures and program design opportunities.

D. Collecting sufficient project documentation

The project-level documentation received as part of the PY2013 desk review process was often limited. And although the EM&V team found that project tracking of savings were, for the most part, correctly entered from project savings calculators into tracking databases, the EM&V team was not able to replicate savings calculations for some programs. Savings calculations should have supporting documentation that allows for measure-level verification, especially those key project inputs and parameters that drive a significant portion of calculated savings. Robust and organized program documentation will help improve the accuracy and transparency of estimated savings in future program years. Project activities should be conducted and documented in a way that allows for effective independent review.

Below we document the type of documentation required by measure type for the documentation to be considered sufficient. Although this detail is included in the CSOP section, it is relevant to CMTP programs as well.

- **Lighting projects.** The key inputs for deemed savings projects are fixture type, lamp type, and quantities for pre and post periods, along with the presence of lighting controls, where installed. These should be provided in the form of pre- and post-inspection forms (with field notes). In addition, invoices should be provided to confirm the installed quantities in the absence of inspection forms. For LED installations, documentation must be provided to confirm the LED fixtures and lamps are certified by Design Lights Consortium (DLC) or ENERGY STAR®. For projects where M&V plans have been implemented, lighting logger data and associated calculations should be provided to confirm the operating hours and coincidence factors used in the savings calculations.
- **HVAC projects.** The key inputs are equipment specifications (full-load and part-load efficiencies), age of existing equipment, and quantity. These should be provided in the form of manufacturer specification sheets (or AHRI Certificate), photos of pre- and post- equipment nameplates, and pre- and post-inspection reports. In addition, the pre- inspection should confirm the working condition of the existing equipment to determine if the project is an early replacement or replace-on-burnout type.
- **Other end-uses.** The key inputs needed for non-lighting and non-HVAC end-uses include the following: pre- and post-inspection forms (when M&V has been conducted) should be provided to confirm that the equipment is installed and operating. Manufacturer specification sheets are necessary to ensure that all the key parameters are input into savings calculators and algorithms accurately. The presence of installed equipment without a formal inspection form can be supported through photo documentation (where applicable) to confirm equipment counts, roofing top color, nameplate data, make and model information. Finally, supporting documentation to confirm the project type (replace-on-burnout or early retirement) should be provided.

- **Multi-site customers.** When customers have multiple sites where retrofits are replicated in exact project scope from one another, but inspections do not occur at all sites, then inspection documentation should be provided as backup documentation for all non-inspected sites.

4.5.5 CMTP opportunities for process improvements

Below we document the opportunities for process improvement for the following program types:

- Small Commercial/Small Business MTP
- Score/CitySmart/Education/Government/Sustainable Schools/Commercial Solutions/Large C&I MTP
- Retro-Commissioning MTP
- Advanced Lighting MTP.

A. Small Commercial/Small Business MTP

Overall, the evaluation found that the small commercial/small business programs were operating as intended and, where customer data was collected, the programs were impactful on customers' decisions. Additionally, EESPs interviewed were fairly satisfied with the program(s). The only areas where EESPs voiced lower satisfaction were in the value of the incentive offered and amount of paperwork required. This type of rating for incentive offered and paperwork requirements from EESPs is not uncommon in other similar types of programs within Texas and across the country, as it is often the case that contractors would like increased incentives and also say program reporting requirements are time consuming.

Four utilities introduced new small business programs in PY2013. A new electronic application tool allows for contractors to upload site information directly to an online database from the field. Reception of this contractor-based program which is contractor based has been well received. The field application also provides for one site visit which has been well received by customers.

One utility is making some significant design changes for PY2014 including increasing their participation level for a small business peak demand from 50 kW to 100 kW. This will put the program in line with the other five in Texas. The program is also moving from a web accessed application submission process to a field based application submission process. These design changes may likely have an impact on program participation since this customer segment typically has unique needs compared to those larger commercial customers who participate in the Commercial Solutions MTP.

The EM&V team identified several opportunities for program staff consideration based on evaluation activities:

- **Program inspection protocols may provide unique opportunities for project inspection.** Due to the smaller size of projects, 100 percent pre/post inspection of projects is unlikely. The electronic format for project application submission also provides an opportunity for contractors to directly upload project documentation that has typically been captured by the utility during their own inspection surveys such as

pre and post photos that can assist to verify quantities and types of equipment, signed customer proposals that can assist with condition of systems, and other digital records. Providing direction for such protocols and integrating these electronic files so that they are consolidated and available for program evaluation will also allow for easier evaluation.

- **There are opportunities for increased program awareness.** Nearly all EESPs the EM&V team spoke with said they always inform their customers that the service and/or equipment improvements are being incentivized through the utility-sponsored Small Commercial Solutions program (5/6). Two EESPs said that most of the customers are aware of the Small Commercial Solutions program prior to the EESP mentioning it to them, two said that some of their customers are aware, and two said that none of their customers are aware.
- **There are opportunities for increased measure mix.** Only one small business program offered measures beyond lighting in PY2013; however, new measures are being added for PY2014.

B. Score/CitySmart/Education/Government/Sustainable Schools/Commercial Solutions/Large C&I MTP

Through the EM&V research it was clear that the technical and other assistance provided through the program is valued and impactful on customers' decisions. Additionally, the PY2013 on-site evaluation surveys and discussions with program managers identified that some contractors are providing additional "value add" to projects in the form of additional installed equipment at no cost to the customer, providing further benefit to the customer.

One challenge identified is that ESCOs may, at times, compete with program efforts. During the market actor interviews, two ESCOs mentioned that at times they felt they were competing with MTPs for customers. This was also confirmed in program manager interviews. Sometimes the competition occurs when ESCOs would like to guide customers to the higher CSOP incentives. The increase in incentive levels for a number of MTPs in PY2014 may help to reduce this competition.

There are signs that some CMTPs that have been targeting specific sectors are beginning to transition. During one utility program manager interview, a utility reported that they discontinued their CMTPs for PY2014. They stated these CMTPs have served certain commercial customer segments for a number of years and are now rolling these customers into their CSOP in PY2014. The utility made this decision due to the level of technical assistance and information provided to this customer segment over a number of years. Given this reduced level of technical assistance needed, the utility decided that this customer segment should now be empowered to participate effectively in the CSOP, but will still maintain key account managers for these customers. As a contrast, a different utility has introduced "Lite" and "Fast Track" MTPs in conjunction with their full MTPs such as Score Lite and RCx Fast Track. These Lite and Fast Track programs offer higher incentives to those customers that do not require the technical assistance or engineering analysis provided by the implementer. This is an alternative approach to transition this market while continuing to provide segmented access to incentives. The success of these different approaches to transitions plans would be an interesting targeted process evaluation piece in a future evaluation effort. This research is further described within Section 5.2 ,*The Mix Of Standard Offer/Market Transformation Programs In A Utility Portfolio*.

The EM&V team identified several opportunities for program staff consideration based on evaluation activities:

- **Improvements in light level designs may provide additional influence on savings beyond the retrofit.** The programs and some EESPs provide lighting level design as part of lighting improvement projects. With today's lighting technologies and other influences on light level requirements, this can ultimately result in not only improved lighting, but reductions in lighting levels for over lit areas. Making sure lighting levels are appropriate for the space as part of the retrofit may be a component that could contribute significantly to energy savings for lighting projects beyond the equipment efficiency savings. Currently, retrofit projects do not formally limit the overall building lighting load like new construction projects within the deemed calculators. Some EESPs who specialize in lighting design commented during the market actor surveys that the Texas programs do not promote and/or focus on this design piece. This is also true in different parts of the country.

- **Technical assistance provided by MTPs may be transitioning.** Multiple utilities mentioned during program manager interviews that they are seeing a fairly significant reduction in the need for benchmarking and master planning. Some utilities also indicated at the same time they've observed an increased need in walk through audits. The traditional types of technical assistance for these programs in Texas (e.g., benchmarking and master planning) may have achieved their purpose for some customer segments, such as schools where utilities have developed long term relationships. As MTPs are in place for a number of years, the role of technical assistance may transition and further research may be necessary to determine future requirements. This research is further described within Section 5.2, *The Mix Of Standard Offer/Market Transformation Programs In A Utility Portfolio.*

- **Small schools may be an opportunity for additional program outreach.** A few utilities are starting to focus on smaller schools. These customers are typically overlooked by EESPs and ESCOs who tend to focus on larger schools. This may be an opportunity for MTPs that have not focused on this customer segment in the past.

- **Unique customers may mean future opportunities.** Utilities have begun to target different building and business types, which has thereby diversified their participant group. Some utilities mentioned a recent increase in the mix of building and customer types during program manager interviews for three CMT program categories (Score/CitySmart, Commercial Solutions, and Small Commercial). Historically, the target markets for these programs have included educational facilities, government facilities, and larger commercial/industrial facilities. Some examples of new customer segments reached are nonprofits, churches and car lot facilities, and smaller companies such as nail salons, bail bond companies, convenience stores, and pet stores.

- **There are opportunities for increased program incentives.** Market actors interviewed that participate in Score/CitySmart MTPs noted sizeable differences in incentive levels by utility and commercial programs that made CMTP projects more difficult to close with customers. Program managers interviewed alluded to the fact that MTP incentive levels were increasing to be more in line with CSOP for PY2014, so this may help improve satisfaction with this aspect of the CMTPs.

- **There are opportunities for increased program ease of use.** Two-thirds (10 of 15) of market actors interviewed that participate in Commercial Solutions MTPs noted difficulties with program requirements. There were differences in perspective with regard to these difficulties, and their suggestions for program improvements provide further insight for describing these program complexities and/or difficulties from a contractor's standpoint. Some indicated the need to just make them simpler in general, while others suggested more specific recommendations as a need to streamline and improve the application process, and described difficulty with the savings calculations, calculators, and/or program software. Other comments included a need for more program marketing, more education especially with the software, more direct install measures, and comparing the programs as a bit of a struggle compared to other similar utility programs they work with nationwide.
- **Future impacts to equipment baselines may require alternative program adjustments.** One utility reported during program manager interviews that they are introducing a new tiered incentive level to help with impacts from baseline adjustments. Most utility programs are focused on increasing MTP measure mixes as a way to combat changes to baselines especially in lighting which has been a predominant measures for most MTPs in PY2013. There are a number of measure types (both deemed and custom) that may offer savings beyond the traditional lighting measures. These alternative measure types may also introduce an even larger mix of customer segments that may need further planning process.

C. Retro-Commissioning Market Transformation Programs

There was limited EM&V activity for the RCx MTP due to limited participation. Only two utilities are currently offering an RCx program.

One of the two utilities has been offering this program for ten years. Over this time they have developed a streamlined approach. This approach has allowed for a reduced preliminary study phase which may eventually be eliminated in the near future with the use of a Building Efficiency Intelligence software platform that will use billing data to qualify potential participants. Introducing these innovative program approaches may assist in reducing the amount of time to develop and implement RCx projects (which have been up to 18 months in the past), reduce the costs for the RCx Agents involved, provide fewer burdens to the customer, and provide for a very effective RCx program launch.

In general, the evaluation found that the program was operating well and resulted in high realization rates. There may be an opportunity for other utilities to introduce this program to provide customers with a comprehensive versus measure specific improvements in building performance.

D. Advanced Lighting Market Transformation Programs

The advanced lighting programs are preparing for 2014 baseline changes that impact lighting products. It is not clear if the preparations will fully counteract the baseline impacts, however, program managers are trying to stay ahead of the impacts with alternative solutions.

For example, during the program manager interview for the residential advanced lighting program, it was noted that as additional LED lamps are brought to market and qualified as

energy efficient units, the program will look to include and will assist in improving the variety of products offered by the program.

Due to the research on this program being limited to desk reviews, no specific opportunities for process improvements were identified.

4.5.6 Solar PV opportunities for process improvements

The Solar PV programs generally resulted in high realization rates and were received favorably by customers and market actors interviewed. However, there were a couple of opportunities for process improvements identified through the research, summarized below.

- **Continue to clearly inform customers on program requirements and processes.** Some market actors and participants voiced complaints about too much paperwork and payment delays. The utilities are already performing some outreach to educate applicants and are undertaking efforts to streamline the application process. These efforts should be continued and if possible, expanded.
- **Consider removing or changing the requirement for PV meters.** The programs should consider the value the PV generation meters have for program delivery, as implemented in the current programs. In regards to EM&V, the data collected through the generation meters have little value. The meters only record a total kWh and the only way to collect this metered data is to ask the host to read the meter over the phone or for field personnel to travel to the site and read the meter. The kWh data would then need to be extrapolated to a full year for evaluation purposes, a task that is inherently error prone.

  In addition, to use these metered data for evaluation, an exact PV turn on date is critical. For example, an actual PV turn on date a month later than meter install could lower metered realization rates by as much as 50 percent if data are available for only two months.

  Many Solar PV contractors currently provide internet based metering as part of their service package. Leveraging these interval data would be much more useful to quantify actual performance. Thirty-two percent of participants interviewed report using such a service with an additional 45 percent reporting that they monitor the system, many with smart phones or web apps. Requiring one-time access to such data as part of the incentive for some or all systems could eliminate the need for meter installations and help provide much richer and useful data to both the host customers and the utilities.

4.5.7 Load management opportunities for process improvements

The EM&V team proposes the following recommendations based on the findings from discussions with participants and aggregators of load management programs.

- **Distinguish Utility Load Management Programs from ERCOT ERS.** During the course of this evaluation, some customers exhibited difficulty discerning between load management programs and the ERS offered by ERCOT. Utilities and EESPs could provide more customer education in this regard.

- **Explore Opportunities to Standardize Load Management Programs.** Program aggregators cited customer confusion resulting from the different load management programs offered by various utilities and asked for more similarity across utility load management programs. One aggregator stated, "*For marketing purposes, It would be convenient if we could offer a more consolidated product across all of Texas, or at least the metro areas.*" The standardization of load management programs could reduce customer confusion and streamline the marketing of load management programs.
- **Simplify the Enrollment Process.** Several aggregators expressed frustration with the "*first come, first serve*" model of enrollment used by some utilities, and cited the inability to register customers and nominated demand due to customer demand outstripping the program's supply. Aggregators reported that one program was fully subscribed within the first minute of enrollment. One aggregator stated, "*It's difficult to align all our customers at once and register them, so it's defeating when we aren't able to enter all of our resources because another aggregator clicked the mouse a few moments before us.*" Due to these limits, aggregators indicated that they have little incentive to increase the scope of their outreach efforts. Respondents also cited a desire for a simpler enrollment process. Two customers operating in two utilities' service areas cited issues enrolling due to their passwords from the previous season no longer being valid.

5. STATEWIDE PORTFOLIO RESULTS—RESIDENTIAL SECTOR

This section documents the statewide portfolio results for the residential sector within the following sub-sections:

- Impact results
  - Overall
  - By measure category
  - Prospective realization rates for select measures
- Program attribution (net-to-gross)
- Customer survey results
- Market actor survey results
- Recommendations
  - Improving savings estimates
  - Measures that are good candidates to use deemed savings
  - Maximizing net savings
  - Opportunities for process improvements.

5.1 IMPACT RESULTS

The residential sector claimed energy savings are similar to those reported within the commercial sector (261,855,118 and 260,443,667, respectively). However, the evaluated residential savings are higher than the commercial sector (299,604,892 and 263, 638,864, respectively). The difference in the evaluated savings reflects the high energy realization rates made for tracking system adjustments.

Similarly, the residential sector reported higher claimed and evaluated demand savings than the commercial sector, excluding load management savings (111,130 evaluated residential demand savings compared with 58,512 evaluated commercial demand savings). This difference is primarily due to a higher percent of seasonal peak demand measures in the residential programs than the nonresidential programs. The majority of residential demand and energy savings came from shell and HVAC measures (42 percent for each measure representing a total of 84 percent residential demand and energy savings). Shell measures include duct sealing and air infiltration, which comprised a large percentage of the savings reported by utilities.

While realization rates were high, the EM&V team made adjustments—oftentimes downward—to duct efficiency and air infiltration measures based on testing during on-site visits. Due to the nature of blower door and Duct Blaster tests, natural variation between tracking system and on-site measurements is expected. For duct improvement measures, variation in measured post-retrofit leakage is expected to be within ± 20 percent using a Duct Blaster test; for infiltration measures, variation within ± 10 percent is expected for blower door test results. In some cases, the evaluation found that the M&V measurement was higher than the post-service measurement in the tracking system by a greater percentage than these

thresholds, and in some cases at or slightly higher than the pre-service measurement. These findings indicated that in these instances there was some failure in the service received.

Table 5-1 shows the claimed and evaluated demand savings for each utility's residential energy efficiency portfolio for PY2013 and the precision levels around the evaluated savings estimates at a 90 percent confidence interval. There are five utilities with realization rates at or below 85 percent. There are two issues driving these lower realization rates. First, these utilities had a higher proportion of projects where adjustments were made to air sealing and duct efficiency measures, as described above. But, second, these utilities also tended to have smaller on-site sample sizes (fewer than 15), which increased the magnitude that those adjustments had on the overall results.

Table 5-1. Program Year 2013 Claimed and Evaluated Demand Savings—Residential Sector

Utility	Percent Statewide Savings (kW)	2013 Claimed Demand Savings (kW)	2013 Evaluated Demand Savings (kW)	Realization Rate (kW)	Precision at 90% Confidence
AEP TCC	10.6%	9,455	9,820	103.9%	13.6%
AEP TNC	1.6%	1,454	1,163	80.0%	18.2%
CenterPoint	23.6%	21,094	20,988	99.5%	3.3%
El Paso Electric	1.3%	1,164	1,800	154.6%	20.1%
Entergy	10.3%	9,164	7,516	82.0%	7.5%
Oncor	40.6%	36,190	60,809	168.0%	7.9%
Sharyland	0.4%	351	385	109.6%	18.7%
SWEPCO	4.1%	3,676	3,008	81.8%	17.9%
TNMP	5.4%	4,827	4,325	89.6%	8.7%
Xcel SPS	2.1%	1,872	1,315	70.2%	16.0%

Table 5-2 shows the claimed and evaluated energy savings for each utility's residential energy efficiency portfolio for PY2013. While evaluated savings are similar to claimed savings, minor adjustments were made across all utilities' claimed savings. One utility had an energy realization rate under 90 percent for similar reasons as stated above for kW adjustments.

Table 5-2. Program Year 2013 Claimed and Evaluated Energy Savings—Residential Sector

Utility	Percent Statewide Savings (kWh)	2013 Claimed Demand Savings (kWh)	2013 Evaluated Demand Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
AEP TCC	9.2%	24,050,327	32,150,742	133.7%	13.1%
AEP TNC	1.3%	3,457,058	3,426,721	99.1%	15.2%
CenterPoint	19.4%	50,687,516	50,725,352	100.1%	1.5%
El Paso Electric	1.8%	4,807,687	6,085,394	126.6%	7.7%

Utility	Percent Statewide Savings (kWh)	2013 Claimed Demand Savings (kWh)	2013 Evaluated Demand Savings (kWh)	Realization Rate (kWh)	Precision at 90% Confidence
Entergy	6.8%	17,821,558	21,659,707	121.5%	8.1%
Oncor	52.4%	137,158,207	159,731,351	116.5%	5.8%
Sharyland	0.4%	1,002,959	1,212,698	120.9%	26.5%
SWEPCO	3.2%	8,478,843	7,538,643	88.9%	26.5%
TNMP	3.8%	9,928,736	11,829,721	119.1%	14.6%
Xcel SPS	1.7%	4,462,229	5,244,561	117.5%	24.4%

5.1.1 Savings summary by measure type

The tracking systems provided by the utilities and their contractors provide measure-level details, which the EM&V team then assigned into measure category. Table 5-3 documents the percentage of energy savings by measure category. Not surprisingly, a majority of the residential programs' savings come from HVAC and shell measures (inclusive of insulation, air sealing, and duct efficiency), followed distantly by new construction. Lighting and solar PV only contributed a total of 4 percent of energy savings in the residential portfolio.

Table 5-3. Residential Energy Savings by Measure Category

Measure Category	Claimed Energy Savings (kWh)	Evaluated Energy Savings (kWh)	Realization Rate (kWh)	Percent Residential Savings (kWh)
HVAC	110,608,775	128,410,049	116%	41.8%
Shell	107,627,374	126,584,501	118%	41.2%
New Homes	31,622,818	31,609,453	100%	10.3%
Lighting	5,572,501	6,338,728	114%	2.1%
Solar PV	5,972,099	6,023,168	101%	2.0%
Other	5,417,142	5,417,142	100%	1.8%
Appliance	1,945,344	2,037,357	105%	0.7%
Water Heat	373,395	466,895	125%	0.2%
Windows	74,446	74,106	100%	0.0%
Total	**269,213,892**	**306,961,399**	**114%**	

Note: Totals in this table will not match the sector total, since this table includes pilot programs.

The residential sector demand savings are largely a result of shell and HVAC measures followed by new construction. Again, solar PV represented about 3 percent of the demand savings statewide; lighting contributed less than 1 percent of demand savings (Table 5-4).

Table 5-4. Residential Demand Savings by Measure Category

Measure Category	Claimed Demand Savings (kW)	Evaluated Demand Savings (kW)	Realization Rate (kW)	Percent Residential Savings (kW)
Shell	33,996	47,758	140%	41.9%
HVAC	39,104	47,241	121%	41.5%
New Homes	14,094	14,074	100%	12.4%
Solar PV	3,314	3,316	100%	2.9%
Lighting	628	622	99%	0.5%
Other	499	499	100%	0.4%
Appliance	300	306	102%	0.3%
Water Heat	63	60	96%	0.1%
Windows	54	54	100%	0.0%
Total	**92,052**	**113,930**	**124%**	

Note: Totals in this table will not match the sector total, since this table includes pilot programs.

5.1.2 Prospective realization rates by measure type

A. Residential

Across the residential programs, there were five measures for which the EM&V team estimated a prospective realization rate. These measures are ceiling insulation, CFLs, ground-source heat pumps (GSHPs), window air conditioners (AC), and refrigerators. Details on the adjustments are provided below.

Ceiling Insulation. This measure's prospective realization rate is due to the impact on savings for customers with evaporative coolers rather than central AC. Currently, the savings are based on a central AC system; however, an evaporative cooler uses less energy than a central AC system and thus would result in lower savings. This is true for all shell measures; however, cooling system type was only present for ceiling insulation and so the prospective realization rate was only estimated for this measure. The EM&V team estimated the consumption of an evaporative cooler by performing building simulation models (EnergyPro) on prototypical single family homes. Our findings indicate an evaporative cooler uses 35-40 percent of the energy as a central AC unit, depending on climate zone. This percentage adjustment was applied to the savings to estimate the prospective realization rate for this measure. To more accurately determine the savings, the existing models used to estimate savings for shell measures should be rerun for evaporative coolers.

CFLs. The current savings algorithm for CFLs does not include an HVAC interactive factor (HCIF). Since CFLs produce less waste heat than incandescent, installing CFLs in a home lowers the cooling load, but increases the heating load. The HCIF is a factor multiplied by the calculated savings to account for this interactive effect. The EM&V team estimated the HCIF by performing building simulations to estimate this factor across climate zones. This factor

depends on the saturation of cooling and electric heating equipment, as well as the heating and cooling degree days. For this prospective realization rate estimate, we used census data to estimate the equipment saturations and applied a weighted average by climate zone. Our findings indicate an HCIF for energy ranging from 0.90 to 1.13, depending on climate zone. The summer peak HCIF is fairly consistent across climate zones, ranging from 1.40 to 1.43. The winter peak HCIF ranges from 0.54 to 0.77.

Ground-source heat pumps. The TRM v2.0 uses a new methodology to estimate savings, the impact of which is demonstrated in this prospective realization rate.

Window AC units. The TRM v2.0 has updated equivalent full load hour (EFLH) table, the impact of which is demonstrated in this prospective realization rate.

Refrigerators. The TRM v2.0 remaining useful life is estimated using a decay function different from before to determine the remaining useful life, the impact of which is demonstrated in this prospective realization rate.

The overall impact of these changes is presented at the statewide program level for energy and demand in Table 5-5 and Table 5-6, respectively. As the EM&V team only estimated the prospective realization rate at the *data review* level (i.e., compared the savings in the tracking system against the TRM v1.0 algorithms), these numbers do not reflect total reported realization rates that incorporate desk and site visit reviews[35].

Table 5-5. RSOP, HTR, and LI Energy Prospective Realization Rates

Statewide Program kWh Realization Rates	RSOP	HTR	LI
Overall Realization Rate (Evaluated/Claimed)	130.11%	128.31%	106.54%
Prospective Realization Rate (Prospective/Claimed)	130.08%	127.79%	106.53%
Percentage Difference	-0.02%	-0.40%	-0.01%

Table 5-6. RSOP, HTR, and LI Demand Prospective Realization Rates

Statewide Program kW Realization Rates	RSOP	HTR	LI
Overall Realization Rate (Evaluated / Claimed)	130.99%	116.85%	102.45%
Prospective Realization Rate (Prospective / Claimed)	130.93%	116.81%	102.82%
Percentage Difference	-0.05%	-0.03%	0.36%

Given that the bulk of the savings for RSOP and HTR are from duct sealing and air infiltration, neither of which have prospective realization rate adjustments, the overall impact on the residential programs' savings is small. The impact of the adjustments (percentage difference)

[35] The El Paso HTR Solutions program was not included in this analysis, as measure-specific data required to estimate the impact on the realization rate were not available.

at the measure level are provided in Table 5-7 and Table 5-8 for energy and demand, respectively, by program. N/A indicates this measure was not found in that program.

Table 5-7. Differences in realization rates (kWh)

Measure-Level kWh Realization Rates Difference	RSOP	HTR	LI
Ceiling Insulation[36]	-1.91%	-4.20%	0.00%
CFLs	5.42%	5.93%	2.52%
Ground-source Heat Pump	132.98%	n/a	n/a
Refrigerator	0.00%	n/a	-0.89%
Window AC	28.73%	28.73%	36.43%

Table 5-8. Differences in realization rates (kW)

Measure-Level kW Realization Rates Difference	RSOP	HTR	LI
Ceiling Insulation[37]	-1.23%	-0.86%	0.00%
CFLs	13.56%	13.16%	13.17%
Ground-source Heat Pump	-21.03%	n/a	n/a
Refrigerator	0.00%	n/a	-0.89%
Window AC	28.73%	28.73%	36.62%

B. Solar PV

The EM&V team used the same method described in the commercial Solar PV section to calculate prospective savings for residential Solar PV. Table 5-9 shows the prospective residential savings and realization rates.

[36] Oncor data did not include cooling system type; thus, the measure-level impact on the realization rates are exclusive of Oncor participants.

[37] Oncor data did not include cooling system type; thus, the measure-level impact on the realization rates are exclusive of Oncor participants.

Table 5-9. Residential Solar PV Prospective Savings

Utility	Claimed Demand Savings (kW)	Prospective Demand Savings (kW)	Prospective Demand Realization Rate (kW)	Claimed Energy Savings (kWh)	Prospective Energy Savings (kWh)	Prospective Energy Realization Rate (kWh)
AEP TCC	107	104	0.97	205,472	166,570	0.81
AEP TNC	33	33	1.00	62,800	57,479	0.92
El Paso Electric	240	253	1.05	462,888	491,256	1.06
Oncor	2,891	3,085	1.07	5,157,153	5,197,373	1.01
SWEPCO	43	45	1.05	83,786	77,272	0.92
Statewide	**3,314**	**3,520**	**1.06**	**5,972,099**	**5,989,950**	**1.00**

Because the PvWatts simulations account for available sunlight and panel orientation, the savings vary from those calculated using the approved deemed savings factors. Those deemed factors largely resulted in realization rates equal to one. The statewide prospective PY2013 energy realization rate varies from 81 percent for AEP TCC to 106 percent for El Paso Electric, although statewide the realization rate remains at 100 percent. The statewide prospective PY2013 demand realization rate is 106 percent; utility-specific rates vary from a low of 97 percent for AEP TCC to a high of 107 percent for Oncor.

Prospective demand savings are the maximum hourly output of the systems, so like annual savings, demand savings are driven by the available sunlight that is more abundant further from the gulf coast. The majority of these demand savings occur at noon, so if a utility's peak demand were later in the afternoon, the demand savings could be substantially less as the sun sinks into the west.

5.2 PROGRAM ATTRIBUTION

This section will outline the program-specific approaches and results for residential sector program attribution.

5.2.1 RSOP results

The EM&V team used both market actor and customer surveys to calculate free-ridership. The customer survey results were averaged with the market actor free-ridership results. The team calculated spillover using market actor surveys. The evaluation team completed 259 customer participant surveys and 51 market actor interviews to support the RSOP attribution results.

A. Freeridership

Table 5-10 and Table 5-11 document the kWh and kW free-ridership rates for customers and market actors. All customers that were aware they received a markdown for the measures installed were included in the analysis.

Table 5-10. Free-ridership results for RSOP (kWh)

Customer kWh free-ridership rate (n=259)[38]	Customer kWh Precision at 90% CI	Market actor free-ridership rate (n=51)[39]	Market actor kWh Precision at 90% CI	Final free-ridership rate (inclusive of customer and market actor results)
31%	6%	19%	7%	25%

Table 5-11. Free-ridership results for RSOP (kW)

Customer kW free-ridership rate (n=319)[40]	Customer kW Precision at 90% CI	Market actor free-ridership rate (n=51)[41]	Market actor kWh Precision at 90% CI	Final free-ridership rate (inclusive of customer and market actor results)
29%	6%	20%	7%	25%

Table 5-12 shows the kWh and kW free-ridership rates by measure category from the customer surveys. Sample sizes were large enough to estimate free-ridership rates for air sealing and duct sealing measures. All other measures, including insulation, central air conditioning, CFLs, heat pumps, water heater measures, and window air conditioners, had low sample sizes and were grouped together in the Other Measures category in Table 5-12. Central air conditioning is the largest contributor to the Other Measures category and is the primary driver of the relatively high free-ridership rate (over 43 percent). The market actor sample sizes were too small to provide free-ridership rates at the measure category.

Table 5-12. RSOP Measure-level Results

Measure Category	Customer kWh Free-ridership Rate	Customer kW Free-ridership Rate
Overall Free-ridership Rate	**31%**	**29%**
Air Sealing (n=98)	34%	30%
Duct Sealing (n=94)	21%	15%
Other Measures (n=67)	43%	50%

B. Spillover

The EM&V team calculated the spillover rate for RSOP at 3 percent based on market actor surveys only. The precision at 90% confidence is 3.3% weighted by kWh and is 3.1% weighted by kW.

[38] Participant results are weighted by savings and disproportionate sampling.
[39] Market actor results are weighted by individual market actor savings.
[40] Participant results are weighted by savings and disproportionate sampling.
[41] Market actor results are weighted by individual market actor savings.

5. Statewide Portfolio Results—Residential Sector…

C. NTG results and comparison to other jurisdictions

The final NTG ratio, accounting for free-ridership and spillover is 78 percent. Table 5-13 shows the final RSOP statewide NTG ratio.

Table 5-13. Final RSOP Statewide NTG Ratio

Weighting	Freeridership	Spillover	NTG
kWh	25%	3%	78%
kW	25%	3%	78%

D. Comparison to other jurisdictions

The EM&V team reviewed five NTG studies from other jurisdictions for residential programs with similar measure offerings as the RSOP. The reviewed programs included three utilities located in the West North Central region of the United States, one in the West South Central region, and one in the South Atlantic.

NTG ratios ranged from 65 to 89 percent. The Texas utilities' programs are well within these ranges. Note that the programs reviewed in this benchmarking activity are not designed and implemented exactly the same as the Texas RSOP as for these programs the customer receives a rebate check rather than the contractor receiving the incentive. However, all of these programs use contractors to deliver services to residential customers.

5.2.2 RMTP results

The RMTPs vary widely in design and delivery, and for this reason there is a similarly wide variety of approaches used to arrive at NTG results for this group of programs.

A. A/C Distributor

For the A/C Distributor programs, the EM&V team used customer surveys as the primary method to calculate free-ridership. The EM&V team also surveyed participating market actors to calculate free-ridership and spillover. The market actor survey results were triangulated against and used as a reasonableness check against the customer surveys free-ridership results. As noted above, customers were randomly sampled by utility program and measure type using the tracking data provided by utilities. The evaluation team conducted 35 customer participant surveys and 24 market actor interviews to support the A/C Distributor attribution results.

i. Freeridership

Table 5-14 and Table 5-15 document the free-ridership rates for customers and market actors. The customer results exclude customers that said they did not receive a final incentive or markdown for the measure *and* were not aware that the services provided by the EESP was coordinated through a utility program. Few customers (six) were excluded from the analysis based on this logic.

The market actor results include responses from 12 unique market actors. Several of these market actors reported participating in multiple different utility territories.

Table 5-14. A/C Distributor Free-ridership Results (kWh)

Customer kWh Free-ridership Rate (n=35)[42]	Customer kWh Precision at 90% CI	Market Actor Free-ridership Rate (n=12)	Market Actor kWh Precision at 90% CI	Final Free-ridership Rate (inclusive of customer and market actor results)
56.6%	12.8%	43.6%	10.0%	50.1%

Table 5-15. A/C Distributor Free-ridership Results (kW)

Customer kW Free-ridership Rate (n=35)[43]	Customer kW Precision at 90% CI	Market Actor Free-ridership Rate (n=12)	Market Actor kW Precision at 90% CI	Final Free-ridership Fate (inclusive of customer and market actor results)
56%	13%	44%	10.0%	50.0%

ii. Spillover

The EM&V team calculated the spillover rate for the A/C Distributor program at 34 percent. The market actor results include responses from seven unique market actors. The spillover results exclude five market actors for whom a spillover rate could not be evaluated due to "don't know" responses or limitations in the tracking data. There were two market actors for which the results were capped at 200 percent; these market actors reported spillover rates of 290 percent and 1,020 percent, respectively.

iii. NTG results

The final AC Distributor NTG ratio, accounting for free-ridership and spillover, is 84 percent for kWh and kW, as reported in Table 5-16.

Table 5-16. Final A/C Distributor Statewide NTG Ratio

Weighting	Freeridership	Spillover	NTG
kWh	50%	34%	84%
kW	50%	34%	84%

iv. Comparison to other jurisdictions

The EM&V team primarily reviewed three NTG studies from other jurisdictions for residential programs with similar measure offerings as the A/C Distributor. States reviewed include California, Arkansas, and Nevada. NTG ratios ranged from 48 to 80 percent according to these studies. The Texas utilities' programs are just above this range due to the spillover reported.

[42] Participant results are weighted by savings and disproportionate sampling.
[43] Participant results are weighted by savings and disproportionate sampling.

B. CoolSaver A/C Tune-up

Due to the small sample sizes for both telephone surveys with end use customers and market actors, NTG is stipulated for the CoolSaver A/C Tune-up programs. The stipulated values are informed by the limited primary research completed with Texas customers and market actors. The EM&V team completed five customer participant surveys and three market actor surveys.

i. CoolSaver A/C Tune-up stipulated NTG value

The EM&V team recommends stipulating the NTG value for the CoolSaver A/C Tune-up programs at 90 percent. This value is based on NTG studies from three states with residential programs similar to the CoolSaver A/C Tune-up programs. The team specifically focused on reports with climates similar to Texas, including California, Arkansas, and Nevada. Per these studies, NTG ratios ranged from 69 to 91 percent. According to implementation contractors, the program is designed to push market actors to offer a higher level of tune-up service than standard tune-up practices. Based on this program design, along with market actor comments via the Texas study that affirmed those program requirements were outside of standard practice, we stipulated the NTG ratio at the higher end of the range.

C. Existing Homes

Similarly, NTG is stipulated for the Existing Homes programs. However, both survey types were used as a reasonableness check against the stipulated value. Customers were randomly sampled by utility program and measure type using the tracking data provided by utilities. The EM&V team completed 33 customer participant surveys and eight market actor interviews to support the Existing Homes attribution results.

i. Existing Homes stipulated NTG value

The EM&V team recommends stipulating the NTG value for the Existing Homes programs at 80 percent. For the Existing Homes programs, the EM&V team found two recent evaluations in a similar region for a comparable program at the whole-house level—both from Arkansas utilities. Arkansas Oklahoma Gas Corporation implements a Residential Solutions Reward program that reflects a 100 percent stipulated NTG value and SourceGas implements a Home Performance with ENERGY STAR® program the reflects a recent NTG value of 80 percent. The evaluation team also reviewed other studies in Iowa, Colorado, Connecticut, Pennsylvania, and New York. These studies found NTG results ranging from a low of 51 percent and a high of 84 percent. Although qualitative, it is worth noting that the NTG ratios calculated based on Texas customer and market actor surveys were within this range.

We know that, other than their potential request for measure-level service (e.g., insulation), customers typically do not specify the level of whole-house service they should receive. However, insulation measures make up a majority of the measures surveyed, and from a qualitative perspective, has a higher free-ridership rate than other measures (not shown due to very small sample sizes, n=9). This is reinforced by slightly higher insulation free-ridership seen in the RSOP results as well.

D. New Homes

Net-to-Gross is also stipulated for the New Homes programs. The stipulated values are informed by the limited primary research completed with Texas market actors. No customer surveys were completed for this program; while customers are the end-user, it is the design and specification process implemented by the builder that is the primary program target for influence[44]. The EM&V team completed 31 market actor interviews to support the New Homes attribution results.

i. New Homes stipulated NTG value

The EM&V team recommends stipulating the NTG value for the New Homes programs at 70 percent. For the New Homes programs, the EM&V team reviewed NTG ratios established by four different entities—NV Energy, California Public Utilities Commission, Entergy New Orleans, and Arkansas Oklahoma Gas Corp. NTG ratios for these studies ranged from 68 to 85 percent.

The EM&V team completed interviews with builders to understand a number of issues, including standard building practices; adoption of ENERGY STAR® v3.0; likelihood to build to program specifications absent a program; and influence of training, technical assistance, and other offerings provided through the program. The builders interviewed were generally those that were most active in the program as the evaluation identified builders that represent the highest proportion of savings to include in the sample. Many of the builders the EM&V team spoke with have been participating in the Texas new homes programs for a number of years. Most builders interviewed participated over five years, and one builder said he has been participating over ten years.

The interviews referenced builders to ENERGY STAR® v3.0 to gauge freeridership while addressing other program components (e.g., program assistance) to understand the extent of program influence. Builders' responses indicated a relatively high level of free-ridership (over 60 percent) as those interviewed generally stated they built homes at or above ENERGY STAR® standards. Given the longevity of the Texas new homes programs and their focus on changing building practices, it seems reasonable to assume that the program has had significant influence in moving the market (leading to market transformation).

Recognizing the market shifts, as well as the fact that ENERGY STAR® V3.0 focuses on home building requirements as well as energy efficiency, the program contractor and utilities modified their program design to shift from an exclusive whole-home model to include a performance-based component that focuses on influencing the adoption of higher efficiency measures. As a result, the program implementer reports that their primary focus is in working directly with the builders during the specification stage to encourage including higher-efficiency equipment, using the incentive offering to offset the incremental costs of those individual components (in addition to trying to move builders to ENERGY STAR® v3.0). This program design shift began in late PY2012 but took hold in the latter part of PY2013.

To most effectively measure net savings for future planning and cost-effectiveness, it is important to account for this relatively new component-level program design. Any future NTG

[44] For more information on the RMTP new homes customer and market actor survey methodologies, see the *New Homes PY2013 EMV scope change* document dated December 11, 2013.

studies for this program will need to include questions to determine net savings at this level; the whole-house focus of the current NTG study did not include those questions.

Additionally, for those builders interviewed, the incentive levels offered by the programs do not offset the significant incremental cost of going to ENERGY STAR® v3.0. Builders who are participating in V3.0 tend to make that part of their business plan. However, it is likely, given the sampling strategy for this study, that the results reflect the most progressive builders when it comes to building practices. Including builders that have a lower rate of participation may provide different perspectives.

Last, another major factor for new homes programs to contend with is building codes. While Texas has a statewide energy code (IECC2009/IRC2009), a number of municipalities have adopted higher codes than what is required at the statewide level. A significant challenge surrounding building codes is the enforcement of these codes. Without enforcement, it can often be the case that builders not participating in energy efficiency programs are not building to code even if a higher code is adopted. A rigorous NTG study should engage code officials to understand the compliance rates.

Given the considerations above (change in program design and characteristics of sampled builders), the EM&V team recommends stipulating the NTG for this program at 70 percent. This stipulated value considers the results from other jurisdictions and Texas' market.

E. Energy Education and Appliance Programs

In the prioritization process set forth at the beginning of this evaluation, the RMTP Energy Education, Appliance Recycling, and Appliance Rebate programs did not have any customer or market actor primary data collection. The EM&V team primarily reviewed NTG studies from other jurisdictions for residential programs with similar measure offerings as the RMTP Energy Education, Appliance Recycling, and Appliance Rebate programs. Specifically, the team reviewed analysis from California, Arkansas, Colorado, and Nevada.

i. Energy Education and Appliance Stipulated NTG Values

The EM&V team primarily reviewed NTG studies from other jurisdictions for residential programs with similar measure offerings as the RMTP Energy Education, Appliance Recycling, and Appliance Rebate programs. Specifically, the team reviewed analysis from California, Arkansas, Colorado, and Nevada. The NTG ranges varied considerably by program, as shown in Table 5-17 below.

Table 5-17. Energy Education, Appliance Recycling, and Appliance Rebate Benchmarking

Program	NTG Ratio Range
Energy Education	51–90%
Appliance Recycling—Refrigerators	36–100%
Appliance Recycling—Freezers	54–100%
Appliance Rebate	40–81%

We recommend a stipulated NTG ratio for energy education of 80 percent, for appliance recycling of 70 percent and for appliance rebates of 60 percent.

5.2.3 Solar PV results

The EM&V team used market actor interviews as the primary method to calculate free-ridership and spillover. The EM&V team also surveyed participating customers to calculate free-ridership. The customer survey results were triangulated against and used as a reasonableness check against the market actor free-ridership results. The EM&V team completed 18 customer participant surveys and four market actor interviews to support the residential solar PV attribution results.

A. Freeridership

Table 5-18 and Table 5-19 document the free-ridership rates for customers and market actors. The customer results exclude customers that said either they did not receive a final incentive or markdown for the measure or they did not know if they received a final incentive or markdown for the measure. Two customers were excluded from the analysis based on this logic. Two additional customers were excluded from the analysis because there was not enough information to assess NTG.

Table 5-18. Free-ridership results for Solar PV (kWh)

	Customer kWh free-ridership rate (n=18)	Market actor kWh free-ridership rate (n=4)	Final kWh free-ridership rate (inclusive of customer and market actor results)
Residential	23%	5%	14%

Table 5-19. Free-ridership results for Solar PV (kW)

	Customer kW free-ridership rate (n=18)	Market actor kW free-ridership rate (n=4)	Final kW free-ridership rate (inclusive of customer and market actor results)
Residential	24%	5%	14%

The majority (56 percent) of residential consumers reported that they planned to install solar technology before they heard about the program; however, 83 percent of residential consumers said that they would not have purchased and installed the solar technology when they did if the equipment had not been incentivized. Residential consumers were also asked to rate different components that influenced their decision to install the solar equipment on a 0 to 10 scale, where 0 is “not at all important” and 10 is “very important.” The program rebate was the highest rated factor with an average rating of 8.9.

B. Spillover

The EM&V team calculated the spillover rate for Solar PV at 9 percent for residential.

5.2.4 NTG results and comparison to other jurisdictions

The final NTG ratios, shown in Table 5-20 and Table 5-21, accounting for free-ridership and spillover, are 96 and 95 percent for residential kWh and kW, respectively. Note that the numbers displayed are rounded to the nearest whole percent so the NTG appears slightly off due to rounding of free-ridership and spillover.

Table 5-20. Final Solar PV Statewide kWh NTG Ratio

	Solar PV Freeridership	Solar PV Spillover	Solar PV NTG
Residential	14%	9%	96%

Table 5-21. Final Solar PV Statewide kW NTG Ratio

	Solar PV Freeridership	Solar PV Spillover	Solar PV NTG
Residential	14%	9%	95%

The EM&V team reviewed a NTG study from the New York State Energy Research and Development Authority (NYSERDA) for a similar residential Solar PV program. In the NYSERDA study, the NTG ratio was 93.4 percent for residential customers. The Texas utilities' programs display very similar overall NTG results. However, the NYSERDA study found lower rates of free-ridership (7.4 percent) and spillover (1.0 percent).

5.3 CUSTOMER RESULTS

5.3.1 Overview

The EM&V team conducted a residential participant telephone survey to inform the evaluation effort. The survey was conducted in two waves; the first ran from August 19, 2013, to September 27, 2013, and the second ran from December 5, 2013, to January 30, 2014. Table 5-22 shows the number of completed surveys by utility and program type.

Table 5-22. Residential Surveys Completed by Utility and Program Type

Utility	MTP	SOP	LI/HTR	Solar PV	Total
AEP TCC	6	20	23	1	50
AEP TNC	9	17	13	0	39
CenterPoint	17	19	12	0	48
EPE	15	0	17	2	34
Entergy	9	40	9	0	58
Oncor	44	42	34	19	139
Sharyland	0	12	5	0	17
SWEPCO	2	20	15	0	37

Utility	MTP	SOP	LI/HTR	Solar PV	Total
TNMP	0	34	15	0	49
Xcel SPS	0	20	22	0	42
Total	**102**	**224**	**165**	**22**	**513**

The following section summarizes key findings from the customer participant survey. This survey asked questions to inform installation and persistence rates, net-to-gross ratios, and customer satisfaction, and it collected information about the participants' households. The survey focused on energy-efficiency and renewable programs, including MTP, SOP, low-income (LI) or HTR, and Solar PV programs. Note that there were very few respondents in the Solar PV programs, so their responses should be treated as qualitative information.

5.3.2 Energy efficiency program key findings

Key findings are summarized below regarding program awareness, satisfaction, measure persistence, and demographics.

A. Awareness

The survey asked the respondents how they first heard about the energy efficiency program. The most common response given by 40 percent of respondents was that they heard about it through word of mouth from a friend, family member, or other household. This was predominant especially in the LI and HTR programs (58 percent) and SOP (42 percent). The next most common response was the EESP or contractor, which was more common for MTP participants, mentioned by 52 percent of respondents.

The survey also asked participants if they were aware that the program services were coordinated by their utility. Some of the programs are designed in a way that does not directly advertise the utility's involvement to the customer. Over a quarter of participants did not recognize that the utility was involved. Participants in MTPs were least likely to recognize that the utility sponsored the program—45 percent were unaware.

Table 5-23. Familiarity with Utility Involvement in Energy Efficiency Program

	Program Type				
	MTP	SOP	LI/HTR	Solar PV	Statewide Total
Yes	55.3%	79.2%	69.5%	90.9%	72.1%
No	44.7%	20.8%	30.5%	9.1%	27.9%
Respondents (n)	94	212	141	22	469

Source: Question INC0, 2013 Residential Participant Survey
Note: Totals may not sum to 100 percent due to rounding

B. Satisfaction

The survey included a short series of questions to gauge customer satisfaction with their participation experience. The programs are generating high satisfaction among participants.

Respondents rated their satisfaction an average of 8.9 on a scale from 0 to 10, where 0 is very dissatisfied and 10 is very satisfied, and 87 percent of customers gave a rating of 8 or higher.

Table 5-24. Satisfaction with Programs

	Program Type				
	MTP	SOP	LI/HTR	Solar PV	Statewide Total
0 - Very dissatisfied	0.0%	1.3%	1.2%	0.0%	1.0%
1	0.0%	1.3%	0.0%	0.0%	0.6%
2	0.0%	0.9%	0.6%	0.0%	0.6%
3	0.0%	0.4%	0.6%	0.0%	0.4%
4	1.0%	1.3%	1.2%	9.5%	1.6%
5	3.1%	1.8%	1.8%	9.5%	2.4%
6	2.1%	2.2%	3.0%	4.8%	2.6%
7	2.1%	5.4%	1.8%	4.8%	3.6%
8	12.5%	16.1%	13.4%	19.0%	14.7%
9	18.8%	15.6%	11.6%	9.5%	14.7%
10 - Very satisfied	60.4%	53.6%	64.6%	42.9%	58.0%
Respondents (n)	96	224	164	21	505
Mean	9.20	8.75	9.06	8.14	8.91

Source: Question SA2, 2013 Residential Participant Survey

Note: Totals may not sum to 100 percent due to rounding

The customers who were very satisfied with the program brought up a variety of topics that contributed to their satisfaction, including:

- Improved comfort, better cooling, better air quality
- Positive experience with contractor
- Savings on energy bills
- Affordability of the project.

Of the customers who rated their satisfaction less than 5 out of 10, most referred to dissatisfaction with the quality of the work that was completed. A few respondents mentioned that they had not noticed savings in their energy bills.

C. Measure persistence

Nearly all of the measures implemented through the program are still installed and operating. Around two percent of respondents reported that the measure was never installed. These respondents were split between market transformation program (MTP) and standard offer program (SOP) participants. All of the Solar PV equipment was still installed and operating.

D. Demographics

Finally, the survey included demographic questions about the household to characterize the customers who participated in the survey. Over 90 percent of respondents live in single-family homes. Only seven percent rent the home, while the rest own the property where the measures were implemented. This could present an opportunity for programs to reach both more rental properties as well as other types of housing beyond single-family homes.

The homes vary in age from having been built before 1940 to some built after 2010, and varied in size from under 1,000 square feet to more than 3,000 square feet. Both the age and size of the home were normally distributed, with the most responses grouped around the middle of each range.

5.4 MARKET ACTOR RESULTS

5.4.1 Overview

This section of the report summarizes market actor results for all Texas residential programs. The results represent market actors' perspectives at a statewide level. Note that the number of market actor interviews were limited by program; therefore, these results should be viewed qualitatively.

The EM&V team obtained the market actor sample from program year PY2013 program tracking databases, utilities, and/or implementation market actors. At minimum, we received the market actor company name and telephone number. Some market actor data also included individual contact name, email address, projects completed and associated savings.

5.4.2 RSOP/HTR SOP

The EM&V team completed 21 market actor interviews for the utility portfolio. The total sample of market actors was small and therefore all market actors with available contact information were included in the sample.

Overall, market actors are satisfied with the design and implementation of the programs. The highest satisfaction rated categories were the clarity of program manuals and documentation and the online program application process. Contactors also had high satisfaction ratings for the support they receive from utilities and the clarity of program eligibility requirements and participation instructions.

The amount of incentive offered received the lowest satisfaction of all categories. One respondent indicated that utilities are paying less for incentives while market actor costs keep going up which makes it difficult to sell the projects to customers. In addition, several market actors said they felt the incentive payout for gas heated homes was incorrectly calculated and needs to be increased.

An overall theme brought up by market actors was that there is not enough marketing done by the utilities to raise awareness among customers. A majority of market actors said that not having utility support on marketing makes it very difficult for them to gain customer trust about the legitimacy of the program. Interestingly, the customers themselves had a high awareness

level of the program with the majority of market actors (17/21) stating that most or some of their customers knew about the program before the market actor mentioned it to them.

When asked about existing barriers to customer participation in energy efficiency programs and adoption of energy efficient technologies, most market actor responses centered around customer awareness of energy efficiency in general. The theme of customer awareness persisted through many of the interviews as market actors felt that raising customer awareness of the programs would help them sell more projects. In addition, most market actors mentioned that customers had a general skepticism about the program incentives and product incentives.

Most market actors said they had to complete some form of training in order to become a qualified program sponsor, but a few market actors said they did not receive training directly through the program. A couple of market actors indicated that they would appreciate receiving more paid training provided by the utility as it would help them provide better services to customers within the bounds of the program requirements.

A few market actors across multiple utilities noted that the use of electronic application forms in the field is the best way to document and submit information for the program. Those who are using electronic forms currently are very happy with them and other market actors suggested that utilities move away from paper and start using tablets.

5.4.3 New Homes

The EM&V team completed 21 interviews for the New Homes program (12 builders and 9 raters). The EM&V team spoke with a mix of builders that work across the four new homes programs in Texas. Organizations included in the study vary by number of homes built annually (under ten to thousands) as well as type of home (production to fully custom homes). Many of the builders interviewed said their home building standards meet the ENERGY STAR® v3.0 requirements or similar type of program (e.g., Environments for Living®).

A. Builders

The majority of home builders interviewed have been building homes through the Texas programs for five or more years. Only one respondent said that they began participating in the program recently; in this case, the individual said they started participating in the program in 2013. Because of the relative long-standing experience with the program, most respondents could not recall how they first heard about the program.

Many builders interviewed service customers across multiple service territories. The interviews probed these builders on differences in program requirements, satisfaction, etc. by utility. Other than a few variations in program design, builders did not identify differences among the various utilities for this program.

The amount of incentive offered received the lowest satisfaction of all categories. A number of builders mentioned that while the incentive is nice to have, the available dollar value is low compared with the additional cost to build a home to the program's requirements. In addition, with the exception of one builder, all respondents said that as standard practice they build homes that meet or exceed program requirements. They oftentimes do so as they participate in other national or regional programs (e.g., Environments for Living®).

Builders typically use the incentive to reduce their cost of building the home. The reduced cost is generally not directly passed onto the customer, however. Additionally, over half of the builders the EM&V team spoke with said they do not tell their customers that their utility is contributing funds to their home (6/11). The other builders said they sometimes (1/11) or always (4/11) inform their customers of the utility incentive.

Builders stated that the most prevalent barrier to customers' purchasing program homes is cost. Another barrier is customers' lack of understanding (or shorter-termed perspective) of the energy saved and how the savings will benefit them. There does seem to be a difference in these perspectives, though, based on the market served. For example, one builder that serves a "starter home" market said that the value of building a program-qualifying home is not always apparent to their customers who are likely to move to another home in a few years. Alternately, a smaller custom builder interviewed said that while their customers may not really understand the energy saving benefits up front, they quickly see and appreciate the energy savings once they move in.

Given this information, it is not surprising that the item rated lowest for satisfaction is the amount of incentive offered by the utility. One respondent, whose company is not very active in the program, expanded to say that the incentive was not sufficient to even offset the central air conditioning Seasonal Energy Efficiency Rating (SEER) requirement, which in turn is why their applications are rejected.

While builders tend to rely on their raters for information, respondents said they are participating in various types of training (e.g., webinars, lunch events, and in-person seminars) offered by the utility and/or the implementation contractor. Training topics focus on new construction and program requirements (e.g., ENERGY STAR® standards, online submission process, etc.). Respondents were asked about their experience with training and informational sessions offered by the programs. Most respondents spoke very highly of the training, as well as the availability of program and utility staff to respond to their questions. While most respondents said the training just provided a good reminder on requirements and building practices, others said that it affected the organization's building practices.

One respondent provided some constructive feedback on the training and content. He said that he works with two groups of individuals in his position—those that need to sell the energy-efficiency home to the customers, and those that need to know the technical requirements of building the home. This particular builder said that while the trainings may target the technical audience, it oftentimes does not appropriately target and teach to the sales force staff that is at the forefront of engaging the customers. He believes this is an area for potential improvement.

B. Raters

The EM&V team spoke with at least one rater representative for each of the four new homes programs in Texas. Rater organizations included in the study vary by number of home ratings annually (20 to thousands), and work with anywhere from three to upwards of 80 builders. Many of the builders these raters work with are building to the ENERGY STAR® v3.0 standards or similar type of program (e.g., Environments for Living®).

The majority of raters interviewed have been working with builders that participate in the Texas new homes programs for five or more years. The vast majority of raters said they

anticipate about the same amount of new homes business in 2014, but this is a two-sided story—on one hand, raters indicated they will be losing some builders due to additional program reporting requirements (e.g., documentation requirements), but on the other hand indicated they would be picking up new builders due to program design changes (e.g., moving from ENERGY STAR® v3.0 to an energy savings/ code model). All but one rater we spoke with works 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 design, raters did not identify differences among the various utilities for this program.

Most raters indicated that communication related to program requirements have historically been pretty clear. However, as programs change, or consider changing, to an energy savings/ code-based program, raters noted that more training would very helpful. Moving from an ENERGY STAR® format to a code-based format will require raters to both re-think and re-do reference homes.

Raters take care of almost all program activities for their builders, helping to ensure program requirements are met. A few raters said they enter all program information into the required portals, from both the builder and rater perspectives. Another rater mentioned that they provide their building files to the utility, but then are also required to enter the data to a website. This can create an environment for human error, which can result in a home being rejected and an unhappy builder. As a result, these raters mentioned that streamlining the program requirements so they can stay on top of their paperwork would be very helpful. Most raters also mentioned they are receiving the support they need in a timely manner.

When asked what they think the biggest challenges are for constructing and/or selling energy efficient homes going forward, raters provided various comments but most of the responses focused on the value proposition for the builder.

> *"Some of the builders just decide not to participate due to the incremental costs; the rebates don't outweigh the incremental costs; you have to be a big builder to make it worth it."* – Rater

Additionally, raters noted they believe the perception of homebuyers is that program-qualifying energy efficient homes are more expensive than non-program homes and that homebuyers do not recognize the value, with the exception of people who are already "green"-minded. Energy education is needed to change this perception and increase demand for energy efficient homes.

5.4.4 Existing Homes

The EM&V team completed seven unique market actor interviews for the Existing Homes programs. Because several of the market actors work with different utility programs, the seven unique market actor interviews represent eight utility program level interviews completed.

Specially trained participating contractors diagnose the home's energy use and recommend steps homeowners can take to improve the comfort, durability, and energy efficiency of their home. Organizations included in the study vary by number of completed projects annually (seven to thousands). Organizations vary with regard to the number of employees in Texas as well (from 1 to almost 50). EESPs we spoke with also provide a variety of equipment sales

and services, ranging from home energy audits to HVAC sales and installation to insulation sales and installation.

EESPs interviewed began participating in the existing homes programs at varying times—two in 2013, two in 2012, two in 2011, and one in 2010. How EESPs first learned of the program also varies—three heard about it from either a utility account representative or utility program staff, two learned about it through their participation in other energy efficiency programs, one heard about it at a trade show, and another heard about it through a contractors association.

EESPs are generally very satisfied with all program elements. Utilities (and/or their implementers) are providing sufficient program instructions and documentation, reflected by the fact that the two of the elements most EESPs said they are "very satisfied" with is the clarity of program participation instructions (5/7) and clarity of program manuals/documentation (5/7). EESPs said they are also "very satisfied" with responses to questions raised (5/7), amount of incentive offered (5/7), and training received (5/6). A key area where improvements could be made (where more respondents said they are either "somewhat satisfied" or "not satisfied") include support from the utility (3/7).

Most EESPs (5/7) said they always inform their customers that the equipment or service is being incentivized through the utility-sponsored existing homes program. Almost all (6/7) EESPs said they leverage the incentive to mark down the price of the service or equipment. One EESP said either the incentive goes to the customer or they mark down the price, depending on the situation.

EESPs agree that costs influence their customers' investments in improved energy efficiency: four EESPs said that lack of investment capital is a primary barrier, and two said lack of knowledge.

The cost theme also continued into the different barriers to customers' *participation* in the program, with three EESPs mentioning that the incentive is not high enough to make up for the additional cost of efficient equipment or related services. One EESP mentioned customers were concerned that the incentive process would delay the project, one mentioned energy efficiency awareness, one mentioned the challenge of working in parallel with the Standard Offer Program (SOP), and another one said it just depends on the time of year.

5.4.5 Solar PV (Nonresidential and Residential)

The reader is referred to 4.4.4 for the market actor results related to the Solar PV program.

5.5 RECOMMENDATIONS

5.5.1 Improving saving estimates

We first provide options for improving savings estimates for the residential measures, followed by Solar PV and Load Management programs.

A. Residential Programs (RSOP, HTR SOP, and RMTP)

The EM&V team identified the following areas where savings estimates could be improved for residential applications. The analysis reviews peak demand, whole-house, and individual measures such as air sealing and duct efficiency measures.

- **Add energy and demand savings specific to the Texas TRM's climate zone five (West), when missing.** Several measures are missing energy and demand savings specific to the Texas climate zone five specified in the TRM. In the past, climate zone two values have been substituted for those measures where savings specific to climate zone five were not available. However, due to the sensitivity of many measures to climate zone, as well as the substantial differences between the western (climate zone 5) and northeastern (climate zone 2) regions, the team recommends that energy and demand savings specific to climate zone five be developed wherever they are not currently available.
- **Update the model parameters/characteristics used in all of the whole-house models for consistency and to increase accuracy.** The whole-house models that were created to derive winter demand savings used recently updated values as input parameters. The evaluation team recommends updating all old models on which deemed savings have been based to reflect this new set of basic assumptions, to maintain consistency, and to make the savings more accurate. For example, certain assumptions such as average HVAC efficiency rating for existing homes should remain consistent across all models used to develop savings for envelope insulation and air sealing measures. A unified set of assumptions should also be maintained when modeling across different climate zones for a single measure type. The EM&V team understands that these parameters evolve and will continue to be updated through time; it would be worth updating the old models periodically to keep the deemed savings values updated.
- **Adjust the energy and demand savings for the envelope measure category, excluding the air infiltration measure, for homes with evaporative coolers.** The EM&V team created prototype EnergyPro models for each of the five Texas climate zones specified in the TRM using the basic parameters and characteristics set forth in the winter demand savings petition, Project No. 41722, in order to maintain consistency with the basic assumptions supporting the most recent set of whole-house models from which savings are derived. The team's review showed that cooling and fan consumption is significantly lower in homes with evaporative coolers, ranging from 32 percent to 37 percent of the consumption in homes with central air conditioners. This decrease is mainly due to evaporative coolers' electricity consumption only stemming from fan use, since they have no compressors and rely instead on passive cooling. Although fan consumption is higher for homes with evaporative coolers, the eliminated cooling consumption is more significant than the increased fan usage. Given the substantial difference between consumption in homes with evaporative coolers and central air conditioning systems, the EM&V team recommends revising the deemed savings for envelope measures installed in homes with evaporative coolers, particularly present in the western climate zone (climate zone 5).
- **Look into the notable variance between the savings generated by the previously-used duct savings calculator and the engineering algorithm**

approach introduced in Texas TRM v.1.0. The methodology and the assumptions used in the duct savings calculator previously used to determine savings should be compared to those underlying the new engineering algorithm approach in order to explain the significant variance of savings resulting from each methodology, and to ensure that the most accurate methodology has been selected. Benchmarking the savings can be done through employing a third methodology, such as whole-house modeling, to help assess the accuracy of the savings calculated using each approach.

- **Introduce a heating/cooling interaction factor (HCIF) to the savings calculation for lighting measures.** The current methodology for calculating energy and demand savings associated with lighting measure does not account for the secondary effects of lighting efficiency improvements on building HVAC usage, also known as HCIF. Incorporating an HCIF into the energy and demand savings algorithm will more accurately account for the impact on energy and demand from the measure.
- **Collect primary data or use climate zone specific TMY3 weather data to estimate the average ambient air temperature for heat pump water heaters located in unconditioned spaces.** Currently, the savings algorithm relies on secondary studies that may or may not be relevant to the state of Texas regarding the assumed average balance set point of 65˚F. The team encourages that residential models be built and calibrated against actual energy consumption data. These models would represent the internal loads as well as the cooling and heating loads that are estimated using TMY3 weather data. The suggested balance point for both new construction and retrofit homes derived from these models should be used as an input in the existing the savings algorithm.
- **Update the methodology used to calculate energy and demand savings for ground source heat pumps with desuperheaters.** In the Texas TRM v.2.0, the methodology used to calculate energy and demand savings for ground source heat pumps was updated to rely on an engineering algorithm. However, savings associated with desuperheaters continue to be based on a 1998 modeling study conducted in Louisiana. The EM&V team recommends revisiting this methodology and finding a way to calculate energy and demand savings for ground source heat pumps with desuperheaters using one unified methodology to increase the accuracy of the predicted savings.
- **Update the energy and demand savings for the solar water heater measure.** The methodology used to estimate energy and demand savings for the solar water heater is not specific to climate zone and installation parameters (orientation and tilt of the installed panel). In order to improve the savings estimate, the EM&V team recommends adopting one of the two following approaches:
  - Using nearest available location-specific SRCC OG-300 ratings for each climate zone
  - Creating deemed savings tables for each climate zone based on some prototype models using NREL's System Advisor Model (SAM) hourly simulation tool (preferred approach).

B. Solar PV

The recommendations for process improvements described in the commercial Solar PV section apply equally to residential Solar PV.

5.5.2 Measures that are good candidates to use deemed savings

Similar to the process followed for the commercial programs, the current list of residential measure categories utilized in Texas was reviewed to identify those which are not currently using deemed savings and whose use may have been significant or were on the rise from 2012 to 2013. These were discussed during utility program manager staff interviews.

This section provides a list of measures for which a TRM protocol could likely be developed. The measures listed below have existing protocols in other state TRMs, have an ENERGY STAR® calculator available, and/or for which a relatively low-cost pilot study can determine the savings.

A. Advanced power strips

Advanced power strips typically have one master or controller outlet, several controlled or switched outlets, and one or two uncontrolled or always-on outlets. The controlled outlets automatically draw no power when the homeowner turns off the controller device. This creates energy savings by reducing the power draw from the controlled devices' standby mode. (Devices continue to draw power when inactive but still plugged into a live outlet.)

Some smart strips contain occupancy sensors, but fewer studies about these devices have been conducted, and they are less common in residential settings. These are mainly designed to work in an office setting, where computers may remain turned on for long periods of time without being used. At this time, the team recommends that deemed savings be developed for load-sensing power strips not equipped with occupancy sensors.

This measure has been introduced to many TRMs nationwide, most of which use a combination of the device power consumption (active, low, and standby mode), hours of use, and saturation in the home in order to calculate smart strip energy savings. The 2011 New York State Energy Research and Development Authority (NYSERDA) report, "Advanced Power Strip Research Report," compiles data from six sources to establish the power consumption and hours of use for the devices. This source reflects some of the most recent data on device power consumption, usage, and relative saturation of various equipment. Primary data collection, particularly metering studies, are encouraged to improve savings estimates.

An additional consideration for this measure regards customer education. Operation of advanced power strips is not yet commonly understood, and installation rates may be low when devices are left for customers to install.

B. ENERGY STAR® freezers

While the current TRM provides detailed savings for ENERGY STAR® refrigerators, no savings are currently awarded for the installation of a stand-alone ENERGY STAR® freezer. Savings for this measure, while lower than for refrigerators, are widely available in other

TRMs; the EM&V team believes that savings for this measure can be developed at a relatively low cost.

Using the ENERGY STAR® appliance calculator for freezers[45] in conjunction with the updated federal standards that will take effect September 15, 2014, a similar approach to that filed for ENERGY STAR® refrigerators in the Texas TRM v.2.0 may be employed for this measure. Through this methodology, the annual energy consumption for baseline and ENERGY STAR® freezers may be determined based on volume and configuration data collected by contractors during installation.

While there is no current consensus across other TRMs on the use of coincidence factors or other adjustment factors to derive demand savings, the EM&V team believes that the adjustment factors (temperature adjustment factor [TAF] and load shape adjustment factor [LSAF]) introduced in the Texas TRM v.2.0 ENERGY STAR® refrigerator measure may be applied for ENERGY STAR® freezer demand savings, following the example of the 2013 Mid-Atlantic TRM.[46] Although other TRMs[47,48] award demand savings under the assumption of a coincidence factor of one, the EM&V team recommends that savings for this measure be petitioned consistent with the adopted approach for ENERGY STAR® refrigerators.

C. ENERGY STAR® pool pumps

Standard single-speed pool pumps currently constitute the majority of the current pool pump market; however, energy savings are available through installation of variable-speed or multi-speed pool pumps, which allow for adjustment of pump speed to match different operations, such as filtration and cleaning. ENERGY STAR® designation for efficient residential pool pumps was introduced in February, 2013. As of May, 2014, only one single-speed pool pump qualifies as ENERGY STAR®; the EM&V team therefore limited its consideration to multi-speed and variable-speed pumps at this time. This measure has been integrated into a number of TRMs, with annual savings per pump reaching more than 1,000 kilowatt-hours. According to industry data collected by the Association of Pool and Spa Professionals (APSP) in 2013, Texas accounted for 7.7 percent of in ground pools, behind only California and Florida,[49] making the pool pump a good candidate for new petitioned savings.

ENERGY STAR® has produced a pool pump calculator[50] that can be used to calculate savings associated with installing an efficient pool pump. The calculator relies on a number of assumptions with regard to characteristics of the baseline pool pump and pool pump

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[45] http://www.energystar.gov/buildings/sites/default/uploads/files/appliance_calculator.xlsx?e1bb-45ed&e1bb-45ed. Accessed May 30, 2014.

[46] Mid-Atlantic Technical Reference Manual, Version 3.0. Developed by Shelter Analytics for Northeast Energy Efficiency Partnerships. March 2013. http://www.neep.org/Assets/uploads/files/emv/emv-products/TRM_March2013Version.pdf.

[47] Pennsylvania Public Utility Commission Technical Reference Manual. June 2014. http://www.puc.pa.gov/pcdocs/1265230.docx.

[48] Arkansas Technical Reference Manual, Version 3.0. Arkansas Public Service Commission. August 2013. http://www.apscservices.info/EEInfo/TRM.pdf

[49] Association of Pool and Spa Professionals, U.S. Swimming Pool and Hot Tub Market 2013. https://apsp.org/portals/0/images/APSP%20statistics%202013.jpg. Accessed May 29, 2014.

[50] Savings Calculator for ENERGY STAR® Certified Inground Pool Pumps. http://www.energystar.gov/buildings/sites/default/uploads/files/Pool%20Pump%20Calculator121113.xlsx?e81b-ef5c&e81b-ef5c. Accessed May 30, 2014.

operation. Until primary data can be collected to determine Texas-specific values for these factors, deemed savings tables may be developed using the default values for Texas in ENERGY STAR®'s pool pump savings calculator. As the calculator provides only energy savings, a coincidence factor must be derived from additional research. The Pennsylvania TRM recommends that a coincidence factor be recorded based on the timeclock of the replaced single-speed pool pump, while the Mid-Atlantic TRM references a coincidence factor put forward in a 2009 report developed for Southern California Edison.[51]

Energy and demand savings tables should be developed for a range of common nameplate pump horsepowers and for different ranges of pool volumes so that savings might be assigned dependent upon contractor-recorded pool and pump characteristics.

D. Shower auto-shutoff thermostatic valve

Auto-shutoff thermostatic valves installed on showerheads are intended to prevent "behavioral waste" by shutting off water flow once the temperature reaches a specified setpoint. Electric savings are achieved in homes with electric water heating by reducing the amount of unused heated water, reducing water heating loads. Based on pilot studies, such as that conducted by the City of San Diego in 2008,[52] the EM&V team anticipates that savings will approach those awarded for faucet aerators.

Key determinants of deemed savings for this measure are showerhead flow rate and the decreased hot water runtime, from which the volume of water saved can be calculated. As these devices may be installed in conjunction with a low-flow showerhead, dependence of savings on flow rate is critical. While small-scale studies have been performed to determine the baseline wasted shower run time, the EM&V team recommends that a larger study be performed so that appropriate savings may be petitioned for this measure.

Once appropriate values are determined for the volume of water saved through installation of these devices, the methodology used to calculate energy and demand savings for low-flow showerheads may be applied to auto-shutoff thermostatic valve installations.

E. LED lamps

As standard incandescent lamps are phased out due to implementation of EISA, lower baseline wattages will reduce the amount of potential savings from installations of compact fluorescent lamps (CFLs). LEDs present a lower-wattage alternative to CFLs that allow for larger claimed savings, particularly in warm climates where the low waste heat given off by LED installations will reduce the sizable cooling loads.

The EM&V team recommends that savings for LED lamp installation be developed following the same methodology for calculating CFL savings presented in the Texas TRM Version 2.0. Baseline wattages for various LED wattages and lamp types can be found through primary

[51] INTEGRATION OF DEMAND RESPONSE INTO TITLE 20 FOR RESIDENTIAL POOL PUMPS, SCE Design & Engineering; Phase1: Demand Response Potential DR 09.05.10 Report. http://www.etcc-ca.com/sites/default/files/OLD/images/stories/dr_09.05.10_residentialpoolpumps_v7_10-0312.pdf.

[52] City of San Diego Water Conservation Program, Showerstart Pilot Project White Paper, August 2008.

market research, and are also available from secondary sources such as the Arkansas TRM Version 3.0. To determine any additional savings or penalties associated with waste heat effects on heating and cooling loads, the EM&V team recommends that the HCIF methodology developed for CFLs be applied to LED savings.

F. Occupancy sensors

Lighting occupancy sensors can provide a significant source of savings by curtailing unneeded lighting usage, and may lower cooling loads through reduction of lighting waste heat. While deemed savings for installation of occupancy sensors are widely available for commercial applications, savings have not been commonly developed for residential settings. The 2014 Pennsylvania TRM asserts that occupancy sensors can lead to a 30 percent reduction in lighting hours of use for residential applications. This value is consistent with the reduction cited in the 2012 Massachusetts TRM[53] for multifamily applications. Due to the high potential for savings, the EM&V team recommends that deemed savings be developed for occupancy sensors installed in multifamily residences. For single-family residential applications, further research must be conducted to determine the appropriate reduction in hours of use.

G. HVAC tune-ups

From 2012 to 2013, the residential sector overall saw pretty much the same mix of measures for which savings were claimed. However, one measure that saw a significant increase in PY2013 over PY2012 is the air conditioning tune-ups (including packaged AC, packaged heat pump, split AC, and split heat pump). The claimed savings for this measure increased significantly in PY2013, driven in large part due to CenterPoint's introduction of the measure through its Retail Electric Provider Pilot in PY2013 which recognized 5,191,877 kWh. However, not including CenterPoint's program, the savings for air conditioning tune-up measures more than doubled in PY2013. Additionally, it was the case in PY2013 that some of the air conditioning tune-up measures were deemed and some were completed through an M&V process. Most TRMs do include the air conditioning tune-up measure as a deemed measure.

In several utility territories, the CoolSaver residential market transformation program awards savings for tune-ups performed on central air conditioning units. The CoolSaver program has featured substantial measurement and verification (M&V) efforts, from which the program implementer has derived deemed energy and demand savings for residential customers. Deemed savings derived for a similar program conducted in Arkansas will be evaluated by members of the EM&V team in 2014. The EM&V team recommends that a petition for deemed savings be filed so that these savings might be awarded under Texas programs, pending the results of the Arkansas evaluation.

Based on the 2013 CoolSaver Option A M&V Plan, tune-up savings may be awarded for some combination of the following activities:

- Clean the condenser

[53] Massachusetts Technical Reference Manual for Estimating Savings from Energy Efficiency Measures: 2013-2015 Program Years – Plan Version. October 2012. http://www.ma-eeac.org/Docs/8.3_TRMs/1MATRM_2013-15%20PLAN_FINAL.pdf. Accessed May 30, 2014.

- Clean the evaporator
- Clean the blower assembly
- Verify clean filter—change or clean as needed
- Verify airflow within range (±15 percent of 400 cfm/ton)
- Check refrigerant charge and adjust to manufacturer's specifications as needed.

The Arkansas TRM Version 3.0 also awards savings for tune-up measures, but stipulates several additional tune-up and inspection activities based on the ENERGY STAR® HVAC Maintenance Checklist.[54] The Arkansas TRM uses an algorithmic approach to award savings for tune-up of residential air conditioners and heat pumps, relying on extensive on-site data collection.

To minimize the burden on contractor data collection and training, the team recommends that the deemed savings developed as a result of CoolSaver M&V efforts be awarded for air conditioner tune-up activities conducted in Texas. However, additional M&V efforts are encouraged to award heating and cooling savings for treated heat pumps, and to determine savings for an extensive tune-up as described in the ENERGY STAR® HVAC Maintenance Checklist.

H. Ductless "mini-split" heat pumps

Ductless, or mini-split, heat pumps (DHPs) are highly-efficient, zone-specific HVAC equipment that can produce substantial heating and cooling savings. DHPs avoid losses from leaky ducts, and encourage zonal rather than whole-home heating and cooling. Homes can be retrofit without removing current equipment, allowing older systems to function as back-up units and enabling easy retrofit of homes with electric resistance heating.[55] They are particularly appropriate for sites with room- or zone-specific HVAC needs, such as rooms served by window ACs and electric resistance heating, and multi-family residences.

As DHPs serve only a single room or zone, savings calculations must take into account any back-up HVAC systems, and the areas served by each installed unit. The 2012 Bonneville Power Administration (BPA) "Emerging Technologies for Energy Efficiency" report on DHPs[56] noted that back-up HVAC type and operation pattern were key determinants of savings. Because of the influence of behavioral factors on savings for this measure, a metering study or billing analysis may be desirable for a robust estimate of savings.

[54] Maintenance Checklist. ENERGY STAR®. http://www.energystar.gov/index.cfm?c=heat_cool.pr_maintenance. Accessed May 30, 2014.

[55] Ductless Heat Pumps: BPA Brown Bag Presentation. Jeffrey R. Pratt, Inc. on behalf of the Northwest Energy Efficiency Alliance. http://www.bpa.gov/energy/n/Utilities_Sharing_EE/Energy_Smart_Awareness/pdf/BPA_DHP_Presentation_022708.pdf.

[56] Ductless Heat Pump Engineering Analysis: Single-Family and Manufactured Homes with Electric Forced-Air Furnaces. Bonneville Power Administration. December 2012. http://www.bpa.gov/energy/n/emerging_technology/pdf/DHP_FAF_Dec_12.pdf

I. Radiant barriers

Radiant barriers can provide large cooling savings in hot climates such as ASHRAE weather zones 1 and 2,[57] which encompass all but the panhandle of Texas. In these areas, where cooling loads are high and roofs receive large amounts of direct sunlight, radiant barriers can increase effectiveness of installed attic insulation by reflecting solar heat absorbed and re-radiated by roofing materials. Radiant barriers can lower cooling loads and improve performance of any ductwork located in attic spaces.

While coatings may also be employed to reduce roof heat radiation into the attic space, the 2013 Arkansas TRM reports that requirements for these coatings are not as stringent as for radiant barriers, and that as of August 2012, market research performed by the Reflective Insulation Manufacturers Association International indicated that coatings did not approach the effectiveness of radiant barriers in achieving energy savings.[58] In order to claim savings for radiation control coatings, additional market research should be performed to determine whether qualifying coatings are available.

Savings attributable to radiant barriers depend on the square footage of the barrier installed, the roofing materials used, and the level of ceiling insulation in place, as well as the location and insulation levels of any ductwork. The team recommends that deemed savings be developed for this measure using residential building simulations for each Texas climate zone, with values dependent on insulation levels and ductwork location. As ceiling insulation measures accounted for more than 10 percent of program year 2013 energy and demand savings, encouraging installation of radiant barriers in conjunction with these insulation measures, thereby improving their effectiveness, can lead to large savings.

J. ENERGY STAR® dehumidifiers

As Texas homes are upgraded with energy-saving envelope measures, such as improved insulation, air sealing, and ENERGY STAR® windows, cooling loads may be reduced such that additional dehumidification equipment is necessary, especially in the eastern regions of the state where humidity levels can be high.[59] ENERGY STAR® dehumidifiers are 15 percent more efficient than standard models, and have been available since January 2001.[60]

For the Texas market, this measure may only be appropriate for low-income and hard-to-reach customers due to high market share of ENERGY STAR® units and related concerns about freeridership. For these customers, this measure may also be needed to improve health and comfort, as well as contributing to energy savings.

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[57] Radiant Barrier Fact Sheet. Oak Ridge National Laboratory. http://web.ornl.gov/sci/ees/etsd/btric/RadiantBarrier/RBFactSheet2010.pdf. Accessed May 30, 2014.

[58] Thermal Emittange Evaluation of Coatings for Use as Interior Radiation Control Coatings. Reflective Insulation Manufacturers Association International. http://www.rimainternational.org/index.php/technical/ircc/. Accessed May 30, 2014.

[59] Residential Dehumidification Systems Research for Hot-Humid Climates. February 2005. NREL/SR-550-36643. http://www.nrel.gov/docs/fy05osti/36643.pdf.

[60] ENERGY STAR® Dehumidifier Key Product Criteria. http://www.energystar.gov/certified-products/detail/dehumidifiers. Accessed May 30, 2014.

Several other TRMs, including those for Ohio, Pennsylvania, and the Mid-Atlantic region, have developed deemed savings for this measure using an algorithmic approach consistent with the ENERGY STAR® appliance calculator. However, the baseline assumptions for this approach may need to be modified for the Texas market. Due to the anticipated interaction between air conditioning usage and dehumidification, as well as an unidentified baseline for income-qualified customers, determination of an appropriate baseline condition for dehumidifier installations may require substantial M&V efforts. Given the level of effort expected, deemed savings for this measure may be developed on an extended timeline.

5.5.3 Maximizing net savings

A. RSOP

The NTG rates for the RSOP are within the range of industry standards, and a considerable portion of both customers and market actors attribute their decisions and recommendation practices on program offerings. Technical support from EESPs and the utility and the direct installation of measures are reported as being highly influential by customers.

Two measures where free-ridership is somewhat higher are central air conditioners and heat pumps. Although sample size for these measures are relatively small (approximately 20 customers interviewed), the free-ridership calculations for these customers are consistently higher (over 50 percent). One recommendation may be to focus incentives offered for high efficiency air conditioning units and heat pumps at the highest efficiency options or increase incentive amounts substantially as efficiency increases. By targeting the incentive amount for the highest-efficiency options for AC and heat pump measures, the RSOP program may experience an overall lower free-ridership ratio.

B. RMTP

A/C Distributor. For upstream programs, such as A/C Distributor, the customer may be aware of the incentives offered (if the EESP installing the equipment chooses to pass along any incentive the distributor passed through to the EESP), but a majority of the program's marketing, outreach, and education is directed to distributors with the end goal of encouraging them to promote higher efficiency equipment. The A/C Distributor NTG research indicates programs have had at least some level of influence on distributors to promote energy efficient technologies that they would not have otherwise done.

While the benchmarked results in general substantiated the reasonableness of the Texas determinations, the Texas results also are at the high end of the benchmarked ranges of results due to spillover. This suggests that Texas utilities have generally employed strategies to keep program attribution high. The high spillover suggests the utilities and their implementation contractors are providing technical expertise and support that is influencing distributors' stocking and sales practices. In program manager interviews it was discussed that the utilities and their implementation contractors make a concerted effort to target the A/C distributor market through education and networking opportunities.

CoolSaver A/C Tune-up. The primary data collection did not provide sufficiently conclusive results or data points to inform recommendations for the Existing Homes programs. Additional research for this program type, with higher number of sample points, would strengthen this study and be more likely to allow us to more confidently calculate NTG ratios and provide

related recommendations. However, at this time there are limited program offerings of this type in Texas.

There are strategies that have been employed with existing homes programs in other jurisdictions to maximize NTG. For example, other programs may make concerted efforts to target the EESP market through education, training, and networking opportunities. Additionally, these programs provide direct outreach and marketing to the end use customer to ensure they are aware of the utility's contribution in the program. Last, we have seen offering multiple measure "bonus" incentives as a way to increase program attribution.

Existing Homes. The primary data collection did not provide sufficiently conclusive results or data points to inform recommendations for the Existing Homes programs. However, there are strategies that have been employed with existing homes programs in other jurisdictions to maximize NTG. For example, other programs may make concerted efforts to target the EESP market through education, training, and networking opportunities. Additionally, these programs provide direct outreach and marketing to the end use customer to ensure they are aware of the utility's contribution in the program. Last, offering multiple measure "bonus" incentives has been used as a strategy to increase program attribution in other jurisdictions.

New Homes. The Texas New Homes programs should continue to have their programs evolve as building codes and standard practice evolve. The new homes programs have already shifted their focus to both a code-based energy savings goal (e.g., new homes must save 15 percent more kWh than a home built to code) and are focusing on specific components to make new homes more energy efficient. We are recommending follow-up research in PY2015 to assess if the program changes are sufficiently pushing the market and increasing the NTG ratio for this type of program. We also recommend the study include sufficient sample and stratification to account for the variations by market and utility program designs.

Last, two key components to the new homes market that the EM&V team was not able to assess was the nonparticipating builder market and code compliance. A statewide market assessment that includes these two items would provide further insight into the market and NTG issues as there may be opportunity to increase the energy efficiency practices of nonparticipating builders as well as compliance with codes.

Energy Education and Appliance Programs. Because there was no primary data collection completed for these three programs, the EM&V team does not recommend any program changes. However, based on the EM&V team's work in other jurisdictions, we note one item to keep in mind for appliance rebate programs are federal appliance standards. Depending on the cost effectiveness of the measures, it may not be beneficial to continue offering rebates for equipment at 20 percent above federal standard, as this efficiency level is becoming the standard efficiency around the country. A program to consider for guidance is the Consortium for Energy Efficiency's Super-Efficient Home Appliances Initiative program, which encourages efficiency levels exceeding that of ENERGY STAR®, through multiple tiers.[61] This program offers incentives that incrementally increase for appliances that extend above and beyond the ENERGY STAR® standard. However, at this time, it is the EM&V team's understanding that the one utility offering an Appliance Rebate program has discontinued it for 2014.

[61] http://library.cee1.org/content/cee-super-efficient-home-appliances-initiative-2012/.

5.5.4 Opportunities for process improvements in residential sector programs

A. Overall process improvements

Facilitate collaboration between contractors to encourage increased services to individual participating customers. While utilities continue to meet their energy savings goals, there are potential opportunities while contractors are on site to deliver more energy-efficiency measures to participants, approximating a more holistic or whole-house program design. Currently, participating contractors are specialized (e.g., HVAC, insulation and air sealing) and focus on only a couple of measure offerings within the program. A customer could potentially participate in the program multiple times as contractors would come back to deliver one-off measures. In addition, utilities are having difficulty promoting the installation of HVAC measures as there are limited contractors with the necessary certifications actively participating in the program. The single measure focus and limited HVAC contractor participation decreases the potential for the programs to provide a whole-house approach.

A potential design change could include the coordination of a general contractor who is responsible for pulling in program-qualified weatherization and air sealing contractors to perform the work in a home. Another option is offering a referral bonus to encourage networking and cooperation between contractors. Alternatively, an initial home audit/inspection could serve to identify other qualifying measures and provide a roadmap for subsequent work—this audit could be performed by the contractor who is the initial point of contact, or (in the case a very specialized contractor, like HVAC, was initially solicited by the customer) the contractor could encourage participants to take the next step in receiving a free home audit through a subsequent visit. Similar modifications to design would help ensure the customer receives more qualifying measures and services during their program participation. In addition to increased measure installations, this design would help contractors coordinate customer marketing and outreach activities with other participating contractors in an area of focused program activity.

Utilities that do not already use them should introduce electronic field forms for data collection. Contractors appreciated utilities where electronic field forms are made available. Utilizing electronic field forms will also support the EM&V effort, as it will make these electronic files more easily available. Collecting field data in an electronic format should help reduce redundancy and data entry errors.

Collect sufficient project documentation. As discussed in the commercial findings, the project-level documentation received as part of the PY2013 desk review process was often limited. And although the EM&V team found that project tracking of savings were, for the most part, correctly entered from project savings calculators into tracking databases, the EM&V team was not able to replicate savings calculations for some programs. Savings calculations should have supporting documentation that allows for measure-level verification, especially those key project inputs and parameters that drive a significant portion of calculated savings. Robust and organized program documentation will help improve the accuracy and transparency of estimated savings in future program years. Project activities should be conducted and documented in a way that allows for effective independent review.

For residential programs, the EM&V team is looking for documentation that includes all inputs needed to replicate the savings calculations. The team first reviewed the tracking system to identify measure attribute data that could be used to calculate the savings. For most measures, this attribute data is critical for calculating savings through the data review

process. Additionally, the EM&V team also requested back-up documentation to support measure quantity and attributes, such as purchase orders and invoices, and input files where relevant (such as new homes programs).

5.5.5 RSOP, HTR, and low-income opportunities for process improvements

Coordinate an in-person meeting between RSOP program managers from all Texas utilities to discuss program design. Utility program managers are curious to learn how their program design compares to the other utility RSOP offerings. Initially, the standard offer program was designed to meet statewide commission requirements, but most utilities' programs have evolved to better serve their specific service territory. RSOP program managers would benefit from open communication between utilities about best practices and lessons learned. For added insight, utilities that span multiple states should invite the program managers of similar RSOP offerings in other service territories.

For utilities that offer both HTR and low-income programs, consider ways to bridge the two program offerings. While the HTR and low-income programs serve similar populations, the low-income program provides a targeted whole-house approach (addressing all qualifying measures using a combination of utility and state/federal funds) while the HTR program tends to focus on specific measures for individual customers through the specialized contractor base (e.g., a customer may only receive insulation). For an income-qualified customer, their participation in the HTR program can limit their potential to also participate in the low-income program, as specific measure installations may inhibit the agencies from servicing the home and reduce cost-effectiveness of subsequent measures if high-savings/low-cost installations have already been addressed. Furthermore, given similar income-qualifications, it is highly possible that eligible customers for both programs may be on low-income program waiting lists (in a queue to be served) and contacted by HTR contractors.

It may be possible for agencies delivering the low-income programs to piggyback on recent work performed by HTR contractors in their areas, leveraging this previous effort rather than preventing the delivery of additional services. Both programs would be able to provide more comprehensive services to the targeted low-income population by increasing communication from HTR market actors to agencies so they know where work has been completed and can serve the whole house. More substantial design changes may be required to achieve this collaboration; however, it should result in increased energy savings and greater benefits to individual participating low-income households.

5.5.6 RMTP opportunities for process improvements

The key findings described in this section focus on cross-cutting, rather than program-specific, issues due to the limited process evaluation activities conducted in PY2013.

The PY2013 evaluation effort focused primarily on the evaluation of the reported, or ex-ante, electric savings and demand reduction results. A limited process evaluation effort provided insight into program operations and produced key findings that are applicable across the portfolio of residential market transformation programs.

Similar to PY2012, the EM&V effort found that utilities generally have well-established RMTP program design and delivery processes, supported by developed program tracking systems, program documentation, and savings calculations. This finding is supported by the generally

healthy realization rates across utility portfolios. Additionally, all RMTPs reported a low level of uncertainty in documentation for PY2013.

The EM&V team noted during interviews that program staff were generally very knowledgeable about their programs and seemed to have good working relationships with their implementation contractors. Additionally, both the implementation contractors and utility staff were very helpful in responding in a timely manner to various requests from the EM&V team for program data, reviews, and other information requests.

Fifteen of the 19 RMTP program verified results, or ex-post savings, determined by the EM&V team recognized 100 percent of the reported savings. In many of the cases where realization rates were not 100 percent it was due to not selecting the correct weather zone—a process that has already been corrected for PY2014.

Individuals interviewed as part of the RMTP telephone and market actor survey efforts expressed satisfaction with the RMTPs and the interactions with program staff and EESPs performing the work. The vast majority (91.7 percent) of customers interviewed were satisfied overall with the project they completed[62] Almost half (46.5 percent) of customers interviewed for the RMTPs said they have recommended the program to others.

Various opportunities for process improvements are summarized below. It is worthwhile to note that many of these opportunities are common to program implementation efforts, both new and more mature. At the same time, these issues should be assessed and addressed for more effective operations and, ultimately, more effective and efficient acquisition of energy savings.

Utilities should establish their own internal controls for data quality checks and ensure project files and supporting program documentation is complete and accurate. During program staff interviews, the EM&V team learned that many of utilities rely on their implementers for quality assurance (QA) and quality control (QC). And even when implementer quality control processes do exist, it may not be uncommon for them to be loosely followed as implementers can often be focused on many other tasks associated with program implementation.

While it is necessary for implementers to conduct and ensure QA/QC for their programs, it is also a best practice for utilities to have some level of QA/QC and verification of both data tracking and field activity. Included at the utility level QA/QC should be metrics for implementer QA/QC, as it was not uncommon to hear that there was uncertainty around the specifics of implementer QA/QC. Designing program application and contractor installation reports or checklists that capture the required data for evaluation as well as for accurate calculation of savings is essential. The EM&V team recommends a more thorough review of the RMTP applications and contractor reporting requirements as part of future process evaluation activities.

Ensure the rebate submission process for EESPs is streamlined. Although the majority of EESPs were satisfied with many of the program components, the amount of paperwork required frequently received lower satisfaction scores than other program components.

[62] Satisfied is defined as those customers rating their satisfaction as an 8, 9, or 10 on a 0 to 10 scale, with 0 being “very dissatisfied” and 10 being “very satisfied.”

Implementers should consider creating a mechanism for EESPs to complete applications online and give them the option of submitting the rebate application online or of filling out the application online and printing it through Adobe Acrobat. This would streamline the application process for many EESPs and potentially end the problems associated with rebate process time and handwriting (e.g., not enough space on the rebate forms, illegible handwriting).

> *"We work with over 500 contractors, but only 50 to 60 contractors choose to participate due to the paperwork involved and the amount of time it takes to get the funding."* – A/C Distributor

5.5.7 Solar PV opportunities for process improvements

The opportunities for improvement for the residential Solar PV program is consistent with that reported in the commercial section. The two recommendations were:

- Continue to clearly inform customers on program requirements and processes
- Consider removing or changing the requirement for PV meters.

The reader is referred to Section 4.5.6 for more discussion on these recommendations.

6. STATEWIDE PROCESS ISSUES

This section documents the results of four specific process areas. The EM&V team, along with the PUCT and/or utilities, identified these specific process areas for research within the evaluation planning as well as from follow-up to the PY2012 results. The areas presented are:

- Mix of standard offer/market transformation programs in a utility portfolio
- Utility quality assurance/quality control processes
- Participant definitions.

6.1 THE MIX OF STANDARD OFFER/MARKET TRANSFORMATION PROGRAMS IN A UTILITY PORTFOLIO

6.1.1 Discussion

Standard offer and market transformation programs use different program strategies to achieve energy and demand savings. Standard offer programs use a contract between an energy efficiency service provider (EESP) and a participating utility where standard payments are made based upon the amount of energy and peak demand savings achieved. Commercial customers with a peak load equal to or greater than 50 kW can participate directly with the utility. Market transformation programs are strategic efforts, including but not limited to, incentives and education designed to reduce market barriers for energy efficiency technologies and practices. (§25.181(k)).

In PY2013, SOPs represented the majority of statewide savings—the CSOPs represented the largest percent of savings representing 29 percent of energy and 71 percent of demand savings, while CMTPs delivered 21 percent of energy savings and 7 percent of demand savings. However, this comparison is inclusive of the load management programs. When load management is excluded, the CSOPs and CMTPs are more closely aligned with CSOP representing 22 percent and CMTP representing 18 percent statewide kW savings, and CSOP representing 29 percent and CMTP representing 22 percent of kWh savings.

The RSOPs represented 28 percent of the statewide energy and 11 percent of demand savings compared to 11 percent of energy and 6 percent of demand savings for the RMTPs. Note that this analysis excludes the low-income and HTR programs.

6.1.2 Background and program strategy

In utility interviews, most of the utilities indicated running SOPs internally while having an implementation contractor for the MTPs. Utilities reported working closely with EESPs participating in SOPs. As part of SOP activities, utilities conduct outreach to EESPs, answer questions related to program applications, and review customer-focused marketing materials. EESPs then in turn work directly with the end-use customer.

Implementation contractors deliver the MTPs to the market on behalf of the utility, working directly with the potential participant to provide education, technical assistance, and other project support. In many cases, the potential participant is the end-use customer such as schools, municipalities, non-profits, and small business. However, there are MTPs that also target market actors such as builders and distributors.

In general, the larger utilities with an urban base reported a more developed contractor infrastructure allowing them to have healthy participation in their SOP. Smaller utilities with rural territories tended to report they had limited participation in SOPs, which has led to increased MTPs in their portfolios.

The EM&V team's research indicates the utility programs have been successful in establishing the EESP infrastructure to support the successful delivery of SOPs statewide, as the PY2013 tracking system review reflects a considerable network of EESPs. Across the ten utility SOPs, the PY2013 tracking data showed that over 100 unique EESPs participated in the commercial SOPs[63] and over 200 unique EESPs participated across the residential SOPs. In addition, approximately 2,300 commercial customers participated directly in the utility SOPs statewide. Some utilities have fairly large participating service provider networks while others purposely limited the number of participating EESPs for greater quality control.

While EESPs include many large ESCOs, some utilities also reported working to develop the local contractor network, which is substantiated in the evaluation research; the number of ESCOs compared to the overall number of contractors is relatively small. A similar comparison for the number of EESPs working with MTPs is not available as this information is not consistently housed in tracking systems for many of these programs.

Because MTPs are strategic efforts that are able to include both incentives and education designed to reduce market barriers for energy efficient technologies and practices, these programs can provide value in delivering services that encompass the comprehensive treatment of existing homes and facilities, including Home Performance with ENERGY STAR® and RCx-type programs. In most markets, these particular sectors continue to have an uphill battle to overcome barriers such as imperfect information presented to the market; high upfront costs; and identifying, evaluating, undertaking, and financing investments in energy efficiency. MTPs, by definition, can address these barriers by providing information and education (i.e., through comprehensive audits) as well as incentives directly to customers to encourage them to undertake significant energy efficiency improvements to their homes and businesses. MTPs can also provide EESPs with the training necessary to consistently achieve comprehensive energy savings in existing homes and businesses and ensure an adequate supply of qualified contractors.

MTPs can also play a valuable role for new energy efficiency technologies or services, as well as be specifically designed to express support for new codes and standards adoptions or enforcements. Examples of energy efficiency technologies that have recently been promoted through MTPs include solar photovoltaics and air conditioning tune-ups. Energy efficiency technologies newer to the Texas portfolio that are being considered by a few utilities are pool pumps, geothermal, and combination gas heat and hot water units. Last, utilities can leverage MTPs to support the early adoption, implementation, and enforcement of the most recent version of the International Energy Conservation Code (IECC) for residential or commercial buildings.

The PY2013 EM&V team's research does indicate that for some markets in select utility service territories, such as residential new construction programs, may have largely addressed the barriers they were designed to overcome. As a result, it is important that these programs are assessed to determine their ongoing need in the market (e.g., customer segments served, measures offered, and barriers addressed). This allows utilities to direct

[63] Load Management programs are included in the commercial SOP numbers.

monies where this program type is most needed to effectively gain savings. There may be prior target areas where the market is sufficiently developed such that additional intervention is not needed. In addition, this should help minimize any issues of MTPs 'competing' with other EESPs as discussed under PY2013 process results.

A specific example of this monitoring of the market and changing the mix of MTPs versus SOPs was discussed in one utility program manager interview. This particular utility reported that they discontinued their CMTPs that had served certain commercial customer segments and instead rolled these customers into their CSOP in PY2014. The utility made this decision due to the level of technical assistance and information provided to this customer segment over a number of years. Given this reduced level of technical assistance needed, the utility decided that this customer segment should now be empowered to participate effectively in the CSOP, but will still maintain key account managers for these customers.

Another utility has introduced "Lite" and "Fast Track" MTPs in conjunction with their full MTPs such as Score Lite and RCx Fast Track. These Lite and Fast Track programs offer higher incentives to customers that do not require the technical assistance or engineering analysis provided by the implementer. This approach is also a way to transition these markets while continuing to provide segmented access to incentives. Last, a number of utilities have decided to increase their MTP incentives in PY2014, aligning more with CSOP incentives, as discussed under the PY2013 market actor results. Reviewing the success of these different approaches will be considered in a future evaluation effort.

While recognizing the important role of SOPs as market-driven programs, MTPs will continue to play a valuable role in reaching market sectors that traditionally have not been effectively served by the SOPs. Examples include small business customers and retail electric providers. Several utilities rolled out small business programs in PY2013 and the EM&V team will be evaluating these programs in more depth in PY2014, including looking at program attribution. The EM&V team's PY2014 evaluation activities will also explore engaging retail electric providers in program design and delivery.

6.1.3 Recommendations

The EM&V team recommends each utility assess the market barriers each program type is designed to address within their own service territory to determine the right mix of market transformation offerings versus standard offer program offerings, given their customer base and available contractors to deliver the programs to the market. Baseline studies should be conducted approximately every three years to determine the need for market transformation offerings. The program theory behind the market transformation programs should be clearly articulated, including clearly identifying the market barriers the programs are designed to address and what program activities (e.g., training, technical assistance) are addressing the identified barrier. This will allow each utility to monitor progress toward transforming the market and/or transforming it to SOP if that is the goal.

6.2 OPTIMIZING UTILITY QA/QC PROCESSES

The QA/AC component of a program refers to ongoing planned and systematic activities intended to detect and address programmatic process, technical, and performance issues as soon as possible in order to correct them during program operation. This is separate from EM&V activities, which are intended to serve a more strategic purpose for program design and implementation. Routine QA/QC helps support better claimed savings estimates and

EM&V outcomes by reducing the risk of systematic or repetitive errors, "gaming," or other activities that could negatively affect the programs, utilities, and customers.

All utilities have established QA/QC processes. While these processes vary by utility, in general they are more rigorous for nonresidential projects with census sampling of contractors or projects and both pre- and post-inspections. Residential processes involve sampling a percentage of projects for post-inspections only, most typically reported as 10 percent. Who conducts the QA/QC inspections also varies—some utilities do all of the inspections with their own staff, some use implementation contractors, and some have inspections done by a combination of utility and implementation contractor staff. One utility has tried to streamline their nonresidential QA/QC processes by reducing on-site requirements for smaller projects (less than 25 kW) and requesting digital photographs instead to verify installation.

The appropriate level of QA/QC is an important topic as many utilities are operating near their administrative cost cap and QA/QC is a large implementation cost. At the same time, QA/QC is a very important function for utilities to complete as it helps ensures the savings are resulting and that program satisfaction remains high. While utilities' QA/QC requirements are addressed in 25.181(p), specific guidelines regarding sampling of projects are not included. Below the EM&V team discusses further details of the current Texas QA/QC practices and provides additional information regarding national industry standards. These are presented for residential and nonresidential projects in order to provide additional guidance on the appropriate levels of QA/QC.

6.2.1 Residential

A. Discussion

The standard approach to QA/QC issues, identifying error and extrapolating percent savings differential to all project savings within an invoice period, appears to be too sweeping and punitive. There is the potential for effects of random errors to be applied unduly to the bulk of projects within an invoice period. Reviewing around 15 percent of projects by contractor per invoice period seems to be a high number of reviews to continuously perform; industry practice is around 10 percent. For contractors with fewer projects per month, a single on-site review can result in more than 15 percent of the monthly total. As such, any adjustment based on a single error will have a more punitive effect than for contractors with a larger number of projects reviewed.

In addition, as the majority of the savings come from duct improvements and infiltration control, verifying the savings through an on-site inspection based on a visual confirmation of the work may not be sufficient. As a result, the EM&V team may find unexpectedly large differences in post-CFM measurement, even though the site received a post-inspection by the utility program manager, which did happen for some utilities in PY2013.

B. Recommendation

Utilities should continue performing a similar level of QA/QC of projects but may want to reduce sampled contractor projects from 15 percent to 10 percent for contractors with consistently high performance. We also recommend correcting only site-specific errors without extrapolating these savings adjustments across projects within invoice periods. Utilities should also continue to keep watch on contractors that have persistent QA/QC issues

and establish a threshold for triggering more intensive QA/QC of these contractor (e.g., 20 percent to 25 percent of projects).

Utilities may also want to perform ride-alongs with contractors while the work is being completed. For example, if a homeowner is receiving duct improvement work, the utility QA/QC manager could be present while the contractor is performing the Duct Blaster test. Similar to the recommendation above, these ride-alongs can be focused on those contractors that are new to the program or for whom there have been quality issues.

6.2.2 Nonresidential

A. Discussion

The standard QA/QC approach for commercial projects, verifying preexisting and post installed equipment specifications, and quantities, and estimating of savings using calculators appears to be solid. The EM&V team did not find any major issues or recurring errors with the utility QA/QC procedures. However, the one area identified for potential improvement is better documentation of findings from the inspection visits. The utilities did not always follow a consistent or a clear procedure for documenting the findings from the field visits and final engineering reviews and their impact on the project savings.

Texas utilities' current practice of close to census sampling and often completing both pre- and post-inspections is more rigorous than national industry practice. The EM&V team has found standard practice on the nonresidential side is normally a certain level of sampling (10 percent to 20 percent) coupled with "triggers" for automatic QA/QC based on rebate and/or savings levels.

B. Recommendation

The utility site inspectors and engineering assessors should clearly document the findings from the field inspection visits and modifications made during final project reviews. The field notes should be legible and provide details for any discrepancies found. The utilities' reviewers should clearly document the discrepancies identified from the inspection field visits including the reasons for adjusting or not adjusting savings. Additionally, the utilities should ensure that the customers provide equipment specifications sheets to assist both the utility and EM&V QA/QC processes.

We also recommend that EUMMOT coordinate to revise QA/QC guidelines for deemed savings projects (not custom projects) that would include a sample of approved applications in the ten to 20 percent range as well as savings and rebate thresholds for automatic QA/QC review. Rebate level thresholds the EM&V team has seen in other jurisdictions have started in the range of $10,000–$20,000 and a kWh savings threshold starting around 200,000–300,000 kWh.

6.2.3 Determining consistent definitions of participants

As part of the PY2012 EM&V effort, the EM&V team attempted to calculate the number of participants for each utility program and match this to the numbers reported in the EEPRs. Through this process, it was identified that utilities defined participants differently; therefore, the numbers could not be compared or consistently referenced. For example, one utility may

reference a participant by account number, whereas another might identify a participant by a unique measure installed. Furthermore, contractors also defined participants and at times provided their assessment of participant counts to utilities, but those reports were rarely referenced in the EEPRs.

The EM&V team discussed this finding with both the PUCT and utilities as well as in an EEIP meeting and it was agreed that establishing a consistent definition of a participant, and how to calculate the number of participants, will provide consistency across the state and allow for comparability. It was agreed that the EM&V team would conduct research with the utilities to provide statewide recommendations for participant definitions in this PY2013 report. This section summarizes the results of this research and the EM&V team's recommendations regarding defining participants.

A. Discussion

Half of the utilities in the evaluation define program participants by account number or Electric Service Identifier ID (ESIID) number. This maximizes disaggregation and granularity when tracking participants during a program year and over multiple years. Additionally, using these predefined identification numbers increases internal transparency, allowing staff and evaluators to match projects with specific records.

While the remaining utilities also define participants primarily at the level of individual meters and account numbers, all employ additional definitions for specific programs. In instances where utilities opt against using individual meters or ESIIDs, customer tax ID numbers are a popular identifier for participants of commercial programs. While this definition succeeds in providing a unique code for each business or commercial participant, it also has the potential to either duplicate records or fail to create a record for a specific business altogether. Specifically, if a business has multiple locations participating in one or more energy efficiency programs, tracking the projects implemented and measures installed at each premise may prove burdensome if using the same unique identifier to track the implementation. More than likely, a second identifier will be necessary to differentiate work at different premises attributable to the same customer tax ID. When faced with this situation, some utilities used the premise's ESIID as the secondary identifier to disaggregate projects attributable to one larger commercial customer with installations at multiple locations.

Last, larger commercial programs and the residential air conditioning programs often define participants as individual home builders, developers, distribution firms, or contractors—the party ultimately responsible for designing a home or selling an air conditioning unit. Because these contractors are identified as the participant, the tracking systems do not always capture the end-user's unique identifier.

Although the criteria for defining participants may be similar, the way utilities characterize the number of participants vary somewhat. For example, for several utilities how they counted customers not only varied from other utilities, but by program. In some instances, one line item equaled one participant, meaning that individual sites could be counted more than once. In other instances, the program collapsed the customer, regardless of number of installations, and reported the number of unique sites in the program.

Participants can also be defined by dates of participation. With the exception of load management programs, which are active between June and September, and programs

providing educational kits to school children, which are active during the school year, the dates for program participation across utilities typically begins on January 1 (few programs begin February 1) and ends in December or when all program funding is expended. However, several programs end their program year one month earlier, on November 30.

B. Recommendations

The vast majority of programs define participants using account numbers or ESIID. This is the ideal method of identifying and tracking participants—it allows for a high level of granularity using a preexisting unique identifier, eliminating the need to create additional tracking methods. For programs using an identifier other than account number or ESIID (such as a commercial tax ID) to define participants, a secondary, more granular method of identifying specific premises attributable to the primary identifier is a prudent step to ensure the participant tracking can be aggregated and disaggregated as necessary. The EM&V team discussed using other identifiers, such as meter ID, in their PY2014 extracts if ESIID is not available.

Additionally, it is also valuable to capture the unique customer identifier where the contractor, or EESP, is tracked as the participant. The customer identifier should be an ESIID (if available by utilities), a meter number, or another unique identifier. The EM&V team recommends avoiding basing unique identifiers on addresses or other textual indicators; these fields can vary for the same name (e.g., Dr. vs. Drive) which makes it difficult to aggregate and organize the data.

Last, there may be variation in how utilities and implementers capture the customer-level information and count participants. If important for the two parties to have the same information, then it would be beneficial to coordinate with each other to ensure the same identifier is being used to count customers as well as the same level to count the customers (e.g., individual participants aggregated and counted regardless of number of measures/times participating, or count customers represented in a line item, where a single customer could be counted multiple times if they installed multiple measure types).