INDEPENDENT AUDIT OF TEXAS ENERGY EFFICIENCY PROGRAMS IN 2003 AND 2004

FINAL REPORT

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EXECUTIVE SUMMARY

This executive summary highlights the key findings and recommendations from the measurement and verification (M&V) audit of energy savings programs established in response to Public Utility Commission of Texas (PUCT) Substantive Rule §25.181. This Substantive Rule established energy efficiency goals and program guidelines to implement Senate Bill 7 (SB7), which was passed by the Texas legislature in 1999. The M&V study reviewed the estimates of energy and demand savings at each participating utility, on a program by program basis, to gauge progress toward achieving the established energy efficiency goals in each of their service territories.

For 2003, the audit verified 154,579 kW across the six utilities, or 102.6% of reported savings. For 2004, verified savings were 196,582 kW, or 102.0% of reported savings. Based on these figures, verified peak demand reductions exceeded statewide goals by approximately 14% in 2003 and 34% in 2004

Since this M&V review is primarily a ***desk audit*** of the energy and demand savings reported by the utilities, the scope of work did not include an impact evaluation of programs, but rather a thorough review of the programs' delivery methods and savings claims based on interviews, program databases, and paper records. No on-site inspections, metering, or customer billing analyses were conducted. Based on the audit, approximately 102% of claimed savings were verified. Recommendations are included in the report for revising program rules and planning, improving program delivery and documentation of savings, and conducting other activities that may facilitate greater precision and reliability in verifying future savings.

SB 7 requires the utilities to:

- *Administer energy savings incentive programs in a market-neutral, nondiscriminatory manner, but will not themselves offer competitive services.*
- *Provide all customers in the state with a choice of and access to energy efficiency alternatives, and other choices from the market that allow each customer to reduce energy consumption and costs.*
- *Provide, through market-based standard offer programs or targeted market transformation programs, incentives sufficient for retail electric providers and competitive energy service providers to acquire additional cost-effective efficiency equivalent to at least 10 percent of the utility's annual load growth.*

The statewide program goals were based on forecasts from historical load growth and were set to achieve demand reductions of 136 MW in 2003 and 147 MW in 2004. Each investor-owned utility in the state was required to report estimated savings in April of the year following the program year. This M&V study began in January of 2006, and was designed to achieve the following objectives:

- Provide the Commission with an independent assessment of the progress that is being made toward the goals for energy efficiency established by PURA § 39.905. This will encompass a review and verification of the estimates of energy savings and peak demand reduction that are reported by EESPs and compiled by the utilities.
- Identify opportunities to improve the programs through a limited process evaluation, involving interviews with utility program administrators and EESPs, a review of program materials, and a review of regulatory requirements.
- Provide the Commission with recommendations to assist the Commission and the utilities affected by the Energy Efficiency Rule in meeting the State's goals for energy efficiency in a cost-effective and equitable manner.

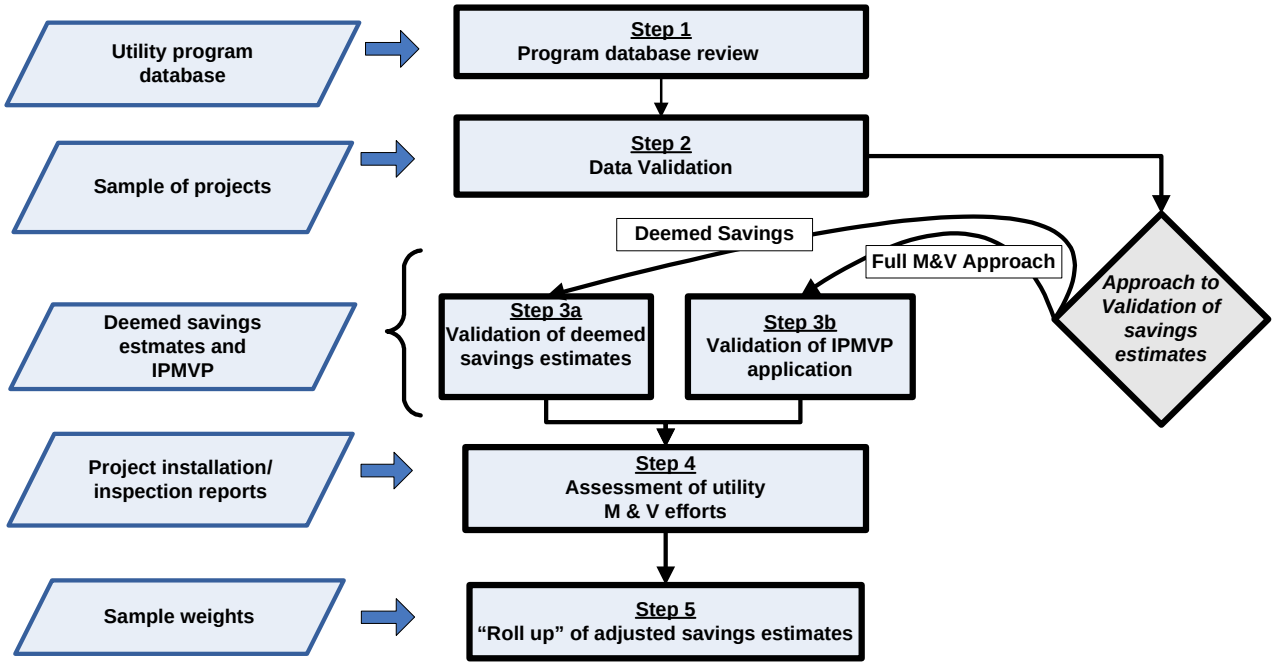
Study Methods

The review team accomplished the stated objectives through two primary tasks:

- A *savings audit* with five discrete steps (Figure E-1). In Step 1, program databases obtained from the utilities were used to document possible discrepancies between official program records and the utilities' reported savings. Program applications, customer acknowledgement forms, and other documentation from a sample of projects/customers were reviewed in Step 2 in order to identify energy savings claims that were not fully supported by program documentation. In Step 3, energy savings from either the Step 2 sample or from entire program databases were recalculated using approved deemed savings values (or by verifying the adequacy of M&V documentation against the International Performance Measurement and Verification Protocol) to identify the need for adjustments to savings for individual projects. Quantitative adjustments were not made in the Step 4 review of utilities' inspection/verification procedures, although findings were noted and contributed to recommendations for process improvements. In Step 5, findings from all prior steps were combined, including extrapolation of results from the sample of projects/customers to the entire population of participants.

- A *process evaluation* that sought to explore issues surrounding market neutrality, how non-discriminatory in nature programs are, availability of customer choice in the market, and barriers to participation.

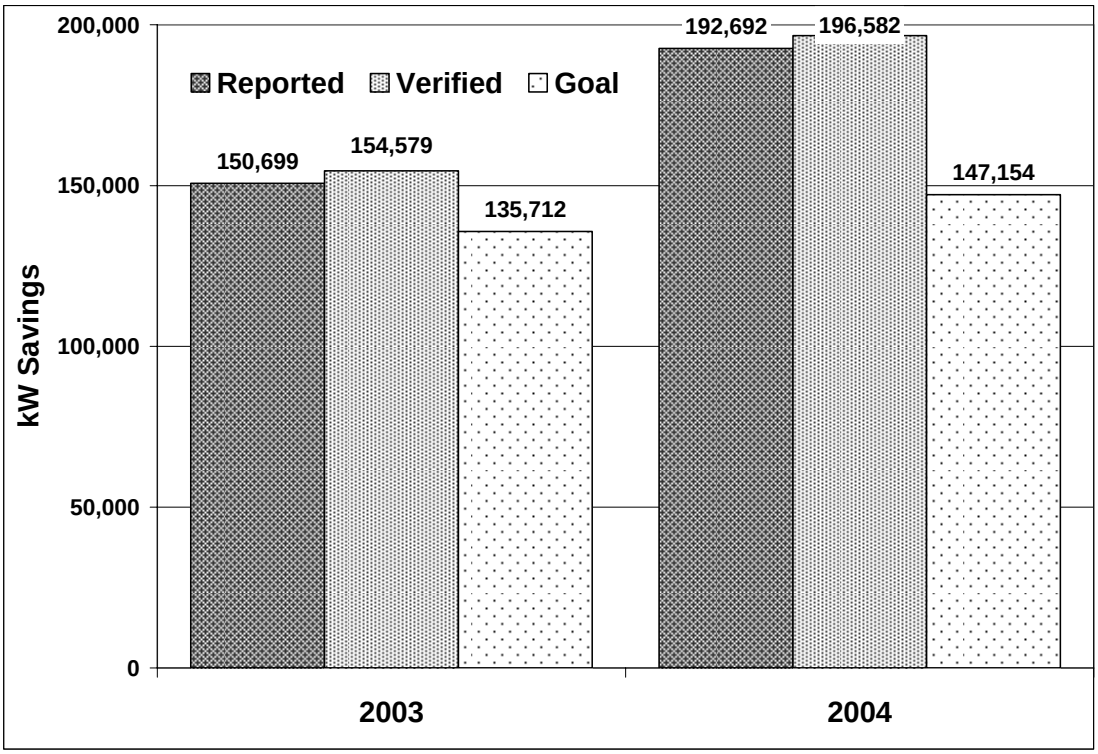
Figure E-1. Savings Audit Flowchart



Program Impacts

Savings values for some utility programs were reduced from the reported values as a result of the audit. and were increased for a few others. For a few programs, the verified savings exceeded the reported savings due to corrections that increased calculated savings figures. Realization rates (verified savings as a share of reported savings) ranged from 92.1% to 111.7% across the two years for the nine programs reviewed. Across the six utilities the M&V audit verified 154,579 kW of demand savings in 2003 and 196,582 kW in 2004.[1] Based on these figures, verified peak demand reductions exceeded statewide goals by approximately 14% in 2003 and 34% in 2004 (Figure E-2).[2]

Figure E-2. Comparison of Reported and Verified Demand Savings (kW) with Statewide Utility Goals, 2003 and 2004[3]



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

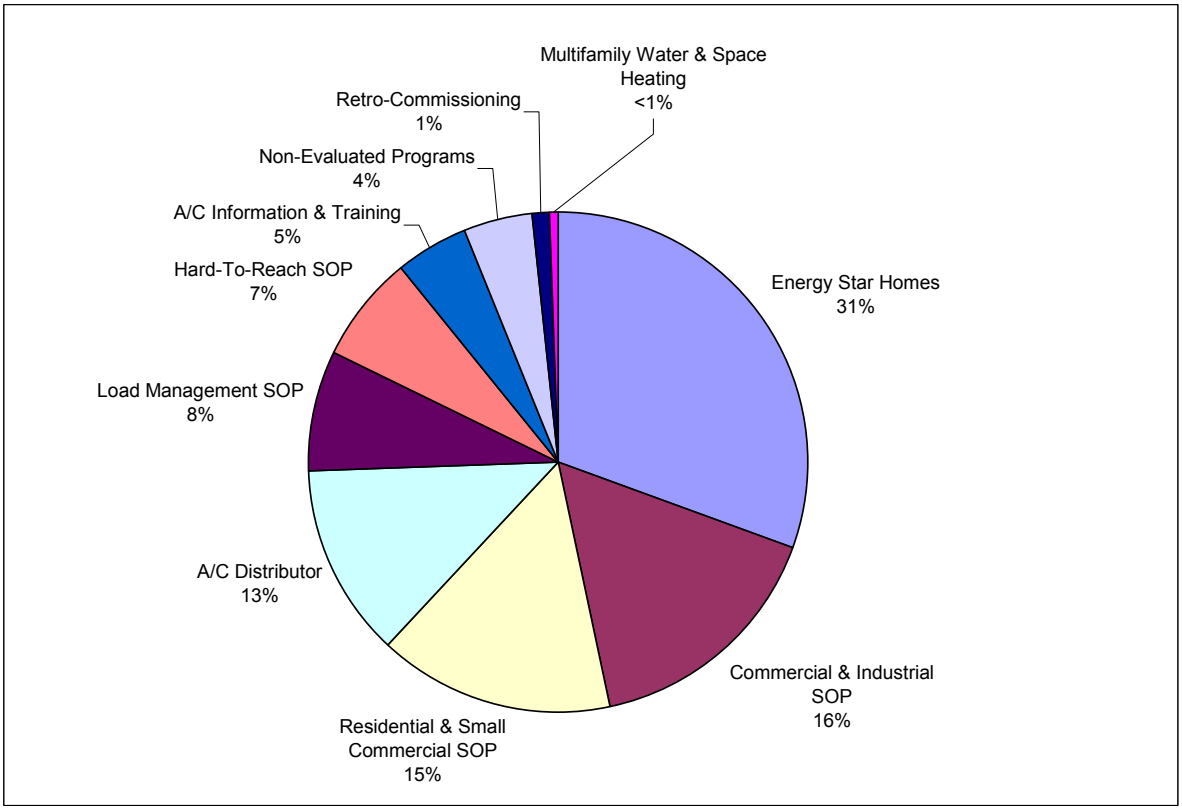
[1] The M&V team was tasked with verifying savings only from the nine programs identified in this report. However, the utilities' reported savings figures include savings from several other efforts such as TDHCA (Texas Department of Housing and Community Affairs) and 3rd Party DSM Contracts. Across all utilities, peak demand reductions from these efforts account for 3% of reported peak demand reductions in 2003 and 5% in 2004. The total verified savings figures presented here assume 100% realization of reported savings for these programs.

[2] Reported savings and peak demand reduction goals were obtained from utility Annual Reports filed in April of the year following program operation and in April of the program year, respectively.

[3] Verified savings values presented here and elsewhere in the Executive Summary are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor savings uncertainty explicitly identified by the audit.

By 2004, peak demand reductions were being realized across nine unique programs (not including several smaller programs not included in this study). The Energy Star Homes program accounted for the greatest share of savings, at 31% of the total, followed by the Commercial & Industrial and the Residential/Small Commercial Standard Offer Programs and the A/C Distributor program, each of which accounted for at least 13% of savings (Figure E-3). The breakdown of savings by program was similar in 2003, although the A/C programs were significantly smaller then, and the Retro-commissioning and the Multi-family Water and Space Heating programs were not offered in that year.

Figure E-3. Verified Peak Demand Savings (kW) by Program, 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Among the nine programs audited, most had realization rates of 99% or more for both years (Table E-1). The most notable exceptions are: 1) the C&I Standard Offer Program, which had realization rates of 96% and 98% for 2003 and 2004 respectively, owing largely to uncertainty in savings calculated by sponsors using M&V for some projects, and 2) the Retro-commissioning program, administered by only one utility in 2004, for which reported peak load reductions were adjusted downward by 8%.

The overall realization rate of verified to reported savings of approximately 102% for both 2003 and 2004 demonstrates excellent overall performance, including thorough record-keeping, proper application of approved deemed savings values, and adherence to program rules. There are few comparable studies against which to benchmark these findings, since this review was a desk audit as opposed to an impact evaluation. Perhaps the most appropriate study for purposes of comparison is the 2004 review of

shareholder incentive claims for energy efficiency programs administered by utilities in California. This review verified 96% of the incentive dollars claimed by utilities for energy savings goals.[4]

Table E-1. Peak Demand Savings (kW) by Program – All Utilities, 2003 and 2004

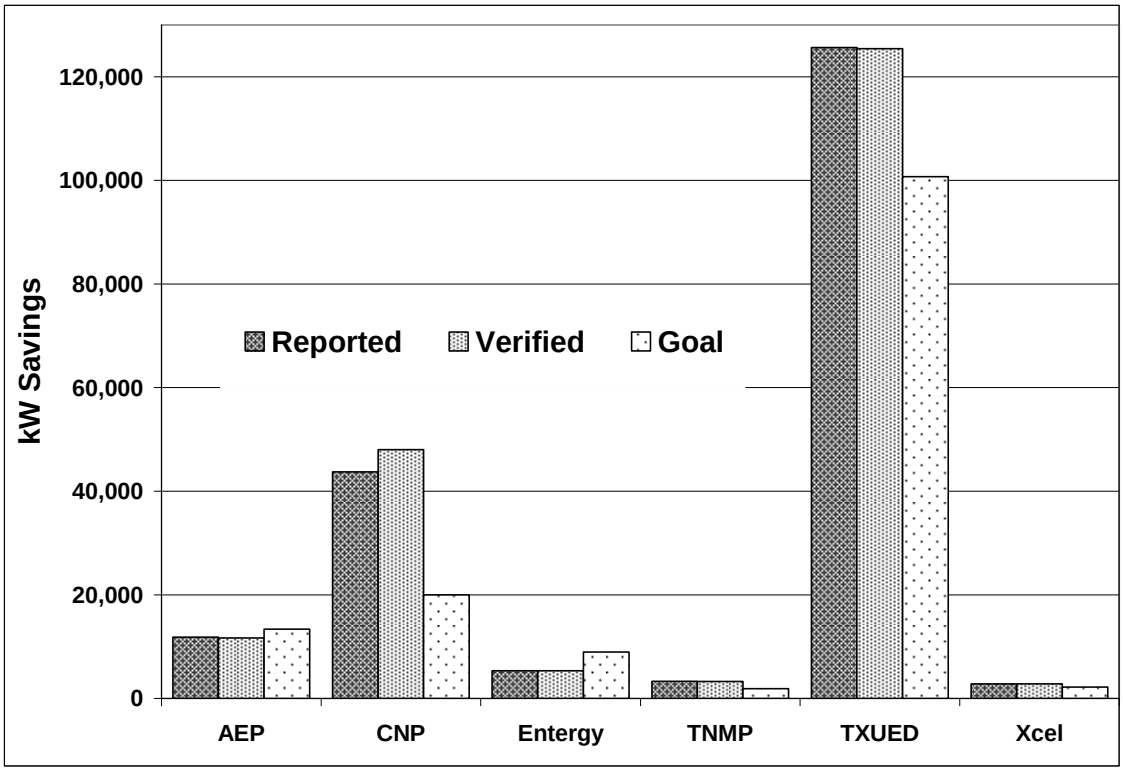
	2003			2004		
	Reported	**Verified***	**Realization Rate**	**Reported**	**Verified***	**Realization Rate**
Residential SOP	25,118	25,055	99.7%	29,695	29,686	100.0%
Hard-To-Reach SOP	9,043	8,971	99.2%	13,966	13,921	99.7%
C&I SOP	33,292	32,101	96.4%	32,863	32,061	97.6%
Load Management SOP	13,129	13,129	100.0%	15,108	15,108	100.0%
Energy Star Homes	48,545	54,207	111.7%	54,577	59,862	109.7%
A/C Distributor	15,295	14,839	97.0%	24,966	24,762	99.2%
A/C Info & Training	1,790	1,790	100.0%	9,360	9,237	98.7%
Multifamily Heating	0	0	NA	903	902	99.9%
Retro-Commissioning	0	0	NA	2,665	2,455	92.1%
Non-Audited Programs	4,487	4,487	100.0%	8,589	8,589	100.0%
Total	**150,699**	**154,579**	**102.6%**	**192,692**	**196,582**	**102.0%**

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Four of the six utilities exceeded their individual goals in both years. One utility reached its goal only in 2003 and another achieved savings below its goal in both years. Figure E-4 presents a comparison between utilities' 2004 *reported* peak demand reductions, the savings *verified* through this assessment, and the utilities' *goals* (see Footnotes 1 and 2). Most utilities' savings figures were reduced very slightly as a result of adjustments from the M&V audit, with none adjusted by more than 2.4%. After adjustments for verified savings were made, the four utilities that had reported savings exceeding their goals for 2004 still exceeded the goals (Figure E-4). Detailed data on verified savings for each utility, along with findings for 2003, are provided in Section 3.1 of this report.

[4] In California, utilities were awarded financial incentives for achieving various energy savings goals (including gas savings) and other program milestones. The 96% figure cited here is for "energy savings" milestones only. However, the complex structure of the incentives awards limits the applicability of a direct comparison to realization rates in Texas. See *Review of AEAP Milestone Incentive Awards, Program Years 1999-2002,* SERA, Inc. and Summit Blue Consulting for the California Public Utilities Commission, September 2004.

Figure E-4. Comparison of Reported and Verified Savings (kW) with Utility Goals, By Utility, 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

In order to estimate uncertainty regarding savings, the M&V team estimated lower and upper bounds of verified savings in addition to the *best estimates* presented above. These bounds are derived from both sample extrapolation and uncertainty due to insufficient supporting documentation. The uncertainty analysis is described in Section 2 of the report. It should be noted that even the low estimates exceed the goals for nearly all utilities in both years. In the three cases where the lower bounds do not exceed the goals, the best estimate of verified savings also does not exceed the goal. This suggests that even using the more conservative lower bounds as point estimates would not impact the conclusion regarding whether or not a utility met its demand reduction goals.

Key Process Findings

Findings from the limited process evaluation are detailed in Chapter 5 of the report. A summary of some of the key findings as they pertain to program planning and program delivery is included below.

Program Planning and Reporting

- The 10% administrative limit has not proven burdensome, but does not allow for significant program enhancements or changes. Most of the utilities indicated that the 10% administrative budget ceiling is sufficient, but that the funds are completely expended, and it does not allow room for further program enhancements or process changes.

- Utility program incentives are more than sufficient to encourage participation. In general, program managers and sponsors indicated that incentives were sufficient to allow them to offer measures at an attractive price. However, some measures in the Hard-to-Reach and Residential

standard offer programs are currently installed for free. This implies that some reduction in incentive level would be possible without discouraging participation, allowing utilities to secure more resources with the same dollars.

- The small business set-aside has helped diversify sponsor representation and encourage local sponsor participation. The small business set-aside used for the Residential and HTR Standard Offer Programs has been successful in allowing smaller, local sponsors to participate.

- There is a need to establish protocols for MTP savings estimates. Currently there are no deemed savings estimates for the Market Transformation Programs (MTPs). The utilities utilized different methodologies to calculate savings for a number of the market transformation programs, leading to significantly different savings values. Consistent energy calculations or deemed savings tables, similar to those used by the SOP programs, will streamline program administration and reduce costs for future program evaluations and reporting.

Program Delivery

- The current first-come, first-served online enrollment process is generally working well, but it does not allow for equal access to program funds among all potential sponsors. For many programs, the internet-based incentive reservation system used by most utilities is preventing many small contractors from participating because of real and perceived complexities in the system. The online enrollment process has proven to favor larger, often out-of-state, companies with faster Internet connections. Also, *program enrollment process does not encourage installation "best practices."* Sponsors are accepted into the program based on how quickly they can get their application in, not on the quality of their workmanship or flexibility in where and what they are willing to offer.

- Cooperation among the utilities has generally been quite good. The larger utilities have been very open about sharing tools and ideas. Utilities with service territories in close proximity have gone so far as to share formats to make the processes seamless for contractors who service both areas.

- The program databases developed by Frontier have been a key asset for program administration. Utility personnel consistently emphasized that the 10% administrative limit on budgets would not be possible without the databases and support provided by Frontier.

- Utility program staff are responsive and helpful with both technical and administrative issues. Sponsors found program staff accessible and responsive to questions concerning both the administrative and technical requirements of the programs.

- Program outreach and marketing have been very successful. Initial program outreach to sponsors has been very successful. Sponsors now market the program offerings to participants with no marketing efforts required by the utilities, though several still do advertise. As a result, *programs have consistently been oversubscribed.*

- The training offered by the utilities has been very effective and well received. Utilities have offered a variety of training opportunities for the programs, including Home Energy Rating System (HERS) rater training, installer training for various measures, and onsite assistance with project problems. Some sponsors and program managers indicated that the training may be the most valuable aspect of the programs. This is especially true for market transformation programs.

Summary of Recommendations

The study recommendations address potential actions that can be taken by the PUCT and the utilities to improve program design, implementation, and reporting. The first set of recommendations focuses on program planning and oversight activities and the second set provides suggestions to improve program delivery. In addition, research activities intended to support program design and better estimation of program impacts are also included. Within these broad topic areas, the recommendations are organized as follows:

Program Planning and Reporting

- Goals, funding and portfolio selection
- Incentives
- Deemed savings estimates
- Reporting & communications

Program Delivery

- Marketing & outreach
- Enrollment
- Data management
- Inspections

Table E-2 presents the key recommendations intended for the Commission and for the utilities. Recommendations are identified with a letter indicating whether the recommendation addresses Program Planning (P) or Program Delivery (D). Discussion of these recommendations is included in Section 6 of the report. In addition, the following recommendations for potential *Additional Research Activities* (R) are provided below and discussed in Section 6:

R1. Conduct a free ridership study to estimate savings attributable to the programs.

R2. Conduct a study of measure persistence aimed at determining how much of the estimated savings from program activities are still being realized three years or more after the measures were installed.

R3. Conduct a market study to identify unclaimed savings resulting from program spillover and market transformation.

R4. Conduct a DSM potential study to determine the amount of additional savings that are technologically and economically feasible throughout the state.

R5. Perform market research to identify the typical costs of installations by measure type.

Table E-2. Key Recommendations for Decision Makers

Key Recommendations for the Commission	Key Recommendations for Utilities
Program Planning and Reporting	*Program Planning and Reporting*
P1 Increase program goals beyond the current 10% of historical demand growth.	P9 Continue the common practice of ratcheting down incentives for SOP measures.
P2 Develop a mechanism that links program funding to utility goals.	P11 Promote installation of cost-effective measures that produce high energy savings (kWh) but that are not being heavily pursued by sponsors.
P3 Measure the impact of market transformation programs over a multi-year period, with multi-year targets.	P12 Promote and/or require the installation of multiple measures at customer sites.
P4 Consider providing financial incentives to utilities for meeting or exceeding program goals.	P13 Develop new incentives or approaches to promote adoption of high efficiency air conditioners.
P5 Provide flexibility to utilities in the share of program funds available for administrative purposes.	*Program Delivery*
P5b Create a separate pool of program funds reserved for inspection/evaluation activities.	D1 Offer technical training to build market capacity on high demand skills.
P10 Allow different incentive levels for different measures within the same program.	D4 Modify the current first-come, first-served enrollment process to allow for more equal access to program funds among all potential sponsors.
P11 Promote installation of cost-effective measures that produce high energy savings (kWh) but that are not being heavily pursued by sponsors.	D5 Establish enrollment guidelines to achieve utility objectives regarding the mix of sponsors and measures funded through the programs.
P16 Create a process to allow for the addition of new deemed savings measures to existing programs.	D6 Introduce mechanisms for providing incentives that offer more financial stability for sponsors.
P22 Establish uniform procedures for utility reporting of peak demand and energy savings.	D11 Promote greater consistency between utility forms and processes.
P23 Refine guidelines for documentation of reported savings.	D12 Establish input ranges for database entry to reduce potential data entry errors.
P24 Clarify the definition of Peak Demand Reduction to ensure that reported savings are coincident with system peak.	D15 Develop a tool that allows program managers to easily check for duplicate incentive applications and double counting of energy savings across programs.
Program Delivery	D17 Introduce third-party, independent inspections of customer sites.
D19 Require more precise inspection protocols and adjustment mechanisms for standard offer programs.	D18 Improve recording of inspection results and maintain more thorough documentation.
D20 Establish inspection protocols for MT programs.	

P = Program Planning; D= Program Delivery

1. INTRODUCTION

As a result of legislation passed in 1999, Texas utilities have been conducting energy efficiency programs since 2002, with full rollout for most programs by 2003. While a number of systems have been put into place to assure more precise estimation and reporting of energy and demand savings across the program offerings, this study is the first independent audit of the reported savings.

The three main objectives of this independent measurement and verification (M&V) review of energy and demand savings are to:

1. Provide the Commission with an *independent assessment* of the progress that is being made toward the goals for energy efficiency established by PURA § 39.905. This would encompass a review and verification of the estimates of energy savings and peak demand reduction that are reported by Energy Efficiency Service Providers (EESPs, or "sponsors") and compiled by the utilities.

2. Identify opportunities to improve the programs through a *limited process evaluation*, involving interviews with utility program administrators and sponsors, a review of program materials, and a review of regulatory requirements.

3. Provide *recommendations* to assist the Commission and the utilities affected by the Energy Efficiency Rule in meeting the State's goals for energy efficiency in a cost-effective and equitable manner.

In order to achieve these objectives, the Summit Blue team reviewed program savings both at individual utilities and statewide. Specifically, the six utilities covered in this study include the following:

- American Electric Power (AEP)
- CenterPoint Energy (CNP)
- Entergy – Gulf States (Entergy)
- Texas-New Mexico Power (TNMP)
- TXU Electric Delivery (TXUED)
- Xcel Energy (Xcel)

Estimates of energy savings and peak demand reduction were reviewed for calendar years 2003 and 2004 program activities, as reported by the utilities in their April 1, 2004, and April 1, 2005, Annual Energy Efficiency Report filings to the PUCT. The M&V review of savings and the process evaluation were conducted beginning in January 2006, and this report summarizes the methods and findings of the assessment. The following is a general overview of the approaches employed by the study team:

- For each program, the M&V team reviewed program databases and validated the information contained in them.

- On a statewide basis, the audit reviewed the assumptions upon which the deemed savings values for key measures are based, to determine whether they are valid.[5]

- For programs where the International Performance Measurement and Verification Protocol (IPMVP) M&V approach to estimating savings was applied (primarily the Commercial and Industrial Standard Offer Program), an assessment was made of whether the sites and measures selected by sponsors for M&V protocol resulted in an accurate estimate of savings and whether the appropriate protocol option was followed correctly.

- A process evaluation sought to explore issues surrounding market neutrality, how non-discriminatory in nature programs are, availability of customer choice in the market, and barriers to participation (both at the customer and sponsor level).

The results of the program-by-program audit process, along with the review of deemed savings and the process assessment, were "rolled up" to provide a statewide summary of findings and *actionable recommendations* that can be used by both the PUCT and the utilities to improve program performance going forward. These recommendations address potential changes in current reporting requirements, project inspection efforts, measure selection, and deemed savings assumptions that would improve programs' ability to achieve future energy efficiency savings targets in a cost-effective manner.

It should be noted that since this M&V review is primarily a ***desk audit*** of the energy and demand savings reported by the utilities, the scope of work did not include an impact evaluation of programs, but rather a thorough review of the programs' delivery methods and savings claims based on interviews, program databases, and paper records. No on-site inspections, metering, or customer billing analyses were conducted. Recommendations are included in the report for revising program rules and planning, improving program delivery and documentation of savings, and conducting other activities that may facilitate greater precision and reliability in verifying future savings.

1.1 Background

This audit involves verifying estimates of energy and demand savings at each participating utility, on a program by program basis, to estimate if they are achieving progress toward the established energy efficiency goals in their service territory – defined in Section 39.905 of SB7 as 'additional cost-effective energy efficiency equivalent to at least 10% of the electric utility's annual growth in demand.' SB7 further outlined goals indicating that electric utilities will:

- Administer energy savings incentive programs in a market-neutral, nondiscriminatory manner, but will not themselves offer competitive services.

- Provide all customers in the state with a choice of and access to energy efficiency alternatives, and other choices from the market that allow each customer to reduce energy consumption and costs.

- Provide, through market-based standard offer programs or targeted market transformation programs, incentives sufficient for retail electric providers and competitive energy service

[5] In *Deemed Savings, Installation & Efficiency Standards*, prepared by Frontier Associates LLC, February 22, 2002, specifications for minimum efficiency standards are spelled out by measure. For climate-sensitive measures, requirements are provided for each of the 4 climate regions for which savings models were developed and verified.

providers to acquire additional cost-effective efficiency equivalent to at least 10 percent of the utility's annual load growth.

The programs offered during the 2003-2004 program years, including both standard offer programs (SOPs) and market transformation programs (MTPs), are listed, by utility, in Table 1-1. The programs, in aggregate, achieved the following *reported* savings in those two years, exceeding the goals as defined by the PUCT in § 25.181:

- In 2003, reported demand savings = 150 MW (the goal = 136 MW).
- In 2004, reported demand savings = 192 MW (the goal = 147 MW).[6]

Table 1-1. Utility Programs Included in M&V Audit

Program	AEP	CNP	Entergy	TXUED	TNMP	Xcel	Years
Residential & Small Commercial SOP	✓	✓	✓	✓	✓	✓	2003, 2004
Hard to Reach SOP	✓	✓	✓	✓	✓	✓	2003, 2004
Commercial & Industrial SOP	✓	✓	✓	✓	✓	✓	2003, 2004
Load Management SOP				✓			2003, 2004
ENERGY STAR New Homes MTP		✓	✓	✓	✓		2003, 2004
AC Distributor MTP		✓	✓	✓		✓	2003, 2004
AC Information & Training MTP				✓			2003, 2004
Multi-Family Water & Space Heating MTP		✓		✓			2004
Retro-Commissioning MTP		✓					2004

Utilities were given some latitude in the selection of programs within their portfolio, and program templates that could be shared across the state were developed with the assistance of contractors. In addition, deemed savings values were approved by the Commission for use by project sponsors in situations where the same measure would yield similar savings when installed in a wide variety of different settings and in situations where more extensive measurement and verification activities would prove cost prohibitive. Sponsors have relied upon the deemed savings values for nearly all of the energy efficiency projects completed through the Residential and Small Commercial Standard Offer Program, the Hard-to-Reach Standard Offer Program, the ENERGY STAR New Home Program, and the AC Distributor Program.

The following provides a brief description of each program:

- Residential and Small Commercial SOP (Residential SOP) provides incentives for the installation of efficiency measures for residential and small commercial customers. Incentives are paid primarily on the basis of deemed savings, but M&V-based incentives are permitted for measures

[6] Peak demand reduction goals were obtained from utility Annual Reports filed in April of the program year to which the goal applies.

where deemed savings have not been established. Small commercial customers are defined as retail, non-residential customers with a maximum demand that does not exceed 100 kW. Sponsors are responsible for aggregating the savings achieved in households and small commercial facilities in order to meet the minimum project size established by each utility.

- Hard to Reach SOP (HTR SOP) – This program is similar to the Residential SOP but it is limited to customers eligible for HTR program incentives, defined as those with annual income below 200% of federal poverty guidelines. PUCT Substantive Rule 25.181 requires that each utility meet at least 5% of its savings goal for each year through programs targeted to these customers.

- Commercial and Industrial SOP (C&I SOP) provides incentives for the retrofit installation of a wide variety of measures that reduce customer energy costs, peak demand, and/or energy consumption in non-residential facilities. Incentives are paid to sponsors on the basis of deemed savings.[7] If deemed savings have not been established, incentives may be paid on the basis of verified savings using IPMVP protocols.

- Load Management SOP provides load control or shifting of a reliable quantity of electric load on short notice. Incentives are paid to sponsors on the basis of verified peak demand savings.

- ENERGY STAR® New Homes MTP (Energy Star Homes) leverages the nationally recognized ENERGY STAR name to improve residential new construction practices. The program is designed to condition the market so that consumers are aware of and demand ENERGY STAR homes and products, and so that builders have the technical capacity to supply them. The program provides ENERGY STAR certification, marketing assistance to builders, technical assistance to builders and subcontractors, incentives for builders, education for consumers, and a uniform statewide energy rating system.

- AC Distributor MTP provides incentives for the installation of high efficiency air conditioning units less than 20 tons installed in residential, small commercial, and large commercial applications. The program targets cooling loads that are typically coincident with the summer utility peak. This program is designed to operate in conjunction with the AC Installer MTP.

- AC Installer MTP is designed to encourage improved installation practices for HVAC equipment, including measures to reduce leakage in air ducts. It is designed to operate in conjunction with the AC Distributor program.

Multifamily Water and Space Heating MTP is intended to provide incentives to multifamily project developers who install gas or other non-electric water heating systems in multifamily residences. Electric resistance water heating and space heating systems are present in most multifamily properties, primarily because of the lower initial costs associated with their installation. This Program helps overcome this market barrier and helps increase the awareness of water and space heating options for multifamily customers.

Retro-commissioning MTP is designed to provide energy end-users with an expert analysis to improve the performance of energy using systems to reduce peak demand and annual energy use. Demand and energy savings are realized through the systematic evaluation of building and industrial systems and the

[7] Deemed savings are defined (in PURA §25.184(c) as 'standardized savings values or formulas for a wide range of measures in representative building types.'

implementation of low-cost and no-cost measures. Incentives are provided to fund and manage sponsors efforts and offset implementation costs for building owners.

1.2 Layout of the Report

This report is organized as follows:

- *Section 2* discusses the study methodology, including both savings M&V and the process sampling plans, data collection activities, and analysis procedures.
- *Section 3* presents the results of the M&V audit, by program and utility.
- *Section 4* describes the review of deemed savings assumptions.
- *Section 5* presents the process evaluation findings
- *Section 6* presents recommendations derived from the M&V audit and the evaluation findings.
- Appendices (provided in separate volume) include:
    - Data log of information sources consulted during the course of the study
    - Data collection instruments used for in-depth interviews and list of interviewees
    - Discussions of program-specific methods used in the M&V audit
    - Supplemental data on verified energy savings (MWh) from the M&V audit.

2. METHODOLOGY

2.1 Approach to Verification of Peak Demand and Energy Savings

The Summit Blue team conducted an M&V audit that verified the accuracy of the utilities' reported achievements in a uniform, systematic manner. This section describes the general approach followed during the assessment. Detailed discussion of the specific sampling strategy and review methods utilized for each program are contained in Appendix C. The approach described below ensured equal treatment of each utility's claims while also allowing for review of the unique aspects of each of the energy efficiency programs. Specifically, application of a common approach helped to ensure that:

- The demand and energy savings reported by the utilities were supported by program databases.
- Information in the databases was valid and was supported by program applications, inspection reports, or similar documentation.
- The sponsors utilized approved deemed savings estimates and applied them in an appropriate manner and/or the sponsors employed appropriate M&V procedures in accordance with the IPMVP (where a "full M&V" approach was used).
- Reasonable efforts were made to verify equipment installations and related activities performed as part of the programs (e.g., through post-installation inspections).

Throughout this process, any differences between the energy savings verified by the Summit Blue team and the savings reported by the utilities were recorded.[8] The M&V assessment grouped savings into one of three categories, with all reported kW and kWh savings assigned to one of the following:

1. **Verified Savings.** These are the reported savings considered by the review team to be real and verifiable based on program databases and supporting documentation provided by the utilities.
2. **Uncertain savings.** This category represents reported savings that are subject to some uncertainty due to insufficient quantity or scope of supporting documentation. These savings may or may not have been realized, and their inclusion in (or omission from) savings totals reflects an upper (or lower) bound of verified savings estimates. Depending on the specific reasons for the uncertainty, the best estimate of verified savings typically reflects either 50% or 100% of the uncertain savings.[9]

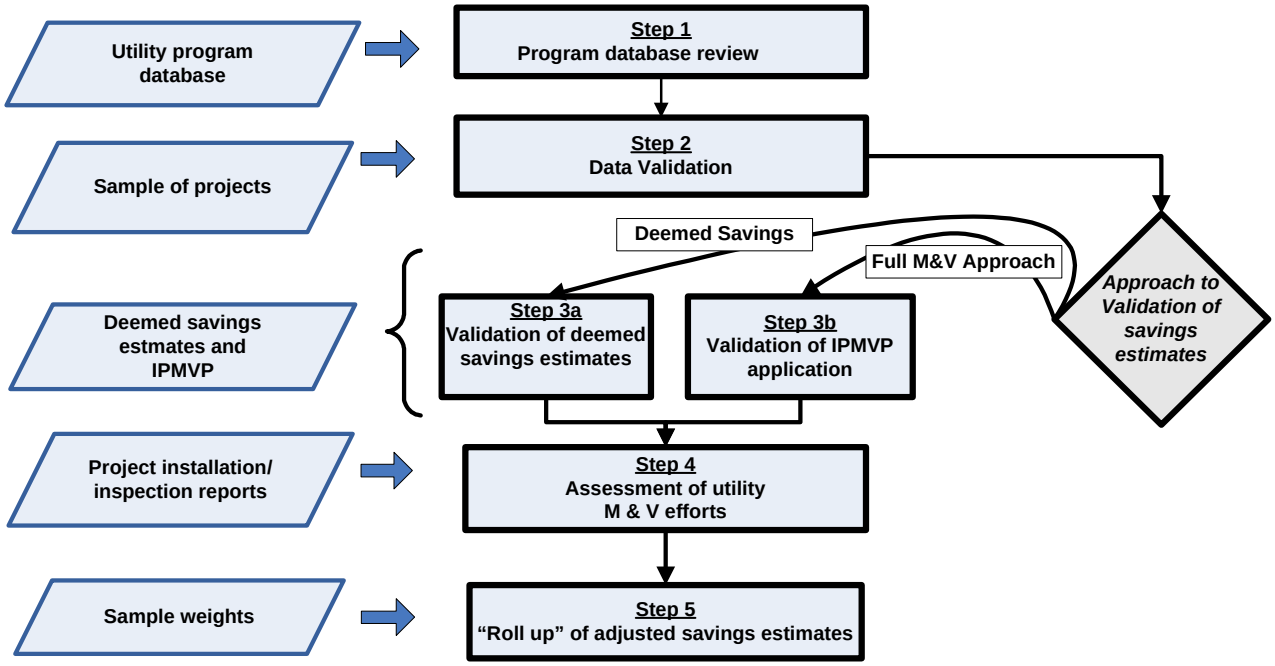
[8] For major discrepancies, the utilities were contacted to make certain that the Summit Blue team was not misinterpreting the information provided in supporting documentation. Concerted efforts were made to provide opportunities for the utilities to respond to follow-up requests with additional documentation or verbal/e-mail clarification that could resolve apparent discrepancies.

[9] In general, if the M&V team believes that reported savings have occurred, but insufficient documentation is available to support to utility claims, then up to 100% of the "uncertain" savings are included in the best estimate of verified savings (but not more than the average realization rate of all other customers in the sample for whom savings are not uncertain). However, if the lack of documentation precludes the M&V team from verifying savings beyond a reasonable doubt, then the best estimate is assumed to be only half of the "uncertain" savings. Statistical uncertainty from sample extrapolation also contributes to the values of the upper and lower bounds.

3. **Reported savings that were not achieved.** Values of kW and kWh in this category represent savings reported by the utilities but for which essential supporting documentation was not provided or for which the review team has identified information in program records indicating that the savings were not realized.

There were five discrete steps in the verification process . In Step 1, program databases obtained from the utilities were used to document any discrepancies between official program records and the utilities' reported savings. Program applications, customer acknowledgement forms, and other documentation from a sample of projects/customers were reviewed in Step 2 in order to identify energy savings claims that were not fully supported by program documentation. In Step 3, energy savings from either the Step 2 sample or from entire program databases were recalculated using approved deemed savings values (or by verifying the adequacy of M&V documentation against the IPMVP) to identify the need for adjustments to savings for individual projects. Quantitative adjustments were not made in the Step 4 review of utilities' inspection/verification procedures, although findings were noted and contributed to recommendations for process improvements. In Step 5, findings from all prior steps were combined, including extrapolation of results from the sample of projects/customers to the entire population of participants. The five steps of the verification process are presented in Figure 2-1, along with the key inputs feeding the analysis.

Figure 2-1. Savings Audit Flowchart



Step 1: Confirmation that Program Databases Support Reported Savings

The first step of the savings verification ensured that program databases contain savings figures corresponding to the values claimed by the utilities in their Annual Energy Efficiency Report filings to the PUCT. As necessary, utilities were asked to provide additional documentation or clarification supporting the values reported to the Commission. In particular, the utilities often were consulted to identify the specific customers and installations in the databases that formed the basis of the reported savings. If it was

determined that a program database could not fully support reported savings, the verified savings from the M&V analysis reflected this difference.

The database was further validated by a comprehensive review that looked for anomalies suggesting data-entry errors. For example, one ENERGY STAR Homes participant was listed as having an invalid HERS rating of over 100.

Step 2: Random Sample Validation of Database Information with Supporting Documentation

Once the M&V team established which customers, installations, and savings values in a program database were reported by a utility, the validity and accuracy of the information in the database were verified. This entailed identifying a random sample of customers and reviewing utility-provided invoices and supporting documentation that pertain to the customers in the sample. The goal of this review was to confirm, where possible, that the number and type of equipment installations and the customer/site characteristics (particularly those such as square footage, which affect deemed savings calculations) match the entries in the database. Any errors were noted and the resulting impacts on demand and energy savings were calculated.

For most programs, the sample of customers was identified through simple random selection, with 2003 and 2004 receiving an equal number of customers selected for review. Only the C&I SOP – in which savings varied significantly between customers – warranted a stratified random sample. This sample was based on energy savings reported in the program database (see the methods discussion for the C&I SOP in Appendix C). A census of all participating customers was selected for the Emergency Load Management and Retro-Commissioning programs, which had nine and four participants, respectively. (See Section 2.2: Audit Sampling Plan for details on the sampling methodology and sample sizes.)

For each program, utilities were asked to provide "appropriate program documents/files that can verify specific equipment installation or actions taken at specific customer sites." The following specific information was requested for each customer in the sample:[10]

- Applications
- Invoices from Sponsors
- Inspection reports (if there was an inspection for the project)
- Customer affidavits or other confirmation of participation in the program
- Any other supporting materials (*e.g.*, additional paperwork with information about the customer/site)

Utilities responded to these requests by providing copies of paper and/or electronic files from program records. The M&V team then discussed the content of the files with utility staff as needed and, in many cases, made written follow-up requests for clarification or additional documentation. Utilities were given ample opportunity to provide missing documentation, respond to follow-up requests, or clarify the documentation provided prior to completion of the draft report. Where obvious errors were detected in

[10] The sample documentation requests for the Residential and C&I SOPs, the Emergency Load Management program, and the Retro-Commissioning program were customized based on discussions with utility staff and are discussed in the program-specific methods below (see Appendix C).

calculating or reporting savings, the appropriate adjustments were made. Where documentation for customers in the sample was missing, the savings were determined to be somewhat uncertain:

- Where key documentation was missing for a customer even after any follow-up requests (*e.g.,* signed customer acknowledgement forms in the Residential SOP), 10% of the reported savings was classified as "uncertain," resulting in a lower bound of verified savings of 90% of the reported savings.
- Where documentation was missing completely, 20% of the reported savings was classified as "uncertain," and the lower bound of verified savings was 80% of the reported savings.

For most programs, missing paper documentation was not, in itself, reason for disqualification of savings so long as the customer was listed on a sponsor invoice. The rationale for this decision is based largely on the fact that in all of the programs in Texas, the program databases contain the primary record of activity. Further, the inspection process, where applicable, sufficiently validates installations by identifying the presence of "phantom" customers if any sponsors reported installations that did not occur. The guidelines for verification of savings for the C&I SOP is a bit more complex and is explained under the C&I SOP heading in the program-specific methods and impact findings sections (Appendix C).

Step 3: Verify Appropriate Application of Deemed Savings Estimates and IPMVP

Deemed Savings

Demand and energy savings were often calculated by sponsors using deemed savings estimates approved by the Commission.[11] These estimated energy savings are a function of not only the measure installed (as verified in Step 2), but also the assumptions used in estimating savings, such as operating hours. Since these assumptions are a major determinant of savings, the M&V team explicitly verified that the appropriate values were utilized in determining energy and demand savings. For example, the peak demand savings from air conditioners vary not only by the type and size of the unit, but also by the climate zone in which they are installed. The M&V team ensured that program databases appropriately capture the necessary information and that the appropriate deemed savings value is applied to each project reviewed. Depending on the nature of the program and database structure, this verification was performed either on all customers or, at a minimum, on the sample described in Step 2 above.

Approved deemed savings values are not contained in a single document, but rather are found in an assortment of regulatory filings, approved state codes, and market effects studies. The M&V team confirmed which documents contain applicable deemed savings assumptions and estimation methods through discussions with Frontier Associates and/or the utilities. The specific documents referenced are discussed in the section of program-specific verification methods below. Additionally, interviews with the key staff at Frontier Associates and other contractors[12] were conducted to review questions regarding savings assumptions to their source, and to determine whether these assumptions were appropriately applied.

IPMVP

The C&I SOP is the only program for which a "full measurement and verification" approach (*i.e.*, IPMVP) was used. For those sampled projects employing IPMVP, the review looked for adherence with the following principles:

[11] Note that the Market Transformation Programs were not required to use deemed savings estimates.

[12] ICF Consulting and Nexant both provided savings estimates from engineering models for some programs.

- Establishment of a *site-specific M&V plan* that specifies the metering/monitoring to be conducted and states how the baseline is to be established, including:
    - What measurements were to be taken
    - How the data were to be used
    - What variables were to be stipulated and the basis for stipulation
    - Metering equipment to be used, its calibration, the location of measurements, duration of the metering period, etc.
- Identification in the M&V plan of the following:
    - How calculations were to be made by stating the variables (run-time hours, electrical consumption in a lighting fixture, kW/ton, etc.) that should be measured and any associated assumptions.
    - How quality assurance was to be maintained and the ability to replicate confirmed.
    - The reports to be prepared, their contents and formats, and a stipulated timeframe during which they should be furnished.
- Terminology consistent with IPMVP definitions.

Most importantly, this review determined whether the most suitable IPMVP option was chosen for a given project, whether appropriate baselines were chosen, whether the field data were gathered correctly, and whether savings calculations using these data were then properly applied.

Step 4: Assess Adequacy of Utilities' Verification/Inspection of Project Activities

In order to verify that projects were carried out as reported, the M&V team reviewed evidence of steps taken to verify installation of the measures included in the program databases. Utility program staff were interviewed to understand the inspection process and, for some programs, the utilities provided inspection reports in response to the team's Step 2 request for documentation for a sample of participating customers. Reported savings were verified to ensure that reasonable inspection procedures were employed and that inadequate measure installations identified through inspections were reflected in the databases through a reduction in savings.

No quantitative adjustments were made to the reported savings on the basis of the inspection documentation review since the utilities already used the inspections to adjust savings figures prior to their annual reporting. The impact of inspections can be observed in the program databases by comparing initial savings estimates with the adjusted savings values.

Step 5: Savings Roll-Up

In this final step, impact adjustments from Steps 1-4 were combined to determine a best estimate and upper and lower bounds for the verified savings for each utility program. First, adjustments affecting all customers/projects (as opposed to just those from the Step 2 sample) were tallied by year as Program-wide Adjustments and subtracted from the reported savings (Table 2-1). These adjustments generally include the Step 1 database review, the Step 3 deemed savings review, and sometimes other miscellaneous adjustments such as outliers/data entry errors in the database.

The remaining savings for each year were then adjusted based on findings from the review of supporting documentation for the random sample. Specifically, the verified savings realization rate from the sample was applied to all remaining savings for each year to yield a point estimate of verified savings.[13]

Table 2-1. Template for Calculation of Verified Savings

	Calculation	2003	2004
Reported Savings	**A**		
Program-wide Adjustments	**B**		
Subtotal	**C=A+B**		
Sample Realization Rate	**D**		
Verified Savings	**E=C*D**		
Total Adjustments to Reported Savings	**E-A**		
Program Realization Rate	**E/A**		

The lower and upper bounds of verified savings reflect both statistical uncertainty from extrapolation of the sample results and also the savings uncertainty explicitly identified by the review team. The statistical uncertainty is represented by a plus-or-minus (±) savings band around the point estimate and is determined using a 90% confidence interval. Furthermore, these uncertainty bands were determined using the standard error of the *differences* between *claimed* savings in the database and the best estimate of *verified* savings for each customer in the sample.

In addition to the statistical uncertainty, further assessments of the potential low and high values were made when necessary. As a result, these ranges are at times not symmetrical. The method for determining the bounds is explained in the Program-Specific Methods section and/or in the introduction to the Program-Specific Findings.

2.2 Audit Sampling Plan

The starting point of any sampling plan is a judgment call regarding the desired levels of confidence and precision. This is an extremely important component of sampling. The width of the interval that brackets the true value of the parameter of interest indicates the level of *precision*. The confidence level is the probability that this interval will include the true value of the parameter. The conventional recommendation for impact evaluation protocols is 90/10 (confidence level %/precision %). This was originally adopted as the PURPA requirement for load research samples and has since become the norm.

The next equally important decision is at which level to apply these values. In other words, should the desired confidence and precision be aimed at the overall program level, individual utility, program year, individual program, or individual utility program. If 90/10 confidence/precision is required at the finest granularity, greater disaggregation of the sample is required (*e.g.*, individual utility versus program overall), and larger sample sizes are needed overall. Further, the more heterogeneous the population (*e.g.*, large C&I versus residential programs), the larger the sample size needed to achieve given levels of statistical confidence and precision.

[13] For the Emergency Load Management and Retro-commissioning programs – where the M&V team reviewed documentation on all participating projects, and not just a random sample – all adjustments were "program wide." For the C&I SOP, the largest projects were explicitly sampled and a program-wide adjustments were made specific to the year in which the project was enrolled in the program. For each year, remaining savings after all program-wide adjustments were then adjusted according to the realization rate from the random sample of smaller projects.

Impact evaluations often use the binomial (two possible outcomes) distribution in determining sample sizes. Sampling is used to select files to review for accuracy and reasonableness of assumptions. Any one file will primarily fail or pass the inspection. In reality though, there may be varying degrees of failure (or success). We opted for a conservative approach of binary outcomes with equal chance of occurrence in determining the sample sizes. Any different likelihood (60/40, 70/30, etc.) will require smaller sample sizes.

The goal for this audit effort was set to attain the 90/10 levels at the overall statewide program level. We also aimed for a minimum of 90/15 *at the individual utility/program level. As such, the individual cells in* Table 2-2 *below all required a minimum number of files to be pulled for inspection.* Due to the small size of some utility/program groups, it was possible to apply a finite population correction to reduce the sample size of these subpopulations and still meet the desired confidence and precision levels. The resulting sample sizes were summed across programs and across utilities to determine overall sample size. Table 2-2 displays sample sizes by program and by utility.

Table 2-2. Sample Sizes by Program and by Utility

	AEP	CNP	Entergy	TXUED	TNMP	Xcel	Total
Residential SOP	25	25	25	25	24	24	148
HTR SOP	21	21	21	21	19	19	122
C&I SOP	29	33	17	35	14	23	151
Load Management SOP				9			9
ENERGY STAR Homes		30	30	30	29		119
AC Distributor		25	25	25		25	100
AC Info & Training				30			30
Multifamily Heating		30		30			60
Retro-commissioning		4		0			4
Total	**75**	**168**	**118**	**205**	**86**	**91**	**743**

The sample sizes presented above were specifically chosen to be sufficient to achieve, at a minimum, a reasonable level of precision comparable to evaluations conducted of energy efficiency programs across the country. In practice, due to a lack of documentation in some cases and the subjective nature of some analyses (*e.g.,* adequacy of M&V efforts), the audit team often combined statistical uncertainty with expert judgment on the potential range of realized savings. In fact, the uncertainty explicitly identified by the audit team is often at least as great as the uncertainty in the statistical sampling. Consequently, the verified peak demand and energy savings are not presented in terms of statistical confidence intervals (*i.e.,* "plus or minus" error bands), and the lower and upper bounds are not always symmetrical around the best estimates.

2.3 Process Evaluation

The process evaluation reviewed the steps taken by the utilities to administer the programs and identify opportunities to improve the delivery of energy efficiency services through the programs. Based on interviews with the utility program administrators, participating and non-participating EESPs, and other selected stakeholders, the Summit Blue team addressed the following four topic areas:

- Do the funding arrangements pose a barrier to participation in the programs?

- Is the application and project qualification process efficient and effective?
- What were the reasons that some projects were never successfully completed by sponsors that had reserved program funding?
- Have M&V requirements posed a barrier to certain projects?

The RFP directs that seven programs were to receive the majority of the evaluation work effort due to the fact that they comprised the majority of program activities in 2003 and 2004:

- Commercial and Industrial SOP
- Residential and Small Commercial SOP
- Hard-to-Reach SOP
- ENERGY STAR Homes Market Transformation Program
- Air Conditioning Distributor Market Transformation Program
- Air Conditioning Information and Training Market Transformation Program
- Load Management SOP

With this scope of work in mind, the review team conducted a core set of interviews to include three stakeholder groups:

- Utility staff who administer the programs.
- Program sponsors, including both program participants and a small sample of non-participants (identified by the utilities from past promotional activities, workshops, and other outreach activities).
- Other individuals, including regulatory staff, relevant interest groups, and select others such as active participants in the Energy Efficiency Implementation Project (EEIP) collaborative process established in Docket No. 27647.

Most interviews were conducted in person. A set of prioritized evaluation issues were developed, based on the four key questions set forth above. From this issue set, an interview guide for each of the three stakeholder groups noted above was developed in advance of the interviews and, if requested, provided to interviewees in advance. All interviewees are listed in Appendix B.

Interviews were conducted for the process evaluation, but the entire M&V audit contributed to this effort. For example, in conducting the impact assessment, it became clear that there are differences in reporting and inspection methods between utilities that make the annual savings claims difficult to compare. This suggests the need for guidelines that can ensure more consistent inspection and reporting approaches so that utilities can be judged fairly in their efforts to meet their energy savings goals. Process findings from both the interviews and from the impact assessment are included in Section 4, and the resulting recommendations are contained in Section 5.

2.3.1 Utility Staff Interviews

Selected staff at the six utilities involved in the review were interviewed. The audit team worked with the principal utility liaison to identify appropriate personnel and schedule interviews. For each utility, interviews were conducted with the principal liaison and one other manager, as well as at least one staff person directly responsible for administration of each program. In cases where an outside contractor acted

as a surrogate for internal staff in administering a program (such as ICF for the TXUED ENERGY STAR Homes program), that contractor was interviewed.

There is a wide range of potential topics that could be investigated. We have broken down the strategic research question into several potential probing questions covering various sub-issues that were incorporated into the utility interview guide, as shown in Table 2-3.

Interviewers also inquired of utility staff how their various program administration and support activities had gone, exploring their interactions with sponsors and the level of satisfaction with sponsors carrying out the program's intent. This included an assessment of the utilities' expectations when the programs were developed versus how they have actually were implemented.

Table 2-3. Summary of Issues to be Investigated in Staff Interviews

Do the funding arrangements pose a barrier to participation in the programs?
1. Utilities' experience to date with the funding arrangements: structure, processes, and outcomes in terms of EESP participation and subsequent customer participation – investigate both strengths and weaknesses. 2. Utilities' views on funding structure and processing constraints that prevent either EESPs or customers from participating either at all or more broadly – how the structure and processes are impediments, or not. 3. Ideas of utility staffs on what may be done to address funding arrangements and their dynamics so that program participation is increased
Is the application and project qualification process efficient and effective?
1. Identify and assess strengths and weaknesses in the application and project qualification process as seen by each utility; discuss notable differences in the process among utilities. Focus on process aspects under utilities' control. 2. Identify and assess where the process can be changed or not to improve it – and why changes can or cannot be effected where identified as possible improvements. Focus on utility-controllable aspects. 3. Elicit suggestions for process improvements based on program experience to date
What were the reasons that some projects were never successfully completed by EESPs that had reserved program funding?
1. From the utility perspective, identify and assess market and programmatic barriers that prevented fund-reserved projects' completions – are these barriers primarily market-related (*a priori* barriers such as project payback) or are they program-related (e.g., due to lack of EESP follow-through)? 2. Identify and assess ideas to reduce market and programmatic barriers that have contributed to projects not being completed. Focus on utility-controllable aspects but elicit general ideas, too.
Have M&V requirements posed a barrier to certain projects?
1. Identify specific M&V requirements that have posed either real or perceived barriers, and why the utility sees those being problematic. 2. Assess utility staff ideas on how to mitigate those M&V requirements seen to be burdensome.

2.3.2 Energy Efficiency Service Provider Interviews

In a manner similar to that proposed for utility staff, interviews of EESPs were conducted to obtain their views regarding the strategic research questions for the process evaluation. A total of 30 interviews of participating sponsors were conducted, focusing on those who have conducted the greatest volume of work, but also a small subsample who have done relatively few projects to better understand their perspective and whether program assistance can be improved so that those sponsors can participate in more projects.

The study team also interviewed 24 non-participating sponsors, in a complementary fashion to participating EESPs, to understand their perspective and why they have not participated in the programs. The utilities helped identify and prioritize some of these respondents. Table 2-4 lists the kinds of probing issues that were investigated with each group.

Participating Sponsor Interview Candidate Selection:

The following steps were used to select participating sponsors for interviews:

- The analysis team ran a query on databases, by utility, by program to get the top five participants based on their kW contribution to the program.
- A query was run for each program that had both a large and small set-aside participant pool, selecting the top five in each category, for each program, for each utility.
- Calls were made to participants selected through the database queries to attempt to reach at least two completed interviews for each utility and each program.
- Given that the top five participants varied between 2003-2004, priority was given to those that participated in both years for a given utility and program.

Non-Participant Candidate Selection:

- Utilities were asked to provide lists of non-participants who either applied to the programs but were not accepted or who attended informational seminars or inquired about the programs but did not apply.
- Utilities were also asked if any of the contacts mentioned would be of particular interest for a non-participant interview. In most cases, no names were provided.
- If names were given, those non-participants were called first, in random order, attempting to get two completes by utility and by program.

Table 2-4. Potential Issues to be Investigated in EESP Interviews

Do the funding arrangements pose a barrier to participation in the programs?
1. EESPs' experience to date with the funding arrangements: structure, processes, and outcomes in terms of participation and subsequent customer participation – investigate both strengths and weaknesses. 2. Funding structure and processing constraints that prevent either EESPs or their end customers from participating either at all or more broadly – how the structure and processes are impediments, or not 3. EESP ideas on what may be done to address funding arrangements and their dynamics so that program participation is increased.
Is the application and project qualification process efficient and effective?
1. Identify and assess strengths and weaknesses in the application and project qualification process as seen by each EESP; in particular, to review the electronic reservation system operated for some programs; to discuss notable differences in the process among utilities as seen by each EESP. For example: timely execution of processes including service delivery and incentive payments, thoroughness of information and interaction with customers, convenience to customers, sufficient follow-up support, etc. 2. Identify and assess where the process can be changed or not to improve it – and why changes can or cannot be effected where identified as possible improvements. Focus on process aspects that most affect EESPs (vs. utilities). 3. Elicit suggestions for process improvements based on program experience to date
What were the reasons that some projects were never successfully completed by EESPs that had reserved program funding?
1. From the EESP perspective, identify and assess market and programmatic barriers that prevented fund-reserved projects' completions – are these barriers primarily market-related (*a priori* barriers such as project payback) or are they program-related (*e.g.*, due to lack of EESP follow-through)? 2. Identify and assess ideas to reduce market and programmatic barriers that have contributed to projects not being completed.
Have M&V requirements posed a barrier to certain projects?
1. Identify specific M&V requirements that have posed either real or perceived barriers, either to EESPs or their end customers, and why the EESP sees those being problematic. 2. Assess EESPs' ideas on how to mitigate those M&V requirements seen to be burdensome.

In addition, interviewers asked sponsors (both participants and non-participants) about the program's effect on their volume of products, services, and business in general. This line of inquiry would help understand the level of market transformation occurring in Texas. Sponsors were also asked about their expectations going into the programs and their satisfaction with utilities' administration and support efforts.

2.3.3 Additional Interviews

There are other stakeholders with valuable ideas about the structure and process of the programs, funding, etc. These include regulatory staff, members of the community, and professional or non-governmental organizations who have been involved in some way with energy efficiency program developments in Texas, (*e.g.*, members of the EEIP process). The Summit Blue team interviewed six additional stakeholders. Interviewees were selected from the EEIP list provided by the PUCT, and through discussions with Commission staff.

Table 2-5. Potential Issues to be Investigated in Other Stakeholder Interviews

Do the funding arrangements pose a barrier to participation in the programs?
1. Identify other stakeholders' views on whether/why funding structure and processes are affecting EESP and end customer participation – investigate both strengths and weaknesses. 2. Funding structure and processing constraints that prevent either EESPs or customers from participating either at all or more broadly – identify other stakeholders' views on why and how the structure and processes are impediments, or not. 3. Ideas on what may be done to address funding arrangements and their dynamics so that program participation is increased.
Is the application and project qualification process efficient and effective?
1. Identify and assess (in relation to process-related documentation to be provided by utilities) strengths and weaknesses in the application and project qualification process as seen by each stakeholder. 2. Identify and assess stakeholders' views on where the process can be changed or not to improve it – and why changes can or cannot be effected where identified as possible improvements. 3. Elicit suggestions for process improvements based on program experience to date.
What were the reasons that some projects were never successfully completed by EESPs that had reserved program funding?
1. From the stakeholder's perspective, identify and assess market and programmatic barriers that prevented fund-reserved projects' completions – are these barriers primarily market-related (*a priori* barriers such as project payback) or are they program-related (e.g., due to lack of EESP follow-through)? 2. Identify and assess ideas to reduce market and programmatic barriers that have contributed to projects not being completed.
Have M&V requirements posed a barrier to certain projects?
1. Identify specific M&V requirements that have posed either real or perceived barriers, and why the stakeholder sees those being problematic. 3. Assess ideas on how to mitigate those M&V requirements seen to be burdensome.

3. AUDIT FINDINGS – VERIFICATION OF REPORTED SAVINGS

This chapter presents the results of the program audit and savings verification process. Section 3.1 provides a statewide summary of savings compared to goals, along with a utility-by-utility summary that includes verified demand savings for individual programs administered by each utility. This is followed by descriptions of the detailed audit findings for each program. Within each of these sections (*e.g.,* Residential SOP – Section 3.2) a brief discussion of peak reduction (kW) findings for each utility is provided. In addition to these findings, tables of verified energy savings (MWh) are included in Appendix D for statewide findings, for each program, and for each utility.

It should be noted that since this M&V review is primarily a ***desk audit*** of the energy and demand savings reported by the utilities, the scope of work did not include an impact evaluation of programs, but rather a thorough review of the programs' delivery methods and savings claims based on interviews, program databases, and paper records. No on-site inspections, metering, or customer billing analyses were conducted. Recommendations include suggestions for revising program rules and planning, improving program delivery and documentation of savings, and conducting other activities that may facilitate greater precision and reliability in verifying future savings.

3.1 Summary of Findings

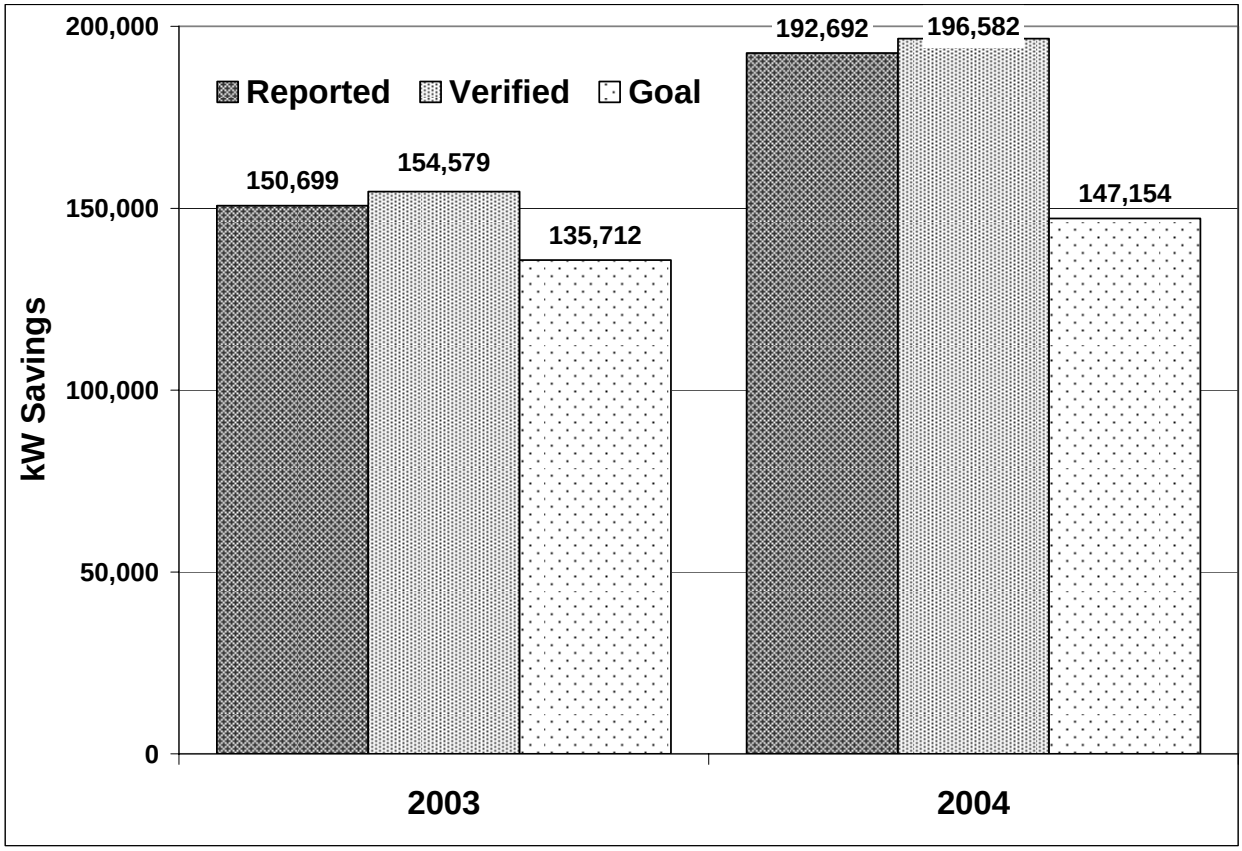
3.1.1 Summary of State Level Findings

Savings values for some utility programs were reduced from the reported values as a result of the impact assessment, with realization rates (or verified savings as a share of reported savings) ranging from 92.1% to 111.7%. For one program in 2003, the verified savings exceeded the reported savings due to corrections that increased calculated savings figures. Across the six utilities the M&V audit verified 154,579 kW of savings in 2003 and 196,582 kW in 2004.[14] Based on these figures, verified peak demand reductions exceeded statewide goals by 14% in 2003 and 34% in 2004 (Figure 3-1).[15]

[14] The M&V team was tasked with verifying savings only from the nine programs identified in this report. However, the utilities' reported savings figures include savings from several other efforts such as the TDHCA (Texas Department of Housing and Community Affairs) and 3rd Party DSM Contracts. Across all utilities, peak demand reductions from these efforts account for 3% of reported peak demand reductions in 2003 and 5% in 2004. The total verified savings figures presented in this section assume 100% realization of reported savings for these programs.

[15] Reported savings and peak demand reduction goals were obtained from utility Annual Reports filed in April of the year following program operation and in April of the program year, respectively.

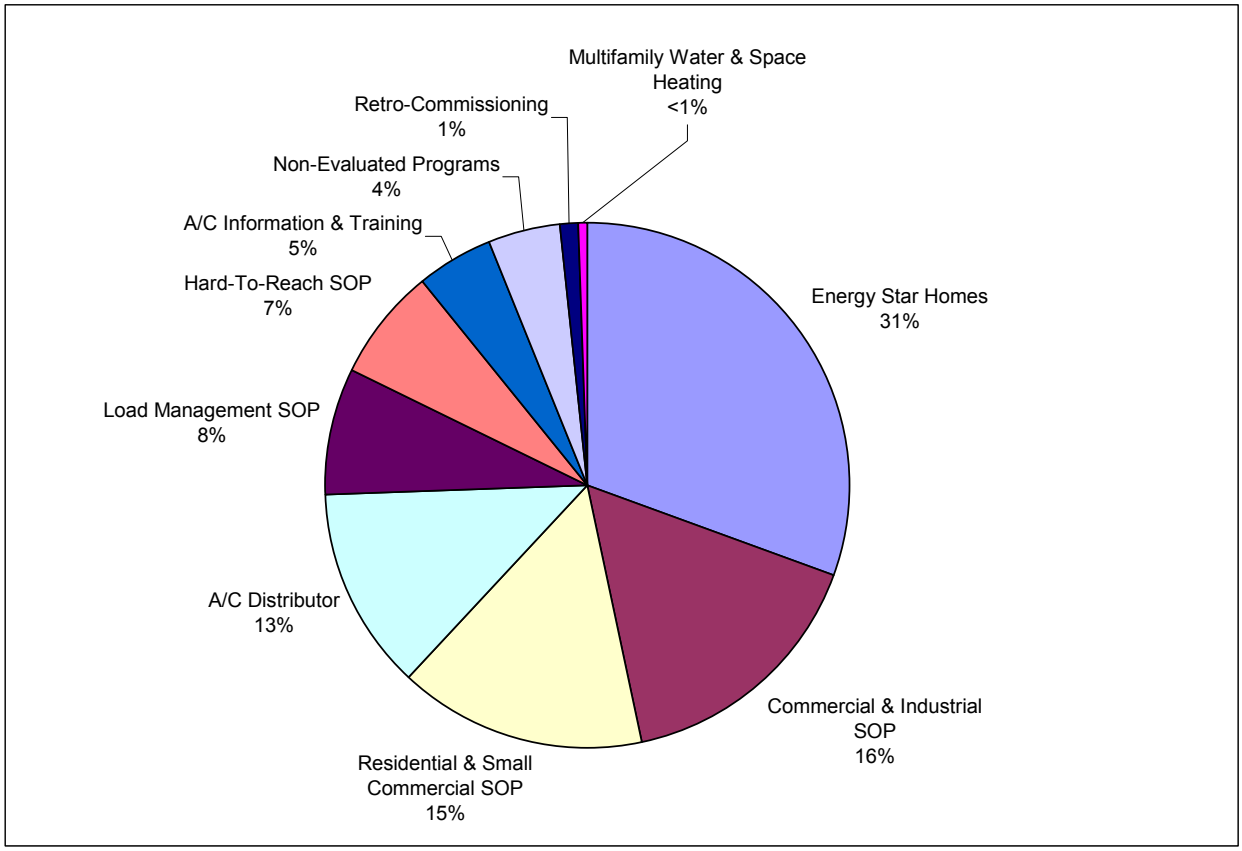
Figure 3-1. Comparison of Reported and Verified Savings (kW) with Utility Goals, Statewide 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

By 2004, peak demand reductions were being realized across nine unique programs (not including a series of smaller programs not included in this study). Energy Star Homes accounted for the greatest share of savings, at 31% of the total, followed by the C&I and Residential SOPs and the A/C Distributor program, each of which accounted for at least 13% of savings (Figure 3-2). The breakdown of savings by program was similar in 2003, although the A/C programs were significantly smaller, and the Retro-commissioning and the Multi-family Water and Space Heating programs were not being administered.

Figure 3-2. Verified Peak Demand Savings (kW) by Program, 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Among the nine programs reviewed, most were given realization rates (*i.e.,* verified savings as a share of reported savings) of 99% or more for both years (Table 3-1). The most notable exceptions are: 1) the C&I SOP, which had realization rates of 96% and 98% across the two years, owing largely to uncertainty in savings calculated by sponsors using the IPMVP protocols for projects requiring M&V, and 2) the Retro-commissioning program, administered by only one utility in 2004, for which reported peak load reductions were adjusted downward by 8%.

Table 3-1. Peak Demand Savings (kW) by Program – All Utilities, 2003 and 2004

	2003			2004		
	Reported	**Verified***	**Realization Rate**	**Reported**	**Verified***	**Realization Rate**
Residential SOP	25,118	25,055	99.7%	29,695	29,686	100.0%
Hard-To-Reach SOP	9,043	8,971	99.2%	13,966	13,921	99.7%
C&I SOP	33,292	32,101	96.4%	32,863	32,061	97.6%
Load Management SOP	13,129	13,129	100.0%	15,108	15,108	100.0%
Energy Star Homes	48,545	54,207	111.7%	54,577	59,862	109.7%
A/C Distributor	15,295	14,839	97.0%	24,966	24,762	99.2%
A/C Info & Training	1,790	1,790	100.0%	9,360	9,237	98.7%
Multifamily Gas	0	0	NA	903	902	99.9%
Retro-Commissioning	0	0	NA	2,665	2,455	92.1%
Non-Audited Programs	4,487	4,487	100.0%	8,589	8,589	100.0%
Total	**150,699**	**154,579**	**102.6%**	**192,692**	**196,582**	**102.0%**

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

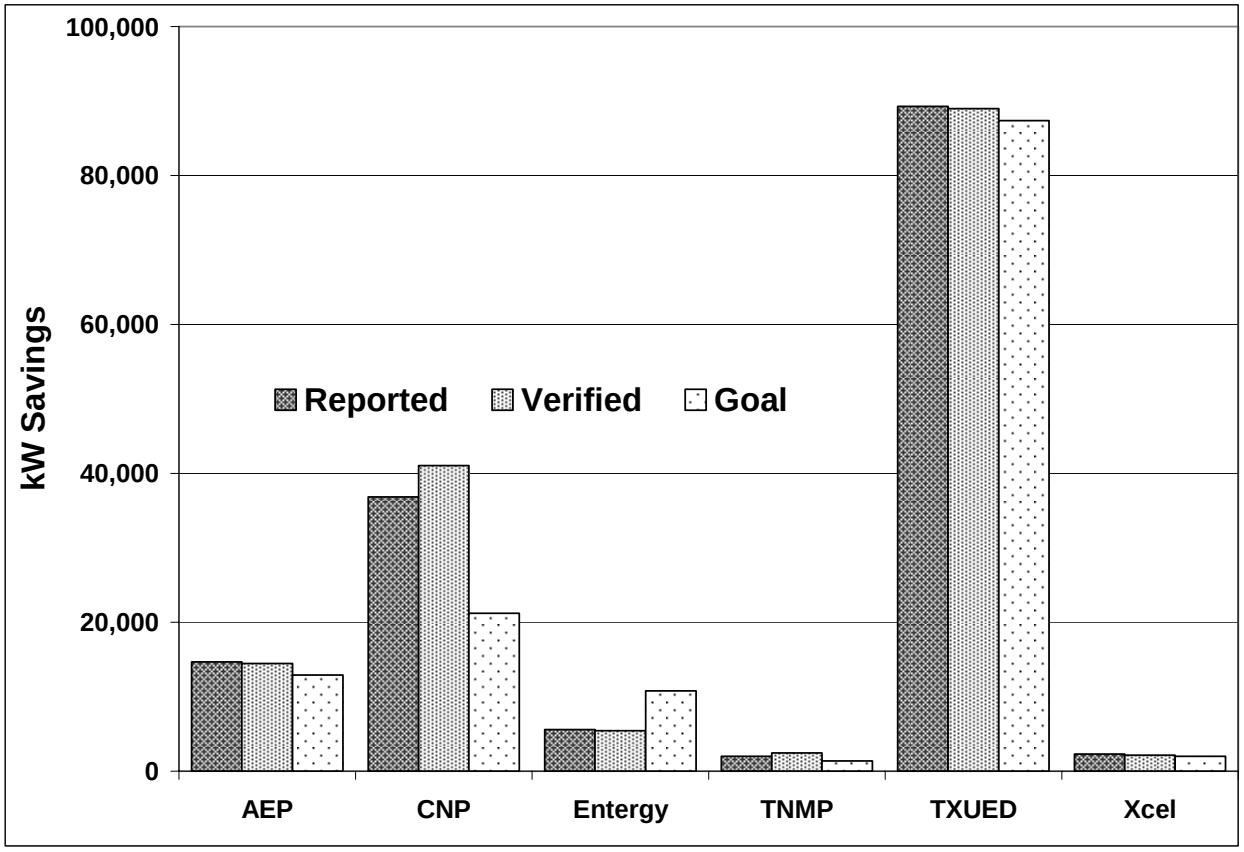
The overall realization rate of verified to reported savings of approximately 102% in both 2003 and 2004 demonstrates excellent overall performance, including thorough record-keeping, proper application of approved deemed savings values, and adherence to program rules. There are few comparable studies against which to benchmark these findings, since this review was a desk audit as opposed to an impact evaluation. Perhaps the most appropriate study for purposes of comparison is the 2004 review of shareholder incentive claims for energy efficiency programs administered by utilities in California. This review verified 96% of the incentive dollars claimed by utilities for energy savings goals.[16]

3.1.2 Summary of Utility Findings

Four of the six utilities exceeded their individual goals in both years, while one reached its goal only in 2003 and another achieved savings below its goal in both years. Figure 3-3 presents a comparison between utilities' 2003 reported peak demand reductions, the savings verified through this assessment, and the utilities' goals (see Footnotes 14 and 15). Most utilities' savings figures were reduced very slightly as a result of adjustments from the M&V audit (four utilities had realization rates between 93% and 100%), while two utilities had verified savings that were higher than reported figures. All five utilities whose reported savings exceeded their goals still exceeded the goals after adjustments from verified savings.

[16] In California, utilities were awarded financial incentives for achieving various energy savings goals (including gas savings) and other program milestones. The 96% figure cited here is for "energy savings" milestones only. However, the complex structure of the incentives awards limits the applicability of a direct comparison to realization rates in Texas. See *Review of AEAP Milestone Incentive Awards, Program Years 1999-2002,* SERA, Inc. and Summit Blue Consulting for the California Public Utilities Commission, September 2004.

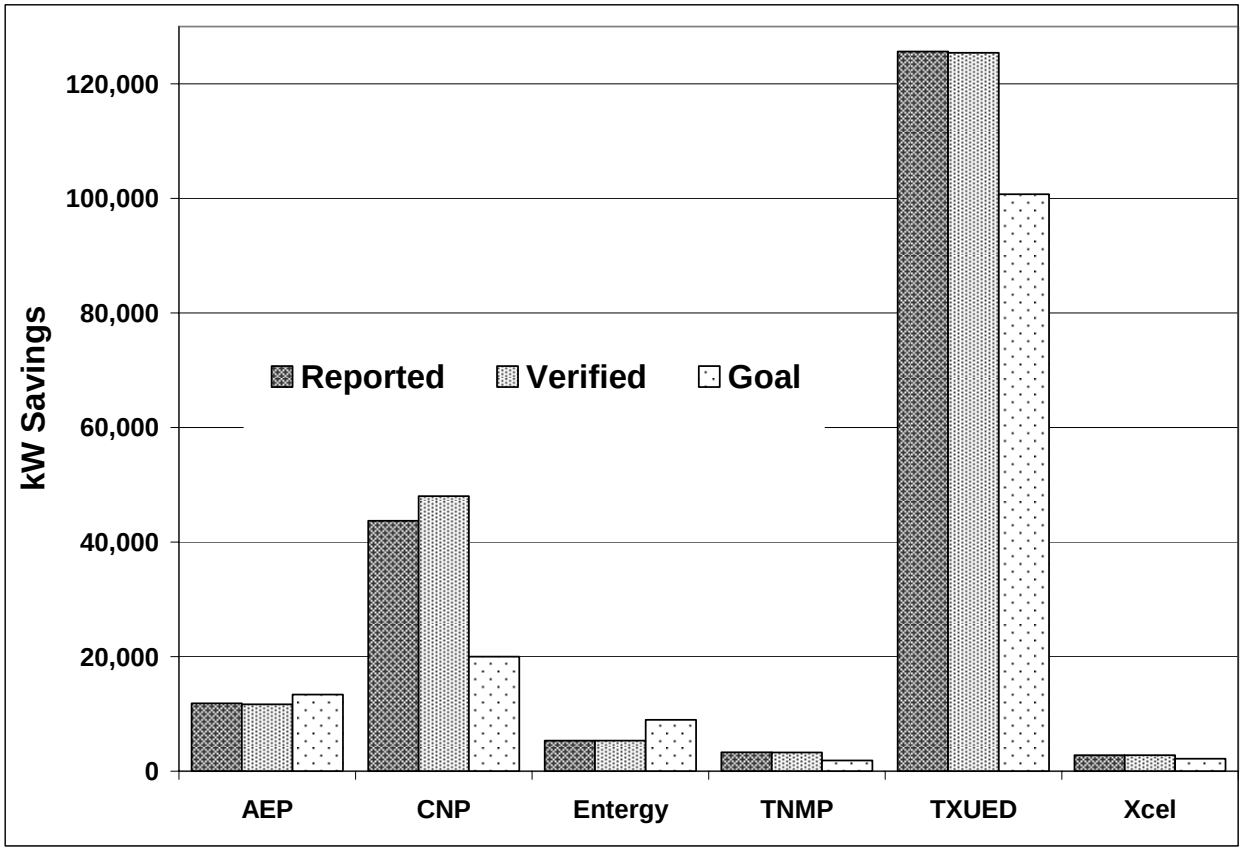
Figure 3-3. Comparison of Reported and Verified Savings (kW) with Utility Goals, By Utility, 2003



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

In 2004 the M&V audit reduced peak demand reduction figures by less than 3% for all utilities. All four utilities whose reported savings exceeded their goals still exceeded the goals after adjustments from verified savings (Figure 3-4).

Figure 3-4. Comparison of Reported and Verified Savings (kW) with Utility Goals, By Utility, 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Verified energy savings across the six utilities were determined to be 361,791 MWh in 2003 and 442,014 MWh in 2004. In general, realization rates for energy savings (in MWh) were similar to those for peak demand savings (kW). Due to the large volume of data analyzed for this report and the Commission's emphasis on peak demand savings, limited findings on energy savings are presented in the program-specific discussions below. Detailed tables and figures on kWh savings are included in Appendix D.

Table 3-2 through Table 3-7 present reported and verified savings for each utility, by program type. For each utility, total savings are presented along with the utility's demand goal and the percent of the goal achieved, based on verified savings. The audit team estimated lower and upper bounds of verified savings in addition to the best estimates presented above. These bounds are derived from both sample extrapolation and uncertainty due to insufficient quantity or scope of supporting documentation, as explained in Section 2. It should be noted that even the low estimates exceed the goals for nearly all utilities in both years. In the three cases where the lower bounds do not exceed the goals, the best estimate of verified savings also does not exceed the goal, suggesting that even using the more conservative lower bounds as point estimates would not impact the conclusion regarding whether or not a utility met its

demand reduction goals. Statewide, the lower bound of verified savings across all utilities also exceeds the aggregate goals for both years.[17]

The utility-specific tables below summarize the reported versus verified demand savings and realization rates for each of the utility-administered programs in 2003 and 2004. The detailed analysis to develop the verified savings estimates are presented in the next section, organized by each program with subsections for each utility.

Table 3-2. Peak Demand Savings (kW) by Program - AEP

	2003			2004		
	Reported	**Verified**	**Realization Rate**	**Reported**	**Verified**	**Realization Rate**
Residential SOP	9,162	9,114	99.5%	5,552	5,546	99.9%
Hard-To-Reach SOP	1,232	1,184	96.1%	1,120	1,120	100.0%
C&I SOP	2,987	2,871	96.1%	5,063	4,911	97.0%
Load Management SOP	0	0	NA	0	0	NA
Energy Star Homes	0	0	NA	0	0	NA
A/C Distributor	0	0	NA	0	0	NA
A/C Info & Training	0	0	NA	0	0	NA
Multifamily Gas	0	0	NA	0	0	NA
Retro-Commissioning	0	0	NA	0	0	NA
Non-Audited Programs	1,294	1,294	100.0%	111	111	100.0%
Total	**14,675**	**14,463**	**98.6%**	**11,846**	**11,688**	**98.7%**
Verified Savings Range	13,733 – 14,623			11,144 – 11,842		
Demand Goal	**12,940**			**13,370**		
% of Goal Achieved	**111.8%**			**87.4%**		

***** Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

[17] The lower (and upper) bounds for the utility and state totals were calculated as the sums of the lower (and upper) bounds for each program. The resulting confidence intervals are based on highly conservative *(i.e., unlikely)* scenarios in which it is assumed that all programs achieve the lower (or upper) bound at the same time.

Table 3-3. Peak Demand Savings (kW) by Program - CNP

	2003			2004		
	Reported	**Verified**	**Realization Rate**	**Reported**	**Verified**	**Realization Rate**
Residential SOP	3,504	3,504	100.0%	2,474	2,474	100.0%
Hard-To-Reach SOP	615	615	100.0%	907	906	99.9%
C&I SOP	10,779	10,216	94.8%	11,355	10,726	94.5%
Load Management SOP	0	0	NA	0	0	NA
Energy Star Homes	18,546	23,476	126.6%	22,099	27,428	124.1%
A/C Distributor	3,383	3,227	95.4%	3,915	3,756	95.9%
A/C Info & Training	0	0	NA	0	0	NA
Multifamily Gas	0	0	NA	299	299	100.0%
Retro-Commissioning	0	0	NA	2,665	2,455	92.1%
Non-Audited Programs	0	0	NA	0	0	NA
Total	**36,827**	**41,038**	**111.4%**	**43,714**	**48,044**	**109.9%**
Verified Savings Range	40,839 – 41,203			47,694 – 48,370		
Demand Goal	**21,210**			**20,007**		
% of Goal Achieved	**193.5%**			**240.1%**		

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Table 3-4. Peak Demand Savings (kW) by Program - Entergy

	2003			2004		
	Reported	**Verified**	**Realization Rate**	**Reported**	**Verified**	**Realization Rate**
Residential SOP	1,102	1,092	99.1%	879	879	100.0%
Hard-To-Reach SOP	719	719	100.0%	731	731	100.0%
C&I SOP	1,439	1,307	90.8%	877	875	99.8%
Load Management SOP	0	0	NA	0	0	NA
Energy Star Homes	1,467	1,467	100.0%	2,262	2,252	99.6%
A/C Distributor	379	379	100.0%	448	448	100.0%
A/C Info & Training	0	0	NA	0	0	NA
Multifamily Gas	0	0	NA	0	0	NA
Retro-Commissioning	0	0	NA	0	0	NA
Non-Audited Programs	480	480	100.0%	167	167	100.0%
Total	**5,586**	**5,444**	**97.5%**	**5,364**	**5,352**	**99.8%**
Verified Savings Range	5,335 – 5,455			5,180 – 5,354		
Demand Goal	**10,800**			**8,973**		
% of Goal Achieved	**50.4%**			**59.6%**		

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Table 3-5. Peak Demand Savings (kW) by Program - TNMP

	2003			2004		
	Reported	**Verified**	**Realization Rate**	**Reported**	**Verified**	**Realization Rate**
Residential SOP	390	390	100.0%	379	379	100.0%
Hard-To-Reach SOP	0	0	NA	183	183	100.0%
C&I SOP	791	529	66.9%	835	817	97.9%
Load Management SOP	0	0	NA	0	0	NA
Energy Star Homes	831	1,550	186.5%	1,907	1,907	100.0%
A/C Distributor	0	0	NA	0	0	NA
A/C Info & Training	0	0	NA	0	0	NA
Multifamily Gas	0	0	NA	0	0	NA
Retro-Commissioning	0	0	NA	0	0	NA
Non-Audited Programs	0	0	NA	0	0	NA
Total	**2,012**	**2,469**	**122.7%**	**3,304**	**3,286**	**99.5%**
Verified Savings Range	2,312 – 2,503			3,135 – 3,304		
Demand Goal	**1,400**			**1,900**		
% of Goal Achieved	**176.4%**			**173.0%**		

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Table 3-6. Peak Demand Savings (kW) by Program - TXUED

	2003			2004		
	Reported	**Verified**	**Realization Rate**	**Reported**	**Verified**	**Realization Rate**
Residential SOP	10,186	10,184	100.0%	19,627	19,624	100.0%
Hard-To-Reach SOP	6,372	6,348	99.6%	10,941	10,897	99.6%
C&I SOP	16,598	16,598	100.0%	13,384	13,384	100.0%
Load Management SOP	13,129	13,129	100.0%	15,108	15,108	100.0%
Energy Star Homes	27,701	27,714	100.0%	28,309	28,275	99.9%
A/C Distributor	10,800	10,525	97.5%	20,100	20,055	99.8%
A/C Info & Training	1,790	1,790	100.0%	9,360	9,237	98.7%
Multifamily Gas	0	0	NA	604	603	99.8%
Retro-Commissioning	0	0	NA	0	0	NA
Non-Audited Programs	2,713	2,713	100.0%	8,238	8,238	100.0%
Total	**89,289**	**89,001**	**99.7%**	**125,671**	**125,421**	**99.8%**
Verified Savings Range	88,911 – 89,007			125,276 – 125,425		
Demand Goal	**87,362**			**100,721**		
% of Goal Achieved	**101.9%**			**124.5%**		

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Table 3-7. Peak Demand Savings (kW) by Program - Xcel

	2003			2004		
	Reported	**Verified**	**Realization Rate**	**Reported**	**Verified**	**Realization Rate**
Residential SOP	774	771	99.6%	784	784	100.0%
Hard-To-Reach SOP	105	105	100.0%	84	84	100.0%
C&I SOP	698	581	83.2%	1,349	1,347	99.9%
Load Management SOP	0	0	NA	0	0	NA
Energy Star Homes	0	0	NA	0	0	NA
A/C Distributor	733	708	96.6%	503	503	100.0%
A/C Info & Training	0	0	NA	0	0	NA
Multifamily Gas	0	0	NA	0	0	NA
Retro-Commissioning	0	0	NA	0	0	NA
Non-Audited Programs	0	0	NA	73	73	100.0%
Total	**2,310**	**2,165**	**93.7%**	**2,793**	**2,791**	**99.9%**
Verified Savings Range	2,033 – 2,251			2,738 – 2,794		
Demand Goal	**2,000**			**2,183**		
% of Goal Achieved	**108.2%**			**127.9%**		

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

3.2 Residential SOP

Across the six utilities administering the Residential SOP, 25,054 kW of peak demand reduction were realized in 2003 and 29,686 kW in 2004. These verified savings represent realization rates of nearly 100% for both 2003 and 2004 (Table 3-8). The exceptionally high realization rate reflects accurate reporting by the utilities, appropriate use of deemed savings values for virtually all installations, and an effective inspection process that reduced savings for invalid installations prior to the utilities' annual reporting of program accomplishments. Verified energy savings for the Residential SOP are determined to be 92,452 MWh in 2003 and 99,672 MWh in 2004 (Appendix D).

Table 3-8. Peak Demand Savings (kW) by Utility, Residential SOP, 2003 and 2004

	2003			2004		
	Reported	**Verified***	**Verification Realization Rate**	**Reported**	**Verified***	**Verification Realization Rate**
AEP	9,162	9,114	99.5%	5,552	5,546	99.9%
CNP	3,504	3,504	100.0%	2,474	2,474	100.0%
Entergy	1,102	1,092	99.1%	879	879	100.0%
TNMP	390	390	100.0%	379	379	100.0%
TXUED	10,186	10,184	100.0%	19,627	19,624	100.0%
Xcel	774	771	99.5%	784	784	100.0%
TOTAL	**25,118**	**25,055**	**99.7%**	**29,695**	**29,686**	**100.0%**

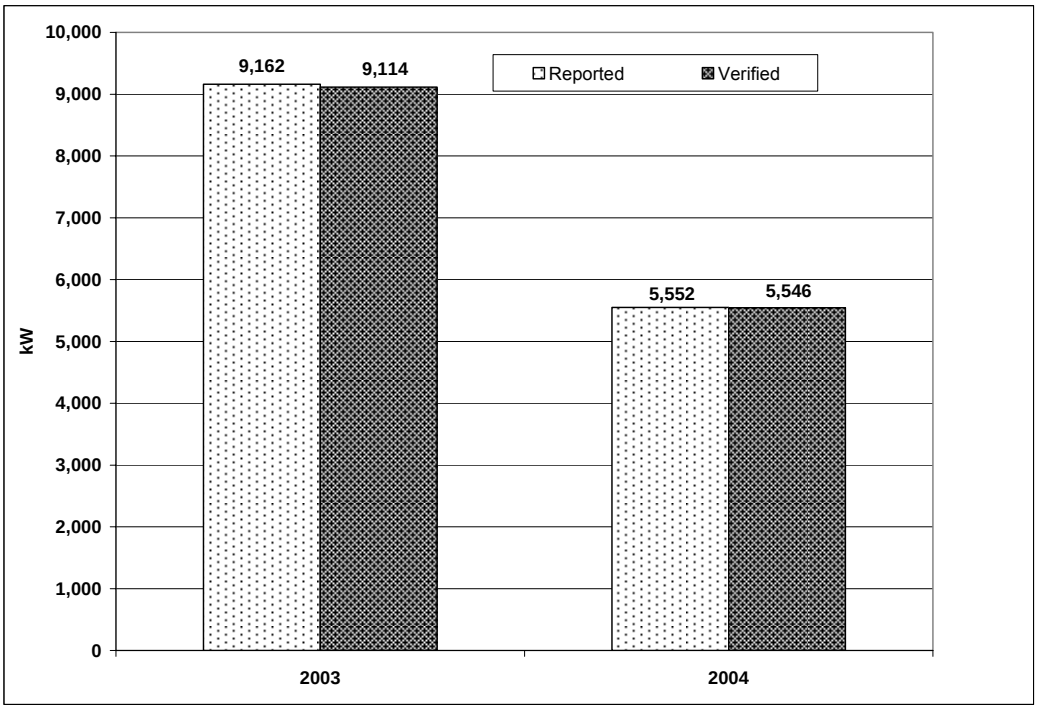
***** Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

For each utility, adjustments to the reported savings were made based on the results of the impact audit. However, all projects in the random sample received 100% realization (*i.e.,* all reported savings were verified) as the best estimate of savings since there was little basis on which to identify erroneous installations that appeared in program databases. In all of the programs in Texas, and particularly in the Residential SOP, the program databases contain the primary record of activity, and the inspection process sufficiently validates installations. Therefore, the primary area in which to identify potential savings adjustments are not in the review of sample documentation (Step 2), but rather in the comparison of the database to reported savings (Step 1) and in the deemed savings review (Step 3). As described below, only very small adjustments were made as a result of these steps.

AEP

The M&V audit of AEP's Residential SOP verified 9,114 kW of savings in 2003, and 5,546 kW of savings in 2004 (Figure 3-5). These savings represent demand realization rates of 99.5% for 2003 and 99.9% for 2004.

Figure 3-5. Peak Demand Savings (kW), AEP Residential SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

AEP's Residential SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% or more of the reported savings.[18]

The review of database records indicates that the air conditioner replacement, ceiling insulation, duct efficiency, and air infiltration measures account for more than 99% of the installed measures and 95% of the reported demand reduction. For each of these measure installations in the database, the audit team recalculated the deemed savings values using data from the definition documents identified in the program-specific methodology in Appendix C. Virtually all savings values in the databases were corroborated through this analysis. The impact was a 0.05% reduction in demand savings in 2003 and a 0.01% reduction in 2004. This slight difference comes from 2% of the air conditioner measures and 1% of the ceiling insulation measures that were calculated differently in the database than all the other similar measures. Additionally, the database review indicated that six air infiltration measure installations reached a CFM50 percentage reduction of 90% or greater. This very high reduction percentage and correspondingly high savings are most likely due to data-entry errors, and these records were regarded as outliers. Correcting for these errors leads to a program-wide reduction of 48 kW in 2003 and 6 kW in 2004 (Table 3-9).

[18] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

The audit team also reviewed supporting documentation for a sample of 37 AEP Residential SOP customers representing reported demand savings of 28.4 kW. This documentation review did not indicate the need for any adjustments to the reported savings values, and therefore a sample realization rate of 100% was applied to program savings for both 2003 and 2004. Considering both the program-wide adjustments and the sample realization rate, the overall realization rate is nearly 100% for each of the two years (Table 3-9). In addition, AEP inspected 11% of customers in 2003 and 18% of customers in 2004. Evidence from the 14 inspected customers in the sample indicates that inspection failures were properly reflected in the database and that savings adjustments made by AEP to inspected customers were properly applied to all non-inspected customers on the same sponsor invoice.

Table 3-9. Peak Demand Savings Adjustments and Sample Realization Rates, AEP Residential SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	9,162	5,552
Program-wide Adjustments	**B**	-48	-6
Subtotal	**C=A+B**	9,114	5,546
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**9,114**	**5,546**
Total Adjustments to Reported Savings	**E-A**	-48	-6
Program Realization Rate	**E/A**	99.5%	99.9%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Although the best estimate of verified savings is 100% of the reported savings, there is some uncertainty due to missing documentation for some customers in the sample. AEP was not able to provide any supporting documentation for 10 customers (9.2 kW of demand savings). Thus, 20% of the savings from these sites was considered "uncertain." Although the missing records do not impact the best estimate of verified savings, the uncertainty around these savings is reflected in the lower-bound estimate, which was adjusted to include only 80% of the reported savings from this site. Furthermore, AEP staff could not provide signed forms for three additional customers, representing 1.9 kW of demand savings. Ten percent of these savings were considered "uncertain," and the lower bound estimate of verified savings was adjusted accordingly. For the program as a whole, the lower bound of realized savings is 92.4% of the reported savings for 2003 and 92.8% for 2004, while the upper bound is the same as the best estimate for both years. The range of peak demand savings is presented in Table 3-10.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. The only difference was in the review of the deemed savings application, which showed a slight increase from reported values in both 2003 and 2004. As a result, the lower bound of energy savings is 92.7% of reported savings for 2003 and 93.3% for 2004, while realization rates for the best estimate and upper bound are very near 100%. The range of energy savings is also presented in Table 3-10.

Table 3-10. Range of Peak Demand and Energy Savings, AEP Residential SOP, 2003 and 2004

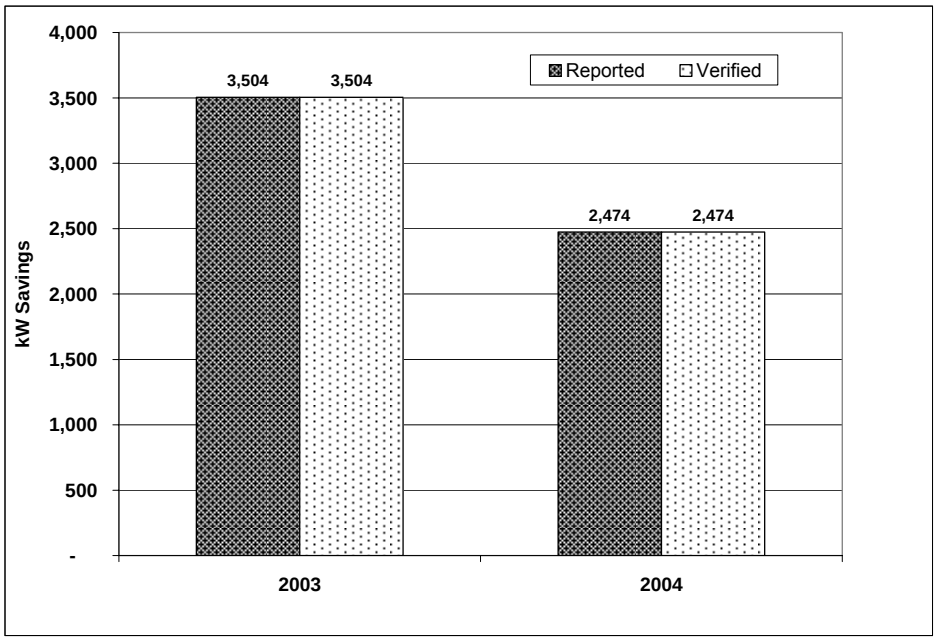
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	9,162	8,464	9,114	9,114	5,552	5,151	5,546	5,546
MWh	29,754	27,578	29,696	29,696	15,937	14,872	16,014	16,014

The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

CNP

The M&V audit of CNP's Residential SOP verified 3,504 kW of savings in 2003, and 2,474 kW of savings in 2004 (Figure 3-6). These savings represent demand realization rates of 100% for both years.

Figure 3-6. Peak Demand Savings (kW), CNP Residential SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

CNP's Residential SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% or more of the reported savings.[19]

[19] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

The review of database records indicates that five measures account for 90% of the installed measures and 96% of the reported demand reduction. For each of these measure installations in the database, the audit team recalculated the deemed savings values using data from the definition documents identified in Appendix C. All demand savings values in the databases were corroborated through this analysis. In addition, the audit team identified no egregious data-entry errors indicating the presence of outliers, and no adjustment from this analysis was applied to the reported savings (Table 3-11).

The audit team also reviewed supporting documentation for a sample of 36 CNP Residential SOP customers representing reported demand savings of 14.4 kW. This documentation review did not indicate the need for any adjustments to the reported savings values, and therefore a sample realization rate of 100% was applied to program savings for both 2003 and 2004 (Table 3-11). In addition, CNP inspected 11% of customers in 2003 and 8% of customers in 2004. Evidence from the 11 inspected customers in the sample indicates that inspection failures were properly reflected in the database and that savings adjustments made by CNP to inspected customers were properly applied to all non-inspected customers on the same sponsor invoice.

Table 3-11. Peak Demand Savings Adjustments and Sample Realization Rates, CNP Residential SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	3,504	2,474
Program-wide Adjustments	**B**	0	0
Subtotal	**C=A+B**	3,504	2,474
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**3,504**	**2,474**
Total Adjustments to Reported Savings	**E-A**	0	0
Program Realization Rate	**E/A**	100.0%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Although the best estimate of verified savings is 100% of the reported savings, there is some uncertainty due to missing documentation. CNP staff could not provide a signed customer form for one customer, and 10% of these savings were considered "uncertain." Although the missing customer form does not impact the best estimate of verified savings, the uncertainty around these savings is reflected in the lower-bound estimate, which was adjusted to include only 90% of the reported savings from this customer. For the program as a whole, the lower bound of realized savings is 99.1% of the reported savings for both 2003 and 2004, while the upper bound is 100.0%. The range of peak demand savings is presented in Table 3-12.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. The only difference was in the review of the deemed savings application, which showed a slight decrease from reported values in both 2003 and 2004. As a result, the lower bound of energy savings is 98.4% of reported savings in 2003 and 97.9% in 2004, while realization rates for the best estimate and upper bound are 99.3% in 2003 and 98.8% in 2004. The range of energy savings is presented in Table 3-12.

Table 3-12. Range of Peak Demand and Energy Savings, CNP Residential SOP, 2003 and 2004

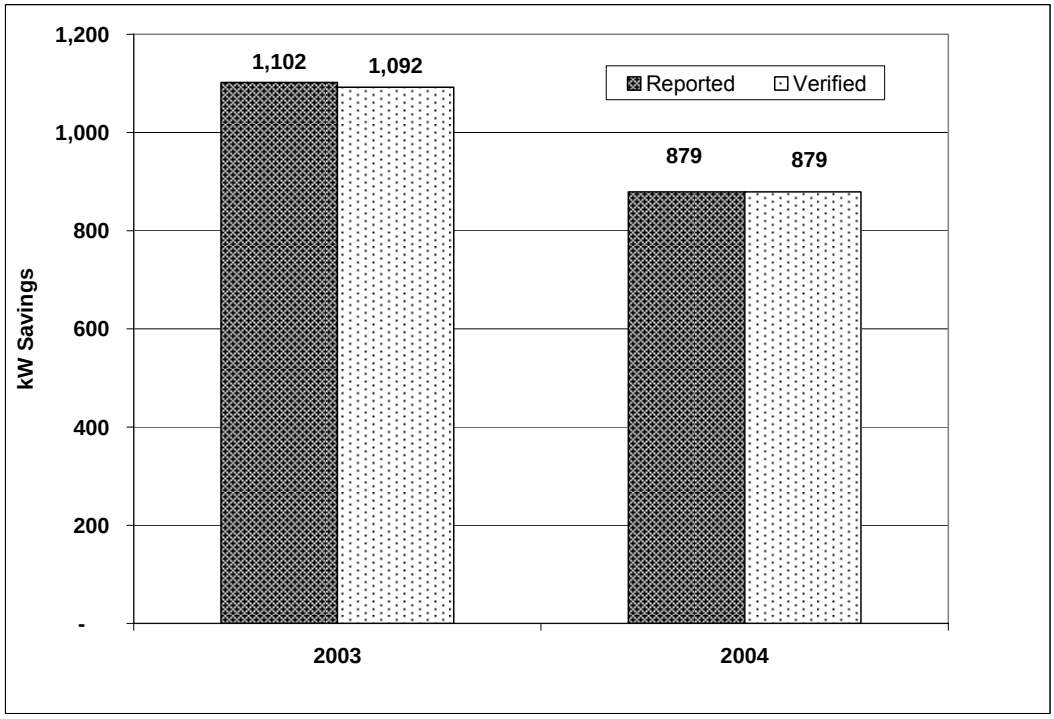
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	3,504	3,471	3,504	3,504	2,474	2,451	2,474	2,474
MWh	11,085	10,905	11,009	11,009	6,533	6,397	6,458	6,458

The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

Entergy

The M&V audit of Entergy's Residential SOP verified 1,092 kW of savings in 2003, and 879 kW of savings in 2004 (Figure 3-7). These savings represent demand realization rates of 99% for 2003 and 100% for 2004.

Figure 3-7. Peak Demand Savings (kW), Entergy Residential SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Entergy's Residential SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% or more of the reported savings.[20]

[20] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all

The review of database records indicates that four measures account for 95% of the installed measures and also 95% of the reported demand reduction. For each of these measure installations in the database, the audit team recalculated the deemed savings values using data from the definition documents identified in Appendix C. All demand savings values in the databases were corroborated through this analysis. Additionally, the database review indicated that two air infiltration measure installations reached a CFM50 percentage reduction of 90% or greater. This very high reduction percentage and correspondingly high savings are most likely due to data-entry errors, and these records were regarded as outliers. Both of these outliers occurred in 2003, and correcting for these outliers leads to a program-wide reduction of 10 kW in 2003 (Table 3-13).

The audit team also reviewed supporting documentation for a sample of 33 Entergy Residential SOP customers representing reported demand savings of 20.2 kW. This documentation review did not indicate the need for any adjustments to the reported savings values, and therefore a sample realization rate of 100% was applied to program savings for both 2003 and 2004 (Table 3-13). In addition, Entergy inspected 13% of customers in 2003 and 19% of customers in 2004. Evidence from the 12 inspected customers in the sample indicates that the majority of inspection failures were properly reflected in the database and that savings adjustments made by Entergy to inspected customers were properly applied to all non-inspected customers on the same sponsor invoice.[21]

Table 3-13. Peak Demand Savings Adjustments and Sample Realization Rates, Entergy Residential SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	1,102	879
Program-wide Adjustments	**B**	-10	0
Subtotal	**C=A+B**	1,092	879
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**1,092**	**879**
Total Adjustments to Reported Savings	**E-A**	-10	0
Program Realization Rate	**E/A**	99.1%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Although the best estimate of verified savings is 100% of the reported savings, there is generally some uncertainty due to missing documentation, and this uncertainty is reflected in the lower-bound estimate of savings. Utility staff could not provide a signed customer form for one customer, but Entergy claimed zero savings for this particular customer. As a result, the "uncertainty" surrounding this customer had no effect on the lower-bound estimate of savings. For the program as a whole, the lower bound, upper bound, and best estimate of verified savings were 100.0% for both 2003 and 2004. The range of peak demand savings is presented in Table 3-14.

unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

[21]One sponsor invoice covering six customers was supposed to have a 7.9% reduction across un-inspected customers based on the inspection results, but this reduction appears not to have been applied to the four un-inspected customers. If the reduction had been applied, it would have reduced savings for this invoice by less than 1 kW. No adjustments were made to the savings, however, because of the minimal impact and small sample size.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. The only difference was in the review of the deemed savings application, which showed a slight increase from reported values in 2004. Since this was a program-wide adjustment and no uncertainty was identified by the audit team during the sample review, the lower bound, upper bound, and best estimate of verified energy savings are all the same. As a result, the realization rate is 99% of reported savings in 2003 and 100% in 2004. The range of energy savings is presented in Table 3-14.

Table 3-14. Range of Peak Demand and Energy Savings, Entergy Residential SOP, 2003 and 2004

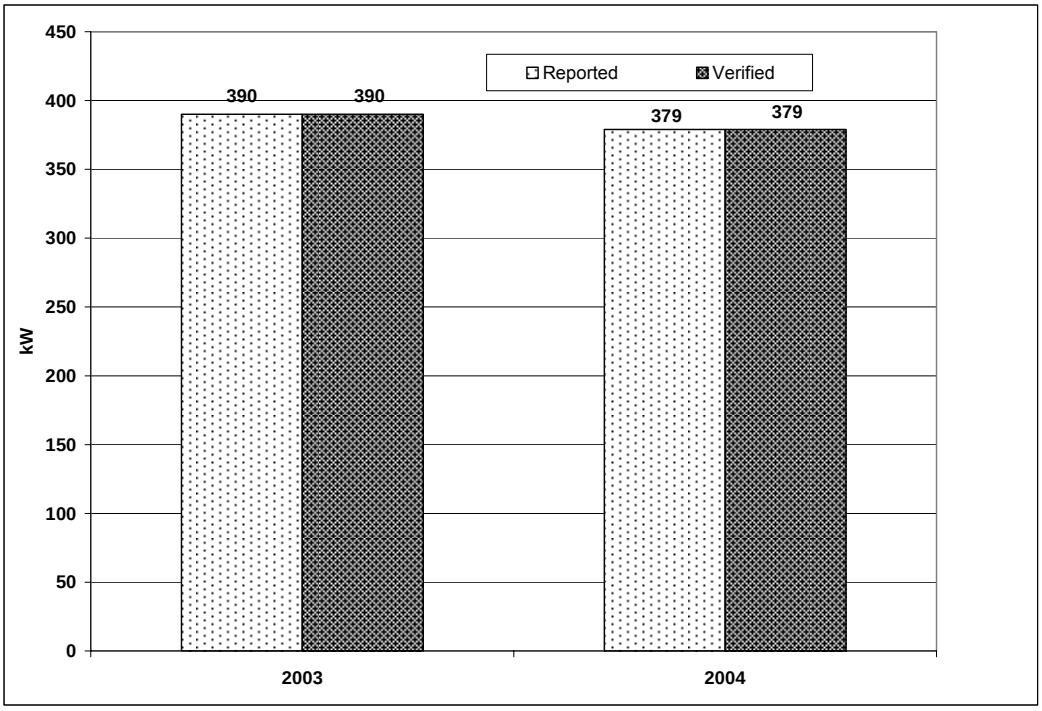
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	1,102	1,092	1,092	1,092	879	879	879	879
MWh	3,606	3,575	3,575	3,575	2,825	2,828	2,828	2,828

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

TNMP

The M&V audit of TNMP's Residential SOP verified 390 kW of savings in 2003, and 379 kW of savings in 2004 (Figure 3-8). These savings represent demand realization rates of 100% for both years.

Figure 3-8. Peak Demand Savings (kW), TNMP Residential SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TNMP's Residential SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% or more of the reported savings.[22]

The review of database records indicates that three measures account for 99% of the installed measures and almost 100% of the reported demand reduction. For each of these measure installations in the database, the audit team recalculated the deemed savings values using data from the definition documents identified in Appendix C. All demand savings values in the databases were corroborated through this analysis. In addition, the audit team identified no egregious data-entry errors indicating the presence of outliers, and no adjustment from this analysis was applied to the reported savings (Table 3-15).

The audit team also reviewed supporting documentation for a sample of 33 TNMP Residential SOP customers representing reported demand savings of 20.4 kW. This documentation review did not indicate the need for any adjustments to the reported savings values, and therefore a sample realization rate of 100% was applied to program savings for both 2003 and 2004 (Table 3-15). In addition, TNMP inspected 5% of customers in 2003 and 4% of customers in 2004. According to TNMP staff, no customers failed inspection in 2003 or 2004, and this was verified in the database by the audit team. Since no customers failed inspection, inspection field forms were not required by the audit team.

Table 3-15. Peak Demand Savings Adjustments and Sample Realization Rates, TNMP Residential SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	390	379
Program-wide Adjustments	**B**	0	0
Subtotal	**C=A+B**	390	379
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**390**	**379**
Total Adjustments to Reported Savings	**E-A**	0	0
Program Realization Rate	**E/A**	100.0%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Although the best estimate of verified savings is 100% of the reported savings, there is some uncertainty due to missing documentation for some customers in the sample. TNMP was not able to provide any supporting documentation for 12 customers (6.2 kW of demand savings). Thus, 20% of the savings from these sites was considered "uncertain." Although the missing records do not impact the best estimate of verified savings, the uncertainty around these savings is reflected in the lower-bound estimate, which was adjusted to include only 80% of the reported savings from these sites. For the program as a whole, the lower bound of realized demand savings is 93.9% of the reported savings for both 2003 and 2004, while the upper bound is 100.0%. The reported energy savings were verified in the same proportion as the peak demand savings, and the energy realization rates are the same as the demand realization rates. The range of peak demand and energy savings is presented in Table 3-16.

[22] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

Table 3-16. Range of Peak Demand and Energy Savings, TNMP Residential SOP, 2003 and 2004

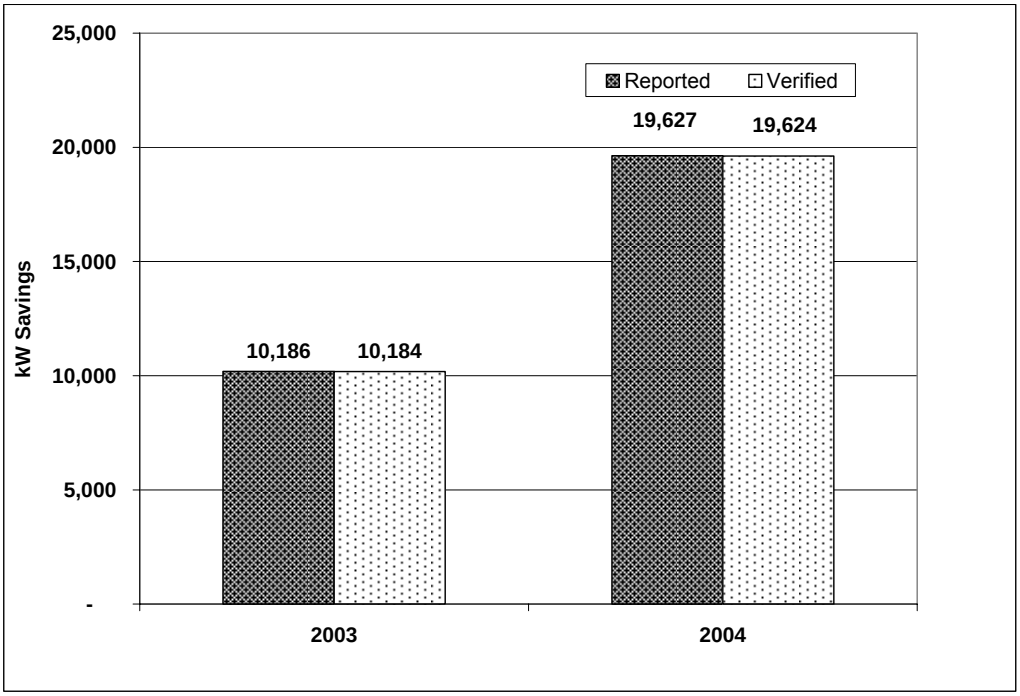
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	390	366	390	390	379	356	379	379
MWh	1,217	1,143	1,217	1,217	1,122	1,054	1,122	1,122

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

TXUED

The M&V audit of TXUED's Residential SOP verified 10,184 kW of savings in 2003, and 19,624 kW of savings in 2004 (Figure 3-9). These savings represent demand realization rates of virtually 100% for both years.

Figure 3-9. Peak Demand Savings (kW), TXUED Residential SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TXUED's Residential SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% or more of the reported savings.

The review of database records indicates that five measures account for 93% of the installed measures and 97% of the reported demand reduction. For each of these measure installations in the database, the audit team recalculated the deemed savings values using data from the definition documents identified in

Appendix C. Virtually all savings values in the databases were corroborated through this analysis, and the only impact was a 0.02% reduction in 2004. This slight difference comes from 1% of the ceiling insulation measures and 0.5% of the lighting retrofit measures that were calculated differently in the database than all the other similar measures. In addition, the database review indicated that one air infiltration measure installation reached a CFM50 percentage reduction of 90% or greater. This very high reduction percentage and correspondingly high savings are most likely due to data-entry errors, and this record was regarded as an outlier. Correcting for these errors leads to a program-wide reduction of 2 kW in 2003 and 3 kW in 2004 (Table 3-17).

The audit team also reviewed supporting documentation for a sample of 30 TXUED Residential SOP customers representing reported demand savings of 44.2 kW. This documentation review did not indicate the need for any adjustments to the reported savings values, and therefore a sample realization rate of 100% was applied to program savings for both 2003 and 2004 (Table 3-17). Evidence from the inspected customers in the sample indicates that inspection failures were properly reflected in the database and that savings adjustments made by TXUED to inspected customers were properly applied to all non-inspected customers on the same sponsor invoice.

Table 3-17. Peak Demand Savings Adjustments and Sample Realization Rates, TXUED Residential SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	10,186	19,627
Program-wide Adjustments	**B**	-2	-3
Subtotal	**C=A+B**	10,184	19,624
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**10,184**	**19,624**
Total Adjustments to Reported Savings	**E-A**	-2	-3
Program Realization Rate	**E/A**	100.0%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TXUED provided every signed customer form requested for the sample review, and thus no uncertainty was identified by the audit team in the utility's claimed savings. For the program as a whole, the lower bound, upper bound, and best estimate of verified savings were virtually 100% of the reported savings for both 2003 and 2004. The range of peak demand and energy savings is presented in Table 3-18.

Table 3-18. Verified Peak Demand and Energy Savings, TXUED 2003 and 2004

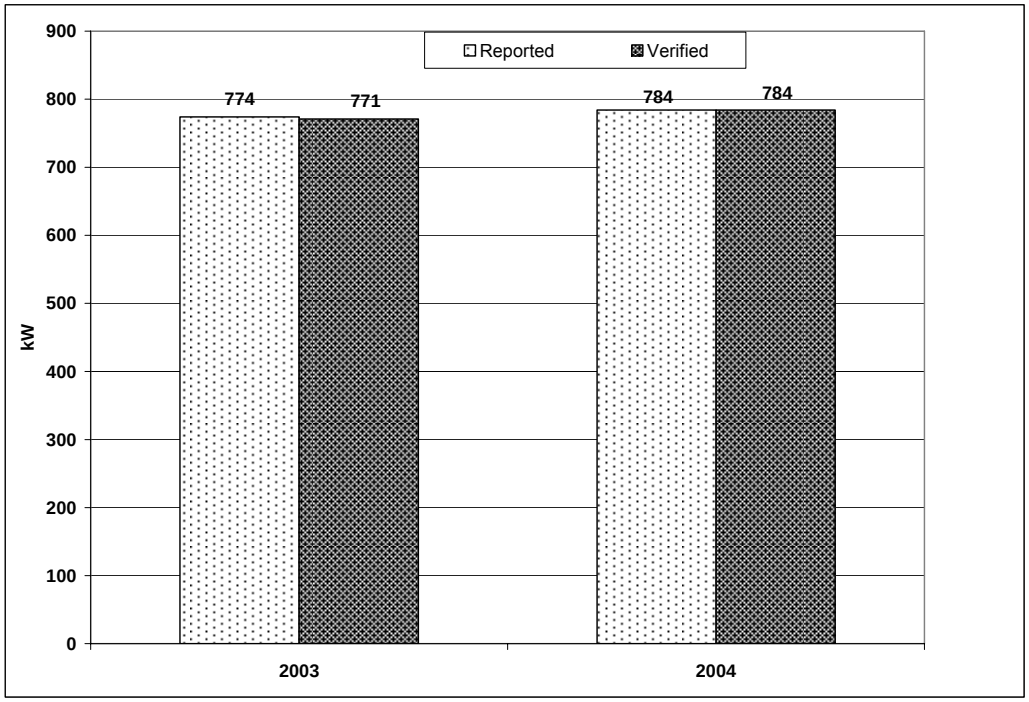
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	10,186	10,184	10,184	10,184	19,627	19,624	19,624	19,624
MWh	44,285	44,275	44,275	44,275	71,037	71,037	71,037	71,037

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

Xcel

The M&V audit of Xcel's Residential SOP verified 771 kW of savings in 2003, and 784 kW of savings in 2004 (Figure 3-10). These savings represent demand realization rates of 99.5% for 2003 and 100.0% for 2004.

Figure 3-10. Peak Demand Savings (kW), Xcel Residential SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Xcel's Residential SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% or more of the reported savings.[23]

The review of database records indicates that five measures account for 99% of the installed measures and 98% of the reported demand reduction. For each of these measure installations in the database, the audit team recalculated the deemed savings values using data from the definition documents identified in Appendix C. All demand savings values in the databases were corroborated through this analysis. In addition, the database review indicated that one air infiltration measure installation reached a CFM50 percentage reduction of 90% or greater. This very high reduction percentage and correspondingly high savings are most likely due to data-entry errors, and this record was regarded as an outlier. This single outlier occurred in 2003, and correcting for it leads to a program-wide reduction of 3 kW in 2003 (Table 3-19).

[23] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

The audit team also reviewed supporting documentation for a sample of 33 Xcel Residential SOP customers representing reported demand savings of 72.0 kW. This documentation review did not indicate the need for any adjustments to the reported savings values, and therefore a sample realization rate of 100% was applied to program savings for both 2003 and 2004 (Table 3-19). In addition, Xcel inspected 5% of customers in 2003 and 7% of customers in 2004. According to Xcel staff, no customers failed inspection in 2003 or 2004, and this was verified in the database by the audit team. Since no customers failed inspection, inspection field forms were not required by the audit team.

Table 3-19. Peak Demand Savings Adjustments and Sample Realization Rates, Xcel Residential SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	774	784
Program-wide Adjustments	**B**	-3	0
Subtotal	**C=A+B**	771	784
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**771**	**784**
Total Adjustments to Reported Savings	**E-A**	-3	0
Program Realization Rate	**E/A**	99.5%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Although the best estimate of verified savings is 100% of the reported savings, there is some uncertainty due to missing documentation. The audit team was unable to match names and addresses from the invoices to the database for five customers, and 10% of these savings were considered "uncertain." Although this does not impact the best estimate of verified savings, the uncertainty around these savings is reflected in the lower-bound estimate, which was adjusted to include only 90% of the reported savings from these customers. For the program as a whole, the lower bound of realized demand savings is 92.9% of the reported savings for 2003 and 93.3% for 2004, while the upper bound is the same as the best estimate. The range of peak demand savings is presented in Table 3-20.

The majority of reported energy savings were verified in the same proportion as the peak demand savings, the only difference coming from the outlier in 2003. As a result, the realization rate is 99% of reported savings in 2003 and 100% in 2004. The range of energy savings is presented in Table 3-20.

Table 3-20. Range of Peak Demand and Energy Savings, Xcel Residential SOP, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	774	719	771	771	784	731	784	784
MWh	2,705	2,501	2,680	2,680	2,213	2,065	2,213	2,213

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.3 HTR SOP

Across the six utilities administering the HTR SOP, 8,971 kW of peak demand reduction were realized in 2003 and 13,953 kW in 2004 (Table 3-21), which is 99.2% of the total reported savings for 2003 and 99.7% for 2004. The verified savings were generally within 1% of the reported savings for all utilities in both years. Verified energy savings for the HTR SOP are determined to be 39,891 MWh in 2003 and 49,199 MWh in 2004 (Appendix D).

For the HTR SOP adjustments to the reported saving were based on findings from the comparison of the database to reported savings (Step 1) and review of sample documentation (Step 2). The deemed savings review (Step 3) and inspection/verification review (Step 4) did not lead to any adjustments in verified savings.

Table 3-21. Peak Demand Savings (kW) by Utility—HTR SOP

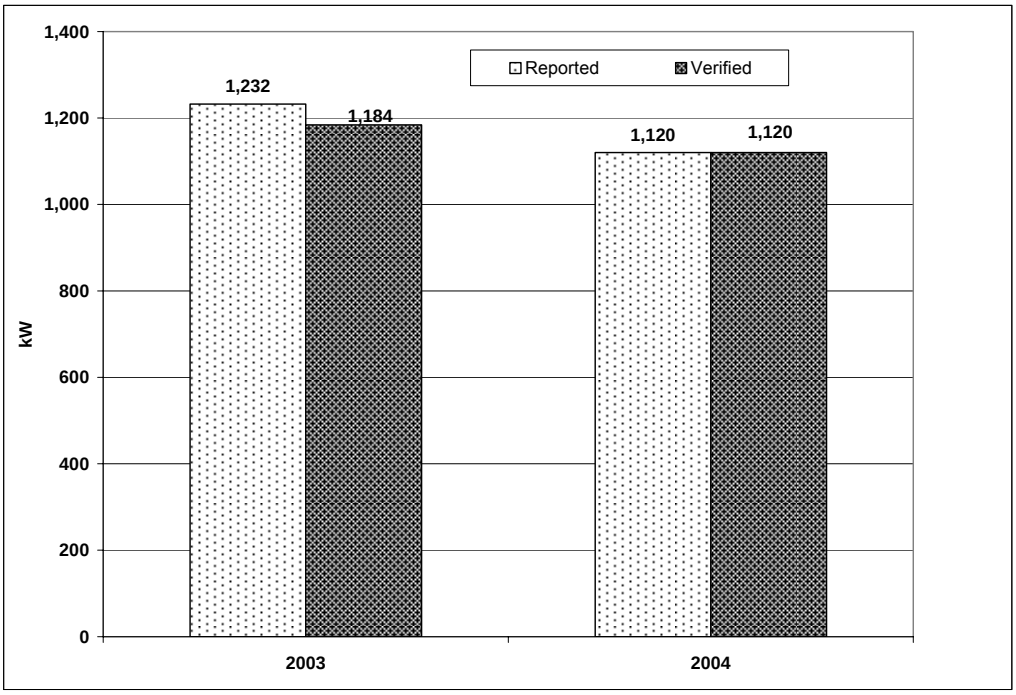
	2003			2004		
	Reported	**Verified***	**Verification Realization Rate**	**Reported**	**Verified***	**Verification Realization Rate**
AEP	1,232	1,184	96.1%	1,120	1,120	100.0%
CNP	615	615	100.0%	907	906	99.9%
Entergy	719	719	100.0%	731	731	100.0%
TNMP	NA	NA	NA	183	183	100.0%
TXUED	6,372	6,348	99.6%	10,941	10,897	99.6%
Xcel	105	105	100.0%	84	84	100.0%
TOTAL	**9,043**	**8,971**	**99.2%**	**13,966**	**13,921**	**99.7%**

* Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

3.3.1 AEP

The M&V audit of AEP's HTR SOP verified 1,184 kW in 2003 and 1,120 kW in 2004 (Figure 3-11). These savings represent kW realization rates (compared to reported values) of 96.1% and 100.0%, respectively.

Figure 3-11. Peak Demand Savings (kW), AEP HTR SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

A review of AEP's HTR SOP database revealed that the 2003 AEP SWEPCO annual report savings included savings from participants in the Residential SOP (i.e., these participants were counted in both programs). In addition, the 2003 kW and MWh database savings from AEP TCC were slightly below the reported numbers.[24] After accounting for these two factors the HTR SOP database represents 95.6% of the 2003 kW savings for 2003 and 94.5% of the MWh savings for 2003; the kW and MWh savings for 2004 were 100.0% (see Appendix D).

A review of the census of records in the database also revealed that there was one outlier: a site with a pre-program CFM of 1,658 was erroneously entered into the database as 16,658 CFM. Correcting for this outlier and the overlap with HTR SOP resulted in a program-wide net decrease in 2003 savings of 48 kW (Table 3-22). There were no program-wide adjustments to savings for 2004.

The verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, resulting in a sample realization rate of 100.0%. One requested record, however, was unavailable. Although the missing record does not impact the mid-point of our estimate, the uncertainty around the savings from the missing record is reflected in the lower-bound estimate, which was adjusted to include 80% of the reported savings from this site.

In addition, a review of the savings estimates indicated that the deemed savings values were correctly applied to the program measures for each of the program participants. There were therefore no additional adjustments to the savings estimates for the AEP HTR SOP. The program-wide adjustments resulted in

[24] This difference was unable to be reconciled, but is believed to derive from late adjustments in reporting that could not be replicated through database queries.

program kW realization rates of 96.1% for 2003 and 100.0% for 2004 (Table 3-22). The range of peak demand savings is presented in Table 3-23.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-23.

A review of the database also indicated that AEP had inspected 859 participants (33.6%) in 2003 and 495 participants (21.6%) in 2004. A review of a sample of ten inspected sites revealed that savings for the inspected sites were correctly adjusted following inspection, due to claimed measures not being installed or the measures having been also claimed in another program. However, both the paperwork and a database query revealed that the invoices were not always adjusted by a ratio equal to the adjustment for inspected sites.

Table 3-22. Peak Demand Savings Adjustments and Sample Realization Rates, AEP 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	1,232	1,120
Program-wide Adjustments	**B**	-48	0
Subtotal	**C=A+B**	1,184	1,120
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**1,184**	**1,120**
Total Adjustments to Reported Savings	**E-A**	-48	0
Program Realization Rate	**E/A**	96.1%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-23. Verified Peak Demand and Energy Savings, AEP HTR SOP, 2003 and 2004

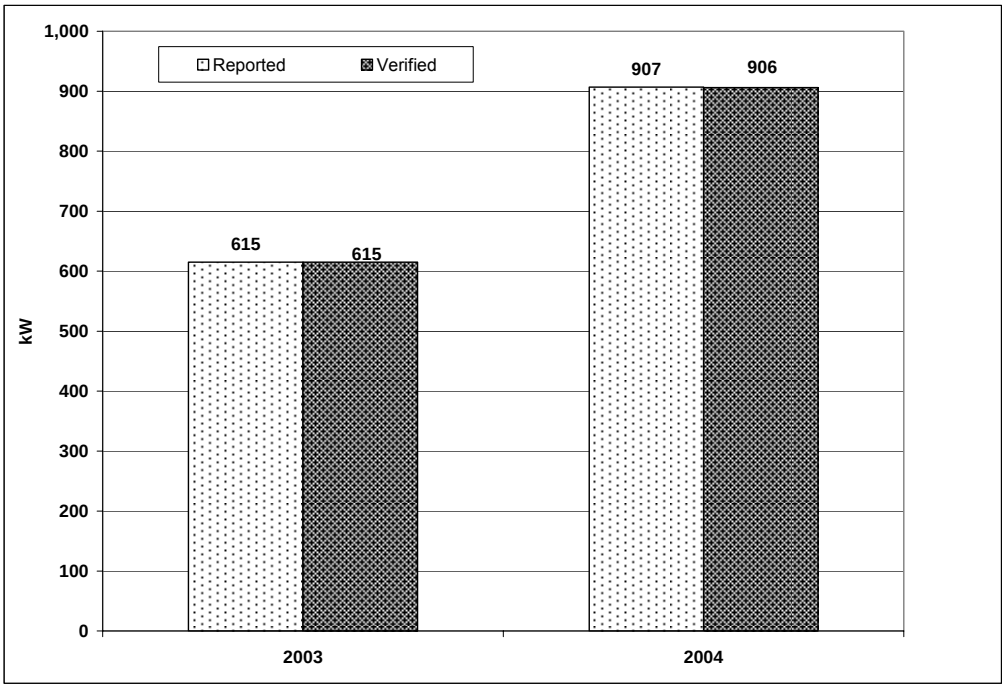
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	1,232	1,179	1,184	1,184	1,120	1,116	1,120	1,120
MWh	4,501	4,463	4,487	4,487	3,527	3,508	3,527	3,527

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.3.2 CNP

The M&V audit of CNP's HTR SOP verified 615 kW of savings in 2003 and 906 kW of savings in 2004 (Figure 3-12). These savings represent kW realization rates (compared to reported values) of 100.0% and 99.9%, respectively.

Figure 3-12. Peak Demand Savings (kW), CNP HTR SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

CNP's HTR SOP database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% of the reported savings.

A review of the census of records in the database revealed that there was one outlier: one site had unreasonably high values for both pre-program (11,236) and post-program (8,863) CFM. Correcting these values to the actual values resulted in a program-wide net decrease in 2004 savings of 1 kW (Table 3-24). There were no program-wide adjustments to savings for 2003.

The verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, resulting in a sample realization rate of 100.0%. In addition, a review of the savings estimates indicated that the deemed savings values were correctly applied to the program measures for each of the program participants. There were therefore no additional adjustments to the savings estimates for the CNP HTR SOP. The program-wide adjustments resulted in program kW realization rates of 100.0% for 2003 and 99.9% for 2004 (Table 3-24). There was no uncertainty for the verified savings (Table 3-25).

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-25.

A review of the database also indicated that CNP had inspected 374 participants (9.3%) in 2003 and 332 participants (13.4%) in 2004. A review of a sample of ten inspected sites revealed that inspected sites were properly adjusted for measures not being installed and poor installation, and a database query showed that all adjustment factors were applied correctly to all invoices.

Table 3-24. Peak Demand Savings Adjustments and Sample Realization Rates, CNP HTR SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	615	907
Program-wide Adjustments	**B**	0	-1
Subtotal	**C=A+B**	615	906
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**615**	**906**
Total Adjustments to Reported Savings	**E-A**	0	-1
Program Realization Rate	**E/A**	100.0%	99.9%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-25. Verified Peak Demand and Energy Savings, CNP HTR SOP, 2003 and 2004

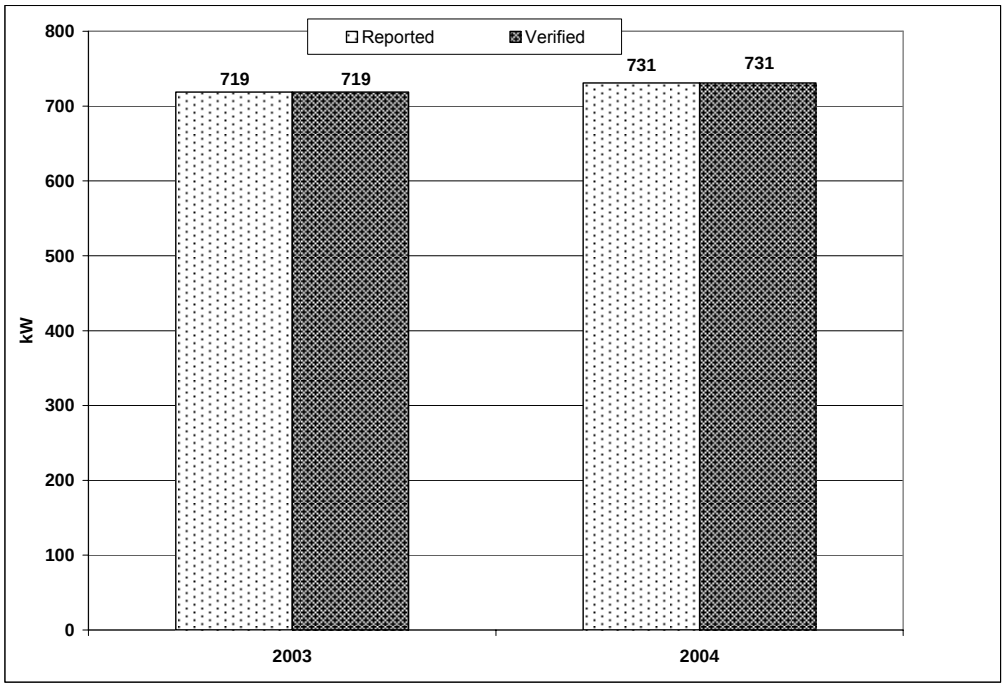
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	615	615	615	615	907	906	906	906
MWh	29,754	27,665	29,789	29,789	15,937	14,877	16,019	16,019

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.3.3 Entergy

The M&V audit of Entergy's HTR SOP verified 719 kW of savings in 2003, and 731 kW of savings in 2004 (Figure 3-13). These savings represent kW realization rates (compared to reported values) of 100.0% for both years.

Figure 3-13. Peak Demand Savings (kW), Entergy HTR SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Entergy's HTR SOP database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% of the reported savings.

A review of the census of records in the database revealed that there were no outliers or questionable data values. The verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, resulting in a sample realization rate of 100.0%. Four requested records, however, were unavailable, and replacement records were requested and received. Although the missing records do not impact the mid-point of our estimate, the uncertainty around the savings from the missing records is reflected in the lower-bound estimate, which was adjusted to include 80% of the reported savings from these sites.

In addition, a review of the savings estimates indicated that the deemed savings values were correctly applied to the program measures for each of the program participants. There were therefore no adjustments to the savings estimates for the Entergy HTR SOP, and realization rates were 100% for both years (Table 3-26). The range of peak demand savings is presented in Table 3-27.

The majority of reported MWh energy savings were verified in the same proportion as the peak demand savings. The final estimates and ranges for MWh savings are presented in Table 3-27.

A review of the database also indicated that Entergy had inspected 399 participants (14.5%) in 2003 and 396 participants (24.4%) in 2004. A review of a sample of ten inspected sites revealed that of the five sites had been adjusted, four of those where adjusted correctly, and one was adjusted for one missing measure, but not adjusted for another missing measure. A database query showed that adjustment factors were applied correctly to invoices for both years.

Table 3-26. Peak Demand Savings Adjustments and Sample Realization Rates, Entergy HTR SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	719	731
Program-wide Adjustments	**B**	0	0
Subtotal	**C=A+B**	719	731
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**719**	**731**
Total Adjustments to Reported Savings	**E-A**	0	0
Program Realization Rate	**E/A**	100.0%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-27. Verified Peak Demand and Energy Savings, Entergy HTR SOP, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	719	697	719	719	731	708	731	731
MWh	2,576	2,504	2,576	2,576	2,476	2,407	2,476	2,476

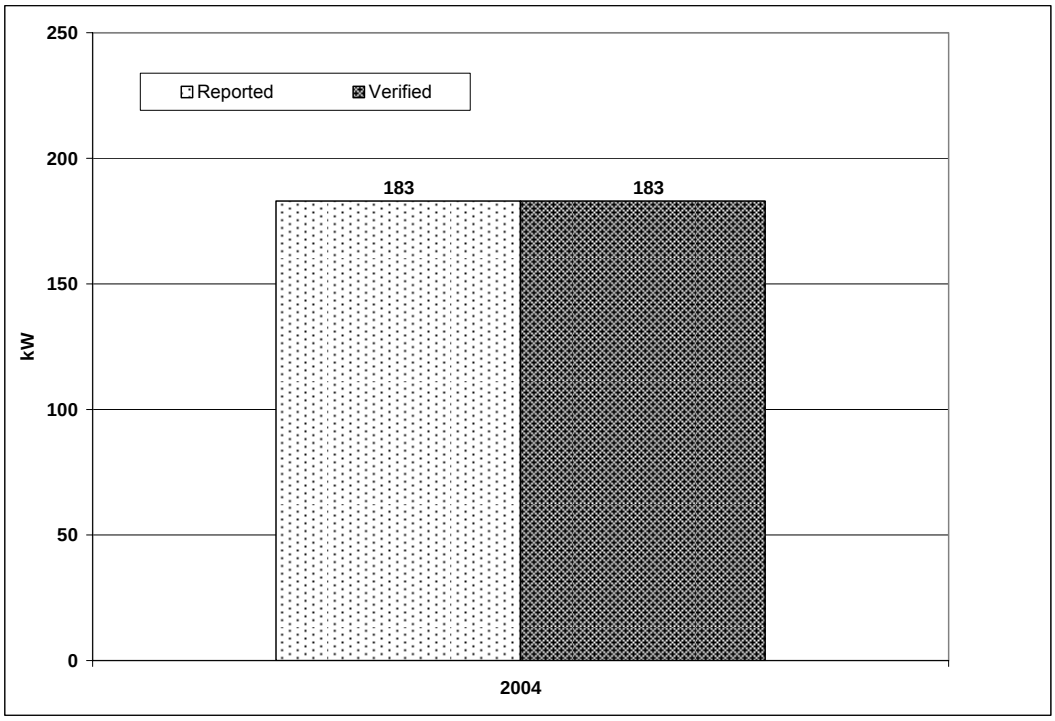
Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.3.4 TNMP

The M&V audit of TNMP's HTR SOP verified 183 kW of savings in 2004 (Figure 3-14).[25] These savings represent kW a realization rate (compared to the reported value) of 100.0%.

[25] Note TNMP did not implement the HTR SOP in 2003.

Figure 3-14. Peak Demand Savings (kW), TNMP HTR SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TNMP's HTR SOP database fully supported the utility's claims of both peak demand and energy savings, with valid customers and installations from the database accounting for 100% of the reported savings.

A review of the census of records in the database revealed that there were no outliers or questionable data values. The verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, resulting in a sample realization rate of 100.0%. One requested record, however, was unavailable, and a replacement record was requested and received. Although the missing record does not impact the mid-point of our estimate, the uncertainty around the savings from the missing record is reflected in the lower-bound estimate, which was adjusted to include 80% of the reported savings from the site.

In addition, a review of the savings estimates indicated that the deemed savings values were correctly applied to the program measures for each of the program participants. There were therefore no adjustments to the savings estimates for the TNMP HTR SOP, with a realization rate of 100% (Table 3-28). The range of peak demand savings is presented in Table 3-29

The majority of reported MWh energy savings were verified in the same proportion as the peak demand savings. The final estimates for MWh savings are presented in Table 3-29.

A review of the database also indicated that TNMP had inspected 149 participants (35.7%) in 2004. No inspection reports were received in the paperwork requested from TNMP, and a database query showed that no adjustments had been made due to failed inspections.

Table 3-28. Peak Demand Savings Adjustments and Sample Realization Rates, TNMP HTR SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	N/A	183
Program-wide Adjustments	**B**	N/A	0
Subtotal	**C=A+B**	N/A	183
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**N/A**	**183**
Total Adjustments to Reported Savings	**E-A**	N/A	0
Program Realization Rate	**E/A**	N/A	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-29. Verified Peak Demand and Energy Savings, TNMP HTR SOP, 2003 and 2004

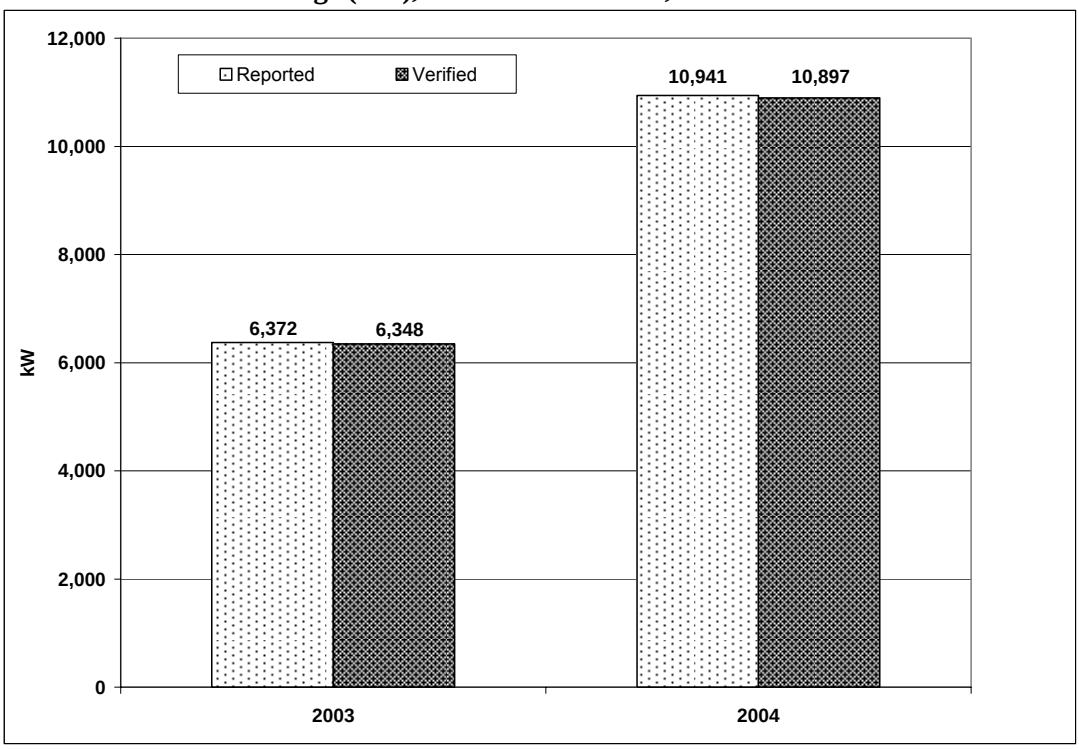
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	N/A	N/A	N/A	N/A	183	180	183	183
MWh	N/A	N/A	N/A	N/A	634	624	634	634

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.3.5 TXUED

The M&V audit of TXUED's HTR SOP verified 6,348 kW of savings in 2003 and 10,897 kW of savings in 2004 (Figure 3-15). These savings represent kW realization rates (compared to reported values) of 99.6% for both years.

Figure 3-15. Peak Demand Savings (kW), TXUED HTR SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TXUED's HTR SOP database fully supported the utility's claims of both peak demand and energy savings for 2004. For 2003, however, the audit team was unable to completely replicate the TXUED HTR reported savings estimates, despite applying the same query for the 2004 database and that was used by other utilities. The final differences were determined to be caused by manual adjustments that were made at the time of reporting and thus could not be replicated through the database queries.

A review of the census of records in the database revealed that there was one outlier: one site had a square footage value of 1,060 incorrectly entered into the database as 10,602. Correcting this value and re-computing savings resulted in a program-wide net decrease in 2004 savings of 1.5 kW (Table 3-30). There were no program-wide adjustments to savings for 2003.

The verification of the 2003-2004 sample of hard copy records found that the documentation was nearly identical to what was recorded in the program database. One data entry error led to a sample realization rate of 99.6%. In addition, one requested record was unavailable, and a replacement record was requested and received. Although the missing record does not impact the mid-point of our estimate, the uncertainty around the savings from the missing record is reflected in the lower-bound estimate, which was adjusted to include 80% of the reported savings from this site.

A review of the savings estimates indicated that the deemed savings values were correctly applied to the program measures for each of the program participants. There were therefore no additional adjustments to the savings estimates for the TXUED HTR SOP. The program-wide and sample-extrapolated adjustments resulted in program kW realization rates of 99.6% for 2003 and 2004 (Table 3-30). The range of peak demand savings is presented in Table 3-31.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-31.

A review of the database also indicated that TXUED had inspected approximately 11% of 2003 and 27% of participants in 2004. A review of a sample of ten inspected sites revealed that one site that was found to have gas heat instead of electric was not adjusted, but should have been. The other sites in the sample were adjusted correctly. A database query showed that all invoices in 2003 were adjusted using the adjustment factor from the results of the inspections, but in 2004 there seem to be a handful of discrepancies. However, the vast majority of the adjustments in 2004 are correct as well.

Table 3-30. Peak Demand Savings Adjustments and Sample Realization Rates, TXUED HTR SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	6,372	10,941
Program-wide Adjustments	**B**	0	-1
Subtotal	**C=A+B**	6,372	10,940
Sample Realization Rate	**D**	99.6%	99.6%
Verified Savings*	**E=C*D**	**6,348**	**10,897**
Total Adjustments to Reported Savings	**E-A**	-25	-44
Program Realization Rate	**E/A**	99.6%	99.6%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-31. Verified Peak Demand and Energy Savings, TXUED HTR SOP, 2003 and 2004

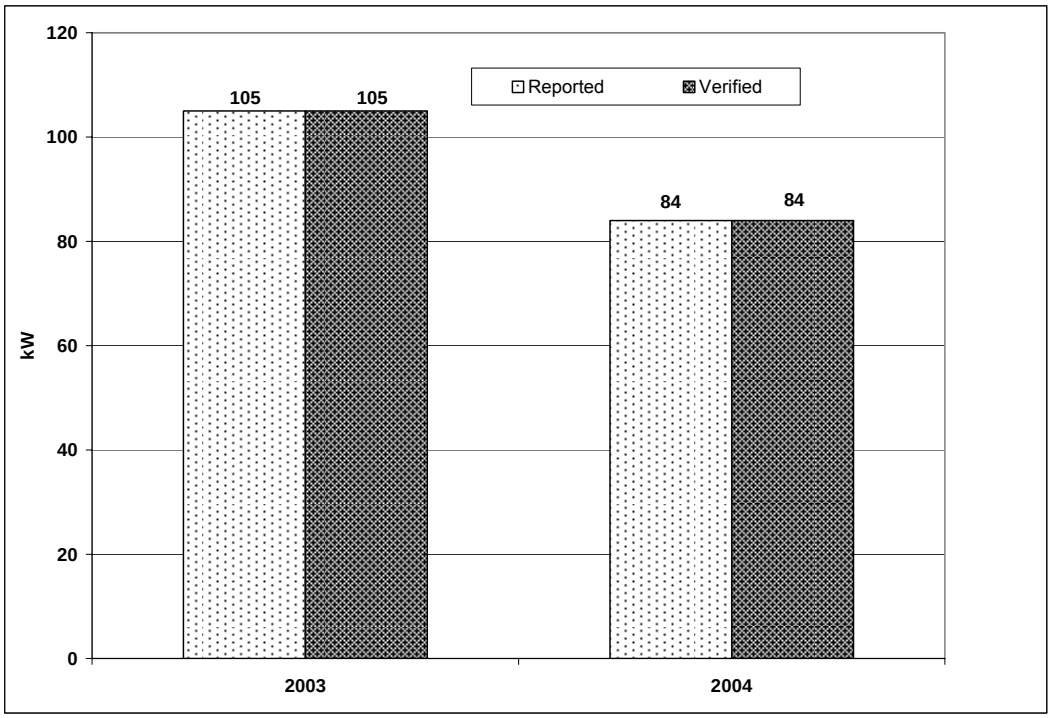
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	6,372	6,275	6,348	6,350	10,941	10,772	10,897	10,900
MWh	30,354	29,714	30,181	30,194	39,561	38,716	39,325	39,341

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.3.6 Xcel

The M&V audit of Xcel's HTR SOP verified 105 kW of savings in 2003 and 84 kW of savings in 2004 (Figure 3-16). These savings represent kW realization rates (compared to reported values) of 100.0% for both years.

Figure 3-16. Peak Demand Savings (kW), Xcel HTR SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Xcel's HTR SOP database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for greater than 100% of the reported savings.[26]

A review of the census of records in the database revealed that there were no outliers or questionable data values. The verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, resulting in a sample realization rate of 100.0%. In addition, a review of the savings estimates indicated that the deemed savings values were correctly applied to the program measures for each of the program participants. There were, therefore, no adjustments to the savings estimates for the Xcel HTR SOP, and realization rates were 100% for both years (Table 3-32). The range of peak demand savings is presented in Table 3-33

The majority of reported MWh energy savings were verified in the same proportion as the peak demand savings. There was no uncertainty for the best estimate of verified savings. The final estimates and ranges for MWh savings are presented in Table 3-33.

A review of the database also indicated that Xcel had inspected 399 participants (14.5%) in 2003 and 396 participants (24.4%) in 2004. A review of a sample of ten inspected sites revealed that there were two discrepancies, but one of these would not affect the savings of the measure, and for the other the difference is savings was within rounding error. A database query showed that no adjustments had been made due to failed inspections.

[26] The Xcel numbers for the HTR small projects were included in the RES SOP savings in their annual report. The HTR large project numbers alone are what are in the annual report for HTR participants and savings.

Table 3-32. Peak Demand Savings Adjustments and Sample Realization Rates, Xcel HTR SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	105	84
Program-wide Adjustments	**B**	0	0
Subtotal	**C=A+B**	105	84
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**105**	**84**
Total Adjustments to Reported Savings	**E-A**	0	0
Program Realization Rate	**E/A**	100.0%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-33. Verified Peak Demand and Energy Savings, Xcel HTR SOP, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	105	105	105	105	84	84	84	84
MWh	361	361	361	361	298	298	298	298

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.4 C&I SOP

Across the six utilities administering the C&I SOP, 32,101 kW of peak demand reduction were realized in 2003 and 32,061 kW in 2004, which is within four percent of total reported savings for each of the two years (Table 3-34). The realization rate for 2003 was an average of 96.4 % for all the utilities, and for 2004 was 97.6 %. The lowest realization rate was 66.9% for TNMP in 2003, and the highest was 100%, which was achieved by TXUED in both years. Ten out of 12 of the realization rates were above 90%.

The verified figures presented here include adjustments due to the reconciliation with the program database, supporting documentation suggesting changes in reported values, and uncertainty caused by incomplete or contradictory documentation. Details of these adjustments are given below in the utility-specific sections. Verified energy savings for the C&I SOP are determined to be 135,683 MWh in 2003 and 136,064 MWh in 2004 (Appendix D).

Table 3-34. Peak Demand Savings (kW) by Utility—C&I SOP, 2003 and 2004

	2003			2004		
	Reported	Verified*	Verification Realization Rate	Reported	Verified*	Verification Realization Rate
AEP	2,987	2,871	96.1%	5,063	4,911	97.0%
CNP	10,779	10,216	94.8%	11,355	10,726	94.5%
Entergy	1,439	1,307	90.8%	877	875	99.8%
TNMP	791	529	66.9%	835	817	97.9%
TXUED	16,598	16,598	100.0%	13,384	13,384	100.0%
Xcel	698	581	83.2%	1,349	1,347	99.9%
TOTAL	**33,292**	**32,101**	**96.4%**	**32,863**	**32,061**	**97.6%**

* Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

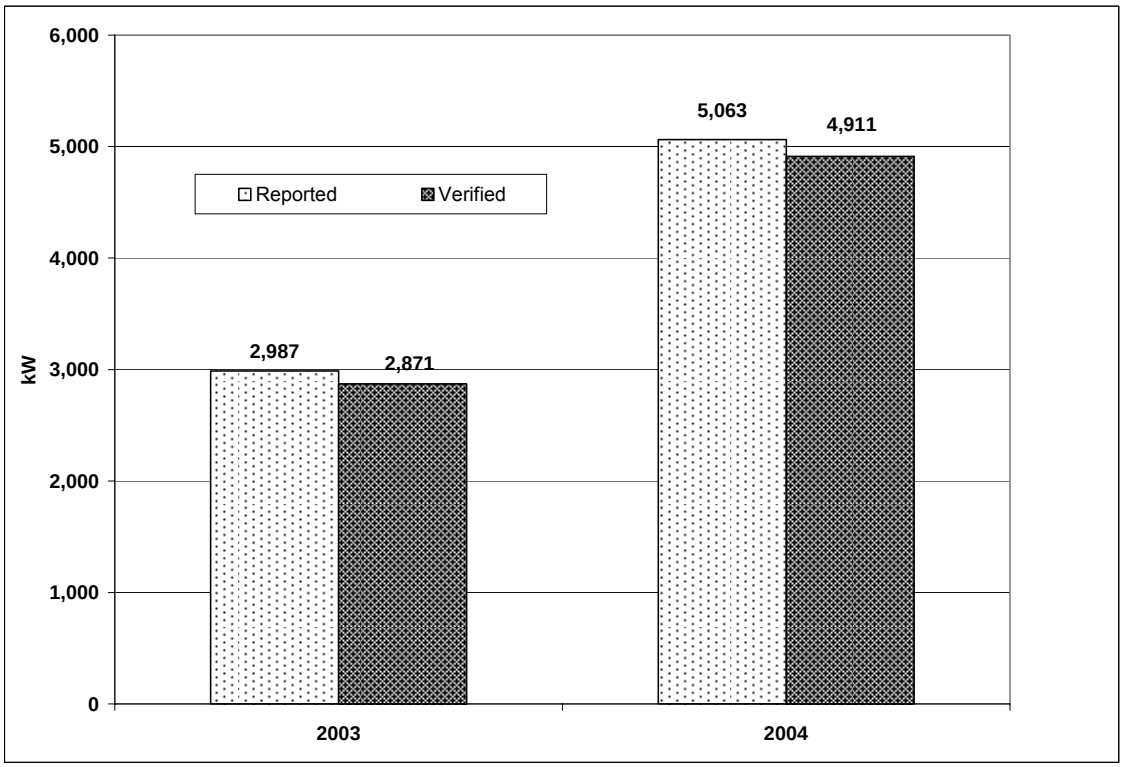
Adjustments were made to the reported figures for a number of reasons:

- If savings were completely unverifiable because there was no paperwork to support the claim, the full savings value was subtracted from value in the database.
- If there was a difference between the final document (savings report or invoice) and the database, and the savings on the final document were less, then the savings were adjusted to match the final document.
- If there was a lack of supporting documents, such as lighting tables, the savings were determined to be subject to some uncertainty, which was assigned as 10% of the reported savings. This uncertainty is reflected in a lower-bound estimate that included only 90% of reported savings from the site.
- If there was no savings report or invoice showing final savings values, the savings were determined to be subject to some uncertainty – even if there were supporting documents available. This is because the final documents show the finalized savings, and it is not always clear if the supporting documents show the interim or the final figures. In this case, the uncertainty is reflected in a best estimate of verified savings of 90% of the reported value, and a lower bound of 80% of the reported value.
- Adjustments were also made as a result of the review of the IPMVP methods used. These adjustments were calculated as degrees of uncertainty expressed as a percentage of reported savings. The full measure of uncertainty, as determined during the review, was used in determining the lower bound of verified savings for the site in question; half of this uncertainty was applied in determining the best estimate.

AEP

The audit of AEP's C&I SOP program verified 2,871 kW of peak demand savings in 2003, and 4,911 kW in 2004, as shown in Figure 3-17 below. These savings represent realization rates of 96.1% in 2003 and 97.0% in 2004.

Figure 3-17. Peak Demand Savings (kW), AEP C&I SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

AEP's C&I SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with the project savings in the database adding up to approximately 100% of the reported savings.

The sample of projects chosen for detailed review of supporting documentation represented 72.6% of total database savings, with the large projects (Stratum 1) accounting for 65% of the total and the random sample of smaller projects (Stratum 2) accounting for 7.6% of the total. As there were no details on installed measures in the original C&I database, it is not possible to show definitively the share of kW by measure for the whole program. However, in the sample, 44.8% of kW was from lighting measures and 55.1% was from HVAC installations.

The review of supporting documents found that one project had a difference of 4.3 kW between the supporting documents and the database, and the savings for this project were adjusted down accordingly. In addition, no savings report was provided with this project, so the best estimate of verified savings reflects 90% of the already-adjusted savings, and the lower bound reflects 80%. Another project was missing supporting documents for 4.8 kW of savings. These savings were assigned an uncertainty rate of 10%, which was reflected in the lower-bound estimate that included only 90% of reported savings from this site.

Two of the seven M&V projects that were reviewed had their savings adjusted as a result of the review of the IPMVP methodology. The uncertainty percentages applied to the savings ranged from 23% to 28%, with half of these values being used for the best estimate of verified savings and the full values for the lower bound.

The combined effect of the adjustments described above reduces reported savings by approximately 245 kW in 2003 and 221 kW in 2004. Realization rates are 96.1% and 97.0%, respectively (Table 3-35).

Table 3-35. Peak Demand Savings Adjustments and Sample Realization Rates, AEP C&I SOP 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	2987	5063
Adjustments for Large Projects (Stratum 1)	**B**	-116	-152
Adjustments for rest of sample (Stratum 2)**	**C**	0	0
Verified Savings*	**D=A+B+C**	2871	4911
Total Adjustments to Reported Savings	**D-A**	-116	-152
Program Realization Rate	**D/A**	96.1%	97.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

**Stratum 1includes all the largest projects and makes up 5,228kW, leaving 2,820 kW represented by the random sample in Stratum 2. The random sample realization rate was 96%, resulting in a reduction of 123kW across the two ye g ars.

Table 3-36 shows the full range of verified savings estimates, including lower and upper bounds, for 2003 and 2004. The reported energy savings were verified in the same proportion as the peak demand savings.

Table 3-36. Verified Peak Demand and Energy Savings, AEP C&I SOP 2003 and 2004

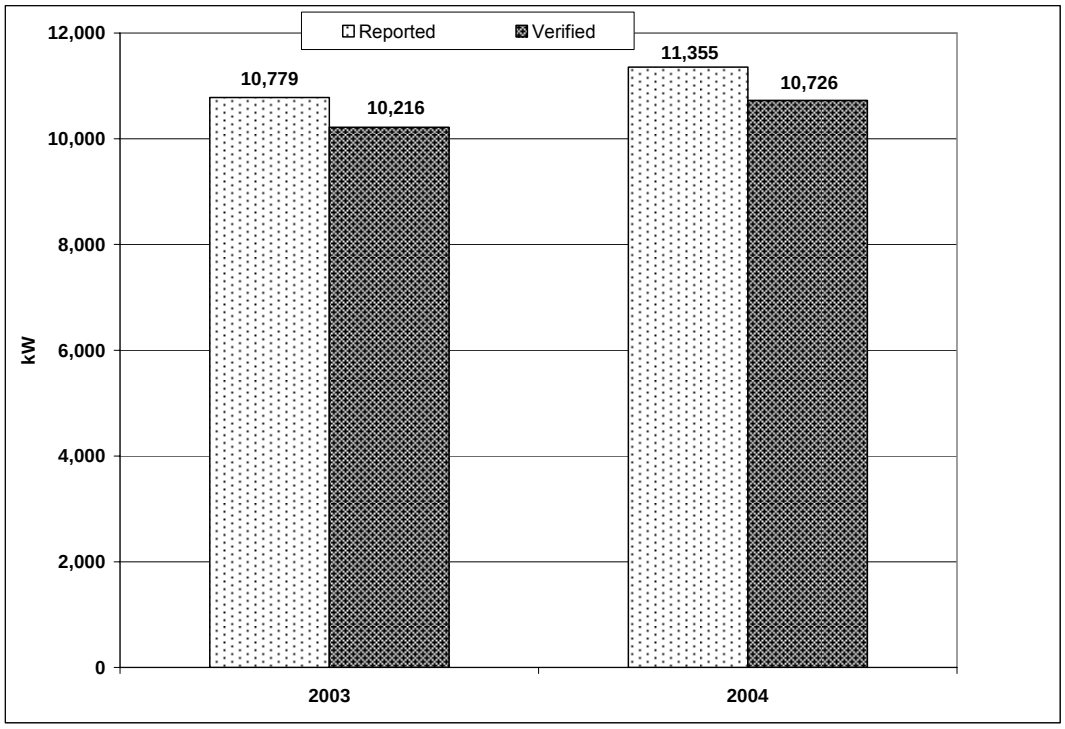
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	2,987	2,755	2,871	2,987	5,063	4,762	4,911	5,060
MWh	12,085	11,145	11,616	12,087	20,393	19,181	19,779	20,380

Note: The values for the best estimate of verified savings are the point estimates that best reflect the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

CNP

The audit of CNP's C&I SOP program verified 10,216 kW of peak demand savings in 2003, and 10,726 kW in 2004, as shown in Figure 3-18 below. These savings represent realization rates of 94.8% in 2003 and 94.5% in 2004.

Figure 3-18. Peak Demand Savings (kW), CNP C&I SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

CNP's C&I SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with the project savings in the database adding up to 100% of the reported savings.

The sample of projects chosen for detailed review of supporting documentation represented 49.5% of total database savings, with the large projects (Stratum 1) accounting for 45% of the total and the random sample of smaller projects (Stratum 2) accounting for 4.5% of the total. As there were no details on installed measures in the original C&I database, it is not possible to show definitively the share of kW by measure for the whole program. However, in the sample, 38.9% of kW was from lighting measures, 63.1% was from HVAC installations, and 3.9% of kW was from other measures, including insulation and roofing.

The review of supporting documents showed that one project had a difference of 76.6 kW due to a change in savings calculation method from M&V to deemed savings. The savings for this project were adjusted down accordingly. There were no projects with missing documentation so no uncertainty was applied to the savings.

Four of the nine M&V projects that were reviewed had their savings adjusted as a result of the review of the IPMVP methodology. The uncertainty rates applied to the savings ranged from 28% to 11%, with half of these values being used for the best estimate of verified savings and the full values for the lower bound.

The combined effect of the adjustments described above reduces reported savings by approximately 564 kW in 2003 and 629 kW in 2004. Realization rates are 94.8% and 94.5%, respectively (Table 3-38).

Table 3-37. Peak Demand Savings Adjustments and Sample Realization Rates, CNP C&I SOP 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	10,779	11,355
Adjustments for Large Projects (Stratum 1)	**B**	0.0	-135
Adjustments for rest of sample (Stratum 2)**	**C**	-564	-494
Verified Savings*	**D=A+B+C**	10,215	10,726
Total Adjustments to Reported Savings	**D-A**	-564	-629
Program Realization Rate	**D/A**	94.8%	94.5%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

**Stratum 1includes all the largest projects and makes up 9.963 kW, leaving 12,171 kW represented by the random sample in Stratum 2. The random sample realization rate was 91%, meaning an adjustment of 914 kW.

The realization rate over both years for Stratum 1 of the sample was 99 %, which was significantly higher than for Stratum 2, with 91 %. The reported energy savings were verified in the same proportion as the peak demand savings.

Table 3-38 below shows the full range of savings estimates for 2003 and 2004, for CNP's C&I SOP program.

Table 3-38. Verified Peak Demand and Energy Savings, CNP C&I SOP 2003 and 2004

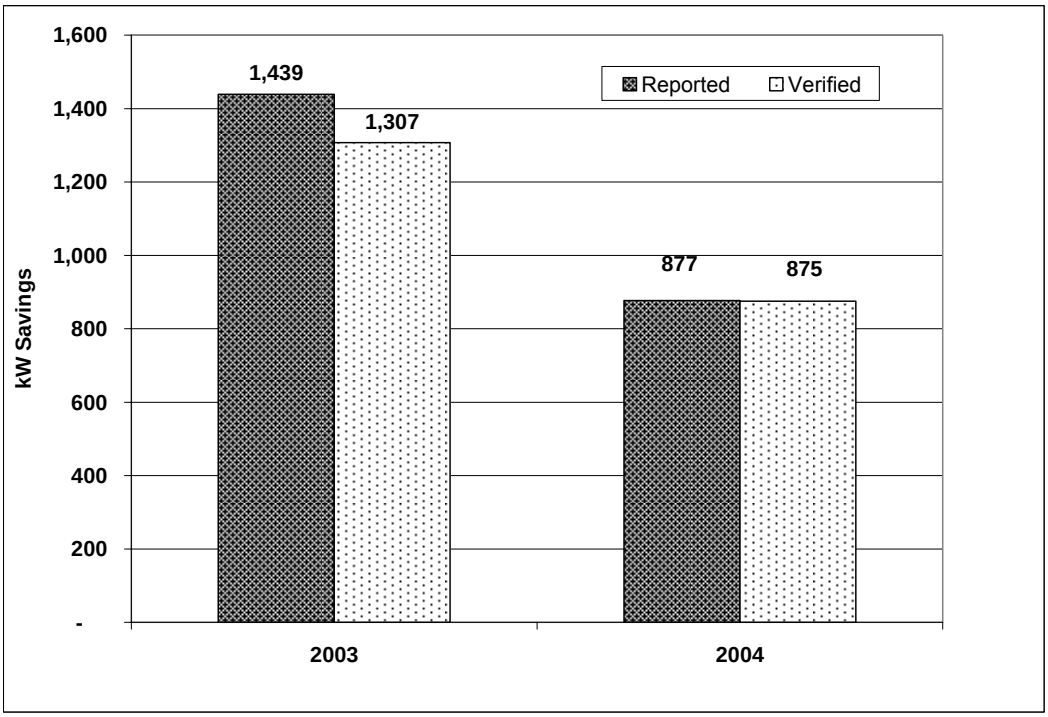
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	10,779	10,145	10,215	10,285	11,355	10,529	10,726	10,923
MWh	46,763	44,013	44,318	44,623	48,871	45,317	46,164	47,012

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

Entergy

The audit of Entergy's C&I SOP program verified 1,307 kW of peak demand savings in 2003, and 875 kW in 2004, as shown in Figure 3-19 below. These savings represent realization rates of 90.8% in 2003 and 99.8% in 2004.

Figure 3-19. Peak Demand Savings (kW), Entergy C&I SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Entergy's C&I SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with the project savings in the database adding up to 100% of the reported savings.

The sample of projects chosen for detailed review of supporting documentation represented 94.2% of total database savings, with the large projects (Stratum 1) accounting for 75.7% of the total and the random sample of smaller projects (Stratum 2) accounting for 18.5% of the total. As there were no details on installed measures in the original C&I database, it is not possible to show definitively the share of kW by measure for the whole program. However, in the sample, 81.7% of kW was from lighting measures, 18.1% was from HVAC installations, and 0.2% of kW was from motors.

The review of supporting documents showed that one project had a difference of 130.8 kW between the database and the savings report. Although the reason for the difference was not known, the sponsor thought that the difference was due to change in savings calculation method from M&V to deemed savings. The savings for this project were adjusted down accordingly. Another project was missing supporting documents for 24.1 kW of savings. These savings were assigned an uncertainty rate of 10%, which was reflected in the lower-bound estimate that included only 90% of reported savings from this site.

Two M&V projects were reviewed but no uncertainty adjustments were needed.

The combined effect of the adjustments described above reduces reported savings by approximately 132 kW in 2003 and 2 kW in 2004. Realization rates are 90.9% and 99.8%, respectively (Table 3-39).

Table 3-39. Peak Demand Savings Adjustments and Sample Realization Rates, Entergy C&I SOP 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	1,439	877
Adjustments for Large Projects (Stratum 1)	**B**	-131	0
Adjustments for rest of sample (Stratum 2)**	**C**	-1	-2
Verified Savings*	**D=A+B+C**	1307	875
Total Adjustments to Reported Savings	**D-A**	-132	-2
Program Realization Rate	**D/A**	90.9%	99.8%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

**Stratum 1includes all the largest projects and makes up 1,754 kW, leaving 562 kW represented by the random sample in Stratum 2. The random sample realization rate was 100%, meaning no adjustments.

The realization rate over both years for Stratum 1 of the sample was 95 %, which was lower than for Stratum 2, with 100 %. The reported energy savings were verified in the same proportion as the peak demand savings.

Table 3-40 below shows the full range of savings estimates for 2003 and 2004, for Entergy's C&I SOP program.

Table 3-40. Verified Peak Demand and Energy Savings, Entergy C&I SOP 2003 and 2004

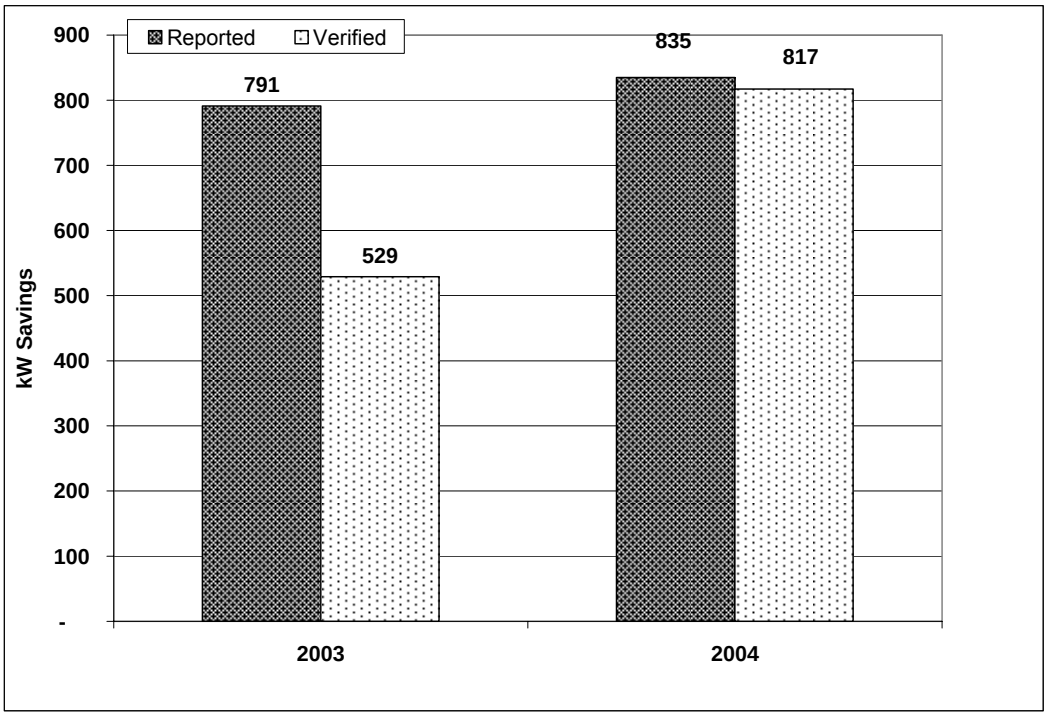
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	1,439	1,307	1,307	1,308	877	875	875	877
MWh	8,523	7,741	7,741	7,749	3,455	3,447	3,447	3,456

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

TNMP

The audit of TNMP's C&I SOP program verified 529 kW of peak demand savings in 2003, and 817 kW in 2004, as shown in Figure 3-20 below. These savings represent realization rates of 66.9 % in 2003 and 97.9 % in 2004.

Figure 3-20. Peak Demand Savings (kW), TNMP C&I SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TNMP's C&I SOP program databases did not fully support the utility's claims of peak demand reduction and energy in 2003. However, the database and reported figures did match up exactly in 2004 for both demand and energy savings. Summit Blue's staff was informed by TNMP staff that a large project was missing from the version of the 2003 database that had been sent to Summit Blue, which explained the discrepancies. This project was included in the sample request and some of the missing savings were later added to the total savings.

The sample of projects chosen for detailed review of supporting documentation represented 86 % of total database savings, with the large projects (Stratum 1) accounting for 75 % of the total and the random sample of smaller projects (Stratum 2) accounting for 12 % of the total. As there were no details on installed measures in the original C&I database, it is not possible to show definitively the share of kW by measure for the whole program. However, in the sample, 75% of kW was from lighting measures, 18% was from HVAC installations, and 7 % of kW was from motors.

The review of supporting documents showed that one project (City of Lewisville) had a difference of 227.7 kW between the database and the supporting documents. This was the project that had been missing from the database. In addition, there was no savings report for this project, so the sum of the savings on the supporting documents was used as the project total. In addition, no savings report was provided with this project, so an adjustment was made to reflect the uncertainty in the savings; the best estimate of verified savings reflects 90% of the already-adjusted savings, and the lower bound reflects 80%.

There were three additional projects with uncertainty due to missing supporting documents, with a total of 176.6 kW not supported by documentation showing equipment installed. These savings were assigned an uncertainty rate of 10%, which was reflected in the lower-bound estimate that included only 90% of reported savings from this site.

No projects were reviewed for M&V methodology due to a lack of detailed paperwork.

The combined effect of the adjustments described above reduces reported savings by approximately 262 kW in 2003 and 18 kW in 2004. Realization rates are 66.9 % and 97.9%, respectively (Table 3-41).

Table 3-41. Peak Demand Savings Adjustments and Sample Realization Rates, TNMP C&I SOP 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	791	835
Adjustments for Large Projects (Stratum 1)	**B**	-261	-15
Adjustments for rest of sample (Stratum 2)**	**C**	-1	-3
Verified Savings*	**D=A+B+C**	529	817
Total Adjustments to Reported Savings	**D-A**	-262	-18
Program Realization Rate	**D/A**	66.9%	97.9%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

**Stratum 1includes all the largest projects and makes up 1,239 kW, leaving 416 kW represented by the random sample in Stratum 2. The random sample realization rate was 99%, meaning an adjustment of 4.5 kW.

The realization rate over both years for Stratum 1 of the sample was 80 %, which was considerably lower than for Stratum 2, with 99 %. The reported energy savings were verified in the same proportion as the peak demand savings.

Table 3-42 below shows the full range of savings estimates for 2003 and 2004, for TNMP's C&I SOP program.

Table 3-42. Verified Peak Demand and Energy Savings, TNMP C&I SOP 2003 and 2004

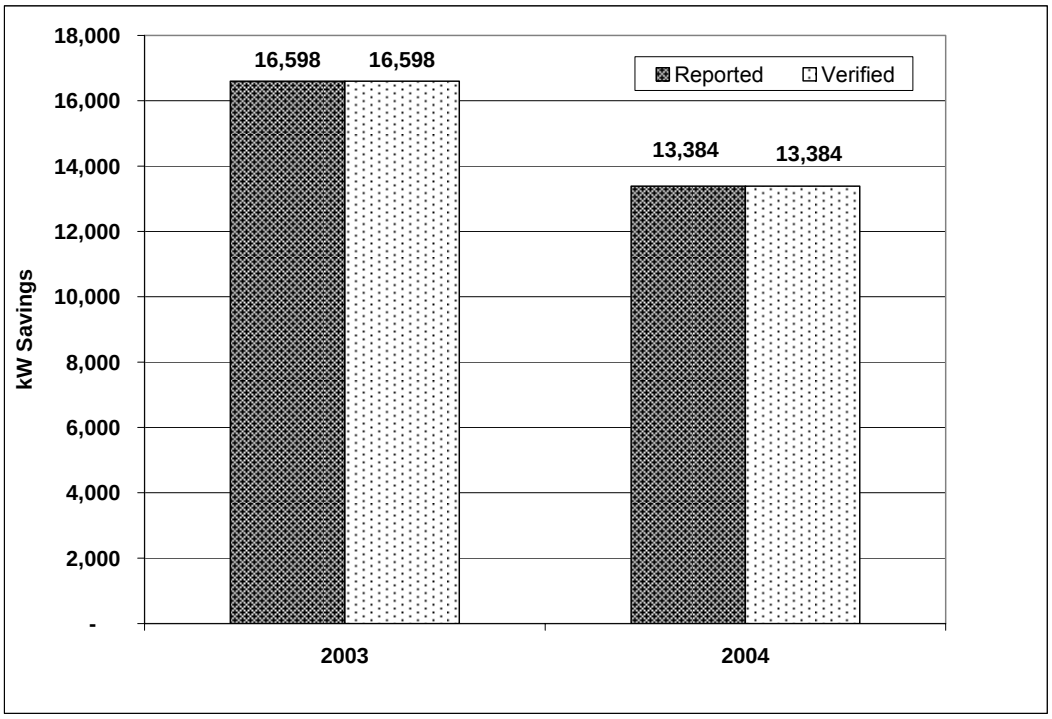
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	791	497	529	563	835	817	817	835
MWh	4,750	2,986	3,178	3,384	3,664	3,585	3,586	3,666

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

TXUED

The audit of TXUED's C&I SOP program verified 16,598 kW of peak demand savings in 2003 and 13,384 kW in 2004, as shown in Figure 3-21 below. These savings represent realization rates of 100 % in both 2003 and 2004.

Figure 3-21. Peak Demand Savings (kW), TXUED C&I SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TXUED's C&I SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with the project savings in the database adding up to approximately 100% or more the reported savings.[27]

The sample of projects chosen for detailed review of supporting documentation represented 36 % of total database savings, with the large projects (Stratum 1) accounting for 31 % of the total and the random sample of smaller projects (Stratum 2) accounting for 5 % of the total. As there were no details on installed measures in the original C&I database (measures are tracked by TXUED in separate spreadsheets for each project), it is not possible to show definitively the share of kW by measure for the whole program. However, in the sample, 55% of kW was from lighting measures, 38% was from HVAC installations, and 7 % of kW was from motors.

The review of supporting documents did not show any discrepancies between the database and the supporting documents, and adequate documentation was provided for all the samples that were requested. Some savings reports showed different savings to the database, but this was due to the system that TXUED use, which is to allow adjustments to project savings totals in the year following the project start year. Thus, staff at TXUED provided evidence that the discrepancies had been resolved in 2005.

Twelve projects were reviewed for M&V methodology and no adjustments were found to be needed.

[27] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

No adjustments were made to the original database values, and so the realization rates for both 2003 and 2004 were 100 % (Table 3-43).

Table 3-43. Peak Demand Savings Adjustments and Sample Realization Rates, TXUED C&I SOP 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	16,598	13,384
Adjustments for Large Projects (Stratum 1)	**B**	0	0
Adjustments for rest of sample (Stratum 2)**	**C**	0	0
Verified Savings*	**D=A+B+C**	16,598	13,384
Total Adjustments to Reported Savings	**D-A**	0	0
Program Realization Rate	**D/A**	100.0%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

**Stratum 1includes all the largest projects and makes up 9,189 kW, leaving 20,838 kW represented by the random sample in Stratum 2. The random sample realization rate was 100%, meaning no adjustments.

The realization rate over both years for Stratum 1 and Stratum 2 were 100%. The reported energy savings were verified in the same proportion as the peak demand savings.

Table 3-44 below shows the full range of savings estimates for 2003 and 2004, for TXUED's C&I SOP program.

Table 3-44. Verified Peak Demand and Energy Savings, TXUED C&I SOP 2003 and 2004

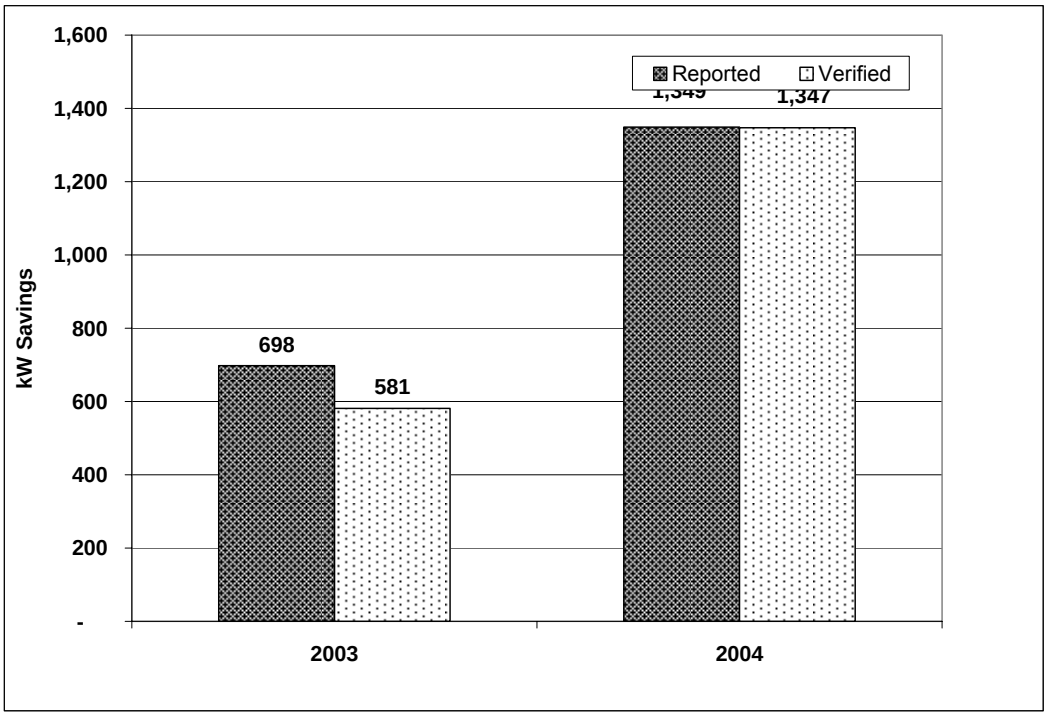
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	16,598	16,597	16,598	16,599	13,384	13,383	13,384	13,386
MWh	66,483	66,477	66,483	66,489	58,352	58,346	58,352	58,358

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

Xcel

The audit of Xcel's C&I SOP program verified 581 kW of peak demand savings in 2003, and 1,347 kW in 2004, as shown in Figure 3-22 below. These savings represent realization rates of 83.2 % in 2003 and 99.9 % in 2004.

Figure 3-22. Peak Demand Savings (kW), Xcel C&I SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Xcel's C&I SOP program databases fully supported the utility's claims of both peak demand reduction and energy savings in both 2003 and 2004, with the project savings in the database adding up to approximately 119 % of reported savings in 2003 and 100 % of reported savings in 2004. [28]

The sample of projects chosen for detailed review of supporting documentation represented 78 % of total database savings, with the large projects (Stratum 1) accounting for 72 % of the total and the random sample of smaller projects (Stratum 2) accounting for 6 % of the total. As there were no details on installed measures in the original C&I database, it is not possible to show definitively the share of kW by measure for the whole program. However, in the sample, 43 % of kW was from lighting measures, 43 % was from HVAC installations, 8 % of kW was from motors, and 6% was from insulation measures.

The review of supporting documents showed that one project had a difference of 34.1 kW between the database and the invoice. The savings value was adjusted to match the invoice. There were two additional projects with uncertainty due to missing supporting documents, with a total of 5.3 kW not supported by documentation showing equipment installed. These savings were assigned an uncertainty rate of 10%, which was reflected in the lower-bound estimate that included only 90% of reported savings from this site.

[28] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

Two projects that used M&V were reviewed and both of them had their savings adjusted as a result of the review of the IPMVP methodology. The uncertainty rate applied to the savings was 36 % for both, half of these values being used for the best estimate of verified savings and the full values for the lower bound.

The combined effect of the adjustments described above reduces reported savings by approximately 117 kW in 2003 and 1 kW in 2004. Realization rates are 83.2 % and 99.9%, respectively (Table 3-45).

Table 3-45. Peak Demand Savings Adjustments and Sample Realization Rates, Xcel C&I SOP 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	698	1,349
Adjustments for Large Projects (Stratum 1)	**B**	-117	1
Adjustments for rest of sample (Stratum 2)**	**C**	0	-3
Verified Savings*	**D=A+B+C**	581	1,347
Total Adjustments to Reported Savings	**D-A**	-117	-2
Program Realization Rate	**D/A**	83.2%	99.9%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

**Stratum 1includes all the largest projects and makes up 1,570 kW, leaving 612 kW represented by the random sample in Stratum 2. The random sample realization rate was 100%, meaning no adjustments.

The realization rate over both years for Stratum 1 of the sample was 91 %, which was lower than for Stratum 2, with 100 %. The reported energy savings were verified in the same proportion as the peak demand savings.

Table 3-46 below shows the full range of savings estimates for 2003 and 2004, for Xcel's C&I SOP program.

Table 3-46. Verified Peak Demand and Energy Savings, Xcel C&I SOP 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	698	497	581	664	1,349	1,347	1,347	1,349
MWh	2,821	2,010	2,347	2,684	4,741	4,733	4,735	4,744

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

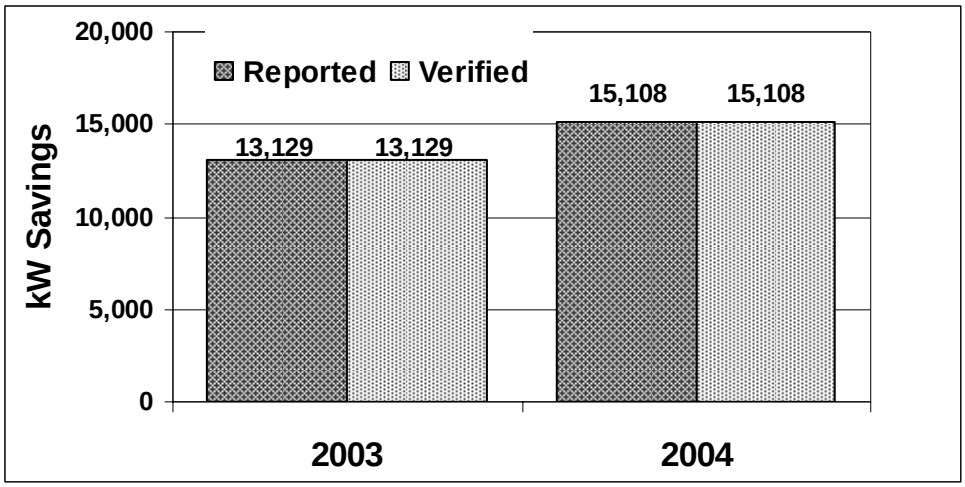
3.5 Load Management SOP

TXUED is the only utility to have offered the Load Management SOP, which began operation in 2003.

3.5.1 TXUED

The M&V audit of TXUED's Load Management SOP verified 13,129 kW of demand reduction in 2003 and 15,108 kW of demand reduction in 2004 (Figure 3-23). These savings represent realization rates of 100% in both years.

Figure 3-23. Verified Peak Demand and Energy Savings, TXUED Load Management SOP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Since the Load Management program only had nine participants, savings figures and documentation for all participants were reviewed. The program database contains load reduction figures representing the following:

- kW *applied for* by each participant.
- kW *approved and contracted* by TXUED (*i.e.,* the kW reduction achieved by the participant during the test event, capped at the level in the participant's application).
- *total, uncapped* kW curtailed during the test event.

The kW load curtailment amount under contract with participants is actually *less than* the reported savings figures by 2,212 kW (17%) in 2003 and 600 kW (4%) in 2004. For 2003, the total kW contained in the applications across all participants was roughly equal to TXUED's demand reduction goal for the program. The shortfall in contracted savings is due to the fact that several customers did not achieve their intended curtailment levels during the test and therefore were contracted for fewer kW than they applied for. However, since several other customers exceeded the curtailment levels in their applications, the actual load reduction achieved during the tests was significantly *higher than* the reported figures. In

particular, in 2003 one large industrial customer curtailed more than 46,000 kW despite being under contract for less than 3000 kW.[29]

In 2004, only one new participant joined the program, but two existing participants—including the large industrial customer discussed above—contracted for additional curtailments totaling 96% of TXUED's reported peak load reduction. Test-event curtailments from all three of these participants exceeded their contract amounts, with the large industrial customer curtailing more than 23,000 kW, compared to its contract amount of just over 11,000 kW.[30] As a result, the actual load reduction achieved during the tests was significantly higher than the reported figures, as occurred in 2003.

A detailed review of interval meter data from baseline days preceding the test curtailment events and from the test events themselves confirmed both the contracted kW values and the total curtailed kW values in the database. Since actual curtailments during test events exceeded the reported figures in both years, TXUED is considered to have achieved its reported savings values. These findings are reflected in Table 3-13, which shows a 100% program realization rate for both 2003 and 2004.

Table 3-47. Peak Demand Savings Adjustments, TXUED Load Management SOP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	13,129	15,108
Program-wide Adjustments	**B**	0	0
Subtotal	**C=A+B**	13,129	15,108
Sample Realization Rate	**D**	No sample—all customers reviewed	
Verified Savings*	**E=C**	**13,129**	**15,108**
Total Adjustments to Reported Savings	**E-A**	0	0
Program Realization Rate	**E/A**	100.0%	100.0%

An inherent characteristic of load curtailment programs such as the Load Management SOP is that the actual curtailment during a given event is unknown prior to the event itself. Curtailments, like peak demand savings from installed efficiency measures, can be reasonably estimated. But only in a load curtailment program are the actual reductions typically calculated after the customer has implemented the initial action—in this case enacting a curtailment plan during the test event. As a result, peak load reductions from curtailment programs do not yield predictable results at a high level of accuracy, especially as measured during a single test event.

Given this difficulty in accurately calculating savings, and since real curtailments were not called during 2003 or 2004, the audit team reviewed program information for any indication of what might represent a reasonable lower or upper bound for peak load reductions achieved by the program. It should be noted that TXUED had customers under contract for less than the reported level of savings. This aggregate contract amount could be considered a lower bound since the customers are only obligated to provide this level of curtailment. However, TXUED is aware that the large industrial customer, whose test

[29] This customer had applied for 10,000 kW but was limited by Commission rules to 20% of the incentive funding awarded through the program, which in this case translated to 2,626 kW. The nature of the customer's production facility limits its ability to shed partial load; therefore, a major portion of the facility was shut down and the kW curtailment far exceeded the contract amount.

[30] In 2004 applicants sought contracts for far fewer kW than the amount sought by TXUED. As a result, the 20% cap (for a single customer) was waived and the utility negotiated a contract with the large industrial customer that accounted for over 70% of curtailments for that year.

curtailments far exceeded its contract amount, is unable to reduce demand significantly without shutting down large, energy-intensive operations. Therefore, any curtailment from this customer will more than compensate for any deficiency in contracted curtailments relative to TXUED's reported savings. As a result, setting a lower bound of verified savings below the reported value is not warranted.

On the contrary, it is conceivable that the Load Management program could achieve peak load reductions in excess of the reported savings due to the likely over-compliance by the large industrial customer and other participants. Precisely establishing such a value would be difficult, however, since curtailment levels for a real event are likely to be different than for the test events. Furthermore, it is possible that the limitations of the large customer's operations that necessitate over-compliance may be overcome in the future, at least to some degree. In 2003, for example, the customer curtailed more than 46,000 kW, far exceeding the 2,626 kW for which it was under contract; yet, in 2004 the same customer was able to limit its curtailment to roughly 26,000 kW. In light of these observations, there is insufficient justification for setting an upper bound higher than the best estimate of verified savings discussed above.

Consequently, the lower and upper bounds of verified savings are both equal to the best estimate for both 2003 and 2004 (Table 3-14). These values are somewhat arbitrary in that TXUED set a specific internal goal in each year for peak demand reductions from its Load Management program, and recruited participants who were able to meet—and even exceed—these goals. If the goals had been set at different levels but the results of the test events were the same, presumably TXUED would have reported savings different from what it presented in its annual reports—solely on account of the savings goals it established for the program. Despite this fact, TXUED has clearly demonstrated that the Load Management program achieved the capability to deliver peak load reductions at least as great as those reported by the utility. This finding is reflected in the verified savings figures below.

Table 3-48. Range of Peak Demand Savings, TXUED Load Management SOP, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	13,129	13,129	13,129	13,129	15,108	15,108	15,108	15,108
MWh	The Load Management SOP is not designed to achieve significant energy savings.							

3.6 ENERGY STAR Homes

The reported and verified savings estimates for the four utilities that implemented the ENERGY STAR Homes Program in 2003 or 2004 are presented in Table 3-49. TNMP had a substantial increase in their estimated savings due to the use of updated savings calculations in 2003. CNP's estimated savings increased substantially due to a recalculation of their values using the same baseline employed by the other utilities. Overall, the ENERGY STAR homes program achieved verified savings, compared to reported savings, of 111.7% for 2003 and 109.7% for 2004. Verified energy savings for the ENERGY STAR Homes Program are determined to be 52,460 MWh in 2003 and 60,467 MWh in 2004 (Appendix D).

Table 3-49. Peak demand savings (kW) by Utility—ENERGY STAR Homes

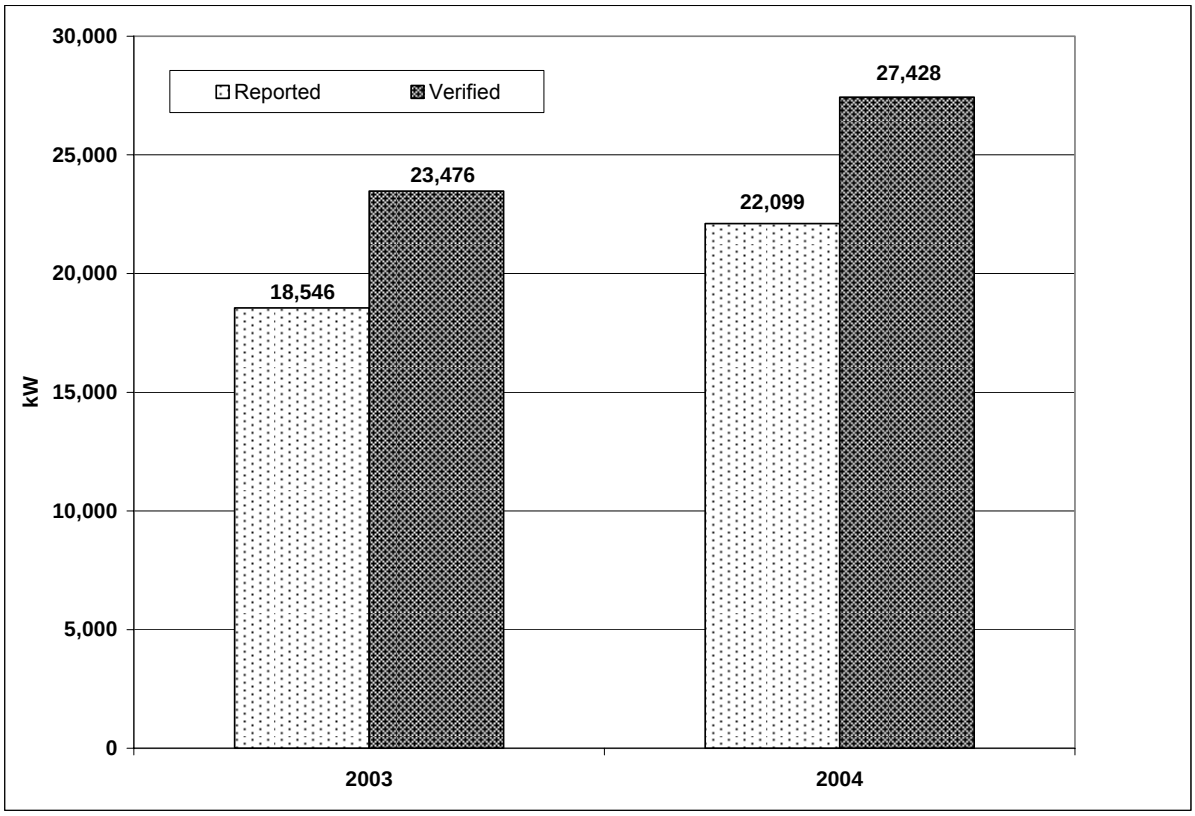
	2003			2004		
	Reported	**Verified***	**Verification Realization Rate**	**Reported**	**Verified***	**Verification Realization Rate**
CNP	18,546	23,476	126.6%	22,099	27,428	124.1%
Entergy	1,467	1,467	100.0%	2,262	2,252	99.6%
TNMP	831	1,550	186.5%	1,907	1,907	100.0%
TXUED	27,701	27,714	100.0%	28,309	28,275	99.9%
TOTAL	**48,545**	**54,207**	**111.7%**	**54,577**	**59,862**	**109.7%**

* Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

3.6.1 CNP

The M&V audit of CenterPoint Energy's ES Homes Program verified 23,476 kW of savings in 2003 and 27,428 kW of savings in 2004 (Figure 3-24). These savings represent kW realization rates (compared to reported values) of 126.6% and 124.1%, respectively.

Figure 3-24. Peak Demand Savings (kW), CNP ES Homes Program, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

CNP's ES Home program database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for 100% or more of the reported savings.[31]

However, careful review of the census of records in the database revealed that three corrections were necessary which resulted in an downward adjustment to energy savings for 2003 of 80.2 kW. These adjustments were as follows:[32]

- Because the energy savings model only accepted one- or two-story homes, savings were not included for 48 three-story homes. The standard practice among other utilities for three-story homes, however, is to enter them into the savings calculator as a two-story home (still a conservative approach to estimating savings). Incorporating the savings from these additional homes resulted in a net savings increase of 69.5 kW.

- A home with a HERS score of 88.6 was incorrectly entered into the database as 886.5. Correcting this data entry error led to a net savings decrease of 144.1 kW.

- A home with a square footage of 1686 was incorrectly entered into the database as 16686. Correcting this data entry error led to a new savings decrease of 5.5 kW.

In addition, the energy savings for 2003 were based on a new Version 4.0 predictive savings tool created by ICF Consulting (ICF). CNP utilized an average HERS and square footage value for 1- and 2-story homes that was obtained from the builders as an input. The audit team re-computed the total savings using actual inputs, obtained from the database, for each program home. The difference of the weighted builder estimates compared to the actual individual inputs resulted in a net increase in savings of 15 kW.

The last program wide adjustment to savings resulted in the decision, during review of the draft report, to recalculate CNP's ESH savings using the same methodology as that employed by the other utilities. The Predictive Savings Tool V4.0 created by ICF contained two options. One option used the International Energy Conservation Code (IECC) established baseline as the starting point and the other option used a market study baseline as the starting point. The two options would result in different savings values for an identical home in the same climate zone. After further review, the audit team decided that the IECC option would provide a more accurate baseline predictor for CNP, plus would be consistent with the baseline used by the other utilities for 2003 and 2004.

The audit team re-computed CNP's ESH savings using the IECC method, using the actual inputs obtained from the database for each program home (i.e., not average values). The use of the IECC baseline resulted in a positive net increase in savings of 5,076 kW for 2003 and 5,405 kW for 2004 for a combined adjustment of 10,481 kW.

For 2004, however, CNP modified the approach to estimating savings compared to 2003, using individual home characteristics to estimate savings, and including three-story homes. As a result of these changes,

[31] Across many of the utilities and programs, the program databases contain installations and customers that were not included in the utilities' reported savings. The audit team has attempted to filter out these entries, but not all unreported savings could be identified. So long as the savings from the databases were greater than or equal to the reported savings, the databases were considered to validate the savings reported by the utilities.

[32] The outliers and missing 3-story homes were corrected by ICF in the IECC calculations. These notes pertained to the initial savings verification, and have been included to show a chronological series of steps that occurred to get to the final verified savings values.

no outliers were detected in 2004 The result of all of these program-wide adjustments was a net increase in savings of 4996 kW in 2003 and 5406 in 2004 (Table 3-50).

The verification of the 2003-2004 sample of hard copy records found that the documentation was nearly identical to what was recorded in the program database. One minor data entry error was detected: a single story home was entered into the database as a two-story home. Correcting this data entry error reduced the sample savings by 0.3%, so that the realization rate for the sample was 99.7%.

These program-wide and sample extrapolated adjustments resulted in program kW realization rates of 126.6% for 2003 and 124.1% for 2004 (Table 3-50). The range of peak demand savings is presented in Table 3-51.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-51.

The market transformation programs do not require inspections, yet a review of documentation revealed that CNP had inspected 517 homes (4.3%) in 2003 and 442 homes (3.4%) in 2004. According to program staff any problems identified during the inspection were resolved so that all homes met the necessary requirements to participate in the program (i.e., there was no reduction in savings based on the inspections). Our review of ten randomly selected files from inspections revealed that, while inspections occurred, there were a number of instances where the results of the inspection were inconsistent with what was recorded in the database. For example, one home was listed as a two-story home on the inspection report, but only one-story in the database. Another home had a NACH value of 26 on the inspection sheet but zero in the database.

Table 3-50. Peak Demand Savings Adjustments and Sample Realization Rates, CNP ES Homes, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	18,546	22,099
Program-wide Adjustments	**B**	4996	5,406
Subtotal	**C=A+B**	23,542	27,505
Sample Realization Rate	**D**	99.7%	99.7%
Verified Savings*	**E=C*D**	**23,476**	**27,428**
Total Adjustments to Reported Savings	**E-A**	-66	-77
Program Realization Rate	**E/A**	126.6%	124.1%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-51. Verified Peak Demand and Energy Savings, CenterPoint Energy ES Homes Program, 2003 and 2004

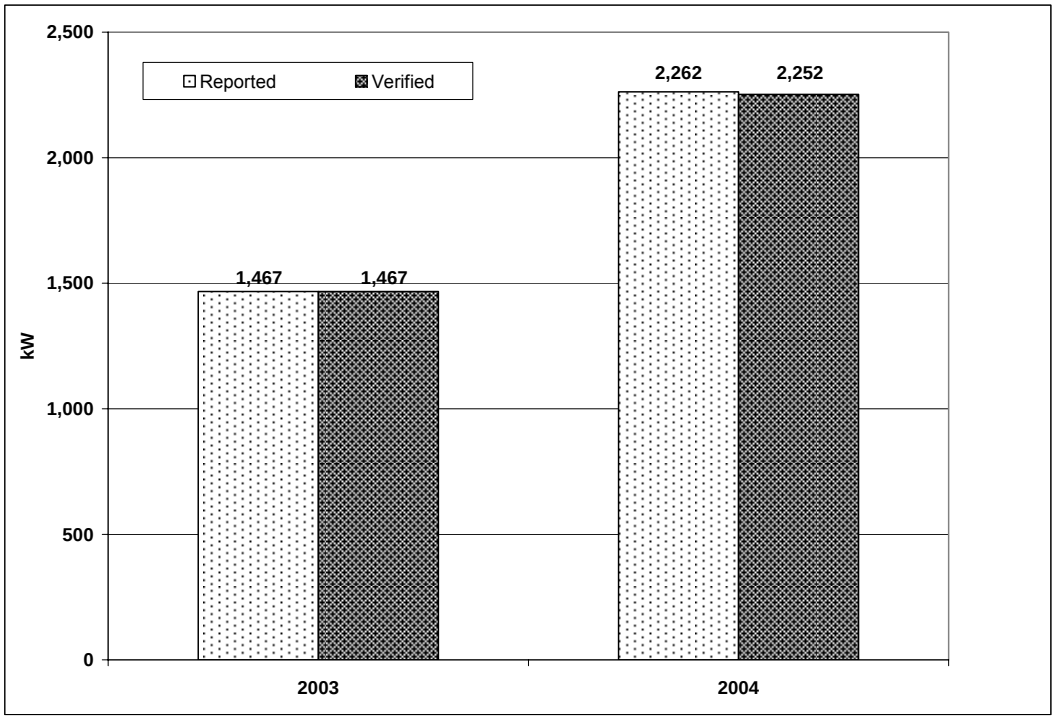
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	18,546	23,381	23,476	23,571	22,099	27,317	27,428	27,539
MWh	27,330	25,893	25,989	26,086	32,270	30,961	31,077	31,192

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.6.2 Entergy

The M&V audit of Entergy's ES Homes Program verified 1,467 kW of savings in 2003 and 2,252 kW of savings in 2004 (Figure 3-25). These savings represent kW realization rates (compared to reported values) of 100.0% and 99.6%, respectively.

Figure 3-25. Peak Demand Savings (kW), Entergy ES Homes Program, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

A review of Entergy's ES Home program database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with valid customers and installations from the databases identically matching the reported savings (Table 3-52).

Table 3-52. Entergy ES Home Database Validation of Reported Savings

	Kilowatts (kW)			Megawatt-hours (MWh)		
	Reported	Database	Percent Validated*	Reported	Database	Percent Validated*
2003	1,467	1,467	100.0%	1,619	1,619	100.0%
2004	2,262	2,262	100.0%	2,602	2,602	100.0%

* Across many of the utilities and programs, databases contain more savings than reported by utilities. These excess savings were not included in verified savings estimates.

However, a review of the census of records in the database revealed that a 2,253 square foot home was incorrectly entered as 22,530 square feet, inflating the savings estimates. The correction for this outlier resulted in a decrease of 10 kW for 2004. The verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, requiring no adjustments (i.e., a realization rate of 100%). A review of the application of the engineering algorithms to estimate savings also revealed no discrepancies from the savings tool, also resulting in no additional adjustments.

The majority of reported MWh energy savings were verified in the same proportion as the peak demand savings. The uncertainty introduced by the TXUED inspection reduction estimate does not impact the best estimate of verified savings and is reflected in the lower-bound estimate, which was adjusted to include only 93.4% of the reported savings for 2003 and 93.0% of the reported savings for 2004.

The market transformation programs do not require inspections, and Entergy selected to rely on the HERS raters and not conduct any on-site inspections of program homes. As presented below, however, TXUED chose to conduct inspections and found that 6.6% of program homes failed to meet the program requirements in 2003 and 2004.[33] Accordingly, the audit team recognizes that some Entergy homes may also have been disqualified from the program had they been inspected, and reflected this uncertainty in the Entergy savings estimates by adjusting the low-end of the estimate downward by 6.6%. Note this adjustment does not impact the mid-point of our estimate, just the uncertainty range. These adjustments, in total, resulted in program kW realization rates of 100.0% for 2003 and 99.6% for 2004 (Table 3-53). The range of peak demand savings is presented in Table 3-54.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-54.

[33] This is a weighted average for both years.

Table 3-53. Peak Demand Savings Adjustments and Sample Realization Rates, Entergy ES Homes, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	1,467	2,262
Program-wide Adjustments	**B**	0	-10
Subtotal	**C=A+B**	1,467	2,252
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**1,467**	**2,252**
Total Adjustments to Reported Savings	**E-A**	0	-10
Program Realization Rate	**E/A**	100.0%	99.6%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-54. Verified Peak Demand and Energy Savings, Entergy ES Homes Program, 2003 and 2004

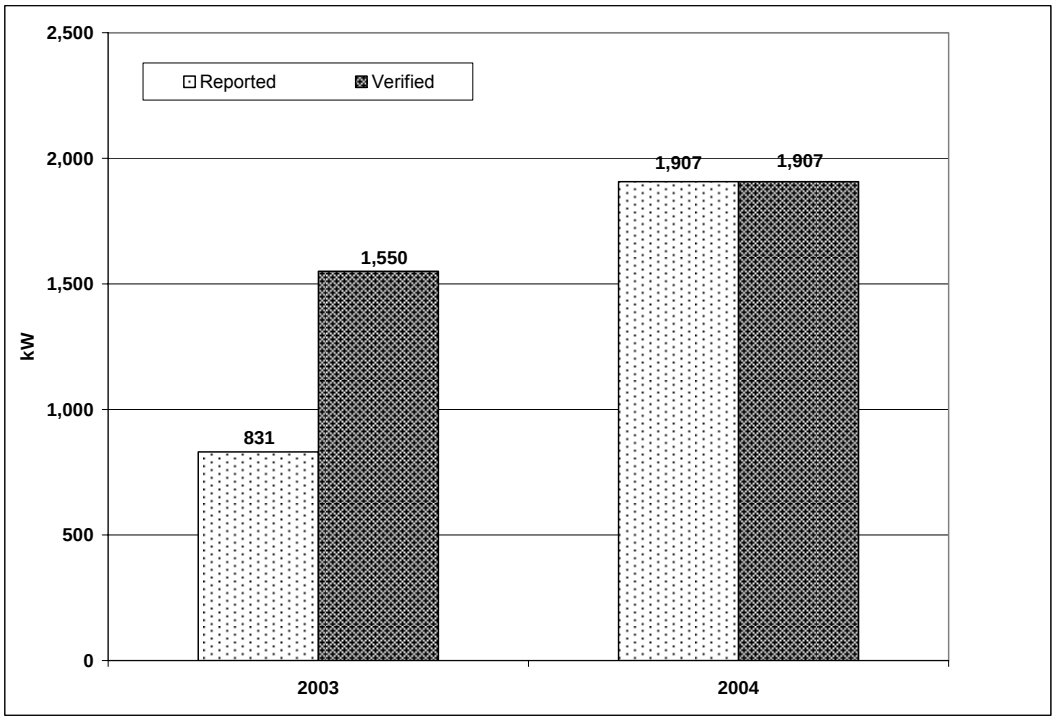
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	1,467	1,371	1,467	1,467	2,262	2,104	2,252	2,252
MWh	1,619	1,512	1,619	1,619	2,602	2,423	2.594	2,594

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.6.3 TNMP

The M&V audit of TNMP's ES Homes Program verified 1,550 kW and 1,715 MWh of savings in 2003, and 1,907 kW and 2,144 MWh of savings in 2004 (Figure 3-26). These savings represent kW realization rates (compared to reported values) of 186.5% and 100.0%, respectively.

Figure 3-26. Peak Demand Savings (kW), TNMP ES Homes Program, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

A review of TNMP's ES Home program database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with the sum of savings recorded in the program databases identically matching the reported savings.

A review of the census of records in the database revealed no outliers. In addition, the verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, although the documentation was limited as the majority of the data were collected via computer (i.e., with little paper trail). So, although the sample did not identify any hard copy vs. database discrepancies, the audit team really could only check HERS scores and addresses.

In checking the application of the ICF savings calculator, the audit team discovered that TNMP used an older tool in 2003, while other utilities had already switched over to the newer v4.0 tool. If the new tool had been used, savings would have increased by 719 kW, a substantial (186%) increase over the estimated savings of 831 kW utilizing the older tool. The audit team believes that because this newer tool was approved in 2003 and used by the other utilities that run ES Homes programs, TNMP should have also used the newer tool at this time. So these additional savings have been credited to the program as a program-wide adjustment, resulting in total estimated savings of 1,550 kW for 2003 (Table 3-55). Note that in 2004 the newer tool was used, and no additional adjustments were required.

The market transformation programs do not require inspections, and TNMP selected to rely on the HERS raters and not conduct any on-site inspections of program homes. As presented below, however, TXUED chose to conduct inspections and found that 6.6% of program homes failed to meet the program

requirements in 2003 and 2004.[34] Accordingly, the audit team recognizes that some TNMP homes may also have been disqualified from the program had they been inspected, and reflected this uncertainty in the TNMP savings estimates by adjusting the low-end of the estimate downward by 6.6%.

In addition, the low-end of the estimate was also adjusted downward due to one record request that could not be fulfilled. A replacement record was delivered, but due to uncertainty around the savings from the missing records the lower-bound was set to include 80% of the reported savings from this site. Note the adjustments for potential on-site inspections and the missing record do not impact the mid-point of our estimate, just the lower-bound of the uncertainty range. The range of peak demand savings is presented in Table 3-56.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-56.

Table 3-55. Peak Demand Savings Adjustments and Sample Realization Rates, TNMP ES Homes, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	831	1,907
Program-wide Adjustments	**B**	719	0
Subtotal	**C=A+B**	1,550	1,907
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**1,550**	**1,907**
Total Adjustments to Reported Savings	**E-A**	719	0
Program Realization Rate	**E/A**	186.5%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-56. Verified Peak Demand and Energy Savings, TNMP ES Homes Program, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	831	1,448	1,550	1,550	1,907	1,782	1,907	1,907
MWh	737	1,603	1,715	1,715	2,144	2,003	2,144	2,144

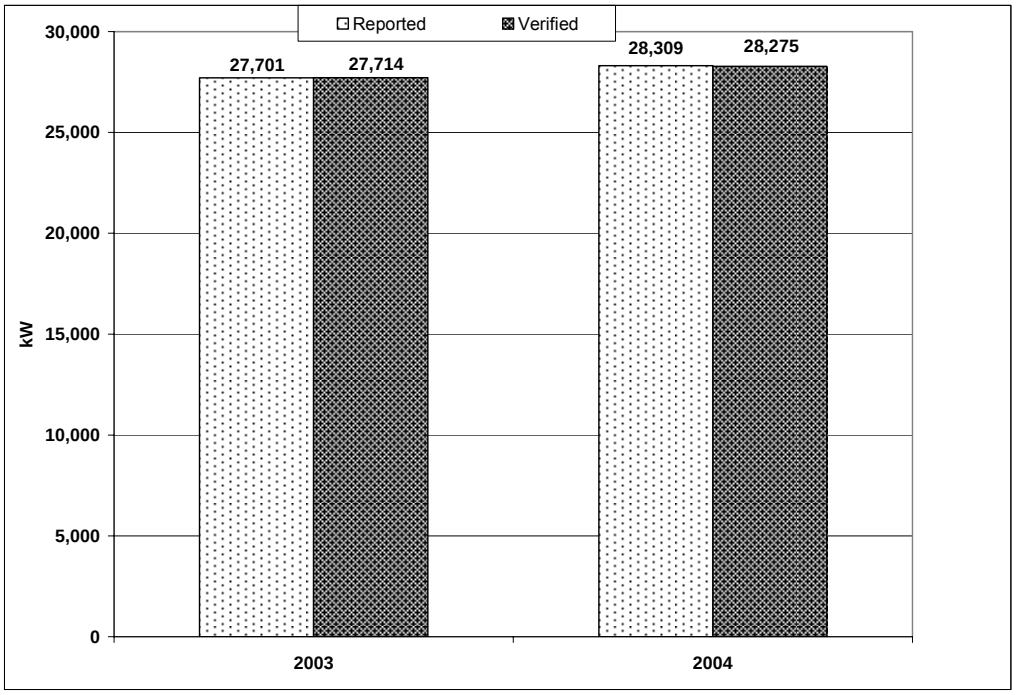
Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.6.4 TXUED

The M&V audit of TXUED's ES Homes Program verified 27,714 kW of savings in 2003 and 28,275 kW of savings in 2004 (Figure 3-27). These savings represent kW realization rates (compared to reported values) of 100.0% and 99.9%, respectively.

[34] This is a weighted average for both years.

Figure 3-27. Peak Demand Savings (kW), TXUED ES Homes Program, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TXUED's ES Home program database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with valid customers and installations from the databases accounting for over 100% or more of the reported savings. As discussed below, the additional savings identified in the database, yet not reported, are due to a universal *ex post* adjustment based on the results of onsite inspections.

A careful review of the census of records in the database revealed that a number of corrections were necessary:

- In 2003, a HERS score of 98.1 should have been entered as 89.1. Corrected this outlier resulted in a reduction in a net savings decrease of 2 kW.

- In 2004 three projects were found to have erroneous square footage entries, all over 20,000 square feet. Correcting each of these resulted in a program-wide adjustment of 49 kW.

The verification of the 2003-2004 sample of hard copy records found that the documentation was nearly identical to what was recorded in the program database. Two minor data entry errors were detected, and when corrected led to a kW sample realization rate of 100.1%.

These program-wide and sample extrapolated adjustments resulted in program kW realization rates of 100.0% for 2003 and 99.9% for 2004 (Table 3-57). The range of peak demand savings is presented in Table 3-58.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates for MWh savings are presented in Table 3-58.

The market transformation programs do not require inspections, yet TXUED, as part of a quality assurance program, inspected 192 homes (1.4%) in 2003[35] and 293 homes (2.3%) in 2004.[36] The results of these inspections revealed that 5% of the 2003 sample and 7.6% of the 2004 sample had HERS scores lower than 86.0, the minimum required score to achieve ENERGY STAR designation. Based on the results of these inspections TXUED chose to apply an *ex post*, universal adjustment to the total kW and MWh savings estimates for both years (5% in 2003 and 7.6% in 2004). In addition, a review of a random sample of ten on-site inspections by the audit team revealed that all the information from the inspection reports was identical to the program database.

Table 3-57. Peak Demand Savings Adjustments and Sample Realization Rates, TXUED ES Homes, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	27,701	28,309
Program-wide Adjustments	**B**	-2	-49
Subtotal	**C=A+B**	27,699	28,260
Sample Realization Rate	**D**	100.1%	100.1%
Verified Savings*	**E=C*D**	**27,714**	**28,275**
Total Adjustments to Reported Savings	**E-A**	13	-34
Program Realization Rate	**E/A**	100.0%	99.9%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-58. Verified Peak Demand and Energy Savings, TXUED ES Homes Program, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	27,701	27,696	27,701	27,714	28,309	28,257	28,275	28,275
MWh	23,139	23,134	23,136	23,137	24,670	25,652	24,654	24,656

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.7 AC Distributor

Across the four utilities administering AC Distributor, 14,839 kW of peak demand reduction were realized in 2003 and 24,762 kW in 2004 (Table 3-59), which is 97.0% of the total reported savings for 2003 and 99.2% for 2004.

[35] Conservation Services Group, "2003 ENERGY STAR® Quality Assurance Inspection Program Final Report," January 2004. Note that a total of 295 quality assurance inspections were conducted, but only 192 were completed with full ratings.

[36] ICF Consulting, "Verifying the Certification of ENERGY STAR® Qualified Homes A Quality Assurance and Quality Control Program of the TXUED Electric Delivery ENERGY STAR Homes Program," 2004 Report.

Table 3-59. Peak demand savings (kW) by Utility—AC Distributor MTP

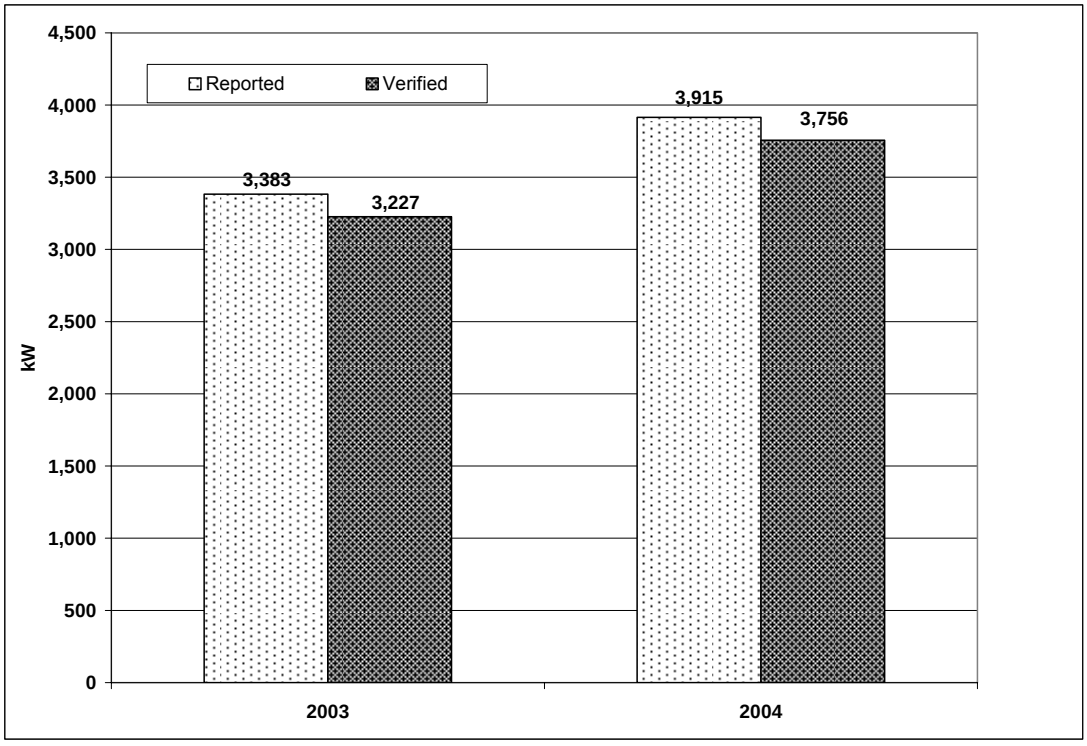
	2003			2004		
	Reported	**Verified***	**Verification Realization Rate**	**Reported**	**Verified***	**Verification Realization Rate**
CNP	3,383	3,227	95.4%	3,915	3,756	95.9%
Entergy	379	379	100.0%	448	448	100.0%
TXUED	10,800	10,525	97.5%	20,100	20,055	99.8%
Xcel	733	708	96.6%	503	503	100.0%
TOTAL	**15,295**	**14,839**	**97.0%**	**24,966**	**24,762**	**99.2%**

* Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

3.7.1 CNP

The M&V audit of CNP's AC Distributor MTP verified 3,227 kW of savings in 2003 and 3,756 kW of savings in 2004 (Figure 3-28). These savings represent kW realization rates (compared to reported values) of 95.4% and 95.9%, respectively.

Figure 3-28. Peak Demand Savings (kW), CNP AC Distributor MTP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

CNP's AC Distributor program database fully supported the utility's claims of both peak demand and energy savings in both 2003 and 2004, with valid customers and installations from the databases

accounting for 100% or more of the reported savings. As discussed below, adjustments were made by the audit team due to outliers (SEER 12) in the database that should not have been claimed and differences in the reported savings versus those calculated for the sample using CNP's AC Features Tool.

A review of the census of records in the database revealed that there were four records in 2003 (9 ton) that indicated a SEER below 13, which was the minimum efficiency level to qualify for incentives. The utility provided paperwork to confirm that seven of the nine tons were in fact SEER 13 or above. Correcting for these errors by eliminating the claimed savings for the two ton SEER 12 unit resulted in a net decrease in 2003 of 1 kW, which was too small to be significant.

The verification of the 2003-2004 sample of hard copy records found that the equipment SEER rating documentation disagreed with what was recorded in the program database on one project (3 ton). The utility provided paperwork to confirm that this unit was in fact SEER 13, therefore no adjustments to the savings were made.

Adjusting for these changes, resulted in kW realization rates of 95.4% for 2003 and 100% for 2004 (Table 3-60).

In addition, a review of the savings values reported by CNP revealed that the total savings were calculated by using the average SEER value calculated from 100% of the installed units (13.44 SEER (2003), 13.50 SEER (2004)), multiplied by an average peak 0.22 kW/ton and 372 MWh/ton for 2003 and 2004.[37] This methodology was documented by ICF.[38] The evaluators verified the calculations by using the AC Features Tool created by ICF for CenterPoint Energy's AC Distributor program. A verification of the savings using the exact tool inputs contained in the database resulted in savings realization rates slightly below those calculated using averages values, as described above.

The market transformation programs do not require inspections, yet CNP, as part of a quality assurance program, inspected 167 projects (4.4%) in 2003 and 190 projects (4.2%) in 2004[39]. No adjustments were made as a result of these inspections.[40] In addition, a review of a random sample of ten on-site inspections by the audit team revealed that all the information from the inspection reports was identical to the program database.

[37] Note the AC Distributor Program does not require that utilities apply an approved deemed savings values, but are free to select their own approach to estimating savings.

[38] Two separate reports dated February 8th, 2005 documented the reported program savings methodology for 2003 and 2004.

[39] Totals derived from a query of the projects flagged as inspected in the CNP AC Distributor database.

[40] CNP felt that any minor adjustments found due to inspections would be accounted for by using the average deemed savings values.

Table 3-60. Peak Demand Savings Adjustments and Sample Realization Rates, CNP AC Distributor MTP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	3,383	3,915
Program-wide Adjustments	**B**	-159	-159
Subtotal	**C=A+B**	3,227	3,756
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**3,227**	**3,756**
Total Adjustments to Reported Savings	**E-A**	-159	-159
Program Realization Rate	**E/A**	95.3%	95.9%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Utility staff could not provide a signed customer form for one customer, but CNP claimed zero savings for this particular customer. As a result, the "uncertainty" surrounding this customer had no effect on the lower-bound estimate of savings. The range of peak demand savings is presented in Table 3-61.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. No uncertainty was identified by the audit team during the sample review, therefore, the lower bound, upper bound, and best estimate of verified energy savings are all the same. As a result, the realization rate is 93.2% of reported savings in 2003 and 93.8% in 2004. The range of energy savings is presented in Table 3-61.

Table 3-61. Verified Peak Demand and Energy Savings, CNP AC Distributor MTP, 2003 and 2004

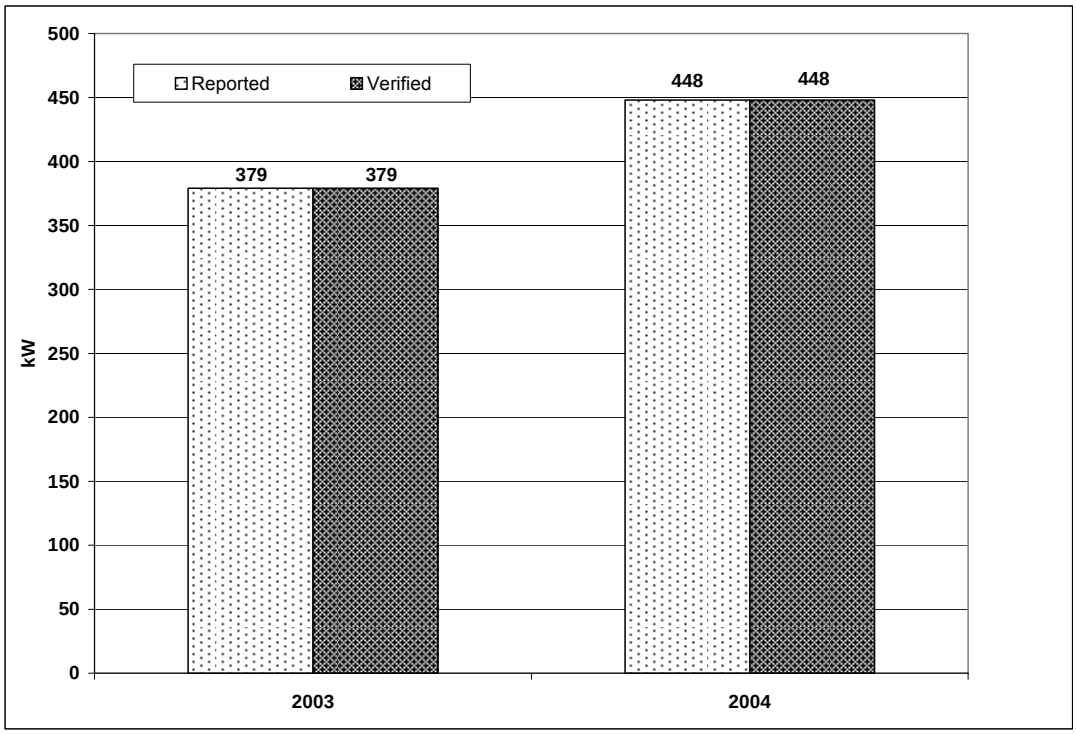
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	3,383	3,227	3,227	3,227	3,915	3,776	3,776	3,776
MWh	5,720	5,697	5,697	5,697	6,762	6,567	6,567	6,567

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.7.2 Entergy

The M&V audit of Entergy's AC Distributor MTP verified 379 kW of savings in 2003, and 448 kW of savings in 2004 (Figure 3-29). These savings represent kW realization rates (compared to reported values) of 100.0% for 2003 and 2004.

Figure 3-29. Peak Demand Savings (kW), Entergy AC Distributor MTP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

Entergy's AC Distributor MTP database fully supported the utility's claims of both peak demand and energy savings in 2003 and was slightly lower than the reported saving in 2004, with valid customers and installations from the databases accounting for 100% of the reported savings in 2003 and 2004.

A review of the census of records in the database revealed no outliers. Entergy elected to use the AC savings values shown in the RES SOP deemed savings document. Verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database and that the deemed savings values were correctly applied, resulting in a sample and database kW and MWh realization rates of 100% for both 2003 and 2004 (see Appendix D). The final estimates for MWh savings are presented in Table 3-63.

The market transformation programs do not require inspections, yet Entergy, as part of a quality assurance program, inspected 66 homes (15.6%) in 2003 and 84 homes (14.9%) in 2004[41]. Adjustments were made as a result of these inspections due to SEER levels below 13.0 (savings zeroed out), incorrect SEER levels (savings adjusted to correct amount), or duplicate invoicing of projects (savings zeroed out for second invoice). In addition, a review of a random sample of ten on-site inspections by the audit team revealed that for nine out of 10 projects, the information from the inspection reports was identical to the program database. One project did not contain enough data to indicate that the site was actually inspected.

[41] Totals derived from a query of the projects flagged as inspected in the Entergy AC Distributor database.

Table 3-62. Peak Demand Savings Adjustments and Sample Realization Rates, Entergy AC Distributor MTP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	379	448
Program-wide Adjustments	**B**	0	0
Subtotal	**C=A+B**	379	448
Sample Realization Rate	**D**	100%	100%
Verified Savings*	**E=C*D**	**379**	**448**
Total Adjustments to Reported Savings	**E-A**	0	0
Program Realization Rate	**E/A**	100.0%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Although the best estimate of verified savings is 100% of the reported savings, there is generally some uncertainty due to missing documentation, and this uncertainty is reflected in the lower-bound estimate of savings. Utility staff could not provide a signed customer form for one customer, but Entergy claimed zero savings for this particular customer. The range of peak demand savings is presented in Table 3-63.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. The range of energy savings is presented in Table 3-63.

Table 3-63. Verified Peak Demand and Energy Savings, Entergy AC Distributor MTP, 2003 and 2004

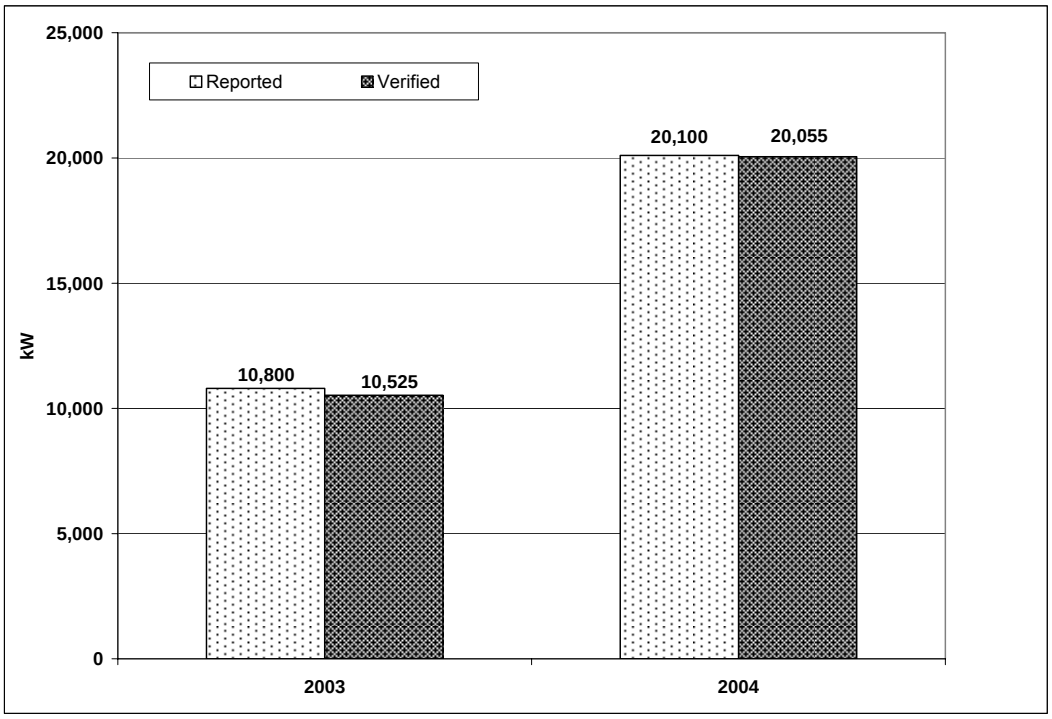
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	379	378	379	379	448	447	448	448
MWh	706	704	706	706	879	877	879	879

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values are based off of statistical uncertainty associated with a sampling approach, plus include some uncertainty to account for a missing record.

3.7.3 TXUED

The M&V audit of TXUED's AC Distributor MTP verified 10,525 kW of savings in 2003, and 20,055 kW of savings in 2004 (Figure 3-30). These savings represent kW realization rates (compared to reported values) of 97.5% and 99.8%, respectively.

Figure 3-30. Peak Demand Savings (kW), TXUED AC Distributor MTP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TXUED's AC Distributor MTP database was not used to support the utility's claims of both peak demand and energy savings in both 2003 and 2004. Instead, TXUED relied on a market impact assessment conducted by Frontier Associates which quantified the then current market baseline, the SEER ratings of units being installed, and the subsequent average kW and MWh savings for all systems installed by participating distributors, regardless of SEER level.[42] For 2003, the study results indicated an average peak savings of 0.14 kW and an average energy savings of 170 MWh per system installed. For 2004, the study results indicated an average peak savings of 0.11 kW and an average energy savings of 142 MWh. The lower average savings values for 2004 can be attributed to a slightly higher baseline.

These average values were then applied to 100% of the system installations by participating dealers and distributors, regardless of whether the individual systems were submitted for incentives, crediting TXUED with 100% of the estimated market effects due to their AC Distributor program. The audit team could not verify the reported number of systems installed in the market study, but did validate that the final figures from the market study were correctly applied in the annual reports in terms of number of participants and savings.

A review of the census of records in the database revealed there were outliers for systems below SEER 13, with the minimum recorded SEER of 10. Given that the savings were derived from a market study rather than using deemed savings, the savings were not adjusted for these outliers. It is assumed that the market study with average installed SEER values of 12.5 for 2003 and 12.6 for 2004 accounts for any system savings that should be disqualified within the TXUED projects awarded incentives.

[42] Separate studies were performed by Frontier Associates for the 2003 and 2004 program market impacts. The studies included results for both the AC Distributor and AC Installer MTPs.

In addition, a comparison of serial numbers and installation addresses between the AC Distributor program and the ENERGY STAR Homes program reviewed overlaps of 275 kW in 2003, and 45 kW in 2004. Since incentives can not be requested from both programs, the savings overlap needed to be adjusted. Because the savings for the ENERGY STAR Homes program included not just the AC unit, but other measures as well, the savings were deducted from the AC Distributor program. TXUED sent the information for the overlap sites, which were then used to estimate the percent reduction in savings for this program. This percentage was applied to the market study savings to determine the final savings realized by TXUED. Similar adjustments were applied in the estimate of the MWh savings.

Verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, resulting in a sample and database kW realization rates of 100% for both 2003 and 2004 (Table 3-64). No uncertainty was identified by the audit team during the sample review, therefore, the lower bound, upper bound, and best estimate of verified energy savings are all the same. The range of peak demand savings is presented in Table 3-65.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. The final estimates and ranges for MWh savings are presented in Table 3-65.

The market transformation programs do not require inspections, yet TXUED, as part of a quality assurance program, inspected 2,108 sites (27.8%) in 2003 and 2189 sites (31.6%) in 2004.[43] In addition, a review of a random sample of ten on-site inspections by the audit team revealed that the equipment SEER rating documentation disagreed with what was recorded in the program database on three projects and the system capacity tonnage disagreed on one project. If the SEER rating for the projects with discrepancies was above 13, the savings were not adjusted. This was the case for all of the records with discrepancies.

Table 3-64. Peak Demand Savings Adjustments and Sample Realization Rates, TXUED AC Distributor MTP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	10,800	20,100
Program-wide Adjustments	**B**	-275	-45
Subtotal	**C=A+B**	10,525	20,055
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**10,525**	**20,055**
Total Adjustments to Reported Savings	**E-A**	-275	-45
Program Realization Rate	**E/A**	97.5%	99.8%

***** Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

[43] Totals derived from a query of the projects flagged as inspected in TXUED's AC Distributor database.

Table 3-65. Verified Peak Demand and Energy Savings, TXUED AC Distributor MTP, 2003 and 2004

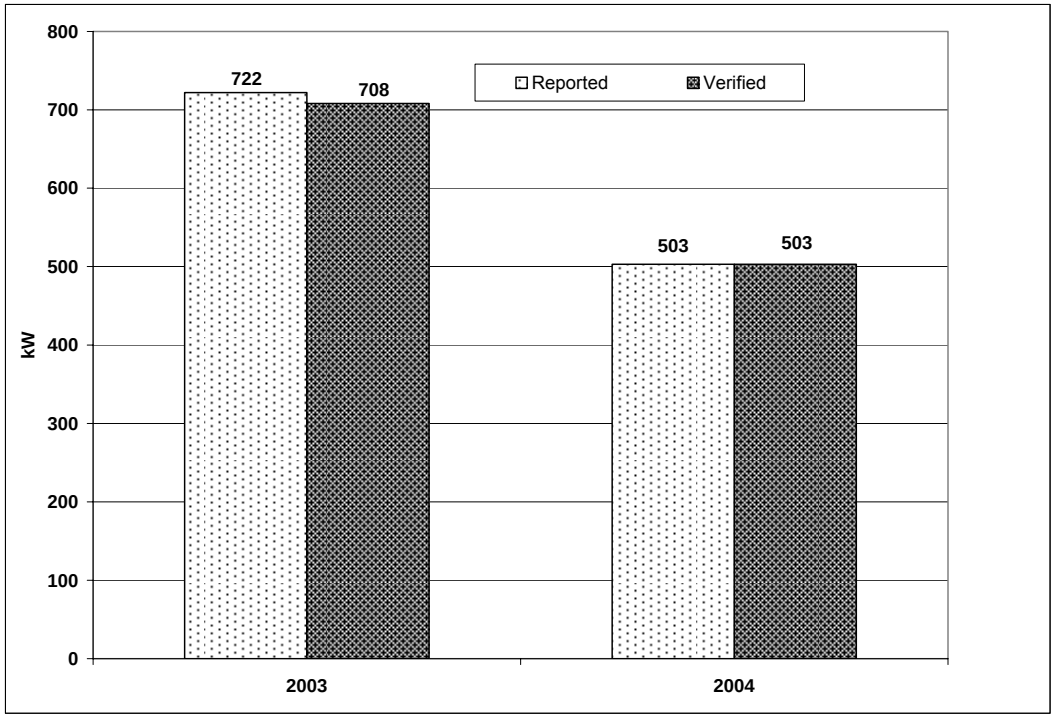
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	10,800	10,525	10,525	10,525	20,100	20,055	20,055	20,055
MWh	13,478	13,135	13,135	13,135	25,112	25,056	25,056	25,056

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.7.4 Xcel

The M&V audit of Xcel's AC Distributor MTP verified 708 kW of savings in 2003 and 503 kW of savings in 2004 (Figure 3-31). These savings represent kW realization rates (compared to reported values) of 98.1% and 100%, respectively.

Figure 3-31. Peak Demand Savings (kW), Xcel AC Distributor MTP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

The 2004 database fully supported the utility's claims of both peak demand and energy savings, with valid customers and installations from the databases accounting for 100% of the reported savings.

A review of Xcel's database revealed that the 2003 annual report savings included a 24,000 Btuh (2 ton) system that was erroneously entered in the database as 240,000 (20 ton). Correcting this value resulted in

a net decrease in 2003 savings of 14 kW (Table 3-66). After accounting for this factor the AC Distributor database represents 98.1% of the 2003 kW savings.

The verification of the 2003-2004 sample of hard copy records found that the documentation was identical to what was recorded in the program database, resulting in a sample realization rate of 100.0%. In addition, a review of the savings estimates indicated that the deemed savings values were correctly applied to the program measures for each of the program participants. There were, therefore, no additional adjustments to the savings estimates for Xcel's AC Distributor MTP. No uncertainty was identified by the audit team during the sample review, so the lower bound, upper bound, and best estimate of verified energy savings are all the same. The range of peak demand savings is presented in Table 3-67.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-67.

The market transformation programs do not require inspections, yet Xcel, as part of a quality assurance program, inspected 9 homes (1.1%) in 2003.[44] In addition, a review of a random sample of ten on-site inspections by the audit team revealed that for 9 out of 10 projects, the information from the inspection reports was identical to the program database, though one of the projects appeared to have been counted twice. The paperwork was missing for the remaining inspected project.

Table 3-66. Peak Demand Savings Adjustments and Sample Realization Rates, Xcel AC Distributor MTP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	722	503
Program-wide Adjustments	**B**	-14	0
Subtotal	**C=A+B**	708	503
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**708**	**503**
Total Adjustments to Reported Savings	**E-A**	-14	0
Program Realization Rate	**E/A**	98.1%	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-67. Verified Peak Demand and Energy Savings, Xcel AC Distributor MTP, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	722	708	708	708	503	503	503	503
MWh	1,086	1,055	1,055	1,055	764	764	764	764

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

[44] Totals derived from a query of the projects flagged as inspected in Xcel's AC Distributor database.

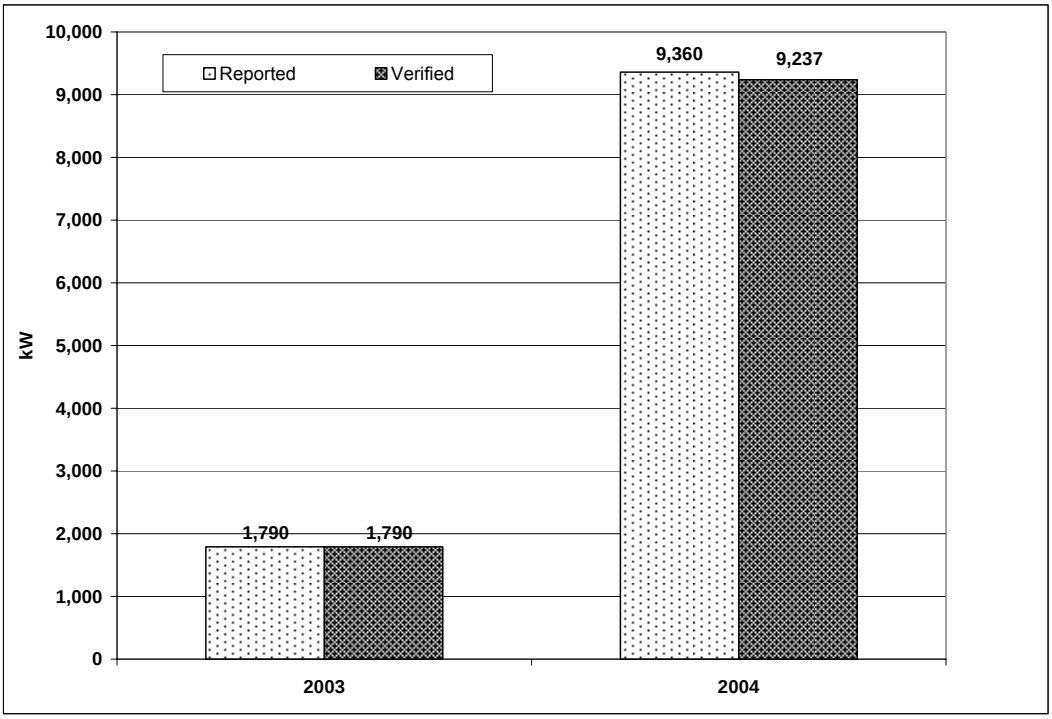
3.8 A/C Installer

For the one utility that administered the AC Installer MTP, 1,790 kW of peak demand reduction were realized in 2003 and 9,237 kW in 2004, which is 100.0% of the reported savings for 2003, and 98.7% of the reported savings for 2004.

3.8.1 TXUED

The M&V audit of TXUED's AC Installer MTP verified 1,790 kW of savings in 2003 and 9,237 kW of savings in 2004 (Figure 3-32). These savings represent kW realization rates (compared to reported values) of 100.0% and 98.7%, respectively.

Figure 3-32. Peak Demand Savings (kW), TXUED AC Installer MTP, 2003 and 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

TXUED's AC Installer MTP database was not used to support the utility's claims of both peak demand and energy savings in both 2003 and 2004. Instead, TXUED relied on a market impact assessment conducted by Frontier Associates which quantified the estimated savings.[45] The audit team could not verify the reported number of systems installed in the market study, but did validate that the final figures from the market study were correctly applied in the annual reports in terms of number of units and savings.

A comparison of serial numbers and installation addresses between the AC Installer program and the ENERGY STAR Homes program reviewed overlaps of 123 kW in 2004. Since savings can not be

[45] Separate studies were performed by Frontier Associates for the 2003 and 2004 program market impacts. The studies included results for both the AC Distributor and AC Installer MTPs.

claimed for both programs, the savings overlap needed to be adjusted. Because the savings for the ENERGY STAR Homes program included not just the AC unit, but other measures as well, the savings were deducted from the AC Installer program. TXUED sent the information for the overlap sites, which were then used to estimate the percent reduction in savings for this program. This percentage was applied to the market study savings to determine the final savings realized by TXUED. Similar adjustments were applied in the estimate of the MWh savings.

A review of TXUED's AC Installer database revealed that the 2004 annual report savings included a 35,200 Btuh (3 ton) system that was erroneously entered in the database as 352,000 (30 ton). In addition, the verification of the 2003-2004 sample of hard copy records found that the equipment SEER or tonnage rating shown in the documentation disagreed with what was recorded in the program database on nine projects, and that the ARI equipment datasheets were missing for two projects. However, given that the SEER rating in both the database and the documentation was above 10 (the minimum SEER level that could be manufactured during these years)[46], and that TXUED used the same market study discussed above for the AC Distributor MTP to determine average system savings for 2003 and 2004, the overall annual savings were not adjusted based on these findings. This resulted in a sample realization rate of 100.0% (Table 3-68).

In reviewing the overall savings claimed to the census of records in the database, the audit team noted that the savings claimed in 2004 are approximately double those claimed in 2003, while the 2004 installations in the database that applied for incentives is approximately half that shown for 2003. This would indicate that the market effects of the program have been significant, crediting TXUED for substantial savings in 2004 that did not require incentives.

Similar adjustments were applied in the estimate of the MWh savings. The final estimates and ranges for MWh savings are presented in Table 3-69.

The market transformation programs do not require inspections, yet TXUED, as part of a quality assurance program, inspected 100% of the systems for both 2003 and 2004 to verify serial numbers and tonnage capacity. The results of these inspections revealed that some systems had installation issues that disqualified them from the program. Installation issues included mismatched coils and compressors, incorrect serial numbers, duct leakage and fan flow relationships above the 10 % maximum, or poor installation practices. Failing systems were zeroed out in the savings database before reporting so no further database wide adjustments were required.

[46] The AC Installer MTP was required to meet the same minimum SEER 13 rating as the AC Distributor.

Table 3-68. Peak Demand Savings Adjustments and Sample Realization Rates, TXUED AC Installer, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	1,790	9,360
Program-wide Adjustments	**B**	0	-123
Subtotal	**C=A+B**	1,790	9,237
Sample Realization Rate	**D**	100.0%	100.0%
Verified Savings*	**E=C*D**	**1,790**	**9,237**
Total Adjustments to Reported Savings	**E-A**	0	-123
Program Realization Rate	**E/A**	100.0%	98.7%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-69. Verified Peak Demand and Energy Savings, TXUED AC Information and Training MTP, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	1,790	1,790	1,790	1,790	9,360	9,237	9,237	9,237
MWh	2,643	2,643	2,643	2,643	12,001	11,844	11,844	11,844

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.9 Multifamily Water & Space Heating

Across the two utilities administering the Multifamily Water & Space Heating MTP, 902 kW of peak demand reduction were realized in 2004, which is 99.9% of the total reported savings (Table 3-70).

Table 3-70. Peak demand savings (kW) by Utility—Multifamily Water & Space Heating[47]

	2003			2004		
	Reported	Verified*	Verification Realization Rate	Reported	Verified*	Verification Realization Rate
CNP	N/A	N/A	N/A	299	299	100.0%
TXUED	N/A	N/A	N/A	604	603	99.8%
TOTAL	**N/A**	**N/A**	**N/A**	**903**	**902**	**99.9%**

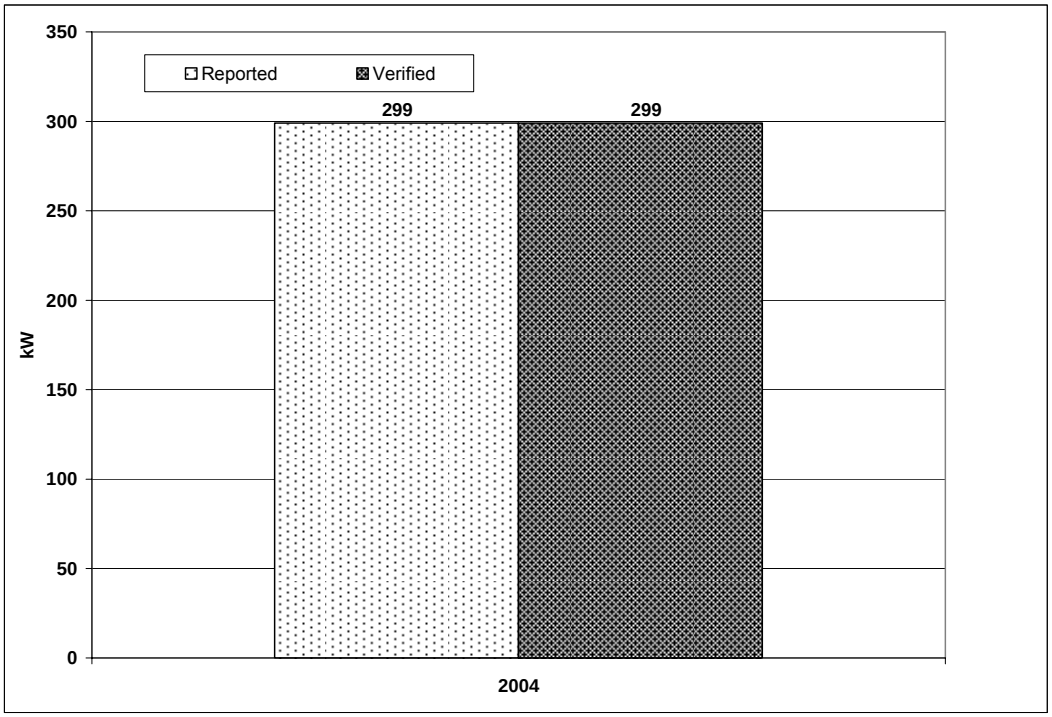
* Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

[47] The MF Water & Space Heating program was not started until 2004.

3.9.1 CNP

The M&V audit of CNP's Multifamily Water & Space Heating MTP verified 299 kW of savings in 2004 (Figure 3-33). These savings represent a kW realization rate (compared to reported values) of 100.0%.

Figure 3-33. Peak Demand Savings (kW), CNP Multifamily Water & Space Heating MTP, 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

The 2004 database fully supported the utility's claims of both peak demand and energy savings, with valid customers and installations from the databases accounting for 100% of the reported savings.

A review of the census of records in the database revealed no outliers. There were, therefore, no adjustments to the savings required for the database review.

The market transformation programs do not require inspections, yet CNP, as part of a quality assurance program, inspected 36 systems (5.1%) in 2004[48]. The results of these inspections revealed that one project site had an incorrect EF value for the equipment installed. This error was found in the inspection but was not corrected in the savings database.

In addition, a review of the census of projects by the audit team revealed that all the information from the inspection reports was identical to the program database, with the exception of the EF value error noted previously. This error, however, did not impact the demand savings, so the sample realization rate was 100.0% (Table 3-71).[49]

[48] Totals derived from a query of the projects inspected in CNP's Multifamily Water & Space Heating database.

[49] The peak demand for water heaters of 0.42 kW does not change with EF value.

No uncertainty was identified by the audit team during the sample review, therefore, the lower bound, upper bound, and best estimate of verified energy savings are all the same. The range of peak demand savings is presented in Table 3-72.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. The final estimates and ranges for MWh savings are presented in Table 3-72.

Table 3-71. Peak Demand Savings Adjustments and Sample Realization Rates, CNP Multifamily Water & Space Heating MTP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	N/A	299
Program-wide Adjustments	**B**	N/A	0
Subtotal	**C=A+B**	N/A	299
Sample Realization Rate	**D**	N/A	100%
Verified Savings*	**E=C*D**	**N/A**	**299**
Total Adjustments to Reported Savings	**E-A**	N/A	0
Program Realization Rate	**E/A**	N/A	100.0%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-72. Verified Peak Demand and Energy Savings, CNP Multifamily Water & Space Heating MTP, 2003 and 2004

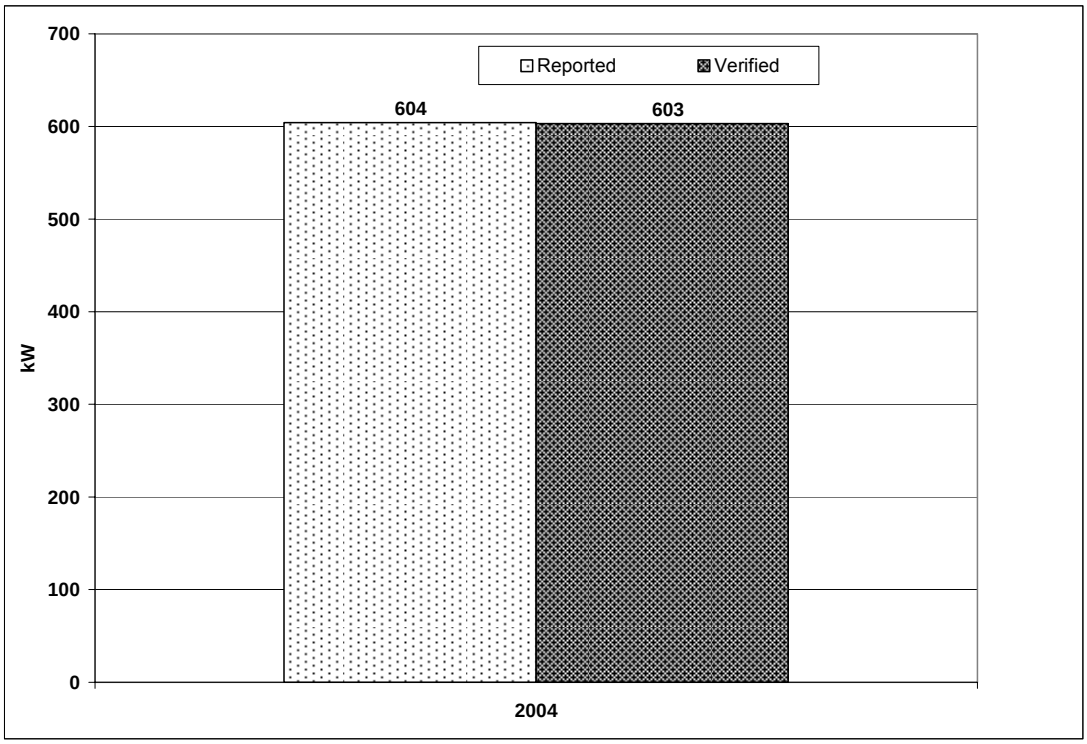
	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	N/A	N/A	N/A	N/A	299	299	299	299
MWh	N/A	N/A	N/A	N/A	1,527	1,503	1,504	1,504

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

3.9.2 TXUED

The M&V audit of TXUED's MF Water & Space Heating MTP verified 603 kW of savings in 2004 (Figure 3-34). These savings represent a kW realization rate (compared to reported values) of 99.8%..

Figure 3-34. Peak Demand Savings (kW), TXUED Multifamily Water & Space Heating MTP, 2004



Verified savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor any savings uncertainty explicitly identified by the audit team.

The 2004 database fully supported the utility's claims of both peak demand and energy savings, with valid customers and installations from the databases accounting for 100% of the reported savings.

A review of the census of records in the database revealed no outliers; however, five of the eleven project sites used central boilers rather than individual water heaters for each home. Actual energy savings, demand savings and efficiency levels for boilers are generally higher than individual units, but could not be calculated without load data for those projects. This information was not supplied in the project datasheet, resulting in no change to the savings for these five sites.

The remaining six project sites used individual water heaters to serve each home, or one commercial size water heater to serve a small group of homes. The savings values could be validated for these projects based on reported tank size and EF values. TXUED elected to use average savings values of 0.42 kW and 1932 MWh per residence for all installations rather than to use the actual deemed savings values based on tank size and EF value.[50] The audit team verified the savings using the actual EF and tank sizes, resulting in a net increase in savings for the sites with individual water heater. Two of the six sites claimed savings for units that supplied pools or spas. These water heaters did not qualify for program incentives and were removed from the savings totals. After accounting for these factors, the Multifamily Water & Space Heating realized 99.8% of the 2004 kW savings (Table 3-73).[51]

[50] These are the savings values for a 40 gallon gas water heater, EF value 0.56 found in the RES/HTR SOP deemed savings document.

[51] The peak demand for water heaters of 0.42 kW does not change with EF value.

No uncertainty was identified by the audit team during the sample review, therefore, the lower bound, upper bound, and best estimate of verified energy savings are all the same. The range of peak demand savings is presented in Table 3-74.

The majority of reported energy savings were verified in the same proportion as the peak demand savings. The final estimates and ranges for MWh savings are presented in Table 3-73.

The market transformation programs do not require inspections, yet TXUED, as part of a quality assurance program, inspected a portion of the apartment units for 100% of the reported MF sites. In the case of individual apartment units within a multi-family site, the inspection percentage varied based on access, but the utility reported inspecting at least 40% of the individual apartment units for each site. The units inspected are noted by the checkmarks placed on the inspection reports, which were verified by the audit team. Individual apartment numbers were not documented due to the large volume inspected at each site.

In the case where a group of individual apartment units in one building were served by a central water heater, each water heater serving those units was inspected. This applied to 100% of the individual apartment buildings at each site. Where a central boiler was installed, 100% of the boilers at each multi-family site were inspected. Where possible a plan review was also performed to ensure the number of individual apartment units served by each boiler was consistent with claims by the sponsor.

Table 3-73. Peak Demand Savings Adjustments and Sample Realization Rates, TXUED Multifamily Water and Space Heating MTP, 2003 and 2004

	Calculation	2003	2004
Reported Savings	**A**	N/A	604
Program-wide Adjustments	**B**	N/A	0
Subtotal	**C=A+B**	N/A	604
Sample Realization Rate	**D**	N/A	99.9%
Verified Savings*	**E=C*D**	**N/A**	**603**
Total Adjustments to Reported Savings	**E-A**	N/A	-1
Program Realization Rate	**E/A**	N/A	99.9%

* Verified Savings values are point estimates that do not reflect statistical uncertainty from extrapolation of the sample results nor the savings uncertainty explicitly identified by the audit team.

Table 3-74. Verified Peak Demand and Energy Savings, TXUED Multifamily Water & Space Heating MTP, 2003 and 2004

	2003				2004			
		Verified				Verified		
	Reported	Low	Best Estimate	High	Reported	Low	Best Estimate	High
kW	N/A	N/A	N/A	N/A	604	603	603	603
MWh	N/A	N/A	N/A	N/A	2,780	2,845	2,845	2,845

Note: The best estimate of verified savings is the point estimate that best reflects the assessment conducted by the audit team. The low and high values reflect both statistical uncertainty from extrapolation of the sample results and any savings uncertainty explicitly identified by the audit team.

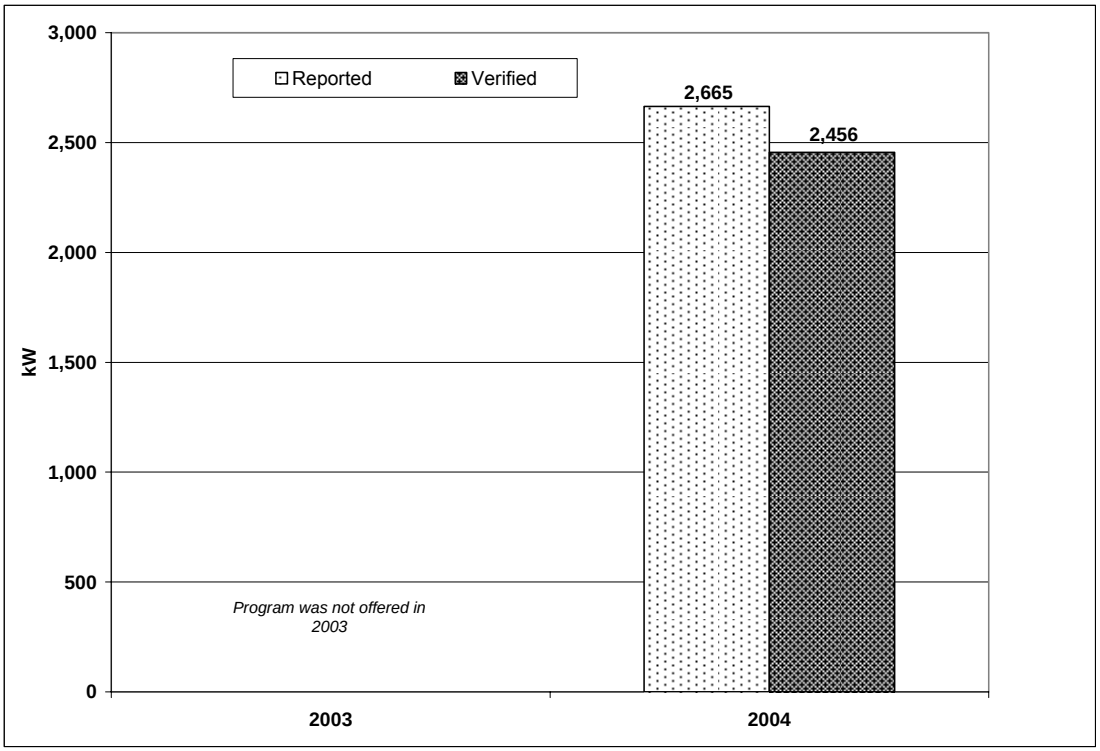
3.10 Retro-Commissioning

CenterPoint Energy is the only utility to have offered the Retro-commissioning program, which began operation in 2004.

3.10.1 CNP

The M&V audit of CenterPoint Energy's Retro-commissioning program verified 2,456 kW and 2,236 MWh of savings in 2004, the first year that the program was offered (Figure 3-35). These savings represent realization rates of 92% for peak demand savings and 83% for energy savings.

Figure 3-35. Verified Peak Demand Savings, CNP Retro-Commissioning 2003 and 2004



Since the RCx program only had four participants, there was no program database. Instead, the Verification Phase reports serve as CenterPoint Energy's record of achieved savings. These reports identify fewer savings than what the utility reported due to the fact that reported savings were based on Investigation Phase reports, which were completed prior to the installation of measures and therefore did not reflect final savings values. Specifically, peak demand savings were 170 kW lower than reported, and energy savings were 346 MWh lower than reported (Table 3-75).

The audit team's review of the measures performed and the associated savings calculations found that most savings estimates from the reports appear valid. However, several reporting and calculation flaws were identified that resulted in a reduction in savings of 39 kW and 107 MWh.

Table 3-75. Savings Adjustments and Program Realization Rates, CNP 2004

	Calculation	kW	MWh
Reported Savings	**A**	**2,665**	**2,689**
Adjustments for Verification Phase Reports	**B**	-170	-346
Adjustments to Savings Calculations	**C**	-39	-107
Subtotal	**D=A+B+C**	2456	2,236
Sample Realization Rate	No sample—all customers reviewed		
Verified Savings*	**E=D**	**2456**	**2,236**
Total Adjustments to Reported Savings	**E-A**	-209	-453
Program Realization Rate	**E/A**	92%	83%

The reporting and calculation flaws that contributed to the savings reductions included the following:

1. VFD calculations assumed un-modified application of theoretical affinity laws, which govern the relationship between drivepower and fluid flow (e.g., air and water). In practice, static pressure losses decrease savings from the theoretical values and inherent losses within the VFDs should have been included. It is estimated that these losses amount to 6 kW and 22,000 kWh.

2. Secondary effects from recommendations were not adequately addressed in calculations. In some cases these omissions overstate savings, in other cases, they understate savings. The net impact of these omissions was quite small but was included in the calculation of verified savings. Some of the issues addressed include:
    a. If discharge air temperatures are raised in a VAV system, airflow and fan power must increase to achieve the same service.
    b. If chilled water temperatures are raised in a variable pumping system, water flow and pump power must increase to deliver the same cooling capacity.
    c. If exhaust fans are turned off, fan power is saved *and* there is a reduction of ventilation loads.

3. Incandescent lighting should be adjusted to reflect the rated voltages of the light bulbs. Almost all building engineers and janitorial staff use 130V rated incandescent lamps to increase bulb life 2-5 times, but de-rate power and light output by 10%-15%. Due to uncertainty regarding the rated voltages of the lamps in question, Summit Blue included 50% of the incremental savings in our best estimate and gave no credit or full credit for the incremental savings in our low and high estimates, respectively. The total incremental savings in question is 2 kW and 7,000 kWh.

4. Estimated savings from two recommendations from the healthcare facility report doubled between the Investigation Report and the Verification Report without any documentation. The audit team found full justification for the original estimate and credited 50% of the increase toward the best estimates and gave no credit or full credit for the savings increase in the lower and upper bound estimates, respectively. The total incremental savings in question is 38 kW and 57,500 kWh.

Due to the uncertainty in verified savings discussed above, the peak demand estimate has a range around it of approximately ±20 kW. Similarly, the verified energy savings are estimated to be within 36 MWh of the best estimate (Table 3-76).

Table 3-76. Verified Peak Demand and Energy Savings, CNP Retro-commissioning, 2004

	2004			
		Verified		
	Reported	Low	Best Estimate	High
kW	2,665	2,436	2,456	2,473
MWh	2,689	2,201	2,236	2,273

In addition to the uncertainty in savings estimates described above, there is a *significant additional element of uncertainty* regarding whether peak demand reductions, as calculated according to the definition in the PUC rules, actually contribute to a reduction in the utility's annual system peak load. At issue are measures that reduce load for only a portion of the "peak period" and for which savings may not be coincident with system peak demand.[52] For example, at one site savings accounting for roughly half of all program savings are expected to occur between 5:00 p.m. and 6:00 p.m. only (from early shut-off of some air-handling equipment). If the annual system peak occurs outside of this narrow window, then the savings will not contribute to reduction of the utility's peak demand. Similarly, another quarter of all program savings (from chiller lag control and temperature reset) are expected to occur only when temperatures are low or moderate—which is not likely to be coincident with the utility's summer peak. Coincidence with system peak varies by measure, and is dependent on each measure's load shape as compared to a baseline load shape. Other measures implemented through the program may be contributing to coincident peak reduction. In general, Retro-commissioning measures contribute energy savings and generally improve equipment performance.

The audit team believes that the savings reported by CenterPoint Energy for the Retro-Commissioning program do, in fact, meet the definition of Peak Demand Reduction, which requires only that reductions occur "over a period of one hour during the peak period" (PUCT Substantive Rule 25.181(c)(26)), and these savings have been verified accordingly in the findings above. However, there is a high probability that the savings would not contribute to a "reduction in growth of demand…measured at the utility's annual system peak…" [25.181(f)] which is the basis of the energy savings goals established by the Commission.

[52] "Peak Period" is defined as "…from May 1 through September 30, during the hours between 1:00 p.m. and 7:00 p.m., excluding federal holidays and weekends." Source: PUCT Substantive Rule 25.181(c)(27)

4. REVIEW OF DEEMED SAVINGS ASSUMPTIONS

This section provides a summary of the desk review of the deemed savings assumptions that was performed for key program measures. The objective of this review was to trace the savings assumptions for key measures, in order to determine if the assumptions appear to be reasonable and appropriate for the applications for which they were used within the programs reported by the utilities. Deemed savings values, many of which were developed by Frontier Associates, are filed with the PUCT and the public had an opportunity to comment on the savings values.[53] Note that this review does not include analysis of the 2006 *provisional* A/C deemed savings, which are being reviewed separately.[54]

The measures reviewed in this chapter account for a very high percentage of overall program savings in the state. Table 4-1 below summarizes the results of this review. Section 4.1 provides a review of the deemed savings for measures in the Residential and Small Commercial programs, Section 4.2 reviews the A/C distributor program, and section 4.3 discusses measures offered in the C&I SOP.

[53] Energy and peak demand savings values used for the 2003-2004 program years were accepted by the PUCT and posted to the PUC Interchange site. These values were primarily obtained from Projects Nos. 22241 and 27903.

[54] Summit Blue is performing a review of the provisional A/C savings that were recently developed by Frontier to adjust baselines for changes in federal A/C standards. This review will be reported through a separate technical memorandum, and will not affect the values used for 2003-2004 programs.

Table 4-1. Summary of Deemed Savings Review of Key Measures

MEASURE	Comments/Recommendations
Duct Efficiency Improvement	Energy savings values are reasonable
Efficient Water Heater Replacements	Deemed energy savings for MF and RSC/HTR water heating measures appear reasonable and accurate
Air Infiltration	Energy savings values are reasonable, and in fact may be underestimated
Low Flow Showerheads	Energy savings are reasonable, and are probably understated for homes with more than one showerhead
Faucet Aerators	Deemed kWh values are conservative & may account for the removal of some aerators after installation. The kW value seems low based on data from other studies, thus the *demand* savings for this measure should be re-assessed for future program years.
Water Heater Jacket	The methodology and values appear to be reasonable.
Water Heater Pipe Insulation	It is recommended that the deemed *demand* savings for this measure be re-evaluated for future program years, but that no savings adjustments be made for the 2003/2004 program reported savings.
Central A/C replacement	Demand savings were overestimated for units ranging from 12-14 SEER and were underestimated for units above 14 SEER. The methodology also does not account for demand for coincidence with system peak. As a result, the deemed peak *demand* reductions associated with this measure should be re-assessed.
Ceiling Insulation	The deemed savings methodology and values for the ceiling insulation measure appear to be reasonable.
Compact Fluorescent Lamps	It is unlikely that all program-installed CFLs meet the 3 hrs per day requirement. Thus, uncertainty is higher for this measure.
A/C Distributor air conditioners	More detailed location-specific modeling would be required to determine the best estimation method for each utility. A standard method of estimation that could be consistently applied across all utilities is recommended going forward.
C&I Cooling Equipment Simplified M&V	Based on sample calculations and industry standards, the methodology and coefficients appear reasonable.
Commercial Lighting Simplified M&V	The wattages tables compare closely with other jurisdictions, thus the M&V team assumes the values in the table are accurate.

4.1 Residential & Small Commercial Deemed Savings

For all envelope measures, (e.g., ceiling insulation) the presence of electric air conditioning or heat pumps were assumed when calculating deemed savings values. Separate deemed savings values were calculated for homes with electric air conditioning / gas heat, and for electric air conditioning/ electric heat.

For climate-sensitive energy efficiency measures, separate calculations were performed for four different regions of the state:

- Panhandle- using typical weather information for Amarillo
- North- using typical weather information for Dallas
- South- using typical weather information for Houston
- Valley- using typical weather information for Corpus Christi

The M&V team assessed the reasonableness of the deemed savings values (kW, kWh) for *key* energy efficiency measures, as listed in Table 4-1 above. In the residential and HTR programs, measures reviewed accounted 99% of the savings for the 2003/2004 timeframe.

4.1.1 Duct Efficiency Improvement

This measure applies to both the RES and HTR SOP. The energy efficiency measure seals leaks in supply and return ducts and repairs or reinsulates the ducts of existing homes and small commercial facilities that have central electric air conditioning or heat pumps. Using long-lasting materials (e.g., mastics, tape-applied mastics, foil tape, and/or aerosol-based sealants) the measure must reduce leakage rates to less than 5% of air handler fan flow, verified by post-retrofit duct pressurization tests. To determine whether deemed savings have been realized, pre- and post-retrofit duct leakage rate measurements are taken with duct pressurization equipment.

Baseline

Minimum pre-installation duct leakage rate is ≥10% of air handler fan flow.[55] In addition, HTR project post-installation leakage rates must comply with the Minimum Final Ventilation Rate table shown in the Air Infiltration section of the deemed savings document noted previously. A baseline home of 1850 sqft was used to calculate deemed savings values at an average pre-installation duct loss factor of 25% and an average post-installation duct loss reduction of 20%.[56] Since this measure is for residential retrofit applications only, it is reasonable to assume that many of the homes treated will have base duct losses of more than this.

Coefficients

The deemed demand (kW/sqft) and energy (kWh/sqft) savings values were calculated by Frontier using ESPRE 2.1 (EPRI Simplified Program for Residential Energy) modeling software and available TMY weather data for a base home in the four climate zones. The deemed savings model was calibrated for the four climate zones using the base home assumptions. Modeling resulted in savings value factors for three configurations of HVAC equipment: electric AC with gas heat, electric AC with electric resistance heat, and an electric AC heat pump for both heating and cooling. These savings value factors are laid out in the deemed savings document sited previously. This combination of heating types and climate zones seems to provide good coverage of the utility service territories, taking into account the wide variety of possible climates and housing types.

Calculation

Based on these values, deemed savings were calculated using the following formulas:

kWh = SqFt * Value *(in kWh Impact Table)*

kW = SqFt * Value *(in kW Impact Table)*

Savings Value Verification

Duct efficiency energy savings are highly dependent on a large number of variables including but not limited to, age and quality of the duct system, climate zone, home size and layout, home infiltration rate,

[55] *Deemed Savings, Installation and Efficiency Standards, Residential and Small commercial Standard Offer Program, and Hard-To-Reach Standard Offer Program, Duct Efficiency Improvement, May 2003,* (16 TAC 25.184(d)(1).

[56] For HTR projects, infiltration must be reduced at least 30%.

volume of conditioned space, home construction materials, duct locations, and heating and cooling hours per year. The interactive nature of these different factors make it impossible to conduct general energy savings comparisons without rigorous calibrated modeling, as was done by Frontier when constructing the deemed savings tables. The audit team, did however, conduct a few comparisons to validate the peak cooling demand savings.

To perform a comparison of demand savings, the four Texas climate zones were matched with cities in California having similar climate zone designations as classified by the Energy Information Administration.[57] The California climate zones were then used to perform energy savings comparisons using the Database for Energy Efficiency Resources (DEER) published by the California Energy Commission.[58]

Existing studies referenced by Frontier indicated an average energy savings of 18.5% for duct efficiency measures.[59] Applying this percentage to the baseline heat pump (HSPF 7.2, 3.5 ton, 10 SEER) energy demand stated in the DEER database for Fresno (comparable to Dallas, Houston and Corpus Christi) resulted in a peak demand reduction of 0.00047 kW/sqft, which is very close to the deemed savings of 0.000486 kW/sqft.

A second approach was used by comparing the magnitude difference between cooling loads for California and Texas using Energy Information Administration (EIA) census data. Average statewide cooling energy consumption reported by the EIA indicate values of 967 kWh/yr for California and 4,327 kWh/yr for Texas.[60] This equates to a cooling load ratio of approximately 4.5 times more for Texas. Referring again to the DEER database for a duct efficiency project in Fresno which reduced the duct leakage from 24% to 12% (a 50% reduction) resulted in a demand savings of 0.00087 kW/sqft. Multiplying this value by the cooling load ratio between CA and TX results in a demand savings of 0.00039 kW/sqft, also similar to the 0.000486 kW/sqft deemed savings.

While the demand savings values seem reasonable, the kWh savings for the different methods and sample DEER project sites were significantly different than the deemed savings tables. The duct savings measure indicated 1.26 kWh/sqft energy savings for a gas heated home, nearly double the deemed kWh savings values while the heat pump comparison indicated 0.63 kWh/sqft savings, approximately 50% of the deemed kWh savings values. These discrepancies are due to the different nature of the two regions with Fresno, a desert area, being much less humid than any region in Texas. Cooling equipment will therefore be used more often in Texas and will, most probably be set to a lower temperature to compensate for the humid climate.

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[57] Climate data for comparable zones in California and Texas were found at EIA website http://www.doe.gov/emeu/recs/climate_zone. Amarillo, TX was found to have a similar climate (EIA zone 4) to Oakland CA. The remaining Texas areas (EIA zone 5) were found to have a similar climate to Fresno, CA. Accessed 7/11/06.

[58] http://eega.cpuc.ca.gov/deer/, Accessed 7/11/06.

[59] Existing studies cited were EPRI's study *Residential Duct Sealing Cost-Benefit Analysis*, June 2000, which estimated 19-21% energy savings, and a LBNL report titled *Analysis of Duct Sealing Savings Potential in Texas*, April 2000, prepared by Mark Modera which supports a demand reduction of 17-20%. An average of these numbers was estimated to be 18.5%.

[60] Energy consumption averages were found for the four most populated states at http://www.eia.doe.gov/emeu/recs/recs2001_ce/ce4-7c_4popsstates2001.html, Accessed 7/11/06.

Based on the demand savings sample calculations, and the use of the ESPRE models by Frontier when developing the deemed savings tables, the audit team believes that the energy savings values are reasonable.

4.1.2 Efficient Water Heater Replacements (Multifamily)

This measure applies to both the RES and HTR SOPs, and the Multifamily Water & Space Heating(MF) MTP. The energy-efficiency measure involves installing new or retrofitting high efficiency gas water heating equipment in place of electric baseline water heating equipment. Minimum efficiency levels for new water heaters is 4% above baseline.

Baseline:
Baseline efficiency factors (EF) for gas and electric water heaters have been listed for standard water heater tank sizes in the deemed savings document.[61] The baseline for electric and gas water heaters is the DOE energy efficiency standard (10 CFR Part 430, 2000). The method for calculating standards compliance is:

*Electric = 0.93 - 0.00 132 * tank volume*

*Gas = 0.62 - 0.0019 * tank volume*

Deemed Savings Values
Energy savings for water heating (kWh) is calculated on a per water tank basis and is highly dependent of tank volume, installed unit energy factor (EF) as rated by the Gas Appliance Manufacturers Association, and the gallons of hot water demand per day.

Calculations
Energy savings can be calculated using standard engineering methods and unit conversion factors with the following base assumptions for residential hot water use:[62]

Average hot water use per person per day	= 13 gal/person/day
Number people per bedroom	= 1.5 (1 bathroom)
	= 2.0 (2 bathroom)
Base hot water demand per day	= 62 gallons/day

Beginning with an equivalent electric tank volume (gallons) and number of bathrooms and bedrooms, one can quickly calculate the annual water heating energy required, adjust this value for the electric water heater EF value, convert the resulting annual DHW kWh to therms, and adjust for the EF of the gas water heater to determine the equivalent kWh that will be used to heat the water with gas.

Savings Value Verification
The net energy savings is the difference between the original calculated electric water heating energy requirement and the equivalent gas water heating energy (both in kWh) to heat the same amount of water.

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[61] *Deemed Savings, Installation and Efficiency Standards, Residential and Small commercial Standard Offer Program, and Hard-To-Reach Standard Offer Program, Water Heater Replacements, May 2003,* (16 TAC 25.184(d)(1).

[62] Data obtained from Water Wiser, 1999 American Water Works Association. These values also validated the same assumptions used in the CNP MF Savings Calculator Spreadsheet.

Several comparable calculations were performed by the audit team for different size water heaters, family sizes, and efficiency levels with identical results to the savings tables shown in the deemed savings document.[63]

Demand savings are based on the maximum kW reduction for the high efficiency water heater during the 1 to 7 PM period May through September. The reduction for high efficiency electric water heaters reflects the delta value for the standard and high efficiency units. The demand reduction for fuel substitution reflects the full diversified demand reduction for the electric water heater and equates to approximately 0.42 kW/yr.

Based on the comparable calculations yielding the same results the audit team finds the deemed energy savings for MF and RSC/HTR water heating reasonable and accurate.

4.1.3 Air Infiltration

This measure applies to both the RES and HTR SOPs. The energy-efficiency measure reduces air infiltration into a residence by installing measures such as foam and window caulking. Blower door air pressure readings are used pre- and post-treatment to confirm air leakage reduction, and to ensure that air infiltration in a residence does not fall below 1500 CFM_{50}. Minimum values for post-treatment ventilation can be found in the Minimum Final Ventilation Rate table. [64]

Baseline:
For residential dwellings, the baseline was an 1850 square foot home categorized as "moderately leaky," and "lightly shielded with an assumed 25% air leakage reduction post-treatment."[65] Baseline Air Infiltration Value assumptions (ACH) can be found in Appendix C of the working papers section for Air Infiltration.[62]

Coefficients
Energy savings calculations were based on the change from pre- to post-treatment air changes per hour (ACH) for the entire volume of the home.[66] The deemed demand (kW/sqft) and energy (kWh/sqft) savings values were calculated by Frontier using ESPRE 2.1 (EPRI Simplified Program for Residential Energy) modeling software and available TMY weather data for a base home in the four climate zones. The deemed savings model was calibrated for the four climate zones using the base home assumptions. [67] Modeling resulted in savings value factors for three configurations of HVAC equipment: electric AC with gas heat, electric AC with electric resistance heat, and an electric AC heat pump for both heating and cooling. These savings value factors are laid out in the deemed savings document sited previously as kWh Impact per CFM_{50} reduction and kW impact per CFM_{50} reduction. This combination of heating types and climate zones seems to provide good coverage of the utility service territories, taking into account the wide variety of possible climates and housing types.

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[63] Ibid.

[64] *Deemed Savings, Installation and Efficiency Standards, Residential and Small commercial Standard Offer Program, and Hard-To-Reach Standard Offer Program, Air Infiltration, May 2003,* (16 TAC 25.184(d)(1)

[65] For the hard-to-reach sector, an 1100 square foot home categorized as "very leaky" and "lightly shielded" was modeled.

[66] Air changes per hour are measured by the blower door test at 50 pascals ($ACH_{50)\_}$ pressure, which can then be converted to standard ACH using a variety of factors concerning the home design and weather (LBNL).

[67] For hard-to-reach a 40% reduction was assumed. A minimum of 30% air leakage reduction is specified in the hard-to-reach program template.

Calculations

Based on these values, deemed savings are calculated using the following formulas:

$kWh = CFM_{50} * Value\ (in\ kWh\ Impact\ Table)$

$kW = CFM_{50} * Value\ (in\ kW\ Impact\ Table)$

Savings Value Verification

Air Infiltration reduction energy savings are highly dependent on a large number of variables including but not limited to, climate zone, home size and layout, home infiltration rate, volume of conditioned space, home leakage, wind factors, stack effects (based on number of stories), and the average design temperature differences between indoor and outdoor air. The interactive nature of these different factors make it impossible to conduct general energy savings comparisons without rigorous calibrated modeling, as was done by Frontier when constructing the deemed savings tables. The audit team, did however, conduct a few comparisons to validate the peak cooling demand savings.

Demand savings values can be directly correlated to the change in measured blower door air flow rates pre- and post-treatment and the temperature delta between the indoor and outdoor air, if certain climate, house, and site specific factors are applied.

Beginning with the blower door measurements (Q_{50}), air changes per hour can be calculated using the following formula:

$ACH_{50} = (Q_{50} * V)$

where:

ACH_{50} = Air Changes Per Hours at 50 pascals
Q_{50} = Blower door measured air pressure at 50 pascals
V = Volume of the house

To convert ACH_{50} into an infiltration rate (I), researchers at Lawrence Berkeley National Laboratory (LBNL) developed a model to convert blower door measurements into an "equivalent leakage area.[68] The equivalent leakage area roughly corresponds to the combined area of all the house's leaks and can ultimately be used to calculate energy loss through infiltration. This base formula is for infiltration is:

$I = ACH = ACH_{50}/N = (Q_{50} * V)/N$

where:

I = Infiltration Rate (cfm)
ACH = Average Air Changes Per Hour of the home
N = Conversion factor from ACH to ACH_{50}

This formula converts the equivalent leakage area into an average infiltration rate in air changes per hour by combining the physical principles causing infiltration with a few subjective estimates of building characteristics, to create relatively robust estimates of infiltration. ASHRAE has approved the technique

[68] LBNL summary taken from an article written by Alan Meier, executive director of Home Energy magazine, *Infiltration: Just ACH Divided by 20?,* http://www.homeenergy.org/archive/hem.dis.anl.gov/eehem/94/940111.html, Accessed 7/12/06.

and describes the formulae in ASHRAE fundaments.[69] The LBNL infiltration model is now the most commonly accepted procedure for estimating infiltration rates.
And the correlation factor (N) is expressed as the product of climate, height, wind shielding and leakiness correction factors shown in the map below.[70]

*N = C*H*S*L = 11 for the model home in Amarillo TX*

where:

C = climate factor per the map	= climate factor determining stack effect = 15.5 for Amarillo, TX
H = height correction factor	= 1 for a single story home
S = wind correction factor	= 1 for a normally exposed home
L = leakiness correction factor	= 0.7 for a loose (large holes) home

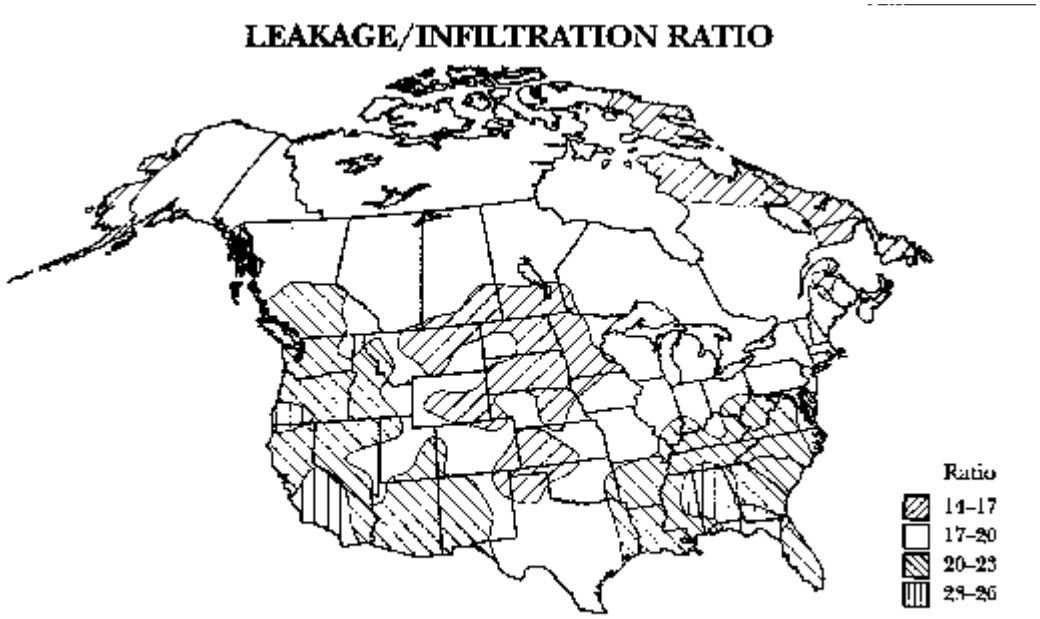

Figure 1. Climate correction factor, "C," for calculating average infiltration rates in North America. Note that the climate correction factor depends on both average temperatures and windiness. It also includes possible air infiltration during the cooling season. For these reasons, locations in greatly dissimilar climates, such as Texas and Vermont, can have equal factors. Select the value nearest to the house's location and insert it in Equation 2. This map is based on data from 250 weather stations.

Calculating from the baseline ACH (1.25) for Amarillo in winter, for a home with conditioned space of 12984 ft^3 equates to a natural air flow of approximately 270 ft^3. Reducing the infiltration by 40% would then equate to a final air flow of approximately 162 ft^3 or a change in airflow (delta Q) of 108 ft^3.

The ASHRAE Fundamentals Handbook[71] provides the following formula for infiltration heat loss based on the change in air flow rates (Q):

[69] ASHRAE Fundamentals 2001, Chapter 28.

[70] See Table 1-3 of Meier, Alan, "Infiltration: Just ACH50 Divided by 20?," Home Energy Magazine Online, January/February 1994. Original research and map created by Max Sherman of Lawrence Berkeley Laboratory.

[71] 2001 ASHRAE Fundamentals Handbook, Chapter 27, Table 1A, Heating and Wind Design Conditions.

$q_s = C_p Q \rho (t_i - t_o)$ = 3506 Btu/h = 1.027 kW = 0.000863 kW/CFM$_{50}$

where:

q_s	= heat loss (BTU/h)	
C_p	= specific heat of air	= 0.24 Btu/lb-F
Q	= air volume leakage	= 108 ft^3
ρ	= density of air @ t_o	= 0.075 lb/ ft^3
$(t_i - t_o)$	= winter delta temp	= 30 degrees F

Using similar assumptions for summer conditions and for other climate zones yields the same estimated peak demand savings, which is four times the deemed value, making the deemed value reasonable, if not quite conservatively low.

Based on the number of assumptions and correction factors that were applied for the demand savings estimates, and the fact that the final value is significantly larger than that deemed for any of the climate regions, the audit team believes that the energy savings values are reasonable, and in fact may be underestimated. This is further validated by the rigorous calculations performed by Frontier using the ESPRE model. More exact energy savings can not be determined without detailed modeling, which was not in the scope of this study.

4.1.4 Low-flow Showerheads

This measure applies to customers under the HTR SOP with electric water heating only. The energy-efficiency measure is for retrofit-only installation of a low-flow showerhead with a rated flow of no more than 2.0 gallons per minute (gpm). To qualify, existing showerheads must have a rated flow of no less than 2.5 gpm.[72] All showerheads in a home must be replaced in order to be eligible for the full deemed savings incentive.

Baseline:
A showerhead installed in a retrofit situation must meet the National Appliance Energy Conservation Act (NAECA) standard for showerheads, which requires a flow rate of 2.5 gpm at 80 psi. The average flow rate of existing stock of showerheads for energy savings calculations is assumed to be 3.4 gpm. Handheld water flow meters are used to measure pre- and post-installation water flow to ensure projects qualify and meet the minimum flow requirements.

Coefficients
Deemed savings values of 0.22 kW and 186 kWh per household were adopted for all climate zones if all showerheads in a home are replaced. Prorated savings were developed if less than 100% of the showerheads were replaced, up to four showerheads. The prorated savings values can be found in the Showerheads Per Household tables for kW and kWh savings in the Frontier deemed savings document.[73]

[72] All flow rate requirements listed here are the rated flow of the showerhead measured at 80 pounds per square inch of pressure (psi).

[73] *Deemed Savings, Installation and Efficiency Standards, Residential and Small commercial Standard Offer Program, and Hard-To-Reach Standard Offer Program, Low-Flow Showerheads May 2003,* (16 TAC 25.184(d)(1). Note that previous iterations of the deemed savings filings (in 2002) had resulted in comments from NAESCO regarding savings associated with low-flow showerheads. The resulting deemed savings values clarified the specifications for baseline and measure savings.

Savings Value Verification

Given that estimates of shower head energy savings have decreased significantly over the past 15 years, a review of only the more recent studies (1993 to 1998) cited by Frontier indicated a range of energy savings from 244 – 381 kWh/yr, with a midpoint value of 312 kWh/yr, very near the deemed value of 335 kWh/yr.[74]

Not cited by Frontier was a study completed by Proctor Engineering Group for PG&E's Low-Flow Rebate Program in 1993 calculated an average energy savings per showerhead of 237 kWh/yr, approximately 30% less than the deemed savings value. [75]

A comparison with DEER data for a single family home low-flow shower head installation resulted in savings of 133 kWh/yr and demand savings of 0.029 kW/yr. While the kW peak demand savings is nearly identical to the deemed savings, the kWh savings are 60% less.

As stated by Frontier, calculation of energy savings for shower heads is troublesome given the difficulty in separating out shower energy demand and load shapes. This uncertainty is echoed in the wide range of kWh savings values predicted by utilities and energy consultants over the past two decades (611 – 133 kWh/yr). For these reasons, and the fact that the demand savings was validated by the DEER database, the audit team feels the deemed energy savings are reasonable, but that the savings estimates should be reviewed every few years as new efficiency program impact data becomes available.

Calculating Savings for Less Than Whole House Retrofit:

No data was found to substantiate the decrease in deemed savings values when multiple showerheads existed in the home, but not all the showerheads were retrofitted.[76] In fact, the DEER data indicated savings of 133 kWh/yr and 0.029 kW/yr per showerhead installed. Most other sources referenced also stated savings in per showerhead terms and did not have algorithms to prorate the savings, with the exception of the Energy Technologies Laboratory study which indicated savings per household and energy use per shower head. Savings per household for the ETL study, however, began at a minimum of 348 kWh/household/yr.

In calculating the differences between the different quantity of showerheads installed, the evaluators found that Frontier used consistent percentages for both kW and kWh. These values as a percent of the one-showerhead option are shown in the table below:

	Showerheads per Household			
kWh & kW Savings	One	Two	Three	Four
First Showerhead	100%	37%	27%	22%
Second		100%	55%	43%
Third			100%	65%
Fourth				100%

Given that water usage is a function of the number of people per home rather than the number of showerheads, it is reasonable and conservative to assume that the deemed savings per shower head would

[74] Studies were for programs run by PG&E, PP&L Oregon, and PacifiCorp.

[75] Home Energy Magazine Jul/Aug 1994, Article titled "Savings and Showers: It's All in the Head", by John Proctor. http://www.homeenergy.org/archive/hem.dis.anl.gov/eehem/94/940112.html, Accessed 7/12/06

[76] The Energy Technologies Laboratory study cited by Frontier as having derated savings showed lower savings if faucet aerators or other shower heads shipped were not installed. It is not clear that this reference directly correlates to savings per showerhead when only looking at this measure.

in fact be less than the value obtained by multiplying the single showerhead value by the number installed. However, until further data can be found, the audit team feels while the savings are reasonable, they are probably understated for homes with more than one showerhead.

4.1.5 Faucet Aerators

This measure applies to customers under the HTR SOP with electric water heating only. The energy-efficiency measure is for retrofit-only installation of faucet aerators with a rated flow of no more than 1.5 gallons per minute (gpm) at 80 psi. To qualify, existing faucet aerators must have a rated flow of no less than 2.5 gpm.[77] Flow ratings on existing aerators must be legible to qualify for incentives.

Baseline:
The average rated flow rate of the existing stock of faucets is assumed to be 4.0 gpm at 80 psi. Handheld water flow meters are used to measure pre- and post-installation water flow to ensure projects qualify and meet the minimum flow requirements.

Coefficients
Deemed savings values of 0.0067kW and 48 kWh per household were adopted for all climate zones regardless of the number of aerators installed.

Savings Value Verification
Savings values for the sources cited by Frontier ranged from 150-100 kWh/household/yr.[78] Similarly, the DEER database indicated savings of 100 kWh/yr and 0.022 kW/yr per household for faucet aerators installations.

While the deemed kWh savings values calculated by Frontier are lower than comparable studies or research, it is conservative and can therefore account for the partial removal of some aerators after installation. This was the approach taken by the Energy Technologies study cited previously. The audit team therefore believes the kWh savings are reasonable, though they may be a bit low.

Conversely, the kW deemed savings value seems extremely low based on the comparative data from DEER which showed similar kWh savings values to two other studies but a kW value which was over 300% of the deemed demand savings. The audit team, therefore, recommends that Frontier reevaluate the deemed demand savings for this measure for future program years.

4.1.6 Water Heater Jacket

This measure applies to customers for both the RSC and HTR SOP with electric water heating only. The energy-efficiency measure is for retrofit-only installation of a water heater jacket with an R-value of no less than R-6.7 (approximately two inches of fiberglass).

[77] All flow rate requirements listed here are the rated flow of the showerhead measured at 80 pounds per square inch of pressure (psi).

[78] The Energy Technologies Laboratory study cited by Frontier as having derated savings showed lower savings if faucet aerators or other shower heads shipped were not installed. Since the HTR program installs measures direction, the audit team assumed a 100% installation rate and increased the deemed savings cited by Frontier from 73 to 100 kWh/household.

Baseline:
Baseline is assumed to be a post-1991, storage-type, electric resistance water heater, with no water heater jacket.

Coefficients
Deemed savings values of 0.01kW and 100 kWh per household were adopted for all climate zones.

Savings Value Verification
Numerous studies have been conducted on the effects of external insulation on electric water heaters. Savings estimates vary significantly based upon water heater size, water heater set-point (140 degrees vs. 120 for post-1991 models), and location (conditioned vs. unconditioned space), and whether the water heater was manufactured pre- or post-1991.

Savings from water heater wraps are considerably less on post-1987 NAECA heaters (manufactured after 1991) for a couple of reasons: newer heaters have higher levels of insulation, and the set-point temperatures have been reduced from 140 degrees to 120 degrees, thereby further reducing standby heat loss. For the purpose of the deemed savings values, we will take the conservative approach in assuming that all retrofitted water heaters will be post-1987 NAECA. Electric water heaters manufactured to NAECA standards typically have R-16 wall insulation (about 2.5 inches of foam insulation), vs. R-6 wall insulation for most units built prior to 1991.

As cited by Frontier, the 4th *Draft of the Northwest Conservation and Electric Power Plan - 1997* (Volume II Part 2, pgs.74-77, indicates that addition of a R-10 wrap on a high efficiency electric water heating tank (EF 0.93) yields an average annual energy savings of 96 kWh, which is very near the deemed savings value of 100 kWh/home.

Demand savings for water heater jackets depend largely on the location of the water heater. Using 100 kWh annual savings for a water heater jacket produces a maximum summer 1 PM to 7 PM period kW reduction of 0.01.

After reviewing the assumptions and source documents for water heater jacket savings estimates, the audit team believes the methodology and values to be reasonable.

4.1.7 Water Heater Pipe Insulation

This measure applies to customers for both the RSC and HTR SOP with electric water heating only. The energy-efficiency measure is for retrofit-only installation of water pipe insulation.

Baseline:
Baseline is assumed to be a typical electric water heater with no insulation on the piping. Water heater pipe insulation must have an R-value of at least R-3.5. Insulation must be applied to all accessible portions of the first five feet of hot water pipes.

Coefficients
Deemed savings values of 0.004 kW and 40 kWh per household were adopted for all climate zones.

Savings Value Verification
Cited by Frontier was Pacific Gas and Electric Company's 1998 Residential Standard Performance Contract which used a deemed savings value of 40 kWh/year for water heater pipe insulation. This document could not be found by the audit team to validate these values.

In comparison the DEER database indicates an energy savings of 133.3 kWh/home and 0.029 kW/home. Both values are significantly larger than the deemed savings values[79].

Finally, in a proposal for the 2004 PG&E Central Valley Mobile Home HTR program, deemed savings values of 87 kWh/yr and 0.012 kW/yr were assumed.[80] Clearly, assumptions for energy savings resulting from pipe insulation vary greatly, with the deemed savings values calculated for Texas being significantly less than comparable programs.

Again, taking the conservative approach, the audit team finds the savings values reasonable, though we would recommend further savings analysis be performed to be sure the deemed savings values have not been significantly underestimated.

The audit team, therefore, recommends that Frontier reevaluate the deemed demand savings for this measure for future program years, but that no savings adjustments be made for the 2003/2004 program reported savings.

4.1.8 Central Air Conditioner Replacement

This measure applies to both the RSC SOP and the HTR SOP. The energy-efficiency measure is a retrofit to a new central air conditioning system with a minimum efficiency of 13 SEER for the RSC SOP and 12 SEER for the HTR SOP. Qualifying units must have cooling capacities in the range of 18,000 – 65,000 Btu/h.

The baseline used for the RSC SOP was 10.5 SEER, while the baseline for the HTR SOP was 10 SEER. The NAECA standard for 2003 and 2004 was 10 SEER. Since this measure is for residential retrofit applications, it is reasonable to assume that many of the replaced units had efficiencies well below the NAECA standard, thus making the program baseline efficiency somewhat conservative. This baseline is also consistent with AC baselines used in other parts of the country. For example, the Database for Energy Efficient Resources (DEER), an authoritative and well-documented resource for estimating energy and peak demand savings, includes many different baseline scenarios for residential AC retrofits. For a 13 SEER system, the baseline scenarios include 6.7, 8.5, 9.0, 9.5, and 10 SEER. [81]

The deemed demand and energy savings are presented in a table whose cells are a combination of unit size and efficiency. Table 4-2 for the RSC SOP includes 8 size categories (ranging from 1.5 to 5.0 tons) and 6 efficiency categories (ranging from 13.00 to 17.99 SEER). Table 4-3 for the HTR SOP includes just 5 efficiency categories (ranging from 12.00 to 15.99 SEER). The two tables presented here include the demand savings for the RSC SOP and the HTR SOP.

[79] http://eega.cpuc.ca.gov/deer/, Accessed 7/12/06.

[80] American Synergy-RMA Hard-to-Reach Mobile Home Proposal for PG&E in the California central valley, February 12, 2002. http://www.synergycompanies.org/CPUC-Proposal-3rdParty.pdf , Accessed 7/12/06.

[81] Retrofits with higher-efficiency systems (14-18 SEER) include a baseline case of 13 SEER, but it is only one case out of six.

Table 4-2. Residential/Small Commercial Standard Offer Program

Central Air Conditioner Replacement – Res/SC SOP Demand Savings, All Climate Zones								
Size (tons)	**ARI Rated BTU/Hr**		***SEER Range***					
	Minimum	**Maximum**	**13.00-13.49**	**13.50-13.99**	**14.00-14.99**	**15.00-15.99**	**16.00-16.99**	**17.00-17.99**
1.5	15,000	20,999	0.36	0.41	0.41	0.41	0.41	0.41
2.0	21,000	26,999	0.47	0.54	0.54	0.54	0.54	0.54
2.5	27,000	32,999	0.59	0.68	0.68	0.68	0.68	0.68
3.0	33,000	38,999	0.71	0.81	0.81	0.81	0.81	0.81
3.5	39,000	44,999	0.83	0.95	0.95	0.95	0.95	0.95
4.0	45,000	50,999	0.95	1.08	1.08	1.08	1.08	1.08
4.5	51,000	56,999	1.07	1.22	1.22	1.22	1.22	1.22
5.0	57,000	62,999	1.19	1.35	1.35	1.35	1.35	1.35

Table 4-3. Hard-to-Reach Program Template

Central Air Conditioner Replacement – HTR SOP Demand Savings, All Climate Zones							
Size (tons)	**ARI Rated BTU/Hr**		**SEER Range**				
	Minimum	**Maximum**	**12.00-12.49**	**12.50-12.99**	**13.00-13.99**	**14.00-14.99**	**15.00-15.99**
1.5	15,000	20,999	0.33	0.39	0.47	0.56	0.56
2.0	21,000	26,999	0.44	0.52	0.62	0.74	0.74
2.5	27,000	32,999	0.55	0.65	0.78	0.93	0.93
3.0	33,000	38,999	0.66	0.78	0.93	1.12	1.12
3.5	39,000	44,999	0.77	0.91	1.09	1.30	1.30
4.0	45,000	50,999	0.88	1.04	1.24	1.49	1.49
4.5	51,000	56,999	0.99	1.16	1.40	1.68	1.68
5.0	57,000	62,999	1.10	1.29	1.56	1.86	1.86

The methodology for determining energy savings involves a standard calculation in which energy savings are a function of the unit size, baseline SEER, energy-efficient SEER, and cooling load hours, which vary by climate zone:

$$kWhSavings = Tons * OpHrs * AdjFactor * \left(\frac{12}{SEER_{base}} - \frac{12}{SEER_{EE}} \right)$$

where:

- *Tons* = Unit capacity in tons of cooling
- *OpHrs* = Operating hours by climate zone
- *AdjFactor* = Appears to be an adjustment for full-load operating conditions
- $SEER_{base}$ = Seasonal energy efficiency of the baseline unit
- $SEER_{EE}$ = Seasonal energy efficiency of the new unit

Since the SEER rating and unit size can be determined from the installed unit, these values can be used to look up the savings. The audit team believes the assumptions and methodology for calculating energy savings due to residential air conditioner upgrades to be reasonable.

The methodology used for determining peak demand savings utilizes the same equation but omits the operating hours and adjustment factor:

$$kWSavings = Tons * \left(\frac{12}{SEER_{base}} - \frac{12}{SEER_{EE}} \right)$$

Although the demand savings in the above equation are a function of the difference in the SEER, the correct metric for determining demand reductions is EER. The EER represents a unit's efficiency at *peak* operating conditions, while the SEER is a seasonal ratio that represents the *average* unit efficiency. The SEER is the appropriate metric when determining energy savings, but it is not suitable for determining peak demand reduction and will generally overestimate actual demand savings. For example, consider an energy-efficient unit rated 14 SEER and 11.5 EER (the current ENERGY STAR specification) and a baseline unit rated at 10 SEER and 9.2 EER (a common unit). All else constant, demand savings calculated from the SEER will be 31% higher than savings calculated from the EER.

Conversations with Frontier staff indicate that the higher savings calculated by using the SEER values were mitigated by capping the peak demand reduction for units above 14 SEER. In essence, savings were overestimated for units ranging from 12-14 SEER and were underestimated for units above 14 SEER. In reality, the incremental increase in peak demand savings from higher-SEER units are already much less than the incremental increase in the lower-SEER units, thus limiting this mitigation factor. In addition, this methodology does not account for demand diversity factor or coincidence with utility peak. As a result, the audit team does not believe the deemed peak demand reductions associated with this measure to be reasonable. The new, provisional A/C savings estimates that were developed for 2006 are being reviewed as part of a separate task.

4.1.9 Ceiling Insulation

This measure applies to both the RSC SOP and the HTR SOP. The energy-efficiency measure is the installation of ceiling insulation above an electrically air-conditioned space. Qualifying measures must have a pre-installation R-value of no greater than R-22 and a post-installation R-value of R-30 or greater.

The baseline R-value for determining peak demand and energy savings is based on the sponsor-reported pre-installation level of insulation. The reported values were put into 5 R-value "buckets", or ranges, between R-0 and R-22. The deemed savings values, listed as savings per square foot of conditioned ceiling area, are then looked up in a table whose cells are a combination of the 5 baseline R-value buckets and 3 categories of heating type. The looked-up value is multiplied by the sponsor-reported conditioned ceiling area to get the peak demand and energy savings for the customer installation. The "Climate Zone 1 – Panhandle Region" table of peak demand and energy savings is presented here for reference.

Table 4-4. Climate Zone 1 – Ceiling Insulation Deemed Savings

Ceiling Insulation Base R-value	kWh Savings	kWh Savings	kWh Savings	Summer Peak kW Savings	
	Gas Heat	Electric Heat	Heat Pump	Gas Heat & Electric Heat	Heat Pump
	(per sq. ft.)	(per sq. ft.)	(per sq. ft.)	(per sq. ft.)	(per sq. ft.)
R-0	0.86	9.99	5.04	0.000973	0.000973
R-1 to R-4	0.52	6.43	3.14	0.000608	0.000622
R-5 to R-8	0.24	3.19	1.48	0.000297	0.000311
R-9 to R-14	0.11	1.67	0.76	0.000153	0.000153
R-15 to R-22	0.05	0.71	0.31	0.000068	0.000074

The methodology for determining the per-unit deemed savings values involves the use of the ESPRE 2.1 building load simulation software. A prototype home was built with the software and calibrated to residential load data from a residential end-use load study completed in 1990. In order to simplify the deemed savings values, the eight weather regions as defined by the Model Energy Code (MEC) were formed into 4 weather regions. All energy savings values vary significantly by climate zone. Simulations were run for each baseline scenario at R-value increments of 1, from R-0 to R-22, with the energy-efficient case as R-30. The results were then averaged for each R-value bucket and each heating type and put into the lookup tables.

The audit team reviewed the characteristics used for the prototype home, such as air conditioner efficiency, heating efficiency, floor area, and wall insulation, and found them all to be reasonable. Next, the per-unit demand savings values for the R-0 baseline case were compared to those in the DEER database, which defines 16 climate zones throughout California. According to the DEER, the range of peak demand impacts for the ceiling insulation measure is 0 – 0.00156 kW/sqft, which encompasses the range of peak demand impacts (0.000973 – 0.001027 kW/sqft) for the same ceiling insulation measure in the RSC SOP and HTR SOP. As a result, the audit team believes the deemed savings methodology and values for the ceiling insulation measure to be reasonable.

4.1.10 Compact Fluorescent Lamps

This measure applies to customers under the HTR SOP only. The energy-efficiency measure is the installation of a compact fluorescent lamp (CFL). Qualifying units must be installed in a location that gets a daily usage of at least 3 hours per day.

The baseline incandescent lamp wattage for determining peak demand and energy impacts is based on the sponsor-reported CFL wattage. The reported values are put into 4 “buckets” between 14 watts and 28 watts, and the comparable incandescent lamp wattage, annual energy savings, and peak demand reduction are all looked up in a deemed savings table. The deemed energy savings assume a usage of 4 hours per day for all lamp wattages. The CFL deemed savings table is presented here for reference.

Table 4-5. Compact Fluorescent Lamp Deemed Savings

Measure CFL (Watt)	Measure CFL (Range of Watts)	Comparable Incandescent Light (Watt)	Daily usage (Hrs./Day)	Annual Energy Savings (kWh)	Demand Savings (kW)
15	14-18	40	4	36.5	0.006
20	19-21	60	4	58.3	0.009
23	22-25	75	4	75.8	0.012
27	26-28	100	4	106.5	0.016

The calculation of peak demand savings is a function of the connected load reduction and coincidence with utility peak. The coincidence factor used for all cases was in the range of 22-25%, which is reasonable for residential lighting. The audit team also reviewed the connected load reduction for each CFL wattage bucket (the comparisons of CFL wattage and comparable incandescent lamp wattage) and found them to be reasonable, if not slightly conservative. In general, the CFL lamp wattage should be 3-4 times less than that of the incandescent lamp that it replaces. Furthermore, a well-known CFL study completed for utilities in California[82] indicates a slightly greater connected load reduction than that assumed for these deemed savings values (Table 4-6) Overall, the audit team believes the deemed peak demand savings for this measure to be reasonable.

Table 4-6. Comparison of Incandescent to CFL Wattages

Original Incandescent Wattage	CFL Replacement Wattage – TX Deemed Savings	Typical CFL Replacement Wattage – CA Study
40 watts	14-18 watts	9-12 watts
60 watts	19-21 watts	13-17 watts
75 watts	22-25 watts	18-22 watts
100 watts	26-28 watts	23-26 watts

The calculation of energy savings is a function of the connected load reduction and the operating hours, which were assumed to be 4 hours per day for all CFL installations. The audit team compared the operating hour assumption to the California CFL metering study [82] and found it to be somewhat high. According to the California study, the average usage of residential indoor CFLs is 2.3 hours per day while the average usage of residential outdoor CFLs is 3.1 hours per day. In fact, none of the 10 residential space types in the study averaged more than 3.5 hours per day. This finding was further corroborated in a study conducted by Summit Blue for the Northwest Energy Efficiency Alliance in 2003[83] that found a reasonable assumption for operating hours for indoor CFLs to be 2.75 hours.

To ensure the greatest possible energy impact, the program designers mandated that CFLs be installed only in fixtures that will be used 3 or more hours per day. While this design parameter excludes some of the low-usage CFLs that were not excluded in the aforementioned studies, it does not fully mitigate the difference. This qualifying parameter is highly susceptible to overestimation, and it is unlikely that all

[82] *CFL Metering Study: Final Report;* KEMA, Inc; February 25, 2005

[83] *Findings and Report – Retrospective Assessment of the Northwest Energy Efficiency Alliance: Final Report;* Summit Blue Consulting, LLC, and Stratus Consulting, Inc; October 1, 2003

program-installed CFLs meet the 3 hrs per day requirement. As a result, the audit team believes a higher-than-normal uncertainty associated with the deemed energy savings values for this measure.

4.2 AC Distributor Program Deemed Savings Estimates

Air conditioner savings, as reviewed above in section 4.1.8 apply to customers for the AC Distributor Market Transformation Program as well. The energy-efficiency measure is for retrofit residential/small commercial installations of high efficiency air conditioning units. Qualifying units must incorporate central AC equipment, be less than 20 tons in capacity, with a minimum seasonal energy efficiency ratio (SEER) of 13. This section describes how the A/C savings values were applied by each utility as they implemented the A/C Distributor Program.

Baseline

Entergy—The baseline efficiency (efficiency of existing air conditioners) used for the AC-Distributor program characterizes the recent sales of units in the State of Texas. Based on cursory investigations, 1999 sales of air conditioning units in Texas of less than 5.4 tons show an average SEER rating of approximately 10.75. Accordingly, the baseline and minimum SEER rating for the pilot program year was set at 11.

TXUED, Xcel & CNP—The baseline efficiency for the remaining utility AC Distributor programs was assumed to be the same as the RSC SOP program, SEER 10.5.

Coefficients

Entergy— Using the same savings calculation methodologies described in the Central AC section, new deemed energy savings (kWh/ton) were calculated for the four climate zones using the new baseline of SEER 11. These values can be found in the table titled Energy Savings (kWh) per ton - by SEER Increment Above Baseline contained in Appendix A of the deemed savings document.[84]. If the AC Unit was a heat pump, Entergy included the additional kWh savings for the heating side of the heat pump, from the deemed savings table in the same document.

During the pilot year (2001) of the program an average demand savings value 0.2 kW/ton was determined based upon ARI Equipment efficiency tables.[85] This value was used by Entergy for 2003 and 2004 to calculate demand savings based on their installed AC tons/yr.

CenterPoint Energy—Savings values used by CNP were determined by the AC Features Tool developed by ICF for CenterPoint Energy's climate zone. This tool was developed using extensive DOE-2 runs and model home assumptions. To simplify savings calculations the average SEER (13.44 SEER (2003), 13.50 SEER (2004)) level for the program's installed units was calculated for each year. This average value was then used to determine the average savings coefficient per ton installed in that year (kWh/ton). During the pilot year (2001) of the program an average demand savings value 0.2 kW/ton was determined based upon ARI Equipment efficiency tables.[86] This value was used by CenterPoint Energy for 2003 and 2004 to calculate demand savings based on their installed AC tons/yr.

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[84] *Deemed Savings, Installation and Efficiency Standards, Residential and Small commercial Standard Offer Program, and Hard-To-Reach Standard Offer Program,* September 2003, (16 TAC 25.184(d)(1)

[85] http://www.mctg.com/ARI2000_all_downloads.htm, Accessed 7/13/06.

[86] Ibid.

TXUED—Frontier was contracted to conduct a market study for both 2003 and 2004 of the entire AC market within TXUED's service territory. The purpose of the studies was to quantify the then current market baseline, the SEER ratings of units being installed, and the subsequent average kW and kWh savings for all systems installed by participating distributors, regardless of SEER level.[87]

For 2003, the study results indicated an average peak savings of 0.14 kW and an average energy savings of 170 kWh per system installed. For 2004, the study results indicated an average peak savings of 0.11 kW and an average energy savings of 142 kWh. The lower average savings values for 2004 can be attributed to a slightly higher baseline.

These average values (kW/unit & kWh/unit) were then applied to 100% of the system installations by participating dealers and distributors, regardless of whether the individual systems were submitted for incentives, crediting TXUED with 100% of the estimated market effects due to their AC Distributor program. Note that the study values used by TXUED are total savings per AC unit, not savings per ton, and are thus lower than the savings per unit calculated by other utilities offering this program.

Xcel—Frontier created deemed savings equations for Xcel, rather than have them use the AC Distributor Deemed Savings tables discussed for Entergy. These calculations were performed using the following equations:

kW = *if lTons <= 5.4 and lEfficiency < 13.5 then*
*Calc_kW = lTons * 0.24*
elseif lTons <= 5.4 and lEfficiency >= 13.5 then
*Calc_kW = lTons * 0.27*
elseif lTons > 5.4 and lTons <= 11.3 then
*Calc_kW = lTons * (lEfficiency - 9) * 0.10*
elseif lTons > 11.4 and lTons <= 20 then
*Calc_kW = lTons * (lEfficiency - 9) * 0.12*
end if

kWh = *if lTons <= 5.4 then*
*Calc_kWh = ((-7.1691 * (lEfficiency * lTons)) + ((283.31 * lEfficiency) - 2175.6) * lTons*
elseif lTons > 5.4 and lTons <= 11.3 then
*Calc_kWh = lTons * (lEfficiency - 9) * 309*
elseif lTons > 11.4 and lTons <= 20 then
*Calc_kWh = lTons * (lEfficiency - 8.5) * 242*
end if

These calculations resulted in savings values very similar to those shown in the Central AC Deemed Savings tables for Zone 2 RES SOP. Xcel ,however, is in Zone 1. When questioned, Frontier indicated it was purely coincidence that the two sets of values (calculated using the Xcel AC Distributor formula's versus the RES SOP AC Deemed Savings tables for Zone 2) were nearly identical.

[87] Separate studies were performed by Frontier Associates for the 2003 and 2004 program market impacts. The studies included results for both the AC Distributor and AC Installer MTPs.

Savings Value Verification

The AC Distributor program was by far the most diverse in terms of different methodologies being used to calculate deemed energy savings for the different utilities and climate zones, with each utility selecting a different method to calculate energy savings. Entergy chose to use the deemed savings for the RSC SOP program for Zone 3, CenterPoint Energy used a savings calculator tool developed by ICF, TXUED used a market study to determine the entire market effects for both the AC Distributor and AC Installer programs together, and Xcel calculated energy savings for AC units based upon a set of engineering formula's developed by Frontier.

Entergy—The deemed savings tables used by Entergy have already been discussed and compared to industry data in the Central AC Deemed Savings section and will not be repeated here. The audit team considers both the RSC SOP and AC Distributor (SEER 11 baseline) deemed savings tables to be reasonable. Entergy did not however use the new baseline (SEER 11) deemed savings tables for their energy calculations, but instead used the RSC SOP tables and Heat Pump savings tables together.

CenterPoint Energy—The calculated savings from the ICF AC Features Tool are comparable to the deemed savings values for the RSC SOP program and are therefore considered reasonable, per the discussion in the Central AC deemed savings section. However, when the evaluators verified the calculations using the AC Features Tool and exact values from CenterPoint Energy's AC Distributor database, the savings totals using the exact project inputs resulted in savings values slightly below those reported. This discrepancy is due to the fact that an average value for kWh was used, instead of a weighted average value, which would have accounted for the skewed distribution of AC tonnage to SEER ratings.

TXUED—The market study relied on by TXUED counted savings for the entire AC market serviced by TXUED, regardless of whether the units qualified for the program or applied for incentives. This market approach, while more than reasonable, was very different from the project specific savings claims of the other utilities. Average SEER levels for both years were in fact below SEER 13.[88]

For 2003, the study results indicated an average peak savings of 0.14 kW and an average energy savings of 170 MWh per system installed. For 2004, the study results indicated an average peak savings of 0.11 kW and an average energy savings of 142 MWh. The lower average savings values for 2004 can be attributed to a slightly higher baseline. Given that the federal standards for 2003/2004 were SEER 10, and that the average SEER level installed for both years was over SEER 12, it is reasonable to surmise that average energy efficiency values of equipment being installed were significantly above code, and that TXUED was influencing the market. The audit team, therefore, found the market study methodology and findings to be reasonable.

Xcel—The calculated energy savings for Xcel are of concern to the audit team, due to the fact that Frontier was the source for all four of the deemed savings values used for AC savings in Zone 1. Our concern is based on the fact that the calculation method shown generates different savings values than any of the deemed savings value tables for Zone 1. These tables include the RSC SOP deemed savings table (SEER 10.5 baseline), the HTR SOP deemed savings table (SEER 10 baseline), the AC Distributor deemed savings table (SEER 11 baseline).

[88] The TXUED market study incorporated savings for both the AC Distributor and AC Installer programs. AC Installer savings are, therefore, not analyzed separately in this section.

Savings Value Summary

Given that there is no requirement to use a consistent energy savings determination methodology for the Market Transformation Programs, the audit team is not suggesting that adjustments be made to claimed savings based on the inconsistencies identified above. What is clear, however, is that the different methods available for a particular utility could yield fairly significant differences in energy savings values, and that use of the many different methods causes a lot of confusion and room for errors. For instance, Xcel, who is in the Zone 1 climate, used formulas for the AC program that calculated savings values nearly identical to the Zone 2 deemed savings table. If the deemed savings tables had been used for all utilities, this would result in a reduction of Xcel's AC program savings by nearly 35%.

Similarly, Entergy had a deemed savings table created by Frontier, specific to their AC Distributor program with a slightly higher baseline than the RSC SOP program, but then elected to use the RSC deemed savings tables anyway, adding the HP savings on top of these savings when heat pumps were installed for heating and cooling. Entergy was the only utility that added additional heat pump savings on top of the deemed AC Distributor table savings.

Recommendations can not be given by the audit team as to the best methods for each utility without more detailed location specific modeling, however, it seems apparent going forward that a standard method could be consistently applied across all utilities.

4.3 C&I Standard Offer Program

4.3.1 C&I Cooling Equipment Simplified M&V

Calculations for C&I cooling equipment savings were either done through direct operational metering (i.e. M&V), or were done with a simplified M&V approach. The required equations, baseline definition, and coefficients for this simplified approach are laid out in the document: *Deemed Savings, Installation and Efficiency Standards, Commercial and Industrial Cooling Equipment, May 2003* (16 TAC 25.184(d)(2)).

Calculation

Simplified M&V does not require on-site metering, but it does require detailed information on the pre- and post- installation equipment. The basic equations for demand and energy savings are as follows:

$$kW_{savings} = Tons * (a * \eta_{baseline} - b * \eta_{post\ installation})$$

$$kWh_{savings} = Tons * (c * \eta_{baseline} - d * \eta_{post\ installation})$$

Where:

- $kW_{savings}$ is the calculated demand savings
- $kWh_{savings}$ is the calculated energy savings
- $\eta_{baseline}$ is the baseline efficiency of the equipment
- $\eta_{post\ installation}$ is the rated efficiency of the installed equipment
- *a, b, c and d* are the simplified M&V calculation coefficients that are provided in the definition document appendix
- *Tons* is the rated equipment cooling capacity (the lower of pre and post)

Baseline

If the installation is in a new building, the baseline unit efficiency is taken from ASHRAE 90.1-1999. If the efficiency and size of the unit being replaced is known, these values are used; otherwise, the value is taken from ASHRAE 90.1-1989. These baseline values seem to be reasonable as they are based on an industry standard. The ASHRAE standards are based on efficiency standards from the ARI and the CTI.

Coefficients

The calculation method and coefficients were developed by Nexant Inc through a detailed modeling analysis. They established a linear relationship between rated full load equipment efficiency and both energy and demand consumption, and created coefficients from this analysis. The inputs to the model, such as equipment performance curves, were verified DOE-2 data, published by ASHRAE. The load shapes used were from RER, Inc. The coefficients were verified by Nexant, Inc. by comparing the predicted energy and demand savings with the actual savings for six projects that had been evaluated with M&V in Texas.

The coefficients were created for four climate zones (Fort Worth, Amarillo, Houston, and Brownsville), 17 different building types, and three types of cooling equipment (air cooled chiller, water cooled chiller and packaged DX air cooled unit). A coefficient was provided for most but not all of these combinations. This combination of options seems to provide good coverage for the whole state of Texas, taking into account the wide variety of possible climates, and the varying operational demands on the cooling units due to building size and use.

The climate zones defined here are not the same as the ones used in the residential deemed savings. The document lists the zones that should be used by different utilities for their whole service area. There is one zone for each utility except for AEP, which has operations in several different climate zones (however, staff at subsidiary TCC confirmed that they use only one zone, and it is assumed that each other subsidiary would use only one zone).

A sample comparison was made with the Database for Energy Efficient Resources, published by the California Energy Commission. The savings per ton in climate zone 15 (El Centro) with 4156 cooling degree days was compared with the savings per ton in Brownsville, with 3888 cooling degree days. The DEER shows demand savings of 313 kW/ton with the replacement of a 9.7 SEER unit with a 14 SEER unit. The savings calculated by following the method given in the definition document, for this replacement, are 339 kW/ton (using the coefficients for retail buildings.) This confirms that the savings are in a comparable range.

However, the kWh savings differ significantly. The DEER shows savings of 638 kWh/ton, and the savings calculated by following the method given in the definition document are 1177 kWh/ton. This discrepancy is probably due to the different nature of the two regions. Although the cooling degree days are similar, Brownsville is much more humid that El Centro, which is in a desert region. Cooling equipment may be used more often and the set point may be set to a lower temperature in a more humid climate.

Based on this sample calculation, and the fact that the baseline and the calculations were all based on industry standards, and that the calculations have been verified by comparing them to savings from metered projects, the audit team believes the simplified M&V methodology and coefficients to be reasonable.

4.3.2 C&I and Small Commercial Lighting Efficiency Simplified M&V

Calculations for lighting efficiency savings were either done through direct operational metering (i.e. M&V), or were done with a simplified M&V approach. The required equations for this simplified approach are laid out in the document: *Measurement and Verification Guidelines* (16 TAC 25.184(d)(2)). In addition, there is a wattage lookup table with a wide variety of combinations of lamps and ballasts given in the document: *Commercial Lighting Table Wattage Lookup* (16 TAC 25.184(d)(3)).

The equations used to calculate savings from lighting installations are standard formulas that are used industry-wide. They include coincidence factor, a HVAC interactive factor, and annual operating hours for the energy calculation, as shown here:

Peak demand savings
Lighting Demand Savings [kW] = Pre Lighting Demand [kW] – Post Lighting Demand [kW]

Interactive HVAC Demand Savings [kW] = Lighting Demand Savings [kW] * Stipulated Interactive HVAC Demand Savings [%]

Total Demand Savings [kW] = (Lighting Demand Savings [kW] + Interactive HVAC Demand Savings [kW]) * Coincidence Factor

Energy savings
Lighting Energy Savings [kWh] = Lighting Demand Savings [kW]*Stipulated Annual Hours of Operation [hrs]

Interactive HVAC Energy Savings [kWh] = Lighting Energy Savings [kWh]*Stipulated Interactive HVAC Energy Savings [%]

Total Energy Savings [kWh] = Lighting Energy Savings [kWh] + Interactive HVAC Energy Savings [kWh]

The sponsor uses a lighting template to calculate savings. One line is used for each type of fixture that has been fitted in the building, or space. Pre- and post-installation information must be filled in on each line.

Baseline

In the case of a new building, the baseline used is the minimum code standard, in W/sq.ft, based on the building type. This comes from the ASHRAE 90.1-1999 code. This is an industry standard and a reasonable baseline to assume.

Coincidence Factor and Annual Operating Hours

The values for coincidence factor, HVAC interaction factor, and annual operating hours are defined in the guidelines document according to seven building types. The audit team compared these values to values used in the evaluation of an energy efficiency program for Xcel Energy, Colorado that was done last year. The coincidence factor and annual operating hours values all within 15% of each other, apart from values for K-12 schools and colleges, as shown below.

Table 4-7. Coincidence Factor and Annual Operating Hours for K-12 Schools and Colleges

Sector	Xcel Colorado		Texas PUC		% Diff	
	Annual Operating Hours	CF	Annual Operating Hours	CF	Annual Operating Hours	CF
Apartment/Condo	5,597	0.78	4,772	0.85	15%	-9%
College	3,863	0.63	2,085	0.67	46%	-6%
Hospital	4,051	0.65	3,750	0.6	7%	8%
K-12 School	2,308	0.14	2,150	0.85	7%	-504%
Office	4,276	0.74	3,760	0.8	12%	-8%
Parking Garage	8,234	0.94	7,884	1	4%	-6%
Retail*	5,155	0.93	5,575	0.95	-8%	-2%
*Texas values for retail are an average of 24-hr and non 24-hr values						

The differences in the coincidence factor for K-12 schools is probably due to the fact that the coincidence factor used for the Colorado program was calculated with respect to summer peak hours, as most K-12 school buildings are used very little in these hours. The other large difference between the two evaluations is in the annual operating hours for colleges. This could be due to the mix of building types within colleges, as dormitories will have lower operating hours than classrooms or offices; the Colorado program included some accommodation for colleges, whereas it is not stated what buildings are included in the college building type.

The coincidence factor values in the simplified M&V document may be averages for the whole year – this is not clear from the document itself. As the Texas programs are designed primarily to reduce summer peak load, the audit team suggest that in the future, different coincidence factors, which reflect summer peak usage by building type, be used for these simplified M&V calculations.

Interactive Savings

HVAC interactive savings are set to a default value of 10% of demand savings and 5% of energy savings, except for buildings with no HVAC. These interactive savings are added at the bottom of the table for some utilities, and sometimes at the savings report stage. The HVAC interaction percentages seem reasonable, although a little on the conservative side; interactive savings based on simulation modeling are often found to exceed 20%. In addition, there could be significant differences in the savings for different building sectors, so we recommend that different interaction factors be developed for different building sectors in the future (as has been done for the coincidence factor).

Wattage Tables

There is no information in the wattage table published by the PUCT on how the wattage values were determined, except that they are based on tests done by independent laboratories under applicable ANSI standards and conditions.

A spot check for several types of fluorescent and other types of fixtures was done to compare the Texas wattage table with a wattage table used in Colorado. The wattages were the same or very close, and as the wattage table is based on test results, the audit team assumes the values in the table are accurate.

5. PROCESS EVALUATION FINDINGS

This chapter presents the findings from the process evaluation conducted by the study team. The process evaluation reviewed the steps taken by the utilities to administer the programs and identified opportunities to improve the delivery of energy efficiency services through the programs. This "limited" process evaluation utilized interviews with key actors in the program design and delivery process to develop an understanding of program strengths, weaknesses, and opportunities for improvement. The interviewees included individuals from the following groups: utility program staff, participating EESPs, non-participating EESPs, and outside stakeholders. Section 2.4 of this report describes the methodologies used to select interviewees, and the issues reviewed during the interview process. Several interview guides were developed, targeted to the each interviewee group. These interview guides, and a complete list of interviewees, are contained in the appendices to this report.

- The Summit Blue team sought to answer the following key questions through the process evaluation:
    - Do the funding arrangements pose a barrier to participation in the programs?
    - Are the application and project-qualification processes efficient and effective?
    - What were the reasons that some projects were never successfully completed by EESPs that had reserved program funding?
    - Have Measurement and Verification (M&V) requirements posed a barrier to certain projects?

These questions are addressed in the findings presented in the remainder of this chapter that were developed through interviews and the audit process. Section 5.1 presents overarching findings that generally apply across programs and across utilities; Section 5.2 presents findings specific to the Market Transformation programs; and Section 5.3 presents findings pertinent to the Standard Offer Programs.

5.1 Overarching Findings

5.1.1 Program Planning & Development

- Utility program incentives are more than sufficient to encourage participation.—Sponsors and program managers, in general, felt the incentives offered by all programs were sufficient. The Residential and HTR SOP program managers and sponsors interviewed indicated that the incentives were sufficient to allow some sponsors to offer the project measures free to homeowners. This implies that some reduction in incentive level would be possible without discouraging participation, allowing utilities to secure more resources with the same dollars.
    - The only program where current incentive levels appear to be an issue since 2004 is the AC Distribution program, which was discontinued by most utilities in 2006 due to the higher SEER standards.
    - *Incentive calculations need to be simplified to flat amounts for more measures.* Incentives based on equipment size and efficiencies have caused confusion among sponsors, requiring additional time to clarify misunderstandings and correct mistakes. (e.g. AC offerings)

- The 10% administrative limit has not proven burdensome, but does not allow for significant program enhancements or changes.—Most of the utilities indicated that the 10% administrative budget ceiling is sufficient, but that the budget is fully utilized, and does not allow room for further program enhancements or process changes. Any significant program or tracking modifications, such as increased inspection or documentation requirements, will require that this spending limit be revisited.

- The small business set-aside has helped diversify sponsor representation and encourage local sponsor participation.—The small business set-aside used for the HTR, and RSC SOP programs has been successful in allowing smaller, local sponsors to participate in the program, and in diversifying the sponsors and expertise admitted to the program each year.

- There is a need to establish protocols for MTP savings estimates.—Currently there are no deemed savings estimates for the MTPs. Some utilities elected to use the savings contained in the RES/HTR SOP deemed savings document, while other utilities created separate calculations or used market studies to estimate savings. For the MF program, savings estimate methodologies must also be established for central boiler systems.

5.1.2 Marketing and Outreach

- Program outreach and marketing have been very successful.—Initial program outreach to sponsors has been very successful. Sponsors now market the program offerings to participants and little to no marketing efforts are required by the utilities, though several still do advertise. As a result, *programs have consistently been oversubscribed.*

    - *The AC Distributor and Installer program appears to be changing installation practices outside utility service territories.* A market study conducted by TXUED indicated that the average SEER level of systems being installed through participating sponsors increased when averaged across all the equipment they installed. This is true regardless of whether the new A/C was installed within TXUED's service territory or not. This could indicate potential spillover from the program and that standard equipment offerings are trending up.

- The training offered by the utilities has been very effective and well received.—Utilities have offered a variety of training opportunities for the programs, including HERs rater training, installer training for different measures, and onsite coaching for project problems. Sponsors and program managers felt, in general, that the training may be the most valuable aspect of the programs. This is especially true for market transformation programs. Still, *blower door testing skills are not readily available.* These skills are new to the market and it is sometimes difficult to find individuals to perform the tests on tight project timelines.

5.1.3 Program Administration and Information Management

- Program staff is responsive and helpful with both technical and administrative issues.—Sponsors found program staff accessible and responsive to questions concerning both the administrative and technical requirements of the programs. Program staff used the inspection process as a forum for relationship-building with sponsors and training to help improve sponsor workmanship and project approvals. *Coaching sponsors on how to submit online project invoices and paperwork comprises a significant time commitment by utility staff.*

- The online processes created to streamline utility and sponsor program administration has proven to be an obstacle to sponsors that use more traditional methods. Utility staff has had to bridge the gap by spending time with sponsors in person or by phone, walking them through the Internet processes required for project submissions and approvals.

- The current first-come, first-served online enrollment process is generally working well, but it does not allow for equal access to program funds among all potential sponsors. Once sponsors have learned how to use the online project submission and approval system they find it very easy to use. Program staff indicated that once sponsors are trained, the online system has proven to be a great administrative tool. There are some *concerns* with the online submission process though:

  - *Program enrollment process discriminates against smaller local companies.* The online enrollment process has proven to favor larger, often out-of-state, companies with faster Internet connections, allowing them to get applications into the utilities within seconds of the "opening bell" for application acceptance. Smaller, local companies are often shut out. This is especially problematic for the market transformation programs, where a primary goal is to transform *local* markets.

  - *Program enrollment process does not encourage installation "best practices."* Sponsors are accepted into the program based on how quickly they can get their application in, not on the quality of their workmanship or flexibility in where and what they are willing to offer. Utilities would like the flexibility to weigh applications based on additional criteria such as prior program performance, willingness to serve larger geographic areas, and willingness to bundle measures.

  - *Program staff noted that if incentive dollars were left over after the first day they could fund projects that come up later in the year.*

- The program databases developed by Frontier have been a key asset for program administration.—Utility personnel consistently emphasized that the 10% administrative limit on budgets would not be possible without the databases and support provided by Frontier. Managers expressed satisfaction with the database support and reporting functions, and Frontier's openness to database enhancements as issues arise.

  - *Some database tools do not check for outlier values.* Many of the reductions in savings for the MTPs resulted from outlier values (e.g. home square footage over 20,000) that should be caught before the projects are accepted.

- The M&V processes utilized for market transformation programs (MTPs) have *not* been a hindrance to project approval or incentive processing.—In general, sponsors and program managers feel the M&V processes implemented by the utilities to ensure quality workmanship and program compliance have worked smoothly. Inspection protocols are not required by the PUC for MTPs. Those that do M&V use the program database or internally developed tools (i.e. TXUED's Inspecticizer) to randomly select sites to be inspected, typically around 10% of each sponsor invoice, though 100% of some programs are inspected and only a small percentage of others are inspected.

  - *M&V processes need standardization.* The extent of M&V performed for programs and measures can vary greatly, depending on the background and experience of the individuals performing the inspections. This creates conflicting feedback to sponsors and inconsistent enforcement of measures specifications. In addition, smaller utilities have

not always implemented M&V procedures for all programs (e.g. ENERGY STAR homes inspection and certification by HERs raters).

- Cooperation among the utilities has generally been quite good.—The larger utilities have been very open about sharing tools and ideas. Utilities with service territories in close proximity have gone so far as to share form format to make the processes seamless for contractors who service both areas. In some cases the utilities have combined resources to outsource tool development, as in the case of the ICF-developed *Savings Calculator Tool for ENERGY STAR Homes.* There are, however, other homegrown tools and spreadsheets that have not been shared, or that could have benefited from the combined resources and knowledge of several utility teams.

    - *Tools to assist sponsors in verifying that projects meet service territory requirements would be useful.* Some utilities indicated that up to 15% of the projects submitted for some programs were rejected because they did not fall within the required service territory. A tool could help sponsors quickly identify whether projects fall within the required service territory before making commitments to customers. Tools of this nature would be ideally accessible online.

- The lengthy contracts between the sponsors and utilities can discourage participation.—Utilities expressed concerns that the contracts required of sponsors are 20+ pages, which is too intimidating for smaller local contractors not used to signing anything larger than two pages. This is especially a problem for the market transformation programs, whose primary goal is to grow the local market for energy efficiency services.

    - *Program insurance requirements, enrollment and project invoicing processes appear discriminatory to small sponsor participation.* The statutory requirement of sponsors to carry workman's compensation insurance when going into homes is considered a hindrance by some EESPs, given the uncertainty of gaining access year-to-year to the program funds. This issue most probably stems more from the enrollment process than the insurance requirements.

5.2 Standard Offer Programs

A variety of stakeholders were interviewed to find out about their experience with the Residential/Small Commercial and C&I Standard Offer Programs. Four general areas were addressed in the interviews:

- Program Planning and Development
- Program Marketing and Outreach
- Program Administration and Information Management
- Other Program Issues

Overall, stakeholder interviews suggest that:

- Project Sponsors are somewhat frustrated with the SOP programs, primarily because of the approach used to reserve and administer funds.

- Funding limits are constraining the number of projects, suggesting that the programs are not saturating the market.

- Non-Participating EESPs were also frustrated with the funding arrangements, so much so that they became alienated from the program. Small contractors do not have either the time or inclination to take time from their efforts just to survive in their business, and do not seem to be reliant on the programs for that survival.

- Though the programs' marketing efforts have been effective in building broad awareness among Non-Participants, and incentive levels seem to be sufficient, some NPs have concluded that the benefits of the programs are not worth the difficulties and frustrations they have experienced in their efforts to participate.

- Some currently non-participating EESPs who had been previous participants in the HTR program (since the program's inception) expressed concern over the expensive, mandatory training. This training was deemed to be too expensive, and some respondents reported that the program should consider "grandfathering" them and other previous participants into the program.

- Other Stakeholders regard the programs as generally successful, given the funding levels available and the basic structure of the programs as given.

- Stakeholders expressed concern regarding the mix and marketing of programs (especially regarding hard-to-reach residential customer segments), the level of sponsor education and training support, and the administrative burdens, particularly for smaller sponsors and their customers.

- The existing M&V requirements are sound, but protocols are not always followed sufficiently. Most of the projects using M&V instead of deemed savings appeared to have followed the guidelines and had excellent M&V plans and clearly-presented results. Deficiencies in following the required IPMVP process were evident in eight out of the 30 M&V projects reviewed, with the most significant problem being the lack of adequate M&V plans. In these situations any data provided was of limited value. Other projects show deficiencies in the general transparency in data collection and calculations.

These and other issues are discussed in the sections that follow, in a more narrative style in an attempt to capture some of the nuances of program delivery.

5.2.1 Residential and HTR SOPs

- Utilities need vehicles to encourage multiple-measure projects.—Program managers expressed frustration over how to encourage sponsors to install multiple measures per project. This is not an uncommon problem for utility energy efficiency programs. A way to incentivize bundles of measures, or even cross-program measure bundles, is needed to better leverage limited program budgets.

- Sponsor Selection of Measures—Currently the programs allow sponsors to select which measures they will install; thus measures most beneficial to the homeowners are not necessarily installed, or complementary measures are not installed together to result in the most energy savings (e.g. duct sealing with weatherization). *Priority is not given for measures that provide the greatest peak demand reduction.*

- Geographic Coverage is Inconsistent—Utilities are not allowed to require that all geographic locations within their service territory are covered by the program sponsors. This has resulted in

more remote areas having no coverage while metro areas are served multiple times across program years. A "rural installation" set-aside could be developed.

- Blower door testing skills are not readily available.—Sponsors and utility personnel indicated that blower door technical skills are new to the market and that it is difficult to find individuals to perform the tests on tight project timelines. This can delay project approvals. This is an area in which additional training resources could be provided by IOUs.

- The complexity of the program offerings can be intimidating to smaller local companies.—Utilities indicate that smaller local companies are hesitant to participate in the program due to the sequencing of particular measure types and the technical requirements for projects to be approved.

- Contracts between the sponsors and participants discourage participation.—Several utilities and project sponsors for the HTR program indicated that the current contracts project owners are required to sign have been intimidating and have limited participation. In particular, homeowners are reluctant to sign income verification forms.

- 501(c) Nonprofit organizations are excluded from participation due to paperwork requirements—Non-profit organizations dealing with low-income families have the easiest access to potential program participants and can pre-identify potential participants, but they indicate that the overhead required to participate in the programs excludes them from applying. Outreach opportunities exist here.

- Program managers expressed concern over whether actual energy savings are being achieved.—Given the freedom of program sponsors to install whatever measures they feel are most cost-effective, and given the lack of requirements to bundle particular types of measures (e.g. duct sealing and weatherization), program managers are concerned whether the savings are actually being achieved.

5.2.2 Program Planning and Development

Program Funding Arrangements

Having become aware of the programs, sponsors sought SOP program funding to provide incentives for a variety of nascent projects, some of which would likely have proceeded with or without the program. Others, however, either would not have been implemented at all or as soon, or would not have had as great an impact were it not for the program.[89] Sponsors have found the program funding arrangements to be frustrating, though they say that once the incentives are reserved and applied toward projects, they have proven sufficient to improve projects' payback.

The program funding reservation and application process is complex and requires significant efforts by sponsors to learn and utilize the system, according to most of the sponsors interviewed. One sponsor interviewee, who works for a large end-customer who has self-sponsored a large project, estimated he had spent three weeks over a three-month period just learning the rules and administrative procedures required to understand how to develop, submit and implement projects according to the program rules—and that

[89] The actual magnitude of free ridership and spillover was not further discussed in the interviews, nor was the possible amount of program attribution otherwise quantified, but there were indications in a number of interviews of both phenomena occurring.

his company's legal, risk management and other departments also spent significant time figuring out the programs. While future efforts will not be as time-consuming now that this company knows how to participate as a self-sponsor, the company has only initiated one project so far.

This sponsor interviewee indicated that the internal labor costs to learn and utilize the program funding processes effectively reduces the value of the incentives by as much as one-half, including back-end M&V requirements. This particular individual has had experience with a variety of DSM programs across the United States. He indicated that the Texas setup is one of the two most difficult to use, and recommended instead that Texas emulate the program structures in New Jersey and California, which he described as being simpler, menu-driven, and more customer-friendly.[90]

The funding arrangements seem to be set up to favor large companies having the resources to learn and utilize the program system, and are discouraging others from participating. This is despite the seemingly market-neutral reservation process. The programs do not appear to be overtly discriminating against particular sponsors; rather, some interviewees think the general structure of the programs and their funding arrangements implicitly discriminate in general against smaller sponsors[91] who do not have the resources and time to learn the system.

One person interviewed even speculated that the current process, which does not use time-stamping of reservations, is being rigged by the utilities to favor certain sponsors and projects (no specific evidence was offered, however—but the point is that the current arrangements engender suspicion and distrust among some sponsors).

By and large the program designs appear to be fairly market neutral. To some other stakeholders, however, the programs are not as market neutral as they might be, in several ways that echo the thoughts of sponsors. *First,* some believe that standard-offer program designs do not serve residential markets particularly well because they tend to be piecemeal in their approach to identifying and implementing efficiency measures. Some sponsors who do weatherization work agree with this view. *Second*, the program administrative requirements are a significant burden for sponsors and customers with fewer resources to pursue program opportunities. This includes reserving funds in the first place, as discussed above, but then also administering program applications and projects, including technical reviews and impact measurement and verification (discussed later in this section). *Third*, there is also some concern that the programs lack a sufficiently broad marketing base (also further discussed below).

The funding arrangements can negatively affect sponsors' staffing. The uncertainty of funds means that sponsors must risk hiring staff to sell, develop and implement end-customer projects, but the uncertainty of funding both within a given year (because the reservation process creates uncertainty for given projects) and across years (because program funding continuity is uncertain year-to-year) affect sponsors' attitudes toward the programs.

Funds are so quickly reserved that the project numbers and associated impacts have been lower than might otherwise be seen because of the attendant risks associated with marketing the program to end-customers without being certain that funds will be available.[92] As a result, projects are either not done at all, or in some cases proceed with a lower payback. In both situations, sponsors and end-customers alike

[90] Another state with a program structure that is difficult to use, according to this interviewee, is New York.

[91] The small set-aside pool notwithstanding—comments noted elsewhere here indicate that the small set-aside component constrains smaller sponsors in its own way because limits on project size are too small.

[92] Notably, TXUED has developed a work-around approach to improve funding certainty, in effect not requiring reservations as such but instead paying incentives upon verification. This has mitigated the concern.

end up dissatisfied and, in some cases, give up on the program entirely. Mechanical systems projects are more likely to be affected than lighting-type projects (both in number and impact scope per project), due to their greater engineering complexity.

A number of alternative funding arrangements were suggested by EESPs. One person suggested a pre-qualification approach, and another suggested a multi-cycle approach—perhaps similar to the small-project set-aside and how TXUED is handling funds disbursements for the residential SOP. Accompanying a pre-qualification approach would be a letter of intent along with documentation, such as a detailed audit, to demonstrate the viability of a prospective project. Another suggestion was to pay out funds as projects are completed, rather than as an up-front reservation process.

The basic concept of having a portfolio of programs from which utilities could select their preferred mix of offerings without special regulatory approval is good, according to several of the Stakeholders interviewed.

The market evidently could support a greater overall funding level if that can be done cost-effectively. Some sponsors, however, indicated they may not participate in the future because of declining total program funding levels, and that they are more cautious now in utilizing the program in marketing projects to their end customers.[93] For example, one firm that targets multi-family projects in particular said they are doing ever-smaller projects because of the declining level of funds, and so an increasing number of potential (larger) projects are going undone. As an example, in 2003 this firm could do 300-unit complexes but today can only fund 80-unit projects.

Revisit the funding limits to a level greater than the current target of 10% of new demand growth. The original underlying reason for limiting the total program funding level was to avoid undue upward pressure on electricity rates caused by unfettered program participation. The cost-benefit analysis apparently has not been updated to reflect the gas cost index used for the program economic analyses. Considering the rise in gas prices, there may be economic justification in revising the 10% target upward.

The incentive levels available to sponsors may be too low to support some M&V activities and other project administration requirements, such that the incentives in effect get eaten up in those activities. This results in a lower sponsor motivation that may be constraining overall program participation.

Marketing and Outreach Structures

That utilities are not directly involved in marketing the programs is not a major concern to most sponsors, as their business is more often generated through word of mouth and other channels. The programs are generally seen as complements to sponsors' core business marketing, in part because of the uncertainty of funding many sponsors see with the programs. Some sponsors utilize flyers to publicize their services through neighborhood canvassing efforts and as general reference material to prospective customers.

Current programs replaced a patchwork of previous utility-based programs. Thus, consolidating programs into a uniform statewide structure reduces the number of program structures with which sponsors have to deal. Once EESPs become aware of the programs, they only have to deal with one set of program structures and funding arrangements.

[93] One person said his company only mentions the program in passing, explaining that if incentives are available they will obtain them but the customer shouldn't expect that to occur due to the uncertainty of reserving funds.

Some market segments may not be gaining as much awareness of the programs as they might if there were a broader base of program marketing to build such awareness. In that sense, program awareness is not as broadly achieved and so the market is not neutral from an equal opportunity perspective. The programs as designed may not be adequately reaching and supporting smaller customer markets.

The 20% cap on budget per sponsor has generally worked well. Those interviewed who had an opinion said they did not feel the budget cap has constrained the overall effort by sponsors, with the possible exception of those working in rural areas.

Program Administrative and Information Structures

Stakeholders feel the 10% administrative overhead cap has proved too limiting for smaller utilities and where project complexities require greater planning, engineering, M&V and other administrative efforts. Some flexibility in this constraining rule may help create additional impacts from smaller utilities and larger, more complex projects. This issue appears to be connected to the issue sponsors have with incentive levels being eaten up by M&V and other program process requirements.

Other Planning and Regulatory Issues

The mix of programs presents some challenges, according to several other stakeholders. One comment made was that the programs as designed basically assume that "one size fits all," but in fact that is not the case. For example, the ENERGY STAR platform may be overly restrictive in relation to Texas state energy codes, and there are difficulties with reaching low-income customers to tie into ENERGY STAR. Though the Commission made some modifications to address this concern, further adjustments may help, though no specific recommendations were made by any of the other stakeholders interviewed.

The minimum project size was not seen as a concern to the sponsors who were interviewed, and having no cap on project size is seen as a good thing among both sponsors and NPs interviewed who have had project situations that potentially could be affected by those arrangements.

The small-project set-aside component has been too small to be effective. The resource-intensive, technical nature of the current funding reservation process may also be precluding at least some public entities from participating. It would be helpful, according to this individual, to modify the set-aside component to make it more meaningful and expansive in its market scope.

Statewide energy codes have raised the benchmark for efficiency, and some other stakeholders feel the programs' benchmarks need to be revised accordingly. Communities could be better served by the programs, however, as one other stakeholder said, by assisting with local building code changes that contribute to long-term savings. Another interviewee cited one city's building codes that require energy-efficient appliances, which may be an alternative means to achieving the desired energy savings for appliances, at least.

Regulatory oversight has generally not been a problem, according to the sponsors interviewed. However, one person interviewed believes that the utility affiliate separation rules are effectively being circumvented by what this person believes is a plethora of (not really) "independent" sponsors coming on to the scene who indeed have some utility affiliation. He noted the five-fold increase in active sponsors in the last two years and asserted that there must be some sort of organizational gaming going on. Further, this person feels that the effect of all the newcomers has been to penalize traditional contractors who do the job right, whereas many newcomers are pursuing the incentives without regard to doing high-quality work for end customers; instead they bid low just to get funds. Whether the PUCT can mitigate such

concerns through more focused oversight is uncertain, but the issue has been brought up to the PUCT by at least one utility.

There is some feeling of being "trapped within the rules." Perhaps the rules could be modified, one stakeholder suggested, so that the basic rules and requirements would be retained in the state code, yet allow selected rules and aspects of the oversight process to be applied without going through the extensive, formal oversight hearings required by the state code. Such a modification in how the rules are administered—perhaps through a virtual, facilitated mediation process[94]—could reduce the burden on stakeholders' time and resources, and improve the ability to adapt program oversight as conditions change and with consideration for stakeholders' ability to engage in formal regulatory proceedings.

Consider implementing a broader range of programs beyond capital-type projects, such as HVAC tune-ups, appliance retirements and thermal storage. There are risks with some alternatives in that they are subject to behavioral whims and being defeated in various ways such that the resource value of such programs is made riskier, but the idea is to consider more possibilities and, where appropriate analysis shows the potential for good persistence, to experiment with alternative program designs. One person suggested adding demand response technologies.

Related to the program mix issue is whether programs should be mandated to be "comprehensive" in various ways that consider what otherwise would be lost opportunities to install certain measures. At issue here is whether the "perfect is the enemy of the good" and whether projects are being lost altogether because of what sponsors or end customers see as onerous requirements to include more measures in order to qualify a project. Perhaps the solution is not to mandate comprehensive projects but offer some sort of bonus incentive to encourage projects to include additional measures. Contractors, particularly mechanical contractors, may not agree with a mandated comprehensive approach. Indeed, a lighting contractor who was interviewed was not pleased with having to pursue non-lighting measures just to get his lighting measures installed.

Local economic development effects did not seem to be a major concern to those interviewed. Even though energy efficiency may bring the most local economic benefits compared to energy supply resource development, it is inappropriate and unnecessary to include economic development goals in an energy efficiency program (though environmental effects could be considered).

It was suggested that SOPs may not overcome market barriers because they simply are subsidies and so, presumably, do not fundamentally change consumer or sponsor attitudes and intentions. Whether this is indeed the case is one of the broad strategic questions this evaluation is attempting to address, but at least one person does not believe it to be so. In fact, this person went on to assert that the MTPs should be designed in such a way as to be self-eliminating, which is the theoretical premise, if perhaps not the pragmatic outcome so far, of market transformation programs.

Consider putting utility financial incentives in place to offset the institutional and financial prejudice resulting from loss of electricity sales. Whether such incentives take the form of lost revenue recovery, some sort of profit on program investments tied to impact achievements, or other financial incentives, several of the other stakeholders interviewed feel some sort of incentive would help utility management more strongly support the programs.

[94] Using Internet conferencing, for example, with e-mail and other electronic documentation procedures. This specific approach was not specifically suggested by any of the other stakeholders interviewed, but based on the nature of their comments it is offered by Summit Blue Consulting as an approach to consider.

5.2.3 Marketing and Outreach

Utility outreach on the programs has been effective in making the trade community aware of the programs. Sponsors found out about the programs both by hearing about or being invited to sponsor participation meetings, and also proactively through their own efforts in seeking business and looking for energy efficiency programs to support projects they were developing for end customers. Sponsors with a history in Texas learned about the programs through ongoing contacts with the utilities' program staff, watched for program mailings and other communications, and attended program orientation meetings. Others responded to utility publicity efforts.

EESPs have done a good job marketing the program. The commonly stated evidence for marketing success was the rapid commitment of program funds. The sponsors participating in the standard offer programs have developed the same kinds of relationships with the utilities as had been the practice before restructuring in Texas, but also stated that more businesses appear to be participating in the program under the standard offer arrangement. Another person said they perceive good relations between EESPs and utilities. One success in the relations between utilities and EESPs has been the ability to police EESPs by challenging contracts and performance quality concerns.

Sponsors believe the programs' credibility and awareness with customers is bolstered by having utilities associated with the program. Some interviewees thought it would be a good idea to have some general utility marketing support to build program awareness, which would bolster the programs' brand identity. A third-party entity could be utilized for a general awareness publicity effort, one person suggested.

Sponsors have had little difficulty marketing projects, in that none of those interviewed had projects that weren't completed where funding had been reserved, or that they had difficulties marketing projects to utilize funds they had been able to reserve.

One market segment that has proved intractable is commercial office properties which, as one non-participant cited, often are investment targets bought and "flipped" for quick profits. Such situations take those properties out of the energy efficiency market because the investor—rightly or wrongly—does not view efficiency improvements as helping to increase the resale value of the property.

The program incentives take some of the "sting" out of the electricity price increase issue. One individual whose firm does weatherization work said that their best marketing collateral was the brightly colored blower doors they would bring onto job sites, which attracted neighbors' attention and resulted in additional weatherization jobs being sold. Their main difficulty selling weatherization is when program incentives are not available and they have to address the fact that their customers' bills will not go down because of base rate increases that offset the savings, and the effort to explain how customers are still better off with more weatherization.

One interviewee shared that the information that their firm's focus (as a residential HVAC contractor) is solely on high-end (i.e., high-efficiency) equipment, so the program incentives serve to increase that sponsor's profits. Indeed, this particular sponsor does not share any incentives with customers, instead passing one-third of the incentive to the sales people as a bonus commission and applying the remainder to the firm's bottom line.[95] Thus, the program does little for this type of contractor in aiding their marketing efforts to end customers.

[95] Whether this contractor constitutes a free rider in the program is uncertain despite this information because, for example, it is uncertain what volume of high-end business this firm would experience were incentives not available.

One sponsor said the small set-aside component is difficult to market to small commercial customers, especially where a leased building has vacancies and other problems with split tenant/landlord decision-making and motivation. Early on, this person said, there was some confusion about how the small set-aside should be targeted, but that splitting the residential and small commercial aspects helped clarify bids for that pool of funds.

5.2.4 Program Administration and Information Management

Consider establishing guidelines for sponsors on the fraction of program funds to retain for administration, because those costs are not trivial—10-15% at least is needed for such tasks as applications, verification inspections, and reporting requirements.

The administrative paperwork/computer processing burdens add significantly to sponsors' internal costs for the program, effectively eating into the incentives they receive. One sponsor has dropped out of the program for that reason, and another interviewee indicated knowing of contractors who will not participate because of this. On the other hand, some said they thought the administrative process is in good shape and improvements have been made that minimize sponsors' administrative burdens, especially with regard to lighting retrofits.

PUCT reporting requirements seem to be extensive, noted one of the other stakeholders, and the person suggested a need to provide some sort of overview to the public regarding what has been going on with the programs and their outcomes.

The inspection process generally runs smoothly. One person noted a relatively minor, but bothersome issue, which is that sponsors often obtain square footage of homes being insulated from tax records, yet utility inspections sometimes find differences that need reconciliation. Another person indicated that the inspection process sometimes runs so slowly that subsequent incentive payments are sometimes delayed. There are concerns where installation contractors perform their own inspections.

Once inspections are done, incentive payments are generally timely, and sponsors appreciate that. One person indicated it would be a good idea to pay in full on deemed savings measures (once inspected) rather than continue the current practice of split payments which adds to overall disbursement costs.

Program Impacts

Too many efficiency measures are required to undergo M&V treatment. A number of measures that currently require M&V could be reclassified as deemed savings measures without significantly reducing the accuracy of their impact levels. Further, some believe that it would be appropriate to update the program-approved efficiency measures, such as including controlled T5 lighting technology as an option for conversion from T12 technology, where the current emphasis is on converting from T12 to T8 technology.

Even though most sponsors felt savings values are conservative, because the deemed savings approach saves so much internal time and cost compared to the M&V approach, contractors often choose deemed savings measures. Sponsors say the M&V requirements seem appropriate for most measures that should have M&V applied, and that in those cases the protocols are not too strict—though one sponsor said it would help reduce the cost of M&V if the precision of the M&V impact estimates could be relaxed somewhat (e.g., a 15% reduction in M&V points). Some sponsors avoid M&V-required measures altogether for this reason.

The deemed savings approach has been successful in simplifying the programs' impact estimation and associated efforts by customers and sponsors to develop and implement projects. Interviewees expressed interest in finding ways to convert more "M&V'd" measures into deemed savings. Eliminating unnecessary verification and follow-up, while still having assurance of achieving impact savings, also was expressed as a desirable direction for the SOPs. Whether this can be done with sufficient confidence in subsequent impact accounting for resource planning in the state is not certain, but may be worth considering.

The air conditioning installation market transformation program was cited by one interviewee as being of potential concern with regard to the proper applications of "Manual J" calculations in estimating impacts. If the manual J calculations are not being used and enforced in that program, the person said, the program should be re-evaluated and possibly eliminated.

5.2.5 Other Program Issues

Program staff are seen as being responsive to sponsors' questions and program needs, and have been a positive force in mitigating program difficulties. One person suggested that the utilities should add technical staff to support the program managers, to help on M&V plans, educate sponsors, and handle sponsor relations when busy program managers are unavailable. The flexibility utility staff has shown on projects that have legitimately dragged on (to deal with M&V issues, for example) has been a big help. Staff continuity at the utilities is also helpful.

One interviewee felt that the cost-effectiveness of the HTR component of the Residential/Small Commercial SOP may be compromised because funds have been directed to a particular non-profit advocacy group that already receives federal and state funding for HTR work, yet (in the interviewee's mind) takes longer to implement projects and uses only the lowest-cost sub-contractor regardless of the work quality. Whether this is a significant program management concern is uncertain, but at least one interviewee thought it important enough to say something about it.

There are underlying problems with equipment and structures that need rectifying before some contractors are able to perform the primary weatherization work. This includes addressing structural and safety problems such as louvered doors that were intended as fresh air intakes originally but now are being covered up to reduce infiltration—resulting in the need to add fresh air intake ductwork that is not covered by the program but comprises a real cost to sponsors and which, again, reduces the effective incentive levels sponsors receive.

Some interviewees indicated that the programs tend to be utilized for projects that would proceed anyway but whose energy efficiency likely would be lower, as the incentives encourage higher efficiency when equipment needs replacement anyway—and in some cases encouraging early retirement. One interviewee, who cited how the incentives do indeed help project paybacks, added that the incentives also serve another useful purpose: to grab customers' attention. One self-sponsor customer said that their upper management was more enamored with the incentive itself than with the fundamental (and higher-return) savings being achieved with the project!

It would be useful to issue an annual summary of program changes, and then also highlight changes in the master program documentation so the changes can be put into their proper context. It would help to develop more scenarios and associated end-use-oriented generic program specifications to show the scenarios' savings impacts would be helpful to sponsors' engineers.

State energy efficiency codes have not been a concern except for air conditioning contractors, where the new SEER 13 code has effectively trumped the programs. One downside to the new codes is that

customers tend to think they need do nothing more once they have met the code. Code inspectors are still learning the new codes and there may be concerns related to the inspectors' knowledge levels.

The concept of comprehensive projects is an issue whose concerns depend on the type of sponsor. Weatherization contractors seem more likely to appreciate the concept as it concerns insulation versus infiltration treatments—doing one without doing the other is a known problem that reduces the effect of the measures taken. On the other hand lighting contractors have been frustrated by the requirement of additional measures and the added burden they feel as a result.

5.3 Market Transformation Programs

5.3.1 ENERGY STAR Homes

- Programs may see a significant drop in participation due to new federal standards.—Some sponsors indicated that qualifying projects will drop significantly due to the difficulties imposed by the new federal standards regarding infiltration and thermal barriers. While these standards may ultimately assist in transforming the home building market, they do reduce the potential savings attributable to program efforts. One participating builder mentioned it would make sense to include a thermal bypass checklist, and echoed the aforementioned drop in the number of qualifying homes. The builder reported, "The new goals are going to be difficult to achieve and build a home in a timely fashion and may reduce our program participation motivation."

- ENERGY STAR homes programs have been so successful that many utilities have set the minimum HERs rating above federal standards.—The utility ENERGY STAR homes programs are averaging above the federal minimum HERs score of 86, with several builders averaging scores of 88 or more. This has resulted in several utilities not incenting homes with scores below 87, far ahead of many program across the country, with some of the lowest incentives seen by the audit team.

- The Savings Calculator Tool developed by ICF has been a key asset for the success of the ENERGY STAR Homes programs.—Utility personnel consistently emphasized the value and ease of use of the ENERGY STAR Homes tool developed by ICF. The program simplifies and streamlines the program by limiting the savings calculations to only three inputs (HERs rating, number of stories, and square footage of the home). This has allowed utilities to focus their budgets on additional quality-assurance inspections and training opportunities with builders having trouble getting projects accepted. In addition, managers expressed satisfaction with the database support provided by ICF as issues or questions arise.

- Administrative commitment of program participation too burdensome for some small builders. - Some non-participants claimed the administrative effort necessary to participate would warrant hiring extra staff, and felt this was simply too costly to accomplish. One non-participant was actually routinely building ENERGY STAR rated homes, but was doing so independent of the incentive program in order to avoid the "burden of the paperwork and bureaucracy" via in house engineers who would ensure the home were built according to ENERGY STAR standards and rate them as well.

5.3.2 Multifamily Water & Space Heating

- Savings per dollar of incentive are small compared to other programs; funding mechanisms do not match project life cycles.—Utilities expressed concern over whether the MF program should

be continued, stating that it is too expensive for the achieved savings, and that the projects tend to be primarily new construction, which spans multiple years while funding is assigned on an annual basis. The development of a program resource cost test that includes lifetime benefits could benefit program efforts.

- Venting requirements are an issue for anything over two stories.—Further limiting program participation are the venting requirements, which restrict projects to single or two-story buildings.

- Air quality concerns in metro areas discourage moving to gas equipment.—Larger metro areas such as Dallas/Fort Worth have air quality issues that will be impacted by a move from electric to gas water or space heating. While most incented equipment would make a small impact on air quality, regulatory changes could affect future programs.

5.3.3 AC Distributor & AC Installer

- Utilities need an easy way to check duplicate incentive applications and savings across programs.—AC equipment qualifies for the AC Distributor program or the RES SOP program. Incentives should not be granted by both programs, but this has occurred with several utilities. In one case the audit team found significant overlap and was required to reduce the AC Distributor program savings estimate reported to the state by as much as 30%. Energy savings reporting for one program only is expected.

- Discontinuance of the AC Distributor program sends the wrong message to the market.—Interviewed sponsors felt the discontinuance of the AC program incentives by most utilities due to higher federal SEER standards was sending the wrong message to the industry, and that some level of incentives should be continued. Utilities expressed frustration at having the same administrative costs for one-third of the savings of previous years. Air conditioning is a very large portion of peak demand loads for the utilities, but without some leeway on the cost-effectiveness criteria for setting program incentives, the utilities can not afford to continue these programs.

- The program template needs to be more explicit for the AC Distributor and AC Installer programs regarding equipment savings calculations. The audit team found the AC Distributor program one of the more difficult to check, given the different methods adopted by the utilities to calculate savings. TXUED used a market study to identify average energy savings for both programs; Entergy and CNP used the deemed savings tables developed for the RES/HTR SOP programs; and Xcel used a calculation methodology developed by Frontier Associates.

6. RECOMMENDATIONS

This chapter summarizes potential actions and further study suggestions developed by the M&V study team. Actions are recommended for both the Commission and the utilities. The first section focuses on program planning and oversight activities, Section 6.2 summarizes program delivery recommendations, and Section 6.3 contains suggestions for additional research activities that have the potential to enhance program effectiveness and/or certainty in savings. Within these broad topic areas, the information is organized as follows:

Program Planning and Reporting

- Goals, funding and portfolio selection
- Incentives
- Deemed savings estimates
- Reporting & communications

Program Delivery

- Marketing & outreach
- Enrollment
- Data management
- Inspections

Additional Research Activities

Table 6-1 provides a summary of some of the key recommendations as they pertain to actions that could be taken by the Commission and by the utilities. This summary is followed by the complete descriptions of all recommendations.[96] Recommendations are identified with a letter that indicates whether the recommendation addresses Program Planning (P), Program Delivery (D), or Research Activities (R).

[96] In comments on the draft audit report, the Electric Utility Marketing Managers of Texas note that recommendations D13, D15, and D18 have been implemented since the 2003-2004 period covered by the audit. Furthermore, program administrators plan to immediately implement recommendation D12 and will initiate discussions toward implementing D11.

Table 6-1. Key Recommendations for Decision Makers

Key Recommendations for the Commission	Key Recommendations for Utilities
Program Planning and Reporting	*Program Planning and Reporting*
P1 Increase program goals beyond the current 10% of historical demand growth.	P9 Continue the common practice of ratcheting down incentives for SOP measures.
P2 Develop a mechanism that links program funding to utility goals.	P11 Promote installation of cost-effective measures that produce high energy savings (kWh) but that are not being heavily pursued by sponsors.
P3 Measure the impact of market transformation programs over a multi-year period, with multi-year targets.	P12 Promote and/or require the installation of multiple measures at customer sites.
P4 Consider providing financial incentives to utilities for meeting or exceeding program goals.	P13 Develop new incentives or approaches to promote adoption of high efficiency air conditioners.
P5a Provide flexibility to utilities in the share of program funds available for administrative purposes.	*Program Delivery*
P5b Create a separate pool of program funds reserved for inspection/evaluation activities.	D1 Offer technical training to build market capacity on high demand skills.
P10 Allow different incentive levels for different measures within the same program.	D4 Modify the current first-come, first-served enrollment process to allow for more equal access to program funds among all potential sponsors.
P11 Promote installation of cost-effective measures that produce high energy savings (kWh) but that are not being heavily pursued by sponsors.	D5 Establish enrollment guidelines to achieve utility objectives regarding the mix of sponsors and measures funded through the programs.
P16 Create a process to allow for the addition of new deemed savings measures to existing programs.	D6 Introduce mechanisms for providing incentives that offer more financial stability for sponsors.
P22 Establish uniform procedures for utility reporting of peak demand and energy savings.	D11 Promote greater consistency between utility forms and processes.
P23 Refine guidelines for documentation of reported savings.	D12 Establish input ranges for database entry to reduce potential data entry errors.
P24 Clarify the definition of Peak Demand Reduction to ensure that reported savings are coincident with system peak.	D15 Develop a tool that allows program managers to easily check for duplicate incentive applications and double counting of energy savings across programs.
Program Delivery	D17 Introduce third-party, independent inspections of customer sites.
D19 Require more precise inspection protocols and adjustment mechanisms for standard offer programs.	D18 Improve recording of inspection results and maintain more thorough documentation.
D20 Establish inspection protocols for MT programs.	

P = Program Planning; D= Program Delivery

6.1 Program Planning and Reporting

Program planning recommendations are intended to improve the way that programs are designed and clarify the rules and guidelines followed by the utilities administering them. These are broad-based recommendations affecting program structure as opposed to the "program delivery" recommendations that are aimed at improving actual program administration.

Goals, Funding & Portfolio Selection

P1. **Increase program goals beyond the current 10% of historical demand growth.** It appears that significant cost effective potential remains in the market (given how quickly some programs funds are reserved) and goals of 20% or more may be achievable at little net cost. A review of the programs' overall cost and benefit, and updating of system avoided costs, may be needed to determine whether and by how much to increase program goals. A review of energy efficiency goals in other states and regions indicates that a more aggressive goal would be a reasonable option for encouraging greater program impacts.[97]

P2. **Develop a mechanism that links program funding to utility goals.** For most utilities in Texas, funding is fixed based according to the utilities latest rate cases, yet energy savings goals change each year based on load growth. If growth is high—or if the goal is increased from the current 10% level—then funding may be inadequate.

P3. **Measure the impact of market transformation programs over a multi-year period, with multi-year targets.** Market transformation programs may slowly build up lasting changes in market behavior, thereby achieving relatively low savings in early years but continuing to have an impact years after the programs are terminated. Current rules are focused on resource acquisition and the peak load reduction goals that force utilities to administer programs to produce immediate savings, possibly at the expense of effecting longer-term market transformation. However, the rules offer utilities the flexibility to offer incentives for market transformation programs other than direct payments for kW and kWh saved. [PUCT Rule 25.181(g)(2)].This flexibility could be useful in promoting greater market transformation if goals can be adjusted accordingly.

P4. **Consider providing financial incentives to utilities for meeting or exceeding program goals**. Many states offer shareholder incentives to utilities that successfully meet energy savings goals set by regulatory commissions. Thus far, Texas' utilities have enthusiastically supported DSM, but disincentives may grow if the goals are made more aggressive. Modest incentives can help ensure that even more aggressive peak load reduction goals are met and exceeded.

[97] For example, the Northwest Power Planning Council is planning to meet 100% of demand growth through the year 2012 through energy efficiency (through 2009 this is an additional 700 average megawatts). An examination of the energy efficiency resource potential in the Northeast shows that cost-effective energy efficiency could not only meet the entire projected demand growth (estimated to be 1.2%) in the region, but could also actually reduce energy demand in the region to 1993 levels by the year 2013—effectively reducing energy demand by 1.38% per year. Finally, the Connecticut Legislature passed the "Energy Independence Act" in 2005 that sets specific, quantifiable conservation and load management targets, including a portfolio standard calling for 1% of demand to be met from energy efficiency by 2007, and 4% by 2010 (see Dan York and Martin Kushler, "*A Nationwide Assessment of Utility Sector Energy Efficiency Spending, Savings, and Integration with Utility System Resource Acquisition*", 2006 American Council for an Energy-Efficient Economy Summer Study on Energy Effiency in Buildings).

Furthermore, by encouraging utilities to achieve peak load reductions greater than their 10% goals, energy savings may be realized at lower per-kW costs than could otherwise be achieved.

P5. **Modify the way in which program funds are allocated for administrative purposes.**

a. **Provide flexibility to utilities in the share of program funds available for administrative purposes**. The current 10% administrative cap effectively focuses program spending on incentives to encourage installation of energy efficiency measures. However, for smaller utilities lacking economies of scale, this cap often limits the ability to conduct outreach to smaller, local sponsors or to conduct inspections as extensively and comprehensively as may be required to ensure proper installations. Roll-out of new programs may also be difficult without additional funding. The Commission may wish to establish guidelines for obtaining exceptions to the 10% admin cap based on utility size, population density, *or other factors* and contingent upon submission of a plan for how the additional administrative funds would be spent.

b. Create a separate pool of program funds reserved for inspection/evaluation activities. The fact that administrative funds are scarce for some utilities suggests that important inspection and evaluation activities—which add transparency and credibility to utility programs, but don't contribute directly to energy savings—may be competing for funding with general program administration. At present utilities have an incentive to do only the minimum amount of inspection required. Although the utilities generally are disciplined and thorough in their inspection procedures, several managers indicated a desire to increase inspection activity if more funding were available. If each utility had a pool of designated inspection/evaluation funds that was part of the administrative funds discussed above in P5a, this would help ensure that reported savings were accurate and would remove some of the uncertainty inherent in a desk audit of the programs.

P6. **Offer the Multi-Family Water and Space Heating program only for niche markets.**—Utilities expressing concerns over the returns for the program indicated that shorter life-cycle projects completed at universities proved more worthwhile and matched the program budget periods. Additionally, given the low percentage of homes with gas space or water heating, it will take more than a utility program to move this market (e.g. supporting building codes or state energy policy).

P7. **Create alternative program designs that could serve residential and commercial markets more comprehensively.** These could include newly structured standardized programs such as *consumer-direct rebate programs* that meet criteria for measure deemed savings and incentives. Program administration requirements would need to change to accommodate these kinds of offerings.

P8. **Expand the load management program offerings to include demand response (DR) and direct load control (DLC) programs** for smaller customers. By widening the scope of programs beyond existing large customers, additional peak load reduction capability may be achieved with minimal capital investment. Develop clear rules for assessing the demand reduction achievements of such programs.

Incentives

P9. **Continue the common practice of ratcheting down incentives for SOP measures.**—In the Residential and HTR SOPs, some sponsors are able to install measures at little or no cost to the

customer due to the significant incentive dollars provided. To better leverage funds for budgets that tend to expire before the end of the year, incentive levels could be reduced further without severely affecting program participation. This may have the added benefit of increasing customer commitment and awareness of energy efficiency.

P10. **Allow different incentive levels for different measures within the same program.** Different incentive levels are required to encourage various actions promoted by the programs, yet the incentives are set according to the kW reduced, not necessarily the incentive level needed to cause an energy efficiency installation to occur. The energy efficiency effort in Texas already allows for different $/kW incentive levels according to program type, reflecting the reality that different customer markets (e.g., residential versus C&I) have different characteristics and require different incentives. By allowing differentiation by measure type within a program, utilities could lower incentive levels for measures that don't require as much support, thereby freeing up funds to promote other measures that are not routinely installed under the current incentive structure.

P11. **Promote installation of cost-effective measures that produce high energy savings (kWh) but that are not being heavily pursued by sponsors.** The focus on peak demand (kW) savings is inhibiting greater adoption of common measures for which peak demand impacts do not generate sufficient incentive revenue for sponsors. For example, variable-speed drives are common in most C&I programs throughout the country, but are relatively rare in Texas due to their limited relative impact on peak demand. Similarly, the retro-commissioning program as a whole tends to have a greater impact on energy than demand, and therefore is less attractive to Texas utilities. By focusing on peak demand savings, Texas may be foregoing opportunities to achieve worthy goals such as reducing customer energy bills and minimizing the cost of providing electricity. Specific recommendations include:

- *Redefining program goals to include savings targets for energy savings, measured in kWh.*
- *Introducing, or increasing, incentives for kWh savings.*

P12. **Promote and/or require the installation of multiple measures at customer sites.**—In the Residential and HTR SOPs (and to a lesser extent the C&I SOP), sponsors often install only one measure, such as duct efficiency or infiltration, despite opportunities for additional savings from other measures. Options for promoting multiple measure installation include:

- *Providing additional incentives for bundling of popular measures with other, less popular measures.*
- *Requiring multiple measures, or measures in addition to the most popular measures, in order for an installation to be eligible for incentives.*
- *Limiting incentives for popular measures to 65% of total incentives for a given customer.* This is an alternative method of reducing incentives for measures that may not require high incentives in order to encourage adoption. This approach would not require a change to the current rule establishing a single $/kW incentive value for each program, and it would build on precedent in that incentives paid for lighting measures are currently limited to 65% of total incentives for a given project in [PUCT Substantive Rule 181.25(j)(2)(G)].

P13. **Develop new incentives or approaches to promote adoption of high efficiency air conditioners**—The redesign of the AC Distributor programs due to the new federal SEER requirements has put a de-emphasis on AC peak reduction due to the resulting reduction in incentives available. Given the large peak demand surrounding AC loads in Texas, it may be reasonable to allow higher incentives for AC measures, beyond the current levels. This could keep key peak demand reduction programs running, while lowering incentives for other measures such that the overall program offerings are still cost effective. An alternative to raising incentives, suggested during the process interviews, would be to focus the budget on advertising and outreach to potential participants, possibly through a third party partner.

P14. **Simplify Incentive Structures to Streamline Processes for Utilities and Sponsors**—Utilities reported that the layering of measures and the calculation requirements for some incentives are confusing to sponsors and have become a deterrent for smaller potential sponsors such as 501(c) corporation that have the best access to low income residents. Examples include the HTR requirement for an envelope measure before other types of measures can qualify for incentives and the deemed savings matrix that must be used for A/C SEER and tonnage. Utilities have, in some cases, developed "cheat sheets" to help determine the correct incentives for invoicing, but believe that flat incentive rates for certain programs or groups of measures may be a better solution.

P15. **Consider standardizing some incentives to flat fees**.—Calculated incentives based on energy savings or equipment size have caused confusion and additional overhead on part of the utilities and sponsors. Standardization of flat incentives for larger groups of equipment or measures can help to minimize this issue and increase operational efficiencies.

Deemed savings estimates

P16. **Create a process to allow for the addition of new deemed savings measures to existing programs.** —Currently there is no easy way to add cost-effective measures to the Residential, HTR, and C&I SOP programs since a rulemaking is required. A *process outside of formal regulatory processes*—and not necessarily led by utilities—should be established by the Commission to solicit ideas from all participants via a standardized technology description form. Any new measures accepted by an approved technical review panel would be eligible for program funding. Perhaps the utilities could conduct "trial" offerings with a limited budget (*e.g.,* spray in attic insulation) to assess the benefits and costs for consideration in the next year's official program offerings. [98]

P17. **Conduct a thorough technical review of measures now required to have M&V** to determine whether any can be converted to deemed savings. Some measures now required to go through M&V (*e.g.,* motors) could be converted to deemed savings measures, simplifying the impact calculation process and encouraging more sponsors to adopt these measures.

P18. **Develop deemed savings or standardized calculation methodologies for the Market Transformation Programs.** Currently there are no deemed savings estimates for the MTP's. The utilities utilized different methodologies to calculate savings for a number of the market transformation programs, leading to significantly different savings values. There were also other

[98] The Electric Utility Marketing Managers of Texas suggested in comments to the draft audit report that the utilities and Commission "also consider streamlined procedures for adopting new program templates or changes to program templates."

applications, such as central boiler systems in multifamily buildings, for which no savings estimates were developed. Consistent energy calculations or deemed savings tables, similar to those used by the SOP programs, will streamline program administration and eliminate errors in calculating energy savings. Consistency across programs will also reduce costs for future program evaluations and reporting.

P19. **Consider adding EER ratings to AC Equipment requirements.**—Utility program managers and industry experts conducting the AC Installer training agreed that specification of EER levels better represents what the utilities are looking for regarding reduction of peak demand and energy consumption.[99]

P20. **Consider establishing a pool of funds to be allocated separately from the general program incentive pool and used to support M&V.** Explicitly recognize the M&V burden of having sponsors monitor projects and assure sponsors that their M&V costs will be covered to at least some extent. This change in the incentive strategy could reduce some sponsors' concerns about incentives being eaten up by M&V. Additional training for sponsors on M&V techniques, and a meter loan program are other options could prove helpful in reducing savings uncertainty.

P21. **Ensure that M&V activities are conducted and documented in a way that allows for effective independent review.** Sponsors must present an easy-to-follow path of data and calculations that reflect the proper conduct of activities laid out in the M&V plan.

- More emphasis could be placed on assuring that the plan is complete prior to making savings payments and continuing with the project.
- Guidelines could also be developed for archiving raw field data and supporting calculations. At a minimum, the electronic data files (*e.g.,* spreadsheets) containing calculations should be maintained, not just paper copies of the results.
- Savings calculations should be presented in a format that adheres to the principles of transparency and repeatability. The easiest way to do this is to provide the savings calculation in standard spreadsheets, as is often done for the simplified methods such as lighting. While it may be reasonable for these spreadsheets to be "locked" when they are passed between program participants, the independent reviewer should have access to all of the equations and cells in the calculation spreadsheets (or programs).

Reporting and Communications

P22. **Establish uniform procedures for utility reporting of peak demand and energy savings.** Current rules provide little guidance on how utilities should report peak demand and energy savings. As a result, each utility has a slightly different procedure for determining which projects to include in its annual report for a given year. This problem is particularly pronounced in the C&I SOP, where many projects are not completed until the following calendar year, and savings from projects requiring M&V may not be known for an additional 12 months. Reporting of these savings in an annual reporting period presents a problem. Uniform procedures could include the following elements:

- **Cut-off dates and criteria.** One option is to include in an annual report only those projects completed by December 31 of the calendar prior to the report filing (e.g.,

[99] A desk review was recently initiated of the provisional A/C demand reduction deemed savings recently developed by Frontier Associates. This will consider how well the provisional method estimates EER.

December 31, 2004 for an April 1, 2005 filing). Another option would be to include all projects for which savings were verified by the utility in time for the annual report. Yet another would report only those savings for which the utility had paid an invoice. All of these options are currently being employed by various utilities in Texas. The decision on which method to employ should reflect whether the Commission and utilities are most interested in the amount of savings *attributable to* a given program year or the savings *accruing* in a given calendar year.

- **Savings from M&V projects.** Several utilities report the estimated savings from measures utilizing M&V, while one (TXUED) reports only the portion of the savings for which it has paid the sponsor. Either of these options is reasonable, although the first is more likely to result in an overestimate of savings.

- **True up.** For several reasons, utilities discover changes to estimated savings figures after annual reports are filed, including M&V adjustments and discovery of data entry errors. It is recommended that a true-up mechanism be established whereby utilities can report on adjustments to previous years' reported savings values. This information should be reported as a separate item from the current-year reporting so that it is possible to accurately true-up past reports and so that current-year figures are not skewed by unrelated true-ups.

P23. **Refine guidelines for documentation of reported savings.** The clarity and detail of documentation supporting reported savings varied greatly by program and by utility. In many cases the audit team could not easily identify which customers were included in the annual reporting figures or what their underlying savings values were. Also, some utilities could not provide the documentation that could most clearly and decisively support their claims. It is recommended that utilities include with their annual reports (at least as backup documentation) a list of customer names and IDs and the related savings values that were used in determining savings. Additionally, guidelines should identify specific documents (e.g., invoices for all programs, savings reports for the C&I SOP) that the utilities are expected to provide to evaluators attempting to verify reported savings.

P24. **Clarify the definition of Peak Demand Reduction to ensure that reported savings contribute to a reduction in annual system peak.** As defined by the Commission, Peak Demand Reduction requires only that reductions occur "over a period of one hour during the peak period."[100] At issue are measures that reduce load for only a portion of the "peak period" (e.g., for only one hour or only in the month of May). Since these load reductions may not be coincident with system peak demand, there is significant uncertainty regarding whether they contribute to a "reduction in growth of demand…measured at the utility's annual system peak…," which is the basis of the energy savings goals established by the Commission [25.181(f)]. *It is recommended that a new definition of Peak Demand Reduction be developed that requires the load reductions to occur throughout the entire Peak Period.* At a minimum, the sponsor (or utility) should demonstrate a high probability that the load reduction will occur coincident with the utility annual system peak. A prorated savings figure could also be

[100] Peak Demand Reduction is defined in PUCT Substantive Rule 25.181(c)(26). "Peak Period" is defined as "…from May 1 through September 30, during the hours between 1:00 p.m. and 7:00 p.m., excluding federal holidays and weekends." [PUCT Substantive Rule 25.181(c)(27)]

calculated based on the percentage of peak period hours that the load reduction is expected to occur.[101]

P25. **Establish a quarterly or semi-annual forum for program managers to share information, best practices, and new ideas.**— Program managers suggested the need for periodic discussion forums to share program tool development, quality assurance, and process improvement data and knowledge in an effort to improve program administration while continuing to keep costs below the 10% administrative limit. The successful efforts by some utilities to modify the first-come, first-served enrollment procedure is a good example of a practice that could be discussed and shared through this forum.

P26. **Develop guidelines for quantifying the peak load reduction capability from load management programs.** An inherent characteristic of load curtailment programs such as the Load Management SOP is that the actual curtailment during a given event is unknown prior to the event itself. As a result, it is difficult to precisely quantify the peak load reduction from a program—especially one that is not called upon other than for test procedures. A reasonable guideline for reporting energy savings from load management would be to report the minimum curtailment achieved during an actual, non-test curtailment event. If a real event was not called, then savings could be defined as either the amount a participant is contracted to provide or the amount curtailed during a test event, whichever is lower.

6.2 Program Delivery

Program delivery recommendations are aimed at improving actual administration of programs by utilities. Some recommendations address changes in PUC rules to allow more flexibility for utilities, while others are directed at the utilities themselves in the way they attract participants, record activity, and verify measure installations.

Marketing and Outreach

D1. **Offer technical training to build market capacity on high demand skills**— The requirement for a minimum 15% infiltration for all HTR envelope measures requires that blower door tests be performed before projects can be approved. HTR projects are often delayed due to the shortage of technicians that have the knowledge to perform blower door tests. Additionally, smaller sponsors find the program technical requirements and measure sequencing intimidating. Technical skills training can help alleviate these issues, build the local market capacity, and encourage participation.

D2. **Expand coverage of service territories.**—Utilities may wish promote programs throughout more of their service territories by adding geographic coverage requirements to the program enrollment process to ensure underserved areas also benefit from the program offerings. For

[101] In its comments on the draft audit report, Good Company Associates, Inc. disagreed with this recommendation, pointing out that "[t]his issue was extensively discussed among stakeholders, and the general consensus was that…technologies…were unlikely to vary greatly in the quantify of demand reduced over the target hours…." The audit team recognizes this fact and the potentially high cost of monitoring the actual reductions in peak demand. However, as discussed in the findings for the Retro-Commissioning program (see Section 3.10), some savings may be based on technologies and measures that cannot reasonably be expected to contribute to annual system peak demand reduction. While the benefit of the doubt should be given to the sponsors and utilities, the audit team believes that savings claims should only be valid if they are likely to reduce the annual system peak.

example, utilities could require that only projects at new customer sites be allowed, versus having repeat customers across multiple years. This could increase the geographic coverage and the amount of low-income participants exposed to the programs.

D3. **Employ a third-party entity to provide broad-based program awareness and marketing**. Small-customer markets could use some sort of extra marketing and technical support to build awareness and facilitate participation. This would be conducted in coordination with generalized marketing support by the utilities, and to the extent such can be done within the constraints as set forth in state law.

Enrollment

D4. **Modify the current first-come, first-served enrollment process to allow for more equal access to program funds among all potential sponsors.** For many programs, most notably the Residential SOP, the internet-based incentive reservation system used by most utilities is preventing many small contractors from participating because of real and perceived complexities in the system. The primary problem is the advantage enjoyed by companies with high-speed internet access and other technological tools used during the enrollment process. Options to address this problem include the following:

- **First-in, first-out approach.** Under this approach funds are reserved for a sponsor only after the sponsor has completed installations and submitted specific customer data to the reservation system. Funds are held until inspections determine whether the incentives should be paid. TXUED has used this approach and reports excellent results and participant satisfaction.

- **Small set-aside model.** Like the existing small set-aside programs, sponsors are severely limited in the amount of incentive funds they can reserve prior to installing measures that use up the funds. After approved installations, sponsors would be eligible to reserve an additional block of funds, subject to availability. Entergy has successfully shifted its entire Residential SOP to this model.

- **Lottery.** Sponsors would be eligible to participate in the lottery if they submit applications prior to a specified date. Thus the program would still be "first-come, first-served," but ties would be decided by lottery rather than by the arrival of sponsors electronic applications, which are often received only seconds apart. Sponsors would be selected according to their lottery number until incentive funds were fully allocated.

- **Eliminate computer-automated funding requests.** One of the advantages that larger, technically savvy sponsors have demonstrated is the ability to use automated computer systems and software to ensure immediate access to utility reservation systems. Utilities can modify reservation systems to require direct human interaction, such as a requirement to type in a word that is graphically presented on the reservation screen.

D5. **Establish enrollment guidelines to achieve utility objectives regarding the mix of sponsors and measures funded through the programs.** The current first-come, first-served system allows the mix of participants, measures, and regions served to be determined solely by sponsor interests and by the unpredictable outcome of the funding reservation process. Utilities may wish to set aside a portion of funds to promote sponsor activity in under-served geographic

areas, to encourage installation of specific measures, and to ensure development of local market infrastructure.

D6. **Introduce mechanisms for providing incentives that offer more financial stability for sponsors.** One of perceived drawbacks of the current funding reservation system is that funds are distributed unevenly throughout the year and sponsors have difficulty balancing their workload and staffing levels. One way to address this issue would be to offer incentives on a semi-annual or quarterly basis, and to withhold a portion of funds until predetermined times of the year. Alternatively, if the small set-aside model is used (see above), the amount of remaining funds could be posted online so that sponsors would know funding availability before committing to customers and equipment purchases. Multi-year contracts may also be useful to ensure sponsors that incentives will be available to them for more than just one funding cycle.

D7. **Develop online program manuals and tutorials sponsors.**—A large portion of program management time is spent helping program sponsors and their employees learn the online processes for project invoicing and approvals. Cross-utility coordination may be possible if processes and databases are standardized.

D8. **Simplify contracts, where possible**.—Contracts between sponsors and utilities, and between sponsors and participants, are too long and intimidating. This is considered a barrier to participation, especially for the market transformation programs that are trying to build local market infrastructure.

D9. **Simplify contracting and income verification processes for HTR SOP**.—Current forms and methods have proven to be intimidating or offensive to participants. Investigation of simplified contracts and alternative methods of verifying income may alleviate these concerns.

D10. **Identify mechanisms that allow 501(c) nonprofit sponsor participation**.—Contracting and income verification issues identified for the HTR program could be reduced if 501(c) organizations serving low-income communities could partner or participate without assuming the overhead required of full program sponsors.

Data management

D11. **Promote greater consistency between utility forms and processes**.—Shared program tools, databases, and forms have proven advantageous to all, including sponsors who are more easily able to offer services in multiple utility service territories. For this study, a significant portion of the audit work was devoted to reconciliation of the databases to reported savings. Similarly, the processes of comparing hard copy files to databases took additional time due to the differences in record keeping and forms. In many cases verification of inspection reports to database records was not possible due to the limited information contained in inspection records. Consistency among programs and utilities will greatly expedite this process in the future and enable administrative efficiencies in tool development, annual reporting, and continual process improvements.

D12. **Establish input ranges to reduce data entry errors.** Many of the reductions in savings for the programs resulted from data entry errors (e.g. home square footage over 20,000) that were identified through outlier analysis. Establishing reasonable input ranges will help alleviate this problem.

D13. **Consistently utilize status designators in program databases.** —Utility databases need to easily allow for flagging of projects in different phases of the program for ease of reporting and program evaluation. Key flags needed are projects that were inspected, projects that were rejected, and projects that have been paid. Most SOP databases contained these fields, but they were not always recorded consistently.

D14. **Provide annual summaries of changes to program rules** to help sponsors keep up on program developments. Continue to examine the current administrative structure and its process and data systems to seek ways to simplify them and make them as intuitive and easy as possible to use. We particularly note the positive efforts of TXUED in this regard.

D15. **Create a tool that allows program managers to easily check for duplicate incentive applications and double counting of energy savings across programs.**—Ideally a tool would be developed that would integrate with the utility tracking databases and the sponsor invoicing systems such that duplicate projects would be rejected before they were submitted for payment. (Note serial number cross-checking between programs is currently being implemented by the Frontier team for the 2006 database tool.)

D16. **Bolster utility program staff with additional technical staff** to better serve sponsors' technical support needs and better maintain overall program accessibility and responsiveness Utility technical support has been admirable, but thin.

Inspections

D17. **Introduce third-party, independent inspections of customer sites.** Utility staff are often stretched thin and are not always able to conduct as many inspections, or in as thorough a manner, as they might wish. Independent inspection of a sample of projects may allow for more comprehensive, or numerous, inspections, and it would lend additional credibility to utility savings claims. (Note that the audit team uncovered nothing to indicate that inspections were not being conducted with reasonable diligence and accuracy.)

D18. **Improve recording of inspection results and maintain more thorough documentation.** Inspection documentation varied widely by utility and often did not include an explicit record of what was found at the inspected sites. It is recommended that a simple paper inspection checklist be used on site (e.g., a printout of what was installed) and that a "Pass/Fail" notation be clearly made upon completion of the inspection. For failed sites, a brief notation on the reason(s) for failure should also be included. If utilities prefer, this documentation may be recorded electronically only. However, it is important that an explicit "Pass/Fail" be noted as a record of the inspection. Currently for the Residential SOP and perhaps other programs, entire invoices can be approved (presumably after confirmation of inspection results) without any explicit indication that sites marked for inspection were either inspected or received passing marks.

D19. **Establish more precise inspection protocols and adjustment mechanisms for Residential and HTR standard offer programs.** The number of onsite inspections and the selection process for the inspections varied by utility despite use by most utilities of the inspection sampling tool integrated into the Frontier database. In addition, a review of onsite inspection forms revealed some inconsistencies between the findings from the inspection and the databases. The utilities should develop QA/QC procedures to ensure that the results from inspections are accurately and reliably reflected in utility databases.

D20. **Establish protocols for onsite inspections for market transformation programs.** Currently no inspection protocols exist for the market transformation programs. Utilities applied substantially different approaches to conducting inspections, with some utilities inspecting a statistically representative sample of homes and adjusting their savings estimates downward for failures, and other utilities conducting no inspections nor applying adjustments. The Commission should establish more consistent guidelines with regard to both the number of participant sites that should be inspected and the adjustment mechanisms that should be applied for failures.

D21. **Conduct periodic impact evaluations to verify key measure savings**.—Programs that allow sponsors to freely select which measures to install or that are highly dependent on sponsor workmanship (*e.g.,* AC Installer) may not be achieving the reported savings. An impact evaluation involving on-site inspections and metering of key measures responsible for a majority of the reported savings could identify needed program changes to ensure estimated savings are being achieved. For example, utilities have expressed concerns that the deemed savings for duct sealing measures (which account for a high percentage of the savings claimed for RES/HTR SOP programs) are too high, especially given the variation in how well the work is performed.

6.3 Recommended Research Activities

This section identifies research activities that may assist the Commission and the utilities in designing more effective programs and better estimating program impacts. The activities can be most efficiently conducted statewide across all utilities, but may be performed for individual utilities, allowing for more customized findings.

R1. **Conduct a free ridership study to estimate savings attributable to the programs.** The fact that a sponsor receives incentive funds for installing energy efficiency measures is not necessarily an indication that the measures were installed solely as a result of the funds being available. Through customer surveys, billing analyses, and other means, a free ridership study can help identify the share of program-reported savings that would not otherwise have occurred. In the chapter on "Energy Efficiency Program Best Practices," the *National Action Plan for Energy Efficiency* recommends conducting impact evaluations that measure the change in energy use attributable to the programs in order to ensure that goals are being met. Free ridership studies are a component of all state/utility evaluation approaches identified in the chapter, including those for New York, California, Wisconsin, and Bonneville Power. [102]

R2. **Conduct a study of measure persistence aimed at determining how much of the estimated savings from program activities are still being realized** three years or more after the measures were installed. Although Commission rules require that measures be expected to last for at least 10 years [PUCT Rule 25.181(j)(2)(H)], there is no guarantee that installed equipment is still being used or that savings have not disappeared due to equipment replacement. A persistence study would allow for a better understanding how much utilities' annual system peak loads have truly been reduced beyond a one-year time horizon. In addition, if performed by an independent party, the onsite inspections that would likely be conducted as part of a persistence study would lend additional credibility to utility savings claims, as noted in recommendation D17 – Introduce third-party, independent inspections of customer sites.

[102] The *National Action Plan for Energy Efficiency* (published by EPA in July 2006) was developed by over 50 organizations including the Texas State Energy Conservation Office, AEP, Entergy, and Xcel.

R3. **Conduct a market study to identify unclaimed savings resulting from program spillover and market transformation.** Program spillover refers to reductions in peak load and energy consumption that are influence by the programs but that are not recorded in program records. It may include direct impacts on contractors and customers as well as indirect "market transformation" effects such as the presence of more contractors in the state who are familiar with and who actively promote installation of high efficiency equipment. Given that the goal of the market transformation programs is to change market practices, and that limited budgets require strict cost effectiveness criteria, periodic market studies to identify program spillover should be conducted to better assess the full impact of the program.

R4. **Conduct a DSM potential study to determine the amount of additional savings that are technologically and economically feasible throughout the state.** By identifying the saturation of equipment at various ages and efficiency levels, this research can help guide program development, marketing, and the setting of incentives. The *National Action Plan for Energy Efficiency* advocates the use of energy efficiency potential studies to "provide the initial justification (the business case) for utilities embarking on or expanding energy efficiency programs…." Potential studies also support many of the Commission's energy efficiency activities and many of the recommendations contained in this audit report. According to the *Plan,* "[w]ith study results in hand, program administrators are well positioned to develop energy efficiency goals, identify program measures and strategies, and determine funding requirements to deliver energy efficiency programs to all customers."

R5. **Perform market research to identify the typical costs of installations by measure type.** Given that sponsors tend to focus their activity on just a few measures, it would appear that some measures are more profitable to install than others. Through an understanding of how much incentive is necessary to encourage installation of various measures, some incentives could be set at lower levels, rather than utilities maintaining a fixed $/kW incentive level regardless of the measure being promoted.

Several comments on the draft audit report recognized the potential value of additional research activities, but pointed out that limited funding could pose a barrier. The Commission may wish to contract for independent M&V audits on alternate years only, and instead require utilities to re-allocate funds that would have otherwise been spent on the audits for the purpose of conducting individual or joint research described above aimed at improving the overall effectiveness of the programs.