AEP Texas Central Company

2013 Energy Efficiency Plan and Report

Substantive Rules § 25.181 and § 25.183

April 1, 2013

Project No. 41196

Table of Contents

INTRODUCTION 3

EEPR ORGANIZATION 4

EXECUTIVE SUMMARY – ENERGY EFFICIENCY PLAN (PLAN) 5

EXECUTIVE SUMMARY – ENERGY EFFICIENCY REPORT (REPORT) 5

ENERGY EFFICIENCY PLAN 6

I. 2013 PROGRAMS 6

A. 2013 Program Portfolio 6
B. Existing Programs 7
C. New Programs for 2013 15
D. Discontinued Programs 17
E. Existing DSM Contracts or Obligations 18

II. CUSTOMER CLASSES 18

III. ENERGY EFFICIENCY GOALS AND PROJECTED SAVINGS 19

IV. PROGRAM BUDGETS 23

ENERGY EFFICIENCY REPORT 26

V. HISTORICAL DEMAND AND ENERGY SAVINGS GOALS FOR THE PREVIOUS FIVE YEARS 26

VI. PROJECTED, REPORTED AND VERIFIED DEMAND AND ENERGY SAVINGS 27

VII. HISTORICAL PROGRAM EXPENDITURES 29

VIII. PROGRAM FUNDING FOR CALENDAR YEAR 2012 31

IX. MARKET TRANSFORMATION PROGRAM RESULTS 33

X. RESEARCH AND DEVELOPMENT 34

XI. CURRENT ENERGY EFFICIENCY COST RECOVERY FACTOR (EECRF) 36

XII. UNDERSERVED COUNTIES 38

XIII. PERFORMANCE BONUS 38

ACRONYMS 40

APPENDIX A: REPORTED AND VERIFIED DEMAND AND ENERGY REDUCTION BY COUNTY 42

APPENDIX B: PROGRAM TEMPLATES 49

APPENDIX C: EXISTING CONTRACTS OR OBLIGATIONS 50

APPENDIX D: OPTIONAL SUPPORT DOCUMENTATION 51

Introduction

AEP Texas Central Company (TCC or Company) presents this Energy Efficiency Plan and Report (EEPR) to comply with Public Utility Commission of Texas (PUCT or Commission) Substantive Rules 25.181 and 25.183 (EE Rule), which implement the Public Utility Regulatory Act (PURA) § 39.905. As mandated by this section of PURA, the EE Rule requires that each investor owned electric transmission and distribution utility (TDU) achieve the following demand reduction goals through market-based standard offer programs (SOPs) and targeted market transformation programs (MTPs):

> (A) The utility shall acquire no less than a 25% reduction of the electric utility's annual growth in demand of residential and commercial customers for the 2012 program year.
>
> (B) Beginning with the 2013 program year, until the trigger described in subparagraph (C) of this paragraph is reached, the utility shall acquire a 30% reduction of its annual growth in demand of residential and commercial customers.
>
> (C) If the demand reduction goal to be acquired by a utility under subparagraph (B) of this paragraph is equivalent to at least four-tenths of 1% of its summer weather-adjusted peak demand for the combined residential and commercial customers for the previous program year, the utility shall meet the energy efficiency goal described in subparagraph (D) of this paragraph for each subsequent program year.
>
> (D) Once the trigger described in subparagraph (C) of this paragraph is reached, the utility shall acquire four-tenths of 1% of its summer weather-adjusted peak demand for the combined residential and commercial customers for the previous program year.
>
> (E) Except as adjusted in accordance with subsection (w) of this section, a utility's demand reduction goal in any year shall not be lower than its goal for the prior year, unless the commission establishes a goal for a utility pursuant to paragraph (2) of this subsection.

The EE Rule includes specific requirements related to the implementation of SOPs and MTPs that control the manner in which TDUs must administer their portfolio of energy efficiency programs in order to achieve their mandated annual demand reduction goals. TCC's plan enables it to meet its statutory goals through implementation of energy efficiency programs in a manner that complies with PURA § 39.905 and the EE Rule. This EEPR covers the periods of time required in Substantive Rule 25.181. The following section describes the information that is contained in each of the subsequent sections and appendices.

EEPR Organization

This EEPR consists of an Executive Summary, thirteen sections, a list of acronyms, and four appendices.

- Executive Summary summarizes TCC's plans for achieving its goals and projected energy efficiency savings for program years 2013 and 2014 and highlights TCC's achievements for program year 2012.

Energy Efficiency Plan

- Section I describes TCC's program portfolio. It details how each program will be implemented, presents related informational and outreach activities, and provides an introduction to any programs not included in TCC's 2012 EEPR.
- Section II explains TCC's targeted customer classes, describes the estimated size of each class and the method of determining those class sizes.
- Section III presents TCC's energy and demand goals and projected savings for the prescribed planning period detailed by program for each customer class.
- Section IV describes TCC's proposed energy efficiency budgets for the prescribed planning period detailed by program for each customer class.

Energy Efficiency Report

- Section V documents TCC's demand reduction goal for each of the previous five years (2008-2012) based on its weather-adjusted peak demand and actual savings achieved for those years.
- Section VI compares TCC's projected energy and demand savings to its reported and verified savings by program for calendar years 2011 and 2012.
- Section VII details TCC's incentive and administration expenditures for each of the previous five years (2008-2012) detailed by program for each customer class.
- Section VIII compares TCC's actual 2012 expenditures with its 2012 budget by program for each customer class. It identifies funds committed but not expended and funds remaining and not committed. It also explains any cost deviations of more than 10% from TCC's overall program budget.
- Section IX describes the results from TCC's MTPs. It compares existing baselines and milestones with actual results, and details updates to those baselines and milestones.
- Section X describes Research and Development activities.
- Section XI documents TCC's most recent Energy Efficiency Cost Recovery Factor (EECRF).
- Section XII documents TCC's Underserved Counties.
- Section XIII describes TCC's Performance Bonus calculation for program year 2012.

Acronyms

- A list of abbreviations for common terms used within this document.

Appendices

- Appendix A – Reported and Verified Demand and Energy Reductions by County for each program.

- Appendix B – Program Templates for any new or significantly modified programs and programs not included in TCC's previous EEPR.
- Appendix C – Existing Energy Efficiency contracts and obligations.
- Appendix D – Data, explanations, or documents supporting other sections of the EEPR.

Executive Summary – Energy Efficiency Plan (Plan)

TCC plans to achieve its 2013 mandated demand and energy goals of 12,930 kW and 22,657,000 kWh as shown in Table 1 below through residential and non-residential standard offer and market transformation programs. TCC will utilize a budget of $14,082,454 to accomplish these goals.

TCC will implement two new MTPs, the Irrigation Load Management MTP and the Open MTP to enhance its ability to achieve these goals. In addition, past experiences and lessons learned will help TCC to achieve its 2013 goals.

Table 1: Summary of Goals, Projected Savings (at the Meter),[1] and Budgets

Calendar Year	Average Growth in Demand (MW)	Goal Metric: 30% Growth (MW)	Weather Adjusted Peak Demand (MW) previous year	Goal Metric: 0.4% Peak Demand (MW)	Peak Demand Goal (MW)*	Energy Goal (MWh)	Projected Demand Reduction (MW)	Projected Energy Savings (MWh)	Projected Budget (000's)**
2013	-3.91	-1.2	4,033	16.13	12.93	22,657	36.46	61,076	$ 14,082
2014	-3.91	-1.2	NAP	NAP	12.93	22,657	36.60	61,756	$ 14,650

* Substantive Rule 25.181(e)(1)(E) - Beginning in 2009 a utility's demand reduction goal in megawatts for any year shall not be less than the previous year's goal.

** The 2014 Projected Budget includes EM&V expenditures for 2013 and 2014.

Executive Summary – Energy Efficiency Report (Report)

TCC achieved demand and energy reductions of 35,702 kW and 54,329,055 kWh respectively in 2012. The total energy efficiency cost for achieving these savings was $12,122,759. TCC's achievement exceeded the 2012 mandated energy efficiency goals of 12,930 kW and 22,657,000 kWh, thus allowing TCC to earn a Performance Bonus.

A broad portfolio of residential and non-residential standard offer and market transformation programs was used to accomplish these savings.

[1] Average Growth in Demand figures are from Table 4; Projected Savings from Table 5; Projected Budgets from Table 6. All kW/MW and kWh/MWh figures in this Table and throughout this EEPR are given "at the Meter."

ENERGY EFFICIENCY PLAN

I. 2013 Programs

A. 2013 Program Portfolio

TCC has implemented a variety of programs in 2013 to enable it to meet its goals in a manner that complies with PURA § 39.905 and the EE Rule. These programs target broad market segments and specific market sub-segments with significant opportunities for cost-effective energy savings.

Table 2 summarizes TCC's programs and targeted customer class markets for Program Year 2013. The programs listed in Table 2 are described in further detail in Subsections B and C. TCC maintains a web site containing information for participation, forms required for project submission, and currently available funding at www.AEPefficiency.com. This site is the primary method of communication used to provide program updates and information to Retail Electric Providers (REPs), potential Energy Efficiency Service Providers (EESPs), and other interested parties.

Table 2: 2013 Energy Efficiency Program Portfolio

Program	Target Market	Application	Link to Program Manual
A/C Distributor Pilot Market Transformation Program	Commercial; Residential	Retrofit	http://www.aepefficiency.com/ACDistributor/
Commercial Solutions Market Transformation Program	Commercial	Retrofit & New Construction	http://www.eeprograms.net/aep/texascentral/commercial_solutions.php
Commercial Standard Offer Program	Commercial	Retrofit & New Construction	http://www.aepefficiency.com/cisop/downloads/index.htm
CoolSaver© A/C Tune-Up Market Transformation Program	Commercial; Residential	Retrofit	http://www.eeprograms.net/aep/texascentral/coolsaver.php
High-Performance New Homes Market Transformation Program	Residential	New Construction	http://www.southtxsaves.com/resources-and-tips
Hard-to-Reach Standard Offer Program	Residential Hard-to-Reach	Retrofit	http://www.aephtrsop.com/TexasCentral/index.html
Load Management Standard Offer Program	Commercial	Retrofit	http://www.aepefficiency.com/loadmanagement/TCC/index html
Residential Standard Offer Program	Residential	Retrofit	http://www.aepressop.com/TexasCentral/index.html
SCORE/CitySmart Market Transformation Program	Commercial	Retrofit & New Construction	http://www.eeprograms.net/aep/texascentral/score php http://www.eeprograms.net/aep/texascentral/citysmart.php
SMART Source℠ Solar PV Market Transformation Program	Commercial; Residential	Retrofit & New Construction	http://www.txreincentives.com/apv/
Targeted Low-Income Energy Efficiency Program	Low-Income Residential	Retrofit	NAP
New Programs for 2013			
Irrigation LM Market Transformation Program	Commercial	Retrofit	http://getmore.enernoc.com/aeptexasilm
Open Market Transformation Program	Commercial	Retrofit	http://eeprograms.net/texascentral/open.php

B. Existing Programs

A/C Distributor Pilot Market Transformation Program (ACD MTP)

Program design

The ACD MTP targets a select number of air conditioning (A/C) equipment distributors in one or more cities served by TCC. The objective of the program is to increase the market penetration of high-efficiency A/C equipment for residential and commercial customers served by TCC. Incentives are paid to the distributor for the installation of high-efficiency A/C equipment of up to 20 tons in cooling capacity.

Implementation process

A third-party implementer is contracted to design, implement, and market the ACD MTP. The implementer recruits and contracts with interested A/C distributors that provide A/C equipment to installers in TCC's service territory.

Outreach activities

TCC and the selected program implementer provide complete program information and application materials to the established A/C equipment distributors selected for the pilot phase of the program. Informational material that explains the value of high-efficiency A/C equipment is provided either individually or at program outreach meetings. This material identifies the importance of proper unit sizing, improved duct efficiency, proper refrigerant charge, and proper air flow over the coil.

Commercial Solutions Market Transformation Program (CS MTP)

Program design

TCC's CS MTP targets commercial customers (other than governmental and educational entities) that do not have the in-house expertise to: 1) identify, evaluate, and undertake energy efficiency improvements; 2) properly evaluate energy efficiency proposals from vendors; and/or 3) understand how to leverage their energy savings to finance projects. Incentives are paid to customers served by TCC for eligible energy efficiency measures that are installed in new or retrofit applications that result in verifiable demand and energy savings.

Implementation process

The CS MTP facilitates the identification of demand and energy savings opportunities, general operating characteristics, long-range energy efficiency planning, and overall measure and program acceptance by the targeted commercial facilities.

Outreach activities

TCC markets the CS MTP in the following manner:

- Contracts with a third-party implementer to conduct outreach and planning activities;
- Targets a number of customer participants during the program year;
- Conducts workshops as necessary to explain elements of the program, such as responsibilities of the participants, project requirements, incentive information, and the application and reporting process;
- Participates in regional outreach activities as may be necessary; and
- Participates in appropriate industry-related meetings to generate awareness and interest.

Commercial Standard Offer Program (CSOP)

Program design

The CSOP targets commercial customers of all sizes. Variable incentives are paid to project sponsors for eligible measures installed in new or retrofit applications based upon verified demand and energy savings.

Implementation process

Any eligible project sponsor may submit an application for a project that meets minimum requirements. The program information on TCC's web site is updated frequently to reflect participating project sponsors and the remaining available incentive budget.

Outreach activities

TCC markets the CSOP in the following manner:

- Utilizes mass e-mail notifications to keep potential project sponsors interested and informed;
- Maintains internet web site with detailed project eligibility, end-use measures, incentives, procedures, and application forms;
- Participates in appropriate industry-related meetings to generate awareness and interest;
- Participates in state-wide outreach activities as may be available; and
- Conducts workshops as necessary to explain elements such as responsibilities of the project sponsor, project requirements, incentive information, and the application and reporting process.

CoolSaver© A/C Tune-Up Market Transformation Program (CoolSaver© MTP)

Program design

In 2012, TCC issued a competitive Request for Proposals (RFP) to select an implementer to begin fully implementing an A/C tune-up program in 2013. The CoolSaver© MTP is designed to overcome market barriers that prevent residential and small business customers from receiving high performance A/C system tune-ups. The program works through local A/C distributor networks to offer key program components, including:

- Training and certifying A/C technicians on the tune-up and air flow correction services and protocols; and
- Paying incentives to A/C contactors for the successful implementation of A/C tune-up and air flow correction services.

Implementation process

A third-party implementer is contracted to design, implement, and market the CoolSaver© MTP as well as to provide specialized training to the A/C technicians. The implementer recruits interested A/C contractors that enter into a contractor partnering agreement that specifies the program requirements. Contractors are trained on the A/C tune-up process and provided incentives and discounts on the cost of field equipment designed to diagnose and quantify energy savings opportunities. Energy savings are captured through the correction of A/C system inefficiencies identified during the tune-up activities.

Outreach activities

TCC markets the CoolSaver© MTP in the following manner:

- Contracts with a third-party implementer to conduct outreach and planning activities;
- Targets residential and commercial A/C contractors that service customers served by TCC;
- Conducts training workshops with contractor staff on the specific tune-up and airflow correction services promoted by the program, as well as the measurement and verification process to document savings;
- Conducts workshops as necessary to explain elements of the program, such as responsibilities of the contractors, project requirements, incentive information, and the application and reporting process; and
- Participates in appropriate industry-related meetings to generate awareness and interest.

High-Performance New Homes Market Transformation Program (New Homes MTP)

Program design

The New Homes MTP, formerly named ENERGY STAR® New Homes MTP, targets several market participants, primarily homebuilders and consumers. The program's goal is to create conditions in which consumers demand ENERGY STAR-certified homes, and homebuilders supply them. Incentives are paid to homebuilders who construct homes in the TCC service territory to strict energy-efficient building guidelines and that are at least 15% above the local building code. The program offers a bonus incentive for homes that are ENERGY STAR-certified. Each home results in verifiable demand and energy savings. In addition to homebuilder and consumer outreach, the New Homes MTP targets key allies in the homebuilding production and sales cycle: home energy raters, homebuilder sales agents, real estate agents, HVAC contractors, mortgage lenders, product manufacturers, homebuilder associations, and media outlets.

Implementation process

A third-party implementer is contracted to implement and market the New Homes MTP as well as to provide specialized training to the builders and raters. Any homebuilder constructing energy-efficient homes that meet the program guidelines in the TCC service territory may apply for incentives. The information on TCC's web site is updated regularly to reflect the most current program information and incentives that are available.

Outreach activities

TCC markets the New Homes MTP in the following manner:

- Contracts with a third-party implementer to conduct outreach and planning activities;
- E-mail and phone notification of informational meetings to homebuilders, home energy raters, HVAC contractors, real estate agents, homebuilder sales agents, mortgage lenders and other allies;
- Maintains internet web site with detailed project eligibility, incentives, procedures and application forms;
- Direct outreach to consumers at home and garden shows and through a multi-city advertising campaign;
- Participates in appropriate industry-related meetings to generate awareness and interest;
- Conducts training workshops as necessary to explain elements such as responsibilities of and benefits to each party or ally, project requirements, incentive information, and the application and reporting process;
- Supports homebuilder sales efforts by providing sales training, marketing materials, and inclusion in print advertisements and the program's web site; and
- Supports the homebuilding process by providing technical training, home plan analysis, and answers to questions as needed.

Hard-to-Reach Standard Offer Program (HTR SOP)

Program design

The HTR SOP targets the retrofit residential market of customers with total annual household incomes at or below 200% of current federal poverty guidelines. Incentives are paid to project sponsors for eligible measures installed in retrofit applications that result in verifiable demand and energy savings. Program incentives are higher for work performed in historically underserved counties and for identified underserved measures to encourage activity. Project comprehensiveness is encouraged and customer education materials regarding energy conservation behavior are distributed by project sponsors.

Implementation process

Eligible project sponsors may submit an application for a project meeting the minimum requirements. The program information on TCC's web site is updated frequently to reflect participating project sponsors and available incentive budgets.

Outreach activities

TCC markets the HTR SOP in the following manner:

- Utilizes mass e-mail notifications to enroll and keep potential project sponsors interested and informed;
- Maintains internet web site with detailed project eligibility, end-use measures, incentives, procedures, and application forms;
- Participates in appropriate industry-related meetings to generate awareness and interest;
- Participates in state-wide outreach activities as may be available; and
- Conducts workshops as necessary to explain elements such as responsibilities of the project sponsor, project requirements, incentive information, and the application and reporting process.

Load Management Standard Offer Program (LM SOP)

Program design

The LM SOP targets commercial customers with a peak electric demand of 500 kW or more. Incentives are paid to project sponsors to reduce peak electric load on one-hour ahead notice for load reduction periods of one to four hours duration. Incentive payments are based upon the verified, metered peak demand reduction as called for by TCC.

Implementation process

Eligible project sponsors may submit an application for a project meeting the minimum requirements as identified by TCC. The program information on TCC's web site is updated frequently to reflect remaining available budget amounts. TCC closely coordinates with ERCOT to avoid duplicative load participation in the LM SOP and ERCOT's Emergency Response Service (ERS) program.

Outreach activities

TCC markets the LM SOP in the following manner:

- Utilizes mass e-mail notifications to enroll and keep potential project sponsors interested and informed;
- Maintains internet web site with detailed project eligibility, incentives, procedures, and application forms;
- Participates in appropriate industry-related meetings to generate awareness and interest;

- Participates in state-wide outreach activities as may be available; and
- Conducts workshops as necessary to explain elements such as responsibilities of the project sponsor, project requirements, incentive information, and the application and reporting process.

Residential Standard Offer Program (RSOP)

Program design

The RSOP targets residential customers in existing homes. Incentives are paid to project sponsors for eligible measures installed in retrofit applications that result in verified demand and energy savings. Program incentives are higher for work performed in historically underserved counties to encourage activity. Project comprehensiveness is encouraged.

Implementation process

Eligible project sponsors may submit applications for projects meeting the minimum requirements. The program information on TCC's web site is updated frequently to reflect participating project sponsors and remaining available incentive amounts.

Outreach activities

TCC markets the RSOP in the following manner:

- Utilizes mass e-mail notifications to inform and update potential project sponsors such as REPs, EESPs, national, and local companies that provide energy-related services;
- Provides additional outreach using direct mail as necessary to attract more participants;
- Maintains internet web site with detailed project eligibility, end-use measures, incentives, procedures, and application forms;
- Participates in appropriate industry-related meetings to generate awareness and interest;
- Participates in state-wide outreach activities as may be available; and
- Conducts workshops as necessary to explain elements such as responsibilities of the project sponsor, project requirements, incentive information, and the application and reporting process.

SCORE/CitySmart Market Transformation Program (SCORE/CS MTP)

Program design

The SCORE/CS MTP provides energy efficiency and demand reduction solutions for educational facilities, including public and private K-12 schools, higher education, and local government institutions. This program is designed to help educate and assist these customers in lowering their energy use by integrating energy efficiency into their short- and long-term planning, budgeting, and operational practices. Incentives are paid to participating customers for eligible energy

efficiency measures that are installed in new or retrofit applications that result in verifiable demand and energy savings.

Implementation process

This program targets eligible customers in TCC's service territory. The program facilitates the identification of potential demand and energy savings opportunities, general electric energy operating characteristics, long-range energy efficiency planning, and overall measure and program acceptance by the targeted educational and governmental entities.

Outreach activities

TCC markets the SCORE/CS MTP in the following manner:

- Contracts with a third-party implementer to conduct outreach and planning activities;
- Targets customer participants;
- Conducts workshops as necessary to explain elements of the program, such as responsibilities of the participants, project requirements, incentive information, and the application and reporting process;
- Participates in regional outreach activities as may be necessary; and
- Participates in appropriate industry-related meetings to generate awareness and interest.

SMART Source[SM] Solar PV Market Transformation Program (PV MTP)

Program design

In 2012, TCC issued a competitive solicitation RFP and selected a third-party implementer to begin full implementation of the PV MTP in 2013. In addition to demand and energy savings achieved from the installations, the program aims to transform the solar PV market by increasing the number of qualified technicians and installers and decreasing the average installed cost of PV systems, thereby creating greater market economies of scale.

Implementation Process

The program targets solar PV installation companies in TCC's service territory. It also promotes program awareness to solar PV manufacturers and customers in TCC's service territory. Solar PV installers who complete the program certification process become eligible to participate in the program. These trained installers then submit completed project applications to be eligible to receive incentives based on program guidelines.

Outreach Activities

TCC markets the PV MTP in the following manner:

- Contracts with a third-party implementer to conduct outreach and planning activities;
- Makes clear and concise material available that describes the program incentives;
- Maintains internet web site and program guidebook to be used as referral tools;
- Conducts workshops and certification training for installers and local code enforcement officials to explain project requirements and incentive information; and
- Facilitates earned media opportunities, spotlighting successful projects and interesting stories when possible.

Targeted Low-Income Energy Efficiency Program (TLIP)

Program design

The TLIP is designed to cost-effectively reduce the energy consumption and energy costs for low-income residential customers in TCC's service territory. Weatherization service providers install eligible weatherization and energy efficiency measures in qualified households that meet the Department of Energy (DOE) income-eligibility guidelines (at or below 200% of the federal poverty guidelines).

Target market

A qualified household must: (1) receive electric power service through the TCC distribution system; (2) meet the current DOE income-eligibility guidelines; and (3) have electric air conditioning.

Implementation and outreach activities

TCC contracts with a third-party implementer that conducts outreach activities targeting existing weatherization service providers in TCC's service territory. These weatherization service providers verify customer eligibility and conduct an energy use assessment of eligible customers' homes. The weatherization service providers install measures based on the savings-to-investment ratio (SIR), which evaluates cost-effectiveness using the present value of the measure's lifetime energy savings divided by the installation costs.

C. New Programs for 2013

In 2012 TCC invited six EESPs that had previously proposed programs for consideration to present their program concepts in detail. From these program presentations, TCC selected two for further analysis and review. The two programs selected for implementation in the 2013 program

year are the Irrigation Load Management MTP and Open MTP. A summary of these two programs is described below:

Irrigation Load Management Market Transformation Program (ILM MTP)

Program design

The ILM MTP targets commercial agricultural customers using electric drive irrigation pumps with at least 25 kW of electric peak demand. Incentive payments are based on measured and verified demand reduction provided by curtailing irrigation pump loads during the summer peak period. Load management events are dispatched by TCC, using a one-hour ahead notice for periods of one to four hours duration.

Implementation process

TCC contracts with a third-party program implementer that is responsible for implementing the program. The program implementer installs remote control and communications hardware at each pump to enable shutdown of pumps during load management events.

Outreach activities

The program implementer markets the ILM MTP in the following manner:

- Utilizes publicly available agricultural industry data and proprietary databases to identify customer prospects and engage with prospects through a direct-sales model;
- Develops marketing materials such as program brochures, case studies, FAQ documents, and other relevant materials;
- Maintains an internet web site with detailed project eligibility, irrigation load control measures, incentive levels, procedures, and application forms; and
- Participates in appropriate industry-related meetings to generate awareness and interest.

Open Market Transformation Program (Open MTP)

Program design

The Open MTP targets traditionally underserved small commercial customers who may not employ knowledgeable personnel with a focus on energy reduction, who are limited in the ability to implement energy efficiency measures, and/or who typically do not actively seek the help of a professional EESP. Small commercial customers with peak demands not exceeding 100 kW in the previous 12 consecutive billing months may qualify to participate in the program. Available incentives are paid directly to the contractor, thereby reducing a portion of the project cost for the

customer. Additionally, customers whose peak demand is less than or equal to 10 kW may qualify for incentives which would offset up to 100% of the cost of their project(s).

Implementation process

The implementer recruits and provides participating contractors with education, training, and tools to identify potential demand and energy savings opportunities for customers. The program is intended to overcome market barriers by providing participating contractors with technical support and incentives to implement energy efficiency upgrades and produce demand and energy savings.

Outreach activities

TCC contracts with a third-party implementer to conduct outreach and planning activities for the Open MTP in the following manner:

- Identifies and recruits contractors who provide services to customers served by TCC to develop a network of participating contractors who will deliver the program directly to customers;
- Maintains an internet web site to provide information to potential participants;
- Develops a recruitment packet with outreach information and enrollment materials that participating contractors can use when marketing the program to customers;
- Conducts training as necessary to explain elements of the program, such as responsibilities of the participants, project requirements, incentive information, and the application and reporting process;
- Participates in regional outreach activities as may be necessary; and
- Participates in appropriate industry-related meetings to generate awareness and interest.

D. Discontinued Programs

AEP Texas CARE$ Energy Efficiency for Not-for-Profit Agencies Standard Offer Program (CARE$ SOP)

The CARE$ SOP targeted commercial not-for-profit (NFP) agencies organized exclusively for religious, scientific, or other charitable purposes. Incentives were paid to participating agencies for certain eligible energy efficiency improvements made to administrative facilities that resulted in verified demand and energy savings. The goal was to reduce the agencies' operating costs by making their administrative facilities more energy efficient. With lower electric bills, a larger share of the agencies' operating funds would be available for client assistance.

The key challenge of this program was meeting the current program cost-effectiveness requirement. TCC determined that the CARE$ SOP could not achieve cost-effectiveness. In

addition, the program continued to demonstrate low participation. As a result, TCC discontinued this program for 2013.

E. Existing DSM Contracts or Obligations

TCC has no existing DSM contracts or obligations.

II. Customer Classes

TCC's energy efficiency programs target its Residential and Commercial customer classes. TCC's energy efficiency programs also target customer sub-classes, such as Residential Hard-to-Reach and Low-Income; and Public Schools, Not-for-Profit Agencies, Agriculture Irrigation, Small Businesses, and Local Governments.

The annual projected savings targets are allocated among these customer classes and sub-classes by examining historical program results and by evaluating economic trends, in compliance with Substantive Rule 25.181(e)(3)(A).

Table 3 summarizes the number of customers in each customer class and the Residential Hard-to-Reach sub-class at TCC. The number of customers listed are the actual number of active electric service accounts by class that TCC served for the month of January 2013. These numbers were used to determine goal and budget allocations for each customer class and program. It should be noted, however, that the actual distribution of the annual goal to be achieved and budget required to achieve the goal must remain flexible based upon the conditions of the marketplace, the potential interest a customer class may have in a specific program, and the overriding objective of meeting TCC's mandated demand and energy reduction goals in total. TCC offers a varied portfolio of SOPs and MTPs such that all eligible customer classes have access to energy efficiency alternatives.

Table 3: Summary of Customer Classes

Customer Class	Number of Customers
Commercial	129,920
Residential	702,740
Hard-to-Reach [2]	231,904*

* Hard-to-Reach customer count is a sub-set of the Residential total.

[2] According to the U.S. Census Bureau's 2009 Current Population Survey, 33.0% of Texas families fall below 200% of the poverty threshold. Applying that percentage to TCC's residential customer base of 702,740, the number of HTR customers is estimated to be 231,904.

III. Energy Efficiency Goals and Projected Savings

As prescribed by the EE Rule, TCC's annual demand reduction goal is specified as a percent of its historical, weather-normalized five-year average growth in demand. TCC's 2013 goal is calculated based on the average annual growth in peak demand for the years 2008 through 2012, inclusive (the most recent historical load growth data available). TCC's 2013 Program Year demand reduction goal to be achieved by December 31, 2013 is prescribed by the EE Rule to be at least 30% of this calculated average annual growth in demand of residential and commercial customers. This calculation results in a negative (-) demand reduction goal; therefore, TCC's 2013 goal to be achieved is 12.93 MW, which is no less than its prior year goal. The corresponding annual energy savings goal is determined by applying a 20% capacity factor to the 2013 demand reduction goal included in this Plan.

Table 4 presents historical annual growth in demand data for the previous five years that was used to calculate TCC's goals. Table 5 presents the projected demand and energy savings by program for each customer class, and for each of the years 2013 and 2014. Projected savings reflect the estimated demand and energy savings TCC's programs are expected to achieve with fully-deployed program budgets for each of the years shown.

Table 4: Annual Growth in Demand and Energy Consumption (at the Meter)

Calendar Year	Peak Demand (MW)				Energy Consumption (GWh)				Growth (MW)	Average Growth (MW) [3]
	Total System		Residential & Commercial		Total System		Residential & Commercial			
	Actual	Actual Weather Adjusted	Actual	Actual Weather Adjusted	Actual	Actual Weather Adjusted	Actual	Actual Weather Adjusted	Actual Weather Adjusted	Actual Weather Adjusted
2007	4,132	4,109	3,846	4,053	21,811	51,533	18,141	17,863	NAP	NAP
2008	3,972	3,971	3,634	4,067	22,166	22,191	18,265	18,289	14	NAP
2009	4,299	4,322	3,854	3,833	22,371	22,513	18,571	18,713	-233	NAP
2010	4,175	4,012	3,799	4,034	22,729	22,071	19,138	18,479	201	NAP
2011	4,242	4,205	3,828	4,093	22,305	22,242	18,199	18,135	59	NAP
2012	4,307	4,393	3,905	4,033	23,983	23,064	19,592	18,673	-60	NAP
2013	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	-3.91
2014	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	-3.91

TCC's historical peak demand (MW) is calculated as the maximum annual hourly demand. In prior years' EEPRs, the reported historical peak demand was TCC's maximum monthly peak based on ERCOT's 4CP (Company's demand at the time of ERCOT's four summer months peak) calculations. TCC has since put its own meters in place to calculate hourly peak demand. This installation made it possible for TCC to determine an annual non-coincident peak for use in this 2013 and future EEPRs.

[3] Average historical growth in demand over the prior five years for residential and commercial customers adjusted for weather fluctuations.

Table 5: Projected Demand and Energy Savings by Program for Each Customer Class for 2013 and 2014 (at the Meter)

2013	Projected Savings	
Customer Class and Program	**kW**	**kWh**
Commercial		
A/C Distributor Pilot MTP	**283**	**1,022,204**
Commercial Solutions MTP	**806**	**3,887,682**
Commercial SOP	**5,448**	**21,563,452**
CoolSaver© A/C Tune-Up MTP	**824**	**1,552,500**
Irrigation Load Management MTP	**4,000**	**256,000**
Load Management SOP	**14,516**	**38,148**
Open MTP	**530**	**1,987,000**
SCORE/CitySmart MTP	**1,591**	**5,749,624**
SMART Source℠ Solar PV MTP	**110**	**211,200**
Residential		
A/C Distributor Pilot MTP	**248**	**893,014**
CoolSaver© A/C Tune-Up MTP	**608**	**1,955,200**
High-Performance New Homes MTP	**300**	**550,000**
Residential SOP	**5,365**	**15,721,073**
SMART Source℠ Solar PV MTP	**110**	**211,000**
Hard-to-Reach		
Hard-to-Reach SOP	**1,324**	**4,216,566**
Targeted Low-Income Energy Efficiency Program	**398**	**1,261,041**
Total Annual Projected Savings	**36,461**	**61,075,704**

Table 5: Continued

2014	Projected Savings	
Customer Class and Program	**kW**	**kWh**
Commercial		
A/C Distributor Pilot MTP	**283**	**1,022,204**
Commercial Solutions MTP	**947**	**4,567,785**
Commercial SOP	**5,448**	**21,563,452**
CoolSaver© A/C Tune-Up MTP	**824**	**1,552,500**
Irrigation Load Management MTP	**4,000**	**256,000**
Load Management SOP	**14,516**	**38,148**
Open MTP	**530**	**1,987,000**
SCORE/CitySmart MTP	**1,591**	**5,749,624**
SMART Source℠ Solar PV MTP	**110**	**211,200**
Residential		
A/C Distributor Pilot MTP	**248**	**893,014**
CoolSaver© A/C Tune-Up MTP	**608**	**1,955,200**
High-Performance New Homes MTP	**300**	**550,000**
Residential SOP	**5,365**	**15,721,073**
SMART Source℠ Solar PV MTP	**110**	**211,000**
Hard-to-Reach		
Hard-to-Reach SOP	**1,324**	**4,216,566**
Targeted Low-Income Energy Efficiency Program	**398**	**1,261,041**
Total Annual Projected Savings	**36,602**	**61,755,807**

IV. Program Budgets

Table 6 presents total proposed budget allocations required to meet TCC's projected demand and energy savings to be achieved for the Program Years 2013 and 2014. The budget allocations are defined by the overall projected demand and energy savings, the avoided costs of capacity and energy specified in Substantive Rule 25.181, allocation of demand goals, and the incentive levels by customer class. Table 6 budget allocations are detailed by customer class, program, and in the following budget categories: incentives, administration, research and development (R&D), and evaluation, measurement and verification (EM&V).

Table 6: Projected Annual Budget by Program for Each Customer Class for 2013 and 2014

2013	Incentives	Admin	R&D	EM&V	Total Budget
Commercial					
A/C Distributor Pilot MTP	**$300,000**	**$33,333**			**$333,333**
Commercial Solutions MTP	**$412,156**	**$45,795**			**$457,951**
Commercial SOP	**$1,689,000**	**$187,667**			**$1,876,667**
CoolSaver© A/C Tune-Up MTP	**$595,950**	**$66,217**			**$662,167**
Irrigation Load Management MTP	**$450,000**	**$50,000**			**$500,000**
Load Management SOP	**$450,000**	**$50,000**			**$500,000**
Open MTP	**$693,546**	**$77,061**			**$770,607**
SCORE/CitySmart MTP	**$827,304**	**$91,923**			**$919,227**
SMART Source℠ Solar PV MTP	**$200,000**	**$22,222**			**$222,222**
Residential					
A/C Distributor Pilot MTP	**$300,000**	**$33,333**			**$333,333**
CoolSaver© A/C Tune-Up MTP	**$525,000**	**$58,333**			**$583,333**
High-Performance New Homes MTP	**$765,000**	**$85,000**			**$850,000**
Residential SOP	**$2,661,115**	**$295,679**			**$2,956,794**
SMART Source℠ Solar PV MTP	**$200,000**	**$22,222**			**$222,222**
Hard-to-Reach					
Hard-to-Reach SOP	**$953,417**	**$105,935**			**$1,059,352**
Targeted Low-Income Energy Efficiency Program	**$1,267,421**	**$140,825**			**$1,408,246**
Research and Development (R&D)					
CCET	**NAP**	**NAP**	**$32,000**		**$32,000**
SMART View℠ In-Home Device R&D Project	**NAP**	**NAP**	**$235,000**		**$235,000**
R&D - Programs	**NAP**	**NAP**	**$160,000**		**$160,000**
Evaluation, Measurement & Verification (EM&V)					
EM&V	**NAP**	**NAP**	**NAP**	**$0**	**$0**
Total Budgets	**$12,289,909**	**$1,365,545**	**$427,000**	**$0**	**$14,082,454**

Table 6: Continued

2014	Incentives	Admin	R&D	EM&V	Total Budget
Commercial					
A/C Distributor Pilot MTP	**$300,000**	**$33,333**			**$333,333**
Commercial Solutions MTP	**$538,156**	**$59,795**			**$597,951**
Commercial SOP	**$1,689,000**	**$187,668**			**$1,876,668**
CoolSaver© A/C Tune-Up MTP	**$595,950**	**$66,217**			**$662,167**
Irrigation Load Management MTP	**$200,000**	**$22,222**			**$222,222**
Load Management SOP	**$450,000**	**$50,000**			**$500,000**
Open MTP	**$693,546**	**$77,061**			**$770,607**
SCORE/CitySmart MTP	**$917,104**	**$101,900**			**$1,019,004**
SMART Source℠ Solar PV MTP	**$200,000**	**$22,222**			**$222,222**
Residential					
A/C Distributor Pilot MTP	**$300,000**	**$33,333**			**$333,333**
CoolSaver© A/C Tune-Up MTP	**$525,000**	**$58,333**			**$583,333**
High-Performance New Homes MTP	**$765,000**	**$85,000**			**$850,000**
Residential SOP	**$2,661,115**	**$295,679**			**$2,956,794**
SMART Source℠ Solar PV MTP	**$200,000**	**$22,222**			**$222,222**
Hard-to-Reach					
Hard-to-Reach SOP	**$953,417**	**$105,935**			**$1,059,352**
Targeted Low-Income Energy Efficiency Program	**$1,267,421**	**$140,825**			**$1,408,246**
Research and Development (R&D)					
R&D - Programs	**NAP**	**NAP**	**$265,000**		**$265,000**
Residential Demand Response R&D Project			**$200,000**		**$200,000**
Evaluation, Measurement & Verification (EM&V)					
EM&V	**NAP**	**NAP**	**NAP**	**$567,400**	**$567,400**
Total Budgets	**$12,255,709**	**$1,361,745**	**$465,000**	**$567,400**	**$14,649,854**

ENERGY EFFICIENCY REPORT

V. Historical Demand and Energy Savings Goals for the Previous Five Years

Table 7 contains TCC's demand and energy reduction goals and actual savings achieved for the previous five years (2008-2012) calculated in accordance with Substantive Rule 25.181.

Table 7: Historical Demand and Energy Savings Goals (at the Meter)

Calendar Year	Actual Weather Adjusted Demand Goal (MW)	Actual Weather Adjusted Energy Goal (MWh)	Actual Savings (MW)	Actual Savings (MWh)
2012 [4]	12.93	22,657	35.70	54,329
2011 [5]	12.93	22,657	27.50	69,158
2010 [6]	12.93	22,657	26.96	57,665
2009 [7]	12.93	22,657	26.07	63,256
2008 [8]	10.63	NAP	13.07	36,118

[4] Actual weather-adjusted MW and MWh Goals as reported in TCC's EEPR filed March 2012 under Project No. 40194.
[5] Actual weather-adjusted numbers from EEPR, Project No. 39105.
[6] Actual weather-adjusted numbers from EEPR, Project No. 37982.
[7] Actual weather-adjusted numbers from EEPR, Project No. 36689.
[8] Actual weather-adjusted numbers from EER, Project No. 35440.

VI. Projected, Reported and Verified Demand and Energy Savings

Table 8: Projected versus Reported and Verified Savings for 2012 and 2011 (at the Meter)

2012	Projected Savings [9]		Reported and Verified Savings	
Customer Class and Program	**kW**	**kWh**	**kW**	**kWh**
Commercial				
A/C Distributor Pilot MTP	**260**	**828,570**	**0**	**0**
AEP Texas CARE$ Energy Efficiency for Not-for-Profit Agencies SOP	**30**	**91,000**	**32**	**124,634**
Commercial Solutions MTP	**770**	**3,091,000**	**889**	**3,545,154**
Commercial SOP	**4,880**	**22,917,000**	**2,842**	**11,248,242**
CoolSaver© A/C Tune-Up Pilot MTP	**248**	**346,912**	**233**	**416,328**
Load Management SOP	**9,760**	**27,000**	**9,760**	**27,000**
Load Management SOP - Expanded	**19,600**	**54,000**	**9,706**	**82,167**
SCORE/CitySmart MTP	**1,515**	**3,600,000**	**1,930**	**8,279,031**
SMART Source℠ Solar PV Pilot MTP	**90**	**178,000**	**109**	**210,240**
Residential				
A/C Distributor Pilot MTP	**300**	**948,000**	**38**	**147,466**
CoolSaver© A/C Tune-Up Pilot MTP	**468**	**1,466,400**	**421**	**1,088,943**
ENERGY STAR New Homes MTP	**300**	**550,000**	**317**	**1,121,881**
Residential SOP	**7,820**	**21,467,000**	**7,299**	**21,390,025**
SMART Source℠ Solar PV Pilot MTP	**90**	**178,000**	**91**	**174,456**
Hard-to-Reach				
Hard-to-Reach SOP	**1,690**	**4,943,000**	**1,637**	**5,212,744**
Targeted Low-Income Energy Efficiency Program	**270**	**1,033,000**	**398**	**1,260,744**
Total Annual Savings	**48,091**	**61,718,882**	**35,702**	**54,329,055**

[9] Projected savings from EEPR filed March 2012, Project No. 40194.

Table 8: Continued

2011 [10]	Projected Savings		Reported and Verified Savings	
Customer Class and Program	**kW**	**kWh**	**kW**	**kWh**
Commercial				
AEP Texas CARE$ Energy Efficiency for Not-for-Profit Agencies SOP	**20**	**84,000**	**28**	**87,973**
Commercial Solutions Pilot MTP	**950**	**3,820,000**	**966**	**3,682,071**
Commercial SOP	**9,330**	**43,050,000**	**5,404**	**25,369,627**
CoolSaver© A/C Tune-Up Pilot MTP	**150**	**402,000**	**283**	**603,546**
Load Management SOP	**9,760**	**27,000**	**6,996**	**177,831**
SCORE/CitySmart MTP	**1,500**	**3,978,000**	**1,520**	**4,321,420**
SMART Source℠ Solar PV Pilot MTP	**80**	**154,000**	**379**	**731,072**
Residential				
CoolSaver© A/C Tune-Up Pilot MTP	**170**	**304,000**	**287**	**828,370**
ENERGY STAR New Homes MTP	**300**	**550,000**	**387**	**1,247,209**
Residential SOP	**8,100**	**23,359,000**	**7,933**	**21,767,921**
SMART Source℠ Solar PV Pilot MTP	**80**	**154,000**	**81**	**156,168**
Hard-to-Reach				
Hard-to-Reach SOP	**3,050**	**9,757,000**	**2,985**	**9,250,662**
Targeted Low-Income Energy Efficiency Program	**180**	**649,000**	**247**	**933,912**
Total Annual Savings	**33,670**	**86,288,000**	**27,496**	**69,157,782**

[10] Projected and Reported/Verified Savings from EEPR filed March 2012, Project No. 40194.

VII. Historical Program Expenditures

This section documents TCC's incentive and administration expenditures for the previous five years (2008-2012) detailed by program for each customer class.

Table 9: Historical Program Incentive and Administrative Expenditures for 2008 through 2012 (000's)[11]

	2012		2011		2010		2009		2008	
	Incent.	Admin	Incent.	Admin	Incent.	Admin	Incent.	Admin	Incent.	Admin
Commercial										
A/C Distributor Pilot MTP	$29.94	$5.32	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP
AEP Texas CARE$ Energy Efficiency for Not-for-Profit Agencies SOP	$54.04	$11.30	$145.00	$18.40	$149.53	$25.08	$166.00	$15.60	$149.50	$21.40
Commercial & Industrial Solicitation Program	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP	$0.20
Commercial Solutions MTP	$419.12	$35.86	$467.23	$56.45	$419.25	$43.47	$219.80	$26.80	$137.50	$6.50
Commercial SOP	$881.36	$143.85	$1,830.61	$192.01	$834.29	$132.69	$1,259.80	$121.10	$644.40	$81.90
CoolSaver© A/C Tune-Up Pilot MTP	$144.76	$13.93	$159.00	$13.18	$19.48	$1.86	NAP	NAP	NAP	NAP
Load Management SOP	$300.00	$32.33	$225.98	$24.38	$299.62	$29.15	$229.40	$11.20	$50.90	$6.30
Load Management SOP - Expanded	$206.63	$22.47	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP
SCORE/CitySmart MTP	$905.59	$70.72	$610.43	$39.00	$626.24	$39.96	$594.40	$47.50	$574.00	$47.40
SMART Source℠ Solar PV Pilot MTP	$197.18	$16.71	$344.97	$21.67	$42.80	$2.20	$180.00	$4.20	NAP	NAP
Residential										
A/C Distributor Pilot MTP	$68.07	$11.73	NAP	NAP	NAP	NAP	NAP	NAP	NAP	NAP
Appliance Recycling Pilot MTP	NAP	NAP	NAP	NAP	NAP	NAP	$42.00	$14.20	$0.00	$0
CoolSaver© A/C Tune-Up Pilot MTP	$375.08	$36.09	$178.91	$14.84	$103.89	$9.94	NAP	NAP	NAP	NAP
ENERGY STAR New Homes MTP	$797.45	$90.48	$671.60	$73.09	$704.16	$80.62	$659.40	$64.50	$474.10	$54.80

[11] 2012 expenditures taken from Table 10 in the current EEPR; 2011 expenditures from EEPR, Project No. 40194; 2010 expenditures from EEPR, Project No. 39105; 2009 expenditures from EER, Project No. 37982; 2008 expenditures from EER, Project No. 36689.

	2012		2011		2010		2009		2008	
	Incent.	**Admin**	**Incent.**	**Admin**	**Incent.**	**Admin**	**Incent.**	**Admin**	**Incent.**	**Admin**
Residential Energy Efficiency Pilot MTP	**NAP**	**NAP**	**NAP**	**NAP**	**$27.12**	**$6.82**	**$40.50**	**$10.60**	**NAP**	**NAP**
Residential SOP	**$3,622.65**	**$374.20**	**$3,712.17**	**$375.14**	**$3,641.54**	**$307.38**	**$3,366.70**	**$231.90**	**$2,330.70**	**$195.80**
SMART Source^{SM} Solar PV Pilot MTP	**$197.19**	**$15.98**	**$184.89**	**$12.39**	**$278.48**	**$14.29**	**$13.00**	**$4.20**	**NAP**	**NAP**
Texas Statewide ENERGY STAR Residential Compact Fluorescent Lighting MTP	**NAP**	**NAP**	**NAP**	**NAP**	**NAP**	**NAP**	**$213.50**	**$11.80**	**$205.00**	**$37.90**
Hard-to-Reach										
Hard-to-Reach SOP	**$1,177.86**	**$114.69**	**$2,024.93**	**$183.43**	**$2,615.63**	**$216.18**	**$3,090.60**	**$204.60**	**$980.40**	**$102.30**
Targeted Low-Income Energy Efficiency Program	**$1,267.07**	**$93.57**	**$1,149.19**	**$89.66**	**$1,749.76**	**$125.80**	**$1,217.20**	**$64.20**	**$236.70**	**$60.30**
Research and Development (R&D)	**NAP**	**$389.54**	**NAP**	**$314.13**	**NAP**	**$351.05**	**NAP**	**$460.40**	**NAP**	**$250.90**
Total Expenditures	**$10,643.99**	**$1,478.77**	**$11,704.91**	**$1,427.77**	**$11,511.79**	**$1,386.49**	**11,292.30**	**$1,292.80**	**$5,783.20**	**$865.70**

VIII. Program Funding for Calendar Year 2012

As shown in Table 10, the total projected budget in 2012 was $14,120,411. Actual total funds expended in 2012 were $12,122,759, an overall total program expenditure difference of more than 10% from the amount budgeted. The reason for this variation was lower than anticipated participation in the programs shown below.

The A/C Distributor Pilot MTP was under budget from lower than projected results because of a delayed start of the program implementation in the Program Year.

The CARE$ SOP was under budget due to lower than anticipated program participation.

The Commercial SOP did not fully utilize its budget due to lower than anticipated program participation and the timing of when some projects were to be completed.

The LM SOP - Expanded was under budget due to lower than expected results from the participating customers, more moderate summer peak period weather than expected, and lower peak reductions during the curtailment events.

The CoolSaver© Pilot MTP commercial component was under budget due to lower than expected participation from commercial HVAC contractors in the program.

TCC's combined 2012 expenditures for the TLIP and the HTR constituted 18.8% of its energy efficiency budget for the 2012 Program Year. TCC's 2012 expenditure for the TLIP constituted 9.6% of its energy efficiency budget for the 2012 Program Year.

Table 10: Program Funding for Calendar Year 2012 (Dollar amounts in 000's)

	Total Projected Budget [12]	Numbers of Customers Participating	Actual Funds Expended (Incentives)	Actual Funds Expended (Admin)	Research and Development (R&D)	Total Funds Expended	Funds Committed (Not Expended)	Funds Remaining (Not Committed)
Commercial								
A/C Distributor Pilot MTP	**$333.33**	**0**	**$29.94**	**$5.32**		**$35.26**	**$0**	**$298.07**
AEP Texas CARE$ Energy Efficiency for Not-for-Profit Agencies SOP	**$166.67**	**10**	**$54.04**	**$11.30**		**$65.34**	**$0**	**$101.33**
Commercial Solutions MTP	**$416.67**	**54**	**$419.12**	**$35.86**		**$454.98**	**$0**	**$0**
Commercial SOP	**$1,876.67**	**115**	**$881.36**	**$143.85**		**$1,025.21**	**$0**	**$851.46**
CoolSaver© A/C Tune-Up Pilot MTP	**$194.44**	**56**	**$144.76**	**$13.93**		**$158.69**	**$0**	**$35.75**
Load Management SOP	**$333.33**	**23**	**$300.00**	**$32.33**		**$332.33**	**$0**	**$1.00**
Load Management SOP - Expanded	**$666.67**	**56**	**$206.63**	**$22.47**		**$229.10**	**$0**	**$437.57**
SCORE/CitySmart MTP	**$833.63**	**110**	**$905.59**	**$70.72**		**$976.31**	**$0**	**$0**
SMART Source℠ Solar PV Pilot MTP	**$222.22**	**13**	**$197.18**	**$16.71**		**$213.89**	**$0**	**$8.33**
Residential								
A/C Distributor Pilot MTP	**$333.33**	**64**	**$68.07**	**$11.73**		**$79.80**	**$0**	**$253.53**
CoolSaver© A/C Tune-Up Pilot MTP	**$400.00**	**1,323**	**$375.08**	**$36.09**		**$411.17**	**$0**	**$0**
ENERGY STAR New Homes MTP	**$850.00**	**439**	**$797.45**	**$90.48**		**$887.93**	**$0**	**$0**
Residential SOP	**$4,067.91**	**8,978**	**$3,622.65**	**$374.20**		**$3,996.85**	**$0**	**$71.06**
SMART Source℠ Solar PV Pilot MTP	**$222.22**	**17**	**$197.19**	**$15.98**		**$213.17**	**$0**	**$9.05**
Hard-to-Reach								
Hard-to-Reach SOP	**$1,309.28**	**1,978**	**$1,177.86**	**$114.69**		**$1,292.55**	**$0**	**$16.73**
Targeted Low-Income Energy Efficiency SOP	**$1,412.04**	**370**	**$1,267.07**	**$93.57**		**$1,360.64**	**NAP**	**NAP**
Research and Development	**$482.00**	**NAP**	**NAP**	**NAP**	**$389.54**	**$389.54**	**NAP**	**NAP**
Total Expenditures	**$14,120.41**	**NAP**	**$10,643.99**	**$1,089.23**	**$389.54**	**$12,122.76**	**NAP**	**NAP**

[12] Projected Budget from the EEPR filed March 2012, Project No. 40194.

IX. Market Transformation Program Results

A/C Distributor Pilot MTP

TCC began implementing the ACD MTP as a pilot program in 2012. The program goal was to acquire 560 kW demand savings in 2012. A total of 37.77 kW was actually achieved. The reason for the lower than expected results was a delayed implementation of the program.

In 2013, TCC will expand the number of A/C distributors included in the pilot and will implement the commercial component. The incentive structure will be adjusted to encourage A/C distributors and contractors to participate. These and other program adjustments should increase participation and savings for the 2013 Program Year.

Commercial Solutions MTP

For 2012, TCC projected to achieve 770 kW of demand savings from this program. TCC's verified and reported results are 889 kW. This included participation by 54 customers in 11 counties.

CoolSaver© Pilot MTP

In 2012, TCC conducted a baseline study of the CoolSaver© program to determine the need for an expansion of the program. Based on the outcome of the baseline study, TCC decided to expand the program to include the entire TCC service territory. TCC issued an RFP through a competitive solicitation process to select an implementer to fully implement the CoolSaver© program in 2013. TCC awarded a contract to a third-party program implementer to provide services, education, and support to assist A/C contractors in selling and performing A/C tune-up services. In 2012, TCC projected to acquire 716 kW demand savings from this program. TCC verified and reported 654 kW. This included participation by four contractors at 1,379 residential and commercial locations in five counties.

ENERGY STAR NEW HOMES MTP (ES MTP)

In 2012, 439 high-performance homes were constructed in the ES MTP program with a savings of 317 kW. TCC provided continuing education courses and other training opportunities for contractors, homebuilders, home energy raters, and HVAC contractors on the advantages of

ENERGY STAR homes and building practices. The training included various aspects of the ENERGY STAR home, from construction and measure installation, to the importance of whole-house energy efficiency. Due to efforts in supporting, communicating, and implementing the ES MTP homes program, TCC received a 2013 ENERGY STAR Partner of the Year Sustained Excellence – Energy Efficiency Program Delivery for New Homes award from the U.S. Environmental Protection Agency (EPA).

SCORE/CitySmart MTP

For 2012, TCC projected to acquire 1,515 kW demand savings from this program. TCC verified and reported 1,930 kW. This included participation by 110 customers in six counties.

SMART Source^{SM} Solar PV Pilot MTP

The PV MTP experienced significant participation in 2012, with the majority of program activity in the residential sector. By the end of the program year, the residential and commercial incentive budgets were 100% committed and expended.

During 2012, 30 residential and commercial solar PV projects were completed resulting in a peak demand reduction of 200 kW and 384,696 kWh of savings. TCC will continue this as a permanent program in 2013.

X. Research and Development

In 2012, R&D activities and projects accounted for 3% of TCC's total program expenses. R&D activities are intended to help TCC meet future energy efficiency goals by researching new technologies and program options and developing better, more efficient ways to administer current programs. The following is a summary of TCC's R&D efforts for 2012:

Center for Commercialization of Electric Technologies (CCET)

TCC is a member of CCET, whose purpose is to enhance the safety, reliability, security, and efficiency of the Texas electric transmission and distribution system through research, development and commercialization of emerging technologies. Activities undertaken in 2012 included participation in a DOE American Reinvestment and Recovery Act (ARRA) Smart Grid Demonstration project supporting wind integration in ERCOT and CCET was instrumental in the completion of a project promoting infrastructure enhancement for Plug-in Electric Vehicles (PEV)

in the Texas Triangle corridor of DFW-Houston-San Antonio. A three-volume final report was completed in October 2012 and can be found in its entirety at **www.electrictechnologycenter.com/texas_triangle_plan.html.**

SMART View[SM] In-Home Device R&D Project

TCC continued its AEP Texas SMART View[SM] In-home Device Project in 2012 with the following objectives:

1. To enable a sampling of TCC's residential end-use customers to receive energy use data from their dwelling premises, and to use that data to make informed decisions regarding timing and magnitude of electric energy use.
2. To enable TCC's Energy Efficiency/Demand Response function to capture, measure, and verify energy and demand savings and to determine if the in-home monitors could be a measure that produces savings that could be used toward its annual energy efficiency goal requirements.
3. To present positive customer information regarding the value and benefits available through the use of TCC's Advanced Meter System, Smart Meter Texas web portal, and in-home monitors available in the market.
4. To enlist REP engagement in providing additional customer energy efficiency education, time-of-use pricing programs, and other retail activities to encourage customer energy efficiency.
5. To test in-home monitors from various technology vendors and manufacturers, and evaluate their ease of use and acceptability by customers.

In early 2012 the research plan was completed. As a result of feedback obtained during the initial testing phase and in order to maximize sample size per treatment group, it was determined that only one in-home device type would be included. During the second quarter of 2012, the recruitment survey was launched. Over 120,000 survey invitations were mailed to randomly selected end-use customers in TCC's and AEP Texas North Company's service territory with smart meters, generating more than 1,900 survey responses. Survey results were analyzed to identify eligible participants, and all eligible participants were randomly assigned to either the treatment or control group. To take advantage of planned upgrades to the meter's Home Area

Network capabilities, distribution of in-home displays to the treatment group began in October 2012 and continued throughout the fourth quarter of 2012.

In 2013, TCC will monitor the energy consumption of participants, as well as a control group, over a period of approximately 12 months. Energy consumption patterns will be analyzed to assess the impact of the displays. The study will assess both immediate and sustained impact of the displays with and without supplemental energy efficiency communications.

Program Research and Development

In 2012, TCC researched and reviewed new programs, resulting in the selection of ILM MTP and the Open MTP that will be implemented in 2013. TCC also dedicated resources to further develop and enhance its electronic data collection and management systems for current programs. In addition, TCC participated with Electric Utility Marketing Managers of Texas (EUMMOT) in research activities including updating the commercial HVAC baseline study, and lighting and HVAC studies that supported the revision of the Commission-approved deemed savings for those measures. Baseline studies were also completed for the Solar PV MTP and the CoolSaver© A/C Tune-up MTP.

Informational Activities

TCC continues its best efforts to encourage and facilitate the involvement of REPs and EESPs in the delivery of its programs to customers. TCC utilizes local, regional and national conferences, trade shows, and other events for outreach and information exchange with participating REPs and EESPs. TCC again disbursed program information at its annual AEP Texas Competitive REP workshop in December 2012. In the fall of 2012, TCC engaged REPs to participate in the development of viable EE programs, by posting a bulletin on the Choice Market Portal. TCC solicited REPs to submit an EE program idea to be evaluated for possible implementation in conjunction with TCC in a future Program Year. No program ideas were submitted by the REPs. TCC provides new and existing energy efficiency program information to the REPs and EESPs throughout the year on a timely basis via e-mail distribution and the www.AEPefficiency.com web site.

XI. Current Energy Efficiency Cost Recovery Factor (EECRF)

On September 20, 2012, in Docket No. 40359, the Commission approved TCC's 2013 EECRF to recover a total of $7,593,766. This 2013 EECRF amount recovers the portion ($7,747,505) of

TCC's energy efficiency program costs projected to be incurred during 2013 to meet its energy efficiency objectives under PURA §39.905 that exceeds the $6,334,949 expressly included in TCC's base rates for energy efficiency; TCC's Performance Bonus of $2,634,727 earned for 2011 results; and a credit of the 2011 over-recovery amount of $2,788,466 to be returned to customers. The approved 2013 EECRF was made effective on December 31, 2012, the beginning of TCC's January 2013 billing month. The resulting energy efficiency factors are shown below in Table 11.

Table 11: 2013 EECRF

Customer Class	EECRF
Residential Service	$0.000494 per kWh
Secondary Service (less than or equal to 10 kW)	$0.000172 per kWh
Secondary Service (greater than 10 kW)	$0.000463 per kWh
Primary Service	($0.000057) per kWh

2012 Collections for Energy Efficiency

TCC collected $6,889,974 through its 2012 base rates and $7,483,818 through its 2012 EECRF for a total of $14,373,792. A performance bonus of $2,579,657 for exceeding its 2010 energy efficiency goals and $2,407,888 returned to customers are reflected in TCC's total amount collected for energy efficiency in 2012.

Energy Efficiency Program Costs Expended

TCC expended a total of $12,122,759 for its 2012 energy efficiency programs. The amount expended is $1,997,652 less than TCC's 2012 projected budget of $14,120,411 for energy efficiency program.

Over-Recovery of Energy Efficiency Costs

Pursuant to the final order in Docket No. 39360, TCC was authorized to recover $7,290,565 through its 2012 EECRF. TCC's actual 2012 EECRF program costs were $5,232,785 and actual EECRF program revenues were $7,312,049. These associated 2012 costs and revenues result in an over-recovery of energy efficiency costs of $2,079,265. This is the amount that TCC will request be returned to customers within its 2014 EECRF. In addition, TCC will return to customers $49,134 in its 2014 EECRF related to a November 26, 2012 revision to the April 2012 EEPR filed in Project No. 40194.

XII. Underserved Counties

TCC has defined Underserved Counties as any county in the TCC service territory for which TCC reported no demand or energy savings through any of its 2012 SOPs or MTPs. Per Substantive Rule 25.181(n)(2)(U), a list of the Underserved Counties is as follows:

Atascosa	Guadalupe	Real
Caldwell	Kenedy	Wilson
DeWitt	Kinney	Zavala
Edwards	Medina	
Gonzales	McMullen	

XIII. Performance Bonus

TCC achieved a 35,702 kW reduction in peak demand from its energy efficiency programs offered in 2012. TCC's demand reduction goal for 2012 was 12,930 kW. This achievement represents 276% of its 2012 demand reduction goal. TCC also achieved energy savings of 54,329,055 kWh, which represents 240% of its 2012 energy goal of 22,657,000 kWh. These results qualify TCC for a Performance Bonus. Per Substantive Rule 25.181(h), TCC is eligible for a Performance Bonus of $3,856,211, which it will request within its May 31, 2013 EECRF Filing for recovery in 2014.

Table 12: Energy Efficiency Performance Bonus Calculation for 2012

	kW	kWh	As Found In Table
2012 Goals	12,930	22,657,000	7
2012 Savings			
Reported/Verified Total (including HTR and measures with <10yr EUL)	35,702	54,329,055	8
Reported/Verified Hard-to-Reach	2,035		8
2012 Program Costs	$12,122,759		10
2012 Performance Bonus	$3,856,211		

Performance Bonus Calculation

276%	Percentage of Demand Reduction Goal Met (Reported kW/Goal kW)
240%	Percentage of Energy Reduction Goal Met (Reported kWh/Goal kWh)
TRUE	Met Requirements for Performance Bonus?
$50,684,871	Total Avoided Cost (Reported kW * PV(Avoided Capacity Cost) + Reported kWh * PV(Avoided Energy Cost))
$12,122,759	Total Program Costs
$38,562,112	Net Benefits (Total Avoided Cost - Total Expenses)

Bonus Calculation

$33,957,056	Calculated Bonus ((Achieved Demand Reduction/Demand Goal - 100%) / 2) * Net Benefits
$3,856,211	Maximum Bonus Allowed (10% of Net Benefits)
$3,856,211	Bonus (Minimum of Calculated Bonus and Bonus Limit)

Acronyms

ACD MTP	A/C Distributor Pilot Market Transformation Program
ARRA	American Reinvestment and Recovery Act
CARE$ SOP	AEP Texas CARE$ Energy Efficiency for Not-for-Profit Agencies Standard Offer Program
CCET	Center for the Commercialization of Electric Technologies
CoolSaver© MTP	CoolSaver© A/C Tune-Up Market Transformation Program
CSOP	Commercial Standard Offer Program
CS MTP	Commercial Solutions Market Transformation Program
DR	Demand Response
DSM	Demand Side Management
EECRF	Energy Efficiency Cost Recovery Factor
EEP	Energy Efficiency Plan, which was filed as a separate document prior to April 2008
EEPR	Energy Efficiency Plan and Report
EER	Energy Efficiency Report, which was filed as a separate document prior to April 2008
EE Rule	Energy Efficiency Rule, PUCT Substantive Rules 25.181 and 25.183
EESP	Energy Efficiency Service Providers
ERCOT	Electric Reliability Council of Texas
EUMMOT	Electric Utility Marketing Managers of Texas
EPA	Environmental Protection Agency
ES MTP	ENERGY STAR New Homes Market Transformation Program
ILM	Irrigation Load Management Market Transformation Program
HTR	Hard-To-Reach
HTR SOP	Hard-to-Reach Standard Offer Program
LM SOP	Load Management Standard Offer Program
MTP	Market Transformation Program
NAP	Not Applicable
New Homes	High-Performance New Home Market Transformation Program
NFP	Not-for-Profit

Acronyms (Continued)

Open	Open Market Transformation Program
PEV	Plug-in Electric Vehicle
PUCT	Public Utility Commission of Texas
PURA	Public Utility Regulatory Act
PV	Photovoltaic
PV MTP	SMART Source^{SM} Solar PV Market Transformation Program
R&D	Research and Development
REP	Retail Electric Provider
RES	Residential
RSOP	Residential Standard Offer Program
SCORE	Schools Conserving Resources
SCORE/CS MTP	SCORE/CitySmart Market Transformation Program
SOP	Standard Offer Program
TCC	AEP Texas Central Company
TDU	Transmission and Distribution Utility
TLIP	Targeted Low-Income Energy Efficiency Program

APPENDIX A:

REPORTED AND VERIFIED DEMAND AND ENERGY REDUCTION BY COUNTY

CALENDAR YEAR 2012

A/C Distributor Pilot MTP

County	Reported and Verified Savings	
	kW	kWh
Aransas	1.91	7,687
Hidalgo	13.03	49,402
Nueces	12.87	55,412
San Patricio	1.32	6,343
Starr	1.18	4,354
Victoria	6.87	22,091
Webb	0.59	2,177
Total	**38**	**147,466**

AEP TEXAS CARE$ ENERGY EFFICIENCY FOR NOT-FOR-PROFIT AGENCIES SOP

County	Reported and Verified Savings	
	kW	kWh
Nueces	24.05	107,924
Victoria	1.70	7,095
Uvalde	6.21	9,615
Total	**32**	**124,634**

COMMERCIAL SOLUTIONS MTP

County	Reported and Verified Savings	
	kW	kWh
Bee	5.68	39,584
Cameron	40.59	202,736
Dimmit	8.80	47,915
Duval	10.31	71,475
Hidalgo	402.00	2,457,914
Nueces	363.05	392,859
San Patricio	5.00	27,742
Uvalde	5.56	33320
Val Verde	24.79	117,099
Victoria	2.36	11,167
Webb	21.32	143,343
Total	**889**	**3,545,154**

COMMERCIAL SOP

County	Reported and Verified Savings	
	kW	kWh
Aransas	1.80	3,859
Bee	8.86	37,609
Cameron	651.50	1,618,852
Hidalgo	1,285.36	4,512,144
Jim Wells	5.11	26,796
Kleberg	5.03	37,916
Matagorda	65.08	347,239
Maverick	36.99	178,152
Nueces	124.01	606,765
San Patricio	58.10	124,622
Starr	54.57	131677
Uvalde	3.21	17,720
Victoria	119.72	635,196
Webb	396.03	2,837,892
Wharton	26.64	131,803
Total	**2,842**	**11,248,242**

COOLSAVER© A/C TUNE-UP PILOT MTP

County	Reported and Verified Savings	
	kW	kWh
Aransas	274.22	617,028
Kleberg	11.40	36,166
Nueces	245.32	569,840
Refugio	6.15	13,612
San Patricio	117.24	268,625
Total	**654**	**1,505,271**

ENERGY STAR MTP

County	Reported and Verified Savings	
	kW	kWh
Aransas	4.79	16,214
Cameron	1.51	5,258
Hidalgo	35.82	124,651
Nueces	154.99	528,863
San Patricio	44.50	149,965
Val Verde	26.30	107,587
Victoria	1.17	3,860
Webb	47.21	182,886
Zapata	0.62	2,597
Total	**317**	**1,121,881**

HARD-TO-REACH SOP

County	Reported and Verified Savings	
	kW	kWh
Aransas	10.19	24,660
Bee	80.22	282,337
Brooks	8.47	29,063
Calhoun	11.64	37,595
Cameron	39.47	142,417
Colorado	38.87	98,091
Duval	3.66	13,889
Hidalgo	702.43	2,313,871
Jackson	0.55	1,254
Jim Wells	80.95	183,299
Karnes	0.52	3,064
Kleberg	87.90	253,427
Matagorda	27.87	62,279
Nueces	168.99	511,194
San Patricio	52.35	168,807
Starr	28.90	100,890
Val Verde	81.53	277,877
Victoria	28.87	77,201
Webb	159.54	566,112
Wharton	20.16	51,063
Willacy	3.92	14,354
Total	**1637**	**5,212,744**

LOAD MANAGEMENT (& EXPANDED LM) SOP

County	Reported and Verified Savings	
	kW	**kWh**
Aransas	4.33	24
Calhoun	185.49	1,040
Cameron	2,418.88	13,566
Colorado	529.50	2,970
Hidalgo	5,268.19	29545
Jim Wells	232.04	1,301
Kleberg	9.75	55
Matagorda	916.74	5,142
Nueces	2,984.64	16,738
Refugio	232.27	1,303
San Patricio	1,788.36	10,029
Starr	289.75	1,625
Uvalde	1,045.20	5,862
Victoria	2,151.52	12,066
Webb	884.46	4,960
Wharton	17.55	98
Willacy	506.94	2,843
Total	**19,466**	**109,167**

RESIDENTIAL SOP

County	Reported and Verified Savings	
	kW	kWh
Aransas	44.11	109,156
Bee	125.20	244,996
Brooks	56.32	174,164
Calhoun	95.54	236,335
Cameron	738.85	2,343,150
Colorado	69.70	152,398
Duval	32.08	105,794
Goliad	1.18	4,744
Hidalgo	2,763.21	8,793,162
Jackson	35.79	47,723
Jim Wells	88.49	248,175
Karnes	47.12	169,534
Kleberg	69.39	194,555
Live Oak	6.15	24,446
Matagorda	63.05	131,448
Maverick	304.19	1,154,410
Nueces	1,017.88	2,479,499
Refugio	21.01	55,919
San Patricio	232.77	596,254
Starr	308.97	934,645
Val Verde	406.50	1,227,727
Victoria	494.05	1,104,632
Webb	251.64	788,849
Wharton	15.09	35,771
Willacy	10.27	30,448
Zapata	0.45	2,091
Total	**7,299**	**21,390,025**

SCORE/CITYSMART MTP

County	Reported and Verified Savings	
	kW	kWh
Cameron	69.64	210,230
Hidalgo	935.41	5,137,426
Nueces	664.79	2,081,835
Val Verde	35.90	144,859
Victoria	24.80	53,222
Webb	199.31	651,459
Total	**1,930**	**8,279,031**

SMART SOURCE[SM] SOLAR PV PILOT MTP

County	Reported and Verified Savings	
	kW	kWh
Aransas	3.12	6,016
Cameron	77.84	150,048
Duval	5.68	10,944
Hidalgo	48.37	93,240
Jim Wells	11.11	21,424
Maverick	5.38	10,368
Nueces	31.54	60,800
Val Verde	4.58	8,832
Webb	11.94	23,024
Total	**200**	**384,696**

TARGETED LOW-INCOME ENERGY EFFICIENCY PROGRAM

County	Reported and Verified Savings	
	kW	kWh
Cameron	142.56	426,082
Dimmit	21.36	102,098
Duval	2.33	9,206
Frio	2.25	11,070
Hidalgo	118.27	383,901
Jackson	0.92	2,024
Jim Hogg	0.99	3,033
Jim Wells	8.60	30,837
Kleberg	7.02	21,054
La Salle	3.66	18,528
Maverick	2.52	11,978
Nueces	72.71	194,930
San Patricio	4.03	15,399
Starr	0.76	2,808
Victoria	7.19	15,373
Webb	3.16	12,423
Total	**398**	**1,260,744**

APPENDIX B:

PROGRAM TEMPLATES

TCC does not have any program templates to report this year.

APPENDIX C:

EXISTING CONTRACTS OR OBLIGATIONS

TCC does not have any Existing Contracts or Obligation documentation to provide.

APPENDIX D:

OPTIONAL SUPPORT DOCUMENTATION

TCC provides the following Optional Supporting Documentation.

AEP Texas President and COO Wade Smith accepts the 2012 Leadership in Housing award from Environmental Agency Policy Analyst Dean Gamble. Also pictured is Garrett Dorsey with ICF International and the AEP Texas ENERGY Star New Homes program.

CHAMPION ENERGY SERVICES

SPRINGnewsletter

(season Preview)

Dear Alex Edens,

Spring is fast approaching, and now is the time to start preparing your house for warmer weather. For reference, we've inc

...And don't forget to set your clocks ahead this Sunday! March 11th is Daylight Savings Time.

Your Energy Usage from Last Spring

Service Period	March	April	May
kWh	1,292	1,387	1,973

Put some spring in your step by saving money on electricity. Simply visit our energy saving tips for Spring to discover ways to make your home more energy efficient this season.

Energy Efficiency Programs Available

Your local Utility, AEP Texas, offers a variety of programs to assist with the installation of energy efficiency measures in residences. You must use an AEP Texas-approved contractor or energy services company to qualify. For more information, visit the AEP Texas website.

Change your filters

Changing your air filters regularly helps your A/C system run more efficiently. Get the filters of your choice delivered directly to your home with On Time Air Filters. Champion Energy customers will receive 25% off their first order with promo code Champion25.

Champion Energy is proud to support great causes in the communities where we live and serve. Nominate your favorite organization to be a Hometown Champion, or visit our website to learn about other organizations we support.

Friends for Life

Texas' only No Kill, Green Powered, Pet Adoption Center receives a donation with each new enrollment using the promo code FriendsForLife.

Fun and Games

Champion Energy supports neighborhood Little Leagues across Texas, including the Pearland Little League, 2011 Southwest Champions.

Ask a Question or Join the Conversation

SEND feedback | CONNECT-a-FRIEND | Ask an Agent | Community

Baseline Study – Solar PV Pilot Programs

For AEP-TCC, AEP-TNC, SWEPCO, and TNMP

Submitted by: Frontier Associates and Clean Energy Associates, May 2012

1. Summary of Solar PV Pilot Programs

Initiated by AEP-Texas Central Company (AEP-TCC), AEP-Texas North Company (AEP-TNC), SouthWestern Electric Power Company (SWEPCO), and Texas-New Mexico Power Company (together, "the Utilities") in mid-2009, the Solar PV Pilot Programs (Programs) were designed to help electricity customers meet a portion of their energy needs with solar (photovoltaic, or "PV") electric systems. The Programs offer financial incentives that help offset the initial cost of installing a solar energy system for residential and non-residential customers.[1]

In addition to achieving kW and kWh savings via installation of distributed solar generation systems, the Programs' goals were to:

- Gain experience in PV installations
- Increase the number of functional capability of local PV installers
- Gather data on costs and performance, and
- Decrease incentives over time

This Baseline Study report provides year-over-year program performance data on each of these metrics. It finds that:

- The Programs to date have resulted in 111 distributed PV installations, totaling more than 1.5 MWdc of PV generating capacity, and achieving peak demand savings of more than 1.3 MWac and energy savings of nearly 2.5 million kWh.
- Between 2008 and 2012, the number of companies offering PV installations throughout Texas increased from 12 to over 200. During the same period the number of NABCEP-certified PV installers in Texas increased from 12 to 154. Relatedly, the Utilities and installers gained experience with and made process improvements through hundreds of DRG interconnections, and local jurisdictions across Texas were exposed to and improved processes for permitting and inspecting solar PV systems per local code requirements.
- Installed costs are declining rapidly, both nationally and in Texas. Texas installed costs are lower than national averages.
- Offered incentive levels have decreased from $2.50/wdc in 2009 to $1.50-$1.75/wdc in 2012, a reduction of 30%-40% in 4 years.

We conclude that the market for distributed PV systems in the Utilities' service areas and in Texas as a whole has undergone significant transformation as a result of the Programs. However, the need for utility incentives remains justified. If current trends and programs continue along a predictable and recommended path, we expect these programs will be 2-5 times more cost-effective by 2016 than in 2009.

[1] Oncor and Entergy also began offering solar PV pilot programs in 2009, and El Paso Electric began offering a program in 2010. All of these programs shared a common design and were administered by Frontier Associates and Clean Energy Associates.

2. Key Findings

a. Program Results

Figures 1 and 2 below summarize the number and capacity of PV installations that have occurred annually through the Programs. The number of installations peaked in 2010 while the total capacity installed peaked in 2011, primarily due to the completion of a large government project in AEP-TCC's service area in 2011. 2012 figures are through May 2012.

Figure 1. Number of PV Installations

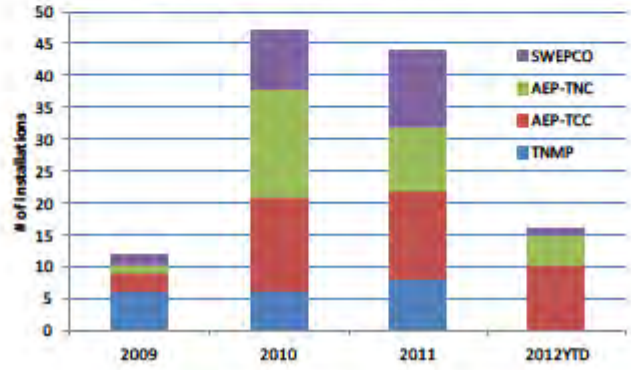


Figure 2. Capacity (MWdc) of PV Installations

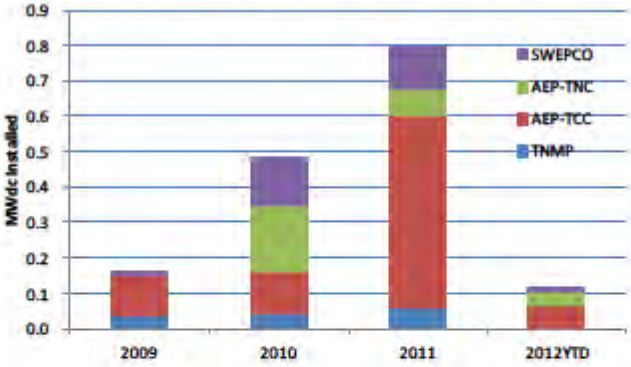
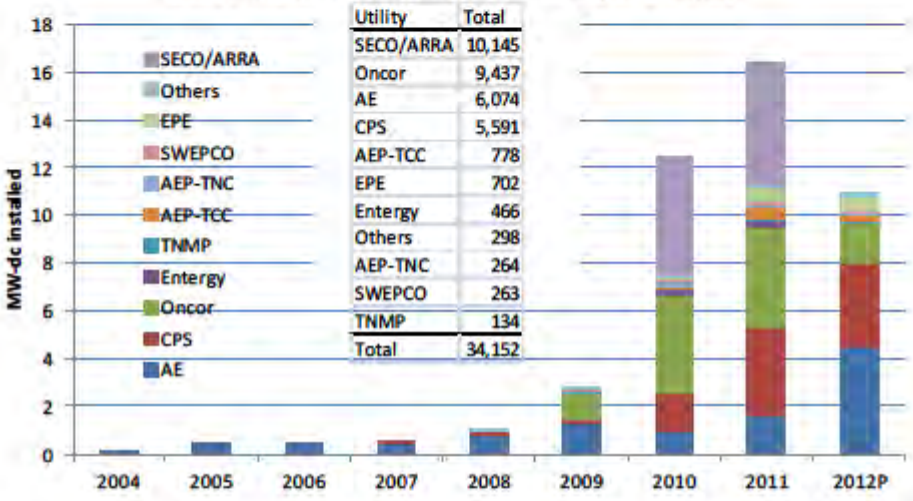


Figure 3 provides context for the AEP-TCC, AEP-TNC, SWEPCO and TNMP data above by showing the PV capacity installed annually through all Texas utility- and state-sponsored PV incentive programs from 2003-2012. Reconciliation of the data in Figure 3 with other published data sources[2] reveals that the vast majority[3] of PV installations in Texas occur through PV incentive programs, while only a tiny fraction of installations occur without assistance from these programs. While the Utilities had some experience with PV system interconnections prior to 2009, such requests were and remain infrequent and sporadic.

Figure 3. Annual Capacity Additions (MWdc) of PV Installations
(table shows cumulative total by program as of year-end 2011)



Utility	Total
SECO/ARRA	10,145
Oncor	9,437
AE	6,074
CPS	5,591
AEP-TCC	778
EPE	702
Entergy	466
Others	298
AEP-TNC	264
SWEPCO	263
TNMP	134
Total	34,152

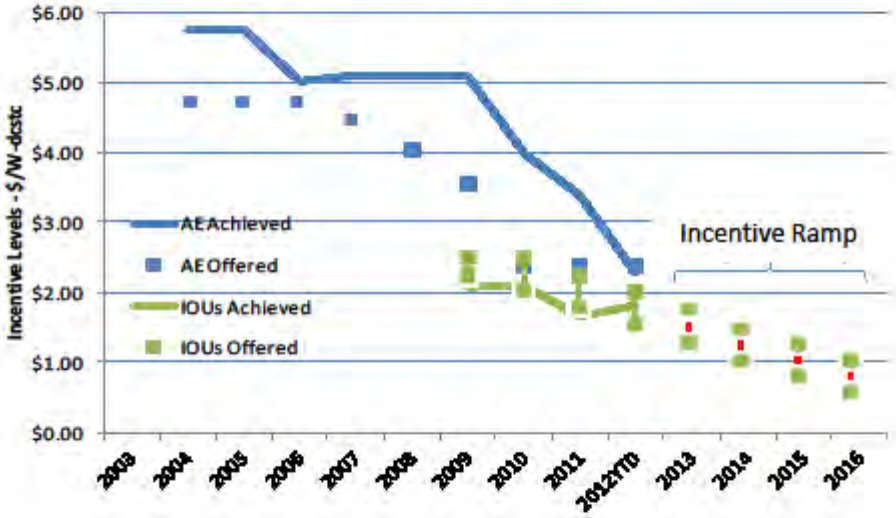
Note: All data from Clean Energy Associates. 2012 data is projected based on available budgets. Actual capacity installed is likely to be less than projected.

[2] Other data sources include NREL's Open PV Database and annual DRG interconnection reports filed by Utilities at the Public Utility Commission of Texas, as researched by Public Citizen in 2011.
[3] CEA estimates that 95% or more of PV installations have occurred through an incentive program.

Figure 4 compares the PV incentive levels offered and achieved annually by Texas investor-owned utility PV incentive programs against the benchmark program offered by Austin Energy. "Offered" incentive level refers to the range of published incentive levels in a given year, while "achieved" is calculated by dividing the total amount of incentives spent during a program year by the total capacity installed during that year. In the investor-owned utility programs, the achieved incentive level is typically less than the offered level because of program limits (some installations exceed published limits on the total incentive available to a project or customer) and because of the annual nature of the programs (projects and incentives are not carried forward at higher levels for completion in subsequent program years).

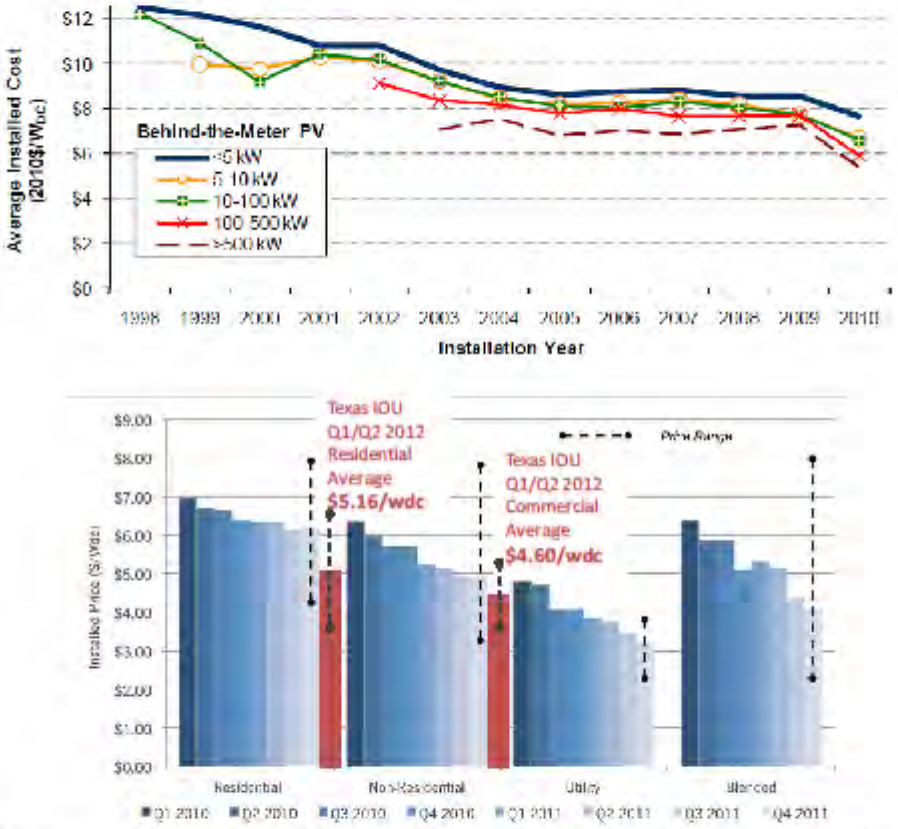
The figure also sets forth a sample forward-looking incentive ramp which projects a continued and predictably declining incentive structure through 2016.

Figure 4. Declining Incentive Levels



The rapidly declining incentive levels shown in Figure 4, above, are made possible by the rapidly declining costs of installed PV systems. Figure 5, below, presents installed costs within the current Texas PV programs in a national and historical context. The upper chart shows declining costs of installed PV systems in the US between 1998 and 2010. The lower chart provides an update, showing quarterly cost data for 2010 and 2011, as well as installed cost data from PV systems completed under the Texas investor-owned utility sponsored PV incentive programs in Q1 and Q2 2012. Installed costs of PV in Texas are less than reported national averages.

Figure 5. Declining Installed Costs



Note: Upper chart from Tracking the Sun IV: An Historical Summary of the Installed Cost of Photovoltaics in the United States from 1998 to 2010, Lawrence Berkeley National Laboratory, Galen Barbose, Naïm Darghouth, Ryan Wiser, Joachim Seel, September 2011. Lower chart from the U.S. Solar Market Insight Report, Q4 2011 & 2011 Year-In-Review, GTM Research, April 2012, with Texas overlays by Clean Energy Associates.

Table 1 on the next page summarizes annual Program budgets, spending, and project completions. It shows that the Programs to date have resulted in 111 distributed PV installations totaling more than 1.5 MWdc of PV generating capacity, and have achieved peak demand savings of more than 1.3 MWac and energy savings of nearly 2.5 million kWh.

Table 1. Solar PV Pilot Program Summary Statistics, 2009-2012

	TNMP	AEP-TCC			AEP-TNC			SWEPCO			Grand
Program Year 2009	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Total
A. Budget	$90,000	$84,450	$275,550	$360,000	$90,000	$90,000	$180,000			$90,000	$720,000
D. Paid	$88,464	$12,960	$180,000	$192,960	$12,960	$0	$12,960			$27,600	$321,974
# of completed projects	6	1	2	3	1	0	1			2	12
kW-dc installed	35.530	5.180	105.300	110.480	5.180	0.000	5.180			11.040	162.230
kWh savings	56,848	8,288	168,480	176,768	8,288	0	8,288			17,664	259,568
kW-ac savings	30.556	4.455	90.558	95.013	4.455	0.000	4.455			9.494	139.518
$/watt incentive level offered	$2.50	$2.50	$2.50	na	$2.50	$2.50	na			$2.50	na
$/watt incentive achieved	$2.49	$2.50	$1.71	$1.75	$2.50	na	$2.50			$2.50	$1.98
Program Year 2010	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Total
A. Budget	$108,000	$201,500	$325,550	$527,050	$167,040	$180,000	$347,040			$287,400	$1,269,490
D. Paid	$101,088	$201,125	$95,550	$296,675	$166,313	$180,000	$346,313			$207,475	$951,550
# of completed projects	6	13	2	15	12	5	17			9	47
kW-dc installed	42.135	83.042	38.430	121.472	67.085	117.775	184.860			132.690	481.157
kWh savings	67,416	132,867	61,488	194,355	107,336	188,440	295,776			212,304	769,851
kW-ac savings	36.236	71.416	33.050	104.466	57.693	101.287	158.980			114.113	413.795
$/watt incentive level offered	$2.50	$2.50	$2.50	na	$2.50	$2.50	na			$2.50	na
$/watt incentive achieved	$2.40	$2.42	$2.49	$2.44	$2.48	$1.53	$1.87			$1.56	$1.98
Program Year 2011	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Total
A. Budget	$108,000	$180,375	$410,000	$590,375	$96,049	$84,679	$180,728	$137,414	$185,806	$323,219	$1,202,322
D. Paid	$107,540	$162,420	$360,000	$522,420	$69,656	$80,279	$149,935	$47,960	$185,806	$233,766	$827,855
# of completed projects	8	10	4	14	6	4	10	4	8	12	36
kW-dc installed	56.210	88.965	456.920	545.885	32.778	41.100	73.878	22.315	96.746	119.061	795.034
kWh savings	89,936	142,344	731,072	873,416	52,445	65,760	118,205	35,704	154,794	190,498	1,272,054
kW-ac savings	48.341	76.510	392.951	469.461	28.189	35.346	63.535	19.191	83.202	102.392	683.729
$/watt incentive level offered	$2.00	$2.00	$1.75	na	$2.25	$2.00	na	$2.00	$1.75	na	na
$/watt incentive achieved	$1.91	$1.83	$0.79	$0.96	$2.13	$1.95	$2.03	$2.15	$1.92	$1.96	$1.04
Program Year 2012	Total (Res Only)	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Res.	Non-Res.	Total	Total
A. Budget	$120,000	$180,000	$180,000	$360,000	$90,000	$71,000	$161,000	$121,500		$121,500	$762,500
D. Paid	$0	$49,419	$53,370	$102,789	$72,990		$72,990	$17,500		$17,500	$193,279
# of completed projects	0	5	5	10	5		5	1		1.00	16
kW-dc installed	0.000	27.365	35.580	62.945	43.560	0.000	43.560	10.000		10.000	116.505
kWh savings	0	43,784	56,928	100,712	69,696	0	69,696	16,000		16,000	186,408
kW-ac savings	0.000	23.534	30.599	54.133	37.462	0.000	37.462	8.600		8.600	100.194
$/watt incentive level offered	$1.75	$1.75	$1.50	na	$1.75	$1.50	na	$1.75		$1.75	na
$/watt incentive achieved	na	$1.81	$1.50	$1.63	$1.68	na	$1.68	$1.75		$1.75	$1.66

Notes:

2009 and 2012 data reflect partial years. The TNMP program opened in April 2009; the AEP-TCC, AEP-TNC, and SWEPCO programs opened in August 2009. Program year 2012 reflects program status as of May 25, 2012.

TNMP's program was open to residential and non-residential customers through 2011. In 2012 the program was limited to residential customers only.

In 2009-2010, SWEPCO's budget was designed as a single pool available to both residential and non-residential customers. In 2011, the program remained open to both residential and non-residential customers, but with separate budgets for each customer class. In 2012, the program was limited to residential customers only.

b. Changes Observed in the Residential and Non-Residential Markets

Three principal changes have been observed in the Texas market for distributed solar generation since the Programs' introduction in 2009: declining installed costs, increased quantity and quality of solar contractors, and the introduction of leasing models. Declining cost trends and trends in the number of installers (and certified installers) are documented above, and are not elaborated here.

The introduction of leasing models to the Texas solar market began in the Oncor program in 2010, when one registered service provider received thousands of calls from potential customers in response to favorable news coverage in the Dallas/Ft. Worth area. Rather than sell the solar energy system directly to the customer, this service provider offered to own and maintain the system while leasing the equipment to the customer. The leasing model was not new – it had been used in other states before – but it was new to Texas. The model leverages scale and available federal tax benefits to reduce overall costs, and exposes customers to a monthly cost profile that many found attractive or interesting in contrast to a large capital investment. The net result is that leasing, and other third party ownership models, potentially expands the market for PV systems to a broader set of customers.

Since 2010, the leasing model has gained traction principally in the DFW area, where sufficient concentrations of PV development opportunities exist. In 2011, the Texas Legislature passed SB 981, which further clarified and simplified regulatory interpretation of third party ownership models such as leasing, and in May 2012, the Public Utility Commission of Texas issued its final Order implementing SB 981. These actions are likely to increase the scope of leasing models in investor-owned utility areas throughout the state.

c. Opportunities and Barriers

Frontier and CEA have identified the following opportunities in the Texas market for solar PV systems:

- Distributed PV can be deployed quickly to help meet resource adequacy concerns in the short term (1-3 years).
- Progress made by the programs to date in lowering costs, reducing incentives, and increasing the number and experience level of PV installers can be continued by leverage volume and stability through several, coordinated multi-year incentive programs sponsored by utilities.
- Integration of PV systems with smart metering to enable time of use valuation of production can increase the value of PV energy for customers.
- Further development of third party ownership models, especially if connected to the utility bill, can expand the market for PV by making investment more affordable.

Barriers include the following:

- The installed cost of PV systems remains the largest barrier to wider adoption, particularly in the current context of historically low electricity prices.
- As equipment prices have come down, the relative impact of "soft costs", such as those associated with inconsistent local permitting processes, have become more important. These

costs are not likely to be reduced without coordinated efforts by authorities having jurisdiction, the state or utilities.

Solar energy produces public benefits – such as peak shaving, reduced water consumption – that are not always able to be monetized by the party making a decision to invest in solar. This lack of alignment continues to make justifying investments in PV more difficult.

3. Customer Attitudes

a. Incentives Influence Purchase Decisions

Figure 3 illustrated that the capacity of installed PV in Texas has increased from just a few MWdc at the end of 2008, prior to the administration of investor owned incentive programs in 2009, to over 34 MWdc by the end of 2011.[4] This is strong evidence that growth in the Texas PV market is highly correlated to the existence of utility incentives. Research conducted by Dr. Varun Rai and his team from the LBJ School of Public Affairs at the University of Texas at Austin takes this correlation one step further, demonstrating that incentive availability remains a strong factor contributing to customer decisions to purchase solar energy systems. His group conducted a survey in 2011 of participants in the utility sponsored incentive programs from 2009-2011, and found that although participants were willing to pay slightly more for their solar PV system (see Figure 5 below), the incentive played a major role in their investment decision.

Figure 5: Customer's Wilingness to Pay for Solar PV (All Utilites)

2. How much do you agree or disagree with each of these statements?

	Strongly agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
I would **not** have installed the PV system if it had cost me $1000 more	○	○	○	○	◉
I would **not** have installed the PV system if it had cost me $2000 more	○	○	○	◉	○
I would **not** have installed the PV system if it had cost me $3000 more	○	○	◉	○	○
I would **not** have installed the PV system if it had cost me $4000 more	○	◉	○	○	○
I would **not** have installed the PV system if it had cost me $5000 more	○	◉	○	○	○

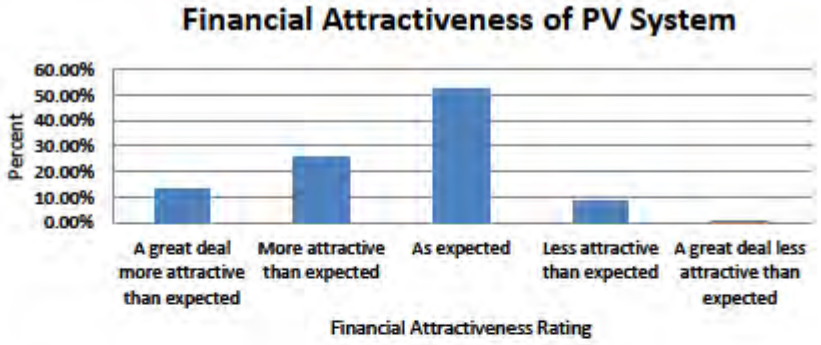
[4] Based on database of installations 2009-2012 from CEA and Frontier. Other data sources include NREL's Open PV Database and annual DRG interconnection reports filed by Utilities at the Public Utility Commission of Texas, as researched by Public Citizen in 2011.

b. Financial Analysis Drives Solar Investment Decisions

The LBJ School's research showed that 77% of customers who purchased solar rated their analysis of solar's financial investment value as either "very" or "extremely" important to their decision to install solar (see Figure 6, below), and that more than 85% felt the financial investment was as good as or better than they expected.

Figure 6: Importance on Decision to Install Solar PV (in percents)

	General interest	Financial investment	Environmental impact	Influence of neighbors	Influence of acquaintance
Not important at all	4.66%	3.83%	8.94%	79.49%	80.69%
Somewhat important	8.47%	5.11%	12.77%	9.83%	3.86%
Moderately important	15.25%	14.04%	17.87%	6.84%	8.15%
Very important	34.32%	32.34%	19.15%	3.42%	4.72%
Extremely important	37.29%	44.68%	41.28%	0.43%	2.58%
Total	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**



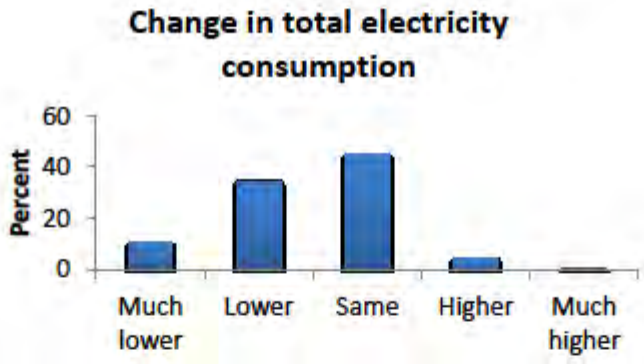
c. Secondary Effects on Electricity Consumption

There may be secondary effects on energy consumption that result from the installation of a PV system. The LBJ School's survey also found that participants in the incentive programs were more likely to report a change in the amount of electricity (PV and grid) they used, compared to their usage prior to the installation of their solar PV system (Figure 7). Customer responses included:

> "I am much, much, much, much, more aware of how much energy I use each month."
>
> "I try to "leverage" the array's input in relation to total electrical consumption so my array will provide 25% of all our power needs."
>
> "I am more apt to use power-consuming appliances (washer/drier, etc) when the sun is up, to take advantage of the cost offset."

These self-reported results are preliminary and are worthy of additional study and validation.

Figure 7: Change in Total Electricity Consumption

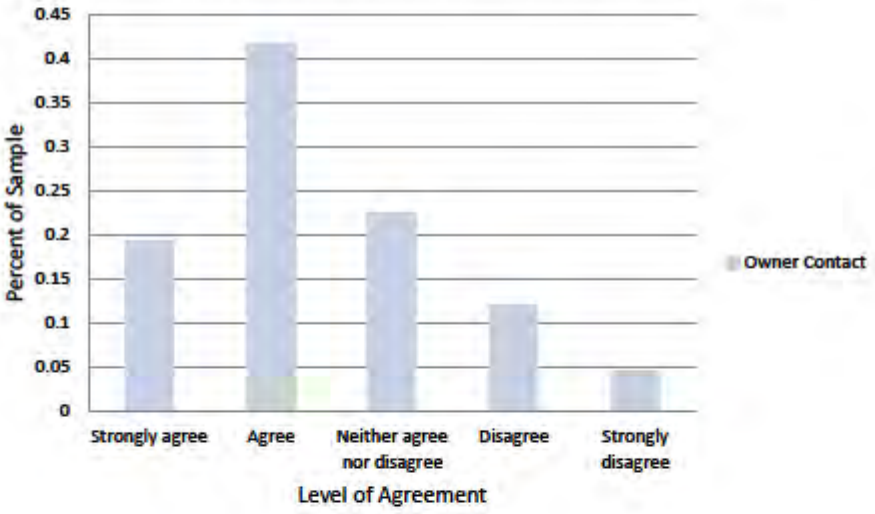


d. Information Network Development

Additionally, the solar PV incentive programs have created a large network of solar PV installers that were not present in Texas prior to the administration of the incentive programs. Between 2008 and 2012, the number of companies offering PV installations throughout Texas increased from approximately 20 to over 200. During the same period the number of NABCEP-certified PV installers in Texas has increased from 12 to 154. The incentive programs offered by the utilities have played the largest role in developing this network. Survey results show that customers rely on this network to influence their decisions to participate in the solar PV programs, both through access to information and help with financial analysis of solar PV for their home.

The survey also found that over 50% of respondents who participated in the solar PV programs were motivated to install solar on their home by other solar PV systems in their neighborhood. As the number of installations in neighborhoods in the utilities service areas increases, previous participants will likely influence additional projects.

Table 9: Existing PV Systems in Participants Neighborhoods Motivated Installation



4. Market Potential

Clean Energy Associates produced an estimate of the technical potential for rooftop solar generation in Austin Energy's service area in 2009. It utilized several data sources to estimate the total area available on rooftops of residential, commercial and industrial buildings. It then employed a stepwise approach to discount the available rooftop area due to shading, improper orientation, structural considerations, and other factors. Finally, the analysis estimated PV generation potential on the remaining rooftop spaces. The study concluded that if fully utilized, rooftop solar energy systems have the potential to produce between 16.1% and 27.6% of Austin Energy's 2008 annual electric energy generation, depending on the PV deployment scenario used. The study demonstrated that rooftops comprise potentially enormous energy generation potential, and that existing installations comprised only about one tenth of one percent of the total potential market.

Additionally, the LBJ School will be providing the results of their 2011 mail and online survey of participants in the utilities solar PV incentive programs. Dr. Rai's research will address the effect that information and perceptions of non-monetary costs of solar PV has on the adoption of solar. It also estimates consumer discount rates for the energy savings associated with installing solar and how this varies with income levels of the participants. This research will help develop further insight into customers' decision making processes in pursing solar PV projects.

5. Conclusions

The market for distributed PV systems in the Utilities' service areas and in Texas as a whole has undergone significant transformation as a result of the Programs.

However, the need for utility incentives remains justified. Despite the progress made over the past several years, without incentives PV installation costs remain too high, customer awareness of PV's long-term value remains too low, and some of the benefits provided by PV (zero emissions, zero water use, local job creation, on-peak or near-peak energy production) remain poorly aligned with customer interest in making the decision to invest in a PV system. Properly designed incentives, such as those provide by the Utilities since 2009, can help restore that alignment.

If current trends and programs continue along a predictable and recommended path, we expect these programs will be 2-5 times more cost-effective by 2016 than in 2009.

BASELINE STUDY

IN SUPPORT OF

AEP TCC'S

COOLSAVER

MARKET TRANSFORMATION PROGRAM

FINAL REPORT

Frontier Associates

1515 South Capital of Texas Highway, Suite 110

Austin, Texas 78746

512/372-8778

October 2012

Table of Contents

I. Introduction **1**
II. Background **1**
III. Industry-Standard AC Tune-Up Procedures **5**
IV. Survey Methodology **6**
V. Data Validation and Analysis **9**
VI. Selected Survey Results **9**
VII. Conclusion **15**
Survey Instrument ..... **Appendix A**
Tabulated Survey Results ..... **Appendix B**

I. Introduction

A more comprehensive tune-up of existing air conditioning and heat pumps has the potential to provide a significant opportunity for reducing peak demand and energy consumption. The common problems with installed systems include low airflow and incorrect charge, which both contribute to reduced operating efficiency. Studies have indicated that 60%-70% of installed residential air conditioning systems have improper refrigerant charge and/or inadequate air flow. The average energy savings potential from addressing improper refrigerant charge is 12%.

As one of its programs to promote energy efficiency and achieve its annual energy efficiency goals, AEP-TCC is currently implementing the CoolSaver Market Transformation Pilot program. To help establish baseline levels of tune-up practices and procedures, AEP-TCC conducted a baseline study of HVAC dealers in the region. The results of this study fulfill the regulatory requirement in PUCT Substantive Rule 25.181 that requires a market transformation program to identify a baseline study that is appropriate in time and geographic region. This study will support program planning, marketing, evaluation and implementation activities.

The survey assessed the current service and tune-up practices among HVAC dealers, and collected data to compare these practices to the specifications and requirements of the Cool Saver Program. Specifically, the survey instrument collected data on the following:

- Refrigerant charging practices and procedures
- Instrumentation and other equipment used to perform tune-ups
- Air flow measurement practices and documentation
- Duct leakage measurement and documentation

A copy of the survey instrument is included as Appendix A.

II. Background

II.A. Review of Previous Studies

The problems associated with improper air conditioner and heat pump installation and servicing practices have been well documented over the past thirty years. The following is a partial listing of the significant field studies that have been performed on air conditioner and heat pump installations:

National Energy Savings Potential from Addressing HVAC Installation Problems, by C. Neme, S. Nadel, and J. Proctor, Vermont Energy Investment Corporation, prepared for US EPA, 1998

Field Measurements of Air Conditioners with and without TXVs, by Robert J. Mowris, Anne Blankenship, and Ean Jones. *Proceedings of the 2004 ACEEE Summer Study on Energy Efficiency in Buildings.* American Council for Energy Efficient Economy, 2004

Energy Savings Potential From Addressing Residential Air Conditioner and Heat Pump Installation Problems, C. Neme, J. Proctor, S. Nadel, ACEEE Report Number A992, American Council for Energy Efficient Economy, 1999

Impact of Evaporator Coil Air Flow in Residential Air Conditioning Systems, D. Parker, J.R. Sherwin, R.A. Raustad, and D.B. Shirey III. Florida Solar Energy Center Publication Number FSEC_PF-321-97, 1997.

Assessment of HVAC Installations in New Homes in Southern California Edison's Service Territory, M. Blasnik, T. Downey, J. Sundal, and G. Peterson. Final report prepared for Southern California Edison, 1995.

Field Adjusted SEER Residential Buildings: Technologies, Design and Performance Analysis, C. Leon Neal, *Proceedings of the 1998 ACEEE Summer Study on Energy Efficiency in Buildings.* American Council for Energy Efficient Economy, 1998.

In *Energy Savings Potential from Addressing Residential Air Conditioner and Heat Pump Installation Problems*, the authors include a meta analysis of a number of related studies. The following tables summarize the survey results presented in this report:

Summary of Studies on Refrigerant Charge and Energy Savings Potential							
Study Author	State	Existing or New Home?	Sample Size	Charge correct to mfg spec	% over charge	% under charge	Energy Savings Potential
Blasnik et al. 1995a	NV	New	30	35%	5%	59%	17%
Blasnik et al. 1995b	CA	New	10				8%
Blasnik et al. 1996	AZ	New	22	18%	4%	78%	21%
Farzad 1993	n.a.	n.a.	n.a.				5%
Farzad 1993	n.a.	n.a.	n.a.				17%
Hammarlund et al 1992	CA	New	12				12%
Hammarlund et al 1992	CA	New	66	31%	61%	8%	12%
Katz 1997	NC/SC	New	22	14%	64%	23%	
Proctor & Pernick 1992	CA	Existing	175	44%	33%	23%	
Proctor 1991	CA	Existing	15	44%			
Proctor et al. 1995	CA	Existing	30	11%	33%	56%	
Proctor et al. 1997a	NJ	New	52				13%
Rodriguez et al. 1995	n.a.	n.a.	n.a.				5%

Rodriguez et al. 1995	n.a.	n.a.	n.a.				15%
Average				26%	33%	41%	12%

Summary of Studies on Air Flow over A/C Coils							
Study Author	State	Existing or New Home?	Sample Size	Average Air Flow	Airflow <350 cfm	Airflow w/in 10% of 400/ton	Energy Savings Potential
Blasnik et al. 1995	NV	New	30	345	50%		8%
Blasnik et al. 1995	CA	New	10	319	90%		
Blasnik et al. 1996	AZ	New	22	344	64%	29%	10%
Hammarlund et al 1992	CA	New	12			30%	10%
Hammarlund et al 1992	CA	New	66		76%	14%	12%
Neme et al. 1997	MD	New	25	340			
Palani et al. 1992	n.a.	n.a.	n.a.				4%
Palani et al. 1997	FL	Both	27	270	89%	7%	10%
Proctor & Pernick 1992	CA	Existing	175		44%		
Proctor 1991	CA	Existing	15			33%	
Proctor et al. 1995	CA	Existing	30	300	80%	11%	
Rodriguez et al. 1995	n.a.	n.a.	n.a.				2%
Rodriguez et al. 1995	n.a.	n.a.	n.a.				10%
VEIC/PEG 1997	NJ	New	52	372		30%	7%
Average				327	70%	22%	8%

II.B. Review of DEER Database

In addition to the numerous studies on the subject of the energy savings potential from improving the operating conditions of air conditioning systems, the California Database for Energy Efficiency Resources (DEER database) contains savings estimates for measures related to AC tune-ups. Several utilities in California have implemented tune-up programs during the past decade, and savings estimates from these programs have been developed and revised several times. The latest version of the DEER database contains 1,485 model runs for the measure labeled "Refrigerant Charge Adjustment in Residential AC Units." Of these, 95 model runs were for California climate zone 15, the weather zone which has the closest number of AC annual operating hours to south Texas, according to EPA data. DEER's average savings values for this measure in CZ15 are 0.15 kW/ton and 260 kWh/ton.

For the measure that involves adjusting the refrigerant charge, adjusting air flow and reducing supply and return duct air leakage to 6% of fan flow, DEER also reports savings values for 95 model

runs in California climate zone 15. The average DEER database savings values for this measure in CZ15 are 0.216 kW/ton and 327 kWh/ton.

II.C. Estimate of Energy Savings Potential for AEP-TCC's CoolSaver Program

With approximately 692,000 residential customers and an estimated central AC saturation of 90%, there are over 600,000 residential AC units in the TCC service area. Applying the savings estimates from the DEER database to this population of central HVAC systems provides the following estimate of the technical potential for energy and demand savings for the TCC service area:

Energy Savings Potential for CoolSaver Program	
AEP TCC residential customer count	692,000
Assumed central AC/HP saturation	90%
Estimated % of AC/HP units with incorrect charge	60%
Residential peak demand savings, kW/ton	0.15
Residential energy savings, kWh/ton	260
Average unit size, tons (from other Frontier studies)	3.4
Technical potential for demand savings, MW	191
Technical potential for energy savings, KWH	330,333,120

III. Industry-Standard AC Tune-Up Procedures

There are numerous HVAC training materials and resources which detail proper HVAC system charging, commissioning and tune-up procedures. The California Energy Commission's *Reference Appendices to the 2008 Building Energy Efficiency Standards for Residential and Nonresidential Buildings,* contains a detailed specification for determining refrigerant charge for split systems.[1] This specification includes procedures for equipment calibration and air flow measurement. The Air Conditioning Contractors of America (ACCA) publishes the *HVAC Quality Installation Specification* (the current version is ANSI/ACCA 5 QI-2010)[2]. This document lists the following as acceptable practices for measuring air flow:

[1] This document may be downloaded from the CEC website at: http://www.energy.ca.gov/2008publications/CEC-400-2008-004/CEC-400-2008-004-CMF.PDF

[2] This document may be downloaded from the ENERGY STAR website at: http://www.energystar.gov/ia/home_improvement/home_contractors/qispec.pdf

a) OEM CFM/static pressure drop coil table method using a manometer and probe to determine the static pressure drop across a cooling coil, furnace, or fan coil unit and compare with OEM values or

b) Traversing using a manometer and probe, or an anemometer (e.g., hot wire, rotary style) or other methods per ACCA, AABC, ASHRAE, ASTM, NEBB, SMACNA, or TABB procedures or

c) Flow grid measurement method or

d) Pressure matching method, using a calibrated fan to match the supply plenum pressure and measurement of the system airflow through the active fan.

Each of the above methods will produce a reasonably accurate measurement of air flow. In addition, the following methods may be used to verify that air flow is adequate, but do not quantify air flow:

e) Measuring static pressure drop across the coil, using a manometer to measure static pressure of the air flow entering the coil and downstream of the coil.

f) Measuring total external static pressure, using methods similar to that for measuring pressure drop across the coil

g) Temperature split method. This process involves measuring the dry-bulb temperature of the supply air, and the dry- and wet-bulb temperature of the return air, and comparing the actual temperature split to the target temperature split for a given wet-bulb return temperature.

Methods that verify adequate air flow without measuring airflow directly (e-g, from above) can be used to perform a tune-up, but cannot be used to measure system capacity, or changes to system capacity resulting from airflow and/or refrigerant charge correction. As a result, these methods do not allow demand or energy savings to be quantified from the tune-up.

The *HVAC Quality Installation Specification* allows the contractor to follow any charging procedure that is recommended by the equipment manufacturer. These procedures include the superheat method, which is the normal method for systems without a thermostatic expansion valve (TXV). For TXV systems, the sub-cooling method is normally recommended, although certain manufacturers have charging procedures that differ from either of these. The QI Spec requires that the contractor's refrigerant charging procedure result in a superheat value that is within ± 5°F of the manufacturer-specified superheat value, and within ± 3°F of the manufacturer-specified subcooling value.

IV. Survey Methodology

IV.A. Sampling Methodology

Previous surveys of HVAC dealers conducted on behalf of Oncor Electric Delivery and Texas A&M Energy Systems Lab have resulted in a sufficiently high response rate and yielded sufficient data to

conclude that the mail survey approach could meet this project's baseline data collection objectives.

For a 90% confidence level and a precision of +/- 10%, the sample size for a population of 700 licensed HVAC dealers is calculated as follows:

$$n = \frac{Nz^2pq}{d^2(N-1)+z^2pq}$$

Where:

n = sample
p = response variable, (assumed to be 0.5)
N = Population
q = 1 - p
d = precision (10%)
z = Reliability factor (1.645 used for 90% confidence level)

Using this calculation, a sample size of 65 would achieve the desired level of confidence and precision.

To obtain the required number of responses, Frontier identified all licensed HVAC contractors within counties in the AEP-TCC service area. The primary source for this data was the Texas Department of Licensing and Regulation (TDLR) database. Frontier then screened this data to exclude license holders that didn't appear to be associated with an HVAC company, and to exclude duplicate license holders associated with the same HVAC contractor. From this population, a random sample of 750 HVAC contractors was drawn. Surveys were sent to each of the dealers in this sample.

IV.B. Survey Instrument

The survey consisted of a cover letter, a two-sided survey instrument, and business reply mail envelope. Each survey was individually addressed and sent via first-class mail. To encourage response, a $25 gift card to either Lowe's or Home Depot was offered to respondents who returned the surveys by September 7.

IV.C. Survey Mailing and Response

Surveys were mailed the week of August 13th. A total of 103 usable responses were received, representing a 13.7% response rate. This response is higher then previous HVAC dealer surveys conducted by Frontier. The average response rate from those surveys was approximately 9%. An identical survey conducted for SWEPCO offered a $50 gift card as an incentive, and yielded a 19.5% response rate.

V. Data Validation and Analysis

Once the survey responses were received, they were logged in by Frontier staff. Data was screened and validated as part of the data entry process.

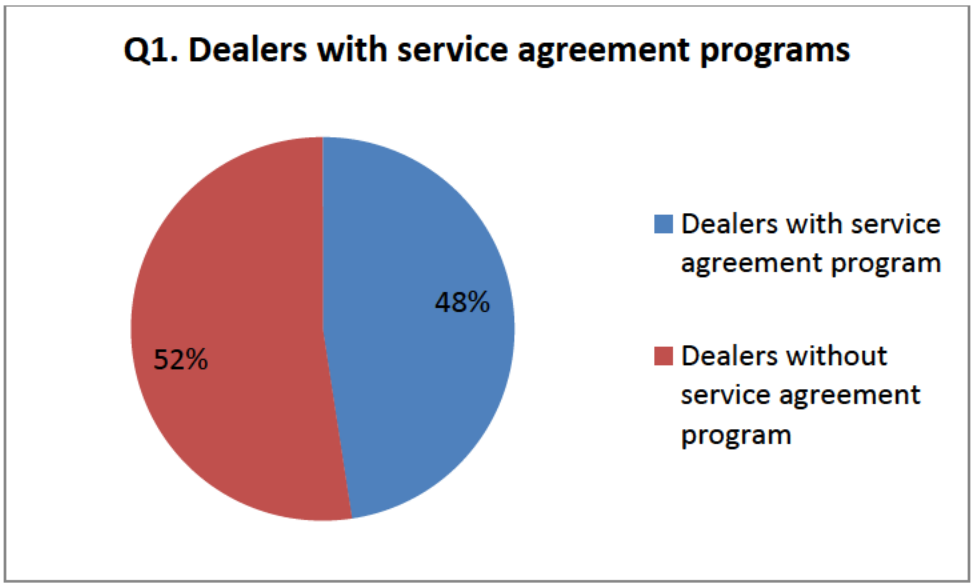
Weighted and un-weighted responses were tabulated for each question. Responses were weighted by the number of residential system tune-ups performed, commercial tune-ups performed, or total tune-ups performed. The survey response tables identify the specific weighting factor used for each question.

VI. Selected Survey Results

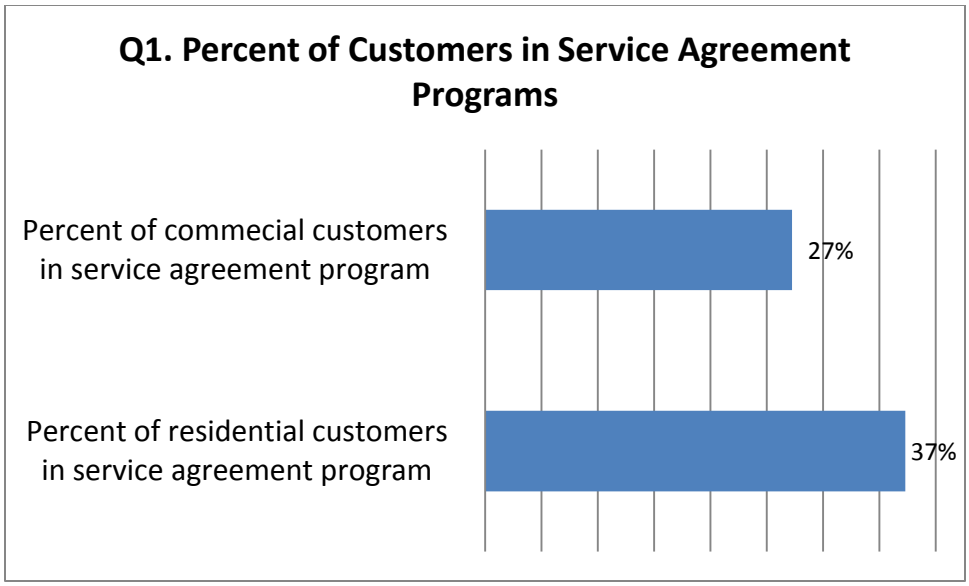
The entire set of survey responses is included as Appendix B. The following are some selected survey results. Except where noted, all responses are weighted based on the number of tune-ups performed.

VI.A. Service Contracts

In other utility tune-up programs, dealers with service contract programs in place have been more likely to be interested in participating. These dealers have a readily-identifiable customer base to whom they can market the tune-up program.

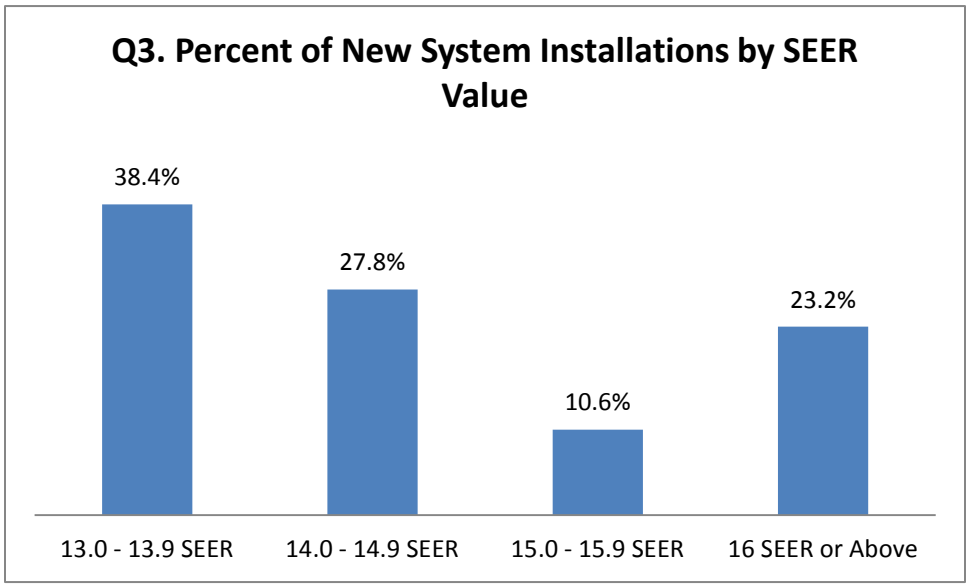


The responses to the above question were not weighted.



VI.B. Average SEER Value of New System Installations

Included in the survey was a question on the SEER value of new system installations. This information is not directly related to the CoolSaver program, but may be of value to AEP in future program planning. The survey responses to this question were weighted by number of residential tune-ups—the survey did not ask the dealers to provide the number of new system installations.

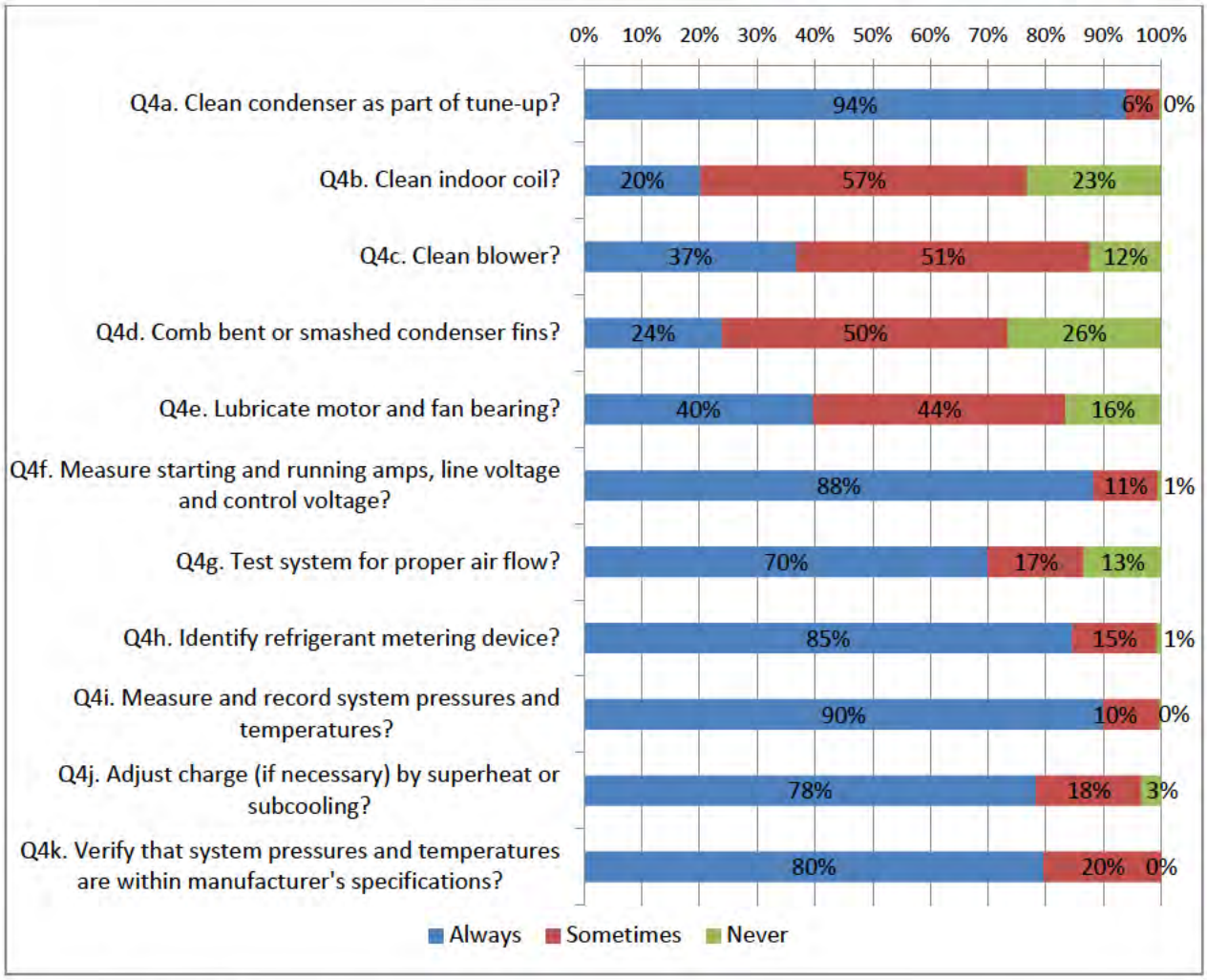


The weighted average SEER value is 14.2.

VI.C. Tune-Up Practices

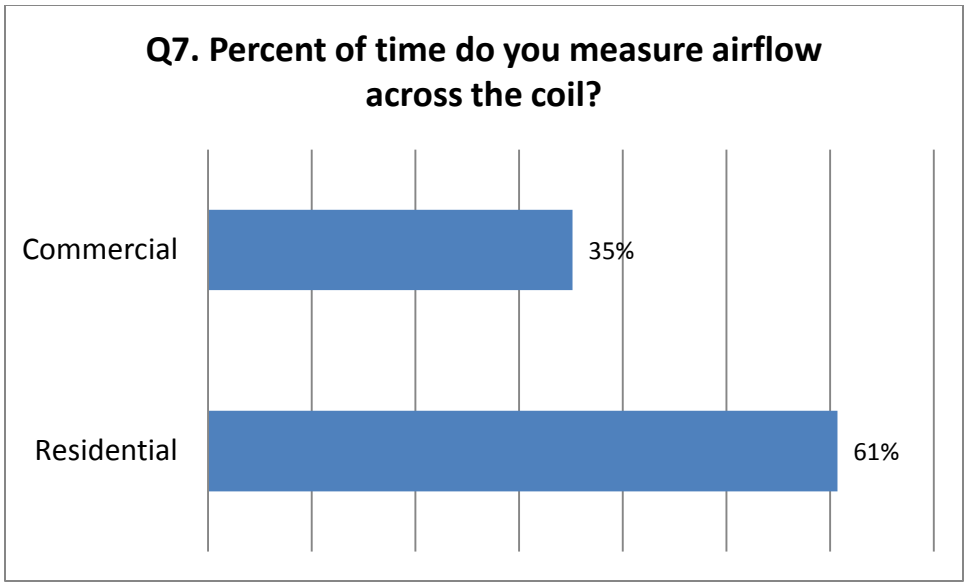
The dealers were asked about various tasks that may be included as part of a tune-up. The response categories for each task were "Always," "Sometimes," and "Never."

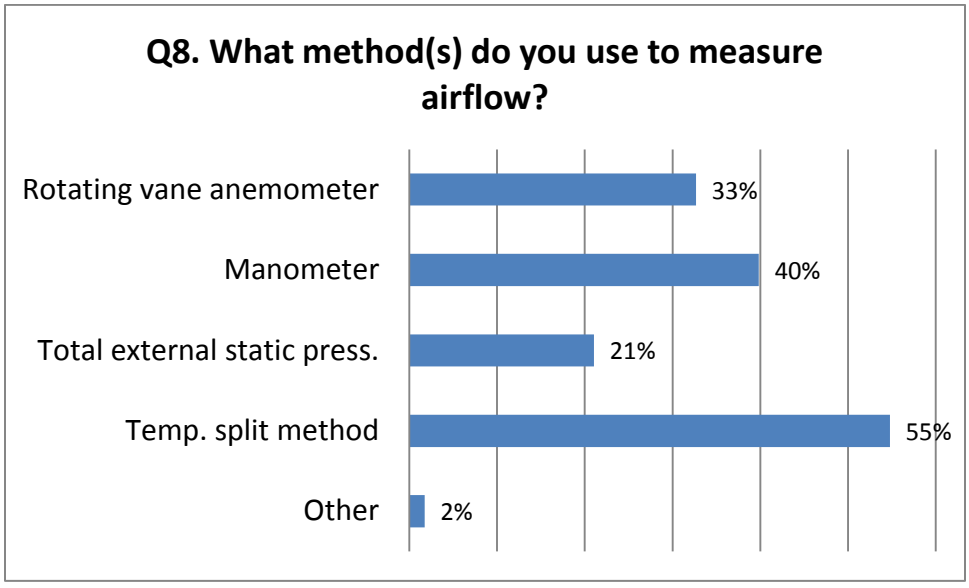
Q4. Tune-Up Practices



VI.D. Air Flow Measurement

As mentioned previously, verification of proper airflow is an important component of the tune-up. Not all practices used by contractors to verify sufficient airflow will provide an actual measurement of airflow.



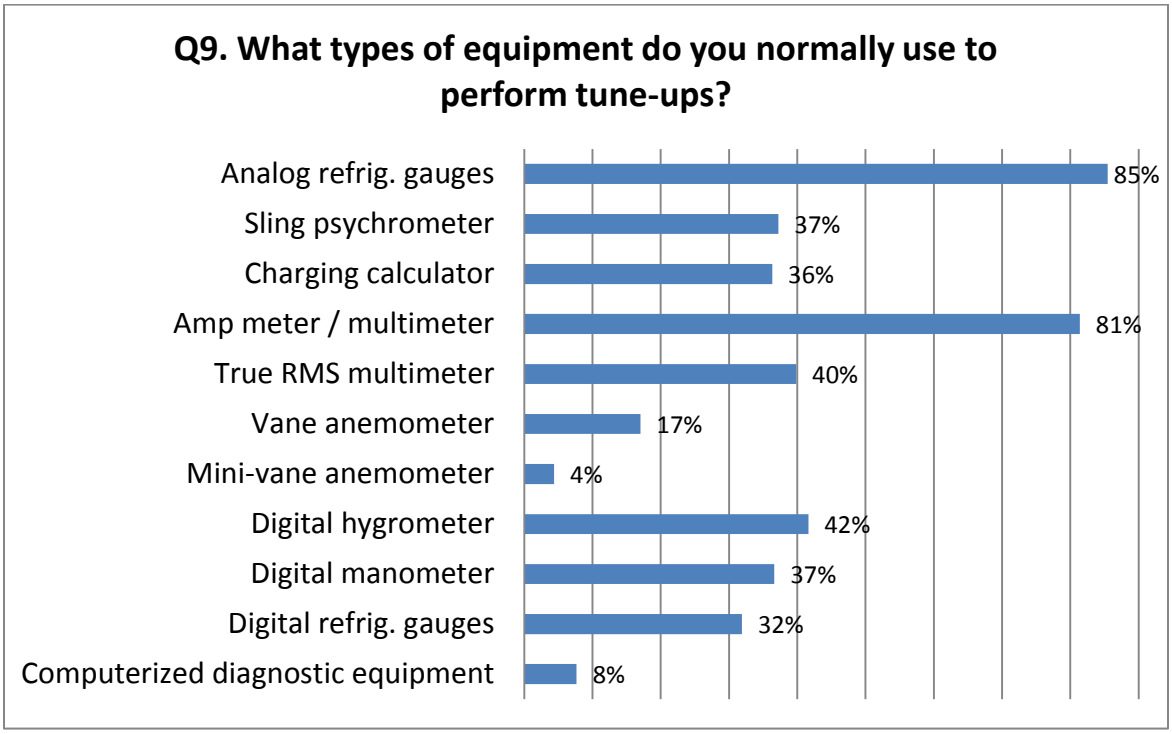


Total external static pressure measurements (using a manometer) and the temperature split method can be used to verify proper airflow, but do not quantify airflow, which is required to estimate energy savings. Unlike these methods, the rotating vane anemometer can be used to directly measure airflow, and is the tool that is most often used to quantify CFM. . Airflow can also be measured using other, less-common techniques, involving the use of a flow hood, Duct Blaster™, Pitot tube, or True Flow® flow meter.

VI.E. Types of Equipment Used to Perform Tune-Ups

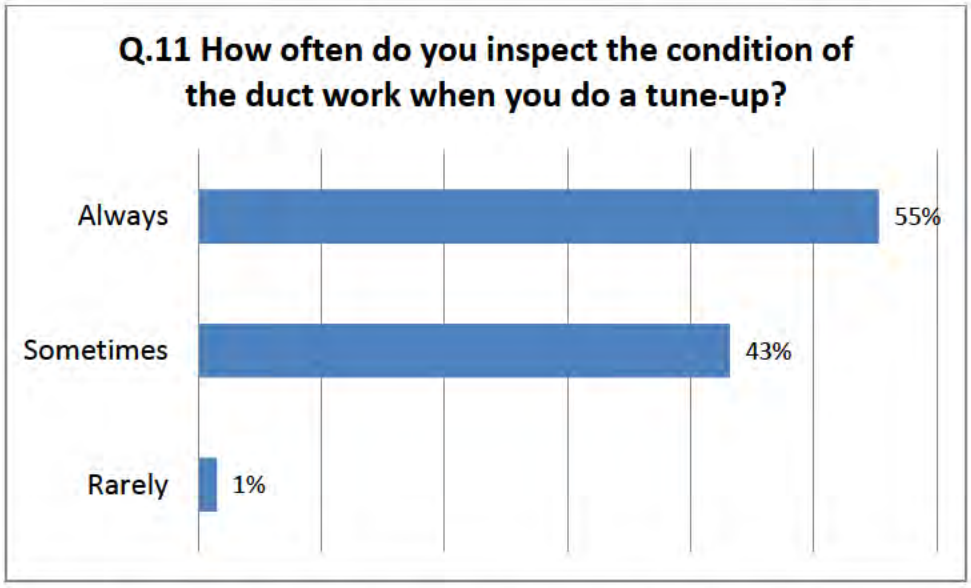
Tune-ups can be performed by a qualified technician using a variety of tools. Newer digital instruments are easier to use and can usually record measurements faster. For example, wet bulb

temperature can be measured with a sling psychrometer, but a digital hygrometer is much easier and faster to use, thereby increasing the likelihood that this measurement will be taken. Digital refrigerant gauges are faster, more accurate, and more precise. They can provide instant superheat and subcooling calculations and can allow the technician to set superheat and subcooling levels with a higher degree of accuracy and precision. A digital mini-vane anemometer is one of the most accurate ways to measure airflow.

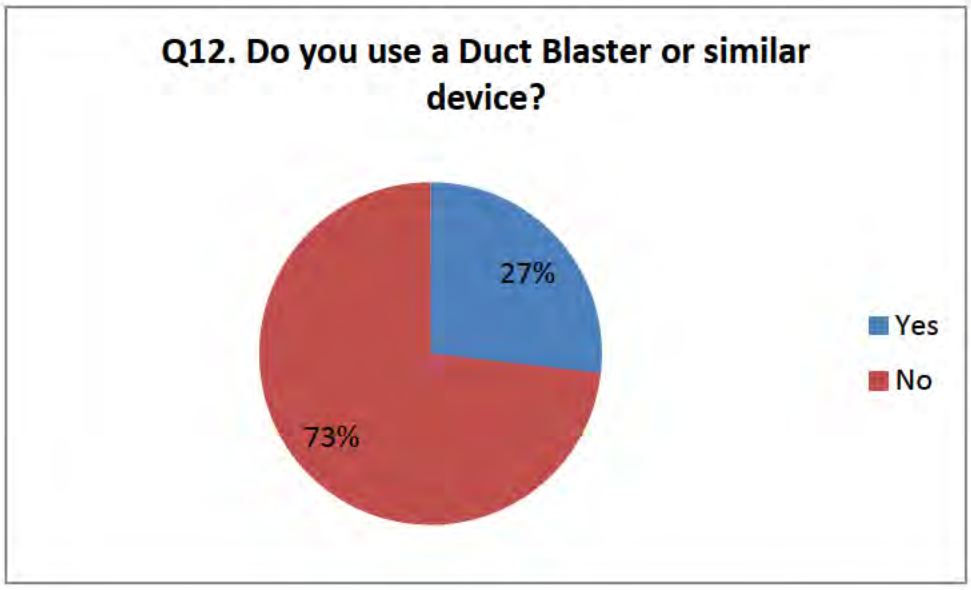


VI.F. Duct Testing

The survey included several questions about duct systems. The first question asked was how often they inspected the duct work as part of a tune-up.



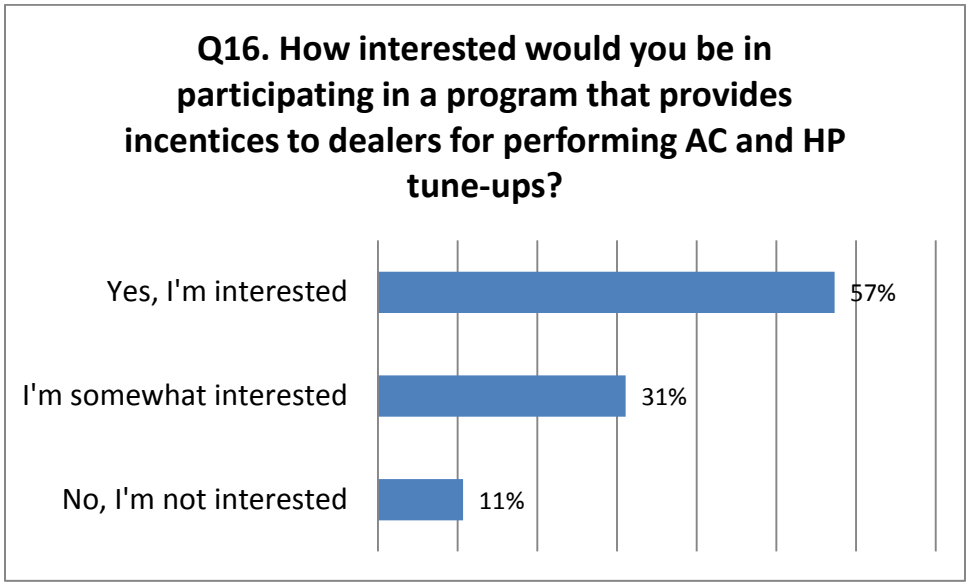
Dealers were also asked whether or not they owned a Duct Blaster™ or similar device.



Dealers who indicated that they owned a Duct Blaster were asked how often duct leakage diagnostic and repair services were performed as part of a tune-up. The dealers indicated that these services were included in 13.4% of tune-ups.

VI.G. Interest in Tune-Up Program

Dealers were asked about their interest in a program that would provide incentives to dealers for performing AC and HP tune-ups:



VII. Conclusion

This survey provides baseline data on tune-up practices that will enable AEP-TCC to measure the effects of a tune-up program on the various market barriers that may be preventing installed HVAC systems from achieving the operational efficiencies that they were designed and engineered to achieve. The potential energy and demand savings from a successful tune-up program are significant. Over time, additional research activities may be useful to gauge the degree to which the tune-up program has been able to address these market barriers, and to quantify any additional market effects that may be attributed to the program.

Appendix A

Mail Survey Instrument

AEP TEXAS®
A unit of American Electric Power

Control # «CONTROL_»

<<First>> <<Last>>
<<Company>>
<< Address>>
<<City>> TX <<Zip>>

Dear <<First>><<Last>>:

AEP-Texas is conducting a survey to learn more about air conditioner and heat pump tune-up practices being utilized by HVAC dealers in the AEP service territory. As a local contractor, the information and input you provide to us on the attached survey will be of great benefit to us as we implement programs to encourage customers to get their systems tuned up properly.

The information you provide will not be shared with any other firm and will be included in a report in aggregate form only with no identifying information that would allow anyone to identify you or the product lines or services that you offer.

We would greatly appreciate your time to complete this short survey and returning it to us in the enclosed postage-paid envelope.

To thank you for answering each of the questions, and for returning the survey to us by September 7, we will send you a $25 gift card to your choice of Home Depot or Lowe's. Please mark your preference:

☐ Home Depot ☐ Lowe's

Name (if different from above): _____

Address: (if different from above): _____

Phone number: _____

P. O. Box 2121
Corpus Christ TX 78403

AEP TEXAS®
A unit of American Electric Power

If you have any questions or problems in answering this survey, please contact Amy Martin toll free at 866-662-5279, extension 125.

Thank you for your assistance.

1. Do you have a service agreement program?

   ☐ Yes ☐ No

   If yes, approximately what percentages of your residential and commercial customers are in your service agreement program?

   _____% Residential

   _____% Commercial

2. Approximately how many air conditioning system tune-ups did your company perform in during the past year?

   _____ Residential systems

   _____ Commercial (RTU) systems

3. In the past year, what percentages of your new system installations were in the following efficiency ranges?

   _____% 13.0 – 13.9 SEER

   _____% 14.0 – 14.9 SEER

   _____% 15.0 – 15.9 SEER

   _____% 16 SEER or above

   (Percentages should sum to 100%)

4. Which of the following are included as part of your standard tune-up?

   A. Clean condenser:
   ☐ Always ☐ Sometimes ☐ Rarely

   B. Clean indoor coil:
   ☐ Always ☐ Sometimes ☐ Rarely

   C. Clean blower:
   ☐ Always ☐ Sometimes ☐ Rarely

   D. Comb bent or smashed condenser fins:
   ☐ Always ☐ Sometimes ☐ Rarely

   E. Lubricate motor and fan bearing:
   ☐ Always ☐ Sometimes ☐ Rarely

   F. Measure starting and running amps, line voltage and control voltage:
   ☐ Always ☐ Sometimes ☐ Rarely

   G. Test system for proper airflow:
   ☐ Always ☐ Sometimes ☐ Rarely

   H. Identify refrigerant metering device:
   ☐ Always ☐ Sometimes ☐ Rarely

   I. Measure and record system pressures and temperatures:
   ☐ Always ☐ Sometimes ☐ Rarely

   J. Adjust charge (if necessary) by superheat or subcooling:
   ☐ Always ☐ Sometimes ☐ Rarely

P. O. Box 2121
Corpus Christ TX 78403

K. Verify that system pressures and temperatures are within manufacturer's specifications

☐ Always ☐ Sometimes ☐ Rarely

5. What is the minimum ambient temperature that you require in order to perform a tune-up?

_____ degrees

6. How long will you usually allow a system to operate before taking any measurements:

_____ minutes

7. What percentage of time do you measure air flow across the coil when you tune up a system?

_____% of residential systems

_____% of commercial systems

8. What method(s) do you use to measure airflow?

- ☐ Temperature split method
- ☐ Rotating vane anemometer
- ☐ Total external static pressure
- ☐ Manometer
- ☐ Other (Specify):

_____

_____

9. What types of equipment do you normally use to perform tune-ups? (Please check all that apply)

- ☐ Analog refrigerant gauge
- ☐ Digital refrigerant gauges
- ☐ Sling psychrometer
- ☐ Charging calculator (e.g. Carrier or Trane)
- ☐ Computerized psychrometric software or diagnostic equipment
- ☐ Digital manometer
- ☐ Digital wet bulb / dry bulb / hygrometer
- ☐ Vane anemometer
- ☐ Mini-vane anemometer
- ☐ Amp meter / multimeter
- ☐ True RMS multimeter
- ☐ True RMS kW meter

10. How often do you calibrate instruments such as refrigerant gauges and temperature sensors?

_____ Monthly

_____ Annually

_____ Other (Specify):

_____

11. How often do you inspect the condition of the duct work when you do a tune-up?

    ☐ Always ☐ Sometimes ☐ Rarely

12. Do you use a Duct Blaster™ or similar device?

    ☐ Yes ☐ No

13. If you answered "no," please skip to Question 14. If you answered "yes," approximately what percentage of residential tune-ups includes duct leakage diagnosis and repair services?

    _____% of tune-ups

14. What charging techniques do you typically use, for example, superheat, subcooling, etc?

    _____

    _____

15. What is your level of awareness of AEP's CoolSaver Program, which provides incentives to HVAC contractors and customers for tune-ups?

    ☐ Never heard of it
    ☐ Heard of it, but don't know much about it
    ☐ Have been contacted about the CoolSaver Program by a CLEAResult or AEP Texas representative

16. How interested would you be in participating in a program that provides incentives to dealers for performing AC and HP tune-ups?

    ☐ No, I'm not interested
    ☐ I'm somewhat interested
    ☐ Yes, I'm interested

Appendix B

Survey Responses

Question	*Q1. Do you have a service agreement program? (% of respondents answering "yes.")*	*Q1. What percentage of your residential customers are in your service agreement program?*		*Q1. What percentage of your commercial customers are in your service agreement program?*	
Weighting Factor	None	None	Res. Tune-Ups	None	Comm. Tune-
All Respondents	47.6%	50.0%	37.3%	28.9%	27.2%

Question	*Q2. How many residential tune-ups did you perform during the past year?*	*Q2. How many commercial tune-ups did you perform during the past year?*	*Total Tune-Ups*
Weighting Factor	Unweighted	Unweighted	Unweighted
All Respondents	19,536	5,335	24,871

Question	*Q3. What percentages of your new system installations were in the following efficiency ranges?*				*Q4a. Clean condenser as part of tune-up?*		
Weighting Factor	Residential Tune-Ups				Total Tune-Ups		
All Respondents	13.0 - 13.9 SEER	14.0 - 14.9 SEER	15.0 - 15.9 SEER	16 SEER or Above	Always	Sometimes	Never
	38.4%	27.8%	10.6%	23.2%	93.9%	5.9%	0.2%

Question	*Q4b. Clean indoor coil as part of tune-up?*			*Q4c. Clean blower as part of tune-up?*		
Weighting Factor	Total Tune-Ups			Total Tune-Ups		
All Respondents	Always	Sometimes	Rarely	Always	Sometimes	Rarely
	20.2%	56.5%	23.1%	36.7%	50.9%	12.2%

Question	*Q4d. Comb bent or smashed condenser fins as part of tune-up?*			*Q4e. Lubricate motor and fan bearing as part of tune-up?*		
Weighting Factor	Total Tune-Ups			Total Tune-Ups		
All Respondents	Always	Sometimes	Rarely	Always	Sometimes	Rarely
	23.9%	49.5%	26.4%	39.6%	43.8%	16.4%

Question	*Q4f. Measure starting and running amps, line voltage and control voltage as part of tune-up?*			*Q4g. Test system for proper air flow as part of tune-up?*		
Weighting Factor	Total Tune-Ups			Total Tune-Ups		
All Respondents	Always	Sometimes	Rarely	Always	Sometimes	Rarely
	88.2%	11.2%	0.6%	69.9%	16.6%	13.4%

Question	*Q4h. Identify refrigerant metering device as part of tune-up?*			*Q4i. Measure and record system pressures and temperatures as part of tune-up?*		
Weighting Factor	Total Tune-Ups			Total Tune-Ups		
All Respondents	Always	Sometimes	Rarely	Always	Sometimes	Rarely
	84.5%	14.7%	0.8%	89.9%	9.7%	0.4%

Question	*Q4j. Adjust charge (if necessary) by superheat or subcooling as part of tune-up?*			*Q4k. Verify that system pressures and temperatures are within manufacturer's specifications as part of tune-up?*		
Weighting Factor	Total Tune-Ups			Total Tune-Ups		
All Respondents	Always	Sometimes	Rarely	Always	Sometimes	Rarely
	78.3%	18.3%	3.5%	79.6%	20.4%	0.0%

Question	*Q5. Minimum ambient temp that you require to perform a tune-up?*	*Q6. How long will you usually allow a system to operate before taking any measurements?*	*Q7. What percentage of time do you measure airflow across the coil when you tune up a system?*	
Weighting Factor	Residential Tune-Ups	Residential Tune-Ups	Res. Tune-Ups	Comm. Tune-Ups
All Respondents	73	15	60.7%	35.2%

Question	*Q8. What method(s) do you use to measure airflow?*				
Weighting Factor	Total Tune-Ups				
All Respondents	Temp. split method	Rotating vane anemometer	Total external static press.	Manometer	Other
	54.8%	32.7%	21.0%	39.8%	1.8%

Question	*Q9. What types of equipment do you normally use to perform tune-ups?*										
Weighting Factor	Total Tune-Ups										
All Respondents	Analog refrig. Gauges	Digital refrig. Gauges	Sling psychrometer	Charging calculator	Computerized diagnostic equipment	Digital manometer	Digital Hygrometer	Vane anemometer	Mini-vane anemometer	Amp meter / multi meter	True RMS multimeter
	85.5%	31.9%	37.2%	36.3%	7.7%	36.6%	41.6%	17.0%	4.4%	81.4%	39.8%

Question	*Q10. How often do you calibrate instruments such as refrigerant gauges and temperature sensors?*			*Q11. How often do you inspect the condition of the duct work when you do a tune-up?*		
Weighting Factor	Total Tune-Ups			Total Tune-Ups		
All Respondents	Monthly	Annually	Other	Always	Sometimes	Rarely
	45.3%	38.9%	16.1%	55.3%	43.2%	1.5%

Question	*Q12. Do you use a Duct Blaster or similar device?*		*Q13. If you answered "yes" to Q12, what percentage of residential tune-ups includes duct leakage diagnosis and repair service?*
Weighting Factor	Total Tune-Ups		Residential Tune-Ups
All Respondents	Yes	No	13.4%
	26.8%	73.1%	

Question	*Q15. What is your level of awareness of the CoolSaver Program?*					
Weighting Factor	None			Total Tune-Ups		
All Respondents	Never heard of it	Heard of it, but don't know much about it	Have been contacted about the Program by AEP or CR representative	Never heard of it	Heard of it, but don't know much about it	Have been contacted about the Program by AEP or CR representative
	61.2%	33.0%	4.9%	52.8%	28.6%	18.5%

Question	*Q16. How interested would you be in participating in a program that provides incentives to dealers for performing AC and HP tune-ups?*					
Weighting Factor	None			Total Tune-Ups		
All Respondents	No, I'm not interested	I'm somewhat interested	Yes, I'm interested	No, I'm not interested	I'm somewhat interested	Yes, I'm interested
	10.7%	31.1%	57.3%	16.8%	17.6%	65.6%

Effective Research Methodology for Smart Grid Enabled Consumer Behavior Impact Assessment

Jordan Michel, Geavista Group
Pam Osterloh, AEP Texas

ABSTRACT

Utilities across the country are assessing the role of smart grid enabled and behavior-based programs in their demand-side management (DSM) portfolios. American Electric Power (AEP) Texas is conducting research that encompasses both smart grid and behavior in the AEP Texas SMART View In-Home Device Research and Development Project (SMART View Project), which is designed to assess the impact of in-home displays on consumer behavior and energy consumption. In this paper, we outline best practices for research design using the AEP Texas SMART View Project as a case study to illustrate critical elements of the research methodology that will allow AEP Texas to identify impacts attributable to the devices. Aspects of the methodology that will be covered include the pre-project pilot, sampling plan, screening methodology, definition of treatment and control groups, and participant surveys. These research practices will be useful to any utility evaluating the role of new technologies in their portfolio.

Background

Like many utilities across the nation, AEP Texas is currently making a significant investment as it upgrades to an advanced metering infrastructure (AMI). Eager to begin quantifying the positive impacts that investment might have on AEP Texas' energy efficiency portfolio, the company decided to allocate a portion of its research and development (R&D) budget to measuring the energy savings impact of in-home displays (IHDs).

Although other utilities have conducted similar studies, their results have varied widely, dependent on the myriad factors that can impact behavior-driven IHD program results (demographics, energy costs, rate plans, climate, IHD capabilities, etc.). Recent meta-analyses published by American Council for an Energy-Efficient Economy (ACEEE) and Electric Power Research Institute (EPRI) found that studies assessing the impact of real-time feedback documented wide-ranging energy savings averages, spanning from -5.5% to 32% (Ehrhardt-Martinez, Donnelly, & Laitner 2010; EPRI 2009). Given the wide range of impacts measured across different studies, this paper focuses not on the results of the AEP Texas research but on the research design that will allow AEP Texas to quantify the impacts of the IHDs they are testing. It is our hope that the research best practices presented here will be of use to other organizations attempting to assess impacts of behavior-based and/or smart grid enabled initiatives, not only for R&D, but for any program that will require impact assessment at its conclusion.

Research Best Practices

Because energy consumption is affected by a multitude of variables and behavior-based savings can be difficult to isolate, it is critical that programs with a goal of assessing behavior

impacts be designed with evaluations in mind. The best practices outlined below are common practice in the market research industry; broader adoption of these techniques in the DSM field will lead to improved ability to evaluate the success of energy efficiency initiatives.

Begin with a Soft Launch

A soft launch is a limited release of a program, offer, or recruitment effort that gives the program team the chance to verify assumptions before too many customers are contacted and significant program funds are expended, making it an essential element of any research plan. Although percentages may vary based on program scope and other factors, a typical soft launch may be conducted with a goal of reaching about ten percent of the total projected participants.

For outreach that requires customer follow-up (e.g., surveys, enrollment opportunities), the soft launch allows the program manager to verify response rates and, if applicable, qualifying rates. For example, if a program manager expects to enroll 1,000 customers by sending 20,000 invitations (a 5% combined response and qualifying rate) and discovers after launching the outreach that the combined response and qualifying rate is actually just 2%, the program budget and feasibility could be impacted. Beginning with a soft launch gives program managers the opportunity to confirm assumptions and adjust plans as needed.

The soft launch is especially critical when new technologies are involved. Even when working properly, adoption of new technologies requires customer support. The soft launch provides an opportunity to assess the support needs and plan appropriately before the technology has been distributed to all participants.

A soft launch can also provide an opportunity to catch mistakes. If there is a problem with the study's recruitment survey, it is much better to address the issue when invitations have gone to just a fraction of the study's sample and not the entire mailing list.

Define the Population and Align the Sample to Maximize External Validity

Before designing sampling methodology and screening criteria, it is critical that the population be clearly defined. A statistical population is the group of people to which the results of a statistical analysis can be applied. In some cases, that population may be an entire segment of a utility's customer base (e.g., all of the utility's residential customers), but in many cases it may be more complex (e.g., likely users of a given technology). Defining the population too broadly may dilute the results (i.e., decrease average savings), whereas defining it too narrowly limits the size of the group on which results can be projected.

External validity means that the research results can be extrapolated from the narrow universe of participants to the larger population. The sampling frame is the group of people from which the sample (i.e., participants) is selected. To achieve external validity, the sampling frame must be representative of the population to which it will be extrapolated. If, for example, a study's population is all of a utility's residential customers, the sampling frame should be either the entire population or a representative sample of the population, not a sub-segment that may differ in important ways from the larger population. Alternatively, if the population is defined as a subset of customers that cannot be pre-identified, the program can apply screening criteria to determine which customers align with the study's population. In this situation, however, program results will not be applicable to customers that do not meet the screening criteria.

One important factor in the alignment of the population with the sampling frame is the enrollment process. Programs designed with opt-in enrollment are inherently limited in sampling frame, because participants who choose to participate cannot be assumed to be the same as those who do not. Programs with opt-out enrollment, on the other hand, can have a larger sampling frame and, therefore, can be extrapolated to a broader population.

Include a Control Group to Maximize Internal Validity

Internal validity refers to a researcher's ability to determine a cause-and-effect relationship between an independent variable (e.g., energy efficiency measure) and a dependent variable (e.g., energy consumption). Identifying those relationships, however, can be difficult, especially when the dependent variable can be affected by many different factors. For that reason, it is important to include a control group within the program design. A control group is similar to other program participants in every way possible but does not experience the effect of the independent variable (e.g., no energy efficiency measure is provided).

In order to ensure similarity between treatment and control groups, participants should be randomly assigned. One of the difficulties in establishing a true control has to do with selection bias. In a program with opt-in enrollment, people who choose to participate cannot be assumed to be the same as people who do not choose to participate. Two common research techniques that allow researchers to minimize selection bias are recruit-and-deny and recruit-and-delay. By recruiting members of the control group through the same methodology as other program participants, program managers can ensure that the groups are as similar as possible.

Design Treatment Groups to Isolate Impacts of Research Variables

It is not unusual in energy efficiency programs to combine multiple measures to increase the overall savings impact. However, when designing programs with a goal of assessing savings impacts, it is important to remember that the impact assessment will be more informative if the program is designed in a way that allows for each treatment (i.e., energy efficiency measure) to be assessed in isolation. A matrix structure (see example below) may be a good solution in these cases, because it allows researchers to test both isolated and combined impacts of measures.

Table 1. Matrix Structure Example

		Measure B	
		Present	Not Present
Measure A	Present	A and B	A only
	Not Present	B only	None

In this example, the three groups with a measure present represent various treatment groups, and the group with neither measure becomes the control. Isolating impacts in this way allows program managers to make more informed decisions about program design. If, for example, Measure A in isolation produces 90% of the savings achieved by Measures A and B combined, but costs half as much as the combined measures, the program manager has the data necessary to determine whether the incremental savings justify the incremental cost.

Recruit Sufficient Sample to Achieve Analysis Goals

Sample size refers to the number of participants being evaluated in a study, and it is a critical factor in determining how precise a study's findings can be while remaining statistically significant. However, sample size is also a key cost driver. Utilities must weigh the benefits of increased precision against the costs of recruitment and implementation to determine the appropriate balance. Although sample size calculations are unique to the type of statistical testing being performed, the calculation will likely include the following elements:

- n – sample size; represents the number of participants within each group being tested
- Δ or E – represent the amount of change that must be observed and the tolerable error (+/- value) respectively; these values may be adjusted in accordance with the program's goals
- α and β – represent the probability of error; there is some flexibility in assigning these values within certain generally accepted boundaries
- σ – standard deviation; in the planning stages, this is usually an estimate and is not within the experimenter's control to manipulate (Ott & Longnecker 2010)

Although it is desirable to have a low Δ or E value and low α and β values, lowering these values increases n. Therefore, the program team must carefully assess the goals of the evaluation as well as the feasibility and cost of increased sample to determine the appropriate balance.

Over-Recruit to Account for Dropouts

Once the sample size goals are established, it is important that program managers remember that not everyone recruited in the beginning of the program will end up providing useful data at the program's conclusion. Customers may enroll but not follow through with installation, move before the evaluation period is concluded, or introduce other variables that cannot be controlled for. For these reasons, it is important that programs recruit more participants than required for the final analysis to ensure that sufficient data is available at the study's conclusion. Appropriate rates of over-recruitment vary, but factors to consider include:

- Demands on the customer – How easy is it to participate?
- Length of the evaluation period – How many days/months/years of data do are needed?
- Participant characteristics – Who is being evaluated? Homeowners? Renters? Commercial property owners? Each population will have unique characteristics impacting the likelihood of follow-through.

Plan for an Assessment Period Sufficient for Evaluation of Long-Term Impacts

Allowing time to assess long-term impacts is especially critical for behavior-based savings where persistence cannot be assumed. Savings observed within the first year of participation may be inflated based on short-term engagement, or they may mark the beginning of long-lasting energy savings habits. What "long-term" means for any given program will depend on the utility's goals, but it is important to remember that behavior-based savings cannot be assumed to extend for a period longer than the period during which they were evaluated.

Combine Various Data Sources to Improve Understanding of Impacts

Energy consumption data is, of course, the most essential component in measuring energy savings impacts. However, additional data can greatly expand the opportunities for analysis:

- Weather data can be used to normalize energy consumption, facilitating comparison between groups. Weather normalization, however, may not be necessary if there is a randomly assigned control group.
- Data from other utility programs can be used to identify energy savings not attributable to the program's treatment(s).
- Participant feedback can provide insight into outside factors that may impact energy consumption, as well as a qualitative assessment of the customer experience.

AEP Texas SMART View Project: A Case Study

To illustrate what these best practices look like when applied, a high-level overview of the AEP Texas SMART View Project research methodology is provided below. This research plan illustrates the implementation of the best practices described above as well as providing an opportunity to discuss alternative approaches and opportunities for improvement of the plan.

Internal Device Pilot

In preparation for launch of the full study, a pilot study was conducted with AEP Texas employees to:

- Identify devices that are the best fit for the study
- Assess the level of support that will be required for launch of the project
- Identify common technical issues, so that:
  - preventative measures can be implemented
  - project support staff is prepared to handle common inquiries

Participants in the internal pilot were recruited through an email to local AEP Texas offices. Volunteers received a free device as well as instructions for provisioning the device (i.e., establishing a connection between the device and the meter). Participant support was managed through a dedicated email account, and all issues were logged in a simple tracking system. Several weeks after provisioning their device, pilot participants completed a short survey about their experience installing and interacting with the device.

As a result of the pilot findings, the project team made several key adjustments to the research plan, which will facilitate a smoother rollout to participants. The changes included:

- Device Selection: The pilot revealed that one of the eligible devices had too many barriers to installation and too little visibility to occupants once installed. For these reasons, the project team elected not to include it in the full study.

- Pre-delivery verification: AEP Texas identified two pre-delivery verification strategies that significantly reduced the percentage of participants who encountered technical issues during the device setup process.
- Staggered Delivery Schedule: Based on support needs encountered during the pilot, the project team determined phasing the delivery schedule over a period of 4-6 weeks would keep the support needs of participants at a manageable level.

This internal pilot may be considered a type of soft launch. However, the recruitment phase also began with a soft launch (see below).

Sampling Plan and Screening Methodology

Because IHD programs require an opt-in recruitment methodology, the project team determined that the population for their study would be likely participants in an AEP Texas IHD program. Knowing that AEP Texas could not claim savings for an IHD unless a program participant had chosen to receive one from the utility, the team knew that there was no value in attempting to apply the results more generally.

Participants will be recruited through an online survey to confirm that they meet the project's screening criteria. Because AEP does not have email addresses, targeted postcards with a link to the survey will be mailed to randomly selected single-family residential homeowners with advanced meters. To encourage a high response rate, survey invitations will promote availability of a sweepstakes incentive (e.g., respond to be entered to win one of ten $100 VISA gift cards). Qualifying survey participants will be given an opportunity to indicate their willingness to participate in the AEP Texas SMART View Project. Because knowledge of the survey's purpose could influence the responses provided by respondents, the opportunity to pilot new technology will not be mentioned until eligibility has been confirmed.

In addition to allowing the project to pre-screen participants, recruiting participants through a survey facilitates the recruit-and-deny methodology for establishing a control group. Because qualified participants will indicate their willingness to participate rather than actually applying to be a participant, the project team will be able to confirm that members of the control group are similar to members of the treatment group in every respect other than the treatment.

Recruitment Soft Launch

Because this study relied on a recruitment method never before used by the utility, it was essential to confirm the response rates and qualifying rates estimated in the research plan. The cost and reach of the postcard recruitment effort made the soft launch especially critical; with a plan to send over 100,000 postcards, it was very important that the team knew what to expect and make no mistakes. The postcard outreach was soft launched with 5% of the total anticipated invitations to assess actual response rate and qualifying rate, as well as test multiple recruitment messages.

To ensure the highest possible response rate, the team developed two unique recruitment postcard templates to test during the soft launch. Both templates included essential elements such as the survey url, the sweepstakes offer, and the entity conducting the research. One template was designed to use the least possible copy while the other was formatted as a letter and included additional elements often listed as best practices for survey recruitment, including a privacy

disclaimer and an explanation of the research purpose. Each template included a unique identifier in the survey url to track results.

Interestingly, the team found that the more formal invitation was less effective in recruiting homeowners; the response rate was one half of the response rate observed with the more concise invitation. The team also evaluated whether qualifying rates varied based on the postcard received, but no significant difference was observed. As a result, the team adopted the higher response rate template as the basis for the final template.

Although the qualifying rate of survey respondents was quite close to the estimated value of 35%, the response rate for the postcards was significantly lower than projected (0.4% as opposed to 1.5%). As a result, the project team made several modifications to the postcard to increase response rate, including:

- addition of an expected timeframe for response to motivate action
- addition of the utility's logo to increase perceived credibility
- increasing size of the survey url to draw attention and improve readability
- use of colored cardstock (white was used in the initial soft launch) to draw attention

The early discovery of the low response rate also allowed the team to prepare an alternative research design in case the sample size required for the original design could not be achieved. To ensure that sufficient sample could be obtained through this recruitment methodology, a second soft launch was conducted before the postcard recruitment was fully launched (results are pending).

Treatment Groups

Because the project team was interested in determining if the impact of IHDs might be augmented by the distribution of supplemental educational materials, the project uses a matrix structure to define the treatment and control groups. Each treatment is being tested in isolation as well as in combination with other treatments, so that when the project concludes, the team will be able to assess the impact of each individually.

Table 2. AEP Texas SMART View Project Treatment Groups[1]

		Supplemental Communication	
		Present	Not Present
Device Type	Device A	A1	A2
	Device B	B1	B2
	No Device	O1	O2

Participants who meet the screening criteria will be randomly assigned to one of the six groups. The number initially recruited into each group will be 20% higher than the targeted sample size to account for participants who do not successfully set up their IHD or must be removed from the assessment for other reasons.

[1] Please note that this is a preliminary design and is subject to change based on the results of the recruitment effort and availability of eligible participants.

Sample Size

Like many programs (especially programs with opt-in recruitment), the AEP Texas SMART View Project had limitations that required the team to make compromises regarding necessary sample size. Minimum sample size needs for the hypothesis test were calculated based on the following formula for a two-sided test comparing means of independent samples:

$$n = 2\sigma^2 \frac{(z_{\alpha/2} + z_{\beta})^2}{\Delta^2}$$

(Ott & Longnecker 2010)

The α and β values were set at 0.05 and 0.1 respectively. The σ was estimated based on past energy consumption data from the region.[2] The estimation of Δ was based on the savings that would be required to justify the cost of the devices to the utility and the range of savings that could be reasonably anticipated based on previous research. Due to the relatively high Δ/σ ratio, the calculated n was quite low.

Because the calculated minimum sample size was low, a second calculation was used to demonstrate the value of increasing the sample size beyond the minimum required for the hypothesis test. This calculation was based on the confidence interval for comparing means of independent samples:

$$E = z_{\alpha/2}\sigma\sqrt{\frac{1}{n} + \frac{1}{n}}$$

(Ott & Longnecker 2010)

The same α and σ values were used in this calculation. Then, n was manipulated upwards to demonstrate how increased sample size allows for a reduced confidence interval. Weighing the results of this calculation and the interest in precision (as indicated by a reduced confidence interval) against the complications of recruiting participants and the need to control costs, the project team determined that a sample size of 100 participants per cell (plus 20% to account for dropouts) was required and that, when appropriate, cells would be combined during analysis to provide increased precision for comparisons between larger participant groups.

Assessment Period

Due to a hard deadline at the end of 2013, the AEP Texas SMART View Project will include an assessment period of 14 to 16 months. This span of time will allow the project team to assess impacts beyond the first year. It will also include two summers, which is a critical period for managing peak demand in Texas. However, if savings are observed and continue into the final months of the assessment period, the team will not have sufficient data to determine the full persistence of the impacts. (If this occurs, the project team may recommend a follow-up evaluation in subsequent years.)

---

[2] Because the study will use difference-in-differences analysis, σ was based on year-to-year change in electricity consumption, rather than total electricity consumption.

Post-Treatment Survey

After the completion of the assessment period, the project team will conduct a survey of participants (including the control group) to assess:

- Participant perception of IHDs' impact, including:
  - Behavior changes
  - Equipment upgrades and home efficiency improvements
- Participant satisfaction with the device
- Changes in awareness/understanding levels evaluated during initial survey
- Other factors that may have impacted energy usage (renovations, change in number of occupants, etc.)

This survey data will be combined with participation data for any SMART View participants who also participated in other AEP Texas energy efficiency programs. Analyzing this data in combination with the consumption data will allow the project team to develop a deeper understanding of the project's impacts, including:

- Cross-program benefits – Are people with a display more likely to participate in other utility-sponsored programs?[3]
- Qualitative participant experience feedback – Do the participants perceive a benefit?
- Additional factors that impact energy savings – Are certain segments of the population (young/old, high/low income, high/low consumption, etc.) more likely to show savings that others?

Conclusion

There are always constraints that make it difficult for programs to achieve optimal design, and each program team must weigh the tradeoffs. These best practices provide an outline of important considerations for the program design process:

- Begin with a soft launch
- Define the population and align the sample to maximize external validity
- Include a control group to maximize internal validity
- Design treatment groups to isolate impacts of research variables
- Recruit sufficient sample to achieve analysis goals
- Over-recruit to account for dropouts
- Plan for an assessment period sufficient for evaluation of long-term impacts
- Combine various data sources to improve understanding of impacts

While these recommendations are especially important for research and development projects, they can improve the opportunities for assessment of any program that will require verification of energy savings.

[3] If such an impact is observed, it will be necessary to discount the savings to avoid double-counting.

References

Ehrhardt-Martinez, K., K. A. Donnelly, & J. A. Laitner. 2010. "Advanced Metering Initiatives and Residential Feedback Programs: A Meta-Review for Household Electricity-Saving Opportunities." Washington, D.C.: American Council for an Energy-Efficient Economy.

EPRI. 2009. *Residential electricity use feedback: A research synthesis and economic framework.* Palo Alto, Calif.: Electrical Power Research Institute.

Ott, R. L. & M. Longnecker. 2010. *An Introduction to Statistical Methods and Data Analysis,* Sixth Edition. Belmont, Calif.: Brooks/Cole.