

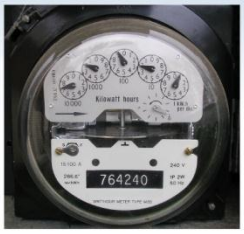


REVISION TO
Measurement and Verification of CPS Energy's 2010 DSM Program Offerings
Submitted to CPS Energy

Submitted by Nexant

June 7, 2011

Revision: Page 60, CSE Equation, Annual Energy Savings Total

Nexant

CONTENTS

Tables

Figures

1 EXECUTIVE SUMMARY

CPS Energy retained Nexant, Inc. (Nexant) to conduct a comprehensive, independent measurement and verification (M&V) evaluation of CPS Energy's 2010 demand side management (DSM) programs. This report describes the M&V methodology and process and presents the findings of the evaluation.

The evaluation primarily focused on calculating the energy and demand savings achieved by CPS Energy's 2010 DSM programs. Additionally, the evaluation reviewed program expenditures to calculate program cost-effectiveness and briefly addressed program operations and procedures to make recommendations on potential program modifications for the future.

1.1 SUMMARY OF ENERGY AND DEMAND IMPACTS

Net energy and demand savings are listed in Table 1-1 for individual programs, as well as totals by Energy Efficiency programs, Demand Response programs and overall.

Table 1-1: 2010 Net Energy and Demand Savings

Program	Net Impacts		
	Energy Savings (kWh)	Peak Demand Savings (kW)	Non-Coinc. Demand Savings (kW)
Energy Efficiency Programs			
CFL	9,969,578	993	11,673
Home Efficiency	2,321,792	944	1,031
Residential HVAC	12,437,505	3,634	4,543
Solar PV & Water Heater	1,729,383	1,090	1,090
Air Flow Performance	505,483	281	281
New Homes Construction	4,406,780	745	1,544
Refrigerator Recycling	859,811	91	114
Wash Right	1,145,856	478	1,949
Residential Subtotal	***33,376,189***	***8,257***	***22,224***
Com Large Lighting	16,421,243	3,203	3,669
Com Small Lighting	99,640	20	24
Com HVAC	6,142,509	2,537	3,295
Motors	179,793	62	62
Window Film	144,700	42	54
Roof Coating	181,405	123	155
Restaurant Equipment	19,969	2	3
Lean Clean Energy	595,441	68	78
Com New Construction	58,636	42	51
Com Custom	823,731	115	116
Commercial Subtotal	***24,667,067***	***6,215***	***7,507***
Energy Efficiency Total	***58,043,256***	***14,472***	***29,731***
Demand Response/Load Control Programs			
PeakSaver	460,676	17,785	17,785
Demand Response	1,283,346	45,028	45,028
Demand Response Total	***1,744,022***	***62,813***	***62,813***
Total	**59,787,278**	**77,285**	**92,544**

1.2 SUMMARY OF ECONOMIC IMPACTS

Nexant's evaluation included collecting program cost data, including internal program costs, such as administration, management, and marketing, as well as total rebates paid, and found the following economic impacts:

- Cost of Saved Energy, which represents the levelized program cost per annual kWh saved, was **$0.044/kWh** for the 2010 programs.
- Net Reduction in Revenue Requirements, which represents the net reduction in utility costs due to the impact of the energy efficiency improvements, was **$7,395,286** for the 2010 programs.

1.3 KEY PROCESS FINDINGS AND RECOMMENDATIONS

The 2010 program expanded at an average rate of over 100% compared to program year 2009. Nexant's evaluation team finds CPS Energy's DSM efforts continue to be led by committed, skilled, and experienced staff. The portfolio of DSM program offerings addresses a wide variety of electric efficiency measures and services for both residential and nonresidential customers.

CPS Energy's programs follow many best practices documented for efficiency programs, including:

- Program quality control procedures include collecting sufficient data to verify installed equipment (pre and post inspections, equipment specification forms, etc), while not requiring excessive reporting by customers and contractors
- Programs have straightforward participation processes, and CPS Energy works closely with customers and contractors to complete applications and ensure projects meet program requirements
- Trade ally network continues to expand and program staff keeps trade allies informed of program updates

To support and extend the many strengths of CPS Energy's programs, the evaluation team offers the following broad process recommendations in addition to program-specific recommendations detailed in each program chapter:

- For purposes of calculating a more precise estimation of energy savings, Nexant recommends CPS collect information for each facility as specified in the program-specific recommendations
- Nexant recommends optimizing M&V activities to include targeting complex commercial projects for more in-depth monitoring (pre- and post) to optimize and capture realized energy and demand savings

- Continue to track changes to minimum efficiency standards, incremental equipment cost, and market trends to evaluate potential changes to program requirements and incentive levels
- As programs continue to expand, CPS Energy should continue planning for the resources necessary to support large-scale deployment of DSM program portfolio and to achieve both short-term and long-term goals

2.1 OVERVIEW OF EVALUATION METHODOLOGY

The general process used by Nexant in the 2010 M&V evaluation is shown in Figure 2-1 and described in detail below.

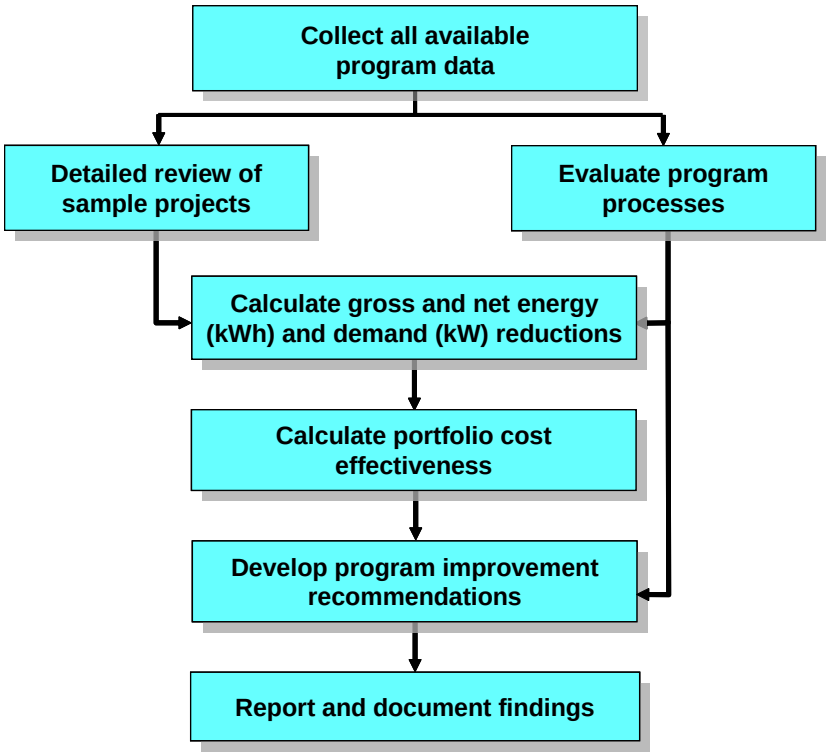

Figure 2-1: M&V Evaluation Process

While the specific evaluation procedures varied slightly for each sector, the general process for calculating the savings was the same across all sectors. Nexant conducted this analysis using the steps described below.

- **Collect Program Data.** CPS Energy provided Nexant with all the individual project data for 2010 DSM projects, including electronic copies of program databases, engineering calculations and spreadsheet analysis, and hard copies of customer applications.
- **Calculate Gross Savings.** Gross savings are the energy and demand savings that are found at a customer site as the direct result of the installation of eligible energy efficiency measures and are determined through data collection, site inspections, and engineering analysis.

  Using the detailed project data provided by CPS Energy, Nexant conducted file reviews of individual projects to check the equipment installed and adherence to program rules. Additionally, for a subset of projects, Nexant performed site inspections to verify equipment installation and operation. Nexant also installed lighting loggers for a subset of

projects to determine actual hours of operation. To determine gross energy and demand savings, Nexant calculated and summed individual project savings using industry standard savings calculation methods, including standard baselines for existing facilities and new construction. Where applicable, the interactive effects of particular energy efficiency measures were incorporated (i.e. reduced internal HVAC loads due to improved lighting efficiency).

- **Determine Net Impacts.** Net program impacts incorporate customer and market behavior into the gross program savings, which can add to or subtract from a program's direct results. Net impacts typically include two metrics: *free ridership*, the proportion of measures that would have been installed in the absence of the program; and *spillover*, additional savings that have occurred because of a program's operations but outside of its administrative framework. To determine net impacts, these metrics are combined into a net-to-gross (NTG) ratio, which is applied to the gross program savings.

  To remain consistent with the 2008 and 2009 M&V evaluations, Nexant used the same methodology for developing program NTG ratios; through market research of similar programs around the country, which were applied to the calculated gross savings for each program.

- **Process Evaluation.** The process evaluation involved reviewing program procedures and providing recommendations on potential improvements. For the 2009 and 2010 M&V evaluation, Nexant primarily focused on program recordkeeping, including information collected on customer applications and tracked in program databases.

- **Program Economic Analysis.** Nexant's economic analysis summarized cost-effectiveness for the overall portfolio of savings from two perspectives: Cost of Saved Energy and Reduction in Revenue Requirements:

  - *Cost of Saved Energy (CSE).* The Cost of Saved Energy is the total cost per kWh of realizing the efficiency improvement. CSE is determined by dividing levelized program costs by the annual energy savings, as shown in the following equation. Levelized program costs are calculated using a Capital Recovery Factor (CRF), which incorporates the number of years that the energy savings persist and an annual discount rate.

$$CSE = \frac{Program\,Costs\ (\$)\ x\ CRF}{Annual\,Energy\,Savings\,(kWh)}$$

  - *Reduction in Revenue Requirements (RRR).* The reduction in revenue requirements is the net reduction in utility costs from the energy saved through the presence of the DSM program offerings. RRR is calculated based on the difference of avoided energy and demand costs from the DSM impacts and the DSM program costs, as shown in the following equation:

$$RRR = Avoided\ Energy\ and\ Demand\ Costs - \mathrm{Pr}\,ogram\,Costs$$

3.1 SUMMARY OF RESIDENTIAL IMPACTS

CPS Energy offered the following programs for the residential sector in 2010:

- Compact Fluorescent Lamps (CFL)
- Home Efficiency
- Air Flow Performance
- HVAC
- Solar Initiative
- New Homes Construction
- Refrigerator Recycling
- Wash Right

The following sections include a brief summary of each program and describe the methodology and the results of the impact analysis.

3.2 COMPACT FLUORESCENT LAMPS (CFL) PROGRAM

3.2.1 Overview

CPS Energy offered instant rebate coupons to customers for the purchase of CFLs, including a $2 coupon for the purchase of a single pack and $4 for a multi-pack of bulbs. The coupons were redeemable at local H-E-B stores and are available from CPS Energy's website. The rebate was credited at the time of purchase. CPS Energy also offers promotional CFL giveaways to customers.

The 2010 program included 450,693 instant rebate coupons, 98% of which were for single pack bulbs. All bulbs purchased were 13 Watts. CPS Energy also gave away 4,380 CFLs in 2010.

3.2.2 Savings Calculations

In 2010 CPS Energy provided Nexant with detailed program data including: the bulb manufacturer and description, quantity of bulbs purchased, wattage, and number of bulbs included in the multi-packs sold.

CPS energy rebated 13 watt lamps and Nexant estimated the saving to be 47 watts, replacing a 60 watt incandescent lamp. To estimate annual energy savings, Nexant conducted market research of available studies on CFL and residential lighting hours of operation, installation rates, and average energy consumption. Based on the findings of KEMA Inc.'s 2005 CFL Metering Study[1] in California, Nexant estimated that the average usage of a CFL is 2.34 hours per day. Several studies in 2009

[1] *CFL Metering Study*, KEMA, Inc., February 25, 2005.

were also conducted on the installation rate of CFLs purchased and given away. Based on a review of available studies, Nexant included the following assumptions on CFL installation rates, which were incorporated into the savings calculations:

Quantity	Installation Rate
Single-Pack	90%
2 or 3 bulb Multi-Pack	90%
4 or 5 bulb Multi-Pack	78%
6 bulb Multi-Pack	57%
CFL giveaway	90%

Annual energy savings for CFLs were calculated using the following formula:

$$kWh savings = (W_{inc} - W_{CFL})\ x\ \frac{1kW}{1{,}000\,watts}\ x\ N_{bulbs}\ x\ Install\ Rate\ x\ Annual\ Hours$$

Where:

W_{inc} = Wattage of incandescent bulb replaced

W_{CFL} = Wattage of CFL

N_{bulbs} = Number of bulbs purchased

Install Rate = Estimated average installation rate based on the number of bulbs purchased

Annual Hours = Annual hours of operation (assuming 2.34 hrs/day)

Non-coincident demand savings for CFLs are calculated simply by taking the difference in wattage of the CFL and the incandescent bulb that was replaced. However, residential lighting usage patterns vary widely and usage is scattered throughout the day; therefore the non-coincident program savings is not a number that could be used for system planning as it will not occur at a single point in time, but be distributed throughout the year.

Peak demand savings capture the coincident demand impacts that occur during the summer peak period. To determine peak demand impacts, Nexant conducted secondary market research of several CFL evaluation studies. Based on a review of available studies, Nexant estimated an average peak savings of 4 watts per bulb.

3.2.3 Findings and Recommendations

The gross energy and demand savings calculated for the CFL program are listed in Table 3-1 below:

Table 3-1: CFL Program Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
12,461,973	1,242	14,591

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Nexant found the program data collection to be sufficient for assessing participation and determining program impacts.
- CPS Energy should incorporate the results of residential appliance surveys and other market research, as well as upcoming changes to federal lighting efficiency standards, to determine the most effective structure for promoting energy efficient lighting technologies for the residential sector.

3.3 HOME EFFICIENCY PROGRAM

3.3.1 Overview

CPS Energy's Home Efficiency Program targets a wide range of energy efficiency measures that save cooling and heating energy in existing homes. In 2010, rebates were provided for the following list of measures:

- Attic insulation
- Cool Roof
- ENERGY STAR® windows
- Spray foam insulation
- Wall insulation
- Window film or solar screens

The Home Efficiency Program had 2,923 projects in 2010, including 36 projects with two eligible measures installed and 6 projects with three eligible measures installed. This corresponds to a 41% increase in program participation from 2009.

Figure 3-1 shows the total number of installations of each type of measure in 2010 (Note: the number of installations exceeds the number of projects due to the projects with multiple measures installed):

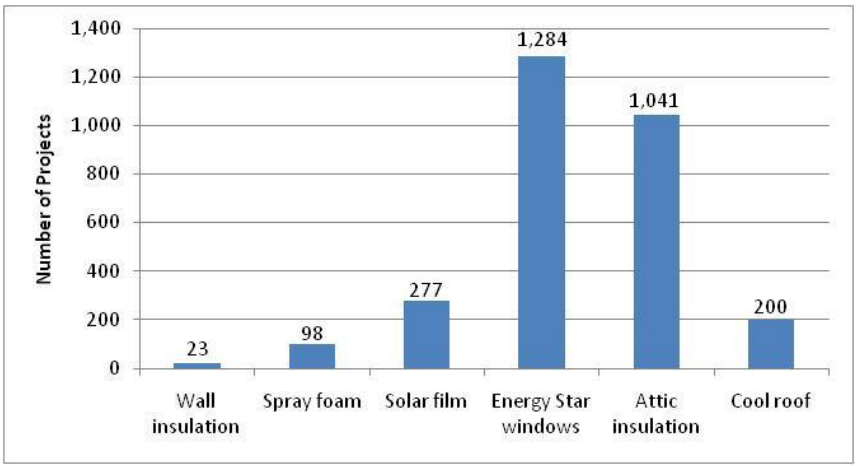

Figure 3-1: Number of Installations of Home Efficiency Measures

3.3.2 Savings Calculations

Nexant estimated the energy savings and demand savings for individual measures based both on the Texas Public Utilities Commission approved deemed values[1] and engineering calculations. For households where multiple measures had been installed, the interactive effects between measures were taken into account in order to avoid overestimating the savings. For each measure, the savings mentioned below are gross savings.

3.3.2.1 Attic Insulation

Nexant used engineering calculations for energy and demand savings for the ceiling insulation measure. Texas PUC deemed savings are available for this measure, however, the deemed savings are based on the installation of R-30 ceiling insulation. Participating CPS Energy customers installed insulation up to R-60; therefore, to capture the impacts of the additional insulation beyond the deemed values, Nexant calculated the reduction in heat loss through the insulation material and took into account the size and the efficiency of the household's air conditioner, using the following equation:

$$kWh savings_{cooling} = \frac{Area_{MeasureArea} \times \left(\frac{1}{R_{base}} - \frac{1}{R_{change}} \right) \times CDD \times 24}{SEER / 1{,}000}$$

[1] Deemed Savings, Installation & Efficiency Standards, Residential and Small Commercial Standard Offer Program and Hard to Reach Standard Offer Program, prepared by Frontier Associates, LLC, February, 2006.

Where:

Area $_{MeasureArea}$ = Area of the insulation, in ft^2

R = Rated R-value for the insulation, ft^2 hr ^{o}F/BTU

CDD = Cooling Degree Days for San Antonio

SEER = Rated SEER value for the A/C Unit, BTU/watt

Homes with electric heating, including electric resistance heaters and heat pumps, will also realize electric savings during the heating season. Based on CPS Energy's Residential Saturation Study[1] and the Energy Information Agency's (EIA) West-South-Central Regional residential consumption data, Nexant estimated 41% of customers used electric heating in their homes. The following formula was used to calculate heating energy and demand savings from improved ceiling insulation:

$$kWh\,savings_{heating} = \frac{Area_{MeasureArea} \times \left(\frac{1}{R_{base}} - \frac{1}{R_{change}}\right) \times HDD \times 24}{HSPF\,/1{,}000}\ x\ Elec\ Heat\ Share$$

Where:

Area $_{MeasureArea}$ = Area of the insulation, in ft^2

R = Rated R-value for the insulation, ft^2 hr ^{o}F/BTU

HDD = Heating Degree Days for San Antonio

HSPF = Rated Heating Seasonal Performance Factor, BTU/watt

Elec Heat Share = the percentage of customers with electric heat

The total gross energy and demand savings for 2010 attic insulation installations are as follows:

Table 3-2: Attic Insulation Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
870,855	193	261

3.3.2.2 Cool Roof

Savings calculations for the residential cool roofs measure were based on online Department of Energy calculator software that evaluates cooling and heating savings for roof products (http://www.ornl.gov/sci/roofs+walls/SteepSlopeCalc/index.htm). Assumptions for the calculation were as follows:

- R-30 ceiling insulation,

[1] San Antonio 2004 Residential Appliance Saturation Study, KEMA, Inc., April 2004

- Air conditioner COP of 2.34 (equivalent to 8 EER)
- Roof reflectance and emittance were set at 43 and 79, respectively, which represent average values for metal cool roof products based on the ENERGY STAR product list[1] (based on available project data, all participating projects appear to have metal roofs)

Based on the assumptions listed above, the DOE calculator estimated 0.0738 watts per square foot of cooling savings for the roof. This average savings value was multiplied by the square footage of roof product installed to estimate the savings per home. Total energy and demand savings for this measure for 2010 projects are listed in the table below.

Table 3-3: Residential Cool Roof Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
107,175	15	32

3.3.2.3 ENERGY STAR Windows

The Texas PUC deemed savings for ENERGY STAR windows states that in order to qualify for the calculated deemed savings values, the windows must have a U-factor of 0.40 or less and a solar heat gain coefficient of 0.40 or less. To be eligible to participate in CPS Energy's program, windows must be ENERGY STAR certified; however, ENERGY STAR criteria for San Antonio's climate zone requires a U-factor of 0.65 or less, which does not match the PUC deemed savings criteria.

Therefore, Nexant calculated the energy and demand savings using engineering calculations based on cooling and heating load energy savings for the windows incorporating the U-value of the window, the number of cooling degree-days and heating degree-days, and HVAC unit efficiencies, as shown in the following equations. Heating savings incorporated the electric heating share assumption described for the ceiling insulation measure above.

$$kWh\,savings_{cooling} = \frac{Area_{MeasureArea} \times (U_{base} - U_{change}) \times CDD \times 24}{SEER / 1{,}000}$$

$$kWh\,savings_{heating} = \frac{Area_{MeasureArea} \times (U_{base} - U_{change}) \times HDD \times 24}{HSPF / 1{,}000} \; x\; Elec\; Heat\; Share$$

[1] http://downloads.energystar.gov/bi/qplist/roofs_prod_list.pdf

Where:

U_{base} = Rated U-value for the baseline window, BTU/ft^2 hr ^{o}F (assumed same baseline value as Texas PUC deemed savings calculations of 0.87)

U_{change} = Rated U-value for the ENERGY STAR window, BTU/ft^2 hr ^{o}F

Nexant used the reported U-value and window area for each ENERGY STAR window installation in the 2010 program, resulting in the following impacts:

Table 3-4: ENERGY STAR Windows Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
1,159,453	681	682

3.3.2.4 Spray Foam Insulation

Nexant used engineering calculations for energy and demand savings for the spray foam insulation measure similar to the ceiling insulation measure. Savings are based on the reduction in heat loss through the insulation material and took into account the R-value of the installed insulation and the size and efficiency of the household's air conditioner using the same equation listed above for ceiling insulation.

The available data supported the fact that the required program insulation depths for closed cell or open cell insulation were achieved in order to provide an insulation value of R-30. Nexant also assumed an average baseline insulation value of existing insulation in the home of R-11 and a building structure insulation value of R-4.

Total energy and demand savings for the 2010 projects that installed spray foam insulation are listed in the following table:

Table 3-5: Spray Foam Insulation Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
103,557	23	31

3.3.2.5 Wall Insulation

Wall insulation energy and demand savings were calculated using engineering calculations similar to the ceiling insulation calculation, incorporating the increase in R-value, square feet of wall area insulated, and the HVAC equipment efficiencies, as shown in the following equations:

$$kWh savings_{cooling} = \frac{Area_{MeasureArea} \times \left(\frac{1}{R_{base}} - \frac{1}{R_{change}} \right) \times CDD \times 24}{SEER / 1{,}000}$$

Where:

Area $_{MeasureArea}$ = Wall area of the insulation, in ft^2

R = Rated R-value for the insulation, ft^2 hr ^{o}F/BTU

CDD = Cooling Degree Days for San Antonio

SEER = Rated SEER value for the A/C Unit, BTU/watt

$$kWh savings_{heating} = \frac{Area_{MeasureArea} \times \left(\frac{1}{R_{base}} - \frac{1}{R_{change}} \right) \times HDD \times 24}{HSPF / 1{,}000} \; x \; Elec \; Heat \; Share$$

Where:

HDD = Heating Degree Days for San Antonio

HSPF = Rated Heating Seasonal Performance Factor, BTU/watt

Elec Heat Share = the percentage of customers with electric heat

The baseline wall insulation was assumed to be R-2, which would include the insulating properties of exterior and interior wall materials and the air pocket in the wall cavity. The post-installation R-value was recorded in the program database or assumed to be R-15 where absent.

The total energy and demand savings for wall insulation installations are listed in the following table:

Table 3-6: Wall Insulation Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
43,410	35	35

3.3.2.6 Window Film or Solar Screens

The window film and solar screen measures reduce the amount of solar radiation that enters a house through its windows, thus decreasing the load on the air conditioner in the summer. Nexant used the Texas PUC deemed savings data for Climate Zone 3 to evaluate the window film and solar screen savings. Based on the market shares of heating equipment, a weighted average of 5.03 kWh/sq ft of solar film was multiplied by the square feet of films or screen installed on each home. Deemed demand savings of 0.00159 kW/sq ft were used to calculate peak demand savings.

Total energy and demand savings for window film and solar screen installations are included in the following table:

Table 3-7: Window Film and Solar Screen Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
212,101	68	68

3.3.3 Findings and Recommendations

The gross energy and demand savings calculated for all measures included in the Home Efficiency Program are listed in Table 3-8 below:

Table 3-8: Home Efficiency Gross Energy and Demand Savings

Measure	Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
Ceiling insulation	870,855	193	261
Cool roof	107,175	15	32
ENERGY STAR Windows	1,159,453	681	682
Spray foam	103,557	23	31
Wall insulation	43,410	35	35
Window film & solar screen	212,101	68	68
Total	**2,496,551**	**1,015**	**1,109**

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Nexant found that the Home Efficiency database is well-designed, comprehensive, and for the majority of measures, collects the appropriate data to evaluate project compliance with program rules and calculate energy and demand savings.
- For future project tracking and to enable a more precise estimation of energy savings, Nexant recommends CPS collect information for each home including the following information:

- For cool roof measures collect specific material information and reflectivity value (from manufacturer or from ENERGY STAR products list)
- For solar screen and window film measures, record if the specific measure was film or a screen.

3.4 AIR FLOW PERFORMANCE PROGRAM

3.4.1 Overview

CPS Energy's Air Flow Performance Program aims to improve the energy efficiency of conditioned air distribution systems by providing rebates for duct testing and duct repair/replacement. The program had 366 projects in 2010, including four repairs, 22 partial replacements, and 317 total duct replacements. This corresponds to a 21% increase in program participation from 2009.

3.4.2 Savings Calculations

Nexant estimated the energy savings and demand savings based on the Texas Public Utilities Commission approved deemed values for Climate Zone 3.[1] The following values were applied based on the type of heating and the conditioned square footage recorded in the CPS program database for each project (with a maximum allowed savings limit of 30% of total estimated annual home energy consumption):

- gas: 0.74378 kWh/SF
- electric: 1.80968 kWh/SF
- heat pump: 1.13027 kWh/SF
- all: 0.000486 kW/SF

3.4.3 Findings and Recommendations

Total energy and demand savings for duct repairs and replacements are included in the following table:

Table 3-9: Duct Repair & Replacement Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
561,648	312	312

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Nexant recommends that the following information be collected:

- Total system airflow, which would allow direct calculation of cooling energy savings from leakage test results to compare to deemed savings estimates.
- Heating system capacity, which would allow direct calculation of heating energy savings for electric and heat pump systems to compare to deemed savings estimates.

3.5 HVAC PROGRAM

3.5.1 Overview

The residential HVAC program provides customers with rebates for the purchase of eligible central air conditioners, heat pumps and room air conditioners. Rebates for the 2010 program year were issued as a bill credit to the customer and varied depending on the size efficiency of the unit installed as follows:

- Central Air Conditioners and Heat Pumps (Feb 1 thru March 31 2010):
  - $110/ton for 15 SEER units
  - $125/ton for 16 SEER units
  - $160/ton for 17 SEER units
  - $225/ton for 18 SEER or greater units
- Central Air Conditioners (April 1 thru Jan 31 2011):
  - $110/ton for 15 SEER/12.0 EER units
  - $125/ton for 16 SEER/12.5 EER units
  - $160/ton for 16 SEER/13.0 EER units
  - $225/ton for 17 SEER/13.0 EER or greater units
- Heat Pumps (April 1 thru Jan 31 2011):
  - $110/ton for 15 SEER/12.0 EER/8.2 HSPF units
  - $125/ton for 15 SEER/12.5 EER/8.5 HSPF units
  - $160/ton for 16 SEER/12.5 EER/8.5 HSPF units
  - $225/ton for 17 SEER/12.5 EER/8.5 HSPF or greater units
- Room Air Conditioners:
  - $50 for ENERGY STAR-certified units 8,000 Btu or less
  - $100 for ENERGY STAR-certified units greater than 8,000 Btu

[1] Deemed Savings, Installation & Efficiency Standards, Residential and Small Commercial Standard Offer Program and Hard to Reach Standard Offer Program, prepared by Frontier Associates, LLC, February, 2006.

In 2010, a total of 12,647 residential HVAC rebates were paid to participating customers, including 4,282 central A/C rebates, 2,846 heat pump rebates, and 5,519 room air-conditioner rebates. This corresponds to a 58% increase in program participation from 2009. Figure 3-2 shows the breakdown of participating central air conditioners and heat pumps by SEER rating:

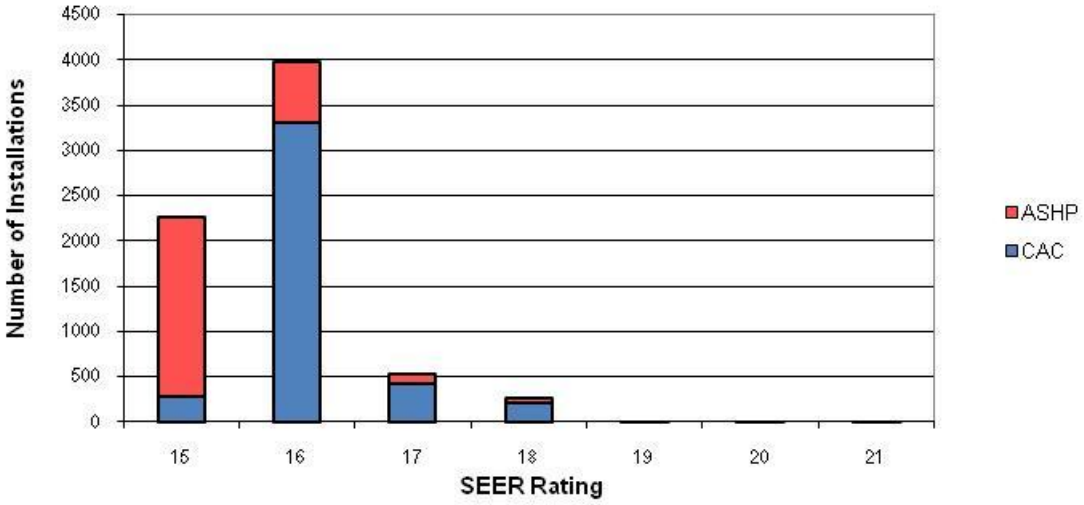

Figure 3-2: SEER Ratings of CAC and ASHP Installations

3.5.2 Savings Calculations

Nexant received program data from CPS Energy's residential HVAC database, which includes detailed information on each unit installed including: brand, model number, and serial number, and equipment size and efficiency. Energy and demand savings were calculated for each type of equipment based on the size and efficiency of the baseline and change case equipment and the following assumptions:

- Base case cooling efficiency for CAC and ASHP was assumed to be 13 SEER, which is the minimum federal efficiency standard for residential equipment. Base case heating efficiency was assumed to be 7.7 HSPF, which is also the minimum federal efficiency standard.
- Base case cooling efficiency for room air conditioners was assumed to meet the federal minimum efficiency standard based on the size and type of unit (http://www.energystar.gov/index.cfm?c=roomac.pr_crit_room_ac)
- The ENERGY STAR equipment installed was assumed to be the same size as the base case equipment.

The following equations were used to calculate energy savings for each type of equipment included in the residential HVAC program:

Central air conditioner and heat pump cooling savings

$$kWh\,savings_{cooling} = Tons \times 12 \times \left(\frac{1}{SEER_{base}} - \frac{1}{SEER_{change}} \right) \times EFLCH$$

Where:

Tons = Size of CAC or ASHP, tons
SEER = Rated SEER value, BTU/watt-hrs
EFLCH = Effective Full Cooling Load Hours for San Antonio

Heat pump heating savings

$$kWh\,savings_{heating} = Tons \times 12 \times \left(\frac{1}{HSPF_{base}} - \frac{1}{HSPF_{change}} \right) \times EFLHH$$

Where:

HSPF = Rated HSPF value, BTU/watt
EFLHH = Effective Full Heating Load Hours

Room air conditioner cooling savings

$$kWh\,savings_{cooling} = Btu\,/\,hr \times \left(\frac{1}{EER_{base}} - \frac{1}{EER_{change}} \right) \times \frac{1\,kW}{1{,}000\,watts}\ x\ EFLCH$$

Where:

Btu/hr = Size of room air conditioner
EER = Rated EER value, BTU/watt
EFLCH = Effective Full Cooling Load Hours for San Antonio

3.5.3 Equipment Verification

To verify the accuracy of the efficiency data listed in the program database, Nexant randomly selected samples of 30 CAC projects, 30 HP projects, and 30 Room A/C projects to verify equipment information and efficiency based on the brand, model number, and serial number provided. Nexant used equipment information listed in databases maintained by the Air Conditioning, Heating, and

Refrigeration Institute (AHRI)[1] and the federal ENERGY STAR website[2]. The results of the equipment verification are as follows:

- 30 of 30 CAC units (100%) were verified as having the correct SEER rating or better according to the AHRI directory
- 30 of 30 heat pump units (100%) were verified as having the correct SEER rating or better according to the AHRI directory
- 29 of the 30 room air conditioners were verified as having the correct EER rating according to ENERGY STAR.

No adjustments to the overall population of projects were made based on the equipment verification findings. However, Nexant did adjust the efficiency ratings for the room air conditioners found to be incorrect in the program database.

3.5.4 Findings and Recommendations

The gross energy and demand savings calculated for the 2010 Residential HVAC program are listed in the table below:

Table 3-10: 2010 Residential HVAC Gross Energy and Demand Savings

Measure	Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
ENERGY STAR Central AC	6,065,856	2,169	2,711
ENERGY STAR Heat Pump	5,642,625	1,162	1,452
ENERGY STAR Room AC	1,383,629	495	619
Total	**13,107,558**	**3,826**	**4,782**

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Nexant found the data collected in the program database to be accurate, comprehensive, and sufficient for assessing participation and determining program impacts.
- The program should also continue to verify equipment efficiencies based on industry databases, such as AHRI and ENERGY STAR, including conducting secondary reviews of a sample of projects to validate the accuracy of the data stored in the program database.

[1] http://www.ahridirectory.org/ahridirectory/pages/home.aspx
[2] http://www.energystar.gov/index.cfm?c=roomac.pr_room_ac

3.6 SOLAR INITIATIVE

3.6.1 Overview

CPS Energy's Solar Initiative provides incentives for the installation of both solar photovoltaic systems and solar water heaters. Participation records show a total of 157 solar photovoltaic systems and 40 solar water heaters installed in 2010. This corresponds to a 369% increase in program participation from 2009. The following sections describe Nexant's approach to evaluating the energy and demand savings provided by the Solar Initiative. All the numbers mentioned below are gross savings.

3.6.2 Savings Calculations

3.6.2.1 Solar Photovoltaic

The energy and power produced by a photovoltaic solar array can be determined by the array rated power, the location (latitude) of the site, the tilt angle of the solar panels, and the azimuth angle. The calculation methodology is based on local weather patterns that condition the solar insolation at the installed location. The calculation methodology then adjusts the solar power captured by the array based on the tilt and azimuth angles. Various software products have been developed by the solar industry in the past decades to estimate the power and the energy produced by solar PV systems. PV Watts is a free, publicly available, online calculator, which is used by CPS Energy in determining project impacts and was used by Nexant to verify the recorded savings estimates in the CPS database.

3.6.2.2 Solar Water Heaters

CPS Energy's records show completion of 40 solar hot water projects in the 2010 program. The energy and demand savings provided by a solar hot water system can be determined by the system size, tilt, and azimuth angle. The Texas A&M University Energy Systems Laboratory's eCalc software (Energy and Emissions Calculator) is based on a DOE-2 building energy simulation platform and has a comprehensive weather patterns database for all counties in Texas.

For this M&V review, system size and angles were not included in the summary database Nexant received. Consequently, Nexant was unable to verify the stated savings in the summary file. However, Nexant considers the aforementioned eCalc software an acceptable method of estimating savings and has therefore used these savings provided by CPS.

3.6.3 Findings and Recommendations

The gross energy and demand savings for the Solar Initiative program are listed in the table below:

Table 3-11: Solar Initiative Gross Energy and Demand Savings

Measure	Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
Solar PV	1,632,022	1,061	1061
Solar Water Heaters	97,361	29	29
Total	**1,729,383**	**1,090**	**1,090**

For future project tracking, Nexant recommends CPS collect information from customers who install solar hot water systems on their existing water heater (type and efficiency).

3.7 NEW HOMES CONSTRUCTION

3.7.1 Overview

In 2010, CPS offered incentives to builders and contractors for new construction projects that exceed City of San Antonio building codes (IECC 2009) by 15% or more. CPS Energy collaborated with Build San Antonio Green to provide consistent approach to incentivizing new construction. The program provides different incentive levels based on the building's performance above code. The incentive tears are as follows:

Using ENERGY STAR®:

- ENERGY STAR® compliant (HERS rating of 75 to 58) = $800 per structure
- ENERGY STAR® compliant (HERS rating of 57 or less) = $1,500 per structure

Using other testing methods:

- Other methods under (2009 IECC) energy codes at (15% to 30% above code) = $800 per structure
- Other methods under (2009 IECC) energy codes at (31% or greater above code) = $1,500 per structure

3.7.2 Savings Calculations

CPS Energy provided Nexant with a listing of 677 ENERGY STAR® compliant homes receiving a 2010 CPS Incentive for Builders and Contractors for New Constructions. To estimate annual energy savings (kWh) for a participating new home, Nexant applied HERS rating data supplied by builders

and multiplied the savings by the average annual consumption of a typical home in Texas provided by Energy Information Administration 2005 Survey[1].

Based on an impact evaluation study conducted by Nexant in 2009 for a utility company with a similar New Homes Construction program, deemed savings of 1.1 kW was used to calculate peak demand savings.

3.7.3 Findings and Recommendations

The gross energy and demand savings for the New Homes Construction program are listed in the table below:

Table 3-12: New Homes Construction Gross Energy and Demand Savings

Gross Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
4,406,780	745	1,544

For future project tracking and to enable a more precise estimation of energy savings, Nexant recommends CPS collect information for each home including the following information:

- ENERGY STAR® HERS rating
- Annual energy consumption (kWh) of designed home
- Annual energy consumption of baseline home
- REMRate file as provided by certified HERS rater

3.8 REFRIGERATOR RECYCLING

3.8.1 Overview

CPS Energy began a refrigerator and freezer recycling program in 2010 with the intent of removing old refrigerators and freezers from the electric grid and incentivizing purchases of new Energy Star units over new standard efficiency units. Customers were offered a $35 rebate for recycling their appliance, a $65 rebate for purchasing an Energy Star certified unit, or a $100 rebate for recycling their old unit and purchasing an Energy Star certified unit. CPS Energy's subcontractor, Appliance Recycling Centers of America, Inc. (ARCA), was responsible for picking up and recycling appliances. ARCA records each appliance pick-up in a database and recycles the appliance in an environmentally responsible manner.

[1] *2005 Energy Consumption Survey*, Energy Information Administration, 2008.

In 2010, 1213 refrigerators and 167 freezers were recycled by CPS customers and ARCA, for a total of 1,380 units recycled, 239 customers purchased Energy Star certified units and 639 customers recycled existing units and also purchased Energy Star certified unit.

3.8.2 Savings Calculations

For new Energy Star purchases, the savings calculations are based on Energy Star Calculator and the difference between energy consumption of a new Energy Star unit and a new standard efficiency unit.

For recycling an existing refrigerator or freezer, estimated annual energy savings are based on the removed appliance's Unit Energy Consumption (UEC), or annual energy consumption. For this evaluation, average UEC values were calculated using a regression equation developed for the California Public Utilities Commission[1]. Using Equation 1 and averaged values from the database, such as age and size, the average refrigerator UEC was calculated.

Equation 1

$$UEC = (Intercept) - (A_1)(\%Single\ Door\ Configuration) + (A_2)(\%\ Side - by - Side\ Configuration) + (A_3)(Average\ Age) + (A_4)(\%\ Primary\ Appliance) + (A_5)(Household\ Occupants) + (A_6)(Climate\ Variable)$$

Where:

Coefficient	Value	T-value
A_1	-629.71	-3.2
A_2	435.71	6
A_3	25.88	5.4
A_4	256.47	3.4
A_5	71.15	2.8
A_6	225.77	3.2

Variable	CPS Average
Intercept	165.7
% Single Door Configuration	0.0112
% Side-by-Side Configuration	0.2884
Average Age (Years)	17.504
% Primary Appliance	0.0494
Household Occupants	2.74
Climate Variable	0.268

[1] Residential Retrofit High Impact Measure Evaluation Report, The Cadmus Group, Inc. February 2010

Once the average refrigerator UEC was established, the average freezer UEC needed to be calculated. This regression equation does not apply to freezers. Therefore, a ratio of refrigerator to freezer UEC values, from other similar studies, was calculated and multiplied by the calculated refrigerator UEC to determine the average freezer UEC using Equation 2:

Equation 2

$$Freezer\ UEC = Refrigerator\ UEC \times UEC\ Ratio$$

Where:

Freezer UEC	= Average UEC for all freezers in database
Refrigerator UEC	= Average UEC for refrigerators calculated with Equation 1
UEC Ratio	= Ratio of refrigerator to freezer UECs from similar studies

The average refrigerator and freezer UECs are then multiplied by the corresponding number of recycled appliances and the part-use factor using Equation 3. The part-use factor accounts for the small percentage of appliances that do not run for the entire year, and adjusts the gross savings accordingly. For this evaluation, the part-use factor is a deemed value from a similar evaluation[1].

Equation 3

$$Gross\ Savings = [(Refrigerator\ UEC \times RR) + (Freezer\ UEC \times FR)] \times U$$

Where:

RR = Number of refrigerators recycled
RF = Number of freezers recycled
U = Part-use factor

3.8.2.1 Demand Savings

Non-coincident and peak demand savings were calculated for this evaluation. Non-coincident demand savings for appliance recycling programs are simply the sum of the kW for all removed appliances. Per unit non-coincident demand savings are calculated using Equation 5:

Equation 5

$$Demand = UEC_{Gross} \div Operating\ Hours$$

Where:

Demand	= Per unit demand reduction
UEC_{Gross}	= Gross unit UEC (refrigerator 1007, freezer 930)
Operating Hours	= Annual operating hours (8,760)

[1] Process and Impact Evaluation of Georgia Power Company's Refrigerator and Freezer Recycling Pilot Program, Nexant, Inc. March 2011

Peak demand savings capture the coincident demand impacts that occur during the summer peak period. Peak demand is calculated using Equation 6:

Equation 6

$$Demand_{Peak} = Demand \times Coincident\ Factor$$

Where:

DemandPeak =Demand reduction during peak summer hours
Demand =Per unit non-coincident demand reduction
Coincident Factor =Ratio of per unit demand reduction during peak hours

The coincident factor was determined from similar studies, which determined a summer coincident factor of 0.80.

3.8.3 Findings and Recommendations

The gross and demand savings calculated for the appliance recycling program are listed in the table below:

Table 3-13: Refrigerator Program Gross Energy and Demand Savings

Customer Options	Gross Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
Recycled Refrigerator/Freezer	1,271,711	136	170
Purchased Energy Star	25,334	3	3
Purchases Energy Star and Recycled	67,734	7	8
Total	**1,364,779**	**146**	**181**

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Record all model numbers: Recording appliance model numbers will assist in future evaluations.
- Perform *In-Situ* metering: CPS Energy should consider performing in-situ metering tests either as part of in-program on-going Measurement & Verification activities, a separate market research study or as part of the next full evaluation.

- Conduct customer surveys: Conducting surveys with customer at the time of appliance pick-up provides insight into program effectiveness and queries customers when they are most familiar with their participation in the program. Survey questions could include:

1. How did you hear about the Refrigerator and Freezer Recycling Program?

    a. Provide a list of current marketing channels.

2. People participate in the program for different reasons. Please tell me whether each of the following aspects of the program influenced your decision to participate.

    a. Rebate paid for participating
    b. Free pick-up
    c. Simple one call procedure
    d. Electricity savings
    e. Help the environment by recycling
    f. Recommendation from friend or family
    g. Recommendation from appliance retailer/dealer
    h. Unaware of other options
    i. Other (*Specify:*_____*)*

3. (If respondent chose more than one answer in Question 2) Of the above reasons, what was the most important reason for participating?

    a. Rebate paid for participating
    b. Free pick-up
    c. Simple one call procedure
    d. Electricity savings
    e. Help the environment by recycling
    f. Recommendation from friend or family
    g. Recommendation from appliance retailer/dealer
    h. Unaware of other options
    i. Other (*Specify:*_____*)*

4. Do you plan to replace the refrigerator(s) or freezer(s) with another one?

    a. Yes, a new model
    b. Yes, a used model
    c. No, not replacing
    d. Don't know

5. Will the replacement unit be an Energy Star unit?

    a. Yes

b. No
c. Don't Know

6. Had you **planned** to dispose of, or recycle your refrigerator before you found out about the program? By planned I mean you had collected information, selected equipment or otherwise begun the process of replacement.

   a. Yes
   b. No
   c. Don't Know

7. How had you planned to dispose of the unit?

   a. Sell the unit
   b. Given the unit away
   c. Thrown the unit away
   d. Hired someone to remove the unit
   e. Taken unit to a recycling center
   f. Left the unit in the house when you moved
   g. Have appliance retailer pickup the unit
   h. Don't know

8. If the unit had not been picked up, and you were not planning on disposing of it, what were you planning to do with it?

   a. Keep the unit plugged in and in use
   b. Kept the unit stored and unplugged
   c. Do not know if unit would have been used or stored
   d. How many months out of the last 12 months was the refrigerator or freezer running?
   e. Record # of Months:_____
   f. Don't know

9. During the years that you would have kept the unit, about how many months of the year would it have been plugged in and running?

   a. Record # of Months:_____

3.9 WASH RIGHT

3.9.1 Overview

CPS Energy's Wash Right program is a collaborative energy efficiency program with San Antonio Water System (SAWS) and Bexar Metropolitan Water District (BexarMet). The program is designed to achieve energy and demand savings as well as reduce residential water consumption through the

use of high efficiency clothes washers. CPS Energy provides a direct customer rebate of $75 for the purchase of an eligible unit[1].

3.9.2 Savings Calculations

CPS Energy provided Nexant with customer and equipment information for 8,620 clothes washers that received a 2010 CPS Energy Wash Right rebate. This corresponds to a 270% increase in program participation from 2009.

To estimate annual energy savings, Nexant used data available in the on-line federal ENERGY STAR® calculator[2] as well as results from CPS Energy's 2009 Residential Appliance Study[3] to develop a deemed savings estimate for participating clothes washers as follows:

- Using baseline and average efficiency ratings for eligible clothes washers, the following deemed savings values were calculated for a variety of combinations of water heating and clothes drying equipment as well as homeowners' clothes drying habits:

Table 3-14: Wash Right Clothes Washer Deemed Savings

Deemed Savings Category			Baseline Equip. kWh/yr	Eligible Equip. kWh/yr	Savings kWh/yr
Electric Water Heater	Electric Dryer	Use clothes dryer for all loads	787	556	231
		Use dryer for some loads	560	373	187
		Use dryer infrequently	378	226	152
	Gas Dryer	Use clothes dryer for all loads	333	190	143
		Use dryer for some loads	333	190	143
		Use dryer infrequently	333	190	143
Gas Water Heater	Electric Dryer	Use clothes dryer for all loads	487	385	102
		Use dryer for some loads	284	221	63
		Use dryer infrequently	121	89	32
	Gas Dryer	Use clothes dryer for all loads	81	56	24
		Use dryer for some loads	81	56	24
		Use dryer infrequently	81	56	24

Based on equipment saturations and homeowner's reported clothes drying habits from CPS Energy's Residential Appliance Study, the weighted deemed savings is calculated to be 144 kWh per unit.

[1] Eligible clothes washers must meet Consortium for Energy Efficiency's Tier 3 eligibility criteria: http://www.cee1.org/resid/seha/rwsh/rwsh-prod.pdf

[2] http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/CalculatorConsumerClothesWasher.xls

[3] *CPS Energy Residential Appliance Study*, Palm Market Research, Inc., February 2010.

3.9.3 Findings and Recommendations

The gross energy and demand savings calculated for the Wash Right program are listed in Table 3-1A below:

Table 3-15: Wash Right Program Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
1,238,764	517	2,107

For future project tracking and to enable a more precise estimation of energy savings, Nexant recommends CPS collect the following information:

- Washer make and model
- Modified Energy Factor (MEF)
- Water Factor (WF)
- Clothes washer volume (cubic feet)
- CEE Tier level
- Make/model/age of existing washer

4.1 SUMMARY OF NON-RESIDENTIAL IMPACTS

The non-residential sector included the following program offerings in 2010:

- Large and Small Lighting
- HVAC
- Motors, Cool Roofs, Window Film
- Restaurant Equipment
- Lean Clean Energy
- New Construction
- Custom

The following sections include a brief summary of each program and describe the methodology and the results of the impact analysis.

4.2 LIGHTING PROGRAM

4.2.1 Overview

The Lighting Program offers incentives to customers who install efficient lighting in their facilities. Incentives are offered for building improvement and retrofit projects. In 2010, CPS Energy offered two program components:

- Large Commercial Lighting projects, with 50 or more applicable lighting fixtures.
- Small Commercial Lighting projects with less than 50 applicable fixtures.

Energy and demand savings are calculated for retrofit projects using pre-retrofit conditions as a baseline.

In 2010, a total of 167 large commercial and 14 small commercial lighting projects received funding through the program. This corresponds to a 36% increase in program participation from 2009.

4.2.2 Savings Calculations

Nexant gathered available program data from the CPS Energy commercial program database and hard copies of project data including customer applications with fixture information for each lighting project. Site inspections were conducted on a sample of projects to verify energy savings and operating hours. Data from the site inspections was input into standardized lighting spreadsheets, which included deemed lighting wattages for each lamp/ballast combination. Peak demand coincidence factors, or the percentage of the facility demand that occurs during the peak period, was estimated for each project based on the facility type. The estimated annual hours of operation were verified during the site inspection using lighting loggers, which record the burn

hours of lighting fixtures. Table 4-1 highlights the coincidence factors and annual operation hours used in the savings calculation methodology for each building type.

Table 4-1: Coincidence factor and Operating Hours for Building Types

Building Type	Description	Coincidence Factor	Annual Operating Hours
Office	Office buildings and other commercial properties in operation during normal business hours	78%	3,850
Retail	Retail facilities, including restaurants	94%	5,167
Warehouse	Warehouse and storage facilities	96%	5,632
Major Healthcare	Hospitals and in-patient health clinics	84%	2,900
24 Hour Facilities	Any facility that operates 24 hours/day or has high occupancy during peak hours	94%	8,234
K-12 Schools	Primary education facilities	73%	2,246
Colleges & Universities	Secondary education facilities.	71%	2,992
Assembly	Conference facilities and public gathering spaces	89%	4,190
Hotel	Lodging facilities	51%	3,735

Retrofit project energy and peak demand savings were calculated based on the difference in deemed lighting wattages between the baseline fixtures and the newly installed fixtures using the following formulas for each fixture type:

$$kW\ savings = (Fixture\ Wattage_{base} - Fixture\ Wattage_{post})\ x\ N_{fixtures}\ x\ \frac{1kW}{1{,}000\ watts}$$

$$Peak\ kW\ savings = kW\ savings \times CF$$

$$kWh\ savings = kW\ savings \times Annual\ Operating\ Hours$$

Where:

$Fixture\ Wattage_{base}$ = Deemed fixture wattage from standard wattage table for pre-retrofit fixture

$Fixture\ Wattage_{post}$ = Deemed fixture wattage from standard wattage table for post-retrofit fixture

$N_{fixtures}$ = Number of fixtures

CF = Deemed coincident demand factor based on building type.

$Annual Operating\ Hours$ = Deemed annual operating hours for the affected space.

The energy and demand savings for each fixture type included in the project was summed to determine the total facility savings.

To capture the reduction in HVAC load from the energy efficient fixtures, an additional 10% demand savings and 5% energy savings for interactive effects were attributed to projects where the retrofit occurred in conditioned spaces.

4.2.3 Findings and Recommendations

The gross energy and demand savings calculated for the commercial lighting program are listed in Table 4-2 below:

Table 4-2: Commercial Lighting Gross Energy and Demand Savings

Program	Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
Large Commercial	19,319,109	3,768	4,317
Small Commercial	117,224	23	28

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Create and utilize a standardized fixture wattage lookup table and standardized customer-input friendly lighting spreadsheets/database.
- Require customer submittal to include room-by-room or floor-by floor fixture counts to optimize the inspection and verification process.
- Include interactive HVAC effects in savings calculations
- Track the facility type for each project, and use deemed operational hours and coincidence factors based on facility type

4.3 HVAC PROGRAM

4.3.1 Overview

The HVAC program offers incentives for the installation of high efficiency unitary AC equipment, heat pumps and chillers. Two tiers of efficiency were established for the 2010 program year for each equipment size and category. Rebates are paid at the following amounts:

- $65/ton for Step 1
- $150/ton for Step 2

In 2010, a total of 130 facilities received funding through the program. This corresponds to a 16% increase in program participation from 2009.

4.3.2 Savings Calculations

Nexant gathered available data from the commercial program database and hard copies of each project for retrofit projects. All the data was subsequently input into the standardized HVAC spreadsheets, which included standard baseline COP/IPLV values for each equipment size, type, and category. Baseline equipment efficiencies for Retrofit projects were assumed to be the ASHRAE 90.1-1989. The following equations were used to calculate HVAC program savings:

Unitary AC Equipment

$$kW\,savings = Capacity \times CF \times ConversionFactor \times \left(\frac{1}{EER_{pre}} - \frac{1}{EER_{post}}\right)$$

$$kWh savings_{AC} = Capacity \times ConversionFactor \times EFLH_C \times \left(\frac{1}{IPLV_{pre}} - \frac{1}{IPLV_{post}}\right)$$

$$EFLH_C = A \times (CDD^{b+1})$$

where:

Capacity = Rated equipment cooling capacity, Btu/hr

CF = Deemed coincident demand factor based on building type.

Conversion Factor = 1 kW / 1000 Watt

EFLH_C = Equivalent full load hours for cooling.

CDD = Cooling degree days.

EER_{pre} = Efficiency of the existing cooling equipment. ASHRAE 90.1-1989 standard

EER_{post} = Efficiency of the new cooling equipment

$IPLV_{pre}$ = Integrated part load value of the existing cooling equipment. ASHRAE 90.1-1989 standard

$IPLV_{post}$ = Integrated part load value of the new cooling equipment

Chillers

$$kW\ savings = Capacity \times CF \times ConversionFactor \times (\frac{1}{COP_{pre}} - \frac{1}{COP_{post}})$$

$$kWh\ savings = Capacity \times EFLH_C \times ConversionFactor \times (\frac{1}{IPLV_{pre}} - \frac{1}{IPLV_{post}})$$

$$EFLH_C = A \times (CDD^{b+1})$$

where:

$\text{Capacity} =$ Rated equipment cooling capacity, ton

$\text{Conversion Factor} =$ 3.517 kW / ton

$\text{CDD} =$ Cooling degree days

$CF =$ Deemed coincident demand factor based on building type.

$\text{EFLH}_C =$ Equivalent full load hours, regression of EFLH_C for various facility types was developed from DEER savings data. See for coefficients A and b.

$COP_{pre} =$ Efficiency of the existing cooling equipment ASHRAE 90.1-1989 standard

$COP_{post} =$ Efficiency of the new cooling equipment

$IPLV_{pre} =$ Integrated part load value of the existing cooling equipment ASHRAE 90.1-1989 standard

$IPLV_{post} =$ Integrated part load value of the new cooling equipment

Table 4-3: Coincidence factor and Coefficients for Building Types

Building Type	A	b	CF
Education - Community College	327.8300	-0.8835	0.71
Education - Secondary School	240.9800	-0.9174	0.73
Education - University	512.1100	-0.9148	0.71
Health/Medical - Clinic	313.5400	-0.8437	0.84
Health/Medical - Hospital	730.7600	-0.8836	0.84
Lodging	589.6100	-0.8750	0.51
Office	657.9100	-0.9437	0.78
Retail	404.0000	-0.8645	0.94

4.3.3 Findings and Recommendations

The gross energy and demand savings calculated for the Commercial HVAC program are listed in the following table:

Table 4-4: Commercial HVAC Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
6,398,447	2,643	3,432

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Track the facility type for each project, and use deemed operational hours and coincidence factors based on facility type
- For program year 2011 stipulate baseline equipment efficiency for retrofit projects as the ASHRAE 90.1 – 1999 standard

- Use customer-friendly input/output spreadsheets or database for savings calculation and program tracking

4.4 MOTORS, COOL ROOFS, AND WINDOW FILM PROGRAMS

4.4.1 Overview

In 2010, CPS Energy offered incentives for the following additional commercial measures:

- High efficiency motors – rebate of $150/kW saved
- Installation of reflective roofs – rebate of $0.10/sq ft
- Window coatings – rebate of $0.40-60/sq ft, depending on type of coating

There were a total of 27 roofing projects, 10 motor replacement project, and 2 window film projects in 2010. This corresponds to a -4% decrease, 900% increase, and -78% decrease in program participation from 2009.

4.4.2 Savings Calculations

The following sections described the savings calculation methods for each program.

4.4.2.1 Roof Savings

Roof Savings were calculated using proprietary Nexant calculation tools, which is based on ASHRAE's Heat Balance Method. An overview of the methodology is illustrated below

$$kW_{savings} = \frac{A}{COP} \times \left[\left(\frac{1}{R_{Exist} + \frac{1}{h_{in,air}}} - \frac{1}{R_{Prop} + \frac{1}{h_{in,air}}} \right) \left(t_0 - \frac{\varepsilon \Delta R}{h_0} - t_{in} \right) + \frac{(1-\rho_{Exist})E_{tP}}{\left(R_{Exist} + \frac{1}{h_{in,air}}\right)h_0} - \frac{(1-\rho_{Prop})E_{tP}}{\left(R_{Prop} + \frac{1}{h_{in,air}}\right)h_0} \right]$$

where:

A: roof area, ft^2.

h_o: coefficient of heat transfer by long-wave radiation and convection at outer surface, Btu/ h °F ft^2.

COP: equipment efficiency

R: the total thermal resistance value (R-value) of the roof, h °F ft^2/Btu.

$h_{in, air}$: the heat transfer coefficient for indoor air, Btu/ h °F ft^2.

ρ: reflectance of surface for solar radiation.

$E_{t,P}$: total peak solar radiation incident on surface during a cooling period, Btu/h ft^2.

ε: Emittance of surface for solar radiation

ΔR: difference between long-wave radiation incident on surface from sky and radiation emitted by blackbody at outdoor air temperature, Btu/h ft^2.

t_{in}: indoor air temperature

t_o: outdoor air temperature

$$kWh_{savings} = \frac{A}{COP} \times \left[\left(\frac{1}{R_{Exist} + \frac{1}{h_{in,air}}} - \frac{1}{R_{Prop} + \frac{1}{h_{in,air}}} \right) \left(\sum_{i=1}^{n} t_{0,i} - n \times \frac{\varepsilon \Delta R}{h_0} - n \times t_{in} \right) + \frac{(1-\rho_{Exist}) \sum_{i=1}^{n} E_{t,i}}{(R_{Exist} + \frac{1}{h_{in,air}}) h_0} - \frac{(1-\rho_{Prop}) \sum_{i=1}^{n} E_{t,i}}{(R_{Prop} + \frac{1}{h_{in,air}}) h_0} \right]$$

where:

A: roof area, ft^2.

h_o: coefficient of heat transfer by long-wave radiation and convection at outer surface, Btu/ h °F ft^2.

COP: equipment efficiency

R: the total thermal resistance value (R-value) of the roof, h °F ft^2/Btu.

$h_{in,\ air}$: the heat transfer coefficient for indoor air, Btu/ h °F ft^2.

ρ: reflectance of surface for solar radiation.

$\Sigma E_{t,i}$: total peak solar radiation incident on surface during a cooling period, Btu/h ft^2.

n: the number of total cooling hours when solar radiation exists.

ε: emittance of surface for solar radiation

ΔR: difference between long-wave radiation incident on surface from sky and radiation emitted by blackbody at outdoor air temperature, Btu/h ft^2.

4.4.2.2 Motor Savings

Savings for motors were calculated using the methodology listed below

$$kW_{Savings} = RatedHorsePower \times ConverstionFactor \times LF \times (\frac{1}{\eta_{pre}} - \frac{1}{\eta_{post}})$$

$$kWh_{Savings} = kW_{Savings} \times AnnualOperationalHours$$

where:

$RatedHorsePower$ = Nameplate horsepower data of the motor

$ConverstionFactor$ = 0.746 kW/hp

LF = Estimated load factor for the motor. If load factor is not available, deemed load factors in Table 4-5 can be used

η_{pre} = Efficiency of the existing motor. If unavailable, efficiencies listed in Table 4-5 can be used

η_{post} = Efficiency of the new motor. If unavailable, efficiencies listed in Table 4-5 can be used

$AnnualOperationalHours$ = Estimated annual operational hours for the motor. If unavailable, annual operational hours in Table 4-5 can be used

Table 4-5: Operation Hours, Load factors, and Efficiencies by Motor Size

hp	Hours	Load Factor	η_{pre}	η_{post}
1	2,373	0.50	80.10%	86.77%
1.5	2,373	0.50	83.75%	88.35%
2	2,373	0.50	84.67%	88.57%
3	2,373	0.50	86.25%	89.88%
5	2,373	0.50	87.17%	90.13%
7.5	2,797	0.50	88.67%	91.83%
10	2,797	0.50	89.45%	92.52%
15	2,797	0.50	90.35%	92.65%
20	2,797	0.50	90.60%	93.13%
25	3,160	0.60	91.58%	93.82%
30	3,160	0.60	91.75%	94.12%
40	3,160	0.60	92.57%	94.53%
50	3,160	0.60	92.80%	94.97%
60	4,067	0.50	93.40%	95.13%
75	4,067	0.50	93.57%	95.17%
100	4,067	0.50	93.90%	95.50%
125	4,335	0.70	94.22%	95.78%
150	4,335	0.70	94.60%	95.97%
200	4,335	0.70	94.83%	96.13%

4.4.2.3 Window Film Savings

Nexant reviewed the project data available for the window film projects, but the available data did not include sufficient information on window orientation or facility HVAC equipment. However, Nexant was able to collect this information during site visits made to the two sites receiving window film rebate. Window savings were calculated using information from an analysis Nexant conducted in 2009, deeming the savings at 0.003 kW/sf and 8.0 kWh/sf of window film installed.

4.4.3 Findings and Recommendations

The gross energy and demand savings calculated for the Motors, Roof Coatings, and Window Film are listed in the table below:

Table 4-6: Commercial Roof, Motors, and Window Film Gross Energy and Demand Savings

Measure	Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
Roof Coatings	201,561	137	172
High Efficiency Motors	191,269	66	66
Window Film	162,584	48	61

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Use customer-friendly input/output spreadsheets or database for savings calculation
- Set up formal inspection protocols and random selection for pre and post inspections
- For motors replacements, use of deemed values may be used, with efficiencies of base case equipment stipulated at the EPACT 1992 standard.
- For roof coating projects, collect and track the following project information:
  - Building Type
  - HVAC equipment type, age, size (tons)
- CPS eliminated commercial window film projects from program year 2011 due to lack of participation in 2010

4.5 COMMERCIAL KITCHEN PROGRAM

4.5.1 Overview

The Restaurant Equipment program was a new offering in 2010 and offers incentives for the installation of high efficiency commercial refrigeration equipment, including refrigerators, freezers, and ice makers. The level of incentive offered depends on the type of equipment and its efficiency rating (EnergyStar or CEE Tier). Incentive amounts vary from $25 to $650 per item.

In 2010, a total of 13 projects received funding through the program.

4.5.2 Savings Calculations

Nexant based savings calculation for this program on outputs from the EnergyStar Commercial Kitchen Equipment Calculator[1]. Nexant gathered information from the rebate application forms and additional submitted materials to determine the most appropriate inputs to the calculator. Required information includes the type and size of equipment.

4.5.3 Findings and Recommendations

The gross energy and demand savings calculated for the Commercial Kitchen Equipment program are listed in the following table:

Table 4-7: Commercial Kitchen Equipment Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
21,244	2	3

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Require submission of equipment spec sheet to ensure EnergyStar rating

4.6 LEAN CLEAN ENERGY PROGRAM

4.6.1 Overview

The Lean Clean Energy program (LCE) provides diagnostic training and facility assessment opportunities for industrial facilities. In some cases, energy efficiency measures were identified through LCE that were eligible for STEP rebates. The savings from these measures were included in the savings totals for the appropriate non-residential program in which they participated and are not individually classified in this report. In the case of four participating facilities, a portion of the installed measures were not rebated through any other commercial program. The savings from measures installed at these facilities are described in the following sections.

4.6.2 Savings Calculations

Nexant performed a review of each other the four facilities that received rebates through the LCE program. For each facility, the savings calculation for each measure was reviewed for correctness, consistency, and conformity with industry-standard guidelines. In some cases, savings numbers were revised either up or down.

[1] EnergyStar Commercial Kitchen Equipment Calculator: http://www.energystar.gov/ia/business/bulk_purchasing/bpsavings_calc/commercial_kitchen_equipment_calculator.xls

4.6.3 Findings and Recommendations

The gross energy and demand savings calculated for the Lean Clean Energy program are listed in the table below:

Table 4-8: Lean Clean Energy Program Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
657,946	75	86

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- Conduct internal review of savings calculations including possible pre- and post data logging prior to paying rebates

4.7 NEW CONSTRUCTION PROGRAM

4.7.1 Overview

In 2010, CPS offered a New Commercial Construction incentive to for new construction projects that exceeded City of San Antonio building codes (IECC 2009) by 15% or more. The program provides different incentive levels based on the building's performance above code. The incentive levels are as follows:

Table 4-9 Commercial New Construction Incentives

	Energy Incentive	Peak Demand Incentive	Percentage Savings Above Code
Tier 1	$0.08/kWh	$125/kW	15% - 24.9%
Tier 2	$0.12/kWh	$150/kW	25% - 34.9%
Tier 3	$0.20/kWh	$200/kW	35% or greater

In 2010, one (1) building received an incentive through the Commercial New Construction program.

4.7.2 Savings Calculations

Nexant performed a review of the facility that received rebates through the New Construction Program. The energy model submitted by the facility was reviewed for correctness, consistency, and conformity with industry-standard guidelines. In some cases, savings numbers were revised either up or down.

The energy savings realized by the design of the facility exceeded code compliance by 23.4%. In addition, the facility is installing solar panels, which will further reduce the energy consumption. The proposed energy usage of the building, including the solar panels, will be 51.0% lower than IECC 2009. The proposed building will use 46,700 less kBtu/h per year of natural gas, and 58,944 less kWh per year of electricity with a peak demand reduction of 42.0 kW.

4.7.3 Findings and Recommendations

The gross energy and demand savings calculated for the New Construction program are listed in the table below:

Table 4-10: Commercial New Construction Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
58,636	42	51

For future project tracking and to enable a more precise estimation of energy savings, Nexant recommends CPS to collect the following information from the applicant:

- Summary of energy usage and demand in the proposed and baseline cases for each of the end uses
- Project drawings in electronic format
- Energy model input data for both baseline and proposed simulations, specifically to include envelope, lighting, plug loads, and HVAC information
- Facility information to include facility type, total square footage, number of occupants, occupancy schedules, equipment schedules

4.8 CUSTOM PROGRAM

4.8.1 Overview

In 2010, CPS Energy offered incentives for custom commercial measures:

- Custom – rebate of $0.08/kWh and $150/kW saved

There were a total of 7 custom projects receiving rebates in 2010. The custom projects primarily involved replacement of constant speed air compressors with variable frequency air compressors. Other project types included lighting occupancy sensors and desiccant dehumidification cooling.

4.8.2 Savings Calculations

Savings for custom projects were reviewed individually. In the case of variable speed air compressor installation (4 of the 7 total custom rebates for 2010), a proprietary Nexant tool was used to determine savings. In the case of the other three projects, the savings calculation submitted by the customer was reviewed and adjusted as deemed appropriate by Nexant.

The following table summarizes the custom rebate projects and the savings calculation method used.

Ctrl #	Project Description	Savings Calculation
20	Variable Speed Compressor	Nexant tool
25	Variable Speed Compressor.	Nexant tool
43	Variable Speed Compressor	Nexant tool
96	Occupancy sensors	Application review
163	Dehumidification	Application review
249	Conversion from compressed air to electric motors (pencil manufacturing)	Application review
257	Variable Speed Compressor, reduced size from 40HP to 25HP	Nexant tool

4.8.3 Findings and Recommendations

The gross energy and demand savings calculated for the Custom Program are listed in the table below:

Table 4-11: Commercial Roof, Window Film, Motor, and Custom Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (kW)	Non-coinc. Demand Savings (kW)
858,053	120	121

The following are program findings and recommendations that CPS Energy may consider for this program in the future:

- Require submission of more vigorous backup calculation of savings.
- In instances where the estimated savings are significant and the proposed measure is complex, consider the requirement of pre- and post-inspections with possible data logging

4.9 INSPECTION METHODOLOGY

As part of the measurement and verification process for commercial projects, Nexant randomly selected the following projects for inspection.

Table 4-12: Initial Random Sample for Inspection

Category	Customer Name
Lighting	ASCO of Texas, L.P. D/B/A Advance America
	Versa Cold
	ASCO of Texas, L.P. D/B/A Advance America
	Michaels Craft Store
	San Antonio Country Club
	SAISD Bowden Elementary School
	St. John Neumann Catholic Church
	Industrial Properties
	Bath & Body Works – Huebner Oaks
	Northside ISD – Glenoaks Elementary School
	Target
HVAC	Office Depot #2793
	Family Thrift
	4040 Building, Ltd.
	Sterling Foods / Eastgroup Properties
	Altex Electronics
	UT Health Science Center San Antonio
	Haljohn-San Antonio
	Rare Hospitality Int. Inc,– Longhorn Steak
	Cedar Creek School
	Golds Gym
	Office Depot
HVAC (Chiller)	Southeast Med Pro, LLC
	9311 Property Interests, LTD
	Six Flags Fiesta Texas
	Intercontinental San Antonio Forum LP
	Methodist Healthcare System
	Port Authority of San Antonio
	AT&T
	Edgewood ISD
	Wereldhave USA San Antonio LP
Window	Alamo Colleges
	City of San Antonio

Category	Customer Name
Roof	Warren Industrial Lubricants Co.
	Ella Austin
	Mrs. Roger Lew
	San Antonio SSP, Ltd.
	Holy Spirit Catholic Church
	Gentry Investment Partners LP
	Alterman, Inc
	Longhorn Packaging Inc
Motor	Frost
	UT Health Science Center San Antonio
	AT&T
	4040 Building Ltd.
	KW Funds – One Technology, LLC
	AT&T
Custom	Maxim Integrated Products
	Harland Clarke
	Universal Bookbindery Inc.
	Munters Corporation
	Blue Line Corporation

All the selected sites were inspected for reported measures. All projects were inspected to verify that the site conditions matched the post-retrofit conditions as stated in the customer submittal. In order to more accurately verify the operating hours of lighting projects, data loggers were installed at 8 of the sample sites. This data was analyzed to compare actual operating conditions to the post-retrofit conditions stated in the customer submittal. The table below illustrates the sample size of actual inspected projects, along with the percentage of savings that the sample contributed to the overall program savings.

The table below shows the total number of inspected projects within each program. The number of inspections to be conducted was determined based on the program's total number of participants, in order to achieve 80% confidence and 20% precision within each program, assuming a coefficient of variation of 0.5. The coefficient of variation is a measure of variance in the parameter being investigated and is defined as the standard deviation of the particular value being divided by the mean.

Within each program, projects for inspection were selected randomly. A secondary check was performed to ensure that the variation of project sizes within the sample roughly matched the variation of project sizes within the entire population.

Table 4-13: Inspected Sample

Program	Number of Program Participants	Number of Inspected Projects
Large Lighting	167	11
HVAC - Unitary Equipment	119	11
HVAC Chillers	32	9
Roof Coatings	27	8
Motors	10	6
Custom	7	5
Window Coatings	2	2

5.1 SUMMARY OF DEMAND RESPONSE IMPACTS

CPS Energy offered the following programs for demand response in 2010:

- Residential Peak Saver Program
- Commercial and Industrial Demand Response Program

The following sections include a brief summary of each program and describe the methodology and the results of the impact analysis.

5.2 PEAK SAVER PROGRAM

5.2.1 Overview

CPS Energy's Peak Saver Program is a direct load control program for residential, multi-family, and small business customers wherein a free programmable thermostat is installed in the residence/facility in exchange for the customer's agreement to allow CPS Energy remote access to their central air conditioning system. Through the program, CPS Energy can cycle on and off the air conditioner compressor for short periods of time on defined event days.

In 2010, CPS Energy enrolled 17,482 customers in the Peak Saver program, which brings the total program enrollment to 43,174 customers as of the end of the program year. This corresponds to a 214% increase in program participation from 2009.

During the summer of 2010, 15 control events were called for system wide program participants for an average duration of slightly less than two and a half hours each event. In comparison, 23 control events were called in the summer of 2009 due to warmer temperatures triggering an event.

5.2.2 Savings Calculations

In 2010, Nexant conducted an impact evaluation of the program to determine the average impact per unit for three temperature bins and three customer sectors, namely residential, multi-family and small commercial, and two cycling strategies, 33% and 50%. The results from these findings were applied to the total number of enrolled customers for each event day to determine total program kW reduction. Therefore, based on the 43,174 units enrolled in the program at the end of the 2010 program year, the enrolled kW available for curtailment is 17,785 kW.

To determine the achieved energy impacts (kWh) during the summer of 2010, CPS Energy provided Nexant with information on the events called during the year, including the event date, event duration, and the number of participants enrolled on the event day. The achieved energy savings is 460,676 kWh.

Average air conditioning load impact results per customer and various temperature bins are presented in the table below.

Table 5-1: Load Impact Results by Cycling Strategy

Segment	Temperature Bin	33% Cycling	50% Cycling
Residential	90-94°F	0.20	0.35
	95-99°F	0.36	0.63
	100°F +	0.49	0.78
Multi-Family	90-94°F	0.10	0.15
	95-99°F	0.10	0.20
	100°F +	0.15	0.06
Commercial	90-94°F	0.57	0.88
	95-99°F	0.84	1.28
	100°F +	1.00	1.46

5.2.3 Findings and Recommendations

The gross energy and demand savings calculated for the Peak Saver program are listed in the following table:

Table 5-2: Peak Saver Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (enrolled kW)	Non-coinc. Demand Savings (enrolled kW)
460,676	17,785	17,785

Nexant recommends continuing to collect program event data, including duration, outside temperature, and number of participants.

5.3 COMMERCIAL AND INDUSTRIAL DEMAND RESPONSE PROGRAM

5.3.1 Overview

The Demand Response (DR) Program is a voluntary load curtailment program offered to commercial and industrial customers. Incentives are provided to participating customers for shedding electric load when requested by CPS Energy during high demand periods in the summer. Incentive payments are made based on the amount of load curtailed during called events. In 2010, CPS Energy enrolled 51 customers in the DR program, and 12 curtailment events were called between June and August. This corresponds to a 168% increase in program participation from 2009.

5.3.2 Savings Calculations

CPS Energy collected participating facility load data and calculated the kW and kWh savings that were achieved during the 2010 DR events. The objective of Nexant's analysis was to independently

verify the savings based on CPS Energy's baseline calculation methodology and the interval meter data collected for the participating facilities. Nexant's analysis included the following steps:

1. Gain an understanding of the methodology used by CPS Energy to calculate the facility's baseline load and determine the load curtailed during called events.
2. Choose a sample of event days and apply CPS Energy's baseline calculation methodology and event data to independently calculate the load impacts and energy savings. The kW and kWh savings were calculated for two randomly chosen sample event days in 2010 – July 15 and August 23 for all the customers.
3. Divide the Nexant-calculated savings by the CPS-calculated savings to derive program kW and kWh realization rates.
4. Apply these realization rates to the program-calculated kW and kWh savings for all event days in 2010 to arrive at the total Nexant kW and kWh savings for the program.

To calculate the curtailed load for each event, facility load data for ten (10) eligible days prior to the event day were provided by CPS Energy. The top three out of the 10 days are selected based on the total kWh during the peak period of 3 PM to 7 PM. The kW for the 3 days is then averaged to derive the baseline. In some cases, this average may not be representative of the baseline due to changes in weather and operations on the event day. To adjust the baseline, a baseline shift factor is applied to this average to derive the "true" baseline.

Due to the number of independent variables that can impact the facility's load, the calculation of the baseline shift factor is one of the subjective components of the calculation methodology. Nexant calculated the baseline shift factor as follows, which may vary slightly from CPS Energy's methodology:

1. Graph the event kW and non-adjusted baseline kW to check for unusual trends like a higher than usual event kW before the event compared to the baseline kW. If no unusual trends are noted and the actual load prior to the event matches the calculated based line, no baseline shift factor is required; otherwise, proceed to Step 2.

2. Calculate the sum of standard deviations between each interval pair of event day and baseline kW between 13:00 and 15:00. In other words, calculate:

   Total deviation = Standard deviation (x1, y1) + Standard deviation (x2, y2) + …… Standard deviation (xn, yn)

   Where:

   x = event kW
   y = baseline kW
   1, 2,….n represent 15 minute intervals from 13:00 through 15:00 which is the 3-hour interval before the event.

3. Look for outlier standard deviations (especially close to the event time) and eliminate them from the total deviation calculation.

4. Solve for the baseline shift factor that minimizes this total deviation.

If the above methodology still fails to match the load profile of the baseline with the event day, the following adjustments are made sequentially till a good fit is achieved:

1. Expand the time window in Step 2 from 13:00 to 15:00 to 12:00 to 15:00 and continue with the iteration as outlined above.

2. Examine the graph of demand versus time for each of the top 3 days, and eliminate any day among that does not match the other two days and the event day. Include the next highest demand day to calculate the unadjusted baseline average.

One of the 10 eligible days with a load shape similar to the event day load shape is used as a proxy to the baseline. The baseline shift factor is then applied to this proxy day to adjust the baseline closer to the event day load profile. The baseline shift factor is calculated as detailed above. At a minimum, the sum of the standard deviations as calculated in Step 2 should be lower than the above two adjustments.

5.3.3 Findings and Recommendations

The gross energy and demand savings calculated for the Commercial DR program are listed in the following table:

Table 5-3: Demand Response Gross Energy and Demand Savings

Energy Savings (kWh)	Peak Demand Savings (average event kW)	Non-coinc. Demand Savings (average event kW)
1,283,346	45,028	45,028

The following are program findings and recommendations that CPS Energy may consider for the program in the future:

- The realization rate or the ratio of Nexant calculated savings and CPS calculated savings is 0.97, which means there is only a 3% difference between the two calculations.
- The R-Square regression factor between Nexant calculated savings and CPS calculated savings for both event days (July 15 and August 23) exceeded 0.99, which signifies a good correlation between the two savings calculations.
- Nexant recommends CPS continue with current calculation methodology

6 TOTAL IMPACTS AND COST-EFFECTIVENESS SUMMARY

6.1 NET PROGRAM IMPACTS

To determine net program impacts, Nexant conducted market research of evaluations for other utility-sponsored DSM programs around the country. NTG ratios from programs similar in operation, goals, and market as CPS Energy's programs were applied to the gross program savings to determine program net impacts, as shown in Table 6-1:

Table 6-1: 2010 Program Gross and Net Impacts

Program	Gross Savings			NTG Ratio	Net Impacts		
	Energy Savings (kWh)	Peak Demand Savings (kW)	Non-Coinc. Demand Savings (kW)		Energy Savings (kWh)	Peak Demand Savings (kW)	Non-Coinc. Demand Savings (kW)
Energy Efficiency Programs							
CFL	12,461,973	1,242	14,591	0.80	9,969,578	993	11,673
Home Efficiency	2,496,551	1,015	1,109	0.93	2,321,792	944	1,031
Residential HVAC	13,092,110	3,826	4,782	0.95	12,437,505	3,634	4,543
Solar PV & Water Heater	1,729,383	1,090	1,090	1.00	1,729,383	1,090	1,090
Air Flow Performance	561,648	312	312	0.90	505,483	281	281
New Homes Construction	4,406,780	745	1,544	1.00	4,406,780	745	1,544
Refrigerator Recycling	1,364,779	145	181	0.63	859,811	91	114
Wash Right	1,238,764	517	2,107	0.93	1,145,856	478	1,949
Residential Subtotal	***37,351,988***	***8,892***	***25,715***		***33,376,189***	***8,257***	***22,224***
Com Large Lighting	19,319,109	3,768	4,317	0.85	16,421,243	3,203	3,669
Com Small Lighting	117,224	23	28	0.85	99,640	20	24
Com HVAC	6,398,447	2,643	3,432	0.96	6,142,509	2,537	3,295
Motors	191,269	66	66	0.94	179,793	62	62
Window Film	162,584	48	61	0.89	144,700	42	54
Roof Coating	201,561	137	172	0.90	181,405	123	155
Restaurant Equipment	21,244	2	3	0.94	19,969	2	3
Lean Clean Energy	657,946	75	86	0.91	595,441	68	78
Com New Construction	58,636	42	51	1.00	58,636	42	51
Com Custom	858,053	120	121	0.96	823,731	115	116
Commercial Subtotal	***27,986,073***	***6,924***	***8,337***		***24,667,067***	***6,215***	***7,507***
Energy Efficiency Total	***65,338,061***	***15,816***	***34,053***		***58,043,256***	***14,472***	***29,731***
Demand Response/Load Control Programs							
PeakSaver	460,676	17,785	17,785	1.00	460,676	17,785	17,785
Demand Response	1,283,346	45,028	45,028	1.00	1,283,346	45,028	45,028
Demand Response Total	***1,744,022***	***62,813***	***62,813***		***1,744,022***	***62,813***	***62,813***
Total	**67,082,083**	**78,629**	**96,866**		**59,787,278**	**77,285**	**92,544**

Figure 6-1 and Figure 6-2 present a breakdown of the contribution by each program to the overall net program impacts:

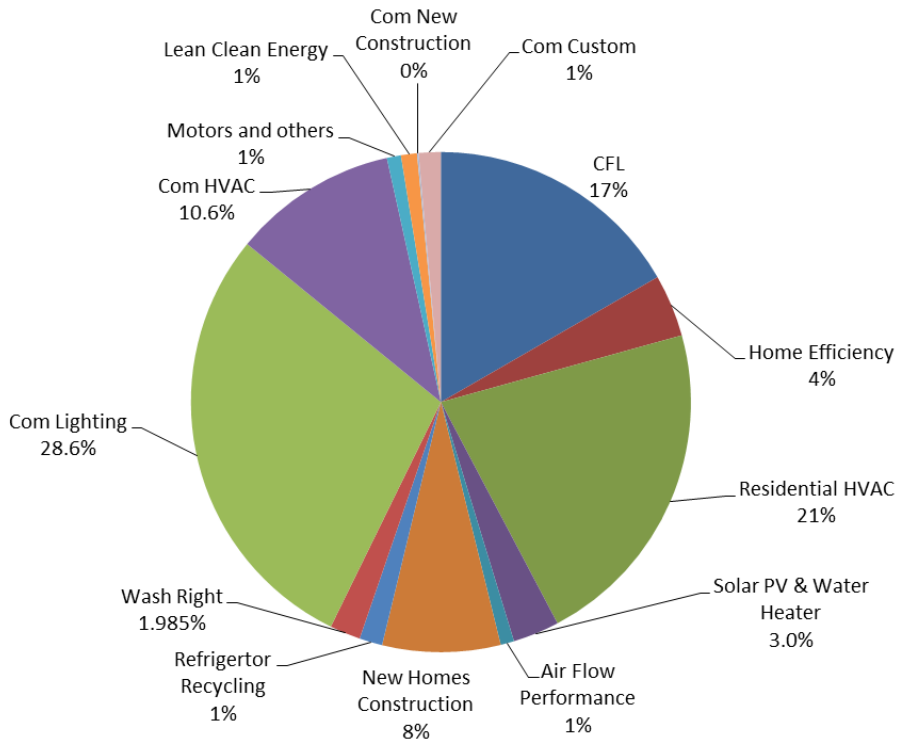

Figure 6-1: 2010 Energy (kWh) Savings by Program

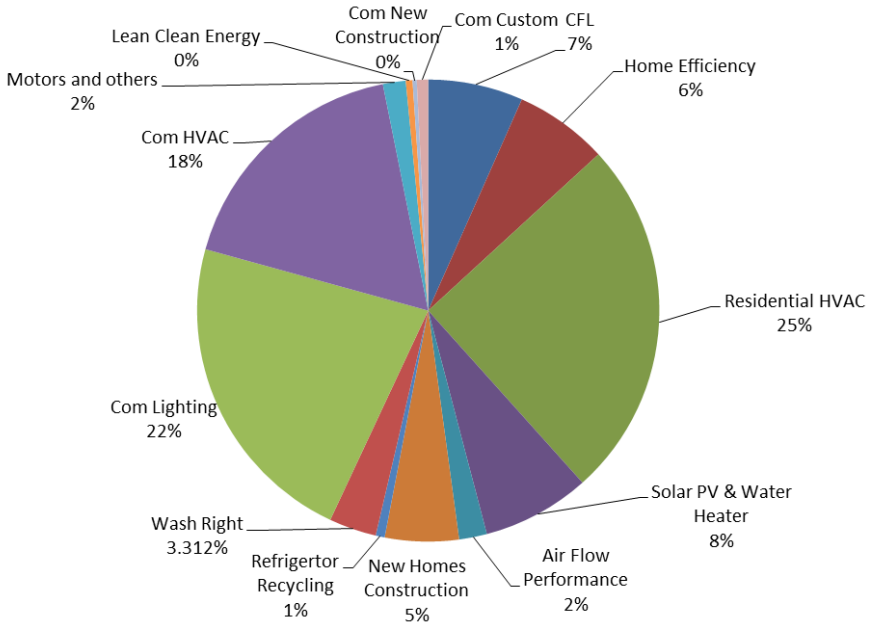

Figure 6-2: 2010 Peak Demand (kW) Savings by Program

Figure 6-3 presents a comparison of the peak demand savings achieved by the 2010 program offerings compared with 2008 and 2009 program results:

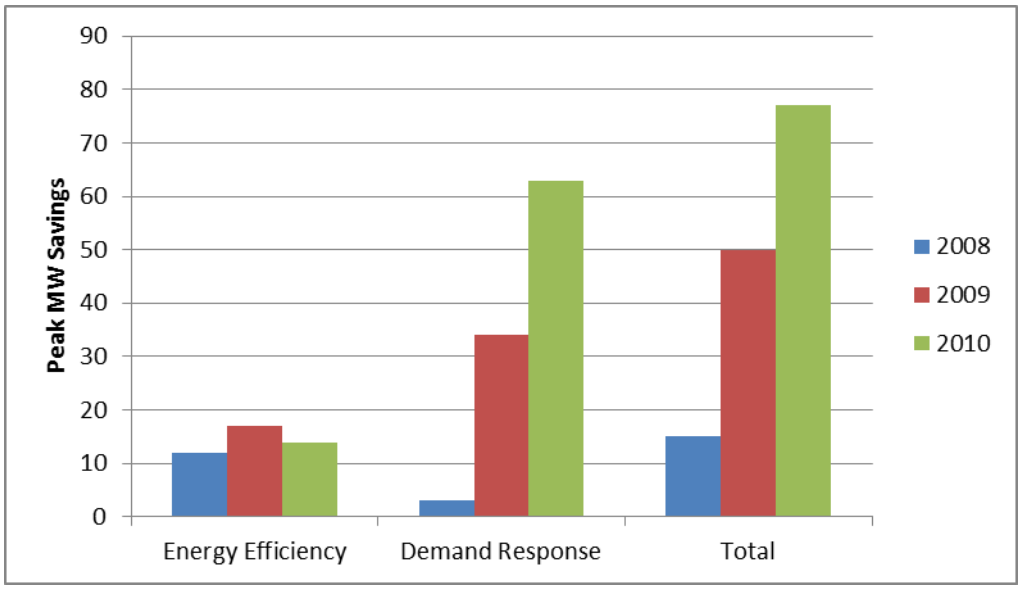

Figure 6-3: Comparison of 2008, 2009, and 2010 Peak Demand (kW) Savings

6.2 PROGRAM PROCESS FINDINGS AND RECOMMENDATIONS

In addition to the program-specific findings and recommendations included in the previous sections, Nexant's evaluation resulting in the following general program findings and recommendations:

- CPS Energy's DSM efforts are led by committed, skilled, and experienced staff.
- The portfolio of DSM program offerings addresses a wide variety of electric efficiency measures and services for both residential and nonresidential customers.
- Existing programs are effectively designed and implemented and are well positioned for continued expansion
- Programs have implemented numerous established DSM best practices, including:
  - Program quality control procedures include collecting sufficient data to verify installed equipment (pre and post inspections, equipment specification forms, etc), while not requiring excessive reporting by customers and contractors
  - Programs have easy participation processes and are satisfying to participants
  - Trade ally network continues to expand and program staff keeps trade allies informed of program updates

- Programs should continue to track changes to minimum efficiency standards, incremental equipment cost, and market trends to evaluate potential changes to program requirements and incentive levels
- As programs expand, CPS Energy should continue planning for the resources necessary to support large-scale deployment of DSM program portfolio and to achieve both short-term and long-term goals

6.3 ECONOMIC ANALYSIS

The economic evaluation of CPS Energy's 2010 DSM program offerings included collection of all program-related costs, which are summarized in the table below. The costs include rebates and incentives paid directly to customers, program administration, marketing outreach to customers and contractors, internal labor costs and incentives provided to CPS Energy staff, consultant fees for program development, implementation, and evaluation, and infrastructure development costs to manage and track the programs:

Table 6-2: 2010 Program Expenditures

Category	Amount
Program Management and Marketing Costs	$2,671,077
Rebates and Incentives Paid	$25,207,947
Total Program Expenditures	$27,879,024

Program cost-effectiveness was evaluated from two perspectives, Cost of Saved Energy and Reduction in Revenue Requirements, resulting in the following:

- Cost of Saved Energy[1]:

$$CSE = \frac{\$18{,}544{,}122 \times 0.1369}{58{,}043{,}256\ kWh} = \textbf{\$0.044/kWh}$$

- Net Reduction in Revenue Requirements

RRR = $35,214,445 - $27,879,024 = **$7,395,286**

[1] Includes costs and energy savings for energy efficiency programs only (does not include Peak Saver or Commercial Demand Response)

Nexant, Inc.
Corporate Headquarters

101 Second Street, 10th Floor
San Francisco, CA 94105-3672
tel: +1 415 369 1000
fax: +1 415 369 9700
www.nexant.com