# Annual Progress Report

**Covering Period:** February 1, 2013 – January 31, 2014
**Date of Report:** May 2014

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**Proposed Funding amount:** $8.6M from base rate + $55.4M from STEP = $64.0M total

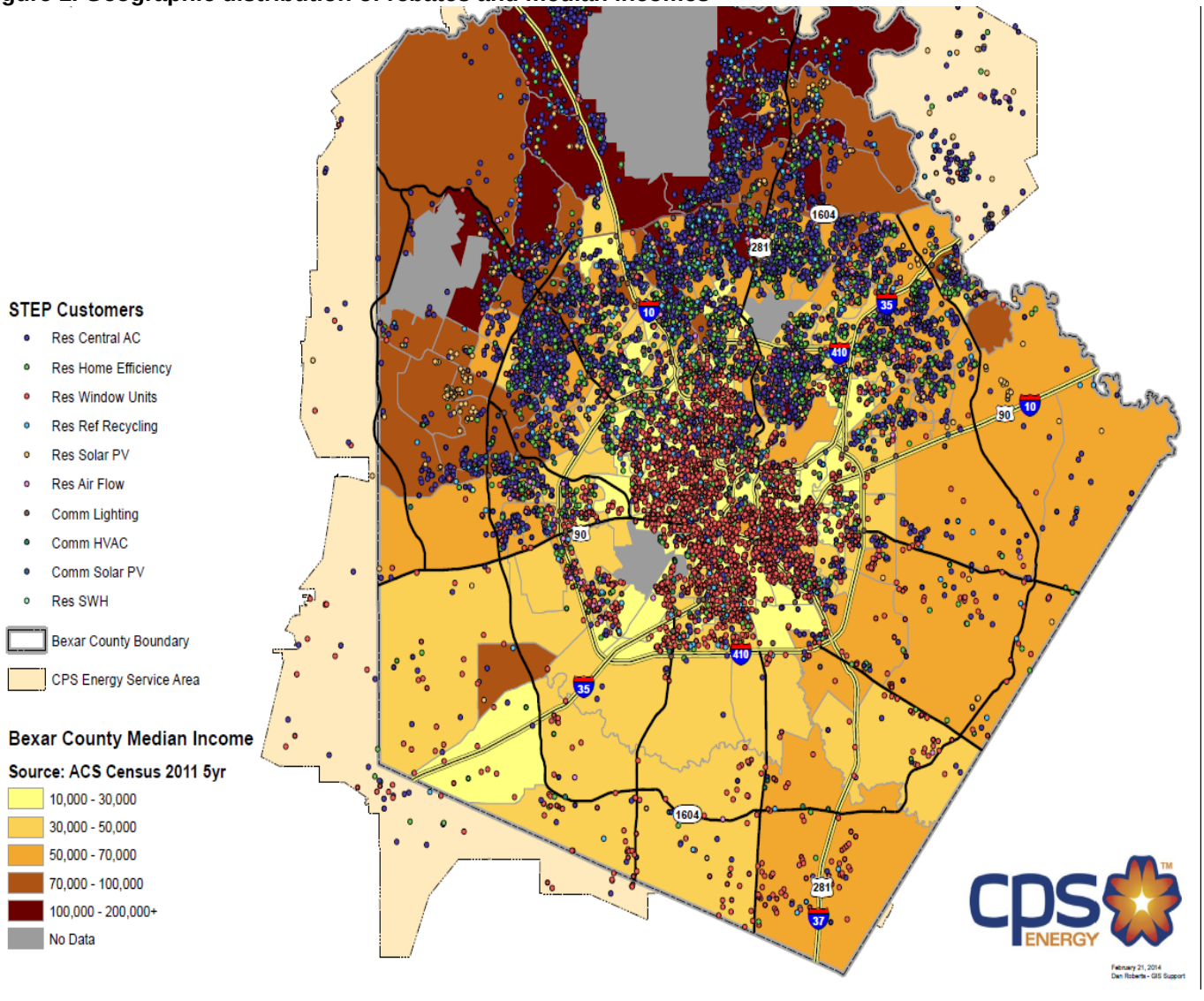
**Council District:** The following allocation of rebates by district excludes the Peak Saver, New Home Construction and Demand Response programs (due to the inability to separate these rebates by district):

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| District 1 | $ 3,870,843.74 | 11% | District 5 | $ 3,008,618.86 | 9% | District 9 | $ 3,221,875.29 | 9% |
| District 2 | $ 3,190,270.98 | 9% | District 6 | $ 2,453,792.41 | 7% | District 10 | $ 2,429,402.96 | 7% |
| District 3 | $ 2,878,852.16 | 8% | District 7 | $ 1,670,011.59 | 5% | Other | $ 8,169,989.56 | 23% |
| District 4 | $ 1,980,538.08 | 6% | District 8 | $ 1,915,202.20 | 6% | Total | $ 34,789,397.83 | |

**Neighborhood Location:** Figure 1 on the following page shows the geographic distribution of rebates along with a median income legend.

**Private sector employment profile:** STEP programs had an estimated 750 firms participate as partners in the program in 2013, assisting customers with the installation of eligible energy efficiency measures. Based on survey data from 106 partners in 2012, 72% hold primary offices in San Antonio. Employee counts averaged 23 for permanent employees and 3 for temporary employees. Employee counts for Bexar County offices averaged 15 permanent and 3 temporary. An average of 4 permanent employees were hired for the Bexar locations in 2012, and 32% of respondents indicated they had hired more people due to the CPS rebate incentives. Contractors believed that 79% of customers used CPS Energy rebates as a deciding factor when hiring them to retrofit their homes.

**Figure 1. Geographic distribution of rebates and median incomes**



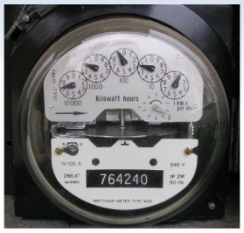

**Number of first time rebate participants:** Of the roughly 16,800 rebates allocated to residential programs in 2013, approximately 15,570 were new rebate customers and 1,230 were repeat customers. (These numbers excludes the Smart Thermostat, Home Manager and New Home Construction programs.) Of the 629 rebates allocated to commercial programs, an estimated 500 were new customers and 129 were repeat customers.

**Number of multiple rebate participants:** Of the roughly 16,800 rebates allocated to residential programs in 2013, approximately 2285 residential customers received more than one rebate this year. (These numbers excludes the Smart Thermostat, Home Manager and New Home Construction programs.) Of the 629 rebates allocated to commercial programs, approximately 169 received more than one rebate.

**Emissions reduction:** The following table contains the tons of avoided emissions of various pollutants for each program:

| | CO2 | NOx | SO2 |
|---|---|---|---|
| Home Efficiency | 926 | 0 | 1 |
| Residential HVAC | 6,532 | 3 | 5 |
| Weatherization | 6,712 | 3 | 5 |
| PeakSaver | 595 | 0 | 0 |
| Solar PV & Water Heater | 5,193 | 2 | 4 |
| Air Flow Performance | 267 | 0 | 0 |
| New Home Construction | 5,286 | 2 | 4 |
| Refrigerator Recycling | 285 | 0 | 0 |
| **Residential Sector Total** | **25,796** | **10** | **19** |
| | | | |
| | | | |
| Com. Lighting | 14,752 | 6 | 12 |
| Com. HVAC | 3,325 | 1 | 3 |
| Home Manager | 105 | 0 | 0 |
| Comm New Construction | 2,894 | 1 | 2 |
| Comm Custom | 4,091 | 2 | 3 |
| Demand Response | 2,106 | 1 | 2 |
| **Commercial Sector Total** | **27,273** | **11** | **22** |
| | | | |
| ***Total*** | **53,069** | **21** | **41** |






# Measurement and Verification of CPS Energy's FY2014 DSM Program Offerings

**Submitted to CPS Energy**

**June 2nd, 2014**

Nexant

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## 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 FY2014 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 FY2014 DSM programs on an annualized basis. Additionally, the evaluation reviewed program expenditures to calculate program cost-effectiveness and briefly addressed some changes in program operations implemented in FY2014.

## 1.1 SUMMARY OF ENERGY AND DEMAND IMPACTS

Net energy and demand savings are listed in **Table 1-1**. The savings below is represented on an ***annualized basis*** in order to simplify the reporting structure and for easy comparison from year to year.

## 1.2 SUMMARY OF ECONOMIC IMPACTS

Nexant's evaluation included collecting administrative, management, and marketing costs as well as total rebates paid. The following economic impact metrics were calculated:

- Cost of Saved Energy (CSE), which represents the levelized program cost per annual kWh saved, was **$0.044/kWh**.
- Net Reduction in Revenue Requirements (RRR), which represents the net reduction in utility costs due to the impact of the energy efficiency improvements, was **$37,537,814**.

**Table 1-1: FY2014 Net Energy and Demand Savings**

| Program | NTG Ratio | Net Impacts | | |
|---|---|---|---|---|
| | | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-Coinc. Demand Savings (kW) |
| **Energy Efficiency Programs** | | | | |
| Home Efficiency | 0.93 | 1,600,016 | 209 | 479 |
| Weatherization | 0.93 | 11,603,145 | 3,674 | 5,969 |
| Air Flow Performance | 0.90 | 461,797 | 265 | 265 |
| Residential HVAC | 0.95 | 11,290,482 | 3,279 | 4,099 |
| Residential Solar | 1.00 | 5,292,733 | 2,747 | 2,747 |
| New Homes Construction | 1.00 | 9,137,801 | 1,969 | 1,969 |
| Refrigerator Recycling | 0.63 | 492,521 | 45 | 57 |
| **Residential Subtotal** | | **39,878,496** | **12,188** | **15,584** |
| Lighting | 0.85 | 25,501,204 | 5,934 | 6,406 |
| Commercial HVAC | 0.96 | 5,747,478 | 4,230 | 5,386 |
| Commercial Solar | 1.00 | 3,683,857 | 2,110 | 2,110 |
| New Construction | 1.00 | 5,001,811 | 861 | 861 |
| LED Street Lights | 0.90 | 7,714,442 | 0 | 1,761 |
| Custom | 0.96 | 7,072,068 | 318 | 318 |
| **Commercial Subtotal** | | **54,720,860** | **13,453** | **16,843** |
| **Energy Efficiency Total** | | **94,599,356** | **25,640** | **32,427** |
| **Demand Response/Load Control Programs** | | | | |
| Smart Thermostat | 1.00 | 1,028,788 | 36,688 | 36,688 |
| Home Manager | 1.00 | 181,394 | 24,115 | 24,115 |
| C&I Demand Response | 1.00 | 2,430,507 | 66,802 | 66,802 |
| **Demand Response Total** | | **3,640,689** | **127,606** | **127,606** |
| **Grand Total** | | **98,240,045** | **153,247** | **160,033** |

# 2 EVALUATION METHODOLOGY

## 2.1 OVERVIEW OF EVALUATION METHODOLOGY

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

- **Collect Program Data.** CPS Energy provided Excel files containing all the individual FY2014 project data, as well as access to the online SalesForce database for all programs.
- **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.

  For a subset of projects, site inspections were performed to verify equipment installation and operation. To determine gross energy and demand savings, individual project savings were calculated and summed 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).

  Rather than attempt site inspections across all programs, this year's effort was focused on select programs – Commercial Lighting and HVAC. It is recommended that different programs receive focused fieldwork each year on a rotating basis. Leveraging the fact that many key program analysis factors do not change significantly from year to year enables a more thorough investigation of each individual program (every 2-3 years) without the budgetary impact of performing that level of effort each year.
- **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 previous evaluations, the same methodology was used 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.
- **Program Economic Analysis.** The economic analysis summarized cost-effectiveness for the overall portfolio of savings from three perspectives: Cost of Saved Energy, Reduction in Revenue Requirements, and Program Administrator Benefit Cost Ratio:

*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.

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

*Program Administrator Benefit Cost Ratio.* The benefit cost ratio calculation used for energy efficiency programs consists of the net present value of avoided energy and capacity cost (benefit) divided by the sum of rebate and administrative costs (cost).

$$Benefit\,Cost\ Ratio = \frac{Net\ Present\ Value\ (NPV)\ Avoided\ Cost}{Rebates + Admin/Marketing\ Costs}$$

*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:

$$RRR = Avoided\ Energy\ and\ Demand\ Costs - Program\ Costs$$

## 3.1 SUMMARY OF RESIDENTIAL IMPACTS

CPS Energy offered the following programs for the residential sector in FY2014:

- Home Efficiency
- Air Flow Performance
- HVAC
- Solar Initiative (Residential)
- New Homes Construction
- Refrigerator Recycling

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

## 3.2 HOME EFFICIENCY PROGRAM

### 3.2.1 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 FY2014, rebates were provided for the following list of measures:

- Attic insulation (contractor installed)
- Do-it-Yourself attic insulation
- Spray foam insulation

The Home Efficiency Program had 1,870 projects in FY2014, which corresponds to a 16% decrease in program participation from last year. Figure 3-1 shows the total number of installations of each type of measure in FY2014.

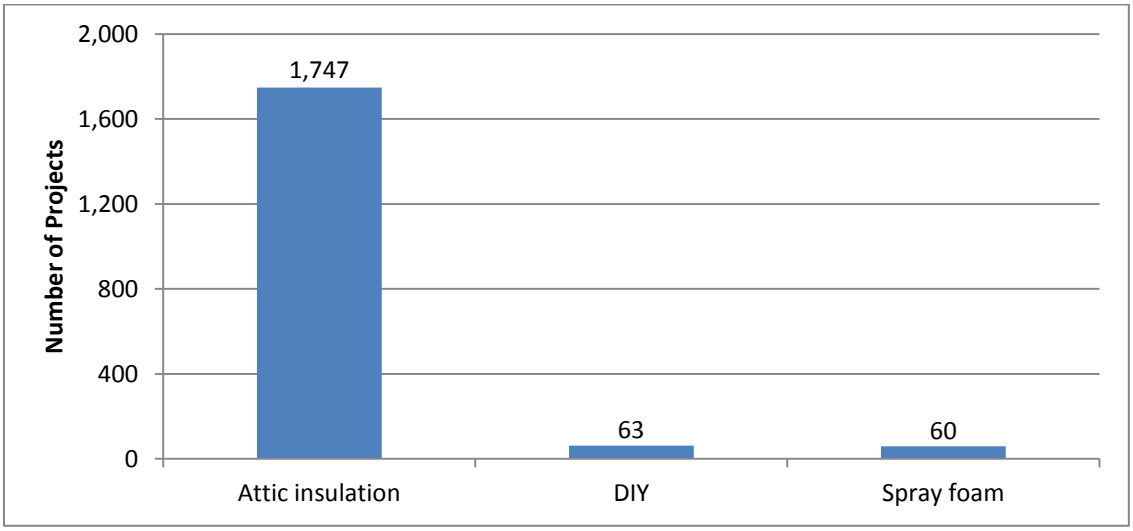



**Figure 3-1: Number of Installations of Home Efficiency Measures**

### 3.2.2 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.

#### 3.2.2.1 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. For equations used for this calculation, please refer to document '2011 CPS STEP (Save for Tomorrow Energy Plan) - RESIDENTIAL REFERENCE MANUAL' obtained from CPS Energy.

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[2] 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.

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

The total gross energy and demand savings for FY2014 attic insulation installations are as follows:

**Table 3-1: Attic Insulation Gross Energy and Demand Savings**

| Measure | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|---|
| Attic Insulation (contractor installed) | 1,608,398 | 209 | 482 |
| Attic Insulation (Do-it-Yourself) | 62,712 | 8 | 19 |
| **Total** | 1,671,110 | 217 | 501 |

#### 3.2.2.1 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 FY2014 projects that installed spray foam insulation are listed in the following table:

**Table 3-2: Spray Foam Insulation Gross Energy and Demand Savings**

| Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|
| 49,337 | 8 | 15 |

### 3.2.3 Findings and Recommendations

The gross energy and demand savings calculated for all measures included in the Home Efficiency Program are listed in Table 3-6 below:

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

| Measure | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|---|
| Attic Insulation (contractor installed) | 1,608,398 | 209 | 482 |
| Attic Insulation (Do-it-Yourself) | 62,712 | 8 | 19 |
| Spray foam | 49,337 | 8 | 15 |
| **Total** | **1,720,448** | **225** | **515** |

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

- Since CPS Energy is now tracking residence heating system type (gas, electric, or heat pump), CPS Energy should consider updating the savings calculations methodology to include this metric, rather than using values from the previous potential study (41% electric heat).

## 3.3 AIR FLOW PERFORMANCE PROGRAM

### 3.3.1 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 364 projects in FY2014. This corresponds to a 12% increase in program participation from last year.

### 3.3.2 Savings Calculations

Nexant estimated the energy savings and demand savings based on the Texas Public Utilities Commission approved deemed values for Climate Zone 3, as issued in 2006.[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

[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.

The PUC has released updated deemed values in FY2014, but current CPS project tracking does not include sufficient information to use the updated tables.

### 3.3.3 Findings and Recommendations

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

**Table 3-4: Duct Repair & Replacement Gross Energy and Demand Savings**

| Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|
| 513,108 | 294 | 294 |

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

- Nexant recommends that total system airflow be collected for each project, to allow for alignment with the updated PUC deemed savings methodology: This would allow direct calculation of cooling energy savings from leakage test results to compare to deemed savings estimates.

## 3.4 HVAC PROGRAM

### 3.4.1 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 FY2014 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:

  $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:

  $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

In FY2014, a total of 9,771 residential HVAC rebates were paid to participating customers, including 3,470 central A/C rebates, 2,279 heat pump rebates, and 4,022 room air-conditioner rebates. This corresponds to a 2% decrease in program participation from last year. Figure 3-2 shows the breakdown of participating central air conditioners and heat pumps by SEER rating:

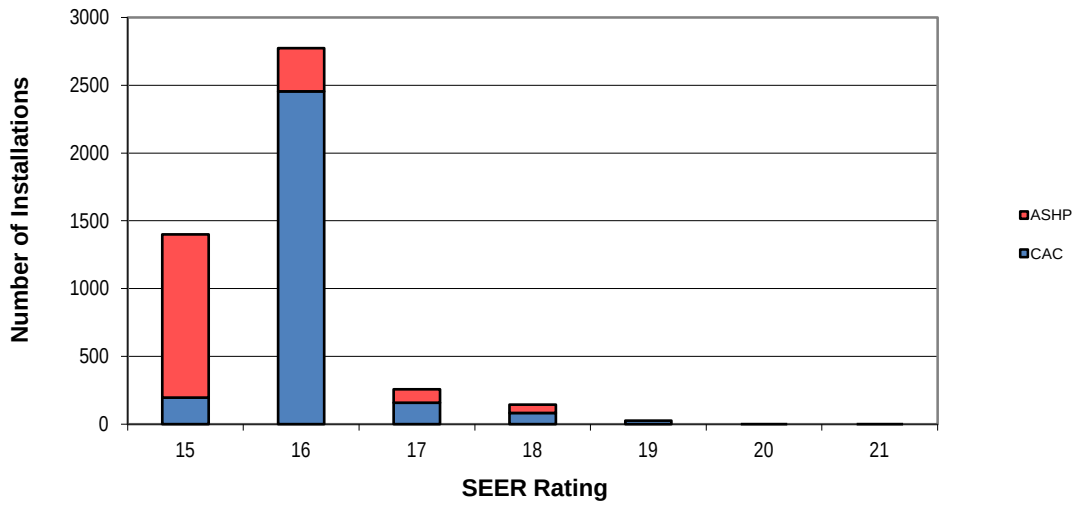



**Figure 3-2: SEER Ratings of CAC and ASHP Installations**

### 3.4.2 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. Texas PUC published savings[1] were used for both energy and peak demand savings, for all three equipment types (central air conditioners, heat pumps, and room air conditioners). Energy and peak demand savings were calculated for each project based on the size and efficiency of the installed equipment. Non-peak demand savings were calculated by assuming an 80% coincidence factor is applied to the peak demand values published by the PUC.

[1] Deemed Savings, Installation & Efficiency Standards. Residential and Small Commercial Standard Offer Program. Frontier Associates LLC. January FY2013.

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. The PUC does allow for the use of a 12.44 SEER baseline for early replacement projects, but the 13 SEER "new construction" baseline was selected to be conservative.

### 3.4.3 Equipment Verification

To verify the accuracy of the efficiency data listed in the program database, Nexant randomly selected samples of 11 CAC projects, 11 HP projects, and 11 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 published specification sheets from manufacturers. The results of the equipment verification are as follows:

- 11 of 11 CAC units (100%) were verified as having the correct SEER or EER rating according to the AHRI directory.
- 11 of 11 heat pump units (100%) were verified as having the correct SEER and HSPF ratings according to the AHRI directory.
- 11 of the 11 room air conditioners (100%) were verified as having the correct EER rating according to manufacturers' published specifications for each unit.

No adjustments to the overall population of projects were made based on the equipment verification findings.

### 3.4.4 Findings and Recommendations

The gross energy and demand savings calculated for the FY2014 Residential HVAC program are listed in the table below:

**Table 3-5: Residential HVAC Gross Energy and Demand Savings**

| Measure | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|---|
| ENERGY STAR Central AC | 6,416,880 | 1,884 | 2,355 |
| ENERGY STAR Heat Pump | 4,680,837 | 1,109 | 1,386 |
| ENERGY STAR Room AC | 787,001 | 458 | 573 |
| **Total** | **11,884,718** | **3,452** | **4,315** |

[1] http://www.ahridirectory.org/ahridirectory/pages/home.aspx

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.

## 3.5 SOLAR INITIATIVE - RESIDENTIAL

### 3.5.1 Overview

CPS Energy's Solar Initiative provides incentives for the installation of both solar photovoltaic (PV) systems and solar water heaters. Regarding the solar PV systems, once energized, CPS Energy rebated systems must adhere to strict CPS Energy policies and cannot be disconnected or moved without CPS Energy approval. CPS Energy requires completion of an Interconnection Application & Agreement for Distributed Generation as the PV system is based on a net metering configuration.

Participation records show a total of 536 residential solar photovoltaic systems installed in FY2014. This corresponds to an 87% increase in program participation from last year. Although solar hot water heater rebates were offered in FY2014, there were no participants. However, a total of 6 rebates carried over from FY2013 were paid from FY2014 funds, so savings from these projects is included in this report.

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.

### 3.5.2 Savings Calculations

#### 3.5.2.1 Solar Photovoltaic

Texas PUC deemed savings values are available for this measure[1]. Deemed energy and demand savings are calculated based on each system's factory rated output using the following equations.

$$\text{Deemed Energy Savings (kWh )} = 1.60 * \text{watts } DC_{STC} \text{ installed}$$

$$\text{Deemed Demand Savings (kW )} = 0.83 * \text{kW } DC_{STC} \text{ installed}$$

"Watts $DC_{STC}$" refers to the system's factory rated output at standard test conditions, which assumes 1,000 w/$m^2$ of solar radiation and 25 degree Celsius cell operating temperature. This rating is recorded by CPS Energy for each installation in the program database.

[1] Deemed Savings, Installation & Efficiency Standards. Residential and Small Commercial Standard Offer Program. Frontier Associates LLC. January FY2013.

#### 3.5.2.2 Solar Water Heaters - Residential

CPS Energy's records show completion of 6 solar hot water projects in the FY2014 program year. For this M&V review, specific project details were not included in the savings database. Consequently, Nexant was unable to verify the stated savings in the summary file. Given the small magnitude of the savings associated with these projects, Nexant considers the savings provided by CPS Energy to be accurate.

### 3.5.3 Findings and Recommendations

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

**Table 3-6: Solar Initiative Gross Energy and Demand Savings**

| Measure | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|---|
| Residential Solar PV | 5,277,856 | 2,743 | 2,743 |
| Residential Solar Hot Water | 14,877 | 4 | 4 |
| **TOTAL** | **5,292,733** | 2,747 | 2,747 |

There are no recommendations for this program at this time.

## 3.6 NEW HOMES CONSTRUCTION

### 3.6.1 Overview

In FY2014, 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

CPS Energy provided Nexant with a listing of 1,790 ENERGY STAR® compliant homes receiving a FY2014 CPS Incentive for Builders and Contractors for New Constructions. This corresponds to a 2% increase in program participation from last year.

### 3.6.2 Savings Calculations

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.

### 3.6.3 Findings and Recommendations

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

**Table 3-7: New Homes Construction Gross Energy and Demand Savings**

| Gross Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|
| 9,137,801 | 1,969 | 1,969 |

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

- Annual energy usage projection of designed home
- Annual energy consumption projection of baseline home

## 3.7 REFRIGERATOR RECYCLING

### 3.7.1 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. In FY2014, customers were offered a $65 rebate for recycling their appliance and offered an additional $35 rebate if an Energy Star certified unit was purchased to replace the old unit. CPS Energy's subcontractor, Appliance Recycling Centers of America, Inc. (ARCA), was responsible for picking up and recycling appliances. ARCA records each

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

appliance pick-up in a database and recycles the appliance in an environmentally responsible manner.

In FY2014, a total of 619 units were recycled by CPS customers and a total of 452 new Energy Star units were purchased. This represents a 58% decrease in recycling and a 62% decrease in new unit purchases compared to FY2013.

### 3.7.2 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 |
|---|---|
| % Single Door Configuration | 0.010 |
| % Side-by-Side Configuration | 0.353 |
| Average Age (Years) | 19.2 |
| % Primary Appliance | 0.280 |
| Household Occupants | 2.74 |
| Climate Variable | 0.268 |

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

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

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

#### 3.7.2.1 Demand Savings

Demand savings for appliance recycling programs are simply the sum of the kW for all removed appliances. Per unit 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)

### 3.7.3 Findings and Recommendations

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

[1] Process and Impact Evaluation of Georgia Power Company's Refrigerator and Freezer Recycling Pilot Program, Nexant, Inc. March FY2013

**Table 3-8: Refrigerator Program Gross Energy and Demand Savings**

| | Gross Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|---|
| Recycled Refrigerator/Freezer | 714,620 | 65 | 82 |
| Purchased Energy Star | 67,160 | 7 | 8 |
| **Total** | **781,780** | **72** | **90** |

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.

## 3.8 WEATHERIZATION

### 3.8.1 Overview

CPS Energy's Weatherization was funded by STEP through FY2014 and touched 3,202 homes in FY2014. Through this program, a variety of energy efficiency measures are provided to low-income residences. Upgrades are provided at no cost to the participant. Installed measures include:

- CFL light bulbs
- Wall Insulation
- Attic Insulation
- Floor Insulation
- Solar window screens
- Hot water pipe insulation
- Water heater wrap
- Low flow shower heads
- Infiltration reduction
- Refrigerator Recycling
- EnergyStar Refrigerators
- EnergyStar Window Unit ACs

### 3.8.2 Savings Calculations

Nexant used the '2011 CPS Energy STEP (Save for Tomorrow Energy Plan) -RESIDENTIAL REFERENCE MANUAL' to calculate demand and energy savings for included measure types. For measure types not included in the manual, equations and deemed savings values published by the Texas PUC are used[1]. The following table summarizes the savings calculation source for each measure type:

| Source | Measures |
|---|---|
| 2011 CPS Energy Residential Reference Manual | CFL Light Bulbs |
| | Wall Insulation |
| | Attic Insulation |
| | Solar Window screens |
| | Refrigerator Recycling |
| | EnergyStar Refrigerators |
| | EnergyStar Window Unit ACs |
| Texas PUC methods[1] | Floor Insulation |
| | Hot water pipe insulation |
| | Water heater wrap |
| | Low-flow shower heads |
| | Infiltration reduction |

### 3.8.3 Findings and Recommendations

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

**Table 3-9: Weatherization Gross Energy and Demand Savings**

| Measure | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|---|
| Weatherization | 12,476,500 | 3,950 | 6,418 |

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

- Going forward, CPS Energy should consider distinguishing between homes that have electric resistance heat and homes with heat pumps, in order to more accurately appropriate savings from infiltration reduction projects.
- For FY2015, CPS Energy should revise the energy savings attributed to CFL lightbulbs, in response to changes in federal efficiency standards that impact incandescent baseline wattages.

[1] Deemed Savings, Installation & Efficiency Standards. Residential and Small Commercial Standard Offer Program. Frontier Associates LLC. January 2012.

## 4.1 SUMMARY OF NON-RESIDENTIAL IMPACTS

The non-residential sector included the following program offerings in FY2014:

- Lighting
- HVAC
- Solar Initiative (Commercial/School)
- 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 FY2014, this program was open to all businesses, regardless of the size of the retrofit.

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

In FY2014, a total of 478 commercial lighting projects received funding through the program. This corresponds to a 20% increase in program participation from FY2012.

The LED Street Lights program is included in the savings numbers provided in this section. The full rebate for the entire program was paid and accounted for fully in FY13, so no rebates or program costs are included this year. Also, the methodology used in FY13 involved crediting only the number of bulbs corresponding to the total program rebate amount spent, assuming 100% of the lighting project cost was paid by the rebate. However, because of the way other programs run and the industry standard of crediting a project's full savings even when the rebate only covers a portion of the project cost, this year's calculations include both lights installed in FY14 and lights installed in FY13 that were not credited in the FY13 M&V.

### 4.2.2 Savings Calculations

Nexant gathered available program data from the CPS Energy Commercial Lighting Program database. For FY2014, site inspections were conducted on a sample of projects to verify energy savings and operating hours. Fixture information including wattages for lamp/ballast combinations was verified during the on-site inspection. 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. Table 4-1 highlights the coincidence factors 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 |
|---|---|---|
| Office | Office buildings and other commercial properties in operation during normal business hours | 78% |
| Retail | Retail facilities, including restaurants | 94% |
| Warehouse | Warehouse and storage facilities | 96% |
| Major Healthcare | Hospitals and in-patient health clinics | 84% |
| 24 Hour Facilities | Any facility that operates 24 hours/day or has high occupancy during peak hours | 94% |
| K-12 Schools | Primary education facilities | 73% |
| Colleges & Universities | Secondary education facilities. | 71% |
| Assembly | Conference facilities and public gathering spaces | 89% |
| Hotel | Lodging facilities | 51% |

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

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

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

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

Where:

$FixtureWattage_{base}$ = Fixture wattage from standard wattage table for pre-retrofit fixture

$FixtureWattage_{post}$ = Fixture wattage from standard wattage table for post-retrofit fixture

$N_{fixtures}$ = Number of fixtures

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

$AnnualOperating\ Hours$ = 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.

The total verified savings for the sampled projects was used to calculate a program-wide realization rate. This realization rate was then applied to CPS Energy's total reported savings for the Commercial Lighting program to determine the gross verified savings.

### 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) |
|---|---|---|---|
| Lighting | 30,001,416 | 6,981 | 7,537 |
| LED Street Lights | 8,571,602 | 0 | 1,957 |

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.
- 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 FY2014 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 FY2014, a total of 81 customers received HVAC equipment rebates through the program. This corresponds to a 36% decrease in program participation from FY2013. A total of 239 pieces of HVAC equipment were rebated.

### 4.3.2 Savings Calculations

Nexant gathered available data from the commercial program database . A random sample of FY2014 HVAC projects, both chiller and unitary, was selected for on-site verification. Detailed project information was collected from the program database for the sampled projects. Following onsite verification, all the data collected during the site visits 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 all unitary equipment projects were assumed to be the ASHRAE 90.1-2007, which is San Antonio's code minimum since 2010. ASHRAE 90.1-2007 was also used as the baseline for new construction chiller projects. For retrofit chiller projects, ASHRAE 90.1-1999 was used to account for the fact that chiller plants can typically be rebuilt rather than replaced. 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:

$\mathrm{Capacity}$ = 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.

$EER_{pre}$ = Cooling equipment baseline efficiency. ASHRAE 90.1-2007 standard.

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

$IPLV_{pre}$ = Cooling equipment integrated part load value. ASHRAE 90.1-2007 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:

Capacity = Rated equipment cooling capacity, ton

Conversion Factor = 3.517 kW / ton

CDD = Cooling degree days

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

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

$COP_{pre}$ = Cooling equipment baseline efficiency. ASHRAE 90.1-2007 or -1999 standard, as appropriate.

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

$IPLV_{pre}$ = Cooling equipment integrated part load value. ASHRAE 90.1-2007 or -1999 standard, as appropriate.

$IPLV_{post}$ = 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 | Peak Demand Savings | Non-coinc. Demand Savings |
|---|---|---|

| (kWh) | (kW) | (kW) |
|---|---|---|
| 5,986,956 | 4,406 | 5,610 |

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

- Update baseline efficiencies in internal savings calculators to match ASHRAE 90.1-2007, the prevailing building code in San Antonio.
- Track the facility type for each project, and use deemed operational hours and coincidence factors based on facility type

## 4.4 SOLAR INITIATIVE – COMMERCIAL & SCHOOL

### 4.4.1 Overview

CPS Energy's Solar Initiative provides incentives for the installation of solar photovoltaic (PV) systems. Regarding the solar PV systems, once energized, CPS Energy rebated systems must adhere to strict CPS Energy policies and cannot be disconnected or moved without CPS Energy approval. CPS Energy requires completion of an Interconnection Application & Agreement for Distributed Generation as the PV system is based on a net metering configuration.

Participation records show a total of 50 commercial and 11 school solar photovoltaic systems installed in FY2014, a 15% decrease from participation in FY2013. 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.

### 4.4.2 Savings Calculations

#### 4.4.2.1 CPS Energy Savings Methodology

CPS Energy uses PV Watts, a free, publicly available, online calculator to determine project impacts. This tool estimates peak power production and annual energy production using array rated power, the location (latitude) of the site, and the tilt and azimuth angles of the solar modules. The calculation methodology is based on local weather patterns that result in an average solar insolation value for the installed location. The calculation methodology then adjusts the solar power captured by the array based on the tilt and azimuth angles. CPS Energy records the output from the PV Watts calculator as the claimed savings for each PV project.

Rebates are calculated based on number of modules multiplied by PTC rating (per http://www.gosolarcalifornia.ca.gov/equipment/pv_modules.php) multiplied by inverter efficiency (per http://www.gosolarcalifornia.ca.gov/equipment/inverters.php) multiplied by rebate amount per associated Tier rating.

#### 4.4.2.2 Nexant Savings Methodology

Nexant conducted on-site inspections for this program for FY2013. Data collected during the site visits was used to calculate verified energy and demand savings for each site. Measurements taken on-site were used as inputs to the System Advisor Model (SAM)[1], which is a robust solar system performance model developed by the National Renewable Energy Laboratory (NREL). The outputs from SAM were calibrated to the collected generation data for each site. A realization rate relating the verified energy and demand savings as compared to the values recorded by CPS was calculated. The following table shows the realization rates for both energy and demand savings.

**Table 4-5: Verified Savings Realization Rates for Commercial Solar Projects**

| kWh Realization Rate | kW Realization Rate |
|---|---|
| **109%** | **95%** |

Since no major changes to the Commercial Solar Program were implemented between FY2013 and FY2014, the realization rates in Table 4-5 were applied to FY2014 to determine verified savings.

### 4.4.3 Findings and Recommendations

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

**Table 4-6: Commercial Solar Gross Energy and Demand Savings**

| Measure | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|---|
| Commercial Solar PV | 3,683,587 | 2,110 | 2,110 |

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

- Nexant recommends CPS Energy continue its savings calculation methodology relying on PVWatts.

## 4.5 CUSTOM PROGRAM

### 4.5.1 Overview

In FY2014, CPS Energy offered incentives for custom commercial measures at $0.08/kWh and $200/kW. There were a total of five custom projects, the same count as FY2013, totaling $655,629.

The internal review process for this program as revised in FY2013 continued in FY2014. Customers are now required to submit explanations for their projected savings along with equipment

[1] https://sam.nrel.gov

information. Each project is reviewed individually, and an appropriate measurement and verification (M&V) plan is developed and provided to the customer. M&V is performed both before and after installation of new equipment, providing a high confidence in the calculation of actual energy savings achieved on each project.

### 4.5.2 Savings Calculations

Savings calculations followed standard industry procedures for each given application. A combination of measured data and manufacturer specifications was generally used, along with engineering assumptions where appropriate.

### 4.5.3 Findings and Recommendations

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

**Table 4-7: Commercial Custom Gross Energy and Demand Savings**

| Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|
| 7,366,738 | 331 | 331 |

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

- Continue requiring customers to submit information and calculations before projects begin work
- Continue performing M&V on each project until project volume increases significantly, at which point a threshold approach should be considered that would send projects to either M&V or simplified desk review based on factors such as rebate level and project complexity

## 4.6 NEW CONSTRUCTION

### 4.6.1 Overview

In FY2014, CPS Energy paid incentives totaling $679,396 for four commercial new construction projects at the following rates:

- $0.08/kWh and $125/kW for savings 15-25% above code
- $0.12/kWh and $150/kW for savings 25-35% above code
- $0.20/kWh and $200/kW for savings beyond 35% above code

In comparison, three commercial new construction projects were rebated in FY2013.

The internal review process for this program as revised in FY2013 continued in FY2014. Customers are now required to submit whole building energy models in approved software and complete sets of design documents. Each project is reviewed, with energy models first compared to design documents to confirm accurate modeling and then compared to ASHRAE baselines to confirm calculations of savings relative to code.

### 4.6.2 Savings Calculations

Savings calculations were based on confirmed energy models. The models provide savings between the new building design and a corresponding baseline designed to meet minimum code requirements.

### 4.6.3 Findings and Recommendations

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

**Table 4-8: Commercial New Construction Gross Energy and Demand Savings**

| Energy Savings (kWh) | Peak Demand Savings (kW) | Non-coinc. Demand Savings (kW) |
|---|---|---|
| 5,001,811 | 861 | 861 |

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

- Continue requiring customers to submit whole building energy models and complete sets of design documents
- Because of the relatively small number of projects, continue requiring detailed reviews of models and design documents relative to ASHRAE guidelines

## 4.7 INSPECTION METHODOLOGY

As part of the measurement and verification process for commercial projects, Nexant randomly selected the following projects for inspection. Site inspections were included in the process for strategically selected programs. For FY2014, site inspections were conducted for the Commercial HVAC and Lighting programs, since these programs are major savings contributors to the overall portfolio, and since site visits were not conducted for these programs in FY2013.

**Table 4-9: Initial Random Sample for Inspection**

| Program | Customer Name |
|---|---|
| Commercial Lighting | HEB #466 |
| | HEB #389 |
| | Valero #1020 |
| | Valero #2165 |
| | Alamo Concrete |
| | Rosemont Realty |
| | ACCD Live Oak Building 6 |
| | ACCD SPC Building 17 |
| | ACCD SPC Portable Building 22 |
| | Goodwill Industries |
| | University United Methodist Church |
| Commercial HVAC | Mount Zion Baptist |
| | Home Depot |
| | St Luke's Episcopal Church |
| | St Luke's Catholic Church |
| | SA ISD – Kazen Middle School |
| | SA ISD – Shepard Middle School |
| | SA ISD – Madia Elementary School |
| | SP Plaza |
| | University Health Building D |
| | Five & Dime |

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.

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.

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.

**Table 4-10: Inspected Sample**

| Program | Number of Program Participants | Number of Inspected Projects |
|---|---|---|
| Commercial Lighting | 478 | 11 |
| Commercial HVAC | 81 | 10 |

## 5.1 SUMMARY OF DEMAND RESPONSE IMPACTS

CPS Energy offered the following programs for demand response in FY2014:

- Residential Smart Thermostat Program
- Residential Home Manager 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 SMART THERMOSTAT PROGRAM

### 5.2.1 Overview

CPS Energy's Smart Thermostat 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 FY2014, enrollment in the Smart Thermostat program reached a total of 80,688 customers by the end of the program year. This corresponds to a 15% increase over program participation levels from FY2013.

During the summer of FY2014, 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, 19 control events were called in the summer of FY2013.

### 5.2.2 Savings Calculations

During FY2014, Nexant conducted an in-depth impact evaluation on the Smart Thermostat program. Results from this study were used to update the savings values for each sector of the program.

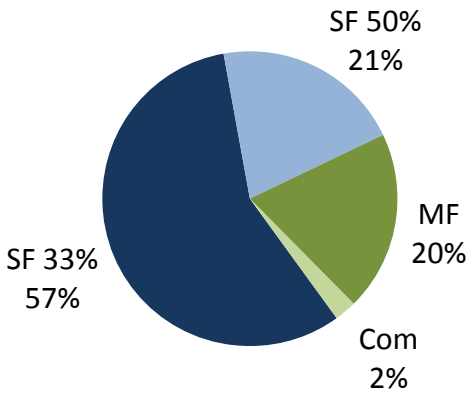
For the impact evaluation, data was collected from a combination of independently installed data loggers and CPS Energy's AMI meter data, as available. Linear regression analysis was conducted on data from each sector of the Smart Thermostat population separately (Residential 33% cycling, Residential 50% cycling, Multi-Family, and Commercial) to quantify the relationship between baseline electric loads, event impacts, and outdoor weather conditions. The output of the regression analysis is a mathematical expression that can be manipulated to express the impact of the FY2014 Smart Thermostat events, as well as provide insight into how the Smart Thermostat program could be expected to perform in future events under different conditions.

The average hourly event impact per customer at various temperature bins for each sector are presented in Table 5-1 below.

**Table 5-1: Load Impact Results by Cycling Strategy**

| Sector | Bin | Average Hourly Event Impact (kW) |
|---|---|---|
| Single-Family 33% Cycling | 90-94° | 0.33 |
| | 95-99° | 0.41 |
| | 100-104° | 0.49 |
| Single-Family 50% Cycling | 90-94° | 0.48 |
| | 95-99° | 0.60 |
| | 100-104° | 0.72 |
| Multi-Family | 90-94° | 0.17 |
| | 95-99° | 0.21 |
| | 100-104° | 0.25 |
| Commercial | 90-94° | 0.30 |
| | 95-99° | 0.38 |
| | 100-104° | 0.46 |

FY2014 participation levels and weather conditions were applied to the results listed in Table 5-1 to calculate kW savings for each event for three customer sectors. The enrolled kW available for curtailment is 36,688 kW. Sector contributions to the total enrolled kW are displayed graphically in Figure 5-1 below.




To determine the achieved energy impacts (kWh) during the summer of FY2014, 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. This information was coupled with the snapback results measured during the impact evaluation for each sector. The achieved energy savings is 1,028,788 kWh.

### 5.2.3 Findings and Recommendations

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

**Table 5-2: Smart Thermostat Gross Energy and Demand Savings**

| Energy Savings (kWh) | Peak Demand Savings (enrolled kW) | Non-coinc. Demand Savings (enrolled kW) |
|---|---|---|
| 1,028,788 | 36,688 | 36,688 |

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

## 5.3 HOME MANAGER PROGRAM

### 5.3.1 Overview

CPS Energy's Home Manager Program is a comprehensive electric load monitoring and direct load control program for residential customers. Equipment controlled through the program includes HVAC units, electric hot water heaters, and pool pumps. Enrollment in the program is free, and the program equipment and web-based interface are the incentive for participation. Enrollment includes installation of the free programmable thermostat and web-based access to equipment scheduling capabilities in exchange for the agreement to allow CPS Energy remote access to take control of equipment during system peak periods.

This program achieved a population of 16,467 residential customers by the end of the FY2014 program year, a 111% increase over FY2013.

The Home Manager system controls three types of devices: HVAC units, electric water heaters, and pool pumps. CPS Energy can call load reduction events for the Home Manager population as necessary to reduce system electric loads. When an event is called, all Home Manager thermostats are adjusted upward by four degrees Fahrenheit from their pre-event setpoints. Water heaters and pool pumps are powered off for the duration of the event. Customers have the ability to reset their thermostat setpoints or drop completely out of the event at any time. In FY2014, CPS Energy called 10 official System Test Events, from June 20 through September 12, ranging from 1.75 to 2.5 hours in duration.

### 5.3.2 Event kW and kWh Savings

To determine peak kW savings attributable to the Home Manager program, Nexant conducted a linear regression analysis on premise-level and device-level energy consumption data collected by the Home Manager system. Regression analysis is a statistical method of quantifying the impact of event participation by isolating the effect of other independent variables such as weather conditions. Load data from non-event days is used to form a mathematical baseline which is then extrapolated to the conditions experienced on event days. Load data during events is analyzed collectively, resulting in a mathematical relationship that also describes event impacts.

All residences with complete datasets were included in the analysis (over 96% of the population) in order to minimize uncertainty associated with sampling. Throughout the regression analysis process, Nexant reviewed key fit statistics to assess the predictive accuracy of the model. The final regression model exhibited strong statistical accuracy and goodness of fit, indicating that the results of the regression analysis are unbiased and exhibit a narrow margin of error (±7.4% at 95% confidence).

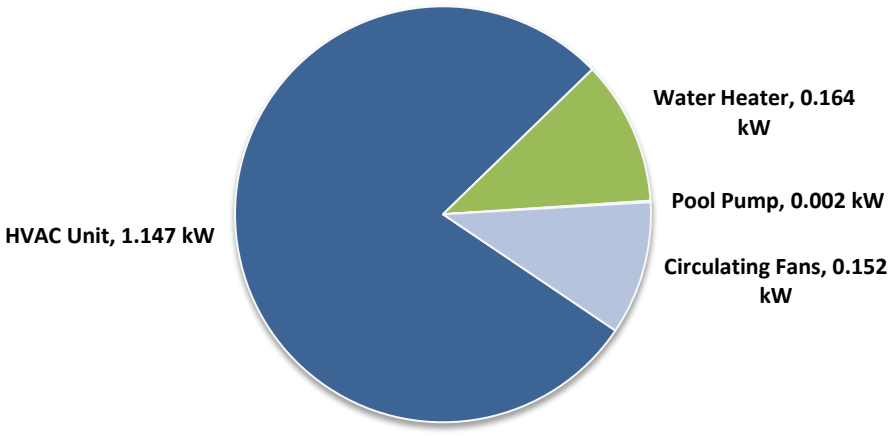
The average impact achieved by the program across all 10 System Test Events was 1.454 kW per customer. This value is averaged across all participants and all event hours. Table 5-3 lists the impact of each of the 10 System Test Events.

**Table 5-3: Home Manager System Test Event Impacts, Summer FY2014**

| Event Day | Event Duration (hrs) | Max Temperature (F) | Average Impact per Home (kW) |
|---|---|---|---|
| 6/20/2013 | 2.5 | 93 | 1.017 |
| 6/27/2013 | 2 | 99 | 1.470 |
| 7/25/2013 | 2 | 99 | 1.471 |
| 7/31/2013 | 2 | 102 | 1.598 |
| 8/1/2013 | 2 | 102 | 1.633 |
| 8/7/2013 | 2 | 103 | 1.688 |
| 8/22/2013 | 2 | 96 | 1.308 |
| 8/30/2013 | 2 | 102 | 1.553 |
| 9/3/2013 | 1.75 | 100 | 1.627 |
| 9/12/2013 | 2 | 96 | 1.280 |
| **System Test Value** | | | **1.464** |

Figure 5-2 is a graphical representation of the impact results at the device level, showing the makeup of event impact attributable to each device type.

**Figure 5-2: Device Contributions to Event Impact (kW)**



Nexant also conducted analysis on the post-event snapback energy usage to quantify the average energy impact of event participation. The snapback was conducted by extending the premise-level regression analysis into the post-event time period. Snapback was investigated from the end of each event until midnight of the event day.

Table 5-4 shows the results of the snapback analysis for the Summer FY2014 period. On average, Home Manager customers save 2.94 kWh during event hours. In the snapback period after events end, energy consumption in the residences is higher by about 1.40 kWh. The net effect on the average residence is a savings of 1.54 kWh. Average event day kWh consumption was determined to be 76.49 kWh per residence, so the event participation energy savings equates to a 2.01% reduction in daily energy use.

**Table 5-4: Snapback Results**

| Parameter | kWh |
|---|---|
| Event Period kWh Saved | 2.94 |
| Snapback kWh | -1.40 |
| Net Energy Savings | 1.54 |

### 5.3.3 Findings and Recommendations

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

**Table 5-5: Home Manager Gross Energy and Demand Savings**

| Energy Savings (kWh) | Peak Demand Savings (enrolled kW) | Non-coinc. Demand Savings (enrolled kW) |
|---|---|---|
| 181,394 | 24,115 | 24,115 |

- The savings values presented in this report are specific to the type of event called in FY2014. Any significant changes to the program's structure could change the level of demand savings. Demand savings should be reevaluated following any major change in future event types or system configuration.

## 5.4 COMMERCIAL AND INDUSTRIAL DEMAND RESPONSE PROGRAM

### 5.4.1 Overview

The Commercial and Industrial Demand Response (C&I 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 FY2014, CPS Energy enrolled 194 customers in the C&I DR program. This corresponds to

a 31% increase in program participation from FY2013. 18 curtailment events were called between June and September, compared to 17 events in FY2013.

### 5.4.2 Savings Calculations

CPS Energy collected participating facility load data and calculated the kW and kWh savings that were achieved during the FY2014 C&I 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. Independently apply CPS Energy's baseline calculation methodology and event data to calculate the load impacts and energy savings. The kW and kWh savings were calculated for the all event days for all customers.
3. Divide the Nexant-calculated savings by the CPS-calculated savings to derive program kW and kWh realization rates.

CPS Energy's baseline methodology is a "Highest 3 of 10" method, with a Day-Of multiplicative adjustment. Under this method, baseline load is calculated from the three days with highest loads among the previous ten (10) eligible (business) days prior to the event day. The kW load shape for these 3 days are 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 a 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 using a method that varies slightly from CPS Energy's methodology. For FY2014, CPS Energy calculated the baseline shift factor by comparing loads on the event day and the estimated baseline loads from the hour of 1PM to 2PM. In certain cases where this baseline shift does not result in appropriate baseline calculations, CPS Energy relies on alternate methods of baseline determination, such as custom selection of proxy baseline days.

For FY2014, Nexant used a one-hour window starting three hours before each event to determine the baseline shift factor for each customer. Nexant also modified the baseline calculation in two instances where appropriate:

1. For three specific industrial facilities, Nexant determined a baseline by averaging all summer non-event days. These facilities have highly variable process loads that are completely independent of weather, and generally independent of time of day and day of week. With this high variability of load throughout the summer, the most appropriate baseline was determined to be a simple average.

2. For four specific event days (7/11, 8/1, 9/12, 9/25), Nexant opted to use a different window for determining the baseline shift factor. On these days, the window starting three hours prior to the event time was determined to fall during a "slump" in facility loads (likely due to lunch break slowdown). Thus, Nexant used a one hour window starting two hours prior for these days.

### 5.4.3 Findings and Recommendations

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

**Table 5-6: Demand Response Gross Energy and Demand Savings**

| Energy Savings (kWh) | Peak Demand Savings (average event kW) | Non-coinc. Demand Savings (average event kW) |
|---|---|---|
| 2,430,507 | 66,802 | 66,802 |

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

- CPS Energy is correctly applying the "Highest 3 of 10" baseline methodology employing a baseline adjustment factor calculated from the 1PM – 2PM timeframe. Using similar methodology to verify CPS Energy's calculations, Nexant's realization rate was 98% for kW savings.
- Nexant recommends that CPS Energy conduct investigations into alternative baseline methodologies, to determine the least biased method for CPS Energy's specific customer base and weather patterns. A variety of different baseline methodologies are in use in similar C&I DR programs across the country. An increasingly common practice in the DR industry is to periodically compare results from a variety of baseline methodologies. Results of this type of study can be used to ensure that the least biased and most appropriate baseline methodology is used.
- CPS Energy's current calculation methodology is performed individually for each customer, for each event throughout the summer. Due to increases in program enrollment levels, Nexant recommends that CPS Energy implement a more uniform and automated means of calculating baselines and event curtailment levels. Using a more automated system would provide several benefits including increased transparency in baseline calculations and increased flexibility in adjusting baseline calculation methodologies program-wide.

# 6 TOTAL IMPACTS AND COST-EFFECTIVENESS SUMMARY

## 6.1 NET PROGRAM IMPACTS

Net-to-gross (NTG) ratios from other programs' experience and evaluations were used to calculate net impacts shown in Table 6-1. The values in Table 6-1 are the initial gross savings values shown in the various program section tables multiplied by the NTG ratios shown in Table 6-1. These ratios account for a variety of factors that result in actual realized savings being less than the savings projected by the simple sum of project level savings estimates.

**Table 6-1: FY2014 Program Net Impacts (*cost for LED Street Lights occurred in FY13)**

| Program | NTG Ratio | Net Impacts | | | Benefit-Cost Ratio |
|---|---|---|---|---|---|
| | | Energy Savings (kWh) | Peak Demand Savings (kW) | Non-Coinc. Demand Savings (kW) | |
| **Energy Efficiency Programs** | | | | | |
| Home Efficiency | 0.93 | 1,600,016 | 209 | 479 | 0.75 |
| Weatherization | 0.93 | 11,603,145 | 3,674 | 5,969 | 0.33 |
| Air Flow Performance | 0.90 | 461,797 | 265 | 265 | 0.37 |
| Residential HVAC | 0.95 | 11,290,482 | 3,279 | 4,099 | 2.27 |
| Residential Solar | 1.00 | 5,292,733 | 2,747 | 2,747 | 0.82 |
| New Homes Construction | 1.00 | 9,137,801 | 1,969 | 1,969 | 2.52 |
| Refrigerator Recycling | 0.63 | 492,521 | 45 | 57 | 1.23 |
| **Residential Subtotal** | | **39,878,496** | **12,188** | **15,584** | **0.82** |
| Lighting | 0.85 | 25,501,204 | 5,934 | 6,406 | 2.05 |
| Commercial HVAC | 0.96 | 5,747,478 | 4,230 | 5,386 | 2.11 |
| Commercial Solar | 1.00 | 3,683,857 | 2,110 | 2,110 | 0.92 |
| New Construction | 1.00 | 5,001,811 | 861 | 861 | 2.82 |
| LED Street Lights | 0.90 | 7,714,442 | 0 | 1,761 | NA* |
| Custom | 0.96 | 7,072,068 | 318 | 318 | 3.3 |
| **Commercial Subtotal** | | **54,720,860** | **13,453** | **16,843** | **2.01** |
| **Energy Efficiency Total** | | **94,599,356** | **25,640** | **32,427** | **1.19** |
| **Demand Response/Load Control Programs** | | | | | |
| Smart Thermostat | 1.00 | 1,028,788 | 36,688 | 36,688 | 4.67 |
| Home Manager | 1.00 | 181,394 | 24,115 | 24,115 | 1.80 |
| C&I Demand Response | 1.00 | 2,430,507 | 66,802 | 66,802 | 0.93 |
| **Demand Response Total** | | **3,640,689** | **127,606** | **127,606** | **2.40** |
| **Grand Total** | | **98,240,045** | **153,247** | **160,033** | **1.59** |

The LED Street Lights program is included in the savings numbers provided in this section. The full rebate for the entire program was paid and accounted for fully in FY13, so no rebates or program costs are included this year. Also, the methodology used in FY13 involved crediting only the number of bulbs corresponding to the total program rebate amount spent, assuming 100% of the lighting project cost was paid by the rebate. However, because of the way other programs run and the industry standard of crediting a project's full savings even when the rebate only covers a portion of the project cost, this year's calculations include both lights installed in FY14 and lights installed in FY13 that were not credited in the FY13 M&V. The BC ratio was reported as 0.46 for FY13 but is expected to exceed 2.5 by the end of the final installation in FY15.

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

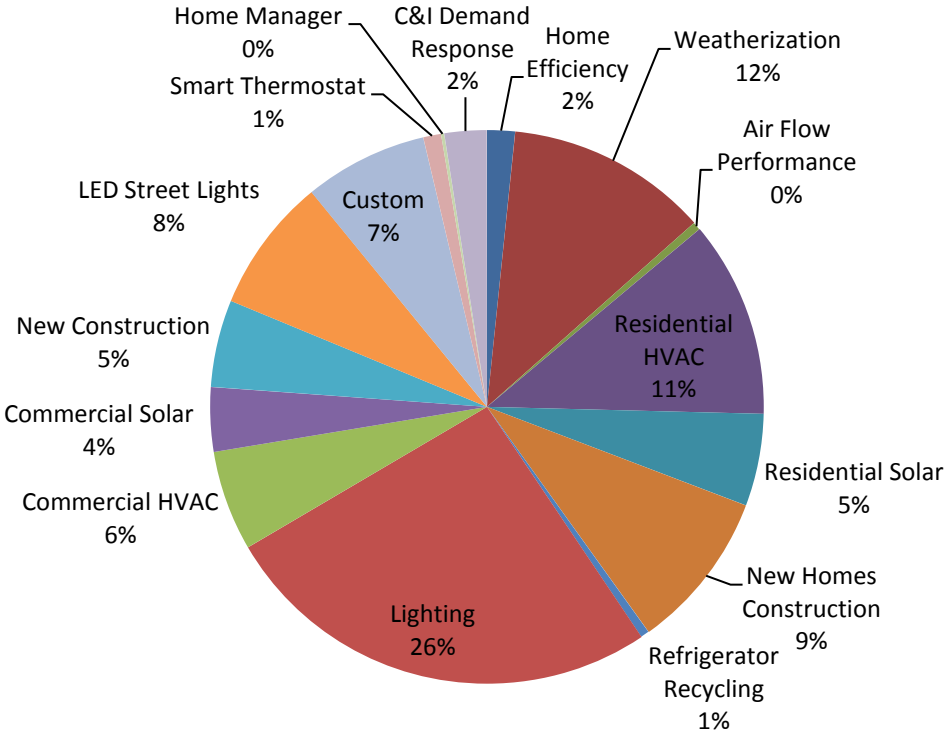



**Figure 6-1: FY2014 Energy (kWh) Savings by Program**

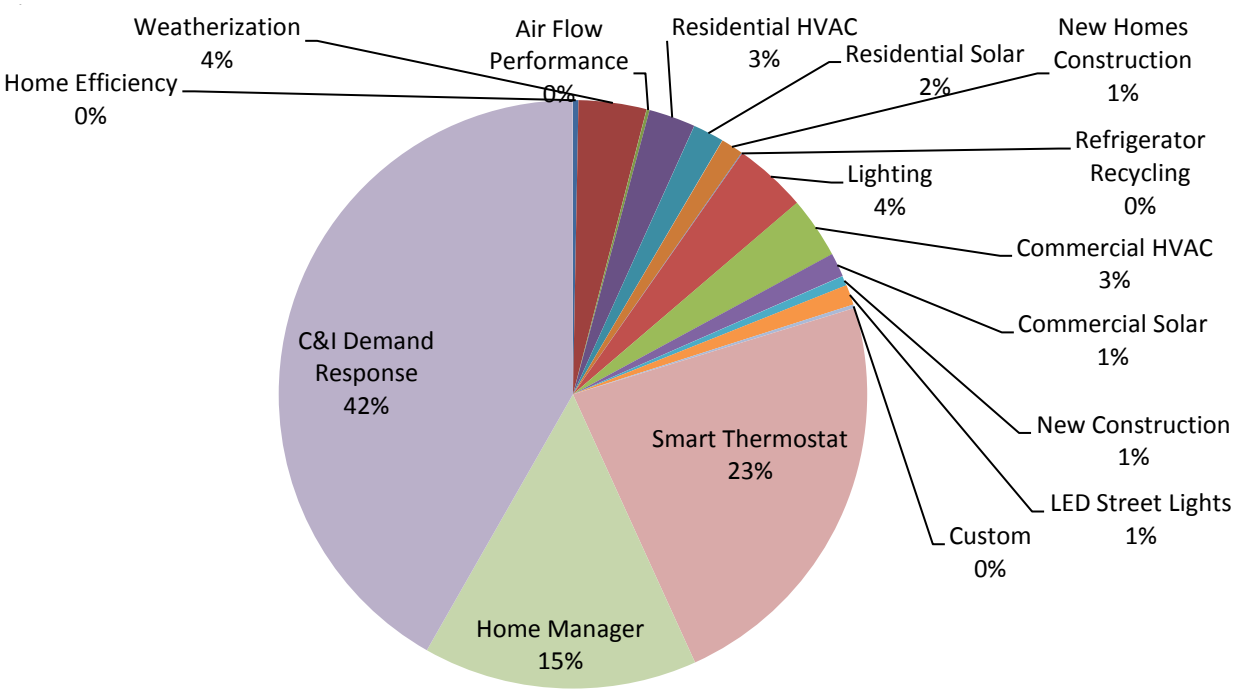



**Figure 6-2: FY2014 Non Coincident Demand (kW) Savings by Program**

Figure 6-3 presents a comparison of the non-coincident demand savings achieved by the FY2014 program offerings compared with program results from prior years:

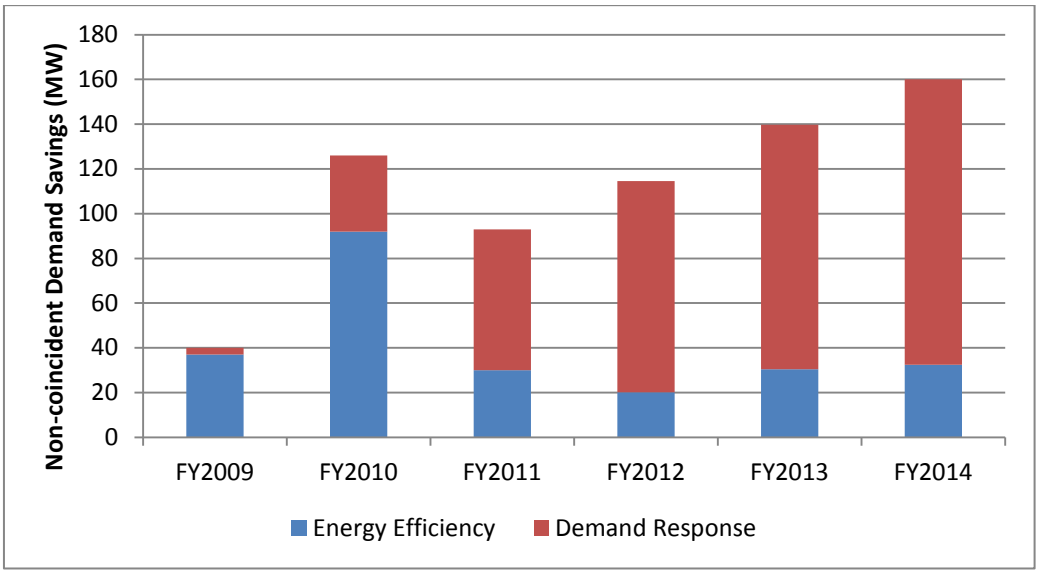



**Figure 6-3: Comparison of Annual Non-Coincident Demand (kW) Savings**

## 6.2 ECONOMIC ANALYSIS

The economic evaluation of CPS Energy's DSM program offerings included collection of all program-related costs such as incentives paid directly to customers, marketing outreach to customers and contractors, internal labor costs and incentives provided to CPS Energy staff, and consultant fees (Table 6-2). The economic impacts of the portfolio are shown below.

- Cost of Saved Energy {excludes DR} ($/kWh): $0.044
- Reduction in Revenue Requirements: $37,537,814
- Benefit Cost Ratio: 1.59

**Table 6-2: FY2014 Program Expenditures**

| Program | Total Incentives Paid | Admin. & Marketing Cost |
|---|---|---|
| **Energy Efficiency Programs** | | |
| Home Efficiency | $745,558 | $143,080 |
| Weatherization | $14,256,958 | $1,726,884 |
| Air Flow Performance | $709,169 | $118,292 |
| Residential HVAC | $3,424,560 | $428,144 |
| Residential Solar | $5,739,276 | $754,636 |
| New Homes Construction | $1,455,100 | $179,915 |
| Refrigerator Recycling | $56,055 | $89,815 |
| **Residential Subtotal** | **$26,386,675** | **$3,440,767** |
| Lighting | $4,374,086 | $628,334 |
| Commercial HVAC | $2,246,077 | $331,697 |
| Commercial Solar | $3,755,814 | $456,473 |
| New Construction | $679,396 | $111,328 |
| Custom | $655,629 | $98,234 |
| **Commercial Subtotal** | **$11,711,001** | **$1,626,067** |
| **Energy Efficiency Total** | **$38,097,676** | **$5,066,834** |
| **Demand Response/Load Control Programs** | | |
| Smart Thermostat | $5,855,338 | $48,981 |
| Home Manager | $7,414,497 | $2,559,548 |
| C&I Demand Response | $4,894,008 | $91,750 |
| **Demand Response Total** | **$18,163,843** | **$2,700,279** |
| **Grand Total** | **$56,261,519** | **$7,767,112** |
| **Total Portfolio Cost** | **$64,028,631** | |

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