CenterPoint Energy
2007 C&I Standard Offer Program
Appendices

These appendices include tables of minimum equipment efficiency standards for cooling, lighting, and motors, as well as other supplemental information about the program. This information is also available on the program Web site at **http://www.centerpointcisop.com/**.

A Standard Cooling Equipment Tables

A.1 Overview

This document contains reference data for estimating demand and energy savings for cooling equipment in the C&I Standard Offer Program. The data are equipment efficiency standards or climate data that will be used to develop the baseline system models and to evaluate savings for all projects under the C&I Standard Offer Program.

Cooling equipment installed under the program must exceed the minimum new equipment efficiency standards shown in the tables. In addition, the minimum baseline efficiencies define the baseline for calculating energy savings. The guidelines in Section III (M&V Guidelines), Chapter 3 (Guidelines for Cooling Equipment) describe the application of these equipment efficiency standards and coefficient tables for estimating baseline demand and energy use and cooling equipment demand and energy savings.

For the following types of cooling equipment, baseline efficiency ratings are provided in Table A.1 through Table A.8 below:

- Unitary air conditioners and heat pumps (air cooled, evaporatively cooled, or water cooled)
- Packaged-terminal air conditioners and heat pumps
- Room air conditioners and heat pumps
- Water-source and ground-water source heat pumps
- Water- and air-cooled water chilling packages

Table A.1 through Table A.8 are based on American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.1-1989 and ASHRAE Standard 90.1-1999. The tables present the minimum efficiencies of particular types of cooling equipment. The performance standard data in these tables should be used to determine the rated baseline equipment efficiencies.

The baseline efficiency for existing equipment shall be established as the 1989 standard efficiency. The baseline for equipment for which rating conditions are not provided shall be defined as the energy consumption of the actual existing equipment.

Table A.9 of this document presents the cooling degree-days (CDD) for a weather station located in the CenterPoint Energy distribution service territory. Cooling degree-day data are used to normalize metered energy consumption to a typical meteorological year (TMY2). M&V Guideline 3 describes the application of weather data for estimating baseline energy use and cooling equipment energy savings.

Table A.10 provides the coefficients necessary to complete the air-conditioning equipment *deemed savings* calculation described in Section III, Chapter 3.

A.2 Tables

Table A.1: Standard rating conditions and minimum performance for unitary air conditioners and heat pumps, air cooled, electric, <135,000 Btu/hr (< 11.25 tons) capacity, - Except packaged terminal and room air conditioners.

Mode	Cooling Capacity		Rating Condition, °F db	Type	Baseline Performance Standard[1]	Minimum Performance Standard[2]
	Btu/hr	tons				
Cooling mode	< 65,000	< 5.42	Seasonal	Split	10.0 SEER	10.0 SEER
	< 65,000	< 5.42	Seasonal	Packaged	9.7 SEER	9.7 SEER
	≥ 65,000 & < 135,000	≥ 5.42 & < 11.25	95	Packaged and split	8.9 EER	10.3 EER†

† Deduct 0.2 from the required EERs for units with a heating section other than electric resistance heat.

$$Performance\left(\frac{kW}{ton}\right) = \frac{1}{EER}\left(\frac{Watt \cdot hr}{Btu_{out}}\right) * 12{,}000\left(\frac{Btu_{out}}{ton \cdot hr}\right) * \frac{1}{1{,}000}\left(\frac{kW}{Watt}\right) = \frac{12}{EER}\left(\frac{kW}{ton}\right)$$

Table A.2: Standard rating conditions and minimum performance for unitary air conditioners and heat pumps – evaporatively cooled, electric, <135,000 Btuh (< 11.25 tons) cooling capacity.

Cooling Capacity		Rating indoor air °F db / °F wb	Rating outdoor air °F db/°F wb	Baseline Performance Standard[3]	Minimum Performance Standard[4]
Btuh	tons				
< 65,000	< 5.42	80/67	95/75	9.3 EER	12.1 EER
≥ 65,000 & < 135,000	≥ 5.42 & < 11.25	80/67	95/75	10.5 EER†	11.5 EER†

† Deduct 0.2 from the required EERs for units with a heating section other than electric resistance heat.

[1] Reference: ASHRAE Standard 90.1-1989, Table 10-1.
[2] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.A and Table 6.2.1.B.
[3] Reference: ASHRAE Standard 90.1-1989, Table 10-2.
[4] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.A.

Table A.3: Standard rating conditions and minimum performance for water-cooled air conditioners and heat pumps, electric, <135,000 Btuh (< 11.25 tons) capacity.

Equipment	Cooling capacity, BTU/h	Rating Condition, air °F db / °F wb	Rating Condition, entering water °F	Baseline Performance Standard[5]	Minimum Performance Standard[6]
Water cooled heat pumps	< 65,000	80/67	85	9.3 EER	-
			86	-	12.0 EER†
	≥ 65,000 and <135,000	80/67	85	10.5 EER	-
			86	-	12.0 EER
Ground water cooled heat pumps	< 135,000	80/67	70	11.0 EER	-
			59	-	16.2 EER
Water cooled unitary air conditioners	< 65,000	80/67	85	9.3 EER	-
			86	-	12.1 EER
	≥ 65,000 and <135,000	80/67	85	10.5 EER	-
			86	-	11.5 EER††

† For units with capacities less than 17,000 Btu/h, the minimum efficiency is 11.2 EER.
†† Deduct 0.2 from the required EERs for units with a heating section other than electric resistance heat.

Table A.4: Standard rating conditions and minimum performance for packaged terminal air conditioners and heat pumps, air-cooled, electric

Mode	Rating condition, outside air °F db	Baseline Performance Standard†[7]	Minimum Performance Standard[8]
Cooling	95	10-(0.16 * Cap/1000) EER	12.5-(0.213 * Cap/1000) EER
Cooling	82	12.2-(0.20 * Cap/1000) EER	-

† Cap is the rated cooling capacity of the unit in Btu/h. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

[5] Reference: ASHRAE Standard 90.1-1989, Table 10-3 and Table 10-5.
[6] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.B.
[7] Reference: ASHRAE Standard 90.1-1989, Table 10-4A.
[8] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.D.

Table A.5: Standard rating conditions and minimum performance for room air conditioners and room air conditioner heat pumps, electric

Category	Capacity, BTUH	Baseline performance standard (EER)[9]	Minimum Performance Standard (EER)[10]
Without reverse cycle and with louvered sides	< 6,000	8.0	9.7
	≥ 6,000 and <8,000	8.5	9.7
	≥ 8,000 and <14,000	9.0	9.8
	≥ 14,000 and <20,000	8.8	9.7
	≥ 20,000	8.2	8.5
Without reverse cycle and without louvered sides	< 6,000	8.0	9.0
	≥ 6,000 and <20,000	8.5	8.5
	≥ 20,000	8.2	8.5
With reverse cycle and with louvered sides	< 20,000	8.5	9.0
	≥ 20,000	8.5	8.5
With reverse cycle and without louvered sides	< 14,000	8.0	8.5
	≥ 14,000	8.0	8.0

[9] Reference: ASHRAE Standard 90.1-1989, Table 10-4B.
[10] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.D.

Table A.6: Baseline and minimum performance standards for large unitary air conditioners and heat pumps, electric, ≥ 135,000 Btuh (≥ 11.25 tons) capacity.

Equipment Type	Cooling Capacity		Baseline Performance Standard[11]		Minimum Performance Standard[12]	
	Btuh	tons	EER	kW/ton	EER	kW/ton
Air cooled air conditioners	≥ 135,000 & <240,000	≥ 11.25 & < 20.00	8.5	1.412	9.7†	1.237
	≥ 240,000 & <760,000	≥ 20.00 & < 63.33	8.5	1.412	9.5†	1.263
	≥ 760,000	≥ 63.33	8.2	1.463	9.2†	1.304
Water or evaporatively cooled air conditioners	≥ 135,000	≥ 11.25	9.6	1.250	11.0	1.091
Air cooled heat pumps	≥ 135,000 & <240,000	≥ 11.25 & < 20.00	8.5†	1.412	9.3†	1.290
	≥ 240,000 & <760,000	≥ 20.00 & < 63.33	8.5†	1.412	9.0†	1.333
	≥ 760,000	≥ 63.33	8.7†	1.379	9.0†	1.333
Air cooled condensing units	≥ 135,000	≥ 11.25	9.9	1.212	10.1	1.188
Water or evaporatively cooled condensing units	≥ 135,000	≥ 11.25	12.9	0.930	13.1	0.916

† Deduct 0.2 from the required EERs for units with a heating section other than electric resistance heat.

$$Performance\left(\frac{kW}{ton}\right) = \frac{1}{EER}\left(\frac{Watt \cdot hr}{Btu_{out}}\right) * 12{,}000\left(\frac{Btu_{out}}{ton \cdot hr}\right) * \frac{1}{1{,}000}\left(\frac{kW}{Watt}\right) = \frac{12}{EER}\left(\frac{kW}{ton}\right)$$

[11] Reference: ASHRAE Standard 90.1-1989, Table 10-6.
[12] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.A and Table 6.2.1.B.

Table A.7: Baseline and minimum performance standards for water chilling packages, electric.

Equipment Type	Cooling Capacity (tons)	Baseline Performance Standard[13]		Minimum Performance Standard[14]	
		COP	kW/ton	COP	kW/ton
Water cooled, positive displacement (rotary screw, scroll)	< 150	3.80	0.926	4.45	0.790
	≥ 150 and <300	4.20	0.837	4.90	0.718
	≥ 300	4.70	0.748	5.50	0.639
Water cooled, centrifugal	< 150	3.80	0.926	5.00	0.703
	≥ 150 and <300	4.20	0.837	5.55	0.634
	≥ 300	4.70	0.748	6.10	0.577
Air cooled with condenser	< 150	2.70	1.303	2.80	1.256
	≥ 150	2.50	1.407	2.80	1.256
Air cooled without condenser	All	3.10	1.135	3.10	1.135

$$Performance\left(\frac{kW}{ton}\right) = \frac{1}{COP}\left(\frac{Btu_{in}}{Btu_{out}}\right) * 12{,}000\left(\frac{Btu_{out}}{ton \cdot hr}\right) * \frac{1}{3{,}412}\left(\frac{kWh}{Btu_{in}}\right) = \frac{3.517}{COP}\left(\frac{kW}{ton}\right)$$

Table A.8: Standard rating conditions and minimum performance for water chilling packages, gas absorption

Equipment Type	Cooling Capacity	Baseline Performance Standard[15] (COP)	Minimum Performance Standard[16] (COP)
Air-cooled absorption, single-effect	All capacities	0.48	0.60
Water-cooled absorption, single-effect	All capacities	0.60	0.70
Absorption double effect, indirect-fired	All capacities	0.95	1.00
Absorption double effect, direct-fired	All capacities	0.95	1.00

Table A.9: TMY2 Cooling Degree Days (base 65) for the CenterPoint Energy service territory

Weather Station	WBAN No.	CDD_{65} (^oF day)
Houston	12960	**2,810**

[13] Reference: ASHRAE Standard 90.1-1989, Table 10-7.
[14] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.C.
[15] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.C.
[16] Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.C.

Table A.10: Deemed savings coefficients for the Houston, TX climate for various building types and equipment types.

Building Type	Demand Coefficient			Energy Coefficient		
	Air Cooled Chiller	Water Cooled Chiller	DX Air Cooled	Air Cooled Chiller	Water Cooled Chiller	DX Air Cooled
College	0.80	0.84	0.85	1,858	2,099	2,175
Convenience			0.88			4,168
Fast Food			0.87			3,365
Grocery		0.88	0.87		3,012	2,935
Hospital	1.05	0.85		2,781	3,172	
Hotel	0.80	0.88	0.84	1,831	1,981	2,266
Motel			0.84			2,404
Nursing Home	0.80	0.84	0.84	1,960	2,172	2,368
Large Office	0.81	0.90	0.85	2,501	2,786	2,750
Small Office	0.81	0.87	0.85	1,860	1,990	2,158
Public Assembly	0.81	0.86	0.86	2,264	2,482	2,559
Restaurant			0.86			2,548
Religious Worship	0.83	0.84	0.87	1,474	1,594	2,028
Retail	0.80	0.84	0.84	2,003	2,162	2,381
School	0.80	0.84	0.85	1,280	1,489	1,639
Service			0.87			2,429
Warehouse	0.84	0.87	0.88	1,534	1,673	2,248

B Table of Standard Motor Efficiencies

B.1 Overview

This document contains reference data for estimating demand and energy savings in C&I Standard Offer Program for energy efficient motors and related measures. For motors installed under the program, the equipment must exceed these minimum efficiency standards. In addition, the minimum efficiencies define the baseline for calculating demand and energy savings. M&V Guideline 4 for motor measures describes the application of these equipment efficiency standards for estimating baseline demand and energy use and measure demand and energy savings.

B.2 Table

The efficiencies of permanently wired, poly-phase motors that are at least one horsepower in size and that are used for fan, pumping, and conveyance applications are defined in Table B.1. Table B.1 is based on ASHRAE Standard 90.1m-1995. Note, however, that the following motors are exempt from these requirements:

- Motors in appliances.
- Refrigeration compressor motors.
- Multi-speed motors.
- Motors that are used as components of cooling equipment where the motors are part of the efficiency ratings listed in the Standard Cooling Equipment Tables.

The efficiency values given in Table B.1 should be used to determine the equipment baseline. Equipment installed under the C&I Standard Offer Program must be more efficient than the standards shown in order to be eligible for incentives.

Table B.1: Minimum nominal full-load motor efficiency for single speed poly-phase motors

Motor	Horsepower	2-Pole	4-Pole	6-Pole	8-Pole
Open	1.0	--	81.5	78.5	72.0
	1.5	81.5	82.5	82.5	74.0
	2.0	82.5	82.5	84.0	84.0
	3.0	82.5	85.5	85.5	85.5
	5.0	84.0	86.5	86.5	86.0
	7.5	86.5	87.5	87.5	87.5
	10.0	87.5	88.5	89.5	88.5
	15.0	88.5	90.2	89.5	88.5
	20.0	89.5	90.2	90.2	89.5
	25.0	90.2	91.0	91.0	89.5
	30.0	90.2	91.7	91.7	90.2
	40.0	91.0	92.4	92.4	90.2
	50.0	91.7	92.4	92.4	91.0
	60.0	92.4	93.0	93.0	91.7
	75.0	92.4	93.6	93.0	93.0
	100.0	92.4	93.6	93.6	93.0
	125.0	93.0	94.1	93.6	93.0
	150.0	93.0	94.5	94.1	93.0
	200.0	94.1	94.5	94.1	93.0
Enclosed	1.0	74.0	81.5	78.5	72.0
	1.5	81.5	82.5	84.0	75.5
	2.0	82.5	82.5	85.5	81.5
	3.0	84.0	86.5	86.5	82.5
	5.0	86.5	86.5	86.5	84.0
	7.5	87.5	88.5	88.5	84.0
	10.0	88.5	88.5	88.5	87.5
	15.0	89.5	90.2	89.5	87.5
	20.0	89.5	90.2	89.5	88.5
	25.0	90.2	91.7	91.0	88.5
	30.0	90.2	91.7	91.0	90.2
	40.0	91.0	92.4	92.4	90.2
	50.0	91.7	92.4	92.4	91.0
	60.0	92.4	93.0	93.0	91.0
	75.0	92.4	93.6	93.0	92.4
	100.0	93.0	94.1	93.6	92.4
	125.0	94.1	94.1	93.6	93.0
	150.0	94.1	94.5	94.5	93.0
	200.0	94.5	94.5	94.5	93.6

C Table of Standard Fixture Wattages

C.1 Overview

The Table of Standard Fixture Wattages contains reference data for estimating demand and energy savings in the C&I Standard Offer Program for lighting measures. The Table assigns identification codes and demand values (watts) to common fixture types (fluorescent, incandescent, HID, LED, etc.) used in commercial applications. The Table wattage values for each fixture type are averages of various manufacturers' laboratory tests performed to ANSI test standards. By using standardized demand values for each fixture type, the Table simplifies the accounting procedures for lighting equipment retrofits.

CenterPoint Energy posts updated versions of the Table on the program Web site at http://www.centerpointefficiency.com as new fixtures are added. Project Sponsors should make sure that they are working with the most recent version of the Table as they prepare *Lighting Equipment Survey* forms.

If a project uses a fixture type not listed in the Table, the Sponsor should request that CenterPoint Energy add a new fixture code. The request should include all information required to uniquely identify the fixture type and to fix its demand. If possible, the request should be supported by manufacturer's ANSI test data.

The *Lighting Equipment Survey Form* is linked to a copy of the Standard Wattage Table and looks up wattage values for fixture codes automatically. For this reason, Sponsors should use only the identification codes included in the Table.

C.2 Table

The Table is subdivided into fixture types such as linear fluorescent, compact fluorescent, mercury vapor, etc, with each subdivision sorted by fixture code. Each record, or row, in the Table contains a fixture code, which serves as a unique identifier. Each record also includes a description of the fixture, the number of lamps, the number of ballasts if applicable, and the fixture wattage. A legend explains the rules behind the fixture codes.

The US Energy Policy Act of 1992 (EPACT) sets energy efficiency standards that preclude certain lamps and ballasts from being manufactured or imported into the US. Under the C&I Standard Offer Program 2002, all lighting equipment, including existing or baseline equipment, must be EPACT compliant. As a result, certain lamp/ballast combinations, which are non-EPACT compliant, are assigned EPACT demand values. Thus, a 4-foot fixture with 40-watt T-12 lamps and a standard magnetic ballast has the same demand value as a like fixture equipped with 34-watt T-12 lamps and an energy efficient magnetic ballast.

The fixture codes and the demand values listed in the watt/fixture column in the Table of Standard Fixture Wattages must be used in calculating energy and demand savings for any lighting efficiency project in the C&I Standard Offer Program.

D M&V Sampling Guidelines

D.1 Overview

This appendix provides guidelines for defining a sample of equipment for measurement and verification purposes. In sampling, a large number of similar pieces of equipment affected by the same energy-efficiency measure can be grouped into usage groups from which samples are selected. These sampling guidelines are designed to provide assistance in determining the number of sample points that should be monitored in order to meet the program precision requirements and provide a reliable estimate of parameters such as annual energy savings or hours of operation. If alternative approaches are proposed, they must be approved by CenterPoint Energy and based on sound statistical principles.

D.2 Steps in Calculating Sample Size

The number of pieces of equipment requiring monitoring can be calculated according to the following steps:

1. Compile measure information

Compile the following information for the equipment affected by the measures. This step is normally undertaken during the preparation of the Final Application.

- *Number of Fixtures/Equipment.* Identify and document the fixtures/equipment that are affected by the installation of measures in a survey that includes nameplate data, quantity of equipment, and location information.
- *Projected Hours of Operation*. Project the average hours of operation of the equipment. It should be based on the experience of the building operator, on the operation of the affected equipment or even some preliminary monitoring.

2. Designate usage group

Next, provide a brief description of the functional use of the space being audited. Functional uses typically encountered in lighting for commercial and industrial facilities are provided in Section III, Chapter 2, Table 2.3 of this manual. Usage groups for non-lighting measures are dependent on type of application. Sources of information on operating characteristics, other than monitoring, used in defining usage groups include: (a) operating schedules that provide information on energy consumption or hours of operation; and (b) type of application or location that provides information on how and when equipment (e.g., fixtures or motors) are operated. In some instances, area type alone may be insufficient to designate usage groups. Usage groups may need to be further subdivided if an area type is inherently variable in nature due to different characteristics of their occupants. For example, some laboratories may have longer operating hours than others and should be divided into different usage groups (e.g., computer laboratory lighting operates for 8 hours per day while agriculture laboratories operate 4 hours per day).

3. Calculate sample sizes

Once the equipment has been divided into usage groups, the total sample size needed for these groupings can be calculated. This approach produces a sample (with a coefficient of variation of 0.5) expected to estimate the average hours of operation with sufficient accuracy. The following table shows the number of samples required in a usage group.

Table D.1: Sample Size based on Usage Group Sampling

Usage Group Population	Sample Size 80/20	Sample Size 80/20, plus 10%
4	3	4
5	4	5
12	6	7
16	7	8
20	7	8
25	8	9
30	8	9
35	8	9
40	9	10
45	9	10
60	9	10
65	9	10
70	9	10
80	10	11
90	10	11
100	10	11
125	10	11
150	10	11
175	10	11
200	10	11
300	10	11
400	11	13
500	11	13

D.3 Over-sampling

The initial sample size should be increased to compensate for potential reductions in the final usable sample due to equipment failure or loss. Suggested guidelines are that the sample size be increased by 10 percent.

E Program and M&V Definitions

The following are definitions to commonly used terms in the CenterPoint Energy C&I Standard Offer Program:

Affiliate — (A) a person who directly or indirectly owns or holds at least 5.0% of the voting securities of an energy efficiency service provider; (B) a person in a chain of successive ownership of at least 5.0% of the voting securities of an energy efficiency service provider; (C) a corporation that has at least 5.0% of its voting securities owned or controlled, directly or indirectly, by an energy efficiency service provider; (D) a corporation that has at least 5.0% of its voting securities owned or controlled, directly or indirectly, by: (i) a person who directly or indirectly owns or controls at least 5.0% of the voting securities of an energy efficiency service provider; or (ii) a person in a chain of successive ownership of at least 5.0% of the voting securities of an energy efficiency service provider; or (E) a person who is an officer or director of an energy efficiency service provider or of a corporation in a chain of successive ownership of at least 5.0% of the voting securities of an energy efficiency service provider; (F) a person who actually exercises substantial influence or control over the policies and actions of an energy efficiency service provider; (G) a person over which the energy efficiency service provider exercises the control described in subparagraph (F) of this paragraph; (H) a person who exercises common control over an energy efficiency service provider, where "exercising common control over an energy efficiency service provider" means having the power, either directly or indirectly, to direct or cause the direction of the management or policies of an energy efficiency service provider, without regard to whether that power is established through ownership or voting of securities or any other direct or indirect means; or (I) a person who, together with one or more persons with whom the person is related by ownership, marriage or blood relationship, or by action in concert, actually exercises substantial influence over the policies and actions of an energy efficiency service provider even though neither person may qualify as an affiliate individually.

Baseline Energy Use: The calculated or measured energy use by a piece of equipment or a site prior to the implementation of the project measures. Baseline physical conditions, such as equipment counts, nameplate data, and control strategies, will typically be determined through surveys, inspections, and/or metering at the site.

Commission: The Public Utility Commission of Texas (PUCT).

Customer: Any individual CenterPoint Energy distribution customer (connected to the CenterPoint Energy distribution system) distinguished by a unique address or CenterPoint Energy account number (ESI ID). For purposes of the C&I Standard Offer Program, "site" is synonymous with "customer," and is also distinguished by a unique address or CenterPoint Energy account number (ESI ID).

Deemed Savings Estimates: A pre-determined, validated estimate of energy and peak demand savings attributable to an energy efficiency measure in a particular type of application that a utility may use instead of energy and peak demand savings determined through measurement and verification activities.

Demand Savings: The maximum one-hour average demand reduction (in kW) that occurs when the system undergoing retrofit is operating at peak conditions during the summer period. The summer period is defined as weekdays, between the hours of 1 PM and 7 PM from May 1 until September 30, excluding holidays.

Energy Efficiency Measure (EEM): A system, piece of equipment, or materials that result in either reduced electric energy consumption, or reduced peak demand, or both.

Energy Efficiency Project: An energy efficiency measure or combination of measures installed under a Standard Agreement that results in both a reduction in customers' electric energy consumption and peak demand, as well as a reduction in energy costs.

Energy Savings Estimates: Energy savings (in kWh) over 12 months derived from metering and/or calculations in accordance with the provisions of the approved measurement and verification plans, and documented in the Savings Report.

Final Application (FA): The purpose of the Final Application is to detail the expected demand and energy savings and incentive payments for each project, to be included in the Project Authorization, which is attached to the signed Standard Offer Program Contract between CenterPoint Energy and the Project Sponsor. The Final Application will require more complex engineering estimates than the IA, and will ask for a letter of intent from the customers involved in each application.

Full Measurement and Verification: A detailed estimate of savings using a higher level of rigor than in the deemed savings or simple M&B approaches through the application of metering, billing analysis, or computer simulation.

Initial Application (IA): In the IA, Project Sponsors must have identified customers and energy efficiency measures, but need not have completed a detailed engineering study. With the IA, CenterPoint Energy will collect a non-refundable deposit equal to 5% of the incentive funding requested. Approval by CenterPoint Energy of the IA signifies that funding has been reserved for the project.

Installation Payment: The first of two incentive payments made to a Project Sponsor. The installation payment is 40% of the total estimated incentive amount.

Installation Report (IR): After approval of the FA and issuance of a Project Authorization, a Project Sponsor may proceed to install the energy efficiency measures included in an application. After installation is complete, the Project Sponsor will submit an Installation Report giving details about the equipment actually installed at each customer site. Once CenterPoint Energy receives the IR, CenterPoint Energy or its M&V contractor will inspect the customer sites to ensure installation and operation of the equipment.

Measurement & Verification (M&V): A term referring to all necessary equipment surveys, metering and monitoring, statistical estimation and analysis, and reporting used to quantify the Energy and Demand savings resulting from the installation of EEMs. Any M&V approach will need to result in savings estimates that meet certain accuracy requirements.

Performance Payment: The second of two incentive payments that is equal to the balance of the incentive calculated from the actual savings minus the installation payment and may be up to 60% of the total estimated incentive payment.

Post-Installation (or Post-Retrofit) Energy Use: The calculated energy usage (or demand) by a piece of equipment or a site after implementation of the project. Post-installation energy use is verified by the Sponsor and CenterPoint Energy. They also verify that the reported equipment components or systems were installed, are operating, and have the potential to generate the predicted savings.

Power Adjustment Factor: A stipulated value used to estimate the reduction in operating hours associated with a lighting controls measure.

Pre-Installation (or Pre-Retrofit) Energy Use: The calculated energy usage (or demand) by a piece of equipment or a site before implementation of the project. Pre-installation energy use is verified by the Sponsor and CenterPoint Energy. They also verify that the existing equipment components or systems were properly documented and can be retrofitted to generate savings.

Project: The term "project" refers to a single application's set of proposed energy efficiency measures or other improvements that are necessary to produce energy savings under the program. To be eligible, a project must be expected to save at least 50 kW of peak demand and must be developed at a CenterPoint Energy commercial or industrial distribution customer's site.

Project Authorization: A document containing project savings and incentive estimates as stated in the approved FA. The CenterPoint Energy Program Manager and the Project Sponsor will sign the Project Authorization and attach it to the Standard Offer Contract. The Project Authorization is a signal to the Project Sponsor to begin the installation of EEMs.

Project-Specific M&V Plan: Plan providing details on how a specific project's savings will be verified based on the general M&V approaches contained in this document and the contract between CenterPoint Energy and Sponsor.

Project Sponsor: Any organization, group, or individual contracting with CenterPoint Energy to provide energy savings at customer sites under the program(s).

Sampling Plan: A description of the methods for choosing a representative number of pieces of equipment for monitoring. Often used with lighting retrofits, sample sizes should be generated based on an 80% confidence interval, precision of 20%, and a coefficient of variation (cv) of 0.5 for the population indicated.

Savings Report (SR): Pre-specified documentation provided by the Sponsor to document energy savings achieved for 12 months after project installation. This documentation verifies continued operation of the installed equipment components or systems and the associated energy savings and provides M&V results. The energy savings documented in the SR serves as the basis for the Sponsor's invoice once the report has been reviewed and approved by CenterPoint Energy.

Simplified M&V: Savings values are based on engineering calculations using typical equipment characteristics and operating schedules developed for particular applications, with some short-term testing of simple, long-term metering.

Standard Agreement: All Project Sponsors participating in any of the Standard Offer Programs will be required to sign a Standard Agreement with CenterPoint Energy. The terms of the contract are standard for all participants, and will include a maximum payment value, a scope of work, a nondisclosure form, and an installation deadline.

Usage Group: A collection of equipment (e.g., motors or rooms with light fixtures) with similar operating schedules and functional uses.

F M&V Example

F.1 Project Summary

An owner of a 250,000 square foot office complex is participating in CenterPoint Energy's Commercial and Industrial Standard Offer Program. A central chilled water plant cools the facility with a 15-year-old 700-ton centrifugal chiller. The owner of the building is planning to replace the older chiller with a new, high efficiency unit. The new unit under consideration is rated with an ARI nominal COP of 6.4 (0.55 kW/Ton). The baseline and minimum efficiency standards for water-cooled electric chillers is taken from Appendix A, Table 7 of the *Standard Cooling Equipment Tables*. For a 700-ton water-cooled chiller, the baseline efficiency is 4.7 COP, which is equivalent to 0.748 kW/ton. Likewise, for a 700-ton water-cooled chiller, the minimum efficiency is 6.1 COP, which is equivalent to 0.577 kW/ton (and the unit qualifies for the program by having a higher efficiency than the required minimum).

F.2 Assumptions

This M&V plan is written with the following assumptions:

1. The office building is not planning any major projects that would significantly alter the chiller load or schedule, such as building additions, significant changes in building occupancy, or significant changes in building schedule.
2. The chiller operating schedule will not change because of this project.

Based on the assumptions and the fact that the new chiller is similar to the existing one (similar size, water-cooled, no VFD, etc.), the only characteristic needed to estimate the demand and energy savings is the full load efficiency of each chiller.

F.3 Project Activities

The proposed method for conducting the M&V is from Section III, Chapter 3: *Guidelines for Replacement of Cooling Equipment*. Since the simplified guidelines are being used, pre-installation monitoring is not required. The project does require pre-installation and post-installation inspections, post-installation monitoring of chiller demand (kW for at least one hour at peak operating conditions), post-installation monitoring of chiller consumption (kWh for the entire year), an Installation Report, and a Savings Report. The Project Sponsor shall be responsible for all M&V activities and production of reports.

F.3.1 Inspections

CenterPoint Energy shall perform a pre-installation inspection to validate assumptions used in the savings calculations, and verify the existing chiller efficiency. The best source of information for the existing efficiency is the ARI certification, which accompanies the existing chiller. A post-installation inspection will be performed to verify that the chiller was installed and is operating as proposed in the approved Final Application.

F.3.2 Post-Installation Monitoring

Post-installation monitoring of chiller electrical consumption shall be conducted for the entire M&V period. This monitoring will be accomplished using an ACME Inc, self contained, three-phase, true RMS kW logger. The logger collects time stamped data at 15-minute intervals. The logger will be downloaded monthly and the data validated and stored. In the event that there is a significant gap in the data due to a logger failure, the process to replace the missing data with interpolated or averaged data will be clearly documented. The 15-minute time stamped data will be used to satisfy all post-installation monitoring requirements.

F.3.3 Reports

After the chiller is installed and commissioned, an Installation Report will be produced documenting that the equipment specified in the FA was installed and is functioning as expected. A Savings Report, following the guidelines and forms provided in the procedures manual, will be generated and submitted upon completion of the data collection activities. Savings estimates will be provided in spreadsheet form, following the template provided in Table 2, below. In addition to the reports, all monitoring data will be submitted in electronic format for review by CenterPoint Energy.

F.4 Metering Plan

The electrical demand of the proposed (new) chiller will be monitored to support the required M&V activities. This three-phase load will be monitored using an ACME true RMS kW meter. Current Transducers will be placed on Breakers 1, 3 and 5 of switch-gear SG-1. These breakers are the A, B, and C phases of the 460 volt service that supplies the chiller. No other devices draw power from these breakers.

The ACME meter will record electrical consumption at 15 Minute intervals for the duration of the monitoring period. This logger is capable of storing 41 days of 15-minute data using a fifteen minute interval. Data will be downloaded and stored on the first working day of each month to ensure that the logger does not run out of memory.

F.5 Accuracy Requirements

The ACME logger will be calibrated at the time of installation and then checked for calibration every 6 months. This will be accomplished using a Powersite true RMS meter calibrated at the factory to ±2 percent of reading.

F.6 Data Gathering and Quality Control

The data will be collected using quality control procedures for checking reasonableness. Any and all missing intervals will be replaced either by interpolation or use of average values. CenterPoint Energy will be notified of any data substitution because of missing data, and the method employed to substitute the data.

F.7 Calculations and Adjustments

The calculations described below will be performed for the Savings Report and will form the basis of incentive payments. The nominal efficiencies of the chillers are provided again in Table F.1 below.

Table F.1: Proposed and Baseline Chiller Statistics

Chiller	Efficiency (COP)	Full-Load kW
Baseline	4.7	524
Proposed	6.4	385

Using the post-installation data described above and the information in Table F.1, the savings will be calculated using Equations F.1 and F.2.

Equation F.1: Calculation of Energy Savings

$$\text{Energy Savings [kWh]} = \text{Post Installation Metering [kWh]} \bullet \left\{ \left[\frac{\text{COP of new chiller}}{\text{Baseline COP}} \right] - 1 \right\}$$

Equation F.2: Calculation of Peak Demand Savings

$$\text{Demand Savings [kW]} = \text{Max Demand Measured [kW]} \bullet \left\{ \left[\frac{\text{COP of new chiller}}{\text{Baseline COP}} \right] - 1 \right\}$$

The ratio of new to existing chiller is computed as 6.4 divided by 4.7 to yield 1.36. Table F.2 below provides a template to illustrate how monthly savings calculations will be estimated when actual M&V data are available.

Table F.2: Template for Computing Savings

Time of Day	Measured kW for peak day in June (hourly average)	Peak savings (kW)	Average demand profile in June (kW)	Days of Operation for June	Energy Consumption (kWh)	Energy Savings for June (kWh)
0:00	127.0	45.7	82.6	23	1899	684
1:00	142.4	51.3	92.6	23	2129	767
2:00	134.8	48.5	87.6	23	2015	725
3:00	127.0	45.7	82.6	23	1899	684
4:00	134.8	48.5	87.6	23	2015	725
5:00	127.0	45.7	95.3	23	2191	789
6:00	142.4	51.3	106.8	23	2456	884
7:00	173.2	62.4	129.9	23	2988	1076
8:00	269.6	97.1	202.2	23	4651	1674
9:00	288.8	104	216.6	23	4982	1793
10:00	319.6	115.1	271.7	23	6248	2250
11:00	346.6	124.8	294.6	23	6776	2439
12:00	354.2	127.5	301.1	23	6925	2493
13:00	358.0	128.9	304.3	23	6999	2520
14:00	362.0	130.3	271.5	23	6245	2248
15:00	365.8	131.7	274.4	23	6310	2272
16:00	365.8	131.7	274.4	23	6310	2272
17:00	346.6	124.8	260.0	23	5979	2153
18:00	327.2	117.8	245.4	23	5644	2032
19:00	308.0	110.9	200.2	23	4605	1658
20:00	192.6	69.3	125.2	23	2879	1037
21:00	127.0	45.7	82.6	23	1899	684
22:00	142.4	51.3	92.6	23	2129	767
23:00	115.6	41.6	75.1	23	1728	622
Total Savings:		131.7				35,248

The illustrative load data represents chiller consumption in the month of June. Energy savings (kWh) will be estimated in each month by multiplying the average hourly kWh with the number of days in the month and then applying equation F.1. The energy savings for each month will then be aggregated into an annual savings estimate. The peak data shall be used in equation F.2 to estimate the peak demand savings (kW).

G Program Documents

This section contains the Program Documents required to participate. The documents include the Letter of Intent, the Standard Agreement, the Customer Agreement, and the Customer Certification.

[Date]

Mr. David Dzierski
CenterPoint Energy
1301 Travis Street, 16th Floor
Houston, TX 77002
RE: Letter of Intent: [Project Sponsor Company] & [Host Customer Company]

Dear Ms. Gregory:

I am writing to inform you that we, [Host Customer Company], have been discussing the implementation of an energy efficiency project with [Project Sponsor Company].

We understand that [Project Sponsor Company] is required to document our intent to implement an energy efficiency project in order to reserve and receive incentives from CenterPoint Energy's Commercial & Industrial Standard Offer Program. We, [Host Customer Company] also understand that [Project Sponsor Company] must meet the program's requirements in order to receive said incentives.

We, [Host Customer Company], also understand that by signing this letter of intent, we are not obligated to follow through with the project, nor does it ensure that [Project Sponsor Company] will receive incentives for the project. The purpose of this letter of intent is to notify CenterPoint Energy that we are in discussion with [Project Sponsor Company] regarding a proposed energy efficiency project for our facility, and we intend for the project to be part of CenterPoint Energy's incentive program.

Thank you,

[Host Customer Company Representative]
[Host Customer Company]
[Host Customer Company Address]
[City], TX [ZIP Code]

Notary: _____

Date: _____

H Program Downloads

This section includes equipment survey forms required to participate in the program. The surveys should be completed determined by measure and M&V approach.