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## Equipment Efficiency Standards Appendices

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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.AEPEfficiency.com>.



## A.1 Overview

This document contains reference data for estimating demand and energy savings for cooling equipment in the Commercial 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 Commercial 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 and IV (M&V Guidelines), 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 AEP 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.

Tables A.10 through A.13 provide the coefficients necessary to complete the air-conditioning equipment *deemed savings* calculation described in Section III.

## 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 <sup>1</sup>	Minimum Performance Standard <sup>2</sup>
	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	< 5.42	95	Packaged and split	9.5 EER	9.5 EER
	≥ 65,000 & < 135,000	≥ 5.42 & < 11.25	95	Packaged and split	8.9 EER	10.3 EER
Heating mode (heat pumps)	< 65,000	< 5.42	Seasonal	Split	6.8 HSPF	6.8 HSPF
	< 65,000	< 5.42	Seasonal	Packaged	6.6 HSPF	6.6 HSPF
	< 65,000	< 5.42	47 db/43 wb	Packaged and split	3.0 COP	3.2 COP
	≥ 65,000 & < 135,000	≥ 5.42 & < 11.25	47 db/43 wb	Packaged and split	3.0 COP	3.2 COP

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

<sup>1</sup> Reference: ASHRAE Standard 90.1-1989, Table 10-1.

<sup>2</sup> Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.A and Table 6.2.1.B.

**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 <sup>3</sup>	Minimum Performance Standard <sup>4</sup>
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 <sup>†</sup>	11.5 EER <sup>†</sup>

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

**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 <sup>†</sup>	Baseline Performance Standard <sup>5</sup>	Minimum Performance Standard <sup>6</sup>
Water cooled heat pumps	< 65,000	80/67	85	9.3 EER	-
			86	-	11.2 EER
	< 65,000	80/67	75	10.2 EER	-
			85	10.5 EER	-
	≥ 65,000 and <135,000	80/67	85	10.5 EER	-
			86	-	12.0 EER
< 135,000, heating	70/60	70	3.8 COP	-	
		68	-	4.2 COP	
Ground water cooled heat pumps	< 135,000	80/67	70	11.0 EER	-
			59	-	16.2 EER
	< 135,000	80/67	50	11.5 EER	-
			< 135,000, heating	70/60	70
< 135,000, heating	70/60	50	3.0 COP	3.6 COP	
Water cooled unitary air conditioners	< 65,000	80/67	85	9.3 EER	-
			86	-	11.2 EER
	≥ 65,000 and <135,000	80/67	85	10.5 EER	-
			86	-	12.0 EER

<sup>3</sup> Reference: ASHRAE Standard 90.1-1989, Table 10-2.

<sup>4</sup> Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.A.

<sup>5</sup> Reference: ASHRAE Standard 90.1-1989, Table 10-3 and Table 10-5.

<sup>6</sup> Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.B.

**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 <sup>†7</sup>	Minimum Performance Standard <sup>8</sup>
Cooling	95	10-(0.16 * Cap/1000) EER	12.5-(0.213 * Cap/1000) EER
Cooling	82	12.2-(0.20 * Cap/1000) EER	-
Heating (heat pump)	47 db/43 wb	2.9 - (0.026 * Cap/1000), COP	2.9 - (0.026 * Cap/1000) COP

† 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.

**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) <sup>9</sup>	Minimum Performance Standard (EER) <sup>10</sup>
<b>Without reverse cycle and with louvered sides</b>	< 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
<b>Without reverse cycle and without louvered sides</b>	< 6,000	8.0	9.0
	≥ 6,000 and <20,000	8.5	8.5
	≥ 20,000	8.2	8.5
<b>With reverse cycle and with louvered sides</b>	< 20,000	8.5	9.0
	≥ 20,000	8.5	8.5
<b>With reverse cycle and without louvered sides</b>	< 14,000	8.0	8.5
	≥ 14,000	8.0	8.0

<sup>7</sup> Reference: ASHRAE Standard 90.1-1989, Table 10-4A.

<sup>8</sup> Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.D.

<sup>9</sup> Reference: ASHRAE Standard 90.1-1989, Table 10-4B.

<sup>10</sup> 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 <sup>11</sup>		Minimum Performance Standard <sup>12</sup>	
	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 <sup>†</sup>	1.412	9.3 <sup>†</sup>	1.290
	≥ 240,000 & <760,000	≥ 20.00 & < 63.33	8.5 <sup>†</sup>	1.412	9.0 <sup>†</sup>	1.333
	≥ 760,000	≥ 63.33	8.7 <sup>†</sup>	1.379	9.0 <sup>†</sup>	1.333
	≥ 135,000	≥ 11.25	2.9 <sup>††</sup>	N/A	3.2 <sup>††</sup>	N/A
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.

†† Coefficient of Performance (COP) for heating mode rated at 47 °F dry bulb, 43 °F wet bulb outdoor conditions.

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

<sup>11</sup> Reference: ASHRAE Standard 90.1-1989, Table 10-6.

<sup>12</sup> 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 <sup>13</sup>		Minimum Performance Standard <sup>14</sup>	
		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 <sup>15</sup> (COP)	Minimum Performance Standard <sup>16</sup> (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

<sup>13</sup> Reference: ASHRAE Standard 90.1-1989, Table 10-7.

<sup>14</sup> Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.C.

<sup>15</sup> Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.C.

<sup>16</sup> Reference: ASHRAE Standard 90.1-1999, Table 6.2.1.C.

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

<b>Weather Station</b>	<b>WBAN No.</b>	<b>CDD<sub>65</sub> (°F day)</b>
Abilene	13962	<b>2,386</b>
Amarillo	23047	<b>1,344</b>
Brownsville	12919	<b>3,874</b>
Corpus Christi	12924	<b>3,497</b>
Houston	12960	<b>3,197</b>
Lubbock	23042	<b>1,769</b>
Lufkin	93987	<b>2,480</b>
Midland	23023	<b>2,139</b>
Odessa/Midland	23023	<b>[ ? ]</b>
Port Arthur	12917	<b>2,823</b>
San Angelo	23034	<b>2,383</b>
Victoria	12912	<b>3,203</b>

Table A.10: Deemed savings coefficients for the Fort Worth, 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	0.89	0.81	0.91	1,587	1,761	1,955
Convenience			0.92			3,831
Fast Food			0.92			3,106
Grocery		0.87	0.92		2,708	2,815
Hospital	1.15	0.83		2,453	2,733	
Hotel	0.89	0.84	0.92	1,633	1,698	2,137
Motel			0.92			2,211
Nursing Home	0.90	0.82	0.92	1,744	1,854	2,218
Large Office	0.88	0.80	0.92	2,232	2,406	2,493
Small Office	0.90	0.80	0.92	1,598	1,649	1,970
Public Assembly	0.90	0.84	0.92	2,005	2,116	2,385
Restaurant			0.92			2,405
Religious Worship	0.88	0.83	0.90	1,355	1,396	1,946
Retail	0.90	0.83	0.92	1,770	1,828	2,225
School	0.88	0.81	0.91	1,136	1,273	1,569
Service			0.92			2,262
Warehouse	0.90	0.86	0.92	1,378	1,435	2,110

Table A.11: Deemed savings coefficients for the Amarillo, 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	0.87	0.68	0.92	1,115	1,243	1,721
Convenience			0.92			3,452
Fast Food			0.92			2,632
Grocery		0.67	0.92		1,892	2,252
Hospital	1.10	0.68		1,910	2,115	
Hotel	0.85	0.66	0.92	1,124	1,138	1,791
Motel			0.92			1,887
Nursing Home	0.87	0.65	0.92	1,230	1,260	1,873
Large Office	0.86	0.68	0.92	1,736	1,874	2,062
Small Office	0.87	0.66	0.92	1,106	1,117	1,705
Public Assembly	0.87	0.65	0.92	1,404	1,444	1,979
Restaurant			0.92			1,928
Religious Worship	0.82	0.67	0.90	848	856	1,585
Retail	0.87	0.65	0.92	1,193	1,185	1,838
School	0.87	0.69	0.92	755	806	1,462
Service			0.92			1,848
Warehouse	0.87	0.66	0.92	802	783	1,639

Table A.12: 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

Table A.13: Deemed savings coefficients for the Brownsville, 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	0.87	0.83	2,340	2,583	2,547
Convenience			0.85			4,647
Fast Food			0.85			3,933
Grocery		0.85	0.85		3,603	3,498
Hospital	0.98	0.92		3,379	3,755	
Hotel	0.79	0.84	0.84	2,482	2,673	2,799
Motel			0.84			2,973
Nursing Home	0.80	0.85	0.85	2,634	2,890	2,953
Large Office	0.77	0.88	0.82	2,907	3,181	3,153
Small Office	0.74	0.77	0.80	2,213	2,323	2,370
Public Assembly	0.80	0.85	0.85	2,857	3,085	3,077
Restaurant			0.84			2,993
Religious Worship	0.81	0.85	0.84	1,754	1,907	2,181
Retail	0.80	0.85	0.84	2,662	2,872	2,917
School	0.79	0.85	0.83	1,537	1,753	1,778
Service			0.85			2,684
Warehouse	0.80	0.85	0.84	1,867	2,014	2,568



### **B.1 Overview**

This document contains reference data for estimating demand and energy savings in Commercial 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 Commercial 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**

<b>Motor</b>	<b>Horsepower</b>	<b>2-Pole</b>	<b>4-Pole</b>	<b>6-Pole</b>	<b>8-Pole</b>
<b>Open</b>	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
<b>Enclosed</b>	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.1 Overview

The Table of Standard Fixture Wattages contains reference data for estimating demand and energy savings in the Commercial 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.

AEP posts updated versions of the Table on the program Web site at [www.AEPefficiency.com](http://www.AEPefficiency.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 AEP 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 Commercial Standard Offer Program, 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 Commercial Standard Offer Program.



## **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 AEP 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.1 Project Summary**

An owner of a 250,000 square foot office complex is participating in AEP's Commercial 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).

## **E.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.

## **E.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.

### **E.3.1 Inspections**

AEP 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.

### **E.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.

### **E.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 AEP.

## **E.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.

## **E.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  $\pm 2$  percent of reading.

## **E.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. AEP will be notified of any data substitution because of missing data, and the method employed to substitute the data.

## **E.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 E.1 below.

**Table E.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 E.1, the savings will be calculated using Equations E.1 and E.2.

Equation E.1: Calculation of Energy Savings
$\text{Energy Savings [kWh]} = \text{Post Installation Metering [kWh]} \cdot \left\{ \left[ \frac{\text{COP of new chiller}}{\text{Baseline COP}} \right] - 1 \right\}$

Equation E.2: Calculation of Peak Demand Savings
$\text{Demand Savings [kW]} = \text{Max Demand Measured [kW]} \cdot \left\{ \left[ \frac{\text{COP of new chiller}}{\text{Baseline COP}} \right] - 1 \right\}$

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

**Table E.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 E.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).

## AEP Texas Central Company

Abram	Dilley	Kenedy
Alamo	Donna	Kingsville
Alice	Driscoll	Knippa
Alleyton	Eagle Lake	La Blanca
Alton	Eagle Pass	La Casita
Aqua Dulce	Edcouch	La Feria
Aransas Pass	Edinburg	La Grulla
Asherton	Edna	La Joya
Austwell	Edroy	La Pryor
Banquette	El Campo	La Rosita
Barksdale	El Cenizo	La Villa
Bay City	El Indio	Laguna Heights
Bayside	El Maton	Laguna Vista
Bayview	Elsa	Lake City
Beeville	Encinal	Lakeside
Belmont	Encino	Lamar
Benavides	Escobares	Laredo
Berclair	Falfurria	Laurelles
Big Wells	Freer	Lazano
Bishop	Fronton	Leakey
Blessing	Fulton	Leesville
Blewett	Ganado	Leming
Bloomington	Garciasville	Long Mott
Bluetown	Garwood	Los Ebanos
Brackettville	George West	Los Fresnos
Brownsville	Gillett	Los Indios
Bruni	Glidden	Louise
Campwood	Goliad	Luling
Carrizo Springs	Granjeno	Lyford
Catarina	Gregory	Lytle
Charlotte	Guadalupe	Madero
Christine	Hargill	Markham
Columbus	Harlingen	Matagorda
Combes	Havana	Mathis
Comstock	Hebbronville	Matthews
Conception	Hidalgo	Mcallen
Corpus Christi	Hillje	Mercedes
Cotulla	Indian Lake	Midfield
Crystal City	Inez	Millett
Da Costa	Ingleside	Mirando City
Del Rio	Ingleside By The Bay	Mission
Derby	Jourdanton	Monte Alto
Devine	Karnes City	Moore

Moore Field	Premont	Santa Monica
Nada	Primera	Santa Rosa
Natalia	Progreso	Seadrift
Nixon	Progreso Lake	Sebastian
Nordheim	Quemado	Seco Mines
Normandy	Rabb	Sejita
Normanna	Ramireno	Seven Sisters
Oakville	Ramirez	Sinton
Odem	Rancho Viejo	Skidmore
Oilton	Raymondville	Smiley
Olmito	Realitos	South Padre Island
Orange Grove	Refugio	Spofford
Palacios	Ricardo	Sullivan City
Palm Valley East	Rio Bravo	Taft
Palmhurst	Rio Grande City	Three Rivers
Palmview	Rio Hondo	Tienditas
Pawnee	Rios	Tivoli
Pearsall	Riviera	Tuleta
Penitas	Robstown	Tulsita
Pernitas Point	Rockport	Tynan
Petronila	Rocksprings	Uvalde
Pettus	Roma	Victoria
Pharr	Runge	Violet
Placedo	Sabinal	Wadsworth
Pleasanton	San Benito	Weesatche
Point Comfort	San Carlos	Weslaco
Port Aransas	San Diego	Westhoff
Port Isabel	San Juan	Winter Haven
Port Lavaca	San Patricio	Woodsboro
Port Mansfield	San Ygnacio	Yorktown
Portland	Sandia	Zapata
Poteet	Santa Maria	

AEP SWEPCO

Alba	Hawkins	Omaha
Atlanta	Henderson	Overton
Avery	Hooks	Pickton
Beckville	Hughes Springs	Pittsburg
Bethany	Jefferson	Pritchett
Bettie	Kilgore	Queen City
Big Sandy	Lakeport	Red Lick
Bloomburg	Leary	Saltillo
Carthage	Linden	Scottsville
Center	Longview	Tatum
Clarksville City	Marshall	Tenaha
Cookville	Maud	Texarkana
Daingerfield	Mena	Union Grove
Dekalb	Millers Cove	Wake Village
East Mountain	Mineola	Warren City
Fruitvale	Mt. Enterprise	Waskom
Gary	Mt. Pleasant	White Oak
Gilmer	Mt. Vernon	Winfield
Gladewater	Naples	Winnsboro
Golden	Nash	Winona
Grand Saline	New Boston	
Hallsville	New London	

### AEP Texas North Company

Abilene	Girard	Newlin
Acme	Girvin	Nimrod
Afton	Glenn	Noodle
Albamy	Goodlett	Norton
Alpine	Goree	O'Brien
Anson	Grayback	Odell
Aspermont	Hamlin	Oklaunion
Avoca	Harrold	Old Glory
Baird	Haskell	Ovalo
Bakersfield	Hatchell	Ozona
Ballinger	Hawley	Paducah
Balmorhea	Hedley	Paint Rock
Barnhart	Hefner	Peacock
Benjamin	Impact	Pioneer
Best	Imperial	Potosi
Big Lake	Iraan	Presidio
Blackwell	Jayton	Putman
Bradshaw	Junction	Quanah
Bronte	Kirkland	Quitaque
Buffalo Gap	Knickerbocker	Rankin
Burkett	Knox City	Rayland
Caps	Lakeview	Redford
Carey	Lawn	Rising Star
Carlsbad	Lela	Roaring Springs
Childress	Lelia Lake	Robert Lee
Chillicothe	Lockett	Roby
Christoval	Loco	Rochell
Cisco	Longworth	Rochester
Clarendon	Lueders	Rotan
Clyde	Lutie	Rowena
Cross Cut	Marathon	Royston
Cross Plains	Marfa	Rule
Crowell	Margaret	Sagerton
Dickens	Matador	San Angelo
Dodson	May	Santa Anna
Eden	McAdoo	Saragosa
Eldorado	McCamey	Scranton
Eli	McCaulley	Sedwick
Elliott	Medicine Mound	Shafter
Elton	Melvin	Shamrock
Eola	Memphis	Sheffield
Estelline	Menard	Sherwood
Eula	Mereta	Sonora
Farmers Valley	Merkel	Spur
Flomont	Mertzon	Stamford
Fort Chadbourne	Miles	Sterling City
Fort Davis	Moran	Swenson
Gasoline	Munday	Sylvester

Talpa  
Tankersley  
Tell  
Thalia  
Throckmorton  
Toyahvale  
Treut  
Truscott  
Turkey

Tuscola  
Twitty  
Tye  
Valentine  
Valera  
Veribest  
Vernon  
View  
Wall

Water Valley  
Weinert  
Wellington  
Whiteland  
Wilmeth  
Wingate  
Winters  
Woodson

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**G**

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# Irrevocable Letter of Credit Checklist

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Irrevocable letters of credit (ILOC) may be accepted in lieu of security deposit from standard offer program (SOP) project sponsors who wish to participate in American Electric Power (AEP) energy efficiency programs. If an ILOC is presented, it must **specify** the following:

- The year of the SOP agreement
- The type of SOP contract agreement (i.e., Residential/Small Commercial, Hard-to-Reach, Commercial/Industrial, etc.)
- All parties to the agreement (i.e., the ILOC applies to the agreement “...to be entered by and between [specific name of the particular AEP company, not just AEP] and [full and complete name of project sponsor]”)
- The amount of credit to be established as security, payable upon demand by AEP
- The full and complete name of the credit institution
- The full name and title of the contact person at the credit institution to whom the demand should be presented
- The expiration date of the ILOC

In addition, the ILOC **must** contain the following language:

**Drafts must be accompanied by the following documents:**

**Presentation of document(s), signed by a duly authorized representative of AEP (specify which of the AEP companies - Texas North, Texas Central or SWEPCO), showing proof that [name of project sponsor] has failed to adhere to the Project Milestone Schedule established in the “Project Implementation” section of the [year] [specify which SOP] Agreement to be entered by and between AEP [specify which AEP company] and [name of project sponsor].**



# Irrevocable Letter of Credit Example

IRREVOCABLE LETTER OF CREDIT

DATE OF LETTER OF CREDIT

CUSTOMER - NAME AND ADDRESS	ISSUING FINANCIAL INSTITUTION NAME AND ADDRESS	NUMBER OF LETTER OF CREDIT  AMOUNT (U.S.DOLLARS):
BENEFICIARY -NAME AND ADDRESS	ADVISING FINANCIAL INSTITUTION - NAME AND ADDRESS	EXPIRATION DATE  TO BE AVAILABLE BY DRAFTS DRAWN AT:

### ADVISING BANK/BENEFICIARY:

We hereby issue this Irrevocable Letter of Credit and authorize you as Beneficiary to draw on ourselves for the account of Customer for any sum or sums not exceeding in the aggregate the amount of this credit as indicated above.

Drafts must be accompanied by the following documents:

Presentation of documents(s), signed by a duly authorized representative of **[Beneficiary/A.E.P. Texas Central Company - Name]**, showing proof that **[Customer/Project Sponsor - Name]** has failed to adhere to the Project Milestone Schedule established in the "Project Implementation" section of the 2010 AEP Commercial Standard Offer Program Agreement to be entered by and between **[Beneficiary/A.E.P. Texas Central Company - Name]** and **[Customer/Project Sponsor - Name]**.

Drafts drawn under this credit must be marked that they are drawn under this Financial Institution's Letter of Credit and must show the Date and Number of the Letter of Credit.

We hereby agree to honor each draft drawn under and in compliance with the terms of this credit, if duly presented (together with the documents specified) to us on or before the close of business on the Expiration Date shown above.

Unless otherwise expressly stated, this Credit is subject to the Uniform Customs and Practice for Documentary Credits (1993 Revision), International Chamber of Commerce Brochure No 500, and, where not inconsistent therewith, to Article Five of the Uniform Commercial Code of the state of the principal office of the Issuing Financial Institution. Unless otherwise expressly stated above, only original documents will be accepted. No reproductions or carbon copies may be substituted for originals.

Very Truly Yours,

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Authorized Signature – Issuing Financial Institution

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Print Name and Title



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# Project Sponsor Participation Process

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## Project Sponsor (PS)

American Electric Power (AEP)

1. **PS**     Reviews CSOP Manual (on web site) – AEPefficiency.com
2. **PS**     Completes and submits Initial Application [IA] (on-line)
  - *(if applicable – Project Sponsor and Customer Agreement must be received by AEP within 15 business days of IA submittal)*
3. **AEP**    Reviews and Approves Initial Application
  - *(within 15 business days of IA submittal)*
4. **PS**     Submits applicable documentation, hardcopy (see Appendix I)
5. **PS**     Submits Final Application [FA] (on-line)
  - *(within 15 business days from IA approval)*
6. **PS**     Submits Security Deposit
  - *(must be received by AEP within 20 business days of IA approval)*
  - *(the greater of \$500 or 5% of the requested incentive amount)*
7. **AEP**    Conducts pre-measure installation inspection
8. **AEP**    Approves Final Application (within 45 business days of FA submittal)
9. **PS**     Accepts, saves, prints, signs and submits two copies of the CSOP Agreement (from the web site)

- (must be received by AEP within 15 business days of the FA approval)
10. AEP Signs the CSOP Agreement
  11. AEP Mails one executed copy of the CSOP Agreement to the PS
  12. PS Installs the new energy efficiency measure(s)
    - (within 6 months of the Effective Date of the Agreement)
  13. PS Submits the Installation Report [IR] (on-line)
    - (within 15 business days from measure installation)
  14. PS Submits applicable documentation, hardcopy (see Appendix I)
    - (*if applicable* - Customer Acknowledgement Form must be received by AEP within 15 business days from measure installation)
  15. AEP Conducts post-measure installation inspection
  16. AEP Approves the Installation Report
    - (within 30 business days of IR submittal)
  17. PS Submits the Savings Report [SR] (on-line)
    - (within 18 months of the Effective Date of the Agreement)
  18. AEP Approves the Savings Report
    - (within 30 business days of SR submittal)
  19. AEP Processes the incentive payment
  20. PS Receives payment

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## Documentation For New & Retrofit Projects

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### **NEW PROJECT** - Documentation (hard copies)

- Lighting layout of the facility(s)
- Documentation on the square footage of the facility
- Manufacturing data on the HVAC efficiency ratings
- Signed Project Sponsor and Customer Agreement
- Signed Customer Acknowledgement Form
- Security Deposit
- Signed Agreement (between Project Sponsor and AEP)

### **RETROFIT PROJECT** - Documentation (hard copies)

- Manufacturing data on the HVAC efficiency ratings
- Signed Project Sponsor and Customer Agreement
- Signed Customer Acknowledgement Form
- Security Deposit
- Signed Agreement (between Project Sponsor and AEP)





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# Customer Acknowledgement Form

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# Customer Acknowledgement Form

AEP Commercial Standard Offer Program

Project Name: \_\_\_\_\_ Project Number: \_\_\_\_\_

Project Location/Site (list all sites): \_\_\_\_\_

The signatures on this document certify that the energy efficient equipment associated with the project measures listed and describe in the Installation Report have been installed.

## Project Sponsor

I hereby certify that the energy efficiency measures  
have been installed as described in this Installation Report:

Signature: \_\_\_\_\_

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

Completion Date: \_\_\_\_\_

## Host Customer

I hereby certify that I am an authorized representative of the Host Customer and that the energy efficiency project has been installed as described in this Installation Report to the Host Customer's satisfaction:

Signature: \_\_\_\_\_

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

Approval Date: \_\_\_\_\_

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# Project Sponsor and Customer Agreement

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# Project Sponsor and Customer Agreement

*This document is only required for Project Sponsors (energy efficiency service providers) submitting a SOP Application on behalf of an AEP distribution customer. Please list each customer site.*

Project Name: \_\_\_\_\_ Project Number: \_\_\_\_\_

Project Location/Site (list all sites): \_\_\_\_\_

Estimated: \_\_\_\_\_ Start Date: \_\_\_\_\_ Completion Date: \_\_\_\_\_

1. Customer agrees to provide AEP, upon five (5) business days' prior oral notice, full and complete access to the project site for any purpose related to the Commercial Standard Offer Program. Access shall be provided during Customer's normal business hours and in compliance with Customer's reasonable access requirements.
2. Customer acknowledges that any view, inspection, or acceptance by AEP of the project site or of the design, construction, installation, operation or maintenance of the measures is solely for the information of AEP and that, in performing any such inspection or review or in accepting the measures, AEP makes no representations or warranty whatsoever as to the economic or technical feasibility, capability, safety or reliability of the measures, their installation by the Project Sponsor, or their compatibility with Customer's facilities.
3. Customer acknowledges that the Project Sponsor is an independent contractor with respect to AEP and the Commercial Standard Offer Program and that the Project Sponsor is not authorized to make representations or incur obligations on behalf of AEP.
4. A Customer acknowledgement that AEP is not a party to the Customer Agreement and that the Project Sponsor is solely responsible for performance thereunder.
5. A Customer acknowledgement that AEP makes no warranty or representation regarding the qualifications of the Project Sponsor, and that the Customer is solely responsible for the selection of the Project Sponsor.
6. A Customer acknowledgement that the Customer may file a complaint with the Public Utility Commission of Texas concerning the Project Sponsor, but that AEP will play no role in resolving any disputes that arise between the Customer and the Project Sponsor.
7. A Customer agreement to release AEP from any and all claims, demands, losses, damages, costs, and legal liability including, but not limited to 1) injury or death of persons, 2) damage to natural resources, 3) violation of any local, state, or federal law or regulation including, but not limited to, environmental and health and safety laws or regulations, 4) strict liability imposed by any law or regulation, 5) equipment malfunctions, or 6) energy savings shortfalls arising out of, related to, or in any way connected with the Project, regardless of any strict liability or negligence of AEP, whether active or passive, excepting only such claims, demands, losses, damages, costs, expenses, liability, or violation of law or regulation as may be caused by the active negligence or willful misconduct of AEP, and resulting from its acceptance of the project for participation in the Commercial Standard Offer Program.

## Customer Representative

## Project Sponsor Representative

Signature: \_\_\_\_\_

Signature: \_\_\_\_\_

Print Name: \_\_\_\_\_

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

Title: \_\_\_\_\_

Date: \_\_\_\_\_

Date: \_\_\_\_\_