

# PPL Electric Utilities Energy Efficiency and Conservation Program

## HVAC Measures

<b>Measure</b>	<b>Qualification</b>		<b>Incentive Amount</b>
(DX) Packaged Air Conditioner System	Qualification before 12/31/2009	Qualification after 12/31/2009	
	11.0 EER	11.5 EER	\$55/Ton
	11.5 EER	12.0 EER	\$80/Ton
	12.0 EER	12.5 EER	\$105/Ton
Cooling Tower-Two-Speed Fan Motor	Replacement of constant speed fan motor		\$1/ton
Cooling Tower - Decrease Approach Temperature	Chiller Tonnage > 100 tons Decreases approach temp by 4 degrees		\$8/ton
Heat Pump - Air Source	Qualification before 12/31/2009	Qualification after 12/31/2009	
	11.0 EER, 3.5 COP	11.5 EER, 3.5 COP	\$75/Ton
	11.8 EER, 3.8 COP	12.3 EER, 3.8 COP	\$160/Ton
Water-Cooled Chiller, Screw Chiller	High Efficiency kW/ton = 0.62		\$7/Ton
	Premium Efficiency kW/Ton = 0.58		\$10/Ton
Chiller Pipe Insulation	≥ R-6		\$1.60 per Linear foot

All Information Subject to Change

Current as of 3/9/10

# PPL Electric Utilities Energy Efficiency and Conservation Program

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### **(DX) Packaged Air Conditioner System**

**Measure Description:** Measure incentivized the installation of Direct Expansion (DX) Packaged Air Conditioning Systems, efficiency levels apply prior to December 31st, 2009. DX Packaged Air Conditioner Systems are rooftop units commonly used on commercial buildings.

**Equipment Eligibility:** 11.0 EER, 11.5 EER, 12.0 EER (installed prior to Dec. 31st, 2009); 11.5 EER, 12.0 EER, 12.5 EER (for equipment installed After Dec. 31st, 2009)

**Incentive:**

Measure	Qualification before 12/31/2009	Qualification after 12/31/2009	Incentive Amount
(DX) Packaged Air Conditioner System	11.0 EER	11.5 EER	\$55/ton
	11.5 EER	12.0 EER	\$80/ton
	12.0 EER	12.5 EER	\$105/ton

**Detailed Information:** Direct Expansion (DX) system use a refrigerant piping circuit, compressor, and refrigerant coils to transfer heat. All components are in a single package typically installed on the building roof. As a measurement of efficiency, commercial sized units are normally rated as Energy Efficient Ratio (EER). The table below displays the different efficiency levels applicable up through 12/31/09. Cooling capacity is rated in MBtuh (Thousand British Thermal Units per Hour) or Ton where Tons = MBtuh/12 or Btuh/12,000.

#### **Prior to Dec 31, 2009 DX AC Unit EER Comparisons**

Measure EER	Baseline EER
11.0	10.3 (state code)
11.5	10.3 (state code)
12.0	10.3 (state code)

#### **After Dec 31, 2009 DX AC Unit EER Comparisons**

Measure EER	Baseline EER
11.5	11.2 (state code)
12.0	11.2 (state code)
12.5	11.2 (state code)

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### **Cooling Tower Two-Speed Fan Motor**

**Measure Description:** Incentivizes the replacement of single-speed fan motors with two-speed fan motors in a cooling tower system. Two-speed motors increase efficiency for the cooling tower, allowing for lower speeds (i.e. less energy consumption) during low use periods.

**Equipment Eligibility:** Replace constant speed fan motor

**Incentive:**

Measure	Qualification	Incentive Amount
Cooling Tower – Two-Speed Fan Motor	Replace constant speed fan motor	\$1/ton

**Detailed Information:** Some cooling towers have fans to increase airflow and water-to-air energy transfer. However, single speed fans have no way of changing their output or energy consumption in response to the particular needs of the chiller. As a result, cooling towers with single speed fans operating on cooler days may be cooling water below what is required for chiller performance. This wastes fan-motor energy, wears out the device prematurely and can negatively affect water and chemical make-up. Two-speed fans add an additional element of flexibility and responsiveness to the cooling tower's performance.

For more information, see:

[http://www.esmagazine.com/Articles/Feature\\_Article/7174a610a2ca8010VgnVCM100000f932a8c0](http://www.esmagazine.com/Articles/Feature_Article/7174a610a2ca8010VgnVCM100000f932a8c0)

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### **Cooling Tower - Decrease Approach Temperature**

**Measure Description:** Measure pertains to the installation of an oversized cooling tower that allows a reduced approach temperature, which saves energy. The approach is the difference in temperature between the cooled-water temperature and the entering air wet bulb temperature.<sup>1</sup> Since the cooling towers are based on the principles of evaporative cooling, the maximum cooling tower efficiency depends on the wet bulb temperature of the air. Since the cooled-water temperature is fixed, the approach temperature would be decreased by adjusting the air wet bulb temperature.

**Equipment Eligibility:** Chiller tonnage > 100 tons and Decrease Approach Temperature by 4 Degrees

**Incentive:**

Measure	Qualification	Incentive Amount
Cooling Tower – Decrease Approach Temp.	Chiller tonnage > 100 tons, Decrease approach temp by 4 degrees	\$8/ton (total chiller tonnage)

**Detailed Information:** Chillers larger than 100 tons generally circulate water through the condenser to remove heat, a by-product of the cooling function as well as the motor, moving parts, etc. Warmed water is sent to the cooling tower. A key cooling tower measurement is approach, the difference in temperature between cooled water and the wet-bulb temperature of the entering air. Generally, the larger the cooling tower, the greater the airflow and the lower the approach temperature. Lower approach temperatures translate into lower water flow requirements to maintain chiller effectiveness, and therefore use less energy use.

For more information, see:

<http://www.csu.org/business/greenback/energy/library/item2344.pdf>

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<sup>1</sup> The wet-bulb temperature is a type of temperature measurement that reflects the physical properties of a system with a mixture of a gas and a vapor, usually air and water vapor. The wet-bulb temperature is an indication of how dry the incoming air is.

All Information Subject to Change

Current as of 3/9/10

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### **Heat Pump - Air Source**

**Measure Description:** Heat pumps offer an energy-efficient alternative to furnaces and air conditioners. Heat pumps use electricity to move heat from a cool space into a warm space, making the cool space cooler and the warm space warmer. The most common type of heat pump is the air-source heat pump.<sup>2</sup>

**Equipment Eligibility:** 11.0 EER and 3.5 COP or better; 11.8 EER and 3.8 COP or better (installed Prior to Dec. 31st, 2009); 11.5 EER and 3.5 COP or better; 12.3 EER and 3.8 COP or better (installed after Dec. 31st, 2009)

**Incentive:**

Measure	Qualification (Prior to Dec. 31st 2009)	Qualification (After Dec. 31st 2009)	Incentive Amount
Heat Pump – Air Source	11.0 EER, 3.5 COP	11.5 EER, 3.5 COP	\$75/ton
	11.8 EER, 3.8 COP	12.3 EER, 3.8 COP	\$160/ton

**Detailed Information:** The heating efficiency of a heat pump is rated in COP (coefficient of performance). It is defined as the ratio of heat delivered by the heat pump and the electricity supplied to the compressor. Energy Efficiency Ratio (EER) is a measure of the instantaneous energy efficiency of cooling equipment. EER is calculated by comparing the steady-state rate of heat energy removal by the equipment expressed in BTU's to the steady-state rate of energy input expressed in watt-hours.<sup>3</sup> The table below gives the required efficiency levels for models installed prior to 12/31/09. The heating and cooling capacity is rated in MBtuh (Thousand British Thermal Units per Hour) or Ton where Tons = MBtuh/12 or Btuh/12,000.

#### **Prior to Dec 31, 2009 Heat Pump Unit EER/COP Comparisons**

Measure EER/COP	Baseline EER/COP
11.0 / 3.5	10.1 / 3.2 (state code)
11.5 / 3.8	10.1 / 3.2 (state code)

The table below gives the required efficiency levels for models installed after 12/31/09. The heating and cooling capacity is rated in MBtuh (Thousand British Thermal Units per Hour) or Ton where Tons = MBtuh/12 or Btuh/12,000. 'After Dec 31, 2009 Heat Pump Unit EER/COP Comparisons

Measure EER/COP	Baseline EER/COP
11.5 / 3.5	11.0 / 3.3 (state code)
12.3 / 3.8	11.0 / 3.3 (state code)

<sup>2</sup> [http://www.energysavers.gov/your\\_home/space\\_heating\\_cooling/index.cfm/mytopic=12610](http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12610)

<sup>3</sup> [http://www.energystar.gov/index.cfm?c=airsrc\\_heat\\_pr\\_crit\\_as\\_heat\\_pumps](http://www.energystar.gov/index.cfm?c=airsrc_heat_pr_crit_as_heat_pumps)

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### **Water-Cooled Chiller, Screw Chiller (High and Premium Efficiency)**

**Measure Description:** Measure incentivizes the installation of a High and Premium Efficiency, Water-Cooled Screw Chiller.

**Equipment Eligibility:** High-Efficiency kW/ton = 0.62 or less

**Incentive:**

Measure	Qualification	Incentive Amount
Water-Cooled Chiller, Screw Chiller	High-Efficiency kW/ton = 0.62	\$7/ton
	Premium-Efficiency kW/ton = 0.58	\$10/ton

**Detailed Information:** Screw compressors are positive displacement devices; in terms of a fluid positive displacement causes a fluid to move by trapping a fixed amount of it then forcing (displacing) that trapped volume into the discharge pipe. In screw chiller, the refrigerant chamber is actively compressed to a smaller volume by the twisting motion of two interlocking, rotating screws. Refrigerant trapped in the space enclosed between the two rotating screws is compressed as it makes its way from the inlet to the outlet of the compressor. A slide valve is used to adjust the compression effect by varying the amount of compression that occurs before the refrigerant is discharged. Screw chillers are generally used for small- to medium-sized buildings. This unit uses water to cool the refrigerant. High efficiency models must use less than 0.62 kW/ton to qualify for incentive.

The incentive is base on installed equipment tons. Example: A 180 Ton screw chiller with an efficiency of 0.60 kW/ton. The incentive would be (180 tons x \$7) = \$1,260.

More information regarding screw chillers:

eSource: [http://www.esource.com/BEA/demo/PDF/P\\_PA\\_15.pdf](http://www.esource.com/BEA/demo/PDF/P_PA_15.pdf)

#### **Chiller Terminology<sup>4</sup>**

**Tons:** One ton of cooling is the amount of heat absorbed by one ton of ice melting in one day: 12,000 Btu/h or 3.516 thermal kilowatts (kW).

**kW/ton rating:** Commonly referred to as efficiency, but actually power input to compressor motor divided by tons of cooling produced. Lower kW/ton indicates higher efficiency.

**Coefficient of performance (COP):** Chiller efficiency measured in Btu output (cooling) divided by Btu input (electric power). Multiplying the COP by 3.412 yields energy efficiency ratio.

**Energy-efficiency ratio (EER):** Performance of smaller chillers and rooftop units is frequently measured

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<sup>4</sup> [http://www.esource.com/BEA/demo/PDF/P\\_PA\\_15.pdf](http://www.esource.com/BEA/demo/PDF/P_PA_15.pdf)

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in EER rather than kW/ton. EER is calculated by dividing a chiller's cooling capacity (in Btu/hour) by its power input (in watts) at full-load conditions. The higher the EER, the more efficient the unit. Dividing 12 by the EER value yields kW/ton.

**ARI conditions:** Standard reference conditions at which chiller performance is measured, as defined by the Air-Conditioning and Refrigeration Institute (ARI): 44° Fahrenheit (F) water leaving the chiller and, for water entering the condenser, 85°F at 100 percent load and 60°F at 0 percent load.

**Integrated part-load value (IPLV):** This metric attempts to capture a more representative "average" chiller efficiency over a representative operating range. It is the efficiency of the chiller, measured in kW/ton, averaged over four operating points according to a standard formula. Other metrics for average efficiency include APLV (application part load value) and NPLV (non-standard part load value).

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### **Chiller Pipe Insulation**

**Measure Description:** This measure entails installing pipe insulation on a chilled water pipe (evaporator side) of an existing cooling chiller system to reduce the ability of ambient air increasing the water temperature.

**Equipment Eligibility:** Pipe insulation must meet statewide commercial energy code of minimum thickness of 1 ½ inches. The insulating value of the pipe insulation must meet code requirements with an R-value equal to or greater than 6 or a thermal conductivity equal to or less than 0.18.

**Incentive:**

Measure	Qualification	Incentive Amount
Chiller Pipe Insulation	= R-6	\$1.60 linear foot

**Detailed Information:**

R-value is a measure of thermal resistance . Increasing the thickness of an insulating layer increases the thermal resistance. R-values are given in units of ft<sup>2</sup>·°F·h/Btu. Thermal conductivity measures the rate of heat transfer through a material over a given area. Thermal conductivity = 1/R. The R-6 minimum requirement is consistent with 2009 International Energy Conservation Code (IECC).