4.4.13 Package Terminal Air Conditioner (PTAC) and Package Terminal Heat Pump (PTHP)

**Description**

A PTAC is a packaged terminal air conditioner that cools and sometimes provides heat through an electric resistance heater (heat strip). A PTHP is a packaged terminal heat pump. A PTHP uses its compressor year round to heat or cool. In warm weather, it efficiently captures heat from inside your building and pumps it outside for cooling. In cool weather, it captures heat from outdoor air and pumps it into your home, adding heat from electric heat strips as necessary to provide heat.

This measure characterizes:

1. Time of Sale: the purchase and installation of a new efficient PTAC or PTHP.
2. Early Replacement: the early removal of an existing PTAC or PTHP from service, prior to its natural end of life, and replacement with a new efficient PTAC or PTHP unit. Savings are calculated between existing unit and efficient unit consumption during the remaining life of the existing unit, and between new baseline unit and efficient unit consumption for the remainder of the measure life. The measure is only valid for non-fuel switching installations – for example replacing a cooling only PTAC with a PTHP can currently not use the TRM.

This measure was developed to be applicable to the following program types: TOS NC, EREP. If applied to other program types, the measure savings should be verified.

**Definition of Efficient Equipment**

In order for this characterization to apply, the efficient equipment is assumed to be PTACs or PTHPs that exceed baseline efficiencies.

**Definition of Baseline Equipment**

Time of Sale: the baseline conditions is provided in the Federal Baseline reference table provided below.

Early Replacement: the baseline is the existing PTAC or PTHP for the assumed remaining useful life of the unit and the new baseline as defined above for the remainder of the measure life.

**Deemed Lifetime of Efficient Equipment**

The expected measure life is assumed to be 15 years. [[1]](#footnote-1)

Remaining life of existing equipment is assumed to be 5 years[[2]](#footnote-2)

**Deemed Measure Cost**

Time of Sale: The incremental capital cost for this equipment is estimated to be $84/ton.[[3]](#footnote-3)

Early Replacement: The measure cost is the full cost of removing the existing unit and installing a new one. The actual program cost should be used. If unknown assume $1,047 per ton[[4]](#footnote-4).

The assumed deferred cost (after 5 years) of replacing existing equipment with new baseline unit is assumed to be $963 per ton[[5]](#footnote-5). This cost should be discounted to present value using the utilities’ discount rate.

**Loadshape**

Loadshape C03 - Commercial Cooling

**Coincidence Factor**

The summer peak coincidence factor for cooling is provided in two different ways below. The first is used to estimate peak savings during the utility peak hour and is most indicative of actual peak benefits, and the second represents the *average* savings over the defined summer peak period, and is presented so that savings can be bid into PJM’s Forward Capacity Market.  Both values provided are based on analysis of Itron eShape data for Missouri, calibrated to Illinois loads, supplied by Ameren.

CFSSP = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3% [[6]](#footnote-6)

CFPJM = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak period)

= 47.8% [[7]](#footnote-7)

**Algorithm**

**Calculation of Savings**

**Electric Energy Savings**

Electric savings for PTACs and PTHPs should be calculated using the following algorithms

**Energy Savings**

Time of Sale:

PTAC ΔkWh[[8]](#footnote-8)= Annual kWh Savingscool

PTHP ΔkWh= Annual kWh Savingscool + Annual kWh Savingsheat

Annual kWh Savingscool = (kBtu/hrcool) \* [(1/EERbase) – (1/EERee)] \* EFLHcool

Annual kWh Savingsheat = (kBtu/hrheat)/3.412 \* [(1/COPbase) – (1/COPee)] \* EFLHheat

Early Replacement:

ΔkWh for remaining life of existing unit (1st 5years) = Annual kWh Savingscool + Annual kWh Savingsheat

Annual kWh Savingscool = (kBtu/hrcool) \* [(1/EERexist) – (1/EERee)] \* EFLHcool

Annual kWh Savingsheat = (kBtu/hrheat)/3.412 \* [(1/COPexist) – (1/COPee)] \* EFLHheat

ΔkWh for remaining measure life (next 10 years) = Annual kWh Savingscool + Annual kWh Savingsheat

Annual kWh Savingscool = (kBtu/hrcool) \* [(1/EERbase) – (1/EERee)] \* EFLHcool

Annual kWh Savingsheat = (kBtu/hrheat)/3.412 \* [(1/COPbase) – (1/COPee)] \* EFLHheat

Where:

kBtu/hrcool = capacity of the cooling equipment in kBtu per hour (1 ton of cooling capacity equals 12 kBtu/hr).

= Actual installed

EFLHcool = Equivalent Full Load Hours for cooling are provided in section 4.4 HVAC End Use:

EFLHheat  = Equivalent Full Load Hours for heating are provided in section 4.4 HVAC End Use

EERexist = Energy Efficiency Ratio of the existing equipment

= Actual. If unknown assume 8.1 EER[[9]](#footnote-9)

EERbase = Energy Efficiency Ratio of the baseline equipment; see the table below for values.

= Based on applicable IECC code on date of building permit

Copy of Table C403.2.3(3): Minimum Efficiency Reguirements: Electrically operated packaged terminal air conditioners, packaged terminal heat pumps

|  |  |  |
| --- | --- | --- |
| **Equipment Type** | **IECC 2012**  **Minimum Efficiency** | **IECC 2015**  **Minimum Efficiency** |
| PTAC (Cooling mode)  New Construction | 13.8 – (0.300 x Cap/1000) EER | 14.0 – (0.300 x Cap/1000) EER |
| PTAC (Cooling mode)  Replacements | 10.9 – (0.213 x Cap/1000) EER | 10.9 – (0.213 x Cap/1000) EER |
| PTHP (Cooling mode)  New Construction | 14.0 – (0.300 x Cap/1000) EER | 14.0 – (0.300 x Cap/1000) EER |
| PTHP (Cooling mode)  Replacements | 10.8 – (0.213 x Cap/1000) EER | 10.8 – (0.213 x Cap/1000) EER |
| PTHP (Heating mode)  New Construction | 3.2 – (0.026 x Cap/1000) COP | 3.2 – (0.026 x Cap/1000) COP |
| PTHP (Heating mode)  Replacements | 2.9 – (0.026 x Cap/1000) COP | 2.9 – (0.026 x Cap/1000) COP |

“Cap” = The rated cooling capacity of the project in Btu/hr. If the units capacity is less than 7000 Btu/hr, use 7,000 Btu/hr in the calculation. If the unit’s capacity is greater than 15,000 Btu/hr, use 15,000 Btu/hr in the calculations.

Replacement unit shall be factory labeled as follows “MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS”, Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406mm) in height and less than 42 inches (1067 mm) in width.

EERee = Energy Efficiency Ratio of the energy efficient equipment. For air-cooled units < 65 kBtu/hr, if the actual EERee is unknown, assume the following conversion from SEER to EER for calculation of peak savings: EER≈SEER/1.1.

= Actual installed

kBtu/hrheat = capacity of the heating equipment in kBtu per hour.

= Actual installed

3.412 = Btu per Wh.

COPexist = coefficient of performance of the existing equipment

= Actual. If unknown assume 1.0 COP for PTAC units and 2.6 COP[[10]](#footnote-10) for PTHPs.

COPbase = coefficient of performance of the baseline equipment; see table above for values.

COPee = coefficient of performance of the energy efficient equipment.

= Actual installed

EXAMPLE:

Time of Sale (assuming new construction baseline):

For example a 1 ton PTAC with an efficient EER of 12 at a guest hotel in Rockford with a building permit dated before 1/1/2016 saves:

= [(12) \* [(1/10.2) – (1/12)] \* 1,042

= 184 kWh

Early Replacement (assuming replacement baseline for deferred replacement in 5 years):

For example a 1 ton PTHP with an efficient EER of 12, COP of 3.0 at a guest hotel in Rockford replaces a PTAC unit (with electric resistance heat) with unknown efficiency.

ΔkWh for remaining life of existing unit (1st 5years)

= (12 \* (1/8.1 – 1/12) \* 1,042) + (12/3.412 \* (1/1.0 – 1/3.0) \* 1,758)

= 502 + 4,122

= 4,624 kWh

ΔkWh for remaining measure life (next 10 years)

= (12 \* (1/8.3 – 1/12) \* 1,042) + (12/3.412 \* (1/1.0 – 1/3.0) \* 1,758)

= 465 + 4,122

= 34,587 kWh

**Summer Coincident Peak Demand Savings**

Time of Sale:

ΔkW = (kBtu/hrcool) \* [(1/EERbase) – (1/EERee)] \*CF

Early Replacement:

ΔkW for remaining life of existing unit (1st 5years) = (kBtu/hrcool) \* [(1/EERexist) – (1/EERee)] \*CF

ΔkWh for remaining measure life (next 10 years) = (kBtu/hrcool) \* [(1/EERbase) – (1/EERee)] \*CF

Where:

CFSSP = Summer System Peak Coincidence Factor for Commercial cooling (during system peak hour)

= 91.3% [[11]](#footnote-11)

CFPJM = PJM Summer Peak Coincidence Factor for Commercial cooling (average during peak period)

= 47.8% [[12]](#footnote-12)

EXAMPLE

Time of Sale:

For example a 1 ton replacement cooling unit with no heating with an efficient EER of 12 saves:

ΔkWSSP = (12 \* (1/10.2 – 1/12) \*0.913

= 0.16 kW

For example a 1 ton PTHP with an efficient EER of 12, COP of 3.0 replacing a PTAC unit with unknown efficiency saves:

ΔkW for remaining life of existing unit (1st 5years):

ΔkWSSP = 12 \* (1/8.1 – 1/12) \* 0.913

= 0.44 kW

ΔkW for remaining measure life (next 10 years):

ΔkWSSP = 12 \* (1/8.3 – 1/12) \* 0.913

= 0.41 kW

**Natural Gas Energy Savings**

N/A

**Water Impact Descriptions and Calculation**

N/A

**Deemed O&M Cost Adjustment Calculation**

N/A

**Measure Code: CI-HVC-PTAC-V06-160601**

1. Measure Life Report: Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, Inc., June 2007 [↑](#footnote-ref-1)
2. Standard assumption of one third of effective useful life. [↑](#footnote-ref-2)
3. DEER 2008. This assumes that baseline shift from IECC 2012 to IECC 2015 carries the same incremental costs. Values should be verified during evaluation [↑](#footnote-ref-3)
4. Based on DCEO – IL PHA Efficient Living Program data. [↑](#footnote-ref-4)
5. Based on subtracting TOS incremental cost from the DCEO data. [↑](#footnote-ref-5)
6. Based on analysis of Itron eShape data for Missouri, calibrated to Illinois loads, supplied by Ameren. The AC load during the utility’s peak hour is divided by the maximum AC load during the year. [↑](#footnote-ref-6)
7. Based on analysis of Itron eShape data for Missouri, calibrated to Illinois loads, supplied by Ameren. The average AC load over the PJM peak period (1-5pm, M-F, June through August) is divided by the maximum AC load during the year [↑](#footnote-ref-7)
8. There are no heating efficiency improvements for PTACs since although some do provide heating, it is always through electric resistance and therefore the COPbase and COPee would be 1.0. [↑](#footnote-ref-8)
9. Estimated using the IECC building energy code up until year 2003 (p107; https://law.resource.org/pub/us/code/ibr/icc.iecc.2000.pdf) and assuming a 1 ton unit; EER = 10 – (0.16 \* 12,000/1,000) = 8.1. [↑](#footnote-ref-9)
10. Estimated using the IECC building energy code up until year 2003 (p107; https://law.resource.org/pub/us/code/ibr/icc.iecc.2000.pdf) and assuming a 1 ton unit; COP = 2.9 – (0.026 \* 12,000/1,000) = 2.6 [↑](#footnote-ref-10)
11. Based on analysis of Itron eShape data for Missouri, calibrated to Illinois loads, supplied by Ameren. The AC load during the utility’s peak hour is divided by the maximum AC load during the year. [↑](#footnote-ref-11)
12. Based on analysis of Itron eShape data for Missouri, calibrated to Illinois loads, supplied by Ameren. The average AC load over the PJM peak period (1-5pm, M-F, June through August) is divided by the maximum AC load during the year [↑](#footnote-ref-12)