### ENERGY STAR Room Air Conditioner

###### Description

This measure relates to:

1. Time of Sale the purchase and installation of a room air conditioning unit that meets ENERGY STAR version 4.0 which is effective October 26th 2015), in place of a baseline unit. The baseline is based on the Federal Standard effective June 1st, 2014.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Product Type and Class (Btu/hr)** | | **Federal Standard with louvered sides**  **(CEER) [[1]](#footnote-2)** | **Federal Standard without louvered sides**  **(CEER)** | **ENERGY STAR v4.0 with louvered sides (CEER)** **[[2]](#footnote-3)** | **ENERGY STAR v4.0 without louvered sides (CEER)** |
| Without Reverse Cycle | < 8,000 | 11.0 | 10.0 | 11.5 | 10.5 |
| 8,000 to 10,999 | 10.9 | 9.6 | 11.4 | 10.1 |
| 11,000 to 13,999 | 10.9 | 9.5 | 11.4 | 10.0 |
| 14,000 to 19,999 | 10.7 | 9.3 | 11.2 | 9.7 |
| 20,000 to 24,999 | 9.4 | 9.4 | 9.8 | 9.8 |
| >=25,000 | 9.0 | 9.4 | 9.4 | 9.8 |
| With Reverse Cycle | <14,000 | 9.8 | 9.3 | 10.3 | 9.7 |
| 14,000 to 19,999 | 9.8 | 8.7 | 10.3 | 9.1 |
| >=20,000 | 9.3 | 8.7 | 9.7 | 9.1 |
| Casement only | | 9.5 | | 10.0 | |
| Casement-Slider | | 10.4 | | 10.8 | |

Side louvers extend from a room air conditioner model in order to position the unit in a window. A model without louvered sides is placed in a built-in wall sleeve and are commonly referred to as "through-the-wall" or "built-in" models.

Casement-only refers to a room air conditioner designed for mounting in a casement window of a specific size.

Casement-slider refers to a room air conditioner with an encased assembly designed for mounting in a sliding or casement window of a specific size.

Reverse cycle refers to the heating function found in certain room air conditioner models.

1. Early Replacement: the early removal of an existing residential inefficient Room AC unit from service, prior to its natural end of life, and replacement with a new ENERGY STAR qualifying 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.

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

To qualify for this measure the new room air conditioning unit must meet the ENERGY STAR version 4.0 (effective October 26th 2015)[[3]](#footnote-4) efficiency standards presented above.

###### Definition of Baseline Equipment

Time of Sale: the baseline assumption is a new room air conditioning unit that meets the Federal Standard (effective June 1st, 2014)[[4]](#footnote-5) efficiency standards as presented above.

Early Replacement: the baseline is the existing Room AC 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 measure life is assumed to be 12 years[[5]](#footnote-6).

Remaining life of existing equipment is assumed to be 4 years[[6]](#footnote-7)

###### Deemed Measure Cost

Time of Sale: The incremental cost for this measure is assumed to be $40 for a ENERGY STAR unit[[7]](#footnote-8).

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 unavailable assume $448 for ENERGY STAR unit[[8]](#footnote-9).

The avoided replacement cost (after 4 years) of a baseline replacement unit is $408.[[9]](#footnote-10)

###### Loadshape

Loadshape R08 - Residential Cooling

###### Coincidence Factor

The coincidence factor for this measure is assumed to be 0.3[[10]](#footnote-11).

**Algorithm**

###### Calculation of Savings

###### Electric Energy Savings

Time of Sale: ΔkWh = (FLHRoomAC \* Btu/H \* (1/CEERbase - 1/CEERee))/1000

Early Replacment:

ΔkWh for remaining life of existing unit (1st 4 years) = (FLHRoomAC \* Btu/H \* (1/(EERexist/1.01) - 1/CEERee))/1000

ΔkWh for remaining measure life (next 8 years) = (FLHRoomAC \* Btu/H \* (1/CEERbase - 1/CEERee))/1000

Where:

FLHRoomAC = Full Load Hours of room air conditioning unit

= dependent on location[[11]](#footnote-12):

|  |  |
| --- | --- |
| **Climate Zone**  **(City based upon)** | **FLHRoomAC** |
| 1 (Rockford) | 220 |
| 2 (Chicago) | 210 |
| 3 (Springfield) | 319 |
| 4 (Belleville) | 428 |
| 5 (Marion) | 374 |
| Weighted Average**[[12]](#footnote-13)** | 248 |

Btu/H = Size of rebated unit

= Actual. If unknown assume 8500 Btu/hr[[13]](#footnote-14)

EERexist =Efficiency of existing unit

= Actual. If unknown assume 7.7[[14]](#footnote-15)

1.01 = Factor to convert EER to CEER (CEER includes standby and off power consumption)[[15]](#footnote-16).

CEERbase = Combined Energy Efficiency Ratio of baseline unit

= As provided in tables above

CEERee = Combined Energy Efficiency Ratio of ENERGY STAR unit

= Actual. If unknown assume minimum qualifying standard as provided in tables above

Time of Sale:

For example for an 8,500 Btu/H capacity unit, with louvered sides, in an unknown location:

ΔkWHCEE TIER 1 = (248 \* 8500 \* (1/10.9 – 1/11.4)) / 1000

= 8.5 kWh

Early Replacement:

A 7.7EER, 9000Btu/h unit is removed from a home in Springfield and replaced with an ENERGY STAR unit with louvered sides:

ΔkWh for remaining life of existing unit (1st 4 years) = (319 \* 9000 \* (1/(7.7/1.01) - 1/11.4))/1000

= 124.7 kWh

ΔkWh for remaining measure life (next 8 years) = (319 \* 9000 \* (1/10.9 - 1/11.4))/1000

= 11.6 kWh

###### Summer Coincident Peak Demand Savings

Time of Sale: ΔkW = Btu/H \* ((1/(CEERbase \*1.01) - 1/(CEERee \* 1.01)))/1000) \* CF

Early Replacement: ΔkW = Btu/H \* ((1/EERexist - 1/(CEERee \* 1.01)))/1000) \* CF

Where:

CF = Summer Peak Coincidence Factor for measure

= 0.3[[16]](#footnote-17)

* 1. = Factor to convert CEER to EER (CEER includes standby and off power consumption)[[17]](#footnote-18).

Other variable as defined above

Time of Sale:

For example for an 8,500 Btu/H capacity unit, with louvered sides, for an unknown location:

ΔkWCEE TIER 1 = (8500 \* (1/(10.9 \* 1.01) – 1/(11.4\*1.01))) / 1000 \* 0.3

= 0.010 kW

Early Replacement:

A 7.7 EER, 9000Btu/h unit is removed from a home in Springfield and replaced with an ENERGY STAR unit with louvered sides:

ΔkW for remaining life of existing unit (1st 4 years) = (9000 \* (1/7.7 - 1/(11.4 \* 1.01)))/1000 \* 0.3

= 0.12 kW

ΔkW for remaining measure life (next 8 years) = (9000 \* (1/(10.9 \* 1.01) - 1/(11.4 \* 1.01)))/1000 \* 0.3

= 0.011 kW

###### Natural Gas Savings

N/A

###### Water Impact Descriptions and Calculation

N/A

###### Deemed O&M Cost Adjustment Calculation

N/A

###### Measure Code: RS-APL-ESRA-V04-160601

1. See DOE’s Appliance and Equipment Standards for Room AC; https://www1.eere.energy.gov/buildings/appliance\_standards/product.aspx/productid/41 [↑](#footnote-ref-2)
2. ENERGY STAR Version 4.0 Room Air Conditioners Program Requirements [↑](#footnote-ref-3)
3. ENERGY STAR Version 4.0 Room Air Conditioners Program Requirements [↑](#footnote-ref-4)
4. See DOE’s Appliance and Equipment Standards for Room AC; https://www1.eere.energy.gov/buildings/appliance\_standards/product.aspx/productid/41 [↑](#footnote-ref-5)
5. Measure Life Report, Residential and Commercial/Industrial Lighting and HVAC Measures, GDS Associates, June 2007.

   http://neep.org/uploads/EMV%20Forum/EMV%20Studies/measure\_life\_GDS%5B1%5D.pdf [↑](#footnote-ref-6)
6. Standard assumption of one third of effective useful life. [↑](#footnote-ref-7)
7. Incremental cost based on field study conducted by Efficiency Vermont. [↑](#footnote-ref-8)
8. Based on IL PHA Efficient Living Program Data for 810 replaced units showing $416 per unit plus $32 average recycling/removal cost. [↑](#footnote-ref-9)
9. Estimate based upon Time of Sale incremental costs. [↑](#footnote-ref-10)
10. Consistent with coincidence factors found in: RLW Report: Final Report Coincidence Factor Study Residential Room Air Conditioners, June 23, 2008 ([http://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/National%20Grid/117\_RLW\_CF%20Res%20RAC.pdf](http://www.ctsavesenergy.org/files/Measure%20Life%20Report%202007.pdf)) [↑](#footnote-ref-11)
11. Full load hours for room AC is significantly lower than for central AC. The average ratio of FLH for Room AC (provided in RLW Report: Final Report Coincidence Factor Study Residential Room Air Conditioners, June 23, 2008) to FLH for Central Cooling for the same location (provided by AHRI: [http://www.energystar.gov/ia/business/bulk\_purchasing/bpsavings\_calc/Calc\_CAC.xls](http://www.puc.nh.gov/Electric/Monitoring%20and%20Evaluation%20Reports/National%20Grid/117_RLW_CF%20Res%20RAC.pdf)) is 31%. This ratio is applied to those IL cities that have FLH for Central Cooling provided in the Energy Star calculator. For other cities this is extrapolated using the FLH assumptions VEIC have developed for Central AC. There is a county mapping table in the Appendix providing the appropriate city to use for each county of Illinois. [↑](#footnote-ref-12)
12. Weighted based on number of residential occupied housing units in each zone. [↑](#footnote-ref-13)
13. Based on maximum capacity average from the RLW Report: Final Report Coincidence Factor Study Residential Room Air Conditioners, June 23, 2008 [↑](#footnote-ref-14)
14. Based on Nexus Market Research Inc, RLW Analytics, December 2005; “Impact, Process, and Market Study of the Connecticut Appliance Retirement Program: Overall Report.” [↑](#footnote-ref-15)
15. Since the existing unit will be rated in EER, this factor is used to appropriately compare with the new CEER rating. Version 3.0 of the ENERGY STAR specification provided equivalent EER and CEER ratings and for the most popular size band the EER rating is approximately 1% higher than the CEER. See ‘ENERGY STAR Version 3.0 Room Air Conditioners Program Requirements’. [↑](#footnote-ref-16)
16. Consistent with coincidence factors found in: RLW Report: Final Report Coincidence Factor Study Residential Room Air Conditioners, June 23, 2008 [↑](#footnote-ref-17)
17. Since the new CEER rating includes standby and off power consumption, for peak calculations it is more appropriate to apply the EER rating, but it appears as though new units will only be rated with a CEER rating. Version 3.0 of the ENERGY STAR specification provided equivalent EER and CEER ratings and for the most popular size band the EER rating is approximately 1% higher than the CEER. See ‘ENERGY STAR Version 3.0 Room Air Conditioners Program Requirements’. [↑](#footnote-ref-18)