### Energy Recovery Ventilator

**Description**

This measure includes the addition of energy recovery equipment on existing or new unitary equipment, where energy recovery is not required by the IECC 2012. This measure analyzes the heating savings potential from recovering energy from exhaust or relief building air. This measure assumes during unoccupied hours of the building no exhaust or relief air is available for energy recovery.

This measure was developed to be applicable to the following program types: TOS, NC, RF.

If applied to other program types, the measure savings should be verified.

**Definition of Efficient Equipment**

Efficient equipment is unitary equipment that incorporates energy recovery not required by the IECC 2012.

**Definition of Baseline Equipment**

The baseline is unitary equipment not require by IECC 2012 to incorporate energy recovery.

**Deemed Lifetime of Efficient Equipment**

The measure life for the domestic energy recovery equipment is 15 years.[[1]](#footnote-1)

**Deemed Measure Cost**

The incremental cost for this measure assumes cost of cabinet and controls incorporated into packaged and built up air handler units. Additionally it assumes 1 to 1 ratio of fresh and exhausted air.

|  |  |
| --- | --- |
| **Energy Recovery Equipment Type** | **Incremental Cost $/CFM[[2]](#footnote-2)** |
| Fixed Plate | $6 |
| Rotary Wheel | $6 |
| Heat Pipe | $6 |

**Deemed O&M Cost Adjustments**

There are no expected O&M savings associated with this measure.

**Loadshape**

N/A

**Coincidence Factor**

N/A

**Algorithm**

**Calculation of Energy Savings**

**Electric Energy Savings**

**Summer Coincident Peak Demand Savings**

There are no anticipated electrical savings from this measure as it is assumed that the additional fan energy due to the increased static pressure drop offsets cooling energy savings. Where this is not expected to be the case, a custom calculation should be used to determine the savings.

**Natural Gas Savings**

Gas savings algorithm is derived from the following:

ΔTherms = (Design Heating Load \* TE\_ERV \* EFLH \* OccHours/24) / (100,000 \* µHeat)

Where:

Design Heating Load = (1.08 \* CFM \* ΔT)

1.08 = A constant for sensible heat equations (BTU/h/CFM.°F)

CFM = Cubic Feet per Minute of Energy Recovery Ventilator

ΔT = T\_RA – T\_DD

T\_RA = Temperature of the Return Air = 70°F or custom

T\_DD = Temperature on design day of outside air[[3]](#footnote-3)

= (see Table below) or custom

|  |  |  |
| --- | --- | --- |
| **Zone** | **Weather Station** | **T\_DD, Temperature, °F** |
| 1 | Greater Rockford | -5.8 |
| 2 | Chicago/O’Hare ARPT. | -1.5 |
| 3 | Springfield/Capital | 0.4 |
| 4 | Scott AFB MidAmerica | 9.0 |
| 5 | Cape Girardeau Regional | 9.7 |
| Average | - | 2.4 |

TE\_ERV = Thermal Effectiveness of Energy Recovery Equipment[[4]](#footnote-4)

= (see Table below) or custom

| **Heat Recovery Equipment Type** | **TE\_ERV (%)** |
| --- | --- |
| Fixed Plate | 0.65 |
| Rotary Equipment | 0.68 |
| Heat Pipe | 0.55 |

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

OccHour = Average Hours per day facility is occupied

= custom or use Modeling Inputs in eQuest models:

|  | **Weekday** | **Saturday** | **Sunday** | **Holiday** | **Occ Hours** |
| --- | --- | --- | --- | --- | --- |
| Assembly/Convention Center | 10am-9pm | 10am-9pm | 10am-9pm | closed | 3905 |
| Assisted Living | 24/7 | 24/7 | 24/7 | 24/7 | 8760 |
| College | 8am-9pm | closed | closed | closed | 3263 |
| Convenience Store | 7am-10pm | 9am-9pm | 10am-5pm | 10am-5pm | 4823 |
| Elementary School | 8am-4pm  (20% in summer) | closed | closed | closed | 1606 |
| Garage | 7am-5pm | 8am-12pm | closed | closed | 3342 |
| Grocery | 7am-9pm | 7am-9pm | 9am-8pm | closed | 4814 |
| Healthcare Clinic | 7am-7pm | 9am-5pm | closed | closed | 3428 |
| High School | 8am-4pm  (20% in summer) | closed | closed | closed | 1606 |
| Hospital | 24/7 | 24/7 | 24/7 | 24/7 | 8760 |
| Motel | 24/7 | 24/7 | 24/7 | 24/7 | 8760 |
| Manufacturing Facility (Light Industry) | Mfg: 6am-10pm, Office: 8am-5pm | Mfg: 6am-10pm, Office: closed | closed | closed | 4848 |
| Multi-Family Mid-Rise | 24/7; Reduced occupancy 7am - 5pm | 24/7; Reduced occupancy 9am - 3pm | 24/7; Reduced occupancy 9am - 3pm | 24/7; Reduced occupancy 9am - 3pm | 7038 |
| Multi-Family High-Rise | 24/7; Reduced occupancy 7am - 5pm | 24/7; Reduced occupancy 9am - 3pm | 24/7; Reduced occupancy 9am - 3pm | 24/7; Reduced occupancy 9am - 3pm | 7038 |
| Movie Theater | 10am-Midnight | 10am-Midnight | 10am-Midnight | 10am-Midnight | 5110 |
| Office - Low-rise | 8am-5pm | closed | closed | closed | 2259 |
| Office - Mid-rise | 8am-5pm | 20% 8am-noon | closed | closed | 2301 |
| Office - High-rise | 8am-5pm | 20% 8am-noon | closed | closed | 2301 |
| Religious Building | Office: 8am-5pm, other: closed | closed | 8am-1pm | closed | 260 |
| Restaurant | 7am-8pm | 7am-8pm | 7am-8pm | closed | 4615 |
| Retail - Department Store | 9am-9pm | 9am-9pm | 10am-5pm | 10am-5pm | 4070 |
| Retail - Strip Mall | 9am-9pm | 9am-9pm | 10am-5pm | 10am-5pm | 4070 |
| Warehouse (Conditioned Storage) | 7am-7pm | 7am-7pm (reduced occupancy) | closed | closed | 3324 |

µHeat = Efficiency of heating system

= Actual

**Water Impact Descriptions and Calculation**

N/A

**Deemed O&M Cost Adjustment Calculation**

N/A

**Measure Code: CI-HVC-ERVE-V02-160601**

1. Assumed service life limited by controls -" Demand Control Ventilation Using CO2 Sensors", pg. 19, by US Department of Energy Efficiency and Renewable Energy [↑](#footnote-ref-1)
2. "Map to HVAC Solutions", by Michigan Air, Issue 3, 2006 [↑](#footnote-ref-2)
3. Weather Station Data, 99.6% Heating DB - 2013 Fundamentals, ASHRAE Handbook [↑](#footnote-ref-3)
4. Energy Recovery Fact Sheet - Center Point Energy, MN [↑](#footnote-ref-4)