Cost-Effectiveness of Heat Recovery Ventilation

DOE Proposal: R-3; ICC proposal: TBA
For 2018 IECC residential code
Pacific Northwest National Lab
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PURPOSE
Determine whether heat recovery ventilators (HRVs) are cost effective in the colder IECC climate zones.

BASIS
This proposal is inspired by the experience of DOE's Building America program, in which a large majority of projects constructed since 2010 in the cold/very cold regions have included heat recovery ventilation.

The energy savings and cost-effectiveness potential of HRVs were evaluated using DOE’s cost-effectiveness methodology.¹

ENERGY PRICES
DOE's cost-effectiveness methodology specifies that for climate zone-level and national-level analyses, energy prices and escalation rates will be taken from the Energy Information Administration's latest estimates. The anticipated 2018 prices and escalation rates² are as follows:

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Price (2018$)</th>
<th>Effective Escalation Rate (per year, real)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>$0.137/kWh</td>
<td>0.69%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>$1.154/therm</td>
<td>1.74%</td>
</tr>
<tr>
<td>Fuel Oil</td>
<td>$2.299/therm</td>
<td>1.84%</td>
</tr>
</tbody>
</table>

ENERGY COST SAVINGS
Most Heat Recovery Ventilation systems (HRVs) have a sensible heat recovery efficiency of 70%-80%.⁴ The present analysis conservatively assumes a sensible heat recovery efficiency of 70%. The energy analysis indicates that HRVs yield about 10% energy cost savings for the total IECC-regulated end-uses (heating, cooling, lighting and water heating) in the colder climate zones, with higher savings achieved in the coldest climate zones.

¹ DOE Cost-Effectiveness Methodology available at https://www.energycodes.gov/development/residential/methodology
³ LCC calculations are based on year-by-year fuel price ratios derived from price estimates published by EIA in its Annual Energy Outlook 2015 (table accessed 2 Dec 2015 from http://www.eia.gov/beta/aeo/#/?id=3-AEO2015&cases=ref2015; 2013$ price estimates converted to ratios relative to year 2018); the effective rates shown in the table are the uniform annual escalation rates that would give the same present value of energy as the estimated year-by-year price ratios.
⁴ See EnergySavers website http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11900
MEASURE COST
The cost of HRV equipment ranges from $500-1100, depending on the manufacturer and capacity. The present analysis assumes a total measure cost of $1300 for a single-point HRV system based on the NREL Retrofit Database, inclusive of equipment and installation. Russell, Sherman and Rudd found a similar cost of $1350 including installation. A study conducted by the National Association of Home Builders (NAHB) indicates the life of HRVs to exceed 20 years.

COST-EFFECTIVENESS
Assuming HRVs to have a useful life of 20 years, an evaluation of the life-cycle cost savings using DOE’s cost-effectiveness methodology shows positive life-cycle cost savings in climate zones 6 through 8.

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5 See cost of 70% effective HRV at [http://www.nrel.gov/ap/retrofits/measures.cfm?gId=10&rtId=236&scId=2522](http://www.nrel.gov/ap/retrofits/measures.cfm?gId=10&rtId=236&scId=2522)
CONCLUSION
HRVs are cost effective in climate zones 6 through 8.