

# 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.<sup>1</sup>

## 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 rates<sup>2</sup> are as follows:

Fuel	Price (2018\$)	Effective <sup>3</sup> Escalation Rate (per year, real)
Electricity	\$0.137/kWh	0.69%
Natural Gas	\$1.154/therm	1.74%
Fuel Oil	\$2.299/therm	1.84%

## ENERGY COST SAVINGS

Most Heat Recovery Ventilation systems (HRVs) have a sensible heat recovery efficiency of 70%-80%.<sup>4</sup> 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

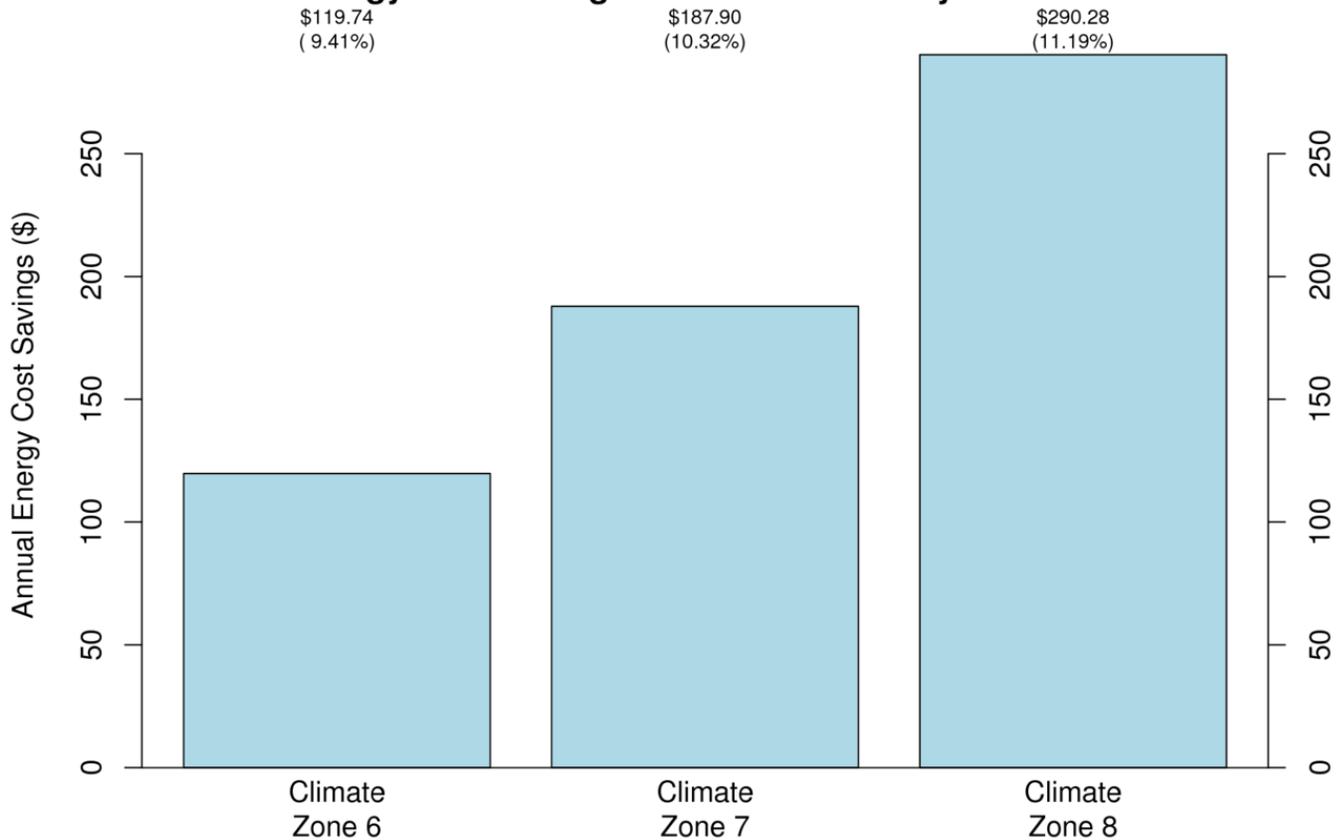
<sup>1</sup> DOE Cost-Effectiveness Methodology available at <https://www.energycodes.gov/development/residential/methodology>

<sup>2</sup> EIA, Annual Energy Outlook 2015, table accessed 2 Dec 2015 from <http://www.eia.gov/beta/aeo/#/?id=3-AEO2015&cases=ref2015>; nominal 2018 prices.

<sup>3</sup> 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.

<sup>4</sup> See EnergySavers website [http://www.energysavers.gov/your\\_home/insulation\\_airsealing/index.cfm/mytopic=11900](http://www.energysavers.gov/your_home/insulation_airsealing/index.cfm/mytopic=11900)

## Energy Cost Savings from Heat Recovery Ventilator



### 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.<sup>5</sup> Russell, Sherman and Rudd found a similar cost of \$1350 including installation.<sup>6</sup> A study conducted by the National Association of Home Builders (NAHB) indicates the life of HRVs to exceed 20 years.<sup>7</sup>

### COST-EFFECTIVENESS

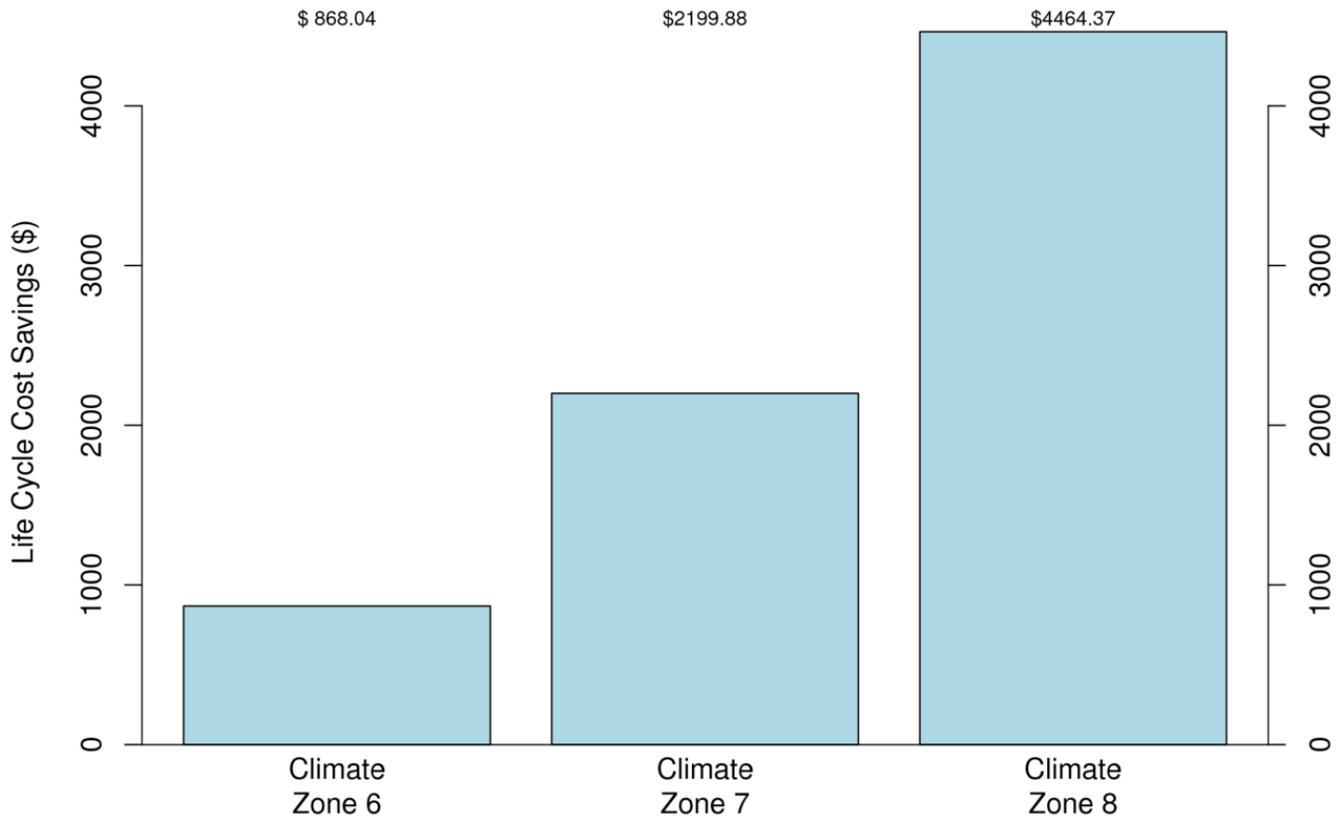
Assuming HRVs to have a useful life of 20 years, an evaluation of the life-cycle cost savings using DOE's cost-effectiveness methodology shows positive life-cycle cost savings in climate zones 6 through 8.

<sup>5</sup> See cost of 70% effective HRV at <http://www.nrel.gov/ap/retrofits/measures.cfm?gId=10&ctId=236&scId=2522>

<sup>6</sup> Russell, Sherman and Rudd. 2007. LBNL 57730 - Review of Residential Ventilation Technologies. HVAC&R Research, Volume 13.

<sup>7</sup> <http://www.deckerhomeservices.com/nahb-study.pdf>

## Life-Cycle Cost Savings from Heat Recovery Ventilator



### CONCLUSION

HRVs are cost effective in climate zones 6 through 8.