

Cost-Effectiveness of Heat Recovery Ventilation

DOE Proposal: R-3; ICC proposal: TBA

For 2018 IECC residential code

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PURPOSE

Determine whether heat recovery ventilators (HRVs) are cost effective in the colder IECC climate zones.

BASIS

The proposed U-factors are based on the previous version of ENERGY STAR (version 5.0) introduced in 2010.¹ Targeting efficiency levels from an older specification of ENERGY STAR is intended to provide adequate consideration for the time required for sufficient market penetration of higher efficiency window products. Because the fenestration U-factor mainly affects heating loads, the proposal is limited to zones 3 and above.

The energy savings and cost-effectiveness potential of these window U-factors were evaluated using DOE's cost-effectiveness methodology.²

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 current rates^{3,4,5,6} are as follows:

Fuel	Price (2015\$)	Escalation Rate (per year, nominal)
Electricity	\$0.1293/kWh	0.71%
Natural Gas	\$1.064/therm	1.63%
Fuel Oil	\$2.412/therm	2.27%

ENERGY COST SAVINGS

Most Heat Recovery Ventilation systems (HRVs) have a sensible heat recovery efficiency of 70%-80%.⁷ The present analysis conservatively assumes a sensible heat recovery efficiency of 70%. The energy analysis indicates that HRVs yield up to 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 See ENERGYSTAR version 5.0 at

[https://www.energystar.gov/sites/default/files/specs//private/Windows, Doors and Skylights Program Requirements%20v5_0%20current.pdf](https://www.energystar.gov/sites/default/files/specs//private/Windows,_Doors_and_Skylights_Program_Requirements%20v5_0%20current.pdf)

² DOE Cost-Effectiveness Methodology available at <https://www.energycodes.gov/development/residential/methodology>

³ http://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_06_a

⁴ http://www.eia.gov/dnav/ng/ng_pri_sum_a_EPG0_PRS_DMcf_a.htm

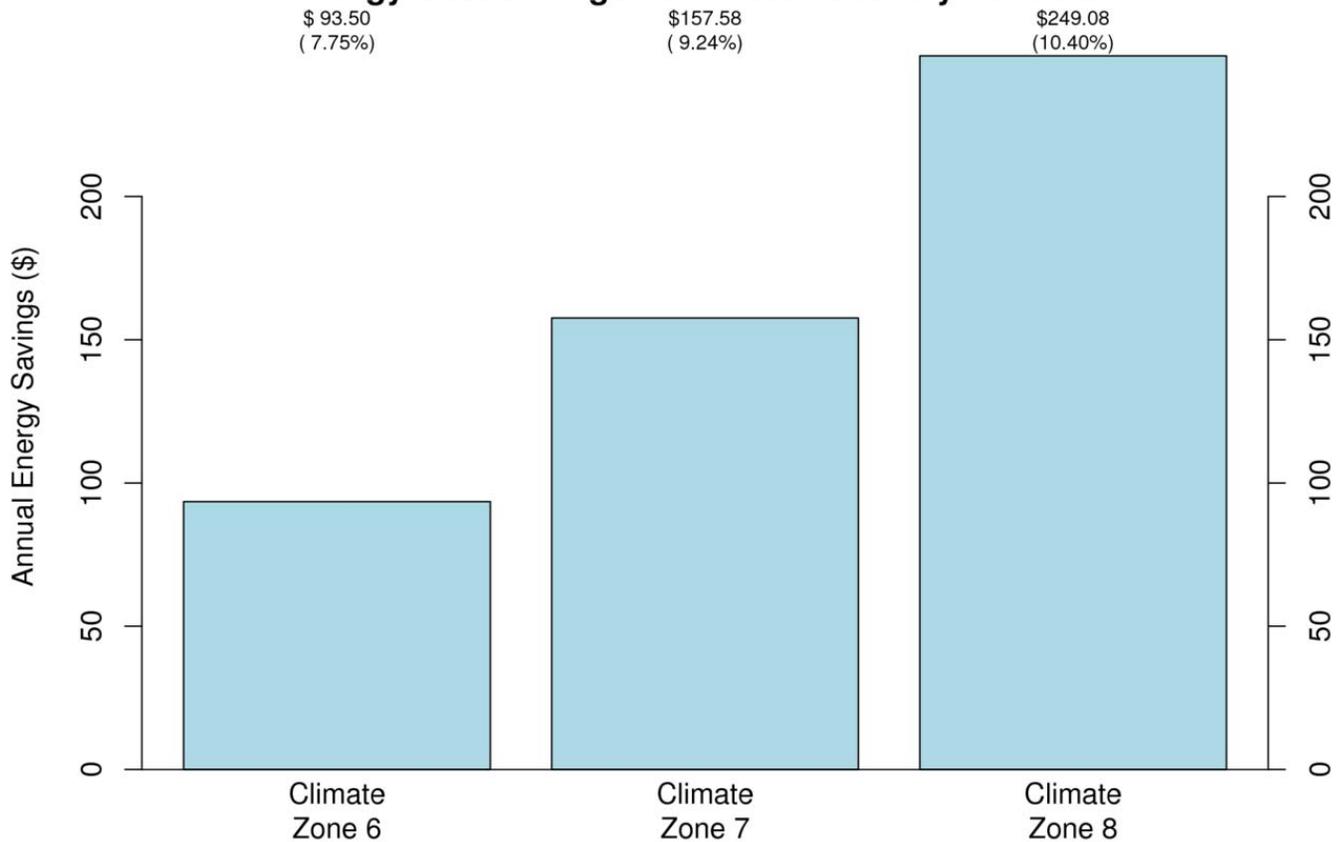
⁵ http://www.eia.gov/dnav/pet/pet_pri_refoth_dcu_nus_a.htm

⁶ <http://www.eia.gov/beta/aeo/#/?id=3-AEO2015>

⁷ See EnergySavers website

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.⁸ Russell, Sherman and Rudd found a similar cost of \$1350 including installation.⁹ A study conducted by the National Association of Home Builders (NAHB) indicates the life of HRVs to exceed 20 years.¹⁰

COST-EFFECTIVENESS

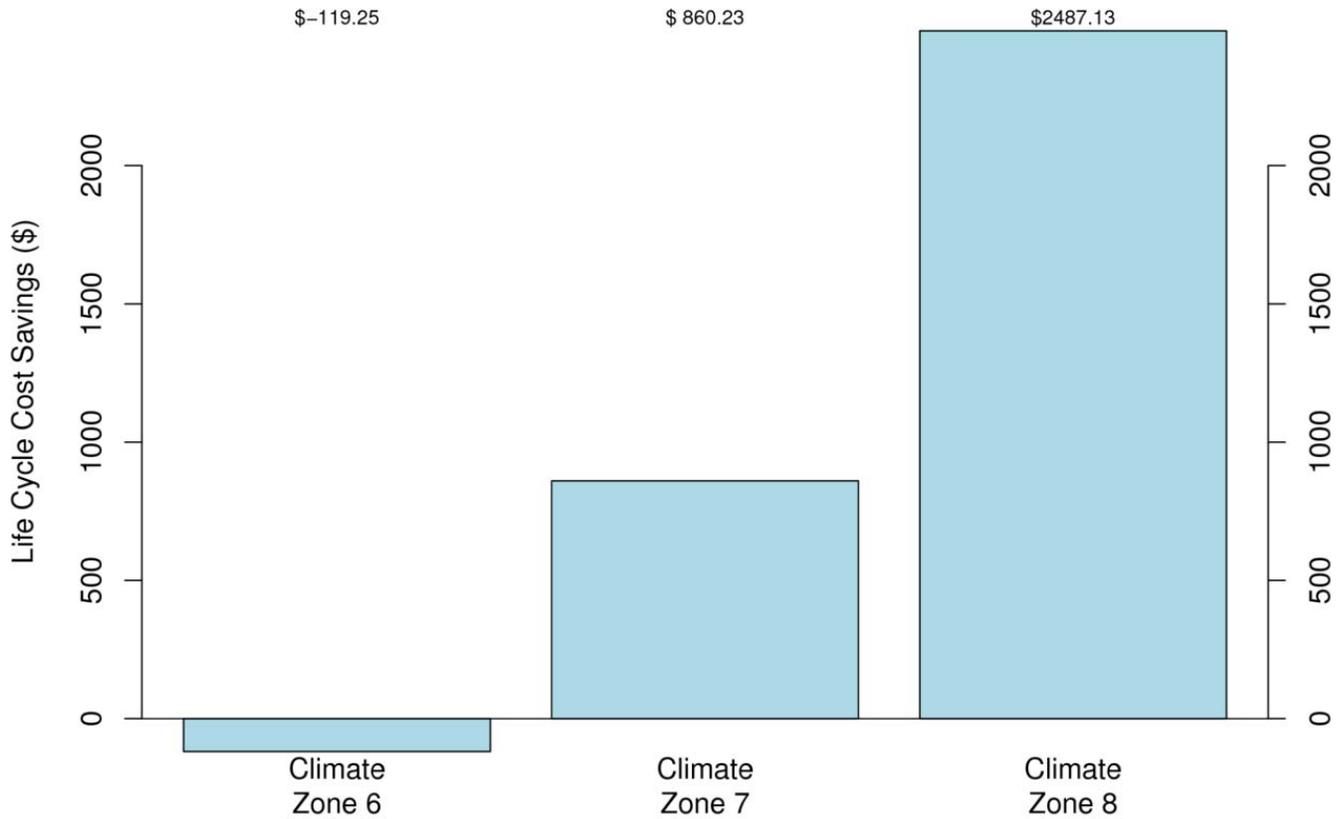
Assuming HRVs to have a useful life of 20 years, an evaluation of the life-cycle cost savings using DOE's cost-effectiveness methodology shows positive life-cycle cost savings in climate zones 7 and 8, and marginally increased life-cycle costs in climate zone 6. The zone-6 results are sensitive to assumptions about the HRV measure life. The reference above cites a useful life of "20+" years. If DOE's analysis is conducted with a measure life of 23 years, HRVs are cost-effective in zone 6.

⁸ See cost of 70% effective HRV at <http://www.nrel.gov/ap/retrofits/measure.cfm?gld=10&ctId=236&scId=2522>

⁹ Russell, Sherman and Rudd. 2007. LBNL 57730 - Review of Residential Ventilation Technologies. HVAC&R Research, Volume 13.

¹⁰ <http://www.deckerhomeservices.com/nahb-study.pdf>

Life-Cycle Cost Savings from Heat Recovery Ventilator



CONCLUSION

When analyzed assuming a measure life of 20 years, HRVs are cost effective in climate zones 7 and 8. With a measure life of 23 years, they are also cost-effective in climate zone 6. DOE is seeking better information on the reasonable life of HRV equipment.