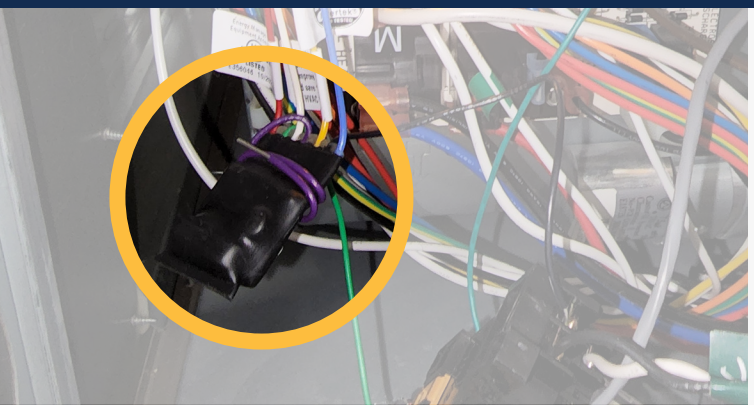
Advanced Controls for Residential Heating Ventilation and Air Conditioning (HVAC) Fan



This study investigated the energy savings potential of a commercially available fan controller designed to be installed in residential HVAC systems. The device lengthens the fan-off delay, or the amount of time the air handler fan continues to operate following a cooling or heating cycle. The device is intended to reduce overall HVAC energy consumption by using the fan to deliver additional heating or cooling capacity relative to the system's baseline operation.

Major Findings

The field evaluation showed that for 14 of 20 sites, there was no statistically significant difference in annual gas use between a system operating with and without the fan controller. For the other six sites, three showed decreases in gas use, while the other three showed increases. A statistically significant increase in fan energy use was observed during the heating season at all four sites with sufficient data to estimate it. In cooling mode, none of the ten sites assessed showed a significant difference in air conditioner electricity consumption between modes. Two of the ten sites had significant increases in fan energy use in cooling mode, while the eight other sites had increases that were statistically insignificant.

A comfort survey including questions related to the quality of the air emitted by HVAC registers, noise, and fan behavior was administered during cooling and heating seasons. Responses were cross-referenced with the current fan control mode at each site. No participants consistently responded with a perception of fan cycle run times that matched the expected cycle time given the active fan control mode.

In each round of surveys, regardless of fan control mode, participants indicated that they felt the fan was running longer, shorter, or the same duration as was typical. Occupants generally felt that their HVAC system was keeping them comfortable.

Simulations of the energy savings potential of this controller using realistic Minnesota building characteristics found that gas use could be reduced by between 0% and 10%, with a median change of 2%, while the median impact on fan runtime was an 8% increase. These simulations assumed that no heat from the furnace heat exchanger moved to the conditioned space unless the fan was on.

Discussion

While the modeling exercise showed the potential for up to 10% gas savings, it relied on the assumption that none of the heat from the heat exchanger moved into the conditioned space while the fan was off. The field analysis results discredited this assumption.

For both heating and cooling operation, unmeasured factors such as solar gains and occupant behavior likely have a much larger effect on HVAC energy requirements than the fan-off delay.

Conclusions

Overall, the results emphasize that any beneficial effect the fan controller has on gas use and air conditioning energy use is small relative to other sources of uncertainty. It is not appropriate to attribute gas or electricity savings to this device in Minnesota homes.

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