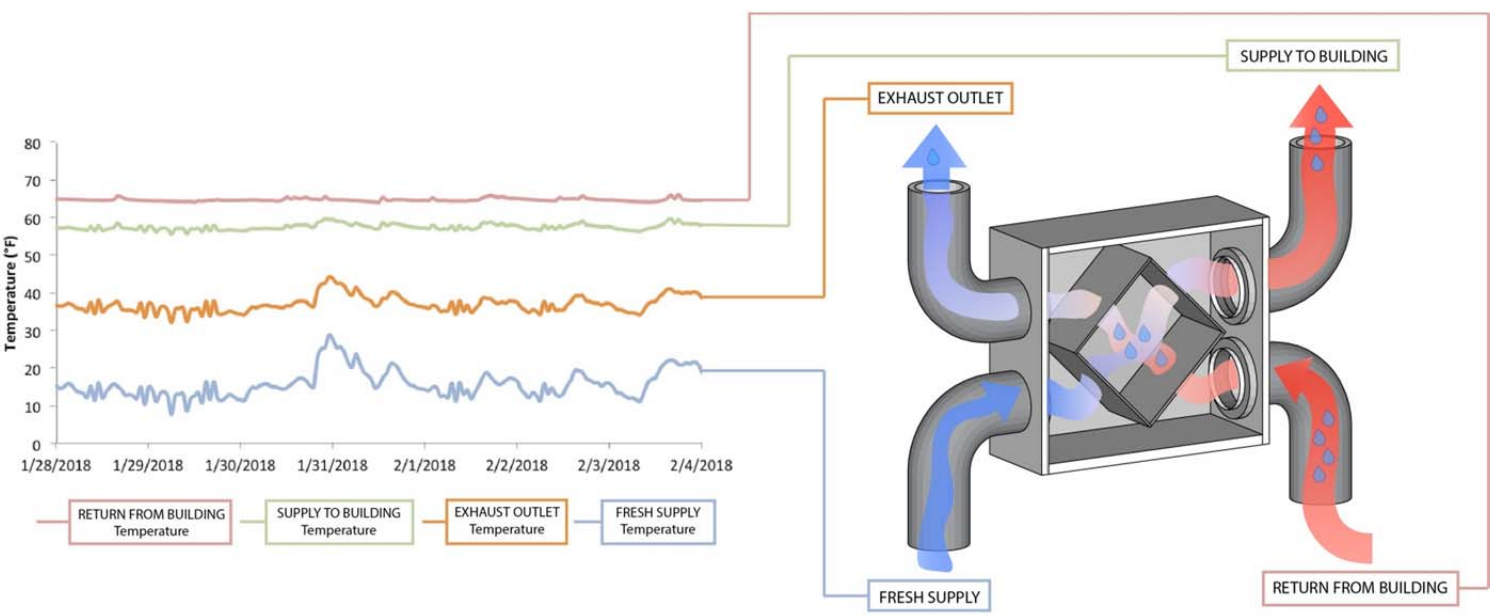
COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC

Energy Recovery Ventilator Testing

Fairbanks winter testing of Panasonic's Intelli-Balance Cold Climate ERV



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Cold Climate Housing Research Center

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CCHRC tested a Panasonic Intelli-Balance Cold Climate Energy Recovery Ventilator (ERV) over the course of the 2017-2018 winter season. The ERV was installed in October 2017 and operated in CCHRC's Research and Testing Facility (RTF) until early April 2018. This report will document the installation of the system and how the system performed over a Fairbanks winter.

The ERV was installed in our HRV/ERV test bed in the upstairs classroom of the RTF. The ERV was set up to serve the classroom, an office, and a restroom. Figure 1 shows the ducting layout for this installation. The building supply duct also has a filter box with MERV 8 and 13 filters in it. Temperature and humidity sensors were installed in all of the incoming and outgoing air ducts.

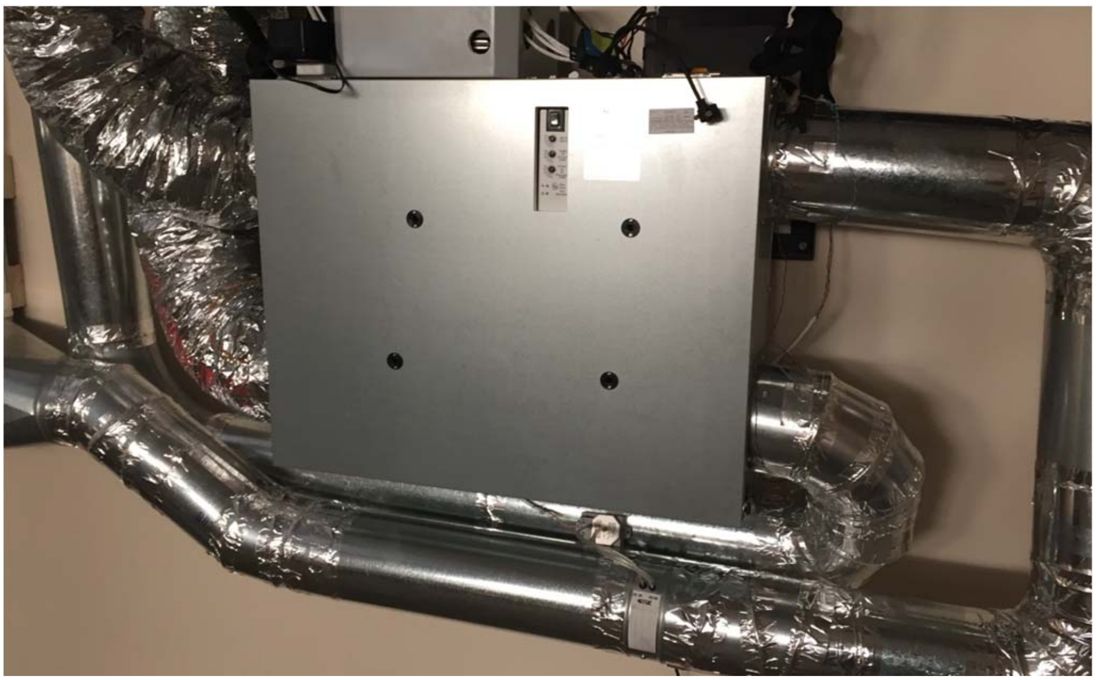

Figure 1. Panasonic Intelli-Balance Cold Climate ERV install. The insulated ducts are going to and from the outside.

In order to evaluate quality data, certain time periods of data were evaluated for temperature, efficiency estimates, and moisture recovery. Table 1 lists the time periods of evaluated data.

Table 1. Data Evaluation Periods.

Time Period	Evaluation Type
Jan 28, 2018 to Feb. 16, 2018	Temperature, efficiency estimates, freezing potential
March 5, 2018 to March 20, 2018	Temperature, efficiency estimates,
April 4, 2018 to April 9, 2018	Temperature, moisture recovery

Temperature data shows the ERV is heating the fresh supply air up to 57°F from an entering temperature of 10°F with exiting air temperature dropping from 64°F to 34°F. Figure 2 shows the varying temperatures across the core for the coldest parts of the study.

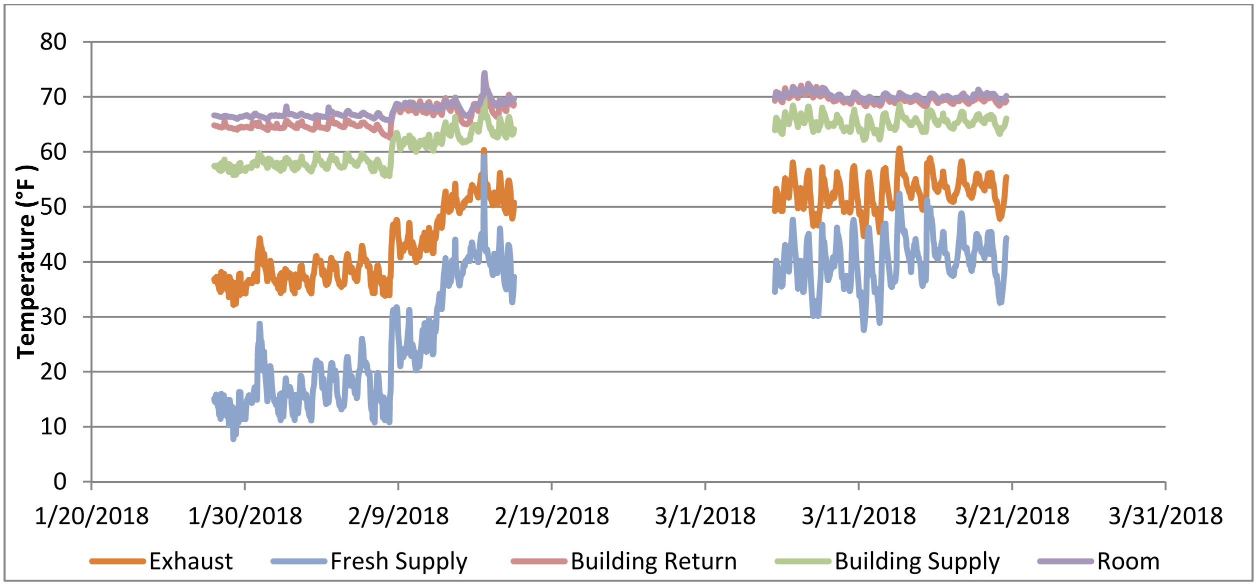

Figure 2. Temperatures across the ERV core. Heat energy recovery across the core worked well to temper the fresh supply air.

The defrost mechanism of the ERV was also working during this period. When the incoming temperature was too cold (10°F) the defrost damper opened creating a temporary (10 minute) increase in temperature. During the period in Figure 3 there was an hour and a half between defrost cycles. The ERV never had any evident frost or moisture build up in the core.

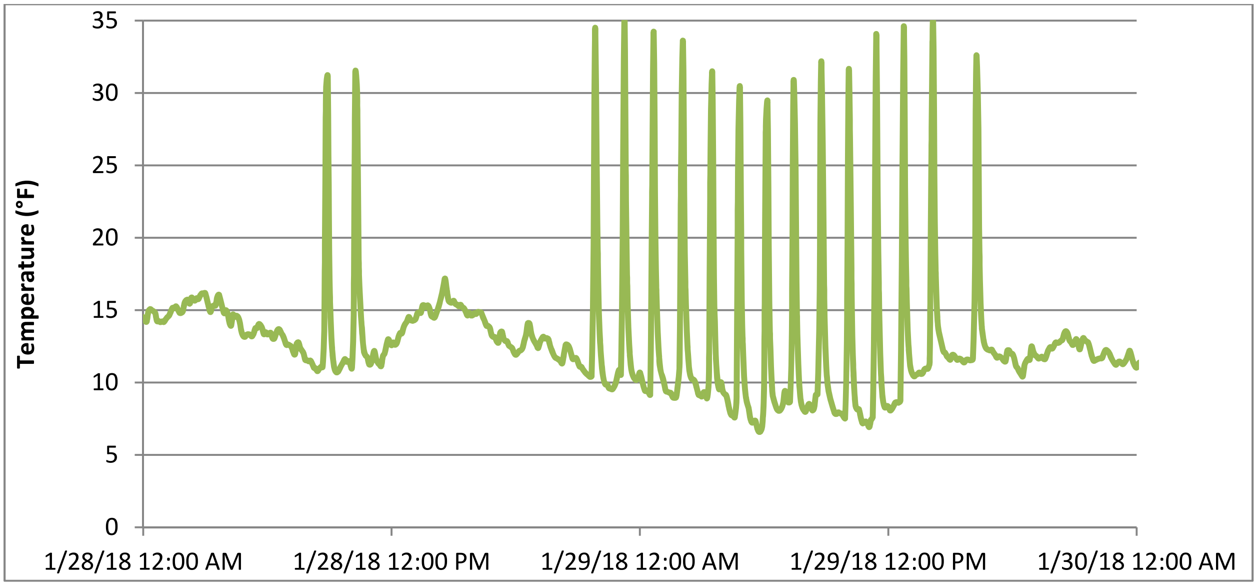

Figure 3. ERV defrost cycles. The defrost mechanism was successful at keeping frost build up out of the core.

The ERV was balanced at the beginning of the project to deliver and return 95 cfm of air to and from the building. A check at the end of the study found fresh supply to be 101 CFM and exhaust to be 94 CFM, so the balance did change over the course of the study (perhaps related to a duct cleaning in February). With these small differences in balance, CCHRC assumed a constant and equal air volume so that the efficiency of the heat and mass transfer across the core could be estimated. Figure 4 shows the efficiency of the ERV over two time periods with entering fresh air temperatures. The sensible and enthalpy efficiency are fairly consistent for both time periods even though the temperatures in March were 20 to 30°F warmer than February.

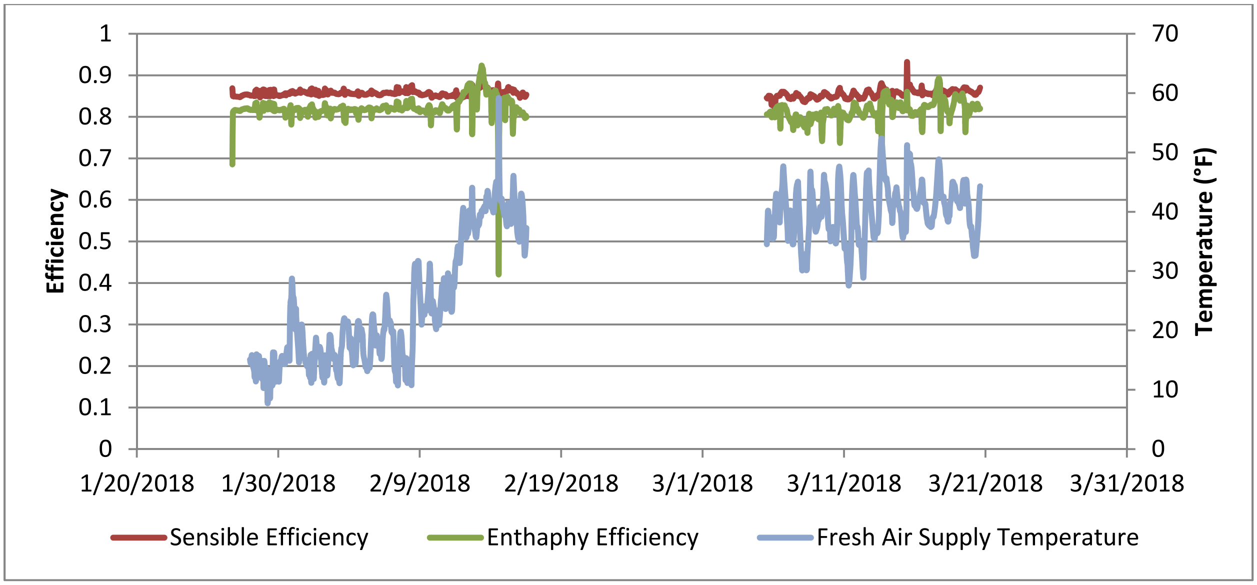

Figure 4. Efficiency estimates for the ERV. The sensible efficiency averaged 85% while the enthalpy efficiency averaged 82%. These are estimates based on in-situ data not on precise laboratory testing.

The mass transfer efficiency was inconsistent and was heavily dependent on the internal relative humidity which was more variable than the temperature. Figure 5 shows an estimate of the mass transfer efficiency at low interior RH.

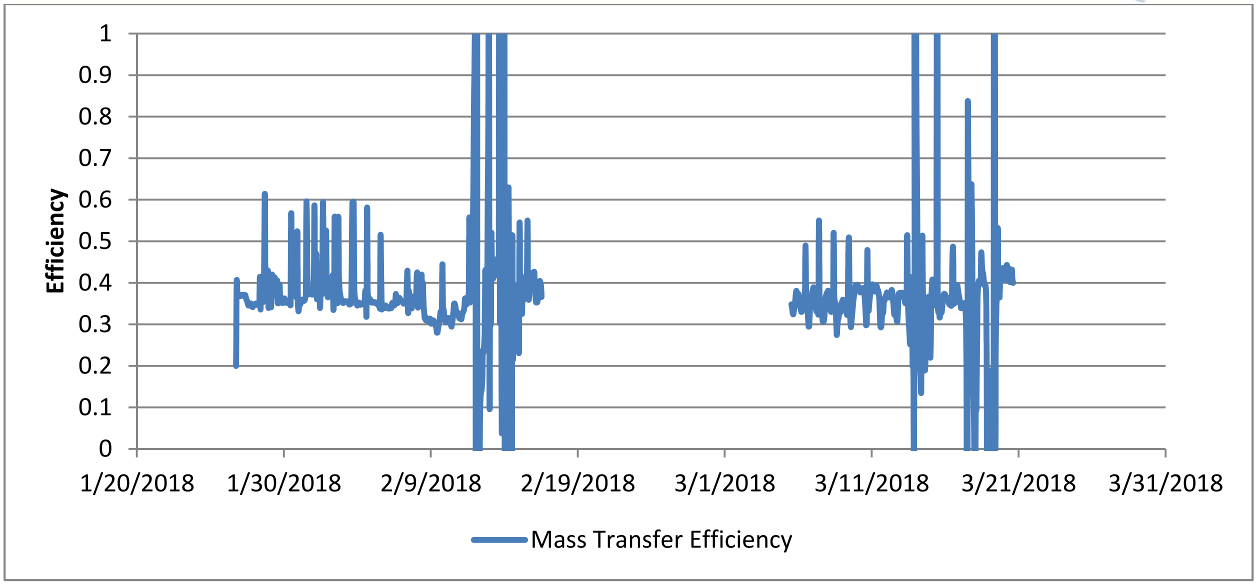

Figure 5. Mass transfer efficiency. Low moisture content in both the exiting and entering air made mass transfer minimal.

The interior RH was elevated and monitored the first week in April to see if higher indoor RH had any effect on the mass transfer efficiency. Figure 6 shows that the higher internal RH improves the mass transfer efficiency.

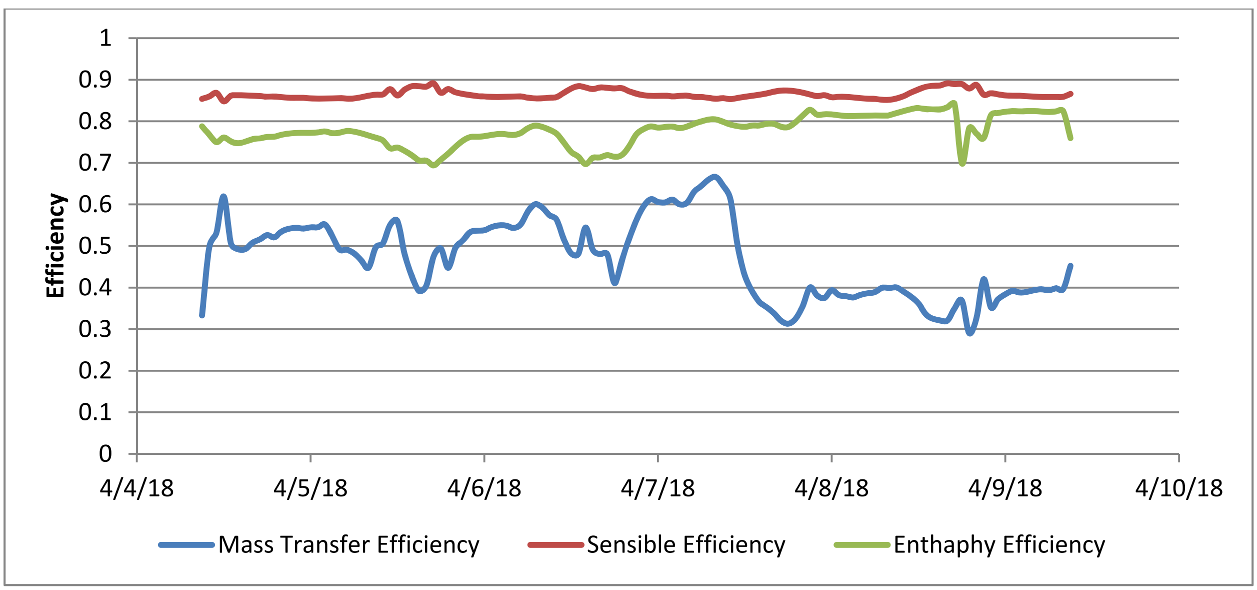

Figure 6. Efficiency estimates with higher interior humidity. Higher moisture in the exiting air made for greater transfer.

The Panasonic ERV performed well in this in-situ cold climate test. There is an adequate system for keeping the core from freezing and the sensible efficiency averaged 85% at cold Fairbanks temperatures. CCHRC will keep the ERV installed in its current location. It may become part of another project on IAQ systems for small houses that will take place next winter if funding is approved.