Energy Savings Potential and RD&D Opportunities for Commercial Building HVAC Systems

Final Report

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B.20 Optimized Heat Exchangers

Systems Impacted by Technology		Energy-Savings Performance	Technical Maturity
Vapor Compression Heat Exchangers		0.05 Quads/yr	R&D (short-term)
Peak-Demand Reduction Potential	**Non-Energy Benefits**	**Ease of Retrofit**	**Cost/ Complexity**
Low	Less Refrigerant	High	Medium

Description of Technology

In vapor compression systems, fin-and-tube heat exchangers (HX) heat or cool the airflow distributed to building occupants. Air passes over the collection of refrigerant filled tubes to either gain or reject heat. The geometry of the HX can be optimized to reduce the energy requirements of the compressor or fan while maintaining capacity. Changing the spacing of fins, along with the number, size, and orientation of tubes can significantly improve system efficiency.

Description of How Technology Saves Energy

Lowering fin density and increasing tube spacing minimizes fan pressure drop and the subsequent fan energy use. Utilizing tubes with larger bends reduces the fluid resistance of the coil. With lower resistance, the compressor better maintains refrigerant flow and capacity while using less energy.

Potential for Retrofit

Advanced HXs could be retrofit into existing systems or in high-efficiency replacement equipment.

Potential Scope of Impact

Evaporators and condensers for vapor compression systems would benefit from this technology. Based on an analysis of its potential impact on HVAC systems in the U.S., this technology would save 0.05 Quads of electricity per year.

Energy-Savings Performance

Domanski et al. (2004) utilized software to evaluate refrigerant circuitry in HXs. The advanced designs found through their analysis could increase total system capacity by 2%.

NIST (2008) used computer based tools to reduce uneven airflow distributions in finned tube coils. Through the use of hi-resolution cameras during experimentation, a 5% increase in system efficiency can be realized during subsequent optimized HX designs.

Thermorise (2009) developed their patented DEEP heat transfer coil with various configurations featuring both fin and tube spacing modifications. Reductions of 19% in fan and 10% in compressor power showed a 20% decrease in total energy use in laboratory testing.