Building Technologies Research and Integration Center

Science Research Seminar Series

Reducing the Energy and Environmental Footprint of Commercial Refrigeration

Friday
June 20, 2014
9–10 a.m.
Building 4500N, Room 250
Wigner Auditorium


Compressor Rack


Condenser

Abstract

The refrigeration equipment used in the food retail and service industries constitutes one of the most energy intensive end uses in the commercial building sector, consuming about 1.2 quads of energy annually, resulting in high indirect greenhouse gas (GHG) emissions. In addition, commercial refrigeration systems are prone to significant refrigerant leakage, which reduces system efficiency and leads to large direct GHG emissions. Hence, an effective commercial refrigeration system should be based on several factors, including the global warming potential (GWP) of the refrigerant, energy consumption of the system over its operating lifetime, and leakage of refrigerant over the system lifetime. A life cycle climate performance design tool that estimates the equivalent CO_2 emissions associated with a refrigeration system throughout its lifetime, from construction to operation and destruction, will be discussed. With the phaseout of chlorofluorocarbon and hydrochlorofluorocarbon refrigerants, the industry has turned to hydrofluorocarbons (HFCs) as substitutes. The zero ozone-depleting potential of HFCs is appealing; however, many have relatively high GWPs. Several lower GWP alternatives have been proposed that provide high energy efficiency while minimizing risk, cost, and modifications to equipment; evaluation of these alternative refrigerants in commercial refrigeration systems and components will also be discussed. In addition, the development of a low-emission commercial refrigeration system using CO_2 as the refrigerant will be presented.

Dr. Brian Fricke

is an R&D staff member in the Building Equipment Research Group at ORNL. He has more than 15 years' experience in the areas of commercial and industrial refrigeration. Dr. Fricke has analyzed the energy and environmental impacts of various commercial refrigeration systems and has studied the energy consumption and sales productivity of open and doored vertical refrigerated display cases. He has also enhanced the refrigeration modeling capabilities of the whole-building energy modeling tool, EnergyPlus, including modeling of transcritical CO_2 booster systems and two-stage compression systems. Industrial refrigeration projects in which he has been involved have included modeling and numerical analysis of cooling and freezing of foods, determination of heat transfer coefficients for food cooling and freezing, and development of design guidelines for refrigerated storage facilities. Dr. Fricke has authored more than 150 publications including journal articles, books, book chapters, presentations, and research reports. He is an active member of the American Society of Heating, Refrigerating and Air-Conditioning Engineers and the International Institute of Refrigeration. Before joining ORNL in December 2010, Dr. Fricke was an assistant professor in the Mechanical Engineering Department at the University of Missouri in Kansas City.

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