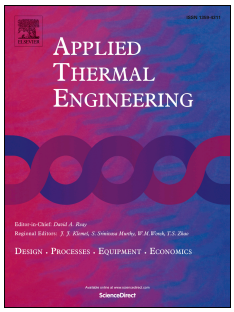
Accepted Manuscript



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PII: S1359-4311(14)01034-5

DOI: 10.1016/j.applthermaleng.2014.11.036

Reference: ATE 6145

To appear in: *Applied Thermal Engineering*

Received Date: 29 July 2014

Revised Date: 15 October 2014

Accepted Date: 13 November 2014

Please cite this article as: A. Hakkaki-Fard, Z. Aidoun, M. Ouzzane, Improving cold climate air-source heat pump performance with refrigerant mixtures, *Applied Thermal Engineering* (2014), doi: 10.1016/j.applthermaleng.2014.11.036.

Improving cold climate air-source heat pump performance with refrigerant mixtures

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Abstract

Heat pumps (HP) are one of the most adapted heating solutions for meeting low energy consumption requirements of buildings. However, improving the performance of the heat pumps at low ambient temperatures is still an open challenge. This paper assesses the potential benefits of implementing zeotropic refrigerant mixtures in residential air-source heat pumps for cold climates, in order to increase their seasonal performance. The seasonal performance of a heating system with an air-source heat pump, supplemented with an auxiliary electric heater is studied in two cold climate cities of Montreal and Edmonton. To this aim, a detailed screening heat pump model previously developed is modified and used. Furthermore, the performance of the system with a variable composition refrigerant mixture is assessed, the main goal being to illustrate the possibility of applying environmentally friendly zeotropic refrigerant mixtures in conventional heat pumps, with minimal changes in the components, in order to improve their performance in cold climate conditions.

Keywords: Heat pump; zeotropic mixture; air-source; cold climate; seasonal performance; variable mixture composition.

Nomenclature

A	area, m^2
A1	no flammability and lower toxicity
A2	lower flammability and toxicity
CND	condenser
EVAP	evaporator

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