

Accepted Manuscript

Title: Energy efficiency evaluation of integrated CO₂ trans-critical system in supermarkets; a field measurements and modelling analysis

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PII: S0140-7007(17)30236-0

DOI: <http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.06.002>

Reference: IJIR 3667

To appear in: *International Journal of Refrigeration*

Received date: 9-2-2017

Revised date: 31-5-2017

Accepted date: 2-6-2017

Please cite this article as: Mazyar Karampour, Samer Sawalha, Energy efficiency evaluation of integrated CO₂ trans-critical system in supermarkets; a field measurements and modelling analysis, *International Journal of Refrigeration* (2017), <http://dx.doi.org/doi: 10.1016/j.ijrefrig.2017.06.002>.

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Energy Efficiency Evaluation of Integrated CO₂ Trans-critical System in Supermarkets; a Field Measurements and Modelling Analysis

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Highlights

- Energy efficiency of an integrated CO₂ system in a Swedish supermarket is studied.
- Different integrated and stand-alone energy systems are modelled and compared.
- The system provides the cooling and heating demands with high energy efficiency.
- The integrated CO₂ system is more efficient than HFC systems in Northern Europe.

ABSTRACT

This paper investigates energy efficiency of an integrated CO₂ trans-critical booster system installed in a supermarket in Sweden. The supermarket has applied several features to improve energy efficiency including space and tap water heating, air conditioning (AC), and parallel compression.

Using field measurements data, the system performance is evaluated in a warm and a cold month. Furthermore, this integrated energy system concept is modelled and compared with stand-alone HFC-based energy systems.

The results show that the system provides the entire AC demands and recovers a great share of the available heat, both with high COP values. The comparative analysis shows that integrated CO₂ system uses about 11% less electricity than stand-alone HFC solutions for refrigeration (i.e. indirect HFC), heating and AC in North of Europe.

Energy efficiency analysis of the integrated CO₂ system proves that this system is an environmentally friendly all-in-one energy efficient solution suitable for cold climate supermarkets.

Keywords: CO₂ trans-critical booster system, Supermarket, Field measurements, Systems integration, Modelling

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