

## **Refrigeration Systems in Supermarkets with Propane and CO<sub>2</sub> – Energy Consumption and Economy**

**K. G. Christensen**

Danish Technological Institute  
Kongsvang Allé 29, 8000 Aarhus C, Denmark  
Phone +45 72201265, Fax +45 72201212  
E-mail: kim.gardo.christensen@teknologisk.dk

### **ABSTRACT**

Due to the introduced tax on HFC refrigerants and the future ban (1 January 2007) on these refrigerants in new installations above 10 kg, the market for commercial refrigeration is experiencing big changes. New systems with natural refrigerant are thus developed and tested.

In 2000, a new refrigeration technology was implemented in the small supermarket "Dagli'Brugsen" in Odense, Denmark. The system has been in operation since then and has demonstrated that it is possible to build cascade systems based on propane and CO<sub>2</sub>. The small supermarket was however very atypical for which reason it was difficult within the frames of the project of that time to provide qualified conclusions concerning the energy consumption and economy.

It was thus decided to carry out a similar project – in a typical supermarket – in order to provide comparative data from new conventional systems based on direct expansion and with modern scroll compressors. The project was carried out in co-operation with Super Køl, the Danish Technological Institute and COOP Denmark FDB (Fakta) and was finalised in 2001. The project was furthermore partly financed by the Danish Environmental Protection Agency.

The supermarkets of the Fakta retail chain (in total 238 supermarkets) have the advantage that the newest ones are very standardised and a statistical comparison therefore can be carried out without great uncertainty.

The project showed very interesting results. The energy consumption was decreased by approx. 5% compared to an average, conventional and comparable supermarket. The investment was 20% higher in the actual case, but is estimated to be 10% higher in the future. In large supermarkets, the increase in the investment will approach zero.

The previous project focused on investigation of function and operation, whereas this project focused on documentation of the system with regard to energy consumption and economy. The unanswered questions of the industry in these areas have to be answered. I hope that this paper might be of help in doing so.