



Conversion of Supermarket Refrigeration Systems from F-Gases to Natural Refrigerants

Background

Facing a shortage of energy supply in South Africa, prices for electricity are increasing. The country is therefore looking for possibilities to manage energy demand. Supermarkets, which are an important sector of the economy, need large amounts of electricity of which most is used in their refrigeration and air-conditioning systems. It is therefore essential to explore options to increase their energy efficiency. For the same reasons, supermarkets worldwide are changing their freezers and refrigeration equipment from fluorinated gases to natural refrigerants with favourable thermodynamic properties and considerable energy saving potential. So called cascade systems, operating with the ozone- and climate-friendly natural refrigerants ammonia and CO₂, are currently considered state-of-the-art in supermarket refrigeration.

Project Description

Currently, all supermarket refrigeration systems in Southern Africa operate on fluorinated refrigerants with high ozone depletion potential (ODP) and/or global warming potential (GWP). Modern, environmentally friendlier technology based on natural refrigerants is still completely unknown there and is seen with concern due to potential safety issues.

Pick n Pay is one of the largest supermarket chains in Southern Africa. Due to increasing energy costs, Pick'n

Pay decided to explore these new technologies based on natural refrigerants. They readily agreed to technical and financial assistance to convert the refrigeration systems in two supermarket stores in climatically different zones of South Africa, namely in Johannesburg and in Cape Town.

The new technology is a cascade system with ammonia as the primary system located in a machine room outside the sales area and a glycol-water solution for distribution inside the store. The CO₂-cascade, as the secondary system, provides the cooling for the low temperature applications. The state-of-the-art equipment comes from Europe, but is supplied through local South African refrigeration companies. This ensures that the technology can spread more easily once its advantages are proven.

Investment costs for the new systems are still relatively high compared to the standard cooling technology in South Africa. But significant energy savings can offset this partially and will contribute to an overall economic benefit. In addition, and to ease the investment decisions for the conversion of more stores in the future, the project also develops a financing model including tradable carbon credits for emissions reductions via the Clean Development Mechanism (CDM).

An integral part of the project is to train the supermarket's service technicians in the professional maintenance and servicing of the new equipment to ensure optimal performance and safe handling of the equipment and to maximise energy efficiency.



Project Impact

The refrigeration system at the supermarket in Johannesburg with a refrigerant charge of 1,200 kg has a 30% leakage rate per year, which equals to a release of 360 kg HCFC-22 and approx. 600 tonnes CO₂e annually.

The system at the supermarket in Cape Town with a refrigerant charge of 1,000 kg has an 80% leakage rate, which equals to a release of 800 kg HCFC-22 and approx. 1,400 tonnes CO₂e per year.

These refrigerant losses need to be replaced regularly to avoid operation at reduced efficiency, which increases energy consumption. Synthetic fluorinated refrigerants are also more expensive than natural refrigerants. The use of natural refrigerants and the higher energy efficiency of the new equipment avoid permanently and sustainably greenhouse gas emissions associated with the current technology. Estimated direct emissions due to leakage of the refrigerant HCFC-22 currently amount to approx. 2,000 tonnes CO₂e for both stores per year. The energy efficiency of the new equipment will significantly reduce the company's electricity expenses and thereby contribute to an overall improvement in profitability.

The results of the project may provide the government of South Africa with policy options on how to encourage further investments in energy savings. It is also intended to provide the Department of Environmental Affairs and Tourism with an example of a CDM project generating carbon credits in the retail sector.

Title Conversion of supermarket refrigeration systems from f-gases to natural refrigerants

Country South Africa

Sector Commercial refrigeration/retail sector

Objective Introduction of ozone- and climate-friendly state-of-the-art refrigeration technology into Southern Africa

Target Group Supermarkets in Southern Africa; suppliers of commercial refrigeration equipment; service technicians

Project Executing Organization BMU (German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety)

Implementing Partner Organization Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH; South African Department of Environmental Affairs and Tourism; National Ozone Office; Designated National Authority; Pick'n Pay (South African supermarket chain)

Project Approval October 2008

Project Duration Until December 2009

Project Budget EUR 1,600,000

Funds The project is funded by the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety within the framework of the International Climate Initiative based on a decision of the German Federal Parliament.

Impact on Ozone Layer and Climate Protection

Direct emissions of 2,000 tonnes CO₂e per year are sustainably and permanently eliminated through replacement of HCFC-22 with natural refrigerants. In addition, there will be significant energy savings through installation of more energy-efficient natural refrigerant based equipment.

Furthermore, about 0.06 ODP tonnes HCFC-22 will be avoided.

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