Non-CO_2 Greenhouse Gases: High-GWP Gases

Source/Sectors: Substitution of ODS/Industrial Process Refrigeration

Technology: Ammonia secondary loop systems (C.1.1.8.3)

Description of the Technology:
Better equipment design and store layout can lead to a reduction in the amount of refrigerant needed for a given amount of product cooling, hence reduce emissions of HFCs. Secondary loop systems circulate a secondary coolant or brine from the central refrigeration system to the display cases. Thus, it operates at reduced charges and allows less leak rates (US Climate Change, 2005; USEPA, 2001). Ammonia is a toxic substance but can replace HFCs in these systems, because the system design does not let this substance contact customers.

The system has great benefits in that it requires less maintenance, has more efficient defrost, and longer shelf life than direct expansion, the conventional systems (IEA, 2003; USEPA, 2001)

Effectiveness: Good

Implementability: Ammonia is a toxic substance that the use in a confined space is a major concern; however, due to its chemical characteristics, the leaks are easily detectable with application of safety equipments. Besides, since it is lighter than air, it is easy to disperse in the event of release (IEA 2003; USEPA 2006b).

Reliability: To ensure its safety, current systems contain regulatory systems to control pressures. Also, emergency diffusion systems and a series of safety relief valves are installed (IEA, 2003).

Maturity: The actual market penetration depends on the potential risks of these technologies, because it affects the acceptance degree from manufacturers, end users, regulators, and insurance companies (IEA, 2003).

Environmental Benefits: HFCs emission reduction

Cost Effectiveness:

Technology	Lifetime (yrs)	MP (%)	RE (%)	TA (%)	Capital cost	Annual cost	Benefits
Ammonia secondary loop systems[1]	20	10	100	2-9	$116	$12.89	$2.76

Note: MP: market penetration; RE: reduction efficiency; TA: technical applicability; costs are in year 2000 US$/$MT_{CO2\text{-}eq.}$
1: IEA (2003) & USEPA (2001)

Industry Acceptance Level: These systems have been in use for decades in Europe; however, it is heavily regulated in North America (IEA, 2003; ACHR News, 2000).

Limitations:
The toxicity and flammability would require major design modifications for the majority of traditional HFC systems (USEPA, 2006b). A revision of codes is necessary in US to allow the expanded use of ammonia in new equipment types (IEA, 2003).

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