

Workshop

F-gases: Responsible Use, Environment and Energy

Athens, 29 September 2003

The benefits of using HFCs for Greece

Assessing the cost of safety and efficiency.

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Refrigerant safety

- HFCs are designed with safety in mind.
 - Widely used HFCs are non-flammable and have low toxicity.
 - Compare favourably with flammable or toxic refrigerants
- It is important to minimize or eliminate emissions from HFC systems, however if a major leak does occur then the safety benefits of HFCs help protect nearby people.
- The hazards of hydrocarbons and ammonia mean the risks can be higher for systems with larger refrigerant charges.
 - particularly during on-site servicing and maintenance.
 - Standards restrict location and/or charge size for these refrigerants

Refrigerant safety

- HFCs are one option from a range of refrigerants industry uses a range of refrigerants appropriate to the application
- “Hydrocarbons and ammonia can be used safely but not in all applications and not in all circumstances, the risks to be managed generally increase with increasing quantity (charge) and proximity to people. The cost of safety required for highly flammable or toxic refrigerants, which may involve system redesign, might be more effectively invested in improved HFC systems.”
 - AD Little 2002

The cost of safety

- Safety remains a fundamental issue when considering the use of alternatives in comparison to HFCs.
 - Using hydrocarbons or ammonia requires additional risks to be managed.
- For many applications complete system design changes would be necessary if HFCs are not used.
 - These generally add cost - the cost of safety, which can lead to lower efficiency and increased energy consumption.
- Utilizing HFC based refrigeration or air-conditioning systems may allow investment in further energy saving measures
 - rather than investing in the mandatory and expensive safety measures required for toxic or highly flammable refrigerants.'

Implications of Replacing HFCs Costs Based on Denmark Study

- Recent study prepared for EPEE estimated costs for the EU based on an in depth Danish Study
- Danish study concluded conversion from HFCs to natural refrigerants “will far exceed €40 million”
- Implications for Greece

Relative Size of Markets

Scaling factors	Denmark	Greece	The EU
GDP % of EU	2.1	1.4	100
Population million	5	10	369
Air-conditioning market % units in 2000	0.22	15.4	100

Cost of Reconversion

Scaling factors	Greece	The EU
GDP % of EU	€27M	€1900M
Population million	€80M	€3000M
Allowing for Air-Conditioning Market Size	€52M to €160M	€4000M to €6000M

Operating Costs and Energy Consumption

- For refrigeration
 - Where secondary systems are required for safety for Hydrocarbons and ammonia
 - installation costs at least 10-20% higher
 - increased operating energy consumption 5-20%
- For air-conditioning
 - Even for Direct systems
 - HFC 410A more efficient (about 5%) than HCFC 22 and propane, which for Greece is about 4% lower energy consumption

Air-Conditioning Energy Consumption

Greece Domestic Air-conditioning	
Annual average electricity consumption <i>Estimate</i>	1000 kWhr/year
Number of Units <i>(Estimate from BSRIA 2002)</i>	2.5Million
Potential Energy savings with HFC 410A per year	100,000 MWhr/year

Implications of Replacing HFCs in Greece

- Significant cost would occur based on Danish Study and EPEE Research:
 - Possibly €52 Million to €160 Million
 - But air-conditioning market is large and growing rapidly
- Increased energy consumption likely
- Important to ensure that Council and Parliament understand the cost, safety and energy implications and support the measures set out in the F-Gas for stationary refrigeration and air-conditioning