



# GREENPEACE

---

**“Cool Technologies : Working Without HFCs”**

**EIA & GP Side Event**

**Presented by : Janos Mate**

**28<sup>th</sup> OEWG & 55<sup>th</sup> ExComm**



## Cool Technologies: Working Without HFCs

---

- This presentation is based on a detailed Greenpeace report by the same title, originally written in 2000 and updated in 2008.
- Electronic copies of the report are available from Janos Mate:  
[jmate@telus.net](mailto:jmate@telus.net)



# No Magic Bullet

---

- Just as there was no single “magic bullet” to replace CFCs, there is no single solution to replace HCFCs and HFCs.
- But there is a wide variety of environmentally superior, efficient, technologically proven, HCFC and HFC-free technologies to meet our cooling needs.
- Alternatives include: natural refrigerants (CO<sub>2</sub>, hydrocarbons, ammonia); secondary cooling systems; desiccant cooling; evaporative cooling, absorption cooling, passive cooling, district cooling.



## HFCs: “Headed for Catastrophes” or “Hell for the Climate”

Refrigerant	Global Warming Potential
HCFC-22	1810
HFC-404A	3922
HFC-507	3985
HFC-407C	1774
HFC-410A	2088
HFC-134a	1430
HFC-417A	2346
HFC-422A	3143
HFC-4220	2729
R-290 (propane)	3.3
R-1270 (propylene)	1.8
R-717 (ammonia)	0
R-744 (carbon dioxide)	1

- HFCs are potent global warming substances and are in the Kyoto basket of greenhouse gases whose combined emissions must be drastically reduced to avert climate chaos.
- If the growth of HFCs is allowed to continue unchecked, the annual emissions of HFCs by 2050 will be between 765 million and 1.5 billion CO<sub>2</sub> equivalent metric tonnes.
- If HFCs-410A, 404A and 507 become the sole replacement for R-22, then under BAU scenario their combined production will peak at an estimated 3.3 million tons per year in 2070. This equals nearly 8 billion tons of CO<sub>2</sub> equivalent, or almost 10 times the projected CO<sub>2</sub> emissions of the USA in 2010.



# Domestic Refrigeration Greenfreeze

---

- There are over 300 million hydrocarbon Greenfreeze refrigerators in the world today.
- Nearly 40% of annual global fridge production is Greenfreeze.
- All major European, Japanese and Chinese companies produce Greenfreeze.
- No Greenfreeze in US or Canada. Why not?

# Greenfreeze in China -2008



## SolarChill



- The SolarChill Project has developed an HFC-free, lead battery free, solar vaccine cooler and refrigerator for parts of the world without reliable electricity.
- 3 billion people live in such regions.
- The development Project Partners were UNEP, WHO, UNICEF, DTI, GTZ ProKlima, PATH and Greenpeace.
- SolarChill won the 2006 UK Cooling Industry's Environmental Award and the President of India was the first to purchase SolarChill.
- SolarChill is now commercially produced by Vestfrost.
- [www.solarchill.org](http://www.solarchill.org)



# Refrigerants, Naturally!

---

- Refrigerants, Naturally! is a global initiative of companies to replace their use of CFCs, HCFCs and HFCs in their point-of-sale cooling applications.
- Current partners in Refrigerants, Naturally! are: Coca Cola, Unilever, McDonald's, IKEA, Carlsberg, Pepsico and it is supported by Greenpeace and UNEP.
- Unilever has up to 275,000 hydrocarbon ice-cream coolers in the field.
- Coca Cola plans to have up 30,000 CO2 vending machines in the field in 2008. All the machines at the Beijing Olympics and at the Vancouver 2010 Winter Games will be HFC-free.
- McDonald's opened the first "fluorocarbon free restaurant" in Demark in 2003, is building another one this year, and is actively seeking HFC-free equipment suppliers.
- Carlsber will 1000 hydrocarbon coolers in the field in 2008.
- IKEA is designing HFC-free buildings.





## HFC-free Cooling in Supermarkets

---

- Several supermarket chains in Europe are now using natural refrigerants (hydrocarbons, carbon dioxide) in their stores.
- In 2006 the UK supermarket chains ASDA, Marks & Spencer, Sainsbury's, Somerfield, Tesco and Waitrose announced their intention to switch to carbon dioxide refrigeration.



# Alternatives to HCFCs and HFCs in commercial cooling

---

- Alternatives include, among others, direct cooling carbon dioxide based systems, direct cooling hydrocarbon or ammonia based secondary cooling systems, dessicant cooling, evaporative cooling, absorption cooling.



# Examples of Hydrocarbon Cooling in Commercial Enterprises and Public Buildings

---

- UK: Middlesex University, Great Ormond Street Children's Hospital, University College in London, Sainsbury's and Tesco's Supermarket, National Hospital, Royal Institute of British Architects, London Transport
- Germany: REWE & Edeka Supermarkets
- Sweden: PUB Department Store, Backhammars Bruk, AG Favor
- New Zealand: Frucor Processors, Kiwi Dairies Ltd.



# Examples of Ammonia Cooling in Commercial Enterprises

---

- International Space Shuttle
- Canada: Campbell's Soup
- Denmark: University Righospitalet, Copenhagen Airport, Magasin Department Store, Scandic Hotel, Danish National TV, SAS Building
- Germany: Hannover Trade Fair Building, Berlin Shopping Center Lindplatz Centrum, Leiptzig Trade Fair Building



# Ammonia Cooling- Continued

---

- Japan: Ashai Brewery
- Luxembourg: Palais Grande Ducal & Parliament, Cactus Supermarket
- Spain: Carlos III University
- United States: Stanford University, McCormick Place Convention Center, University of Miami



# Examples of Dessicant Cooling

---

- **Dessicant cooling is widely used in the United States by supermarkets, chain departments store like Wal-Mart, restaurants, hospitals, community centers and office buildings**



# Evaporative Cooling

---

- In the United States more than 70 companies manufacture evaporative air conditioners for residential, automotive, commercial and industrial markets. Direct, or single-stage, evaporative coolers are used on tens of thousands of homes in the western US, as well as thousands of commercial establishments: shops, restaurants, dry cleaners, offices, warehouses, factories.



# Co-Generation & Absorption Cooling

---

- The Banque Generale du Luxembourg has a gas fired co-generation that produces 90% of the Bank's energy needs & 100% cooling and heating. CO2 emissions are reduced by 6500 tons a year.





# District Cooling

---

- Distributes cooling from a central source to multiple buildings through a pipeline of chilled water
- Benefits include:
  - better quality of cooling
  - maximum cost effectiveness
  - capital cost elimination
  - space saving
  - decrease in sound pollution
  - environmentally friendly



# Examples of District Cooling

---

- Many examples in the US, Canada, Europe and Middle East
- Shopping centers, universities, city districts (Toronto, Helsinki, Copenhagen)



## Environmental impact of car air-conditioning

---

- Approximately 50% of global HFC-134a production is for automotive air-conditioning.
- On the average, 20% of the refrigerant leaks out of MACs each year.
- The HFC-134a leakage from the air-conditioning of cars sold in 1995 in Western Europe alone will have generated the CO<sub>2</sub> equivalent emissions of five new power plants, while the HFC-134a leakage from automobiles sold in Japan in 1995 will have contributed the CO<sub>2</sub> equivalent of ten power plants, or approximately 16 million tonnes of CO<sub>2</sub>.



## HFC-free Mobile Air Conditioning

---

- In 2007, in response to EU decision to ban high-GWP refrigerants in MACs by 2011, the German car manufacturers decided to replace HFC-134a with carbon dioxide.
- Hydrocarbons in primary or secondary loop systems could also be used safely and efficiently in MACs.



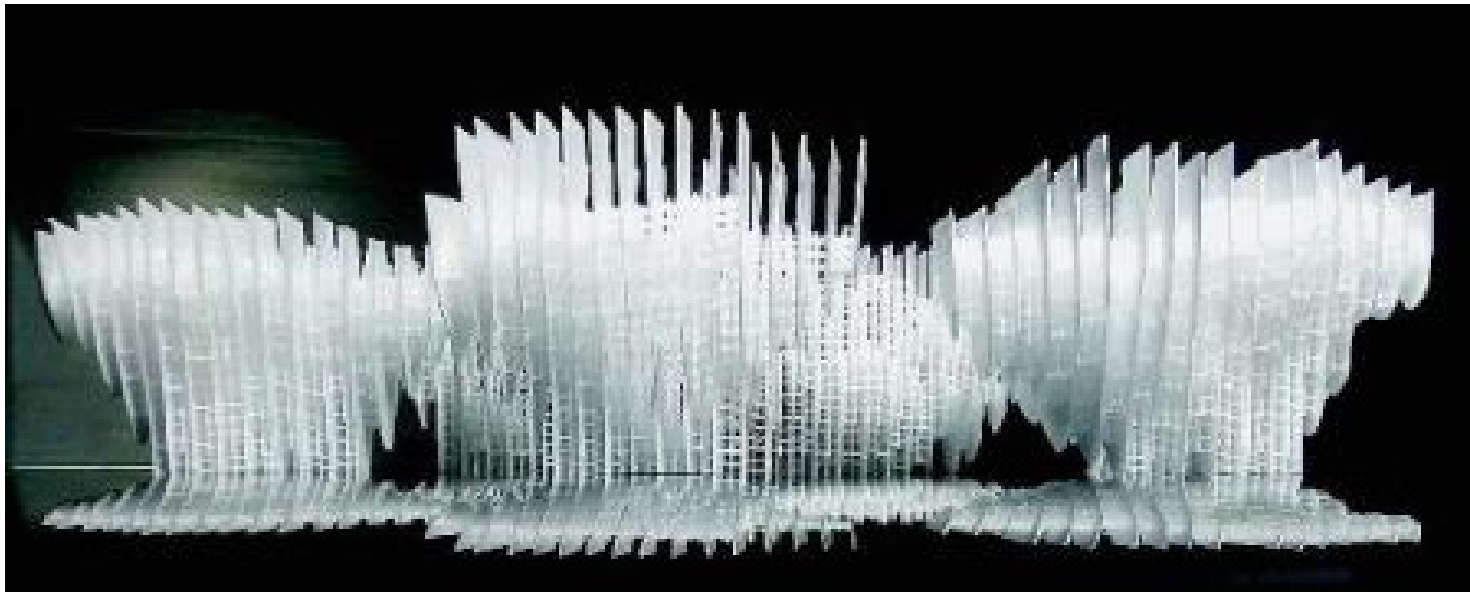
## Passive Cooling

---

- Intelligent architectural design making use of natural ventilation, coupled with efficient insulation, can eliminate or reduce the need for mechanical air-conditioning and thus save energy.

## Passive cooling

- Swabhumi Hotel complex (model) in Kolkata, India, uses innovative building design that simulates the way trees trap winds to deliver cooling services.





# HFC-free Foams

---

- The primary HFC replacements for HCFC-141b are HFC-245fa, HFC-365mfc and HFC-134a : they are all potent global warming gases
- There are different types of PUR foams: board stock, sandwich panels and spray foam
  - board stock used in roof and wall insulation
  - sandwich panels, where foam is sandwiched between facing materials, such as steel or aluminum, are used for insulating cold stores, cold rooms or doors
  - spray foams are made at point of use, and applied to uneven or inaccessible surfaces in storage tanks, pipe works and trailers



# HFC-free Foams 2

---

- In 2005 hydrocarbons represented over 55% global blowing agents for board stock and sandwich panels.
- Large US building insulation producers like Atlas Roofing, Firestone, RMAX, and Johns Manville shifted from HCFC-141b to pentane because it is less costly and more sustainable than the HFCs.
- Thanex in Denmark uses mechanical process for producing PUR foam.
- Recitel (Belgium) the largest European PUR foam producer, Bayer (Germany) and Efisole (France) use hydrocarbons.
- ICI and Liquid Polymers Group (UK), ResinaChemie and BASF (Germany), Nassau Doors, Tinby A/S and Windsor Doors (Denmark), use carbon dioxide.





# HFC-free Foams 3

---

- Darchem (UK) uses magnesium carbonate for insulation used in power stations and oil installation.
- Mineral fibers (dominant in the UK) and fiberboard have always been in competition with PUR.
- Isofloc (Swiss company) makes boardstock panels out of cellulose.
- Extruded polystyrene, produce with CO<sub>2</sub>, is suitable for below ground construction.
- Pre-insulated district heating pipes: More than 50% of world production of pre-insulated district heating pipes is produced in Denmark, by ABB, Logstor Ror, Tarco Energy and Starpipe. They use hydrocarbons and CO<sub>2</sub>.
- Jointing Foam: Baxenden of Scandinavia produces canister foam sealant with propane/butane propellant.



# HFC-free Foam 4

---

- **Flexible integral foam:** Ecco, a large shoe producer working in cooperation with Bayer, is producing shoe soles of flexible integral foam using CO<sub>2</sub>. Baxenden (Scandinavia) produces flexible integral foam using isopentane as blowing agent.
- **Refrigerators, freezer and bottle cooler Insulation:** cyclopentane is now the standard of choice for blowing rigid polyurethane foams used in these applications.
- **Commercial Equipment:** Coca Cola, PepsiCo and Unilever have all phased-out the use of HCFC insulation in their cooler applications and are all using hydrocarbon blown foams.
- **Vacuum insulation** offers superior insulation for appliances using silica, fiberglass, or ceramic spacers: NoFrost Co (UK), General Electric and Owens-Corning (USA), Sharp (Japan) and AEG in Germany have used vacuum panels.



# New global consciousness

---

“No matter what you do in this life it will seem insignificant, but the important thing is that you try.”

-Ghandi



Thank you for your attention

---

For copies of the detailed “Cool  
Technologies; Working Without HFCs”  
report please contact me at:  
[jmate@telus.net](mailto:jmate@telus.net)