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Natural Refrigerants: An Ecofriendly alternative



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The Environmental Information System acronymed as ENVIS was implemented by the Ministry of Environment & Forests by end of the 6th Five Year Plan as a Plan Scheme for environmental information collection, collation, storage, retrieval and dissemination to policy planners, decision makers, scientists and environmentalists, researchers, academicians and other stakeholders.

The Ministry of Environment and Forests has identified Consumer Education and Research Centre (CERC), Ahmedabad, as one of the centres to collect and disseminate information on “Eco-labelling and Promotion of Eco-friendly Products”. The main objective of the ENVIS Centre is to disseminate information on Eco products and International and National Eco labelling programmes.

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The discovery of the hole in the ozone layer in 1985 led to a 130-nation agreement — the Montreal Protocol of 1987. It was designed to protect the ozone layer by phasing out the production of substances like CFCs (chlorofluorocarbons) responsible for ozone depletion. These are used as coolants in refrigeration and air-conditioning applications or as dry cleaning solvents, among other uses. The first stage of phasing out of CFCs was replacing them with hydrochlorofluorocarbons (HCFCs) that break down much faster than CFCs causing less damage to the ozone layer. But, both CFCs and HCFCs are greenhouse gases, with much stronger climate effects than carbon dioxide (CO₂).

Now, both CFCs and HCFCs are being gradually phased out and non-ozone depleting refrigerants are being introduced. Called hydrofluorocarbons (HFCs), they are classified as having zero Ozone Depleting Potential (ODP) and medium to high Global Warming Potential (GWP). They are more environmentally friendly than CFCs and HCFCs.

Today, there is demand for refrigeration solutions that can reduce greenhouse gas emissions and have a lower impact on global warming, and, at the same time, give a reasonable cooling

performance. The solution lies in using natural refrigerants which are chemicals that occur in nature's biochemical processes. Natural refrigerants include air, ammonia, CO₂, hydrocarbons like butane and cyclopentane, and water. They have no or very low GWP and zero ODP and thus meet the prerequisites of the Montreal Protocol. They also accomplish the intent of the Kyoto Protocol in terms of reduction of CO₂-equivalent emissions.

Commercial refrigeration is a large contributor to a corporation's climate footprint — 45% by 2015, as reported by US EPA (United States Environmental Protection Agency) and ADEME (French Environmental Agency). According to Greenpeace, 18 corporations have taken steps towards going HFC-free. For instance, Coca-Cola has committed to going HFC-free in all its new vending machines and coolers by 2015.

This issue of the newsletter presents information about the Fairconditioning Programme launched by Noé21, a UN registered, non-profit organisation headquartered in Geneva. This programme is designed to catalyse sustainable large scale change in how India cools its indoor spaces. This issue also presents the Greenpeace view on natural refrigerants and its role in developing them.

Fairconditioning

– Cooling India Efficiently and Sustainably



SAVE MONEY

The greater energy efficiency Hydrocarbon Acs will benefit consumers for whom ACs weigh heaviest on the electricity bill



REDUCE ENERGY DEMANDS

The addition of power-hungry, inefficient appliances like ACs caused massive power outages in 2012. Reducing additional energy demands is the key to avoiding such situations in the future.



SAVE THE PLANET

Reduce greenhouse gas emissions by both avoiding the use of super climate change gases and by reducing additional needs for coal and uranium power plants.

The Fairconditioning Programme in India is pioneered by Noé21, a UN registered, non-profit organisation headquartered in Geneva. Its goal is to identify, evaluate, and promote powerful as well as realistic solutions to reduce greenhouse gas (GHG) emissions, using a catalytic approach. In June 2012, Noé21 partnered with cBalance, an Indian environmental solutions company with a similar commitment to accelerate the uptake of alternate low carbon technologies that minimise climate change, through rigorous research and proven business models.

Fairconditioning is designed to catalyse sustainable large scale change in how India cools its indoor spaces, through two broad programmes: Firstly, construction of more energy efficient buildings that reduce the quantum of conditioning required and secondly, steady acceleration in the uptake of natural gas ACs over conventional fluorinated gas ACs.

The programmes are designed to accelerate the achievement of the following goals:

- Compliance of new buildings with ECBC (Energy Conservation Building Code) norms as per UNDP forecasts of 20% in 2014, 35% in 2015, and 50% in 2016.

- Integration of the ECBC, sustainable and efficient cooling techniques and natural refrigerant AC technology in formal and semi-formal curricula within architecture and engineering academic programmes in institutes and universities across the country.
- Mainstreaming of natural refrigerant air-conditioners within the vast retail AC sector.
- Recognition of evaporative cooling techniques as an efficient solution for cooling in hot and dry climatic zones and its integration into large-scale projects.

The larger problem fairconditioning is designed to address:

Global warming

Global warming is accelerating desertification, creating more natural disasters, reducing crop yields, and contributing significantly to serious public health implications such as heat related infectious diseases.

The amount of energy (and related GHG emissions) necessary to cool Indian building interiors in the years ahead will depend on how they are designed from now onwards. Energy efficiency and reduced GHG emissions will result from the appropriate

technologies used for cooling as well as the behaviour and use of equipment by occupants of air conditioned spaces. The potential to reduce the energy demand from buildings in India is huge considering this sector's growth rate and the current lack of regard for and knowledge of how much energy use and GHG emissions could be avoided. Example: At present, 2.5 million GHG emitting air conditioning units are sold in India each year.

The high GWP refrigerants challenge

The first two generations of F-gases (CFCs and HCFCs) were eliminated to protect the ozone layer under the Montreal Protocol (United Nations Convention for the Protection of the Ozone Layer). The third generation HFCs (safe for the ozone layer, but hazardous to climate), are being used widely. If nothing is done to reduce the spread of HFCs, this gas could account for 28-45% of all carbon equivalent emissions by 2050, thereby impeding the current efforts to reduce other GHG emissions. In this period of technological lag, the current international negotiations (Montreal and Kyoto protocols) are not fostering the needed momentum for change. Civil society and development agencies can be instrumental in adding the necessary bottom-up impetus, know-how and experience on the ground.

Natural refrigerant AC

The new generation of ACs are run on natural gas R-290, a hydrocarbon. Godrej & Boyce Manufacturing

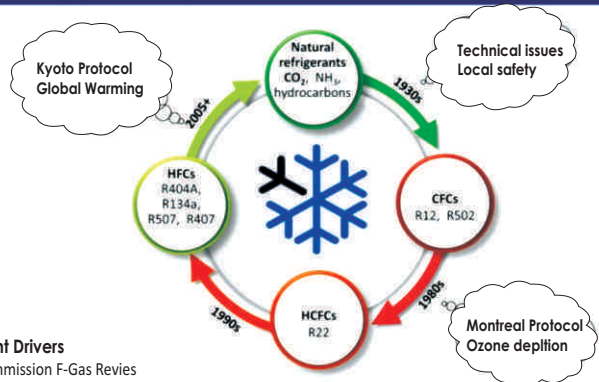
Company of India has a production line to manufacture air-conditioning units equipped for the first time with natural refrigerants, namely propane. Their energy efficiency is 10-15% better than those operating with HFCs, thereby adding value to the final consumer and relieving the country of the additional energy demand in terms of additional coal, nuclear or hydropower plants. The new AC line has been awarded the highest ratings of 5 stars, with the best performance coefficient (COP) in the market, surpassing the Government's Bureau of Energy Efficiency standards for 2014. This advantage in terms of energy efficiency will be critical to consumers, for whom AC induced consumption is the heaviest burden on their electricity bills.

The introduction of natural gas ACs has the potential to have a disruptive impact on the large air-conditioning market in India. Early adopters will have the opportunity to capture a large chunk of market share in sectors with intensive conditioning needs using innovative marketing techniques. This would potentially spur traditional manufacturers to incorporate natural gas ACs into their investment plans not only in India but other fast growing nations as well, thus growing the overall market for these ACs as well as bringing down their cost of production.

Fairconditioning is working towards making the market introduction of natural gas ACs a success in India, by highlighting its lower lifecycle cost of ownership as well as its environmental friendly credentials through quantitative data rather than words as used by traditional manufacturers. This should help consumers make informed choices that benefit them financially and also reduce the impact of their decisions on global warming and climate change.

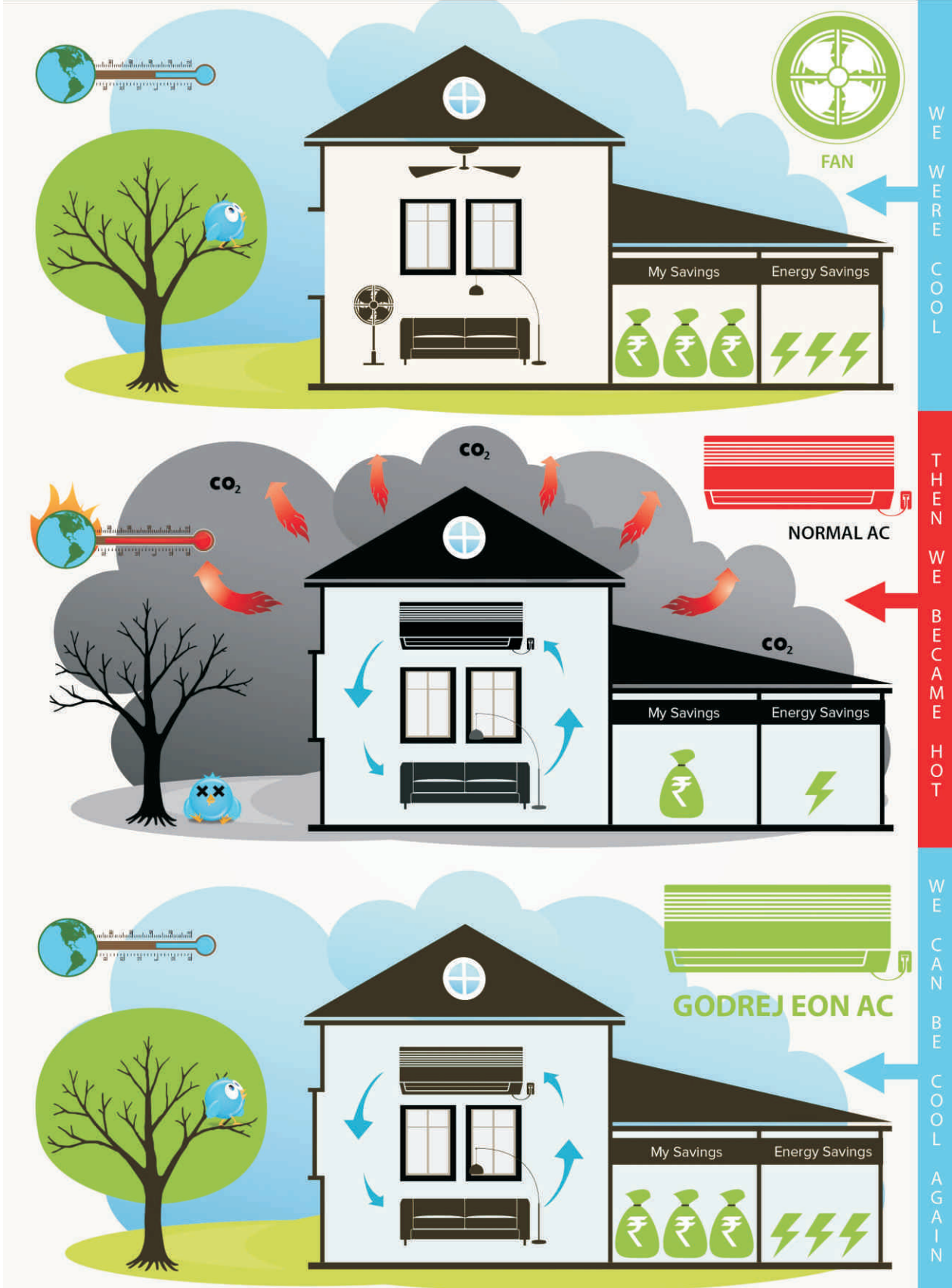
Note: This article is not an advertisement of any company or product. The data is gathered through an objective, scientific assessment of Hydrocarbon Refrigerant AC technology. For further details please visit website <http://www.fairconditioning.org>

The closed Cycle.....Driving Natural & Alternative Refrigerant Solutions



Current Drivers
 EU Commission F-Gas Revises
 Accelerated Phasedown of HFCs
 Ban on HFCs
 Tax on HFCs

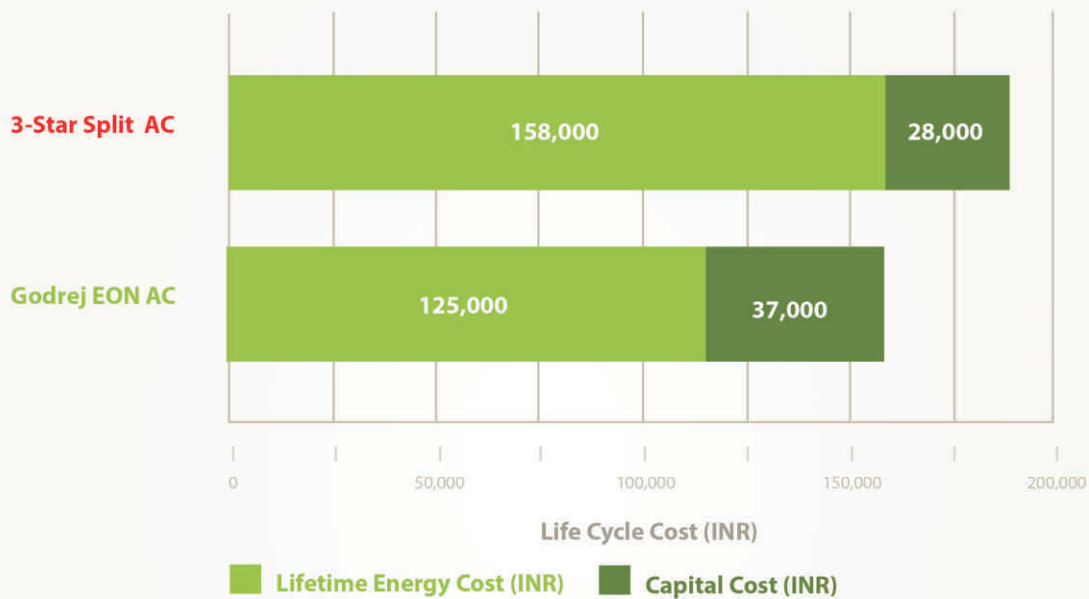
HOME COOLING AND GLOBAL WARMING



fAIR CONDITIONING

CHEATED BY YOUR AC?

While a conventional 3-Star 1.5 ton Split AC costs about Rs. 10,000 less than the 1.5 ton Godrej EON AC, over the 10 year life of the AC, it actually costs more - about Rs. 23,000 more. This is due to the 25% to 30% lower energy consumption of Godrej EON ACs compared to a 3-Star AC.



IF A SINGLE HOME WERE TO USE THE GODREJ EON AC INSTEAD OF A REGULAR 3-STAR AC, IT WOULD RESULT IN THESE POWERFUL BENEFITS FOR ALL – THE HOME AND THE COMMUNITY



36 ceiling fans would be cooling less privileged homes



120 light bulbs would be lighting up less privileged homes



Rs 10,000 can be saved annually on electricity bills



3 lesser cars would be polluting our environment

This is not an advertisement for Godrej EON AC. It is a objective, scientific assessment of the energy, cost and greenhouse gas emission benefits of Hydrocarbon Refrigerant ACs . For further details please visit our website <http://www.fairconditioning.org>



Natural Refrigerants: The Solution

The switch from CFCs and HCFCs to HFCs represents a classic example of industry replacing one harmful chemical with another while protecting the status quo and their market share. All these chemicals contribute to climate change, most with Global Warming Potential (GWP) thousands of times higher than CO₂. By shifting to HCFCs and now HFCs since banning CFCs, we have continued to destroy the ozone layer with HCFCs and harm the climate with both alternatives, and will keep on doing so for the next several decades at least. It has also tarnished the legacy of the Montreal Protocol by creating an enormous and unnecessary problem for the climate. There were natural solutions available (some developed by Greenpeace) when HFCs were originally introduced. Greenpeace believes that these chemicals can and should be replaced with climate-friendly natural refrigerants. This is the only responsible course of action.

What natural refrigerants are

Natural refrigerants are naturally occurring, non-

synthetic substances that can be used as cooling agents in refrigerators and air-conditioners. These substances include hydrocarbons (propane, butane, and cyclopentane), CO₂, ammonia, water and air. These are sometimes referred to as 'the Gentle Five', each with a different area of application. Natural refrigerants are ozone layer and climate-friendly substances. An analysis of the alternative technologies currently available is detailed in the Greenpeace report:

(<http://www.greenpeace.org/international/Global/international/publications/climate/2012/Fgases/Cool-Technologies-2012.pdf>).

History of natural refrigeration technology

In the early 1990s, Greenpeace set out to find climate-friendly alternative technologies, convinced that there was a way to avoid HFCs through innovation. The result is the creation of GreenFreeze, which uses

hydrocarbons for both the blowing of the insulation foam and the refrigerant, and is entirely free of ozone-depleting and global warming chemicals. Greenpeace then commissioned a reluctant manufacturer to build 10 prototypes of the most likely-to-work technology. It open-sourced the technology and has received no financial remuneration or royalty for developing the product.

Since March 15, 1993, when the first GreenFreeze refrigerator rolled off the assembly line, 300 million units have been sold in Europe, Russia, Asia and South America by leading brands including Whirlpool, Bosch, Panasonic, LG, Miele, Electrolux, and Siemens. Greenpeace's achievement was recognized by the United Nations Environment Program (UNEP) in 1997, when GreenFreeze received the prestigious UNEP Ozone Award.

Market for natural refrigeration technology

GreenFreeze technology has spread extensively throughout Europe, Japan, Russia and China. It is currently the refrigerant of choice in 300 million household refrigerators worldwide, but it is still illegal to sell or purchase it in the US and Canada. Greenpeace is currently working to change this situation through a variety of avenues — policy changes, corporate engagement, and, as soon as a manufacturer is ready, market development.

CO₂ and ammonia

It does seem strange that Greenpeace is arguing for the uptake of CO₂ in one area and pushing for its reduction in another. CO₂ has a GWP of 1, and the F-gases currently popular on the market have a GWP in the thousands. CO₂ has no ozone depletion potential (ODP=0) and negligible direct GWP when used as a refrigerant in closed cycles. To put it in perspective, while the average car emits 5 tons of CO₂ per year, a CO₂-charged refrigerator or vending machine would emit say 300 grams of CO₂ after its 10-year lifetime.

Ammonia's ODP is also 0 and so is its GWP. It is considered a natural refrigerant because although



produced synthetically for refrigeration, it occurs in nature's material cycles. It is a hazardous substance, but is used widely and safely around the world in large-scale industrial cooling systems such as food processing and building air-conditioning.

GWP of F-gases and natural refrigerants

Below is a table that compares the GWP of CFCs and HCFCs to natural (CO₂ and hydrocarbon) technology.

Gas	Lifetime (years)	20 year	100 year	500 year
CO ₂		1	1	1
CFC 11	45	6730	4750	1620
CFC 12	100	11,000	10,900	5,200
HCFC 141b	9.3	2250	725	220
HFC 134a	14	3830	1430	435
Cyclopentane	Weeks	<3*	<3*	<3*
Isobutane	Weeks	<3*	<3*	<3*
Propane	Months	<3*	<3*	<3*

*Note that The 20 year GWP of the common HFC-134a is 3830, more than twice its 100 year GWP, meaning cutting emissions now eliminates an even larger near term threat. Natural refrigerants (in this case, hydrocarbons) are incomparably better for the environment than F-gases, because of their low GWPs and very short atmospheric lifetimes.

Cost of natural refrigerants

Natural refrigeration technologies also outperform from an economic standpoint. Many natural refrigerants are inexpensive, some less expensive than HFCs. Some are up to 40% more energy efficient than HFCs. Depending on the type and size of the system, a company may incur additional expenses upon installing a natural refrigerant system, but these costs are offset in the mid to long term by reduced costs. Operating costs are lower when using natural refrigerants because of lower leakage related costs, the low cost of maintenance, and most importantly, low energy consumption. As governments begin to regulate F-gases more diligently, the inexpensive disposal of natural refrigerants at the end of a refrigerator's lifecycle will become a major financial incentive to switch to cleaner cooling systems.

Containment of HFCs

If governments and companies had set up a global network to deal with the recapture and safe destruction of all F-gases, they wouldn't be the huge climate problem they are today. Containment policies have been an absolute failure because containment is virtually unenforceable. Leakage rates tend to be much higher than industry claims. And even the data provided by industry points to a catastrophic failure in containment: a chemical industry website called Alternative Fluorocarbons Environmental Acceptability Study (please link to: www.afeas.org) which compiles and presents F-gas data provided by companies, shows that 81% of the main F-gas currently in use today (HCFC 22) has already been released into the atmosphere. Fifty-nine percent of HFC 134a, the main HFC on the market today, has already been released into the atmosphere.

Containment policies are even more difficult to implement in developing countries because (i) many developing countries lack well-trained personnel who can ensure that fluorine gases will be properly handled and (ii) adequate disposal facilities are almost non-existent in most developing countries, although this latter point applies to most developed countries as well.

Greenpeace thinks that governments should therefore promote the use of natural refrigerants and endorse phase-out dates for HFCs in refrigeration and air-conditioning. These gases have to be eliminated—not just 'contained'.

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Glossary

F-gases: CFCs, HCFCs and HFCs are all part of a family of gases known as F-gases or fluorocarbons. The regulatory control of F-gases is split between the Montreal Protocol and the Kyoto Protocol.

CFCs: Chlorofluorocarbons (and their close cousins HCFCs) are ozone layer depleting substances and are regulated by the Montreal Protocol. These are also strong greenhouse gases but were excluded from the Kyoto Protocol because they were already being regulated.

HFCs: Hydrofluorocarbons are strong greenhouse gases and are regulated by the Kyoto Protocol. HFCs are not ozone-depleting and were developed as replacements for CFCs.

Kyoto Protocol: A 1997 international treaty to solve global warming by curtailing emissions of greenhouse gases.

Montreal Protocol: A 1987 international treaty to heal the ozone layer by controlling ozone depleting substances.

Natural Refrigerants: Common natural refrigerants include isobutane and other hydrocarbons, ammonia, water, air and carbon dioxide.

GWP: Global Warming Potential is the relative power of a given pollutant to cause global warming over a given timescale, factoring its ability to trap the sun's heat and its atmospheric lifetime. GWPs are measured relative to carbon dioxide, which is given a GWP of 1.

ODP: Ozone Depleting Potential is a factor indicating a substance's relative ozone damaging power.

Source: Greenpeace (<http://www.greenpeace.org>)
<http://www.greenpeace.org/international/Global/international/planet-2/report/2009/5/natural-refrigerants.pdf>

ECO NEWS

Most retailers use natural refrigerants, says European study

A survey shows that natural refrigerant solutions are a better investment than the HFCs (hydro-fluorocarbons) system. In western and northern Europe, two-thirds of foremost retailers have chosen to execute natural refrigerant technology in their stores. This study was commissioned by Carrier, a global leader in high-technology heating, air-conditioning and refrigeration solutions. The study found that all respondents were familiar with restrictions on F-gas use and had already, or would soon, implement them. They also indicated that the selection of technologies is increasingly influenced by the belief that carbon footprint reduction is linked to their overall business success. Around 71% of respondents stated policies have been initiated at the highest enterprise group levels of their organisations to drive carbon footprint reduction in their stores through refrigeration.

Refrigeration using energy efficient systems and low Global Warming Potential refrigerants was identified as a significant environmentally friendly feature. Food retailers rated natural refrigerants as a more desirable solution than HFC system. They also believe that legislation can be a key driver in accelerating the decision-making process on sustainability activities by retailers. Respondents placed natural refrigerants on par with HFC systems in terms of reliability and safety. Natural refrigerants were also considered to be on parity in terms of return on investment (ROI) and life-cycle costs.

According to the study, the move towards holistic energy management has been particularly pronounced in Northern Europe where respondents now attach equal importance to overall energy management systems and refrigeration as potential investments to improve a store's overall energy efficiency. The study also revealed a majority (51.7%) of respondents would be willing to shorten their investment cycles to promote the uptake of more

environmentally sustainable refrigeration technology.

Source: <http://www.shecco.com/articles/2014-02-25-.php> http://www.carrier.com/commercial-refrigeration/en/eu/news/news-article/new_study_finds_food_retailers_see_value_in_natural_refrigerants_and_accelerate_their_investment_in_the_technology.aspx

Top brands promote natural refrigerants

Multinational corporations Coca-Cola, PepsiCo, Unilever, McDonald's and Red Bull are in favour of natural refrigerants because these are a better solution for cooling appliances such as freezers, refrigerators and vending machines for drinks. These companies are working towards a phase-out of HFCs in their point-of-sale cooling equipment. HFCs are gases regulated internationally under the Kyoto Protocol.

In 2004, The Coca-Cola Company, Unilever and McDonald established a joint initiative Refrigerants, Naturally! engaging in the fight against climate change and the depletion of the ozone layer. It is international non-profit initiative of companies whose objectives include substituting harmful fluorinated gases, called F-gases (such as CFCs, HCFCs and HFCs) with natural refrigerants.

Greenpeace and the United Nations Environment Programme (UNEP) support Refrigerants, Naturally! The Coca-Cola Company exchanged more than 800,000 devices operating on natural refrigerants. Unilever has introduced more than one million units in all countries in which it operates. Already 313,000 cooling units that represent more than one-third of the Red Bull cooling devices around the world, use natural refrigerants. PepsiCo has already reached over 200,000 HFC-free units.

Source: <http://www.refrigerantsnaturally.com/statements/greenpeace.htm>, <http://www.hvacr.pl/znane-marki-promuja-naturalne-czynniki-chlodnicze>

Write to us

We value your views and suggestions. Please send us your feedback on this issue. We would also like to invite your contributions on the Eco product and Eco labelling.
Please mail: cerc-env@nic.in



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GREENPEACE

Refrigerants, naturally! is an international non-profit initiative whose objectives include substituting harmful fluorinated gases, called F-gases (such as CFCs, HCFCs and HFCs) with natural refrigerants. It is supported by Greenpeace and the United Nations Environment Programme (UNEP).

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