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## Clever Cooling versus Global Warming Refrigerants, Naturally!

### Press Review 2010

#### Refrigerants, Naturally! Secretariat

Contact: Rebecca Kirch  
Tel: +49 6174 964575  
Email: [rebecca.kirch@refrigerantsnaturally.org](mailto:rebecca.kirch@refrigerantsnaturally.org)  
[www.refrigerantsnaturally.com](http://www.refrigerantsnaturally.com)



# OzonAction

SPECIAL ISSUE 2010



## Out of the Maze

Montreal Protocol, Climate Benefits  
and the Green Economy

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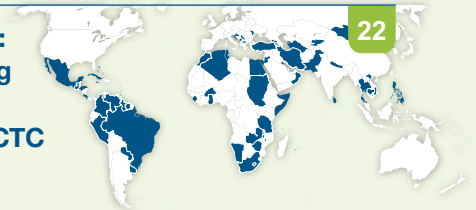


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# Refrigerants, Naturally! – Giving HFCs the Cold Shoulder

**Refrigerants, Naturally!** Partners The Coca-Cola Company, Unilever, McDonald's, Carlsberg, and PepsiCo. Supported by UNEP and Greenpeace

Can we have one solution to the two most burning global problems that humanity will face in the coming millennium? Can two Protocols –Montreal and Kyoto – work toward one goal? Does industry have the potential and the motivation to help solve these kinds of problems? How can interactive dialogue with diverse stakeholders help us move toward the goal of sustainability? That's what Rajendra Shende, Head of the Energy and OzoneAction Branch of UNEP, asked himself in the autumn of 2000, after he attended a meeting organized by The Coca-Cola Company and McDonald's.

At this historic meeting, companies in the food and drinks sector, environmental organisations and representatives of over 30 major refrigeration suppliers came together to discuss alternatives to the use of hydrofluorocarbons (HFCs) in refrigeration. In the coming years, Rajendra Shende was to discover, to his delight, that many of his questions had positive answers.

The meeting not only resulted in subsequent individual actions by the companies, it was also the beginning of a unique business partnership: Refrigerants, Naturally! In June 2004, three food and drinks sector giants – The Coca-Cola Company, Unilever and McDonald's – joined forces to commit to an HFC-free future. The United Nations Environment Programme (UNEP) and Greenpeace became official supporters and took an active role in the management of this alliance.

## Single efforts are not enough!

The members soon realised that single efforts would not be enough. In Carlsberg and PepsiCo they found like-minded companies. The key goal of Refrigerants, Naturally! is to promote a shift in the refrigeration sector towards sustainable natural refrigerant-based technologies. The members of Refrigerants, Naturally! are reducing their impact on climate change and ozone depletion by replacing hydrochlorofluorocarbons (HCFCs) and HFCs with natural refrigerants, by using HCFC-free and HFC-free insulation material, and by reducing the energy consumption of new refrigeration equipment.

## It's time to act!

Refrigerants, Naturally! partners have been taking action to address the problem of HFCs. These are the most commonly used replacements for ozone-depleting HCFCs in refrigeration units. However, HFCs have a very high Global Warming Potential (GWP) and are controlled under the Kyoto Protocol. If HFCs continue to replace ozone-



## Refrigerants, Naturally!

depleting gases, their impact on global warming may lead to irreversible environmental consequences. Therefore, international negotiations have been initiated to address the phase-down of HFCs. Refrigerants, Naturally! supports such an international reduction agreement. It is now time to act and implement climate-friendly natural refrigerants. Natural refrigerants, such as hydrocarbons (HCs), for example propane and iso-butane, carbon dioxide (CO<sub>2</sub>), and ammonia (NH<sub>3</sub>) have no or significantly less GWP compared to HFCs and a zero Ozone Depleting Potential (ODP). Furthermore, they are cheap, reliable and energy-efficient and can be used as cooling and foam-blowing agents in refrigeration and air-conditioning equipment.

## Half a million HFC-free-units

Members of Refrigerants, Naturally! are committed to making a substantial effort and investment to progressively replace fluorocarbons with natural refrigerants in point-of-sale cooling and freezing applications. This includes research and development, testing, financial investment, staff time or public engagement. Research and development is done in close collaboration with suppliers and research institutes. The introduction of natural refrigerants into refrigeration appliances is a part of the overall greenhouse gas reduction effort and environmental policy of the initiative's members. Until the end of 2009, almost half a million units of cooling and freezing equipment, operating either with CO<sub>2</sub> or hydrocarbon refrigerants, have been installed worldwide. "The members of Refrigerants, Naturally! have come a long way in the past 10 years", says Wolfgang Lohbeck from Greenpeace. However he goes on to say: "We challenge them to go the rest of the way now and continue their efforts to become 100 percent HFC-free in their equipment worldwide". In advancing its journey toward climate-friendly cooling, The Coca-Cola Company just recently announced that 100 percent of its new vending machines and coolers will be HFC-free by 2015 (50 percent by 2012).

## Challenges and opportunities

Field tests carried out over the recent years have shown very encouraging results and in many cases have led to the wider use of HFC-free refrigeration equipment. But there are still factors limiting the use of natural refrigerants on a wide scale. These include the following:

**Table 1: Pros and cons of natural refrigerants in refrigerated point-of-sales equipment**

Refrigerant	Pro	Con
CO <sub>2</sub>	<ul style="list-style-type: none"> <li>● Application in all regions</li> <li>● ODP = 0, GWP = 1</li> <li>● Non-flammable/low toxicity</li> <li>● No certain limits on charge size</li> <li>● Higher energy efficiency than R134a under most conditions</li> <li>● High volumetric refrigeration capacity</li> <li>● Smaller compressor</li> </ul>	<ul style="list-style-type: none"> <li>● Lower energy-efficiency under high ambient temperature conditions</li> <li>● High pressure</li> <li>● Limited availability</li> <li>● Limited service infrastructure</li> </ul>
HC	<ul style="list-style-type: none"> <li>● High energy efficiency</li> <li>● ODP = 0, GWP = 3</li> <li>● Availability in Europe and Asia</li> <li>● Less charge than R134a/R404A</li> </ul>	<ul style="list-style-type: none"> <li>● Regulatory restraints in the US</li> <li>● Some safety precautions required</li> <li>● Max. charge restrictions in several international standards</li> <li>● Limited service infrastructure</li> </ul>

**Availability**

Regarding CO<sub>2</sub> technology, the members of Refrigerants, Naturally! have experienced difficulties in sourcing high pressure components. These special components are produced in small numbers, a factor which limits availability and raises costs. In certain regions it is also difficult to obtain HC and CO<sub>2</sub> gases in the quantities and quality required.

**Service and maintenance**

An additional challenge when attempting a major shift to natural refrigerant-based equipment is the lack of service and maintenance infrastructure. In this area the members of Refrigerants, Naturally! cooperate to provide training for technicians to ensure that the overall quality of service and maintenance is kept at a high level.

**Legal restrictions**

Currently, the use of HCs is restricted in the U.S. and Unilever has applied for clearance to use hydrocarbon-based ice cream cabinets. This process involved submitting an EPA (Environmental Protection Agency) application under the Significant New Alternatives Policy (SNAP) for testing new refrigerants and meeting Underwriters’ Laboratories (UL 471) standards for commercial refrigeration equipment. It also included development of a training package for service technicians and making this training available throughout the U.S. Following the approval, field trials of ice cream cabinets using HC refrigerant in the U.S. have now commenced and the Unilever initiative has already encouraged other end-user companies and equipment manufacturers to consider requesting trial approvals and making SNAP applications for their appliances. PepsiCo for instance has started field trials with CO<sub>2</sub> vending machines in Washington. The company has also recently started a field test in Miami with 35 innovative energy-efficient coolers which not only contain HC as natural refrigerant but at the same time use less energy than a 100-watt incandescent light bulb. These coolers are the first HC coolers that have been approved by UL and EPA.

National legal requirements are sometimes linked to international (industry) standards. Several international (ISO, IEC) and European (EN) standards currently place restrictions

on the amount of HC that can be used in refrigerated cabinets. Devices with hermetically sealed refrigeration circuits containing less than 150 grams may be placed in any location or size of room. Larger devices using higher charge levels require specific design criteria and some restrictions on placement. Unilever is investigating the most economical way to introduce natural refrigerants to their larger cabinets, which require charge levels of higher than 150 grams. In line with this, Refrigerants, Naturally! investigates the backgrounds of these restrictions, and considers options to revise these standards on the basis of recent scientific insights.

**Pros and cons**

Based on the current experience and insights of Refrigerants, Naturally! members, Table 1 summarises the pros and cons of natural refrigerants in refrigeration equipment.

As in many businesses, availability and cost of equipment are closely related. Safety is largely design related and is addressed by building systems to designs that mitigate operational safety risks. To reduce servicing risks to a minimum level, technicians must be fully and appropriately trained.

**Yes, it can be done**

The member companies of Refrigerants, Naturally! have already demonstrated that climate-friendly alternatives are, or can become, commercially available in the near future in most point-of-sale applications. The widespread introduction of natural refrigerants in refrigerated point-of-sales equipment in the US and in other regions is the major goal for the years to come.

The members of Refrigerants, Naturally! share a commitment to eliminate HFCs in point-of-sale cooling and freezing applications and a conviction that alternative technologies work efficiently and reliably whilst offering environmental benefits and commercial viability.

<http://www.refrigerantsnaturally.com/> ■



## The Chemistry Of Refrigeration

By: [Franco Zinzi](#) | Posted: Feb 22, 2010

The environmental pressures of global warming have put increased emphasis on the need for alternative types of chemical refrigerants. The trend began in 1996, when the U.S. Environmental Protection Agency's (EPA) Clean Air Act banned the manufacture of the most common refrigerants, because they contributed to the depletion of the ozone layer in our upper atmosphere that protects earth from the sun's ultraviolet radiation. These refrigerants were known by the trademark name of their manufacturer, DuPont, as Freon 12 and Freon 22, although we will refer to them here by their generic names, CFC-12 and HCFC-22. CFC-12 is a chlorofluorocarbon (CFC), a chemical combination of carbon, chlorine, and fluorine.

Chlorine is the culprit that zaps ozone. Under the EPA guidelines, CFC-12 was supposed to be phased completely out of use by the year 2000. In its place, related chemical compounds include hydrofluorocarbons (HFCs) and hydrochlorofluorocarbons (HCFCs). However, HCFCs (HCFC-22) are also slated for extinction by the EPA somewhere between 2015 and 2030. HFCs, without chlorine, have skirted the ban so far; in fact, the most widely used alternative refrigerant is now HFC-134a. All refrigerants are hazardous when exposed to an open flame. Some of them contain butane or propane mixes blended into their formulas. If large quantities of refrigerant are released in a confined area, suffocation is a danger because refrigerant actually displaces oxygen.

Breathing refrigerant can cause nausea, dizziness, shortness of breath, and even death. Thus, any type of refrigerant gas should be handled by a professionally trained technician. Environmental risks and health warnings aside, the cooling power of the modern refrigerator comes from the repeated compression and expansion of a gas. As the gas expands, it cools and is cycled around an insulated compartment, chilling the contents inside. Ammonia, new chemical blends, and even space-age technology using sound waves to cool foods are other options that have been introduced recently with some success. In 2004 the ice cream maker Ben & Jerry's installed the first thermoacoustic freezer in a retail location, developed by Penn State University researchers.

Thermoacoustics is the premise that, as sound travels through air, it alters the temperature of the air. A loudspeaker is used to create 170 to 195 decibels of sound (and yes, that's very loud) in a tube that contains inert, compressed gases (helium or argon), which are environmentally safer than CFCs. The sound causes the gas molecules to vibrate, expand, and contract. When they contract, they heat up; when they expand, they cool down. In refrigeration, the goal is to exhaust the heat generated as the soundwave is compressed and capture the chill as the soundwave expands. The loud screech emitted within the unit is muffled so it is heard as a quiet hum from the outside. Thermoacoustics cools using a type of sealed motor developed in the 1800s by Robert Stirling of Scotland.

You may hear the term "Stirling cycle technology" associated with CFC-free coolant ideas. A Stirling motor can be solar-powered, which is one of its potential "green" advantages. Another promising cooling technology is electromagnetism. A "magnetic" refrigerator can cool by repeatedly switching a magnetic field on and off. The current prototype is made with gadolinium, a metal used in the recording heads of video recorders. Gadolinium and magnets are not cheap, but the technology shows great potential for two reasons: Electromagnetism is environmentally safe (no CFCs), and does not require a compressor (no mechanical humming noise as the refrigerator cycles on and off).

At this writing, Astronautics Corporation of America in Milwaukee, Wisconsin is at the forefront of this field. Expect more technological breakthroughs as global warming headlines become more ominous. A group called Refrigerants, Naturally! formed early in this century by McDonald's, and Unilever to develop and test HFC-free refrigeration technologies, making commitments to eliminate HFCs in their point-of-sale cooling applications. In 2007 Carlsberg, IKEA, and PepsiCo joined the group. How does the foodservice operator cope with the changes and the prospect of expensive new replacements for old workhorse refrigerators? Well, if your equipment is in good repair, you probably should do nothing as long as it lasts except keep it properly maintained.

This especially means cleaning the unit's condensing coil once a month to prevent grease and dirt collection that block air circulation. If your refrigerator needs repair, you have two choices: Voluntarily retrofit it to use an alternative refrigerant, or purchase a new unit that is already equipped to use the newer refrigerants. Retrofitting almost always requires more than one service call and includes these steps: Recovering the outdated refrigerant, changing the coil in the compressor, replacing the filter or dryer, if necessary, recharging with the new refrigerant, checking performance

for the first few weeks.

The EPA now has a sophisticated set of rules for refrigerator repair. The EPA certifies repair technicians and their equipment, and requires that they recycle or safely dispose of refrigerant by sending it to a licensed reclaimer. The rules also state that "substantial leaks...in equipment with a charge greater than 50 pounds" be repaired. This means if the unit leaks 35 percent or more of its pressure per year, it needs fixing. As the owner of commercial refrigeration equipment, you are also required to keep records of the quantity of refrigerant added during any servicing or maintenance procedure.

The EPA Web site contains summaries of the rules as well as lists of acceptable alternative refrigerants that don't contain the ozone-depleting chlorofluorocarbons and hydrochlorofluorocarbons. They're identified with abbreviations and numbers, such as MP-39, HP-80, R-406a, and GHG-X4, which probably don't mean much to you as a foodservice employee. However, the important points to remember are: use an EPA-certified technician, with certified equipment, to do your refrigeration repair work. Underwriters Laboratories (UL) is now authorized to test and approve alternative refrigerants, so look for the UL label on products. Keep your maintenance records updated. Violations of the Clean Air Act can result in fines of up to \$25,000 per day.

If you have more than one piece of older equipment, plan a gradual phase-out or retrofit program. Don't break your budget by trying to do it all at once. This information should also serve as a caution when you are looking at purchasing used equipment. Is the owner getting rid of it because it no longer meets the environmental rules? With that, we've discussed the first major process going on inside the refrigerator: temperature reduction.

### **About the Author**

Franco Zinzi has been involved with online marketing for nearly 3 years and likes to write on various subjects. Come visit his latest website which discusses of [fridge for restaurant](#) and [refrigerator supplies](#) for the owner of his own business.

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## Carlsberg embraces hydrocarbons



2010-03-19 - [hydrocarbons21.com](http://hydrocarbons21.com)



*Carlsberg, a member of the "Refrigerants, Naturally!" campaign, has released its annual report. The company has redefined its refrigerant strategy, ensuring that all newly purchased coolers use climate-friendly hydrocarbon refrigerant and are equipped with an energy-saving management system whenever possible.*

Within Refrigerants Naturally!, a coalition of companies and NGOs dedicated to increasing the use of HFC-free coolers, Carlsberg Group is committed to combat climate change and ozone layer depletion by substituting point-of-sale coolers that contain harmful fluorinated refrigerant gases, such as CFCs, HCFCs and HFCs, with ones that contain natural refrigerants.



As a result of this commitment, the company has introduced more than 4,000 HFC-free coolers in Denmark and Sweden. The phase-in of HFC-free coolers focused initially on Scandinavia where a service and maintenance setup for hydrocarbon commercial cooling cabinets had already been in place.

### Opting for hydrocarbon coolers

In its latest annual report, Carlsberg reports that in 2009 it "redefined its strategy, ensuring that newly purchased coolers have the more climate-friendly HC [hydrocarbon] as coolant and are equipped with an energy-saving management system in markets where supply and the required technical support are available". The company is hence concerned with minimising both direct and indirect emissions from the equipment cooling its products.

Besides committing to continue phasing-in HFC-free coolers in 2010, Carlsberg Group maintains that it will furthermore continue the cooperation with suppliers in the development of more efficient HFC-free point of sales equipment.

### A redefined environmental strategy

The newly redefined refrigerant strategy of Carlsberg embracing hydrocarbon refrigerants is part of a wider environmental strategy developed in 2009 based on an assessment of its current performance on greenhouse gas emissions throughout its value chain. Its ambition is to sustain its industry leader position and be the most efficient global brewer when it comes to beer and soft drinks production's performance for energy use and CO<sub>2</sub> emissions.

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## Greenpeace 2010: Natural Refrigerants are perfectly apt to replace HFCs



2010-06-14 - [hydrocarbons21.com](http://hydrocarbons21.com)

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*Greenpeace has updated its Cool Technologies report, which samples companies and enterprises using HFC-free technologies such as hydrocarbon technologies offered by partners of hydrocarbons21.com among other companies, and brings impressive examples for the application of natural refrigerants in a number of applications.*

Titled 'COOL TECHNOLOGIES: WORKING WITHOUT HFCs - 2010: Examples of HFC-Free Cooling Technologies in Various Industrial Sectors', the report demonstrates that "there is already a wide array of safe and commercially proven HFC-free technologies available to meet nearly all those human needs that were formerly met by fluorocarbons".

HFC-free products are entering the market almost on a weekly basis and cover nearly the full spectrum of applications. And although, so far, HFC-free applications are mainly used in developed countries, they offer a great opportunity for developing countries to leap-frog HFCs on their way of phasing out HCFCs and to chose directly natural refrigerants as an environmentally and economically sustainable solution.

### Domestic refrigeration: Greenfreeze has conquered the markets

In 1992, Greenpeace developed HFC-free refrigerators that use hydrocarbons as refrigerant. The technology is called Greenfreeze and has been so well adopted that there are now more than 400 million hydrocarbon or Greenfreeze refrigerators in the world, with 35-40% of the annual global production of domestic refrigerators and freezers in general (~100 million units/year) being Greenfreeze.

Greenfreeze technology dominating the European, Japanese and Chinese market, all major manufacturers in these markets are producing Greenfreeze refrigerators. In China, 75% of new domestic refrigerators use R-600a. Greenfreeze refrigerators are also produced in Latin America (Argentina and Brasil) and are available in North America (Canada, Mexico, although not in the U.S. yet).

### Domestic and small commercial refrigeration: SolarChill

Another breakthrough technology is SolarChill, a small vaccine refrigerator that operates directly from solar photovoltaic panels without batteries or a charge controller. When the sun is shining, DC power generated by the solar panels operates the variable voltage DC compressor which freezes ice-packs used in an ice bank. The ice bank stores energy which is used to maintain vaccine compartment temperatures at WHO recommended level during periods when the sun is not shining for up to five days. The vaccine compartment temperature is self-regulated by thermal design, and does not rely on electronic control devices.



[ATMOsphere 2010 - International Workshop on Natural Refrigerants](#)

[Hydrocarbons coming to America](#)

[Greenpeace video bares the truth about HFCs](#)

[Urge the EPA to approve GreenFreeze in the USA](#)

[Swaziland presents SolarChill at Montreal Protocol talks](#)



[Greenpeace - COOL TECHNOLOGIES: WORKING WITHOUT HFCs- 2010](#)

[Greenfreeze and SolarChill](#)

The SolarChill has a special built-in feature which prevents freezing of vaccines. An intelligent fan enhances the convection circulation of the cold air and is operated by a small rechargeable battery, which is recharged by the solar power. The current generation of SolarChill (Vestfrost model MKSO44) has WHO PQS qualification for +20 to +32 °C ambient temperatures. However, in field tests, the units have operated under lower and higher ambient temperatures ranges of +10 to +42°C.

### **The big names moving to hydrocarbons**

In the effort to reduce their carbon footprint and show environmental responsibility, several multinational corporations such as Coca Cola, Unilever, McDonald's, Carlsberg and PepsiCo have joined in the campaign Refrigerants, Naturally! which aims at replacing HCFCs and HFCs in their cooling equipment with natural refrigerants. A few examples of their initiatives:

- Pepsi has over 8000 vending machines around the world using hydrocarbons or CO<sub>2</sub> technologies. About 5,000 of these are hydrocarbon units. The company has pioneered the testing of CO<sub>2</sub> and hydrocarbon equipment in the United States. Starting in 2009, all new Pepsi coolers in Turkey are HFC-free.
- By 2009 Unilever had placed over 400,000 hydrocarbon ice-cream coolers around the world, including South Africa, China, Europe, Brasil and the United States. These coolers contain approximately 100 grams of hydrocarbons, and have a 9% energy savings over their HFC counterparts.

Other well known companies opting for natural refrigerants to satisfy their cooling needs include Nestlé who has several thousand hydrocarbon coolers in Germany; Danone with around 1,000 hydrocarbon coolers in operation in Denmark, Mexico, Germany and other countries; and Waitrose who has currently seven UK stores using propane based refrigeration technology with plans to install propane refrigeration in all new and retrofitted stores, so that by 2020 all Waitrose stores will be HFC-free. The company estimates that the propane refrigeration technology will reduce its carbon footprint by 20%.

### **Those who offer the technology**

With the growing global demand for sustainable cooling equipment there is a steady growth in the number of companies producing and marketing equipment with natural refrigerants. To name just a few:

- Sanyo sells hydrocarbon domestic and commercial refrigerators. The company reports that since 2005 almost all beverage companies in Japan have been purchasing vending machines using natural refrigerants (CO<sub>2</sub> or HC).
- Mayekawa developed a central air-conditioning and hot water supply system using hydrocarbon zeotropic blend of isobutane and propane. The "system uses air and water as both the heat sources and heat sink to provide cooling, heating and hot water production".
- Danfoss offers a full line of energy-optimised R600a compressors for all size applications including household appliances and commercial equipment. They are available in a range of voltage ratings. Some are designed specifically for tropical conditions or for direct current solar power or difficult electrical supply connections.
- Earthcare Products Ltd. is marketing a wide range of commercial cooling equipment using hydrocarbons, including water coolers, chest chill cabinets, ice cream conservators, bottle chillers and wine cooler dispensers.

### **Hydrocarbons in air-conditioning**

Hydrocarbons continue to gain acceptance in commercial air-conditioning. Hydrocarbon chillers are now available in a wide variety of sizes, with the largest being around 1000kW.

Furthermore, it is widely accepted that propane and other hydrocarbons are the optimal alternative, nearly drop-in replacements for HCFC-22 in air-conditioning. Companies in the Netherlands, Australia, Singapore, Malaysia, Thailand, Jamaica and other countries have completed numerous conversions of R-22 installations to hydrocarbons with significant energy savings. These conversions of used equipment demonstrate that hydrocarbons can be safely applied, and should be an incentive to equipment manufacturers to produce new air conditioning units with propane and other hydrocarbons. The advantage of converting to hydrocarbon refrigerant is that it is environmentally friendly and little or no changes need to be made to the retrofitted air conditioning units.

A particularly impressive conversion project has been carried out by Eenergy Engineering Services in cooperation with Rexham Engineering at the Mona Campus of the University of West Indies in Jamaica, where they converted nearly 4,000 air-conditioning units from HCFC-22 to R-290. The energy reductions due to the superior efficiency of propane, average between 15 to 20% per unit. In addition, the hydrocarbon units require less maintenance and repair. These two factors combined results in very significant cost benefits to the university.

### **Hydrocarbons in mobile air-conditioning**

Hydrocarbons are also considered a reliable alternative to HFCs in mobile air-conditioning. Though at the present there are no hydrocarbon based mobile air-conditioners on the world market, an estimated 7 million cars have been converted, outside of regulatory framework, from CFCs and HFCs to hydrocarbons. Such routine drop-in conversion are taking place in Australia, United States, Canada, Philippines and elsewhere. Since hydrocarbons are flammable, conversion from HFCs to hydrocarbons must however follow standard safety procedures.

**Send your input for future updates of the report!**

A report under the same title was published by Greenpeace in 2000, 2008 and 2009 and it continues to be updated. Greenpeace welcomes receiving information regarding new examples of HFC-free technologies, such as hydrocarbons. Please forward them to [jmate@telus.net](mailto:jmate@telus.net).

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REPLACING HFCs WITH NATURAL REFRIGERANTS WORLDWIDE TODAY

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**Greenpeace 2010: Natural Refrigerants are perfectly apt to replace HFCs**

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*"There is already a wide array of safe and commercially proven HFC-free technologies available to meet nearly all those human needs that were formerly met by fluorocarbons", is the conclusion of the Greenpeace Cool Technologies Report 2010.*

Titled 'COOL TECHNOLOGIES: WORKING WITHOUT HFCs - 2010: Examples of HFC-Free Cooling Technologies in Various Industrial Sectors', the Greenpeace report brings impressive examples for the application of natural refrigerants in a number of applications and shortly presents the companies offering or using these technologies.



HFC-free products are entering the market almost on a weekly basis and cover nearly the full spectrum of applications. And although, so far, HFC-free applications are mainly used in developed countries, they offer a great opportunity for developing countries to leap-frog HFCs on their way of phasing out HCFCs and to choose directly natural refrigerants like CO<sub>2</sub>, hydrocarbons or ammonia as an environmentally and economically sustainable solution.

**Greenfreeze and SolarChill**

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Another breakthrough technology is SolarChill, a small vaccine refrigerator that operates directly from solar photovoltaic panels without batteries or a charge controller. SolarChill was born through separate discussions between Greenpeace, the United Nations Environment Programme (UNEP), and the World Health Organization. The big challenge: providing affordable and environmentally safe refrigeration for the maintenance of vaccines and medicines, and the preservation of food, in parts of the world that have no electricity or have unreliable supplies of electricity. At the moment refrigerators in developing countries usually use kerosene, propane and to far lesser extent, solar power. Vital medicine is most often stored in unreliable kerosene refrigerators.

The SolarChill stores power generated by sunshine in an ice bank that can maintain vaccine compartment temperatures at WHO recommended level during periods when the sun is not shining for up to five days. The vaccine compartment temperature is self-regulated by thermal design, and does not rely on electronic control devices.

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Anzeige über ein Plug-in

SUPPORTING COMPANIES



SUPPORTING NGOS

contain approximately 100 grams of hydrocarbons, and have a 9% energy savings over their HFC counterparts.

Other well known companies opting for natural refrigerants to satisfy their cooling needs include Nestlé who has several thousand hydrocarbon coolers in Germany; Danone with around 1,000 hydrocarbon coolers in operation in Denmark, Mexico, Germany and other countries; and Waitrose who has currently seven UK stores using propane based refrigeration technology with plans to install propane refrigeration in all new and retrofitted stores, so that by 2020 all Waitrose stores will be HFC-free. The company estimates that the propane refrigeration technology will reduce its carbon footprint by 20%.

#### Converting from HCFCs to natural refrigerants

Hydrocarbons continue also to gain acceptance in commercial and mobile air-conditioning. They are widely accepted as nearly drop-in replacements for HCFC-22 in air-conditioning. Companies in the Netherlands, Australia, Singapore, Malaysia, Thailand, Jamaica and other countries have completed numerous conversions of R-22 installations to hydrocarbons with significant energy savings. These conversions of used equipment demonstrate that hydrocarbons can be safely applied, and should be an incentive to equipment manufacturers to produce new air conditioning units with propane and other hydrocarbons. The advantage of converting to hydrocarbon refrigerant is that it is environmentally friendly and little or no changes need to be made to the retrofitted air conditioning units.

GTZ Proklima, a German organisation working on reducing and phasing-out ozone depleting substances, has carried out several projects in developing countries, converting HCFC systems to ammonia. In Mauritius, CFC12 and CFC11 chillers catering for the air-conditioning needs of two government buildings were replaced with ammonia chillers in order to demonstrate the feasibility and enhanced energy efficiency of ammonia chillers in tropical climates. And in South Africa two HCFC22 stores are being converted to cascades systems with ammonia as the primary refrigerant.

Although HFC-free products are primarily used in industrialised countries for the present, they can be used worldwide. "Developing countries would benefit greatly by leap-frogging HFCs altogether [,] avoid reliance on more expensive, less efficient, HFCs that will need to be phased-out [and] escape the clutches of the fluorocarbon chemical industry's monopoly over their choice of technology", reads the report.

**Greenpeace: COOL TECHNOLOGIES: WORKING WITHOUT HFCs - 2010: Examples of HFC-Free Cooling Technologies in Various Industrial Sectors**

[\[ return to list \]](#)

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## Cold comfort

05 November 2010

**The Montreal protocol was once considered an unparalleled success story**, writes [Stephen Gardner](#). Former United Nations secretary-general Kofi Annan called it "perhaps the single most successful international agreement to date".

Its objective was to phase out ozone-depleting chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), and this it has more or less done. According to the UN, 99 percent of CFC use had stopped by 2005. A slower phase-out of the less dangerous HCFCs is on track.

But there is a large spanner in the works. The gases are mainly used for refrigeration and air conditioning. To a great extent they have been replaced by a third substance, hydrofluorocarbons (HFCs). HFCs are not covered by the Montreal protocol, but they are considered a greenhouse gas under the United Nations Framework Convention on Climate Change. The fear is that their use will rise exponentially, especially in poorer countries as demand for refrigeration grows, exacerbating global warming.

Rajendra Shende of the UN Environment Programme, speaking at a recent conference in Brussels, said the Montreal protocol could still be considered a shining example of international cooperation. CFCs have been "put in the history books", and a properly working financial mechanism has been set up to fund the switch to alternatives in poorer countries.

But the protocol is "heading towards extraordinary collective failure unless it delivers an urgent rescue package to get the climate benefits back on track," Shende warns.

### Searching for alternatives

There are alternatives to HFCs. Greenpeace promotes "natural refrigerants" such as ammonia, hydrocarbons and carbon dioxide, which though itself a greenhouse gas is many times less harmful than HFCs. Greenpeace even developed, in the early 1990s, the Greenfreeze technology, which is now used for about 40 percent of new domestic fridges and freezers.

But a huge amount remains to be done. Greenpeace's Janos Maté says that "the fluorocarbon era needs to end" and countries must make "sustainable decisions" on refrigeration gases by adopting legislation and standards.

This is a slow process. The US Environmental Protection Agency, for example, has dithered over allowing hydrocarbon-based refrigerants, on the basis of their potential flammability. Greenfreeze technology, which uses the hydrocarbons cyclopentane and isobutane, has not been authorised in the US. Greenpeace says that hydrocarbon refrigerants are safe if properly used, and incidents of them igniting are very rare.

So companies must step in, Greenpeace argues. In commercial and industrial refrigeration, natural refrigerants remain little used. If companies make the switch, the market for natural refrigerants could expand rapidly, pushing out more damaging substances.

The biggest firms are taking action. For example, Coca-Cola – which with Carlsberg, McDonalds, Pepsi and Unilever is part of a group called Refrigerants Naturally – has pledged to make its new vending machines and coolers HFC-free by 2015. Many supermarkets are alert to the issue, having realised that action will also help them meet their climate goals. UK retailer Sainsbury's says it will phase out HFCs by 2030, which will have the side-effect of cutting the company's carbon footprint by a third.

But there is pressure to go faster. In the UK, the Environmental Investigation Agency accuses retailers Iceland, The Co-operative and Aldi of lagging. The EIA says Iceland has a "totally inadequate approach" with no plan to phase out HFCs.

This could be short-sighted. As the issue heats up, legislation to ban refrigerants with high global warming potential cannot be ruled out.

*A version of this article was published in [Ethical Corporation](#) magazine.*

Close Window

## And Now for Some Good News—Really

Posted on November 22, 2010 by J.A. Ginsburg



**At *TrackerNews*, we have long mulled adding a tagline to our masthead: “One Damn Thing After Another...” But every now and again, we come across stories that gives us hope. The tale of “Greenfreeze” refrigeration technology is one them: a better, more energy efficient answer to cooling and a successful environmental / industry collaboration. Sweet Water Organics, an aquaponics operation in Milwaukee, is another one of our favorites—one we have been following closely for nearly a year and a half. — Ed.**



“When we ring the siren, at some point we *do* bring the ambulance,” says Amy Larkin, director of [Greenpeace Solutions](#), the environmental organization’s lesser-known division that works *with* industry to find and implement climate-friendlier answers. We recently caught up with Larkin, and her colleague, engineer Claudette Juska, after they taped an [NPR \*Worldview\* interview](#) here in Chicago. Their focus: F-gases, a.k.a. “the worst greenhouse gases you’ve never heard of.”

If you have ever used a refrigerator, flicked on an air-conditioner or strolled the freezer aisle in a grocery store in the U.S., you are guilty-by-unavoidable-association of helping to warm the world through F-gas-driven cooling.

It is a very big deal. F-gases account for 17% of the world’s global warming impact, says Larkin. “That’s not annual emissions. That’s cumulative impact.” In other words, they tend to hang around in the atmosphere. The story gets even more jaw-dropping when when you learn that not only are there alternatives, but they been tested and used by hundreds of millions of people in other countries for the last 20 years.

What gives?

In 1992, F-gases called CFCs—chlorofluorocarbons—were banned by the [Montreal Protocol](#) after it was discovered that they had punched a hole on the planet’s ozone layer. The chemical industry’s alternative? HFCs—hydrofluorocarbons. Although these don’t harm the ozone layer, they still have the “F”—fluorine—a potent greenhouse gas.

Never ones to sit on their hands, in 1993, Greenpeace activists in Germany set about getting a prototype refrigerator built to prove there was another way around the problem using “natural refrigerants” such as isobutane. Then they tried to drum up some interest from manufacturers. Nada. Remarkably undaunted, they then *pre-sold* 70,000 non-existent refrigerators. As Larkin notes, this was way before Facebook and Twitter were even a glimmer on the cyber-horizon (indeed, Mark Zuckerberg was still in diapers...). Greenpeace went back to the manufacturer of the prototype, who was now happy beyond happy to ramp up a production line. The technology was open-sourced, so now all the major manufacturers make them, too.

Today, hundreds of millions of “Greenfreeze” refrigerators have been sold. Although comparable in cost to HFC models, they are much more efficient, so cheaper to run, too. Still, they remain illegal in the U.S. “The natural refrigerants do not have lobbyists,” explains Larkin. “The chemical industry does.”

But the rules may change soon, due in large part to Greenpeace-mediated industry pressure. Coca-Cola, Unilever, McDonald’s, Carlsbad Group and Pepsico banded together with Greenpeace and UNEP to form [Refrigerants, Naturally!](#), to promote the use of climate-friendlier technologies, including regulatory and political frameworks to encourage investment.

Wal-Mart is also sold on the technology, even making improvements improvements and sharing its data. After electricity, refrigeration and cooling rank #2 on the company’s carbon footprint list. Says Larkin:

Large businesses like to have certainty, like to plan, like to see where they’re going to make a profit, like to see where they’re going to get hammered, like to see the regulation down the road and if they can, avoid a regulatory problem or a big, costly mess that they didn’t anticipate... (If they can make) a product that is more efficient, less costly in terms of energy for themselves or their customers, generally, they will be on our side.

...Part of the reason that businesses like to share this is that when all of the retailers and all of the ice-cream makers transfer their technology at the same time, you can achieve economies of scale.

The EPA and Underwriters Laboratory are currently reviewing safety issues—natural refrigerants are flammable—but given the global track record, it is possible that the first consumer Greenfreeze refrigerators will be available in the U.S. sometime in 2011. And that’s just plain cool.

# The Washington Post

## CORRECTION TO THIS ARTICLE

Earlier versions of this article, including in the Dec. 27 print editions of The Washington Post, incorrectly said a German company pre-sold HFC-free "Greenfreeze" refrigerators, which were thought to be more environmentally friendly than refrigerators sold in the United States during the early 1990s. In fact, the nonprofit environmental group Greenpeace, which helped to engineer the refrigerators, pre-sold the units. The German company then began manufacturing the refrigerators. This version has been corrected.

## Greener, HFC-free refrigerator set to enter U.S. market in 2011

By Leslie Tamura  
Washington Post Staff Writer  
Sunday, December 26, 2010; 10:42 PM

Greenhouse gases other than carbon dioxide may not get as much global attention, but policymakers and business leaders view curbing these emissions as a way that nations can shrink their [carbon footprints](#).

Refrigerators have a role in this story.

For decades, Americans have known only two types of household refrigerators: the pre-1996 fridge that uses an ozone-depleting chlorofluorocarbon (CFC) refrigerant - commonly known by its trademark name, Freon - and the subsequent models that use the global-warming refrigerant called hydrofluorocarbon (HFC).

When CFCs float into the air, their chlorine molecules eat the ozone. HFCs may not harm the ozone, but they can hang in the atmosphere for decades, absorbing radiation that would otherwise be released into space.

A better refrigerant, environmentalists have argued since the early 1990s, is a hydrocarbon refrigerant.

Made of only carbons and hydrogens, these "natural" refrigerants do not degrade the ozone and are easily broken down by the sun. Compared with the atmosphere-degrading refrigerants currently used in American households, hydrocarbons contribute little to global warming.

As early as next year, Americans may have a new hydrocarbon refrigerator option that can reduce their global warming impact and their energy bills. U.S. manufacturers would be entering the HFC-free domestic refrigeration market that the Germans helped establish in 1993.

Back then, the United States was phasing out CFCs, and the chemical industry was introducing HFCs as a possible replacement. Greenpeace, the nonprofit advocacy group, was not happy with the "environmental alternative" to CFCs, said Amy Larkin, director of Greenpeace Solutions.

Although domestic refrigeration accounts for less than 2 percent of current [global HFC consumption](#) (automobile air conditioners emit the most HFCs), an HFC refrigerant's impact on the climate is 3,830 times more [potent](#) over a 20-year period than the most common greenhouse gas, carbon dioxide.

"But hydrocarbons weren't on anyone's radar," Larkin said, "and when we brought this to the government agencies, telling them these were a better, safe, efficient alternative, we were ridiculed."

Regardless, Greenpeace appealed to a small German manufacturer and helped engineer the world's first hydrocarbon domestic refrigerator. Within three weeks, Greenpeace pre-sold 70,000 HFC-free "Greenfreeze" refrigerators.

Since March 15, 1993, when the first Greenfreeze refrigerator debuted in Germany, more than 400 million hydrocarbon household units have been sold worldwide by several major manufacturers including Whirlpool, Haier and Sanyo.

HFC-free refrigerators have been sold in Mexico, South America, Cuba and parts of Africa, along with Japan, China and throughout Europe.

"Europe has produced incredibly safe, popular refrigerators, but there's still some suspicion in the U.S.," said [Durwood Zaelke](#), director of the Secretariat of the International Network for Environmental Compliance and Enforcement.

Hydrocarbons are flammable, and there have been isolated incidents of [exploding hydrocarbon refrigerators](#).

But manufacturers meet their country's standards and often have an independent safety organization evaluate their appliances. Although hydrocarbon units may have more robust components to prevent leaks, they do not differ much from HFC refrigerators. Typical refrigerators enclose the refrigerant in a hermetically sealed system away from anything that may spark, such as the refrigerator light.

Based on the track record of the hydrocarbon refrigerators, Zaelke said, it's unclear whether concerns about exploding refrigerators is "a true safety concern or just a clever argument for those who make chemicals. One would think they're relatively safe when there are millions sold in Europe."

General Electric plans to introduce the first hydrocarbon household refrigerator in the United States in June 2011, giving Americans a more environmentally friendly option, though at a hefty price.

Insulated with hydrocarbon foam and cooled by a hydrocarbon refrigerant called isobutane, the 30-inch HFC-free refrigerator would be part of GE's luxury [Monoeram](#) brand, selling for about \$6,000 to \$6,500.

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Insulated with hydrocarbon foam and cooled by a hydrocarbon refrigerant called isobutane, the 30-inch HFC-free refrigerator would be part of GE's luxury [Monogram](#) brand, selling for about \$6,000 to \$6,500.

"You're making a significant investment, but this is all part of the gradual reduction in how much HFCs are used," said Merrell Grant, the general manager of GE Monogram.

Before these refrigerators can roll out to retailers, however, GE says it will wait for final approval from the Environmental Protection Agency's [Significant New Alternatives Program](#).

SNAP, which regulates chemicals or technologies that replace ozone-depleting substances, [ruled](#) in 1994 that hydrocarbon refrigerants were too risky to be used in household refrigerators in the United States. According to an EPA spokesman, at the time there was not enough information about the hydrocarbon refrigerant's flammability potential, and there were other non-flammable refrigerants available.

After issuing a [proposal](#) in July 2010 to amend the SNAP rule, the EPA is expected to approve use of HFC-free refrigerants in domestic refrigerators next year.

"Hydrocarbons will slowly take over the market," said Stephen O. Andersen, former director of Strategic Climate Projects in the EPA's Climate Protection Partnership Division.

Hydrocarbons are already commonplace in many household appliances - gas stoves, water heaters, furnaces - and used in products such as bathroom cleaners, air fresheners and cooking sprays.

"Refrigerators are safe with hydrocarbons," Andersen said. "Come on, people will hold a blow dryer in one hand, and a can of aerosol hairspray in the other."

A handful of companies based in the United States have started using natural refrigerants in industrial food service equipment. [Select Ben & Jerry's stores](#) in Boston and the District received federal approval in 2008 to use [hydrocarbon propane freezers](#) as demonstration projects. Coca-Cola has also invested \$60 million to advance HFC-free cooling globally.

At the recent United Nations Framework Convention on Climate Change in Cancun, Mexico, [400 international companies](#), including Unilever and Wal-Mart, pledged they would phase out HFCs from all industrial equipment by 2015. Said former EPA official Andersen: "I think if the market sees the tide changing and starts converting everything to hydrocarbons . . . it could make a big difference."

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