CFC Free Refrigerator Greenfreeze in Germany

25 years Greenfreeze: A fridge that changed the world

Learning from a leapfrogging success story to implement the Kigali Amendment

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

The beginnings of cooling

The history of cooling is almost as old as the history of humanity. In prehistoric times, men heaped ice in the deep caves to keep goods cold, while in the Middle Ages niches in wood walls had a cooling effect. Cellars and cold rooms were ways to keep food in stock, be it in wooden barrels or clay pots. From the mid-19th century onwards, natural substances such as ammonia, carbon dioxide, isobutane, and others were used as refrigerants for industrial and commercial applications.

With the discovery of chlorofluorocarbons (CFCs) in 1929/1930, a new age began as CFCs were soon used as refrigerants, aerosol propellants, for foam blowing, or as solvents. CFCs reached significant market penetration worldwide; at the latest in the 1960s household refrigerators and home freezers (1970s/1980s) became common goods in Europe´s homes.

It wasn´t until 1973 that the destructive impact of CFCs on the atmospheric ozone layer was detected and further investigated. However, scientific evidence that linked the ozone depletion and emissions of CFCs were denied and it took almost another 15 years until a political agreement on the phase-out of production and consumption of ozone depleting substances (ODS) through international action was reached in the Ozone Protocols in Vienna (1985), Montreal (1987), London (1990), and Copenhagen (1992).

Production of CFC Free Refrigerator in Germany

Policy and industry take action

Hand in hand with political negotiations, the chemical industry started working on the identification of alternative refrigerants. Mainly the Montreal Protocol, which entered into force on 1 January 1989, pushed industry for research. Hydrofluorocarbons (HFCs), in particular HFC-134a, were soon identified and tested as the most promising CFC substitutes during the late 1980s, since they did not harm the ozone layer. Nevertheless, as HFC-134a still had a huge global warming potential (GWP), it was always meant to serve as an "interim refrigerant solution".

The civil society gets involved

Alerted by the slow progress at international political level, the German branch of the environmental group Greenpeace started campaigning against CFCs in late 1980. Large PR actions set the chemical industry under pressure and put the topics of ozone depletion and climate change on the daily news agenda. Due to its high impact on climate, HFC-134a was considered as a "climate killer" early on. A first attempt to involve German refrigerator manufacturers in researching halogen-free fridge technology was hampered by industry stakeholders and the hope for a wider awareness did not materialize.

The "Greenfreeze" is born

In March 1992, the Magazine "Quick" published an article on environmentally friendly cooling, showcasing a mix of the hydrocarbons propane and butane as a successful natural refrigerant. Greenpeace took the opportunity and started raising awareness amongst the large German refrigerator manufacturer. Although the German Federal Ministry for the Environment supported the cause, the efforts initially remained with little success. Only the East German company DKK Scharfenstein (later known as FORON) showed its interest.

The meeting between scientists and DKK Scharfenstein resulted in the birth of the so-called "Greenfreeze" technology for domestic refrigeration. Greenfreeze refrigerators use hydrocarbons for both the blowing of the insulation foam and the refrigerant. They are entirely free of ozone depleting and global warming chemicals.

When DKK Scharfenstein announced its intention to mass-produce Greenfreeze, Greenpeace successfully campaigned to gather tens of thousands of pre-orders for the yet-to-be-produced new refrigerator from members and environmentally conscious consumers in Germany. Upon realizing that the first completely green refrigerator was about to come on the market, the four biggest producers (Bosch, Siemens, Liebherr, and Miele) gave up their resistance to the hydrocarbon technology and introduced their own line of Greenfreeze models in the spring of 1993.

Awarded with the German ecolabel Blue Angel, mass-production of the Greenfreeze no. 1 started on 15 March 1993 with a production capacity of 300,000 units per year. The same year a new standard was adopted allowing the use of hydro-carbons in domestic refrigerators. Five years later, Greenpeace received an award from the United Nations for making the Greenfreeze technology open source and freely available to the world.

CFC Free Refrigerator Greenfreeze in Beijng

Shanghai Refrigeration Meeting im March 1997

Spotlight: A press conference to be remembered

After the fall of the Berlin Wall in Germany, state-owned East German companies were supposed to be (re)privatized. In the case of the DKK Scharfenstein, an initial offer to buy the company placed by Bosch/Siemens Household Appliances Ltd. was withdrawn in 1992. Consequently, the company was destined to be dissolved. Against this threat, Greenpeace together with DKK Scharfenstein organized a press conference at which the basic new technology of the first model of the new eco-friendly refrigerator were planned to be presented. The famous "unauthorized" press conference in a cloak-and-dagger organization – interrupted by an official government agent - took place with Greenpeace making their point on the environmentally friendly refrigerator, thus hindering the closure of the Greenfreeze producer.


Press conference organized by
DKK Scharfenstein and Greenpeace

Greenfreeze going worldwide

The successful conversion of the refrigerator production to hydrocarbons in Germany attracted soon the interest of the industry around the globe.

EASTERN EUROPE
Cooperation between DKK Scharfenstein and other factories started in mid-1993.

GLOBAL
Intervention by German representatives in October 1993 encourages World Bank finance committee to decide that funding for CFC phase-out could be provided not only for projects proposing HFC-134a as replacement but also to hydrocarbon technology.

ARGENTINA
Announcement of shift to hydrocarbon production by Whirlpool in September 1997.

CHINA

Presentation of Greenfreeze at household appliance fair in May 1993. German manufacturers (AEG, Bosch, Siemens, Liebherr, Electrolux, Foron) display their first hydrocarbon refrigerators. Greenpeace discusses the hydrocarbon technology with leading refrigerator manufacturers in China => technical seminar for the Chinese refrigeration producers on hydrocarbons organized by Greenpeace in cooperation with the German Federal Ministry for Economic Cooperation and Development (BMZ) in May 1994.

In 1994, the Montreal Protocol's Multilateral Fund (MLF) agrees for the first time to a hydrocarbon project: The conversion of refrigerator production lines at Haier in China, in cooperation with Liebherr. Initiated by the BMZ commissioned GTZ (now GIZ) programme Proklima, this project marked the first hydrocarbon technology transfer across German borders.

INDIA

Launch of Indo-Swiss technology transfer program in 1992 after ratification of the Montreal Protocol, becoming a platform for a 1993 Indo-German project called 'Ecofrig', which was implemented in cooperation with GTZ Proklima.

JAPAN

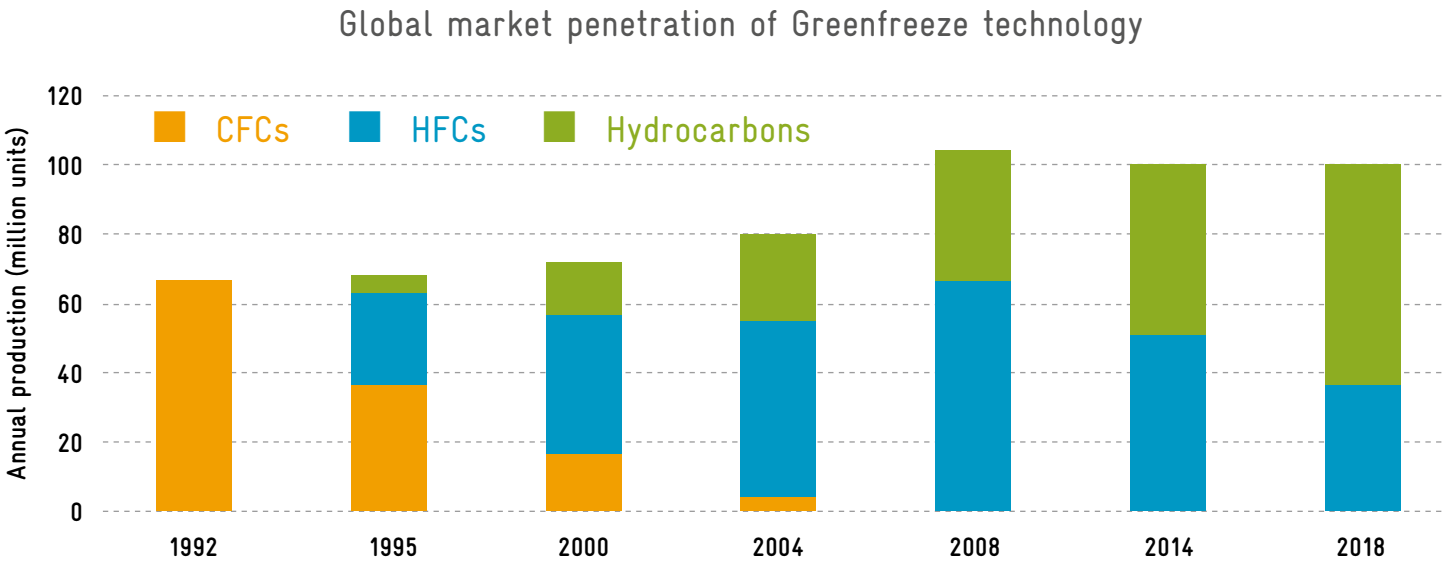
Presentation of Greenfreeze and round table discussions with household appliance manufacturers in June 1993.

AUSTRALIA

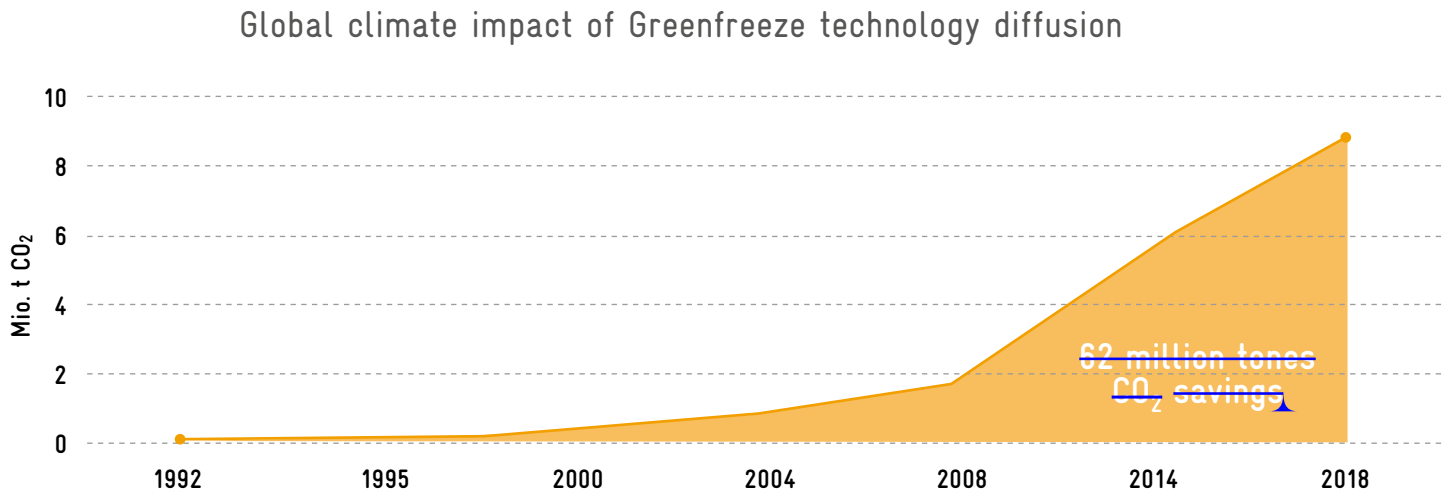
Introduction of first Greenfreeze appliances in October 1995 by the manufacturer Fisher & Paykal. At the end of October 1995, the International CFC and Halon Alternatives Conference and Exhibition in Washington, US, featured for the first time, a section on "hydrocarbons as refrigerant" chaired by the chief Greenfreeze campaigner Wolfgang Lohbeck from Greenpeace.

Market success opens up potential new fields of action

Since the early 1990s, the global refrigerator production increased significantly to about 100 million units per year. CFCs were successfully phased-out worldwide and triggered the demand for substitute technologies in various applications, but in particular in the growing household appliance sector. Today, hydrocarbon technology accounts for around two thirds of the global annual production of domestic refrigerators and freezers (data by UNEP TEAP RTOC; Greenpeace; Figure below). It is expected that this share will grow further in the context of the Kigali Amendment to the Montreal Protocol, which controls the use of very climate damaging CFC-substitutes called HFC.



The introduction of Greenfreeze technology has resulted in accumulated emission reductions of about approx. 62 million tons CO_2 equivalents since the early 1990s (compared to the use of HFC-134a; Figure below).



Learning from the leapfrogging success to advance the Kigali Amendment

The success of the Greenfreeze developed a number of circumstances:

- A feasible and available technical solution was identified just in time, when the Montreal Protocol mandated the substitution of CFCs in equipment production;
- The demand for household appliances was forecasted to grow globally, as positive economic growth in many countries were fueling domestic investments;
- The technical know-how of the engineers at DKK Scharfenstein (later named FORON) paired with the willingness of the management to take the risk and convert to the brand new, largely unproven hydrocarbon technology;
- A new CEN standard was adopted quickly allowing the use of hydrocarbons in domestic refrigerators;
- Early on ministries and government agencies supported the research and introduction of hydrocarbon technology. Political measures such as information and awareness raising (conferences and studies), the award of the Blue Angel ecolabel facilitated the market uptake of the Greenfreeze technology;
- The global diffusion was further promoted by the large-scale German engagement of BMZ and German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) in international cooperation projects implemented by GIZ Proklima;
- In the early 1990s, consumers had a high level of environmental awareness were generally informed about the depletion of the ozone layer and accepted eco-friendly appliances to contribute to environmental protection.
- Greenpeace linked up with the relevant players and featured credible PR action to push the CFC, HCFC and HFC-free refrigerator into the market.

Leapfrogging to hydrocarbons in the air conditioning sector

The Greenfreeze technology revolutionized refrigerator production around the world. While hydrocarbons are globally appreciated as the best available option for refrigerants and foam blowing agents in domestic refrigeration appliances, they still play a minor role in other applications despite their positive thermodynamic and environmental properties.

The most climate-relevant application is the unitary room air conditioner (UAC). Across the globe, the demand for air conditioners is growing rapidly, and expected to accelerate over the next decades in view of increasing prosperity and global warming. The application contributes to climate change through both direct emissions, from the use of synthetic refrigerants (such as HFC), and indirect emissions, from energy consumption. Therefore, it represents a key sector for the implementation of mitigation actions to limit global warming to below 2°C, according to the Paris Climate Agreement.

Since 2008 GIZ Proklima has been supporting the conversion to hydrocarbon technology (Propane, R290) in manufacturing lines in China (at Gree) and India (at Godrej & Boyce). So far, more than 600.000 hydrocarbon AC units have been sold, safely installed and maintained in the Indian market and thus highlighted the high level of readiness for a global uptake. Just recently, the German eco-label Blue Angel was awarded to Midea China for its energy-efficient and climate-friendly R-290 split AC model. Learning from the positive experience of GIZ Proklima, other implementing agencies have started implementing hydrocarbons demonstration and conversion projects at AC manufactures under MLF (such as UNIDO at Midea, Haier, TCL, etc.) in recent years.

Compared to domestic refrigerators, hydrocarbon room air conditioners demand larger refrigerant charges due to required cooling capacities and circuits connecting indoor and outdoor units, potentially resulting in higher risks. A wider market uptake therefore requires a formalized infrastructure of qualified technicians for proper installation and repair.

Although more needs to be done with regards to the training of technicians and setting up of certification schemes, it is important to raise awareness in order to minimize the perceived safety concerns (related to the flammability of hydrocarbons) and environmental lobbying, to convince manufacturers about the numerous advantages and co-benefits of using natural rather than halogenated substances, is important. Therefore, hydrocarbons, and natural substances in general, seem to be the only future-proof solution for ACs and other applications.

Experts expect R290 based ACs to gain market shares quickly as global HFC phase-down proceeds. Rewriting the Greenfreeze success story in the ACs sector could bring not only significant GHG emission reductions, but also considerable cost savings (e.g. avoiding double conversations and paying for patents). This is especially true when the global conversion to hydrocarbons is initiated early and on time to substitute HFCs being controlled under the Montreal Protocol.

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Registered offices
Bonn and Eschborn

Address
Dag-Hammarskjöld-Weg 1 - 5
65760 Eschborn, Germany
T +49 61 96 79-0
F +49 61 96 79-11 15

E info@giz.de
I www.giz.de

Programme:
SV Proklima

Authors:
Barbara Gschrey, Nicole Müller and Franziska Hartwig

Responsible:
Bernhard Siegele

Design:
Jeanette Geppert, pixel und punkt kommunikation, Frankfurt

Photo credits:
Cover © Markus Kratz / Greenpeace; p.2 © Ali Paczensky / Greenpeace;
p.3 © Adrian Bradshaw / Greenpeace; p.3 © GIZ; p. 3 © ARD-Mediathek,
mdr Umschau

Maps:
The maps printed here are intended only for information purposes and in no way constitute recognition under international law of boundaries and territories. GIZ accepts no responsibility for these maps being entirely up to date, correct or complete. All liability for any damage, direct or indirect, resulting from their use is excluded.

On behalf of:
German Federal Ministry for Economic Cooperation and Development (BMZ)
Environment, sustainable use of natural resources, biodiversity, marine conservation
Dahlmannstrasse 4
53113 Bonn, Germany
T: +49 228 99 535-0
F: +49 228 99 535-3500

GIZ is responsible for the content of this publication.

Printing and distribution:
Druckriegel, Frankfurt

Printed on 100% recycled paper, certified to FSC standards.

Eschborn July 2018