

FACT SHEET

HFCs: The Big Bad Greenhouse Gases You Probably Never Heard Of

1. What are F-gases?

F-gases are **potent greenhouse gases** with no natural sources that contain the compounds hydrogen, carbon and fluorine. The chemical industry developed these chlorine-free substitutes in the 1980s to replace ozone-depleting (and chlorine containing) gases (ODS) such as chlorofluorocarbons (**CFCs**) and hydrochloro-fluorocarbons (**HCFCs**), which are being phased out globally under the 1987 Montreal Protocol to protect the Earth's ozone layer. The **major applications** that use F-gases to substitute ODS are refrigeration, air conditioning, foams, aerosols, fire protection and solventsⁱ.

2. Are F-gases environmentally – friendly?

F-gases are often misleadingly portrayed by their manufacturers to be 'environmentally friendly' because some of them do not deplete the ozone layer. However, all of them are highly potent greenhouse gases and contribute significantly to **climate change**. The following F-gases are listed under the Kyoto Protocol on Climate Change: hydrofluorocarbons (**HFCs**), perfluorocarbons (**PFCs**) and sulphur hexafluoride (**SF₆**)ⁱⁱ. HFCs are the most commonly used F-Gases, and they count for more than 90% of total F-Gases emissionsⁱⁱⁱ.

3. How are HFCs (the most commonly used type of F-gases) harmful to climate?

HFCs are potent greenhouse gases with a very **high global warming potential (GWP)**. According to the Intergovernmental Panel on Climate Change (IPCC)^{iv}, the GWP of one kilogram of F-Gases is several thousand times that of one kilogram of CO₂ (using a 100-yr GWP estimate)^v. The most commonly used HFC is HFC 134a. This chemical has a GWP of 1,430 (meaning a ton of HFC 134a in the atmosphere has the same effect as 1,430 tonnes of carbon dioxide)^{vi}. Some of the other HFCs have GWPs that are even worse: HFC-23 has a GWP of 14,760, HFC-143a a GWP of 4,470 and HFC-125 a GWP of 3,500.

4. Where are HFCs being used?

HFCs are widely used in industrial, commercial and consumer products and applications. Two of the **main sources** of global HFC emissions are **refrigeration** and stationary and (auto) mobile **air conditioning** units^{vii}. Unlike other greenhouse gases which are emitted while burning fossil fuels to generate energy, most HFCs are contained within equipment or products where greenhouse gas emissions usually occur as a result of leakage during maintenance checks and when air-conditioners and refrigerators are discarded or have ceased functioning (reached their end of product life cycle). According to recent investigations about 60% of HFC emissions arise from routine leaks from refrigeration and air conditioning^{viii}.

5. What will be the overall impact of HFCs to global warming?

A 2004 study by the German scientific institute Oko-Recherche suggests that the share of F-gases in overall global warming emissions is high and will continue to grow steadily. According to the study, by 2050 emissions of all F-gases combined is expected to reach 5.2% of global greenhouse gas emissions using the 20-yr GWP, the impact of these emissions is equivalent to the CO₂ emissions of all the world's passenger cars in 2004^{ix}.

6. How fast are HFC emissions increasing throughout the world?

HFC emissions are growing at an alarming rate across the world—in 2002, atmospheric levels of HFC 134a and 125 (different types of HFC gases) over Svalbard, an archipelago close to the North Pole, were 20% higher than in 2001^x.

7. What countries contribute most to HFC emissions?

According to recent UNEP (United Nations Environment Programme) reports, 80% of current HFC (but also of CFC and HCFC) emissions originate from industrialised countries^{xi}. The United States, Europe, Russia, Japan and Australia mark the biggest percentages. However, developing countries in East Asia, South Asia, and South America are catching up quickly.

8. What is the current situation on HFCs in China?

Consumption of HFCs in China is **increasing rapidly**. For example, the consumption of HFC-134a in mobile air conditioning increased from 101 MT (mega tonnes) in 1995 to 5,700 MT in 2003. It is expected that this will increase in the next years to approximately 21,000 MT in 2015^{xii}. A large number of chemical industry giants are also increasing their HFC production in China. For instance, DuPont announced in 2004 that production had started at its new joint venture facility in Jiangsu province to manufacture HFC refrigerant blends. That same year, Honeywell also announced that it would have a new facility operational in China to produce HFC refrigerants. Furthermore, Arkema, the world's second largest fluorochemical producer, started an industrial facility in Changshu in 2005. In Zhejiang province, the Chengnan Development Zone has the largest concentration of fluorine chemical industries in China.

9. Has any government taken actions against HFCs and F-Gases?

The industry trade groups such as the 'Alliance for Responsible Atmospheric Policy' (ARAP) and 'European Partnership for Energy and the Environment' (EPEE) have so far lobbied governments hard to prevent a global or regional phase out of HFCs. So far the **European Union** is the only government body that has actively worked to reduce HFC emissions, their approach has been based on **containment and recovery** of HFCs rather than forcing the use of alternatives. However, EU member states **Denmark** and **Austria** were allowed to maintain more stringent measures until 2012, **banning** the import, sale and use of new products containing F-gases as well as banning the import, sale and use of F-gases, new and recovered^{xiii}. In addition, Switzerland also has bans on HFCs in some products and Norway has a high GWP-weighted tax on the sale of HFCs.

10. Are containment and recovery an adequate solution to the climate-harming HFCs?

In 2004 the report, *HFC Containment Has Already Failed*, by renowned environmental chemist Eric Johnson indicates that HFC-134a from automobile air conditioning has continued to leak at around 25-30% annually over the past decade. This contradicts claims by the auto industry that the leakage rates have averaged 10-15% over the same period and calls the EU strategy into question. Furthermore, the fact that the Montreal Protocol is based on phase-out rather than solution again points to the fact that many legislators are doubtful of F-gas containment policies.

11. What has the Chinese government done so far?

In order to address ozone destruction, **China** recently announced to stop the production of CFCs in July 2007, **3 years ahead** of the Montreal Protocol 2010 deadline for developing countries. Unfortunately, as most other countries in the world, China currently does not have a legal mechanism in place yet to phase out HFCs. There is however a huge **potential** in Chinese commercial refrigeration to switch to **climate-friendly natural technology** instead of using HFCs^{xiv}.

12. Can HFCs easily be replaced?

Alternatives to climate-harming HFCs have been available on the market for a long time. Please refer to the Greenpeace fact sheet on '**Natural Refrigerants: The Solution**' for more details.

ⁱ In order to explain their use, the following passage describes their usage in a refrigerator. Some refrigerators use specific substances such as CFCs or HFCs to absorb heat, in order to cool products. These substances start as a liquid, before the pump pushes them through an aperture into pipes in the freezer compartment which significantly reduces the pressure, allowing them to turn into vapour, which helps absorb heat from the freezer compartment. As the pipes get colder and the freezer begins to cool, the pump sucks the CFCs and HFCs in vapour form and forces them into pipes located outside the refrigerator at a much higher pressure, which also increases the temperature. Because the temperature of the gas is significantly higher than room temperature, CFCs or HFCs condense back into liquid form — during this process, heat is released which is absorbed by the air around it.

ⁱⁱ These gases are, together with CO₂, CH₄ and N₂O, contained in the 'basket' of gases whose emissions are controlled under the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change. See also: www.unfccc.int

ⁱⁱⁱ IPCC Special Report on Emissions Scenarios, 2000, Table 5-7

^{iv} IPCC - Third Assessment Report 2001: Technical Summary of the Scientific Basis for Climate Change

^v **Global Warming Potential (GWP)** is the index used to translate the level of emissions of various gases into a common measure in order to compare them. GWPs are calculated as the ratio of the radiative forcing that would result from the emissions of one kilogram of a greenhouse gas to the emission of one kilogram of carbon dioxide over a period of time (taking into account both warming potential of each molecule of a gas, and its atmospheric lifetime, which explains how long the gas will stay in the air). Greenhouse gases are expressed in terms of Carbon Dioxide Equivalent. The International Panel on Climate Change (IPCC) has presented these GWPs and regularly updates them in new assessments. The 100-yr estimates are most commonly used, but GWPs based on cumulative warming over 20- and 500-year periods were also developed by the IPCC and are used in some analyses, because some gases will stay longer in the atmosphere, while other are mainly active in a shorter period of time.

^{vi} IPCC/TEAP Special Report 'Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons –Summary for Policymakers, 2005, p.8

^{vii} IPCC/TEAP Special Report 'Safeguarding the Ozone Layer and the Global Climate System: Issues Related to Hydrofluorocarbons and Perfluorocarbons –Summary for Policymakers, 2005, p.13

^{viii} Schwarz, Winfried. The high and still growing share of fluorinated greenhouse gases in overall global warming emissions-Summary of an Oko-Recherche study (including special remarks on commercial refrigeration), Frankfurt, June 2004, on behalf of Greenpeace

^{ix} Ibid.

^x ENDS Europe Daily, 6 February 2004

^{xi} UNEP, Production and Consumption of Ozone Depleting Substances under the Montreal Protocol, 1986-2000, Ozone Secretariat, UNEP, Nairobi, 2002

^{xii} Jianxin Hu, Chunmei Li & Xu Yi, 'Growing markets of MAC with HFC-134a in China', 2004 (US EPA MAC Summit)

^{xiii} F.e. on Denmark: Official Journal of the European Union, L32/130, 6 February 2007

^{xiv} The Refrigeration Technology Options Committee (RTOC), functioning under the Montreal Protocol, states in its 2006 Assessment, that China had approximately 288.000 supermarkets in 2003, which is almost nine times as much as the United States.