F-GASES

further reducing global warming

CARBON DIOXIDE, N_2O, METHANE

HFCs

F-gases are widely used...

The family of F-gases (*) comprises hydrofluorocarbons (HFCs) perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)

Preserving food and medicines in refrigerators, in supermarkets and transport, minimizing waste

Providing comfortable and safe living through air-conditioning in offices, houses, hospitals, shops, schools, etc.

Saving energy through their use as insulating agents in high performance thermal insulation foam...

(*) In the context of the Kyoto Protocol, the family of F-gases excludes CFCs and HCFCs covered by the Montreal Protocol.

...and often vital to our daily life

HFCs and PFCs are hydrocarbons containing fluorine atoms that give them their exceptional properties

Facilitating the production of semi-conductors and electronics as precision cleaning solvents

Ensuring high safety levels as electrical insulation gases in high voltage equipment (SF_6)

Saving lives, goods and property by using them in water-free fire extinguishers

Treating asthma as propellant in medical inhalers

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F-gases are greenhouse gases that can reduce the greenhouse effect!

In many applications, F-gases help to reduce energy-related CO_2 emissions. Consequently their use reduces the total climate impact.

On average, 80 % of the climate impact of applications like refrigeration or air conditioning results from the CO_2 emissions associated with their energy consumption.

ENERGY EFFICIENCY

The reduction in climate impact results from the energy efficiency gains, made possible with HFCs, leading to less energy consumption through the lifetime of equipment. This reduction outweighs substantially potential direct HFC emissions from the equipment.(*)

Used responsibly F-gases contribute significantly to the objectives of the Kyoto Protocol.

The challenge is now to go further with even better containment and use of these gases in their applications.

(*) This was shown for some applications by verified life cycle analysis, available on request.

So why the debate on F-gases?

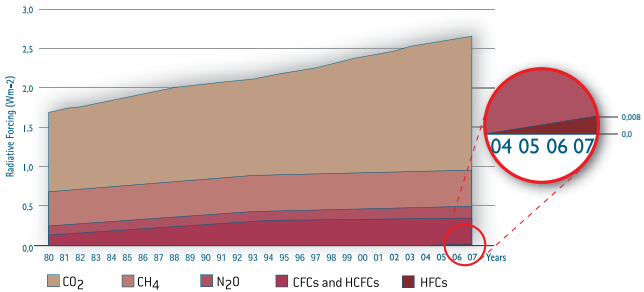
30% of the CO_2 emitted at the time of the cathedral builders of the XII century is still with us !

Basically, the debate is focused solely on the "Global Warming Potential" (GWP) and not on the climate impact of HFCs. GWP is the conversion factor for an emission of a greenhouse gas to be expressed in terms of an equivalent emission of CO_2.

On its own, the GWP of a gas does not define its global climate impact

Two other parameters are equally important:

- **THE QUANTITIES OF GAS EMITTED:** F-gases are minor contributors to climate impact compared with the huge amounts of the other greenhouse gases - CO_2, methane or nitrous oxide - emitted through human activities.
- **THE LIFETIME OF THE GAS IN THE ATMOSPHERE:** HFCs, the main F-gases used, are degraded in the atmosphere within decades; in contrast, CO_2 emissions persist **for centuries.**



Global climate impact of all man-made greenhouse gases. The impact of HFCs is only just discernable above the baseline.

NOAA Global Annual Greenhouse Gas Index (AGGI)
www.cmdl.noaa.gov/aggi/

Going further than the F-gas Regulation

The EU has agreed a target to reduce emissions of all greenhouse gases by 20% (*) in 2020

It is possible to contribute to the EU target through:

- **Reducing charge sizes** and **leakage rates** for new equipment;
- Developing **new fluorinated compounds** with lower GWP that retain the excellent properties of HFCs;
- Further improving **recovery and recycling** of F-gases throughout their complete lifecycle.

The site www.figaroo.org is a unique and regularly updated source of information and advice on the application of the European Regulation on F-gases.

Using F-gases responsibly can help to...

- benefit society in important applications
- directly influence energy use and associated CO_2 emissions
- prevent emissions through containment

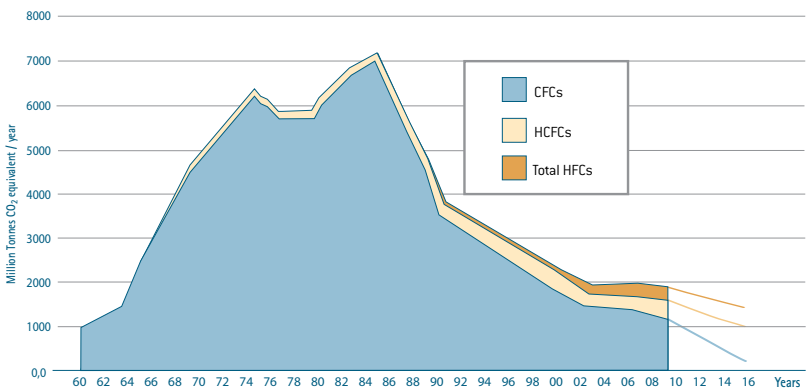
The F-gas Regulation EC 842 adopted in 2006 is leading to improved performance, better maintenance of the appliances with more efficient and safe recycling of the gases. These measures mean that emissions of F-gases will be substantially reduced.

(*) Council of Ministers "Climate Action Plan" for all greenhouse gases which are: carbon dioxide (CO_2), methane, nitrous oxide (N_2O), and F-gases - HFCs, PFCs and SF_6.

HFCs played a key role in the replacement of CFCs, leading to the most significant reduction of greenhouse gases emissions

- CFCs - and now HCFCs - were banned because of their impact on the ozone layer. While also powerful greenhouse gases, they were not included in the Kyoto Protocol because their phase out was already scheduled by the Montreal Protocol.

- HFCs are indeed much less powerful greenhouse gases than CFCs which means that an HFC emission is equivalent to much less CO_2 than the same emission of CFC. The quantity of HFC used in an application today is less than the amount of CFC used for the same service.



Source: www.afeas.org

Expressed in CO_2 equivalent, the emissions of HFCs in 2010 will represent only 2% of CFCs and HCFCs emissions in 1988.

This reduction is nearly 4 times more than the 5.2% target of the Kyoto Protocol.

Design: www.morris-chapman.com

Used responsibly, F-gases are sustainable in many applications in particular those involving public safety

They are:

- **Low in toxicity and low in flammability**
- **Essential for use in many large applications e.g. public places like theatres, supermarkets, airports, stations and tall buildings**

Necessary safety measures for more hazardous alternatives can penalize cost (up to 30%) and energy efficiency

Refrigerants	⊕	⊖	Comments
HFCs	• Low toxicity • Tailored options for energy efficiency	• High GWP- but lower GWP fluids being developed	• Containment is achievable • Reduced charge size minimises use
Hydrocarbons (HCs)	• Low GWP • Energy efficient	• Very flammable and can be explosive • Low level ozone precursors	• Safety requirements • Often restricted in public places • Suitable for low charge factory-sealed units
CO_2	• GWP = 1 • Efficient at low temperature or when combined with heating • Low toxicity	• Risk of asphyxia • Very high pressure • Lower efficiency with higher temperature	• Demanding technology • Efficient hybrid solutions HFCs/CO_2 • Ideal secondary fluid
Ammonia (NH_3)	• No GWP • Energy efficient	• Toxic and flammable • Safety measures penalize cost and efficiency	• Use limited mainly to industrial refrigeration • Specific material required