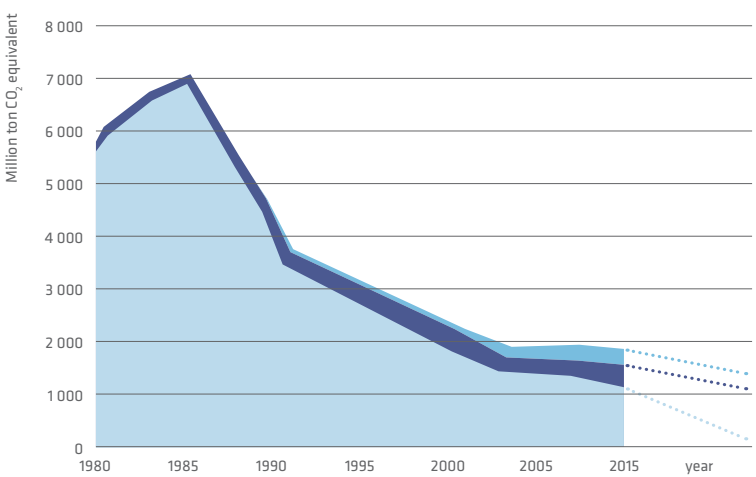
Climate change

Stepping forward with **the F-Gas Regulation Review**

F-gases played a key role in the replacement of **CFCs**, leading to the most significant reduction of global greenhouse gas 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 agreed by the Montreal Protocol.

→ HFCs and even more now HFOs are much less powerful greenhouse gases than CFCs which means that a F-gas emission is much less in terms of CO_2 than the same emission of CFC. The quantity of F-gas used in an application today is much less than the amount of CFC used for the same service.



Expressed in CO_2 equivalent, the emissions of F-gases in 2015 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.

HFCs
HCFCs
CFCs

Source: www.afeas.org

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

Refrigerants	Advantages	Disadvantages	Comments
HFCs	→ Low toxicity → Tailored options for high energy efficiency	→ Still a relatively high GWP	→ Containment is achievable → Reduced charge size minimizes use → Suitable for recovery and re-use
HFOs	→ Low GWP	→ Cost → Higher embedded energy in production	→ Containment is achievable → Reduced charge size minimizes use → Suitable for recovery and re-use
Hydrocarbons (HCs)	→ Low GWP → Low toxicity → Tailored options for high energy efficiency	→ Extremely flammable and can be explosive → Tropospheric level ozone precursors (smog)	→ Safety requirements → Often restricted in public places → Suitable for low charge factory-sealed units
Carbon dioxide (CO_2)	→ GWP = 1 → Efficient at low temperature or when combined with heating → Low toxicity	→ Higher risk of asphyxia → Very high pressure → Lower efficiency at very high pressure in appliances (>30°C)	→ Demanding technology → Efficient hybrid solutions HFCs/CO_2 → Ideal secondary fluid
Ammonia (NH_3)	→ No GWP → Energy efficient	→ Toxic and flammable → Required safety measures penalize cost and efficiency	→ Use limited mainly to industrial refrigeration → Specific material required

(*) HFCs, HFOs, PFCs and SF_6

So why the debate on F-gases?

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.

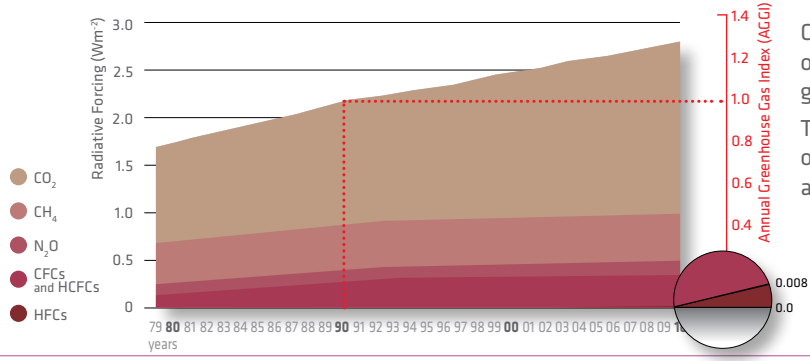
30% of the CO_2 emitted at the time of the cathedral builders of the XII century is still with us!

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 change 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 with the F-gas Regulation Review

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

A POSITIVE CONTRIBUTION OF F-GASES

The Review of the F-Gas Regulation could improve its effectiveness by focusing e.g. on the implementation of a consumption cap and progressive phase-down of HFCs.

Towards the 20% reduction in emissions of all greenhouse gases

A long-term target would encourage further developments

- in the reduction in charge sizes and leakage rates for new equipment;
- of new fluorinated compounds with a lower GWP that retains the same properties;
- of recovery and recycling of F-gases throughout their complete lifecycle.

It would provide a stable framework necessary to

- allow industry to both plan for the long term and deliver emission reductions effectively in the short and medium term;
- avoid picking future winners or losers, it encourages innovation and allows the market, over time, to select the most appropriate cost effective option;
- accommodate geographical and Member State differences in one framework.

Towards the 20% reduction in energy consumption

Maintaining the availability of HFCs:

- **meeting the highest energy efficient** standard for each application by allowing designers to select the best cost effective designs and refrigerants;
- **helps to save energy** through their use in high performance thermal insulation foam, to improve the climate performance of retrofitted existing building stock;
- **for safe (non-flammable) use** in (for example) heat-pump tumble driers reducing energy consumption by about 40%;
- **allows the development of new fluorochemicals**, further reducing their climate impact, achievable without major dislocations to the market.

Towards the 20% renewables in the Energy Mix

Thanks to existing and new HFCs:

- **used as safe fluids** in heat pumps, recognised in the EU as sources of renewable energy, HFCs with GWP <2000 are eligible for EU eco-labelling.
- **Used as waste heat recovery fluid** in Organic Rankine Cycle power generation

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

F-gases are greenhouse gases that can reduce the overall 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.

Used responsibly F-gases contribute significantly to the objectives of reducing our impact on the climate.

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

A POSITIVE CONTRIBUTION OF F-GASES

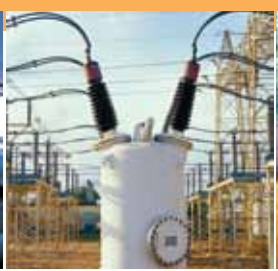
The reduction in climate impact results from the energy efficiency gains, made possible with F-gases, leading to less energy consumption through the lifetime of equipment. This reduction outweighs substantially the potential direct F-gases emissions from the equipment.(*)

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

… and often vital to our daily life

Fluorocarbons and SF_6 are hydrocarbons containing fluorine atoms that give them their exceptional properties

Facilitating the production of semiconductors 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

F-gases are widely used...

The family of F-gases (*) comprises hydrofluorocarbons (HFCs), Hydrofluoro-olefins (HFOs) (**), 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.

(**) HFCs as HFOs are included in F-gases

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