

Global Warming Debate Highlights F-Gases

A Special Report from Linde Gases

Global warming is surpassing ozone depletion as one of the leading environmental concerns. A particular focus area is the increasing release of fluorinated gases (f-gases) into the atmosphere.

Fluorinated greenhouse gases are a group of chemicals containing fluorine. The most common f-gases are hydrochlorofluorocarbons (HCFCs), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). These are all man-made gases that are used in a variety of applications including refrigeration, foam blowing, propellants, aluminum, and semiconductor manufacturing. During their use, these gases can be emitted to the atmosphere. However once released, many of these gases stay in the atmosphere for years and make a far greater contribution to a global greenhouse effect than carbon dioxide. In the European Union (EU), f-gases account for two percent of overall greenhouse gas emissions. (ec.europa.eu/climax/policies/f-gas/index_en.htm)

HFCs, the most common group of f-gases, are used in various sectors and applications, such as refrigerants in refrigeration; air-conditioning, and heat pump equipment; as blowing agents for foams; as solvents; and in fire extinguishers and aerosols. Originally developed to replace ozone-depleting substances (ODS) including chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs), HFCs have rapidly grown in popularity as signatories to the Montreal Protocol phase out the use of CFCs and HCFCs.

See related story, "Trade in Counterfeit and Poor Quality Refrigerants Still Thrives," on page 34 of this issue.

As environmental focus has shifted away from ozone depletion towards global warming, several global environmental authorities have flagged the uncontrolled use of f-gases as a focus area for regulation. Efforts to develop a global approach for the control of HFCs have recently taken



the form of a declaration of support for a global phase-down as one of the outcomes of the "Rio+20" United Nations Conference on Sustainable Development.

Among the world's major politico-economic regions, the EU is taking the most rigorous approach to f-gas regulation. To combat the potential global warming effects of f-gases, and as part of the EU's Kyoto Protocol commitments, in 2006 the EU passed two pieces of legislation controlling their use: the F-gas Regulation (EC) No 842/2006 and the Mobile Air Conditioning Directive 2006/40/EC (the "MAC Directive"). (ec.europa.eu/climax/policies/f-gas/legislation/index_en.htm)

Now, the sale of certain products and equipment that use f-gases with a high global warming potential (GWP) will be restricted. This regulation strengthens many existing measures and also introduces a number of additional changes. First, the total amount of HFCs that can be sold in the EU will be capped in 2015 so it cannot exceed the baseline average of 2009-2012, and then phased down in steps to one-fifth of the baseline by 2030. This will be the main driver of the move towards more climate-friendly technologies.

Secondly, the sale of certain products and equipment that use f-gases with a high

global warming potential (GWP) will be restricted, where less harmful alternatives are widely available, such as in domestic refrigeration, supermarkets, small air conditioning systems, foams, and aerosols.

Thirdly there will be restrictions on the servicing and maintenance of many existing refrigeration systems that use HFCs with a high GWP of 2,500 or above.

Additionally, operations using f-gases will be required to prevent emissions through regular checks, proper servicing, and recovery of the gases at the end of the equipment's life. The new F-gas Regulation is expected to cut the EU's f-gas emissions by two-thirds by 2030, compared with the baseline period.

In the US, according to the Environmental Protection Agency (EPA), overall fluorinated gas emissions have increased by about 83 percent between 1990 and 2012. This increase has been driven by a 310 percent increase in HFC emissions since 1990, even though emissions of PFCs and SF₆ declined during this time, owing to emission reduction efforts in the aluminum production industry (PFCs) and the electricity transmission and distribution industry (SF₆). The EPA expects HFC emissions to grow by nearly 140 percent until 2020, as demands for re-

refrigeration continue to grow and as more ozone-depleting substances are replaced. (epa.gov/climatechange/ghgemissions/gases/fgases.html)

Although there is no current legislation regulating HFC usage in the US or Canada, the EPA recently proposed a new rule called the "Protection of Stratospheric Ozone: Change of Listing Status for Certain Substitutes." Under this proposed rule, various HFCs and HFC-containing blends that were previously listed as acceptable alternatives to ODS will be listed as unacceptable for some uses. This proposed rule is part of the Significant New Alternatives Policy (SNAP) program, under which the EPA continuously reviews alternatives to ODS to find substitutes that pose less overall risk to human health and the environment. As safer alternatives become available for particular applications, the list of acceptable substitutes is evaluated and revised.

See related story, "US Government and Private Industry Partner on New Commitments to Catalyze Global HFC Phase Down," on page 26 of this issue.

In May 2014, the US, Canada, and Mexico submitted an amendment to the Montreal Protocol on Substances that Deplete the Ozone Layer to phase down the production and consumption of HFCs. If adopted, the proposed amendment could yield reductions of over 90 gigatons of carbon dioxide equivalent until 2050, roughly equivalent to two years of current annual emissions of all greenhouse gases. (state.gov/r/pa/prs/ps/2014/05/225927.htm)

Canada has implemented arguably the most successful CFC and HCFC disposal program in the world and is now poised to begin measures to dispose of HFCs, essentially making disposal mandatory for all HFC importers.

In other geographies, in 2013 the Japanese Cabinet approved the revision of its fluorocarbon regulations that will fundamentally change the way high global warming fluorocarbons are produced, used, and disposed of in Japan. It also will lead to a phase-down of HFCs. (eia-global.org/news-media/japan-to-phase-down-hfcs-important-step-to-combat-climate-change-but-not-qu) Australia is considering new

global warming related legislation which is likely, in part, to reflect the EU model.

"All this progressively tighter legislation focused on HFCs will lead to a lot of change in the refrigeration and air-conditioning sectors," predicts Jon Black, Global Head of Chemicals and Refrigerants, Linde Gases Division. "Some operations will be obliged to convert existing equipment and others will need to buy completely new equipment that uses more environmentally friendly gases. In many cases, this will mean a shift to alternatives such as hydrofluoroolefins (HFOs), a new generation of refrigerant gases, and natural refrigerant gases, which include ammonia, carbon dioxide, and hydrocarbons.

"Both HFOs and natural refrigerant gases have zero ODP and very low GWP properties, however they are still in relatively early stages of commercialization, and have other challenges that need to be overcome, such as pressure characteristics, flammability, toxicity, efficiency, and cost." ■

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