



IEAGHG Information Paper: 2015-IP28; HFC's included In Montreal Protocol

The Montreal Protocol on Substances that Deplete the Ozone Layer (a protocol to the Vienna Convention for the Protection of the Ozone Layer) is an international treaty designed to protect the ozone layer by phasing out the production of numerous substances that are responsible for ozone depletion. It was agreed on 16 September 1987, and entered into force on 1 January 1989. The two ozone treaties have been ratified by 197 parties, which includes 196 states and the European Union making them the first universally ratified treaties in United Nations history.

The Montreal Protocol is considered to be the most successful international agreement and its impact was tangibly demonstrated by the recovery of the ozone hole in Antarctica. Climate projections indicate that the ozone layer will return to 1980 levels between 2050 and 2070¹.

The Montreal Protocol has been very successful in gaining global agreement to phase out two gases, Chlorofluorocarbons (CFC's) and Hydrochlorofluorocarbons (HCFC's) both significant ozone depleting chemicals and also gases possessing high global warming potentials.

IEAGHG covered the topic of CFC replacement by HCFC's in 2013, see Information Paper 2013-23 HCFC substitution². At that time it was felt that there were no perfect replacements for HCFC's. The replacements discussed included; CO₂, Propane, Ammonia, Dimethyl Ether, Hydroolefins (HFO's), refrigerant gases containing fluoroethanes, hydrocarbons and of course HFC's. One of the key issues related to some of the proposed alternatives are issues with regard to their flammability, which was considered to be an issue for their deployment in developing countries who did not have the necessary controls/regulations in place.

The issues with HFC's are:

- Hydrofluorocarbons (HFC's) are not potent as an ozone depleting agent (because they do not include chlorine) but are strong global warming gases. For example, the most commonly used HFC, HFC-134a, is 1,430 times more damaging to the climate system than carbon dioxide.
- HFC's have largely been used to replace HCFC's in air conditioning systems, for which there has been a significant growth in their deployment in developing countries.
- Atmospheric HFC abundances are low and their contribution to radiative forcing is small relative to that of the CFCs and HCFCs they replace (less than 1% of the total by well-mixed GHGs). But as they replace CFCs and HCFCs phased out by the Montreal Protocol, however, their contribution to future climate forcing is projected to grow considerably in the absence of controls on global production³.
- HFC's are rapidly increasing in the atmosphere, their emissions are projected to increase nearly twentyfold in the coming decades⁴.
- If HFC growth continues on the current trajectory, the increase in HFC emissions is projected to offset much of the climate benefit achieved to date by phasing out the ozone-depleting substances⁴.

¹ The National Aeronautic and Space Administration in the USA monitors the ozone hole and you can find out the latest status at: <http://ozonewatch.gsfc.nasa.gov/>

² http://www.ieaghg.org/docs/General_Docs/Publications/Information_Papers/2013-IP23.pdf

³ https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter02_FINAL.pdf

⁴

http://www.unep.org/publications/ebooks/emissionsgapreport2014/portals/50268/pdf/EGR2014_LOWRES.pdf



As agreed in by the parties in 1987, the Montreal Protocol does not address HFCs, but these substances figure in the basket of six greenhouse gases under the Kyoto Protocol. Hence developed countries following the Kyoto Protocol report their HFC emission data to UNFCCC; parties to the Montreal Protocol have no such obligation.

However, the United States, Canada, and Mexico together submitted a proposal in April 2015 at a special working group meeting of the parties of the Montreal Protocol to phase-down production and consumption of hydrofluorocarbons (HFCs) under the Montreal Protocol on Substances that Deplete the Ozone Layer⁵. The EU⁶, India and group of Pacific Island states also submitted proposals to include HFC's in the Montreal Protocol at that time. For those interested the proposed amendment to the Montreal Protocol and the briefing paper sent to the parties can be found on the USA EPA website, see footnote 3.

At the 27th Meeting of the Parties to the Montreal Protocol Parties on 8 November 2015 a road map was agreed for negotiating an amendment on the feasibility and ways of managing HFCs. On negotiating the HFCs amendment, the Parties decided to work within the Montreal Protocol toward an amendment in 2016.

The basic premise behind these developments are that: the Montreal Protocol created this problem and has now moved to rectify it. Whilst HFC's should be considered under the Kyoto Protocol, Governments obviously feel that the mechanisms and principles formed under the Montreal Protocol are better suited to solve the problem. Based on the track record of both international agreements to date one would have to agree.

The next question of course is what do we replace HFC's with? This obviously needs careful consideration, so as not to make the same mistake again.

A useful reference point is the USEPA web site provides a number of fact sheets that list options that are available in a number of key market sectors. For example two in the refrigeration sector are:

- *Transitioning to low-GWP alternatives in commercial refrigeration*, see http://www3.epa.gov/ozone/downloads/EPA_HFC_ComRef.pdf. They quote an example from Australia. Whereby Australia's major supermarkets have committed to reducing commercial refrigeration emissions through lower GWP refrigerants, advanced refrigeration technology, and innovative store designs. Since 2008, supermarkets have been incorporating CO₂ cascade and transcritical refrigeration systems to meet their target reductions in CO₂eq. emissions. Shifting from HFC's to CO₂ they suggest can reduce the carbon footprint of supermarkets by 25%.
- *Transitioning to low-GWP alternatives in domestic refrigeration*. See http://www3.epa.gov/ozone/downloads/EPA_HFC_DomRef.pdf. The example they quote here is from Japan. In 2002, Japan, a major producer of domestic refrigerators/freezers, introduced its first hydrocarbon (HC) refrigerators onto the market. HC refrigerants, especially R-600a⁷, have since dominated the Japanese domestic refrigeration market and are continuing to grow in market share.

⁵ <http://www3.epa.gov/ozone/intpol/mpagreement.html>

⁶ The EU agreed in 2013 to phase out HFC's, see IP 2013-12 EU Votes to Reduce HFC's

⁷ R600a is an isobutene refrigerant, see http://www.linde-gas.com/en/products_and_supply/refrigerants/natural_refrigerants/R600a_isobutane/index.html



In these two cases the gases discussed namely CO₂ and hydrocarbons are the same as those considered earlier as HCFC replacements.

The case studies also highlight actions underway in developing countries to replace HFC's. Such activities need to be widespread in developing countries as well. This is another reason why the Montreal Protocol is a good vehicle for this replacement initiative, because to date the Kyoto Protocol does not include developing countries whereas the Montreal Protocol does.

One other global initiative is the Climate and Clean Air Coalition⁸ which was formed in 2012 (see IEAGHG IP-20 2012). One of the target activities of this coalition of countries is Promoting HFC Alternative Technology and Standards, named the "HFC Initiative"⁹.

Under the HFC Initiative, the CCAC partners are currently supporting the development of HFC inventories and studies, information exchange on policy and technical issues, demonstration projects to validate and promote climate-friendly alternatives and technologies, and various capacity-building activities to disseminate information on emerging technologies and practices to transition away from high-GWP HFCs and minimize HFC leakages.

The HFC Initiative's overall objective is to significantly reduce the projected growth in the use and emissions of high-GWP HFCs in coming decades relative to business as usual scenarios. More specifically, it aims to mobilize efforts of the private sector, civil society, international organizations, and governments, with a view to:

- Promote the development, commercialization, and adoption of climate-friendly alternatives to high-GWP HFCs for all relevant industry sectors;
- Build international awareness and support for approaches to curb HFC growth, such as a global phase-down of HFC consumption and production under the Montreal Protocol and commitments/pledges by CCAC Partners;
- Encourage national, regional and global policies or approaches to reduce reliance on high-GWP HFCs and support the uptake of climate-friendly alternatives;
- Overcome barriers that limit the widespread introduction of these climate friendly technologies and practices, including those related to the establishment of standards; and
- Encourage the responsible management of existing equipment and better designs for future equipment in order to minimize leaks.

Activities that the HFC Initiative are undertaking include:

- The CCAC has also produced a fact sheet on Low-GWP Alternatives in Commercial Refrigeration: Propane, CO₂ and HFO Case Studies¹⁰.
- In late November 2015 they are involved in a workshop entitled: Advancing Ozone & Climate Protection Technologies: Food Cold Chain workshop¹¹. Jointly organized by UNEP, CCAC, the US government, the Alliance for Responsible Atmospheric Policy and the Global Food Cold Chain Council, will provide an opportunity to share information and expertise on technologies and policy measures with a focus on the food cold chain and high-global warming potential hydrofluorocarbons (HFCs) in each part of the cold food chain where refrigeration is

⁸ The CCAC is a coalition of 46 countries, the EU and 67 non-state partners like, the UNEP, World Bank, Bellona etc. See <http://www.ccacoalition.org/>

⁹ <http://www.unep.org/ccac/Initiatives/HFCs/tabid/794344/Default.aspx#sthash.aqAAyf2c.dpuf>

¹⁰ http://www.unep.org/ccac/portals/50162/docs/Low-GWP_Alternatives_in_Commercial_Refrigeration-Case_Studies-Final.pdf

¹¹ <http://www.unep.org/ccac/Initiatives/HFCs/tabid/794344/Default.aspx#sthash.daXeMrhd.dpuf>



necessary. The food cold chain represents about a fifth of all HFCs use today, and the use of HFCs expanding

The aim of this paper is to inform IEAGHG members and other interested parties on developments relating to greenhouse gas emissions and mitigation in this case one of the basket of greenhouse gases HFC's until now covered under the Kyoto Protocol. The information paper shows that:

- The emissions, both now and in the future, are quantified for HFC's,
- Mitigation options are identified actions to promote awareness and the replacement of HFC's with other non GWP gases is underway nationally and internationally.
- International action is underway to assist the mitigation of these greenhouse gases, including transferring the governance of HFC replacement to the Montreal Protocol

In terms of what IEAGHG can add to actions/initiatives already under way, it is proposed that we maintain a watching brief and at appropriate times when there are significant developments to inform members of these through further Information Papers.

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