

Introduction to the Kigali Amendment

Background:

In October 2016 the Kigali Amendment was adopted by all Parties to the Montreal Protocol. The Kigali Amendment brings the future production and consumption of hydrofluorocarbons (HFCs¹) under the control of the Protocol and will make a major contribution towards the fight against climate change. Control of HFC production and consumption will add to the climate benefits already achieved by the Montreal Protocol through the phase-out of ozone depleting substances (ODS) including CFCs and HCFCs.

Fluorocarbon chemicals, including HFCs, include many of the most powerful greenhouse gases. The release of 1 kg of certain fluorocarbons is typically between 1 000 and 10 000 times worse than the release of 1 kg of CO₂, in terms of impact on global warming. It has been shown that using alternatives to HFCs in key end-user markets, such as refrigeration and air-conditioning, is one of the most cost-effective ways of reducing greenhouse gas emissions. Under the Kigali Amendment, the global use of HFCs will be cut by around 85% before 2050. This phase-down in the global consumption of HFCs could save as much as 0.5 degrees centigrade of warming.

| GWP ² and ODP ³ of some common refrigerants | | | |
|--|-----------------|------------------|------------------|
| Most of the commonly used fluorocarbons are very powerful greenhouse gases | | | |
| Type | Gas | GWP ² | ODP ³ |
| ODS | CFC-12 | 10 900 | 1.0 |
| | HCFC-22 | 1 810 | 0.055 |
| HFC | HFC-404A | 3 922 | 0 |
| | HFC-410A | 2 088 | 0 |
| | HFC-134a | 1 430 | 0 |
| | HFC-32 | 675 | 0 |
| HFO | HFO-1234yf | 4 | 0 |
| Natural | Propane | 3 | 0 |
| | CO ₂ | 1 | 0 |

HFCs are non-ozone depleting chemicals that were first introduced in the 1990s as alternatives to CFCs and HCFCs. The growing use of HFCs was stimulated by the urgent need for cost effective alternatives to ODS. The use of HFCs has facilitated the rapid phase-out of ODS and has helped protect the Earth's fragile ozone layer. However, the high global warming potential (GWP) of HFCs is a major disadvantage and every effort now needs to be made to use non-ozone depleting alternatives with a low climate impact.

It is worth noting that CFCs had even higher GWPs than HFCs. The phase-out of CFCs was carried out to protect the ozone layer, but it had a very positive secondary benefit in terms of reducing impact on climate change. To further build on this good progress, the Montreal Protocol Parties have agreed that reducing the consumption of HFCs is an important next step.

Which markets are affected?

The biggest market for HFCs is refrigeration, air-conditioning and heat pumps (RACHP). Most applications of RACHP could be affected by the Kigali Amendment; for example, supermarket refrigeration, building air-conditioning and car air-conditioning. Other markets that will be affected include the manufacture of insulation foam, aerosols and fire protection equipment. See [Kigali Fact Sheet 2](#) for further details about current HFC applications.

How is the HFC phase-down process structured?

The aim of the phase-down is to encourage use of low GWP alternatives and to reduce consumption and emissions of high GWP HFCs. To allow a flexible and customised response by individual Parties, the phase-down process is structured with a "basket approach". Progress is measured in terms of reducing the total "tonnes CO₂ equivalent" of all the different HFCs consumed. This favours the use of low GWP gases and low leakage technologies. However,

¹ See [Kigali Fact Sheet 14](#) for a glossary of all acronyms used

² GWP = global warming potential. GWPs used in the Kigali Fact Sheets are from the amended Montreal Protocol text, Annexes A, C and F, which are based on the 2007 UNFCCC 4th Assessment Report and are 100-year values

³ ODP = ozone depletion potential

it does not require any specific technical solutions and it does not prevent use of some higher GWP gases where there is no cost-effective alternative.

See [Kigali Fact Sheet 3](#) for further details about GWP, tonnes CO₂ equivalent and the basket approach.

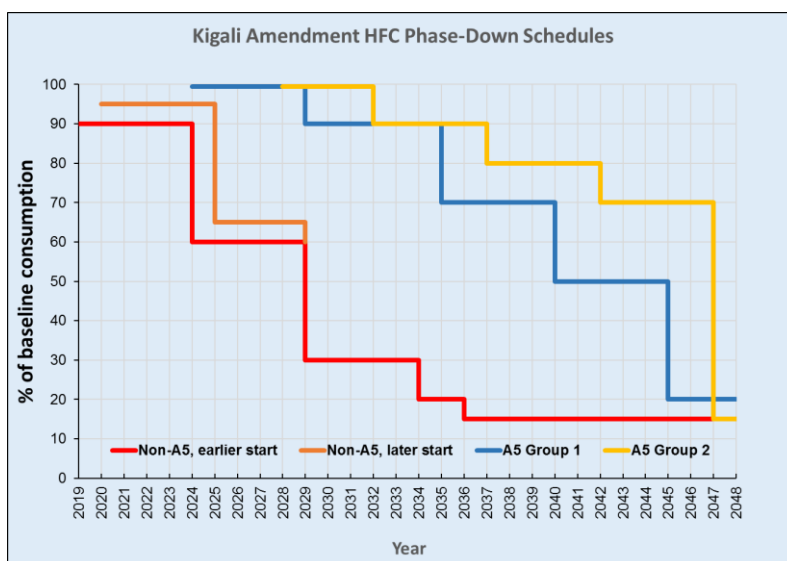
Are low GWP alternatives commercially available?

In some market sectors low GWP alternatives are already in widespread use. For example, there are hundreds of millions of domestic refrigerators using a hydrocarbon refrigerant. The car air-conditioning market recently began a major transition away from HFCs – by the end of 2017 more than 10 million cars will be using a low GWP alternative. Several markets are more challenging and some residual use of high GWP HFCs may be required – which is why the Kigali Amendment is for a phase-down not a phase-out and enables a flexible approach to be adopted by different groups of countries.

See [Kigali Fact Sheet 4](#) for further details about low GWP alternatives.

What is the timetable for HFC phase-down?

Under the Kigali Amendment, the phase-down timetable varies between 4 different country groups. Most non-Article 5 (developed) countries begin their phase-down by 2019 and must achieve an 85% cut from their baseline, by 2036. Article 5 countries are split into 2 groups and will follow a slower timetable starting with a freeze in either 2024 or 2028. The final phase-down steps in A5 countries are in 2045 or 2047. See [Kigali Fact Sheet 5](#) for details about the phase-down timetable and baseline consumption.



What should Parties do next?

All Parties need to be taking active steps to implement the Kigali Amendment and to start planning the reduction of their consumption of HFCs. The actions required by individual countries fall into a number of different areas. These include:

- Development of a national strategy to achieve the phase-down targets in the most practical and cost-effective way (e.g. which market sectors should take early action and which may need to wait for further technology developments). See [Kigali Fact Sheet 6](#).
- Preparation and implementation of relevant legislation (e.g. to ratify the Kigali Amendment and to set up legislation to control HFC use). See [Kigali Fact Sheet 7](#).
- Set up of appropriate national-level administration systems (e.g. to monitor and report HFC consumption and to licence the production or import of HFCs). See [Kigali Fact Sheet 7](#).
- Engagement with relevant stakeholders to help develop and implement the national HFC phase-down strategy. See [Kigali Fact Sheet 8](#).

Some technical issues: The switch to low GWP alternatives presents technical challenges in some HFC applications. It is important to be aware of these challenges and the work that is taking place at an international level to overcome them. Two critical issues are:

- **Operation of RACHP equipment at high ambient temperature (HAT).** Some countries have extreme ambient temperature levels that create technical difficulties related to the design and operation of RACHP systems. These are discussed in [Kigali Fact Sheet 9](#).
- **Use of flammable alternatives.** Some of the low GWP alternatives are flammable (and are replacing high GWP HFCs that are non-flammable). This creates several technical and regulatory issues which are explained in [Kigali Fact Sheet 10](#).



Barriers to HFC phase-down: There are various barriers that make the phase-down of HFCs more difficult. It is important to be aware of the key barriers during the development of a Kigali Amendment implementation plan. Barriers are discussed in [Kigali Fact Sheet 11](#); they include:

- Lack of availability of low GWP fluids and technologies
- Lack of technician skills / training
- Inadequate safety codes and standards

Interaction with other policy measures: The Kigali Amendment should not be treated in isolation. It creates important interactions with other policy measures. These interactions are described in [Kigali Fact Sheet 12](#) and include:

- Links between existing plans to phase-out HCFCs and the new plans to avoid high GWP HFCs. These objectives could be in conflict and should be considered as a package of measures. There could be significant financial and environmental advantage to “leap-frog” from HCFCs to low GWP alternatives, avoiding the use of high GWP fluids altogether.
- Links between the HFC phase-down plan and the wider national climate change policy. There are good opportunities to network with other climate change policy makers and to maximise the HFC emission reductions included in the Intended Nationally Determined Contribution.
- Recognising the energy related emissions from equipment affected by the Kigali Amendment. In particular, it is important that any switch to a low GWP alternative refrigerant does not prejudice efforts to improve energy efficiency of refrigeration and air-conditioning equipment.

Benefits of Rapid Action: The phase-down of HFCs will provide significant environmental benefits and it will stimulate a lot of innovation and design improvements. [Kigali Fact Sheet 13](#) summarises the key benefits of the Kigali Amendment and shows why it is of advantage to avoid the high GWP HFCs currently used in non-A5 countries by starting the phase-down early.



Index of OzonAction Kigali Fact Sheets

OzonAction has prepared a set of Fact Sheets about the Kigali Amendment to the Montreal Protocol. They are aimed at policy makers and industry stakeholders and are intended to help support the successful implementation of a global phase-down of HFC production and consumption.

The Fact Sheets will be regularly updated and are available for viewing and download on the OzonAction website:

www.unep.org/ozonaction

In addition to the Fact Sheets listed below, this website also provides links to other useful resource materials related to the implementation of the Kigali Amendment.

| Kigali Fact Sheet | Title |
|-------------------|--|
| 1 | Introduction to the Kigali Amendment |
| 2 | Current Use of HCFCs and HFCs |
| 3 | GWP, CO ₂ (e) and the Basket of HFCs |
| 4 | Low GWP Fluids and Technologies |
| 5 | HFC Baselines and Phase-down Timetable |
| 6 | Next Steps: HFC Phase-Down Strategy |
| 7 | Next Steps: Legislation and Administration Systems |
| 8 | Next Steps: Stakeholder Engagement |
| 9 | Technical Issues: High Ambient Temperature |
| 10 | Technical Issues: Flammability |
| 11 | Barriers to Successful Implementation |
| 12 | Interactions with Other Policy Measures |
| 13 | Benefits of Rapid Action |
| 14 | Glossary of terms and further sources / references |

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