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**REPORT FROM THE COMMISSION**

**On the application, effects and adequacy of the Regulation on certain fluorinated  
greenhouse gases (Regulation (EC) No 842/2006)**

## 1. INTRODUCTION

This report reviews Regulation (EC) No 842/2006<sup>1</sup> on certain fluorinated greenhouse gases (referred to here as ‘the Regulation’), and thus complies with the Commission’s reporting obligations in Article 10 of the Regulation. It evaluates the application and effects of the current rules and assesses the need for further action to reduce emissions of fluorinated gases in the EU. The evaluation draws upon analytical work undertaken for the Commission<sup>2</sup>.

The Regulation addresses emissions of hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride, collectively known as fluorinated greenhouse gases (‘F-gases’). These gases are man-made chemicals used for instance as refrigerants, foam-blowing agents, aerosol propellants and insulation gases in electrical equipment. Globally, the use of fluorinated gases is growing rapidly due to the increased use of products and equipment relying upon them.

The overall objective of the Regulation is, together with Directive 2006/EC/40 on emissions from air-conditioning systems in motor vehicles (‘the MAC Directive’)<sup>3</sup>, to help fulfil the commitments of the European Union and its Member States under the Kyoto Protocol to the United Nations Framework Convention on Climate Change<sup>4</sup>, for the period 2008 to 2012. The legislation was expected to break the growing trend in the EU and maintain F-gas emissions in EU-15 at 75 million tonnes of CO<sub>2</sub> eq.<sup>5</sup> in 2010, well below the expected level of 98 million tonnes of CO<sub>2</sub> eq. if left unrestricted<sup>6</sup>.

The EU regulatory framework for F-gases covers the key applications in which F-gases are used and follows two lines of action: first, avoiding F-gases where environmentally superior alternatives were already available at sufficiently low cost at the time of adoption, by restricting the use and marketing of specific applications of F-gases; second, reducing their leakage from equipment where F-gases could not be replaced by viable alternatives. This is achieved through a series of measures targeting the proper handling of equipment throughout its lifetime. In addition, reporting provisions were introduced to facilitate monitoring.

The Regulation entered into force on 4 July 2006 and its provisions applied with effect from 4 July 2007<sup>7</sup>. While the Regulation is directly applicable in all Member States, its full application also relied upon 10 implementing Commission Regulations adopted in the period December 2007 — April 2008 and upon the later adoption of certain complementary elements by Member States.

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<sup>1</sup> OJ L 161, 14.6.2006, p. 1–11.

<sup>2</sup> Schwarz, W. et al. (2011) Final Report: Service contract to provide technical support for conducting a review of Regulation (EC) No 842/2008 on certain fluorinated greenhouse gases.

<sup>3</sup> OJ L 161, 14.6.2006, p. 12–18.

<sup>4</sup> Approved by Council Decision 2002/358/EC OJ L 130, 15.5.2002, p. 1–3.

<sup>5</sup> Carbon dioxide equivalent is a measure comparing emissions from various greenhouse gases based on their global warming potential.

<sup>6</sup> COM(2003) 492 final of 11.8.2003. This Commission proposal was the basis of both the Regulation and the MAC Directive.

<sup>7</sup> Article 9 and Annex II introduce prohibitions on the placing on the market of certain products and equipment containing, or whose functioning relies upon, F-Gases. Exceptionally they applied with effect from 4 July 2006 although individual prohibitions became gradually applicable between 4 July 2006 (footwear) and 4 July 2009 (novelty aerosols).

## **2. EXPERIENCE AFTER 4 YEARS**

### **2.1. Successful application of use and marketing restrictions (Articles 8 and 9)**

Individual use and marketing restrictions became gradually applicable between 4 July 2006 (footwear) and 4 July 2009 (novelty aerosols). They have been applied successfully with a few exceptions.

In particular, the exemption of imported non-refillable containers of F-gases manufactured before 4 July 2007<sup>8</sup> from the general prohibition of placing on the EU market has been reported to have been misused. Competent authorities in the Member States have reported difficulties in properly enforcing this prohibition due to the lack of sufficient tools and expertise to verify the authenticity of the certificates, labels and other documents submitted by importers.

### **2.2. Satisfactory application of labelling provisions (Article 7)**

Labelling provisions facilitate responsible installation, maintenance and disposal of products and equipment containing F-gases. The provisions apply to approximately 50 000 contractors in the refrigeration, air conditioning and heat pump sectors and original equipment manufacturers, 100 suppliers of gas containers including for fire protection systems and about 25 manufacturers of high-voltage switchgear equipment.

The industry has primarily encouraged label harmonisation on a voluntary basis, especially for products and equipment marketed across the EU, and included the relevant information on other labels. Some producers chose to include all official languages on labels, which represented a practical challenge for smaller equipment such as heat pump tumble dryers. A few cases have been identified of non-compliant products and equipment imported into the EU. The Commission is currently considering the incorporation of labelling rules into the Integrated Tariff of the European Communities, to support the Member States in enforcing these provisions<sup>9</sup>.

### **2.3. Delays regarding training and certification (Article 5)**

The deadline for the Member States to set up and notify their training and certification systems on the basis of the Commission's minimum requirements was 4 January 2009. On 4 July 2011, 8 Member States had yet to notify all or part of their training and certification arrangements to the Commission.

This difference in the speed of implementation reflects differences in the Member States' vocational training and certification systems before the Regulation applied. Moreover, Member States attribute delays to the size of certain sectors and to underestimation of the administrative effort required to create new systems and adapt existing ones.

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<sup>8</sup> Article 9(2) excludes products and equipment listed in Annex II shown to be manufactured before the date of entry into force of the relevant prohibition from marketing prohibitions.

<sup>9</sup> Established under Council Regulation (EC) No 2658/87 of 23 July 1987 on the tariff and statistical nomenclature and on the Common Customs Tariff, OJ L 256, 7.9.1987, p. 1–675, as amended.

The Commission has convened meetings with Member States on a regular basis to facilitate information exchange and, where appropriate, has launched infringement proceedings to address delays.

The training and certification requirements currently apply to approximately 600 000 persons and 66 000 companies, more than 98 % of which are in the refrigeration, air conditioning and heat pump sectors.

Our analysis shows that quite a significant number of personnel and companies covered by these requirements were not certified by 4 July 2011. For personnel dealing with F-gases in the areas of fire protection, stationary refrigeration, air conditioning, heat pumps and air-conditioning of motor vehicles, more than 50 % were not yet certified. Certification was also pending for 90 % of companies in the fire protection sector and more than 50 % of companies in the stationary refrigeration, air conditioning and heat pumps sectors<sup>10</sup>.

#### **2.4. Varying levels of compliance with containment measures (Article 3)**

A low degree of overall compliance was observed, particularly in Member States where no similar containment requirements applied prior to the Regulation. In those countries there is still low awareness among operators, in particular of smaller equipment, due to deficiencies in enforcement of these provisions.

Analysis has shown that, in the key applications of stationary refrigeration, air conditioning and heat pumps, compliance with the schedules for leakage checks was particularly low among operators of domestic and small commercial equipment. Maintaining of records for these key applications is reportedly below 50 %. Compliance with the obligation to install leakage detection systems seemed satisfactory only in specific fields where the installation of such systems was already standard practice prior to the Regulation. In the fire protection sector, where voluntary technical standards with similar requirements were already widespread, containment provisions are applied to a higher extent.

#### **2.5. Growing potential for recovery of F-gases (Article 4)**

Recovery should take place before final disposal of equipment and, if appropriate, during servicing and maintenance.

In the refrigeration and air conditioning sectors, recovery levels were generally low prior to the Regulation. Some data indicate a slight growth in the quantities recovered, but no systematic data are available to allow more precise assessment. Recovery in the fire protection and high-voltage switchgear sectors is currently a commonly applied practice during servicing and maintenance. In these sectors the potential for recovery from systems containing F-gases will grow in the coming years, as such systems will be reaching their end of life.

Recovered gases need to be recycled, reclaimed or destroyed. In 2010, reclamation and destruction infrastructure was available for hydrofluorocarbons in only about half the Member States and for sulphur hexafluoride in only a couple of Member States. Cross-border shipment of recovered F-gases for reclamation and destruction within the EU is therefore of key

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<sup>10</sup> All personnel and companies in the stationary refrigeration, air conditioning and heat pumps sectors should have been fully certified, at the latest, by 4 July 2011.

importance and should be facilitated by Member States<sup>11</sup>, as stated in recital 9 of the Regulation.

## **2.6. Reporting requirements generally met (Article 6)**

Annual reporting started in 2008, for the calendar year 2007. The reporting provision is overall well applied. Analysis shows that the requirements currently apply to approximately 100 EU companies and a relatively small group of large companies reports a large part of the quantities of production, imports and exports. The quantities potentially excluded from the reporting provisions, due to the one-tonne threshold, are not significant.

Quantities of F-gases contained in imported or exported pre-charged products or equipment are outside the scope of reporting. It is estimated that in 2008, approximately 10% of F-gases imported to the EU were contained in pre-charged room air conditioning and air-conditioning systems of motor vehicles. In the same year approximately 30% of gases exported from the EU were contained in one-component-foam, switchgear, medical aerosols and air-conditioning systems in motor vehicles. This gap in the reporting provisions distorts figures on the total quantities of imports and exports and the composition and intended applications of F-gases available in (and potentially emitted from) the EU.

It is also noted that the requirement to report quantities of F-gases reclaimed or destroyed provides only partial monitoring of the quantities reclaimed and destroyed. This is because these activities are undertaken, to a great extent, by entities which are not producing, importing or exporting F-gases and are therefore not subject to reporting requirements under the Regulation.

For monitoring related to the Kyoto Protocol<sup>12</sup> Member States have been determining and subsequently reporting their annual emissions of F-gases, in accordance with the revised 1996 Intergovernmental Panel on Climate Change guidelines for national greenhouse gas inventories<sup>13</sup>. Existing reporting systems fulfilling these requirements have, largely, been deemed to meet the Regulation's requirement to establish reporting systems for the relevant sectors, to obtain emission data.

## **2.7. National penalties to be adopted in a few Member States (Article 13)**

Member States were required to establish national rules on penalties applicable to infringements and inform the Commission by 4 July 2008. Three years after this deadline, four Member States had yet to notify their rules on penalties to the Commission. Where appropriate, the Commission has launched infringement proceedings to address these delays.

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<sup>11</sup> Regulation (EC) No 1013/2006 on shipments of waste, OJ L 190, 12.7.2006, p. 1–98.

<sup>12</sup> Decision No 280/2004/EC of 11 February 2004 concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, OJ L 49, 19.2.2004, p. 1–8. .

<sup>13</sup> Commission Decision No 2005/166/EC of 10 February 2005 laying down rules implementing Decision No 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions and for implementing the Kyoto Protocol, OJ L 55, 1.3.2005, p. 57–91.

## **2.8. Stricter national provisions in several Member States (Articles 9(3) and 14)**

Under Council Decision 2002/358/EC<sup>14</sup>, individual Member States were committed to different greenhouse gas reduction targets. In view of this, the Regulation allowed Member States which already had stricter national marketing restrictions, to maintain them until 31 December 2012, provided that these measures were compatible with the Treaty and were notified to the Commission. On this basis, the Commission authorised Denmark and Austria to maintain more stringent provisions until 31 December 2012<sup>15</sup>.

In addition, several Member States have national provisions which, in terms of either ambition or scope, go beyond the Regulation's respective requirements. Such measures include the extension of containment provisions to stationary equipment containing lower quantities of F-gases and/or to certain additional equipment, additional measures for records maintained by operators, the establishment of maximum allowable leakage rates for stationary equipment, the extension of certification requirements to other personnel, the mandatory registration of equipment and schemes requiring producers and suppliers to take back recovered F-gases for recycling, reclamation and destruction.

## **3. MEASURING THE EFFECTIVENESS AND EFFICIENCY OF THE REGULATION**

The use and marketing restrictions introduced by the Regulation have, by the end of 2010, already achieved a verifiable reduction of emissions of F-gases close to 3 million tonnes of CO<sub>2</sub> eq. compared to a scenario without the Regulation. But the potential for emission reductions in the applications covered by those restrictions is almost exhausted. Projected reductions of F-gases are only expected to grow slightly above 3 million tonnes of CO<sub>2</sub> eq. by 2020 and above 4 million tonnes of CO<sub>2</sub> eq. by 2050.

For the containment and recovery provisions, the analysis concludes that there is still a lack of reliable and sufficiently long time-data series, and it is therefore too early to quantify their present effectiveness. However, given the nature of those measures, the short period of their application and the current shortcomings of compliance with some of the relevant provisions in key areas, a significant effect on the leakage rates of affected equipment prior to 2010 seems unlikely.

Nonetheless, if fully applied in the short term, the containment and recovery provisions can be expected to achieve a substantial reduction of leakage rates during the operation and end-of-life of affected equipment by 2015. They have the potential to reduce projected emissions by more than 29 million tonnes of CO<sub>2</sub> eq. by 2020 and eventually by more than 38 million tonnes of CO<sub>2</sub> eq. by 2050.

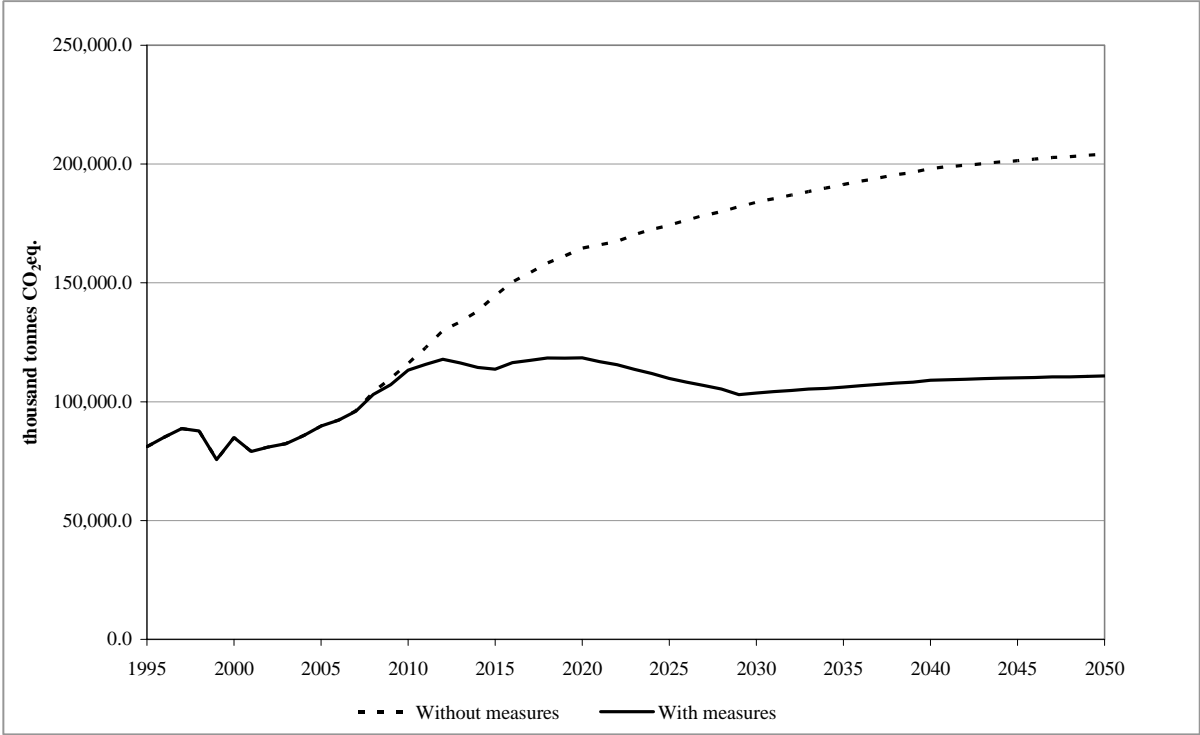
The MAC Directive introduced restrictions on the use of F-gases with a Global Warming Potential (GWP) above 150 in air conditioning systems of motor vehicles, and is expected to achieve substantial reductions of projected emissions of around 13 million tonnes of CO<sub>2</sub> eq. by 2020 and almost 50 million tonnes of CO<sub>2</sub> eq. by 2050.

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<sup>14</sup> OJ L 130, 15.5.2002, p. 1–3. .

<sup>15</sup> Commission Decision 2007/62/EC of 8 December 2006 concerning national provisions notified by Denmark on certain industrial greenhouse gases, OJ L 32, 6.2.2007, p. 130–134 and Commission Decision 2008/80/EC of 21 December 2007 concerning national provisions notified by the Republic of Austria on certain fluorinated greenhouse gases, OJ L 24, 29.1.2008, p. 45–50.

Taking into account the effects of the Regulation and the MAC Directive, the total emissions are expected to stabilise around today's level of 110 million tonnes of CO<sub>2</sub> eq. in EU-27 despite the growing use of many of their key applications, see Figure 1.



**Figure 1: Projections of F-gas emissions in the EU without and with the measures in the F-gas Regulation and the MAC Directive**

The relative emission reduction is estimated to be less than 3 % in 2010. However, projections show that yearly emissions will be reduced by 28 % in 2020, by 44 % in 2030 and by 46 % in 2050. The costs related to the Regulation are estimated to be around 41 € per tonne per CO<sub>2</sub> eq. reduced.

Overall, four years after its entry into application, the Regulation has already contributed to the commitments under the Kyoto Protocol for the period 2008 to 2012. The Regulation, if properly applied in the short-term, has the potential together with the MAC Directive, to avoid almost half of projected emissions, stabilising emissions at today's levels. However, to reach this potential, the Commission calls on Member States to intensify their efforts towards rapid and proper implementation and enforcement.

**4. ASSESSMENT OF THE NEED AND SCOPE FOR FURTHER EMISSION REDUCTIONS**

**4.1. Cost-efficient contribution from F-gases to emission reduction target**

The European Council reconfirmed in February 2011 the objective of reducing greenhouse gas emissions by 80–95 % by 2050 compared to 1990. A cost-effective pathway to these targets would require reductions of non-CO<sub>2</sub> emissions outside agriculture, between 72–73 %

by 2030 and by 70–78 % by 2050 compared to 1990 levels<sup>16</sup>. At international level, as a result of the accelerated phase-out of ozone-depleting substances under the Montreal Protocol, the use of the most common group of F-gases, hydrofluorocarbons, is set to quadruple in the next two decades, hampering efforts to limit global warming to below 2 °C above pre-industrial levels. To address this risk the EU supports global action under the Montreal Protocol on Substances that Deplete the Ozone Layer to phase down hydrofluorocarbons as a complement to mitigation action under the United Nations Framework Convention on Climate Change<sup>17</sup>.

#### 4.2. Technologies in evolution: the current state

In 2006, the Council and the European Parliament acknowledged that development of alternatives to F-gases was ongoing<sup>18</sup> and anticipated that the application and enforcement of the Regulation would spur technological innovation by encouraging continued development of alternative technologies and transition to existing technologies that are more environmentally friendly<sup>19</sup>.

Alternative technologies based on low-GWP fluids or other non-in-kind technologies are today technically feasible in most relevant fields of application. In energy-consuming applications such as refrigeration, air conditioning and heat pumps and in energy-preserving applications such as building and appliance insulation foams, low-GWP technologies can potentially achieve an equivalent performance in most cases. With ongoing research and development constantly improving their safety and performance characteristics and further reducing their cost, such options have the potential to gradually replace technologies based on F-gases with high GWP, thereby contributing to a cost-effective transition to a climate-friendly, low-carbon economy, see Box 1.

#### Box 1: Technology developments in relevant sectors

The chemical industry has developed new fluorocarbons which are considered as potential substitutes to high-GWP F-gases in several sectors, including stationary and mobile refrigeration and air conditioning, heat pumps, foams and aerosols.

In the refrigeration, air conditioning and heat pumps sectors, several low-GWP technologies such as those based on existing fluids (carbon dioxide, ammonia and hydrocarbons) have benefited from improvements to their safety, performance characteristics and cost, through innovative optimisations, although in some applications or under specific circumstances these aspects remain an ongoing challenge. These have recently been gaining market shares, in particular in the EU, in many applications including domestic, commercial and industrial refrigeration, some types of heat pumps and single package air conditioning units.

For several foam products used for insulation in construction and appliances, hydrocarbons are now default options. For many of the foam products used in the

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<sup>16</sup> Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Region: A roadmap for moving to a competitive low carbon economy in 2050. COM(2011) 112 final.

<sup>17</sup> Council Conclusions from 14 October 2010 on Preparation for the 16th Conference of the Parties to the UN Framework Convention on Climate Change Cancún, 29 November to 10 December 2010.

<sup>18</sup> Recital 7, Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases.

<sup>19</sup> Recital 8, Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases.



construction, refrigeration, automotive and furniture sectors, in which F-gases are the most common blowing agents at present, specific technologies based on carbon dioxide, hydrocarbons, unsaturated hydrofluorocarbons and water can, in most cases, be viable and cost-effective options in the future.

Furthermore, available low-GWP fluids could enable a gradual cost-effective substitution of F-gases in other areas of application too, including fire protection, some aerosols, magnesium die-casting and recycling of magnesium alloys.

Mere stabilisation of F-gas emissions at today's levels, as a best case scenario, is not compatible with the EU emissions reduction targets. Emerging opportunities from available and emerging technology in the relevant sectors offer significant scope for additional cost-effective reductions of F-gas emissions in the EU and at international level. That is why policy options to achieve further reductions in the EU must be considered in view of potential impacts, including on energy consumption, administrative burden and safety.

## **5. POTENTIAL OPTIONS TO FURTHER REDUCE F-GAS EMISSIONS**

### **5.1. Driving transition to technologies with lower global warming potential**

Analysis shows that avoiding the use of F-gases where feasible and cost-effective has the highest potential to reduce emissions. Technically it would be possible to avoid up to approximately 70 million tonnes of CO<sub>2</sub> eq. of the projected F-gas emissions in 2030, at an average cost of less than 20 €/per tonne of CO<sub>2</sub> eq. abated.

Options that could contribute to this transition include:

- the introduction of maximum, gradually declining, limits for the quantity of F-gases placed on the EU market (phase down) expressed in terms of CO<sub>2</sub> equivalent;
- use and marketing prohibitions for new equipment and products (bans);
- voluntary environmental agreements at Community level.

### **5.2. Improving containment and recovery provisions**

Even if policies are put in place to gradually avoid the use of highly potent F-gases, it remains of utmost importance to avoid leaks and ensure proper recovery of high-GWP F-gases from equipment still using them. The Regulation already has substantial containment and recovery provisions covering almost all key applications with the capacity to substantially reduce leakage of F-gases and various stakeholders have made significant investments to comply with those provisions. It is therefore crucial that the existing provisions are properly implemented and enforced by Member States.

A number of potential options have been identified to further improve these provisions, including options suggested by Article 10 of the Regulation: including additional equipment, such as air-conditioning and refrigeration systems in transport vehicles, in the scope of particular containment and recovery provisions; extending training and certification

requirements; extending certain containment provisions to smaller equipment; establishing maximum leakage rates for installations; developing EU standards and notes describing best available techniques and best environmental practices for preventing and minimising emissions of fluorinated greenhouse gases.

Analysis indicates that the scope for further improving these provisions cost-effectively is rather limited. However particular options, such as extending existing containment and recovery provisions to refrigeration systems in certain categories of road vehicles such as trucks and trailers and labelling provisions to new products and equipment merit further consideration and assessment.

### **5.3. Taking account of the latest scientific information**

The Regulation currently relates to the three groups of F-gases covered by the Kyoto Protocol. Annex I, Part 1 of the Regulation lists 17 types of hydrofluorocarbons, 7 types of perfluorocarbons and sulphur hexafluoride, which are included in its scope together with their preparations with a total GWP of 150 or more.

The fourth assessment report by the Intergovernmental Panel on Climate Change (IPCC) identifies two additional types of hydrofluorocarbons<sup>20</sup> and two additional types of perfluorocarbons<sup>21</sup>. The same report identifies, for the first time, nitrogen trifluoride<sup>22</sup>, a substance which is increasingly used in the electronics industry for plasma etching and chamber cleaning processes as a substitute for perfluorocarbons and sulphur hexafluoride.

Consideration could be given to adding these gases to Annex I.

Furthermore, it should be considered to update the GWP values listed in Annex I based on the fourth assessment report from the IPCC. The GWP values currently in Annex I are from the third assessment report of the IPCC.

### **5.4. Improving monitoring by enhancing reporting provisions**

Consideration should be given to the costs and benefits of a potential extension of the reporting provisions to F-gases contained in pre-charged products and equipment imported into / exported from the EU, and to entities reclaiming or destroying F-gases in the EU to improve monitoring.

Consideration should also be given to ways of enhancing the quality of Member State reporting systems for emission data, by utilising information recorded and maintained by operators, pursuant to the Regulation. The analysis shows that the quantities potentially excluded from reporting provisions owing to one-tonne limit are not significant, so a modification of this threshold value is not considered necessary.

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<sup>20</sup> HFC-152 and HFC-161 with a 100-year Global Warming Potential of 53 and 12 respectively.

<sup>21</sup> PFC 9-1-18 and perfluorocyclopropane with a 100-year Global Warming Potential greater than 7500 and greater than 17340 respectively.

<sup>22</sup> NF<sub>3</sub> with a 100-year Global Warming Potential of 17200.

## 6. CONCLUSIONS AND NEXT STEPS

The provisions in the Regulation became operational at different stages between 2006 and 2011. The analysis has identified some shortcomings in the current application of some of its key provisions, in particular training and certification, containment, and recovery provisions.

Given the short time period in which the Regulation has been operational, any present effect of the Regulation's containment and recovery provisions cannot yet be quantified. Nonetheless, the Regulation, through its use and marketing restrictions, has already helped the EU and its Member States to be on track with their commitments under the Kyoto Protocol to the United Nations Framework Convention on Climate Change, for the period 2008 to 2012.

If all its current provisions are fully applied in all Member States, the Regulation together with the MAC Directive, would make it possible to avoid almost half of projected emissions by 2050, stabilising EU-27 emissions at today's levels of 110 million tonnes of CO<sub>2</sub> eq.. Consequently, it is critical that Member States rapidly intensify their efforts to implement and enforce the Regulation properly. The Commission is willing to continue to support, organise and facilitate measures aiming at better application of the legislation. The Commission will also start infringement proceedings where appropriate.

However, in the context of the overall EU objective to cut emissions by 80–95 % by 2050, the stabilisation of F-gas emissions at today's levels is not adequate and the analysis shows that already available or emerging low-GWP technologies are technically feasible and can be cost-effective in many application areas. With ongoing research constantly improving their safety and performance characteristics, such options have the potential to gradually replace technology based on F-gases with high-GWP, thereby aiding the transition to a climate-friendly, low carbon economy.

Consequently, the EU must take further action to achieve further cost-effective reductions of greenhouse gas emissions. The EU already supports global action to reduce F-gas emissions under the Montreal Protocol and this report identifies options for additional cost-effective reductions of F-gases in the EU. The Commission will consult stakeholders on these options and will assess their potential economic, social and environmental impacts. On this basis the Commission will, if appropriate, present a legislative proposal for revising this Regulation.

## Annex: Acronyms

F-gases	Fluorinated greenhouse gases
MAC Directive	Directive 2006/EC/40 relating to emissions from air-conditioning systems in motor vehicles
CO <sub>2</sub> eq.	Carbon dioxide equivalent
GWP	Global Warming Potential
HFC	Hydrofluorocarbons
PFC	Perfluorocarbons
SF <sub>6</sub>	Sulphur hexafluoride
NF <sub>3</sub>	Nitrogen trifluoride