END IN SIGHT

PHASING OUT FLUORINATED GREENHOUSE GASES IN EUROPE

EIA Position Paper on HFCs in the Review of the EU F-Gas Regulation

environmental investigation agency

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Five years after the introduction of the European Union's (EU) Regulation No 842/2006 on certain fluorinated greenhouse gases ('the F-Gas Regulation'), analysis of the policy and its implementation shows that it has failed to deliver significant or adequate reductions in emissions of hydrofluorocarbons (HFCs), and that it will continue to fail unless it is comprehensively revised.

EXECUTIVE SUMMARY

- The current F-Gas Regulation has failed to reduce HFC emissions. Instead of declining they have increased by 20% since it was introduced.
- Even if the current containment and recovery measures are fully implemented, the best-case scenario is a stabilisation of HFC emissions at unacceptably high levels until 2050 and beyond.
- Containment and recovery are expensive, costing around €40 per tonne CO_2-equivalent.
- Climate-friendly, commercially and technologically viable alternatives to HFCs are available in all major sectors.
- Banning the use of HFCs is the most cost-effective method of eliminating HFC emissions, costing less than €20 per tonne of CO_2-equivalent reduction.
- An HFC phase-out by 2020 is practical and achievable, with minor derogations for some essential uses where no alternatives are available.
- EIA is calling for an EU-wide phase-out of HFCs by 2020 through a combination of use-bans and placing market restrictions on new equipment.

The F-Gas Regulation relies predominantly on containment and recovery measures to prevent HFC emissions. This has proven to be a fundamental mistake, whose origins trace back to a powerful industry lobby. Experience shows that containment and recovery measures are both ineffective and expensive. In the best case scenario of full implementation of the Regulation, they will only stabilize emissions at around today's level of 110 million tonnes of carbon dioxide (CO_2) equivalent (110 MT CO_2-eq.).[1] In fact, when compared with HFC emissions at the time of its adoption, the F-Gas Regulation actually legislates a 20% increase in HFC emissions by 2050. This is the same timeframe in which the EU has committed to achieve overall greenhouse gas (GHG) emission reductions of 80-95%, meaning HFC emissions would represent as much as 40% of total EU GHG emissions in 2050.[2] It is now clear that the F-Gas Regulation, in its current form, lacks the requisite ambition for the EU to achieve its goal of being a competitive, low carbon economy by 2050. Disturbingly, the F-Gas Regulation has proven to be more than twice as expensive as predicted, with an actual cost-effectiveness around €40/tonne CO_2.[3] These costs, borne by consumers and Member States, not HFC producers, are expected to rise in the future.[4] Fortunately, given the huge flaws in the current framework, a number of recent studies show that the European Union is now in a position to transition away from HFC technologies by 2020 through common-sense measures, setting itself on a low carbon trajectory.

BACKGROUND ON FLUORINATED GASES

Fluorinated gases (F-gases) are used in a wide array of applications, including refrigeration and air-conditioning, foams and fire protection systems in Europe and beyond. As powerful greenhouse gases (GHGs) their use in the European Union is controlled under the F-Gas Regulation, which governs how F-gases must be used and handled. Adopted in 2006, the F-Gas Regulation covers most uses of F-gases with the notable exception of mobile air-conditioning (MAC) in vehicles, which is covered by the MAC Directive.[5]

While there are many kinds of F-gases, the most important ones from a climate perspective are HFCs. HFCs were developed to replace ozone-destroying chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs). Although they do not damage the ozone layer, HFCs have high global warming potentials (GWP) – hundreds to thousands of times higher than carbon dioxide (CO_2) – and thus contribute significantly to climate change. In 2008, global HFC emissions were around 500MT CO_2-eq., approximately one percent of global GHG emissions.[6] This proportion is set to grow rapidly in the future, as HFCs become more widely used in developing countries and demand for air-conditioning and refrigeration soars. By some estimates they could account for 9%-19% of global GHG emissions by 2050 if left unchecked.[7]

HFCs have large climate impacts because they are much more powerful GHGs than CO_2. The most widely used HFCs in the European Union include HFC-134a (GWP 1,430) and the blends R404A (GWP 3,922) and R410A (GWP 2,088). Another common F-gas, HFC-23, which is a by-product of the manufacture of the ozone depleting chemical HCFC-22, has a 100-year GWP nearly 15,000 times that of CO_2.[8]

"Banning the use of HFCs is the most cost-effective method of eliminating HFC emissions"

CONTAINMENT VERSUS BANS

In September 2011, the European Commission released a report analysing the implementation of the F-gas Regulation, based on a multi-year, comprehensive study led by Öko-Recherche and prepared in association with industry, users and other stakeholders.[9] The study shows that the Regulation, which relies predominantly on measures to contain and recover HFCs, has been costly and difficult to implement.

The containment and recovery measures which underpin the F-Gas Regulation were subject to a great deal of controversy throughout the entire process leading up to its adoption in 2006. This was, in part, because they transferred primary responsibility for controlling HFC emissions from producers – largely US and Japanese multinationals – to Member States and end users in contravention of the polluter-pays principle.[10] It was a textbook case of regulatory capture by corporate interests, bearing all the hallmarks of an intense lobbying campaign carried out by the fluorochemical industry in the early 2000s.[11] Many voices, including green groups and MEPs, called for HFC restrictions through an approach based on bans on HFC use and prohibitions on certain HFC technologies as the optimal solution from an environmental point of view.[12] However, big players in the fluorochemical industry secured a retreat on the grounds that '*containment measures work*' and other approaches would be '*technologically prescriptive*.'[13] The F-Gas Regulation in general, and the containment and recovery measures in particular, were concessions to a powerful industry lobby.

The notion that containment and recovery works can be traced back to the Dutch STEK system.[14] The STEK system was touted by the fluorochemcial industry as the best way to reduce F-gas emissions, and it served as a model for the F-Gas Regulation.[15] It subsequently emerged, however, that the STEK system was less effective than advertised, and there were serious questions regarding its suitability in other Member States with unique circumstances.[16] As one observer noted, alluding to the Netherlands' historically progressive stance on environmental policy, "*[i]f the Netherlands cannot effectively contain F-gases with such a system then it is unlikely that any EU Member State can*."[17] The evidence now confirms that containment and recovery measures suffer from intractable implementation problems. Indeed, after a comprehensive review, "*only little evidence [on effectiveness of the containment and recovery measures] has been found so far.*"[18] Additionally, an extraordinary lack of implementation was observed.[19]

Containment and recovery measures have also proven very expensive. The Öko-Recherche study estimates that one-off costs related to implementation and application of the F-Gas Regulation are around €617 million.[20] It further estimates that recurring annual costs are around €1 billion in 2015 increasing to €1.5 billion in 2030.[21] This equates to a cost-effectiveness of €40.8/t CO_2-eq. – more than double the estimate made in 2002.[22] Containment measures account for the majority of these costs, primarily in the refrigeration and air conditioning sectors.[23] By comparison, replacing HFC technologies in closed systems with low-GWP alternatives could avoid more than 60MT CO_2-eq. emissions per year by 2030 at abatement costs of under €20t/CO_2-eq.[24]

Despite its evident failings and given the increasing contribution of HFCs to national GHG emissions inventories, the F-Gas Regulation must play a critical role in meeting EU climate objectives. This requires not only improving and enforcing current measures – HFC technologies already on the market must be controlled better – but rectifying past shortcomings, namely by transitioning towards an HFC-free economy. The Öko-Recherche *et al.* study confirms that bans "*have been the most effective type of measure so far,*" resulting in "significant and measurable reductions of the use of F-gases and hence F-gas emissions."[25] Indeed, in contrast to ineffective and expensive containment and recovery measures, bans "*have been applied to a large extent with minor administrative costs since conversion of production in these sectors largely took place so far, without significant needs for enforcement and control by authorities*."[26] Although the Commission submits that there is "*still a lack of reliable and sufficiently long time-data series, and it is therefore too early to quantify [the] present effectiveness*" of containment and recovery measures,[27] it nevertheless acknowledges that even in the unlikely event of full implementation the "*[m]ere stabilization of F-gas emissions at today's levels… is not compatible with the EU emissions reductions targets.*"[28]

It is essential that the opportunity to enact ambitious prohibition measures is not missed again. Climate-friendly, energy efficient alternatives to HFCs are available in every sector. Not only do these offer the most significant GHG reductions, but they also come at mitigation costs which are less than half of those associated with containment and recovery measures under the F-Gas Regulation.[29]

EIA urges the European Commission to propose an EU-wide phase-out of HFCs by 2020, enacted through a series of prohibition measures including use bans and placing-on-the-market restrictions. An ambitious HFC phase-out is possible, and a swift transition to climate-friendly technologies is needed.

BELOW:
Residential air-conditioning in Europe predominantly uses HFC-410A with a GWP of 2,088.

THE EXISTING FRAMEWORK ON BANS

The F-Gas Regulation already contains the framework for tackling HFC emissions through use bans and placing-on-the-market prohibitions. Under Articles 8 and 9, it contains provisions controlling the use of F-gases (Article 8) and the placing on the market of F-gas-containing products and equipment (Article 9). Articles 8 and 9 serve distinct purposes; their application depends on whether the HFC technologies are used in open or closed systems, and whether the product or equipment is already on the market or not. This distinction is fundamental to the revision of the F-Gas Regulation.

Article 8 is appropriate for open systems that release HFCs during use. It currently bans use of sulphur hexafluoride (SF_6) in two discrete open-system sectors, namely magnesium die-casting and vehicle tyres. In those sectors, operators must use alternative gases. Other open-system sectors include foams and aerosols. Article 8 allows policymakers to prevent HFC use when there is no good reason to use it. The latest technical data indicates that HFC-free alternatives are now available in all open-system sectors, compelling serious revision to the limited scope of this article.

Article 9 is appropriate for closed systems *before* HFC technologies enter the marketplace. It bans certain HFC-containing products and equipment from being placed on the market, requiring HFC-free abatement options when safe, cost-effective, and energy-efficient alternatives exist. Article 9 allows policymakers to transition away from containment and recovery measures – with their high costs, implementation issues, and administrative burden – towards an HFC-free economy by preventing the introduction of HFC technologies in the first place. Article 9 currently only applies to a number of minor uses listed in Annex II.[30] The latest technical data indicates that HFC-free alternatives are now available in all closed-system sectors, compelling serious reconsideration of the limited scope of this article.

In addition, Article 8 is appropriate for closed systems *after* HFC technologies enter the marketplace. For example, the lifetime of some HFC technologies is several decades and consideration should be given to banning high-GWP HFCs from certain applications, either to promote natural refrigerants (preferably) or ensure the use of lower-GWP HFCs during refill. For example, lower-GWP alternatives are available as drop-in replacements for HFC-404a, which has a GWP of 3,922 and is widely used in applications with high leakage rates such as commercial refrigeration.
In effect, Article 8 can serve as an additional approach to reduce HFC emissions during the lifetime of HFC technologies, complementing containment and recovery measures. The overall objective, however, is to prohibit HFC technologies from being placed on the market from the outset through Article 9, and policymakers must ensure that Article 8 prohibitions on use do not displace Article 9 prohibitions on placing on the market.

ABOVE:
Industrial refrigeration using ammonia.

HFC-23

HFC-23 (GWP 14,800) is an unwanted by-product from the production of HCFC-22, itself a powerful GHG. While HCFC-22 production for emissive purposes has been phased out in the European Union, production continues to supply feedstock for polymer products such as Teflon.[50]

In the European Union there are currently five HCFC-22 manufacturing plants with HFC-23 by-product emissions.[51] HFC-23 destruction, an extremely low-cost process (€0.25/tCO_2-eq.), is not currently mandated by the F-Gas Regulation but four of the five plants claim to voluntarily destroy the gas.[52] Despite this, in August 2011, the Swiss Federal Laboratories for Materials Science and Technology (EMPA) published a study in *Geophysical Research Letters* demonstrating that Western European emissions of HFC-23 were as much as 140 per cent higher than the figures contained in national emissions reports.[53]

The HFC-23 venting scandal uncovered by EMPA demonstrates that European chemical manufacturers cannot be trusted to voluntarily abate their HFC-23 emissions, despite the extremely low costs involved. EIA therefore recommends that HFC-23 destruction is mandated in all European countries through amendment to the recovery measures contained in the F-gas Regulation (Article 4).

VIABLE ALTERNATIVES TO HFCs ARE AVAILABLE, AND NEW LEGISLATION WILL TRANSFORM THE MARKET

It is no longer a question of whether to include new sectors under Articles 8 and 9, but when. The Öko-Recherche *et al.* study has based its policy recommendations on the concept of penetration rates, assuming that placing on the market bans "*…cannot be established before the penetration mix of alternative technologies has reached 100% or, if less, if the difference from 100% can clearly be defined for exemptions.*"[31] Experience shows, however, that ambitious dates for market restrictions spur the necessary market transformation enabling a more rapid penetration of climate-friendly technologies.

Indeed, the current prohibitions under Article 9 were adopted when many F-gas-free alternatives in those sectors had achieved only limited share of the marketplace.[32] Those HFC-free technologies have since become the dominant technology with minimal, if any, additional cost to producers and consumers.[33] The EU has also successfully implemented market-transforming prohibitions to reduce its consumption of ozone-depleting substances (ODS) to zero by 2010 – ten years ahead of its international obligations.[34] As noted by the European Commission, the ODS Regulation was not only effective in controlling ODS but served to drive the development of innovative technologies, such as alternatives for methyl bromide, new blowing agents for insulation foam, CFC-free metered dose inhalers for the treatment of asthma, and the creation of innovative fire-fighting systems on board ships and airplanes.[35] There is therefore no need to wait until the alternatives achieve 100% market penetration and little precedent for doing so. In this vein, the Öko-Recherche *et al.* study and its suggested prohibition dates should be considered conservative markers, and be adjusted according to the precautionary principle and previous experiences. In some cases, limited exemptions may be appropriate when market penetration is less than 100%, and those should be granted for a limited period subject to renewal upon application with the burden of proof on the applicant. The exemption-granting process should also be transparent and allow for public participation, as required under existing EU legislation.[36] Including prospective prohibition dates for sectors where alternatives are not immediately available will send a signal to the market, ensuring that manufacturers and users can meet technology and infrastructure needs.

TABLE 1: Sectors identified by Öko-Recherche *et al.* achieving 100% market penetration of alternatives by 2020.

Source: Öko-Recherche *et al*, 2011

Sector	Subsectors	Penetration Rate Mix 100%
Domestic Refrigeration	Refrigerators/Freezers	2015
Commercial Refrigeration	Stand-Alone Systems	2020
	Condensing Units	2020
	Centralized Systems	2020
Transport Refrigeration	Refrigerated Vans	2020
Mobile Air Conditioning	Cargo Ship AC	2020
Stationary Air Conditioning	Moveable Systems	2020
	Split Systems	2020
	Multi-Split/VRF Systems	2020
	Rooftop Systems	2020
	Chillers (Displacement)	2020
	Heat Pumps	2020
Fire Protection	Fire Protection HFC-23	2015

PHASE OUT BY 2020

The Öko-Recherche *et al.* study identifies 100% market penetration rates of HFC-free technologies by 2015 for all foam sectors[37] and all aerosol sectors (except for the non-medical aerosol, which achieves 95% market penetration).[38] The use of HFCs in foams and aerosols should therefore be banned by 2015, with a necessary time-limited exemption for non-medical aerosols. Under such a scenario, the total additional HFC emission reductions in the foam and aerosol sectors would be around 7.6 MT CO_2-eq. per year by 2030.[39]

The largest HFC consuming sector by far is the refrigeration and air-conditioning (RAC) sector, which currently represents around 79% of all F-gas emissions in the European Union.[40] Refrigeration and MAC in motor vehicles constitute most of the HFC emissions – 39% and 32% respectively.[41] But the proportion of stationary air-conditioning (currently less than 15% of HFC emissions) is expected to grow significantly in future years while MAC emissions are projected to decline from 2015 onwards as a result of the MAC Directive.[42] A wide range of energy-efficient alternative technologies to HFCs are already in use, particularly natural refrigerants such as hydrocarbons, CO_2 and ammonia. In some sectors (e.g. domestic refrigeration) these have already become the dominant technology and it is clear that in the presence of regulatory restrictions on HFCs they would be able to meet the demands of other sectors too.

The Öko-Recherche *et al.* study identifies 13 sectors (see Table 1) as achieving 100% market penetration rates by 2020 or earlier. These dates are therefore the most conservative (i.e. the latest) options when setting prohibition dates for placing HFC technologies on the market under Article 9.

HFC technologies can be banned under Article 9 in domestic refrigeration and fire protection equipment (with HFC-23) by 2015, and in the additional sectors before 2020 with limited or no exceptions. In addition, EIA believes that HFC use in industrial refrigeration can be banned by 2020 at the latest, given the current widespread use of alternative refrigerants (ammonia) in this application.

The Öko-Recherche *et al.* analysis calculates that switching to alternative technologies in closed systems where possible will result in additional emission reductions of 62.1 MT CO_2-eq. per year by 2030, over and above reductions from the existing legislation, with a marginal emission abatement cost of €19.5/tCO_2-eq.[43] This is more than 1.7 times higher than the total avoided emissions projected for full implementation of the existing containment and recovery measures *for all sectors combined*, which are around 35.6 MT CO_2-eq. in 2030 under an absolute best case scenario.[44] The marginal abatement cost of the emission reductions through switching to alternative technologies is €19.5/tCO_2-eq., less than half the average emission abatement costs of containment and recovery measures, which are around €41/tCO_2-eq. in 2030.[45] So not only do prohibitions lead to greater reductions in HFC emissions, they also cost less. It is also worth noting that these calculations are based on full implementation of containment and recovery measures by 2015; if containment and recovery measures continue to fail, the impact of use bans on emissions will be even greater.

Retailers are already rising to the challenge of transitioning away from HFC technologies. In 2009, the Consumer Goods Forum (CGF), representing over 650 retailers, manufacturers and service providers, announced that its retailers will "*begin phasing-out HFC refrigerants as of 2015 and replace them with non-HFC refrigerants (natural refrigerant alternatives) where these are legally allowed and available for new purchases of point-of-sale units and large refrigeration installations*".[46] In other words, the commercial refrigeration sector is already preparing for a ban on HFCs in new equipment from 2015. And some CGF members have already gone much further. Tesco, the world's 4th largest retailer has committed to rolling out HFC-free systems in all new stores in the UK and Europe starting from 2012.[47] In addition, the UK supermarket Waitrose has already voluntarily committed to phasing out HFCs from its entire estate by 2020,[48] while Coca-Cola has stated that 100% of their new vending machines and coolers will be HFC-free by 2015.[49]

For the remaining sectors for which market penetration is less than 100% in 2020 – i.e. transport refrigeration, mobile air-conditioning in rail and passenger ships – penetration rates are sufficiently high (usually around 70%) to set a 2020 ban. This would be appropriate in the knowledge that the market will rise to the challenge given necessary support and incentives. A possible exception is centrifugal chillers, which represent less than 6% of HFC consumption in stationary air-conditioning. There, time-limited exemptions may be appropriate, subject to periodic renewal upon application with the burden of proof on the applicant.

"The only way the European Union can maintain its low carbon outlook is to phase out HFCs."

CONCLUSIONS AND RECOMMENDATIONS

It is almost ten years since the F-Gas Regulation was first conceived and alternative technologies, as well as our understanding of the impacts of climate change, have dramatically progressed. EIA recognises that the current containment and recovery measures in the F-Gas Regulation need to be implemented and improved, but the ethos of containment and recovery is not ambitious enough to help the European Union transition towards a competitive low-carbon economy. At best, it will only result in the stabilisation of HFC emissions at unacceptable levels. The only way the European Union can maintain its low carbon outlook is to phase out HFCs.

In addition to setting ambitious HFC phase-out targets, the Commission needs to give due consideration to additional measures that will promote the uptake of natural refrigerant alternatives to HFCs, including adequate funding for their development and promotion, examination of barriers identified in the Öko Recherche study and consideration of additional policy measures such as tax schemes.

While an HFC phase-out is not without challenges, it is also a huge opportunity and the only rational response to the certain and continued failure of containment and recovery measures, as well as the undue and ongoing financial burden that has been unfairly shifted from producers to member states. This conforms to EU policy under the Lisbon Treaty, which requires the European Commission to "*aim at a high level of protection... based on the precautionary principle and on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source and that the polluter should pay.*"[54]

Cost-effective alternatives are available and are already replacing HFC technologies. EIA urges policy makers to seize this opportunity and further encourage and accelerate these responsible transitions, and calls on the Commission to put forward proposals for an HFC phase-out by 2020.

REFERENCES

1. Öko-Recherche *et al*, Preparatory Study for a Review of Regulation (EC) No 842/2006 on Certain Fluorinated Greenhouse Gases, Final Report (September 2011) [hereinafter "Öko-Recherche Study"].Executive Summary PX.
2. See e.g. Öko-Recherche Study, p. 158; see also European Commission, Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions: A Roadmap for moving to a competitive low carbon economy in 2050, SEC(2011) 287 final (8 March 2011), pp. 3 and 6 (the policy of 80-95% reductions for the whole economy by 2050 would mean total emissions of around 275-1100 Mt/year).
3. Institute for European Environmental Policy, Is STEK as good as reported? – Uncertainties in the concept underlying the proposed European Regulation of fluorinated gases, 14 June 2005 [hereinafter "IEEP Report"], pp. 11-12.
4. Öko-Recherche Study, Executive Summary p. XI.
5. Directive 2006/EC/40.
6. Montzka., S.A. *et al.* 2011. Non-CO2 greenhouse gases and climate change. Nature Vol 476:43-50.
7. Velders *et al.*, The large contribution of projected HFC emissions to future climate forcing, p.1, May 14 2009.
8. Intergovernmental Panel on Climate Change Fourth Assessment report: Climate Change 2007 (AR4).
9. Öko-Recherche *et al*, Preparatory Study for a Review of Regulation (EC) No 842/2006 on Certain Fluorinated Greenhouse Gases, Final Report (September 2011) [hereinafter "Öko-Recherche Study"].
10. Lisbon Treaty, Article 191(2).
11. "MEPs 'scaremongered to vote no'", BBC, 22 November 2005 http://news.bbc.co.uk/1/hi/programmes/file_on_4/4459586.stm; File on 4 transcript of interview with Avril Doyle, 22 November 2011 http://news.bbc.co.uk/nol/shared/bsp/hi/pdfs/22_11_05_lobbying.pdf; "Debate heating up over fridge-gas vote", European Voice, 6 October 2005 http://www.europeanvoice.com/article/imported/debate-heating-up-over-fridge-gas-vote/53173.aspx.
12. See e.g. CAN-Europe, Press Release: Industry Claim on Climate Change Gas Containment Disproved (25 February 2004), available at http://www.climnet.org/index.php?option=com_docman&task=doc_view&gid=886&Itemid=343; ENDS Europe, MEPs Ratchet Up Planned EU Curbs on F-Gases (11 October 2005), available at http://www.endseurope.com/11102/meps-ratchet-up-planned-eu-curbs-on-fgases.
13. www.jbce.org/document_downloader.aspx?id=148.
14. Institute for European Environmental Policy, Is STEK as good as reported? – Uncertainties in the concept underlying the proposed European Regulation of fluorinated gases, 14 June 2005.
15. See Institute for European Environmental Policy, Is STEK as good as reported? – Uncertainties in the concept underlying the proposed European Regulation of fluorinated gases, 14 June 2005.
16. Institute for European Environmental Policy, Is STEK as good as reported? – Uncertainties in the concept underlying the proposed European Regulation of fluorinated gases, 14 June 2005, p.7.
17. Memorandum submitted by The Multisectoral Initiative on Potent Industrial Greenhouse Gases (MIPIGGs) to the UK Parliament on 17 September 2005: http://www.publications.parliament.uk/pa/cm200506/cmselect/cmenvaud/584/584we50.htm.
18. Öko-Recherche Study, Executive Summary, p. VIII.
19. See Öko-Recherche Study, pp. 79- 139.
20. Öko-Recherche Study, p. 171.
21. Öko-Recherche Study, p. 171.
22. Institute for European Environmental Policy, Is STEK as good as reported? – Uncertainties in the concept underlying the proposed European Regulation of fluorinated gases, 14 June 2005 [hereinafter "IEEP Report"], pp. 11-12.
23. Öko-Recherche Study, pp.5 and 6.
24. Öko-Recherche Study, p. 264.
25. Öko-Recherche Study, Executive Summary, pp. VIII-XI.
26. Öko-Recherche Study, Executive Summary, p. XI.
27. European Commission, Report from the Commission on the Application, Effects and Adequacy of the Regulation on Certain Fluorinated Greenhouse Gases (Regulation (EC) No 842/2006) (September 2011), p.6.
28. European Commission, Report from the Commission on the Application, Effects and Adequacy of the Regulation on Certain Fluorinated Greenhouse Gases (Regulation (EC) No 842/2006) (September 2011), p.9.
29. Öko-Recherche Study, p. 171 for containment/recovery costs and p. 262 for alternative technology costs.
30. Namely non-refillable containers, non-confined direct-evaporation systems, fire protection systems and extinguishers, windows, footwear, tyres, one-component foams, and novelty aerosols Regulation (EC) No 842/2006 of the Euroepan Parliament and of the Council of 17 May 2006 on certain fluorinated greenhouse gases, Annex II.
31. Öko-Recherche Study, p. 263.
32. See EC 2003 Costs and Impacts Report, pp. 17, 25, 34.
33. See EC 2003 Costs and Impacts Report, pp. 17, 25, 34.
34. European Commission, DG Climate, Protection of the Ozone Layer, located at http://ec.europa.eu/clima/policies/ozone/index_en.htm (last visited 11 July 2011).
35. European Commission, DG Climate, Protection of the Ozone Layer, located at http://ec.europa.eu/clima/policies/ozone/index_en.htm (last visited 11 July 2011).
36. See, generally, Regulation (EC) No 1049/2001 of the European Parliament and of the Council of 30 May 2001 regarding public access to European Parliament, Council and Commission documents; Regulation (EC) No 1367/2006 of the European Parliament and of the Council of 6 September 2006 on the application of the provisions of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters to Community institutions and bodies; Regulation (EC) No 1367/2006, Recitals 3-9; see also Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus, Denmark, 25 June 1998); Council Decision 2005/370/EC (OJ L 124, 17.5.2005, p.1).
37. Öko-Recherche Study, p. 261.
38. Öko-Recherche Study, p. 261.
39. Öko-Recherche Study, p. 261 (emission reductions are calculated for 2030); see also Oko-Recherche, p. 262.
40. Öko-Recherche Study, p. 193.
41. Öko-Recherche Study, p. 193.
42. Öko-Recherche Study, p. 193.
43. Öko-Recherche Study, p. 262.
44. Öko-Recherche Study, p. X Executive Summary.
45. Öko-Recherche Study, p. 171 for containment/recovery costs and p. 262 for alternative technology costs.
46. Consumer Goods Forum Board Resolution on Sustainable Refrigeration http://www.mycgforum.com/_files/Board_Resolutions_on_Deforestation_and_Refrigeration.pdf.
47. EIA Report Chilling Facts III pers. Comm. Tesco December 2010 http://chillingfacts.org.uk/uploads/chillingfacts3.pdf.
48. EIA Report Chilling Facts III, p.5 http://chillingfacts.org.uk/uploads/chillingfacts3.pdf; Financial Times, Retailers: Frosty welcome for HFC gases in supermarkets http://www.ft.com/cms/s/2/9ef49a16-6ddb-11df-b5c9-00144feabdc0,dwp_uuid=34be96ea-6c7f-11df-91c8-00144feab49a.html#axzz1c0W4uZYQ, 3 June 2010.
49. http://www.thecoca-colacompany.com/citizenship/refrigeration_equipment.html.
50. Öko-Recherche Study, p. 174.
51. Öko-Recherche Study, p. 174.
52. Öko-Recherche Study, p. 175.
53. Christoph A. Keller *et al.*: Evidence for under-reported western European emissions of the potent greenhouse gas HFC-23, in Geophysical Research Letters, VOL. 38, L15808, doi: 10.1029/2011GL047976, 2011.
54. Lisbon Treaty, Article 191(2).

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