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EXECUTIVE SUMMARY of the IMPACT ASSESSMENT
Review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases

Accompanying the document

Proposal for a
REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

on fluorinated greenhouse gases

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1. INTRODUCTION

F-gases[1] are increasingly used in a number of different application fields, such as refrigeration & air conditioning, foams, aerosols, fire protection and electrical equipment. F-gases are, however, very potent climate gases.[2] The current F-gas Regulation focuses mainly on reducing emissions of these greenhouse gases during the lifetime of equipment and its end-of-life treatment, while it hardly restricts the use of F-gases in new equipment. At the same time, alternatives to F-gases that are safe and energy-efficient are already available today in nearly all fields of application.

The Commission published a report on the application, effects and adequacy of the F-gas Regulation.[3] Certain implementation shortcomings were identified which need to be addressed. If *fully applied*, the F-gas Regulation in combination with the Directive on mobile air-conditioning (Directive 2006/40/EC) could freeze F-gas emissions at today's levels. However, the report also concluded that the EU should take additional action on F-gases, given the potential to further reduce emissions at relatively low costs.

Similarly, the European Parliament has repeatedly called for ambitious action in this field.[4,5]

At the international level, more than 100 countries are calling for action on F-gases under the Montreal Protocol on Substances that Deplete the Ozone Layer.[6] The EU has, since 2009, supported in principle the proposals made for a global phase-down under the Montreal Protocol. In addition the initiative "Climate and Clean Air Coalition on Short-Lived Climate Pollutants", which includes the US, G8 countries, the European Commission (EC), World Bank and UNEP, promotes various actions on F-gases.[7]

2. PROBLEM DEFINITION

Climate change affects everybody in terms of extreme weather conditions and adaptation costs. The international scientific consensus calls for limiting the global temperature increase to 2°C to avoid undesirable climate effects.[8] In total, F-gases account for 2% of all greenhouse gases in the EU today but have a much more potent atmospheric warming potential than CO_2. According to the cost-effective pathway to decarbonise the EU economy, emissions of F-gases should be reduced in the order of 70-78% by 2050 and by 72-73% by

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1 F-gases include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF6). By weight, 98% of F-gases placed on the market in the EU were HFCs (2010 data).

2 F-gases have global warming potentials that is up to 23,000 times stronger than that of CO_2.

3 COM(2011) 581. *"On the application, effects and adequacy of the Regulation on certain fluorinated greenhouse gases (Regulation (EC) No 842/2006)"*. 26 September 2011. ec.europa.eu/clima/policies/F-gas/docs/report_en.pdf

4 European Parliament Resolution of 14 September 2011. *"A comprehensive approach to non-CO2 climate relevant anthropogenic emissions*." P7_TA-PROV(2011)0384.

5 European Parliament Resolution of 15 March 2012. "*Competitive low carbon economy in 2050 – EP resolution on a Roadmap for moving to a competitive low carbon economy in 2050"* (2011/2095(INI)), P7_TA-PROV(2012)0086.

6 ozone.unep.org/Meeting_Documents/mop/22mop/MOP-22-9E.pdf

7 www.unep.org/ccac/

8 IPCC, 4th Assessment Report, Climate Change 2007: Working Group III: Mitigation of Climate Change. www.ipcc.ch/publications_and_data/ar4/wg3/en/contents.html

2030 at a marginal abatement cost of approximately €50 per tonne CO_2 equivalent.[9] This translates for the F-gas sector to a decrease of ca. 70 million tonnes CO_2 equivalents (Mt CO_2eq) as compared to emissions expected in 2030 under a full application of current legislation.

Global F-gas use has been growing rapidly since 1990 and will, if unaddressed, lead to a considerable increase in emissions. Since equipment and products containing F-gases have a long lifetime of up to 50 years (e.g. building insulation foams), a lack of public intervention today would result in unnecessary, high emissions for many decades.

Therefore, apart from addressing existing shortcomings in the application of the current F-gas Regulation there is a strong need to further reduce future emissions. Analysis[10] shows that two-thirds of the expected emissions[11] in the EU could be avoided cost-efficiently[12] by 2030, if action is taken to avoid the use of F-gases where suitable alternatives exist. Cumulatively, emission savings of ca. 625 Mt CO_2eq can be achieved cost-efficiently over the period from 2015 until 2030.

Lack of action in this area would result either in the EU missing its greenhouse gas emission objectives or require other industrial sectors to take more expensive action, thus causing a loss of cost competitiveness for industry as a whole.

In addition, there is an unexploited potential to encourage the market penetration of green, alternative technologies, thus stimulating innovation, green jobs and growth.[13]

3. POLICY OBJECTIVES

The general objective of the review of the F-gas Regulation is to ensure a cost-efficient[14] contribution to reducing greenhouse gas emissions in the EU by 80 to 95% in 2050 within the global challenge of keeping climate change below 2ºC of pre-industrial levels.

This should be achieved in particular by

– discouraging the use of F-gases with high GWP where suitable alternatives exist;

– encouraging the use of alternative substances or technologies without compromising safety, functionality and energy efficiency;

– preventing leakage from equipment and proper end of life-treatment of F-gas applications;

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9 COM (2011) 112. *"A roadmap for moving to a competitive low carbon economy in 2050."* eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:52011DC0112:EN:NOT

10 Schwarz et al. (2011) *"Preparatory study for a review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases."* Öko-Recherche et al. ec.europa.eu/clima/policies/F-gas/docs/2011_study_en.pdf

11 Projected under the assumption that the F-gas Regulation is fully implemented.

12 Often far below €50 / tonne CO_2eq

13 Many of these "green growth" companies, often SMEs, have stated that they find it hard to market their products under current market conditions.

14 Abatement costs below €50 per tonne of CO_2 abated are considered cost-efficient.

– facilitating convergence towards a potential future agreement to phase down HFCs under the Montreal Protocol;

– enhancing sustainable growth, stimulate innovation and develop green technologies;

– limiting any undesirable effects on SMEs, competitiveness and employment, the administrative burden for companies and authorities and preserving the competition in the Internal Market, to the extent possible.

4. POLICY OPTIONS

The impact assessment considers five policy options. The first option analysed is "*no policy change*" (Option A) which introduces no new legislative requirements but does include clarifications on definitions and non-legislative action at EU level to support a better application of the existing requirements. Current legislation is considered essential but insufficient to reach the objectives and hence it is used as the baseline against which four supplementary policy options are assessed:

– Option B: The use of *"voluntary agreements"* among industry players in sectors where such agreements were considered realistic due to low abatement costs;

– Option C: The option *"extending scope of containment and recovery"* requires containment in sectors currently not covered by the F-gas Regulation;

– Option D: The *"phase-down"* option introduces step-wise declining limits until 2030 for the amounts of HFCs that can be put on the EU market. This option also includes measures targeting HFCs in pre-charged equipment, to avoid that only EU-produced products would be affected by the cap;

– Option E: *"Bans"* on the use of F-gases in sectors where replacement technologies are already available today for 100% of the applications.

Some of these policy options and the measures included thereunder are not mutually exclusive and may be combined with other policy options considered.

Further options and sub-options have been screened and discarded on the basis of four criteria:

– Effectiveness (less than 1 Mt CO_2eq);

– Efficiency (more than 50 € per t CO_2eq abated);

– Technical constraints like safety or energy efficiency;

– Other constraints such as consistency with other EU policies.

Hence, all the chosen options and their sub-options are from the onset effective, cost-efficient, energy-efficient and safe, as health and greenhouse gas lifecycle concerns are inherently addressed in the screening analysis.

5. IMPACTS

5.1. Environmental

The most effective option to reduce greenhouse gas emissions is the phase-down approach (D), saving 71 Mt CO_2eq by 2030 or two-thirds of today's emissions. Bans in certain feasible sectors (E) would deliver emission reductions of 53 Mt CO_2eq, i.e. about half of today's emissions, while introducing voluntary agreements (B) could achieve 22 Mt CO_2eq by 2030 (Table 1). The emission reduction of extending scope of containment (C) would be very small as limited to some transport modes only. These emission savings include energy efficiency impacts (i.e. overall savings from alternatives). The methodological basis for these findings is a detailed and comprehensive analysis of the feasibility of introducing safe and energy–efficient alternatives at costs lower than 50 € per ton of CO_2eq abated in each of the 28 main different sub-sectors that use F-gases[15]. Ecotoxicological risks due to release of substances to the environment are considered to be low or negligible for all options.

5.2. Economic

The F-gas sector comprises a number of different market players who may be affected in different ways by policy changes: Producers of F-gases, manufacturers of equipment, electricity companies, equipment service companies, importers and exporters, users of equipment, the retail and raw material sectors (e.g. metals and products). A number of different economic impacts were analysed (Table 1), using an input/output model (EmIO-F) and a general equilibrium model (GEM-E3). Overall effects are small, with the input/output model suggesting a small, positive impact on overall output (up to 0.009%) and GEM-E3 predicting a small decline (up to -0.006%). These effects are strongest in case of a phasedown (D), followed by bans (E). For the directly impacted sectors, equipment manufacturing may experience small gains, while the energy supply sector could encounter losses due to higher energy efficiency of alternative equipment. Effects on the chemical sector are low. The models predict small losses for the service sector due to the smaller number of F-gas equipment requiring leakage checks. These potential losses should however be fully compensated by new servicing needs for alternative equipment as well as to date unexploited opportunities in the application of the existing containment provisions.

The phase-down (D) touches the highest number of application sectors and hence stimulates novel (green) technologies to the highest degree and leads to the highest use of alternatives. For the same reason total direct costs (investments and operations) to *users* of equipment will also be somewhat higher (followed by bans (E) and voluntary agreements (B)). The underlying assessment is based on a conservative approach by only considering replacement options which are currently available and calculations were performed on the basis of today's costs. The likely decline of costs involved due to future technological development and economies of scale was thus not taken into account.

Indirect effects are considered to be marginal. Due to the low costs, competitiveness is generally not adversely affected, in particular since none of the policy options requires the replacement of existing equipment, so that direct investment costs would only occur after the end-of-life. The impacts on consumer prices will be small for all options and negligible in

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[15] Schwarz et al. (2011) *"Preparatory study for a review of Regulation (EC) No 842/2006 on certain fluorinated greenhouse gases."* Öko-Recherche et al.

macroeconomic terms (-0.01 to 0.00% for Options D and E, based on GEM-E3). As for regional impacts, the direct impact could be €1 higher per inhabitant in Southern European countries due to the more common use of air conditioning equipment.

SMEs form a large part of the overall companies active in sectors using F-gases. In line with the small economic effects observed in the analysis, no excessive burdens for these companies are expected. A phase-down (D) provides more flexibility to industry players than introducing bans (E), which was frequently highlighted by stakeholders. Safeguards, such as *de minimis* clauses, can be introduced to exempt very small F-gas market players from reporting and certain obligations.

All options are designed in a way that domestic producers and importers of appliances will face the same conditions for placing products on the EU market. Therefore international competitiveness will not be affected. First mover-advantages for European companies at the international level are likely, in particular if a global agreement to phase-out F-gases is reached. A phase-down (D) and bans (E) would create a substantial market for low-GWP technologies and thus incentivise the development of such technologies also in exporting third countries. Administrative costs can be kept relatively low as the existing reporting scheme under the F-gas Regulation will form the backbone of data needs for implementing future policy options. Only independent verification would add to the costs, which is the case in particular for a properly executed voluntary agreement (B) approach.

Table 1: *Summary table of environmental, economic and social impacts of the policy options by 2030*[16]

IMPACTS	*Option B* Voluntary agreements	*Option C* Enlarged Scope	*Option D* Phase-down	*Option E* Bans
ENVIRONMENTAL				
Emission Reductions SUM [Mt CO_2eq]	22.2	1.4	70.7	53.3
Total direct costs [(M€/year]	530	66	1500	1330
Administrative costs [M€/year]	10.7	0	0.2 (+ 1.9 one-off)	1.2
Direct effects on sector output (% change) [% of 2007, I/O model]	0.006	Negl.	0.009	0.003
- machinery/ equipment	0.38	Negl.	0.52	0.23
- services/ maintenance	-0.09	Negl.	-0.38	-0.37
- chemicals	-0.19	Negl.	0.17	0.03
- electricity	-0.19	Negl.	-0.59	-0.26
GDP impacts (% change, *GEM-E3* model)	smaller than D	Negl.	-0.006	-0.003
Impacts Regions	Negl.	Negl.	small effects on EU South	smaller than D
Impacts SMEs	no significant effects	Negl.	no significant effects	no significant effects
Internal market	none	none	none	None
Competiveness, trade& investment	small	Negl.	small positive for alternatives	small positive for alternatives
Third countries	Negl.	Negl.	incentivises alternatives globally	incentivises alternatives globally
Consumer price	Negl.	Negl.	Negl.	Negl.
Innovation & research	facilitates new technologies to low degree	Negl.	facilitates new technologies and products	facilitates new technologies and products
SOCIAL				
Employment: impact in 2030 [No. of jobs]	+600	Negl.	-16000 to +7000	-12,000 to +4000
Safety & health risks	Negl.	Negl.	Negl.	Negl.

[16] Negl. = negligible

5.3. Social

Effects on employment are small. For a phase-down (D) modelled effects range between an increase of around 7000 to a decrease of 1600 to 16000 jobs. As the effects of the other options are lower the maximum expected effect on employment is in the order of +0.003% to -0.007% (Option D). Job creation effects would occur in the machinery and equipment sector as well as sectors providing input materials (e.g. basic metals, metal products). Job losses are predicted in the energy supply-sector and the service sector, but the latter effects are likely balanced out by other effects.

Health and occupational risks for alternatives are not expected to increase as long as safety standards and procedures are followed. The feasibility analysis of alternatives was based on the precondition that only proven, safe and energy-efficient technologies should be deployed. Proposed minimum training requirements for certified personnel covering also alternative substances further minimise safety risks.

6. COMPARISON OF OPTIONS

The Impact Assessment concludes that a phase-down (D) would give the highest additional environmental benefit, stimulate innovation to the highest degree and would come at a low cost to the economy and society as a whole. It results in a reduction of around 60% in 2030 compared to 2005 in line with the EU Low Carbon Economy Roadmap and is thus the only option sufficiently effective. This option is also seen as more flexible by many stakeholders, in contrast to bans (E). Voluntary agreements (B) and even more extending scope of containment and recovery (C) are far from yielding sufficient emission savings in view of the overall objective. Social and economic impacts are considered marginal for all options.

Overall, the highest effectiveness can be obtained by complementing the phase-down (option D) with the extension of containment provisions to some transport modes (Option C), as well as placing on the market bans in a few limited areas (gases not targeted by the phase-down and destruction of by-products, which are sub-options included under Option E). Measures to ensure that quantities imported in pre-charged equipment are counted under the cap are indispensable for the environmental integrity of the phase-down mechanism and a level playing field in the market.

Some stakeholders[17] also recommend combining a phase-down with certain "supportive" bans e.g. in the field of refrigeration, to give more certainty of F-gas availability to those sectors where a replacement is more difficult. Such bans would, in principle, not affect the environmental, economic or social impacts, as the "phasedown" would cover these sectors in any case. Consequently, Option D together with Option C, as well as complementary and supportive bans, would achieve an emission reduction of ca. 72 Mt CO_2eq (adding ca. 1 Mt CO_2eq emission reductions to option D).

[17] E.g the Network of Environmental Protection Agencies