WORKING DOCUMENT ON

Possible requirements for air heating products, cooling products and high temperature process chillers

EXPLANATORY NOTES

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1. CONTEXT OF THE PROPOSAL

1.1. Grounds for and objectives of the proposal

The Ecodesign Directive 2009/125/EC[1] establishes a framework for the setting of ecodesign requirements for energy-related products. It is a key instrument of Community policy for improving the energy and other environmental performances of products in the Internal Market. The Directive lists products identified by the Council and the European Parliament as priorities for the Commission for implementation, including heating and cooling equipment (Article 16). Therefore, heating and cooling equipment, widely used in the European Union, are priority product groups considered for implementing measures under the Ecodesign Directive.

The scope of the proposed Regulation includes the following generic types of products:

1) air heating products with a rated heat output up to 1 MW;
2) cooling products with a rated cooling output up to 2 MW;
3) high temperature process chillers.

The types of air heating products to be covered are warm air heaters providing heat from a centralised or decentralised location in the building and heat pump air heaters outside the scope of Commission Regulation (EU) No 206/2012 of 6 March 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners and comfort fans[2]. The scope of the proposed Regulation excludes air heating products providing heat to the room they are installed, as these are to be covered by measures developed for Local Space Heaters (LSH), combining Lot 15 and Lot 20 products, except for decentralised warm air heaters.

Cooling products covered by the proposed Regulation are comfort chillers and air conditioners outside the scope of Commission Regulation (EU) No 206/2012 of 6 March 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for air conditioners and comfort fans and high-temperature chillers intended for industrial process cooling as these products may be similar to comfort chillers used for space cooling purposes.

As many inefficient air heating, cooling products and high temperature process chillers continue to be placed on the market, despite lower life cycle cost for products with higher efficiencies, the proposed Regulation aims at correcting this market failure.

Products covered by the proposed Regulation where analysed in four different preparatory studies: ENTR Lot 1 on refrigeration and freezing equipment (high temperature process chillers), ENTR Lot 6 on air-conditioning and ventilation systems (comfort chillers and air conditioners), ENER Lot 20 on room heating products (decentralised warm air heaters) and ENER Lot 21 on central heating products that use hot air to distribute heat (heat pumps and centralised warm air heaters). These preparatory studies analysed the technical, environmental and economic aspects of the products. The rest of products under the four mentioned preparatory studies are being covered by regulations being developed by DG ENTR and DG ENER which are in different stages of the regulatory process.

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1 OJ L 285, 31.10.2009, p. 10.

2 OJ L 72, 10.3.2012, p. 7.

The preparatory studies have showed that:

- Air heating products and cooling products including high temperature process chillers are placed in significant quantities on the internal market.

- The main environmental impacts in the life cycle of these products are the energy consumption (electricity or gaseous/liquid fuels), the sound power level, and (for products using fuels) the emissions of nitrogen oxides and for products using refrigerants in a vapour compression cycle, the fugitive emissions of these refrigerants. These impacts are considered significant.

- There is a wide disparity in the environmental impacts of the products currently on the market.

- Technically cost-effective solutions exist that could lead to significant improvements as regards their environmental performance.

Under Article 15 of Directive 2009/125/EC, these products should therefore be covered by an ecodesign implementing measure.

1.2. General context

On the basis of data presented in the preparatory studies and additional analysis it has been estimated that the annual energy consumption related to air heating products and cooling products is some 2385 PJ (57 Mtoe) in the European Union in 2005, corresponding to approximately 3 % of the total gross energy consumption of the EU-27[3]. The associated CO_2 emissions are estimated to be 107 Mt per year. If no specific measures are taken, the annual energy consumption is predicted to be 2687 PJ in 2020.

Main reasons for the persistent sales of low efficiency products are market failures that fail to provide incentives for manufacturers to place high-efficiency products on the market (regulatory failure) and to guide end-users away from purchase decisions based on purchase costs rather than on the life cycle cost of the product (asymmetric information and negative externality). Also, persons installing and sometimes buying an air heating or cooling product do not bear the operation costs, such as the building owner buying the product and a tenant paying the electricity bill (split incentive). Cost-effective improvement potentials for the end-user are therefore often not realised.

Energy efficiency requirements for air heating products and cooling products are set on the basis of the seasonal space heating or cooling efficiency which considers the energy inputs to satisfy the space heating or cooling demand pertaining to a designated heating or cooling season under defined conditions.

No energy efficiency requirements for a possible sanitary water heating function of the air heating products are set as the market and environmental impacts of such products were not proven to be significant and not enough information could be presented that indicated urgent market failures. It should be noted that most sanitary water heating products are currently addressed by proposed measures for central heating boilers and water heating products.

[3] The total gross energy consumption of the EU-27 was 1792 Mtoe in 2007 according the Methodology for Ecodesign of energy-related products "MEErP 2011", Methodology report, Part 2: Environmental policies & data, page 52, by VHK, November 2011.

The annual direct emissions of nitrogen oxides (primarily emitted by natural gas fired warm air heaters), expressed as contribution to acidification (SO_x equivalent), were estimated to 14 kt SO_x equivalent in the European Union in 2005. If no specific measures are taken, it is predicted that the annual emissions will be 8 kt SO_x equivalent in 2020.

For products using fuels, maximum emission levels for nitrogen oxides are set by the proposed Regulation.

Products using refrigerants may contribute to Greenhouse Gas emissions as refrigerants with significant global warming potential may leak from the product during operation and at end-of-life. The average contribution of these leaked refrigerants to the total global warming impact during the use and end-of-life phase is significant.

The global warming potential of refrigerants allowed to be placed on the market and controls and inspections of products using large quantities of refrigerants will be dealt with by the recast of the so-called F-Gas Directive.

The information collected during the relevant preparatory studies estimate that between 1% and 5% of the refrigerant charge is leaked each year in comfort cooling products, to this value, the refrigerant losses at the end of life of the product need to be added. Estimations in available literature vary a lot, but, at this stage it can be assumed that between 10% and 20% of the CO_2 equivalent emissions from cooling products are direct emissions due to refrigerant leakage and losses. This estimation is in line with Commission Regulation (EU) 206/2012 with regard to ecodesign requirements to air conditioners and comfort fans[4]. The proposed Regulation introduces a bonus for products that use refrigerants with low global warming potential (GWP) for comfort cooling products.

In the case of high temperature process chillers, direct emissions are estimated be less relevant[5], this is due to the longer operating hours of these products, which are used during up to 80% of the hours of the year. In consequence, indirect emissions due to the energy consumption in the use phase of the products are relatively much more important than direct refrigerant emissions over the whole life cycle of the product, as a result. the introduction of a bonus for high temperature process chillers using refrigerants with a low GWP is considered not adequate.

For heat pumps no bonus is considered for products using refrigerants with a GWP below 675. The preparatory study showed that only a small bonus of 5% would result in overall greenhouse gas emissions that exceed those of products that do not use a bonus. This is due to longer operating hours for heating products than for comfort cooling products.

Apart from energy efficiency, equivalent carbon dioxide and nitrogen oxide emissions the preparatory study also identified sound power levels as significant environmental aspects for certain products. Accordingly, maximum sound power level requirements are proposed.

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4 OJ L 72, 10.3.2012, p. 7.

5 Direct emissions are expected to account for less than 2% of the total annual greenhouse gas emissions (in CO_2 equivalents) associated with the use of high temperature process chillers.

1.3. Market significance

The market significance (in sales and the resulting stock, based on information in the preparatory studies and supplemented/amended by further information from stakeholders) of the products are shown below. Data is presented for the years 1990 to 2030[6]:

Table 1: Sales and stock of products within scope

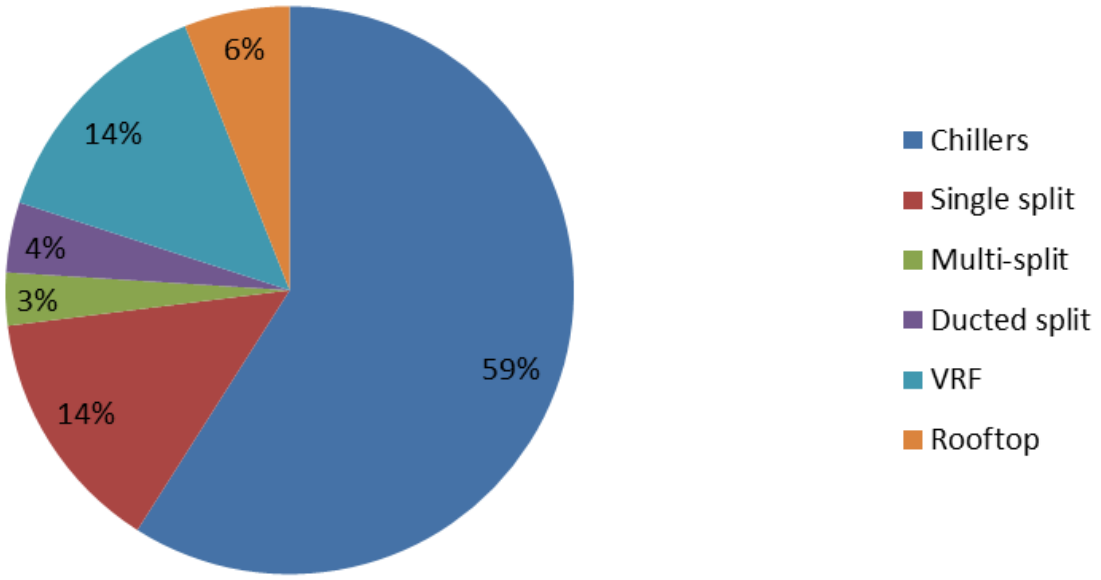
MARKET	Units	1990	2000	2010	2020	2030
SALES/units						
Comfort chillers	No * 1000/yr	26	73	105	127	153
Air-cooled small	No * 1000/yr	21	60	88	107	130
Air cooled large	No * 1000/yr	2	5	6	7	7
Water cooled small	No * 1000/yr	2	6	9	11	13
Water cooled large	No * 1000/yr	1	2	2	3	3
Air conditioners & heat pumps	No * 1000/yr	73	227	324	369	348
of which reversible	No * 1000/yr	22	114	224	311	325
Warm air heaters	No * 1000/yr	148	117	97	82	74
gas and liquid fuel	No * 1000/yr	133	102	87	77	69
electric	No * 1000/yr	15	15	10	5	5
High temp. process chillers	No * 1000/yr	14	20	27	38	53
Air-cooled small	No * 1000/yr	8	11	15	21	29
Air cooled large	No * 1000/yr	2	3	5	7	9
Water cooled small	No * 1000/yr	2	3	4	5	8
Water cooled large	No * 1000/yr	2	2	3	5	7
SALES/capacity						
Comfort chillers	GW cooling	3	8	11	12	14
Air conditioners (AC)	GW cooling	2	6	9	10	10
Heat pumps (HP)	% reversible	68% of AC (assumed constant)				
Warm air heaters	GW heating	8	6	5	5	4
HT process chillers	GW cooling	3	5	6	9	13
STOCK/units						
Comfort chillers	No * 1000	457	734	1.469	2.166	2.631
Air conditioners & heat pumps	No * 1000	354	2.594	5.945	9.116	10.184
Warm air heaters	No * 1000	2.236	1.990	1.588	1.357	1.200
HT process chillers	No * 1000	169	235	327	455	634
STOCK/capacity						
Comfort chillers	GW cooling	60	88	163	230	264
Air conditioners incl reversible heat pumps)	GW cooling	10	73	166	255	285
Warm air heaters	GW heating	133	119	95	81	72
HT process chillers	GW cooling	40	56	78	109	152

[6] Note: Market data for years 1990-2030 are based on information provided in preparatory studies. Where such data was not available data has been estimated.

The data shows that overall sales of cooling products exceeds 450 000 units annually and that of air heating products exceeds 300 000 units (cooling products includes products that are reversible and may also provide in space heating).

The total space cooling capacity placed on the market (including replacements) is some 20 GW. High temperature process chillers add some 6 GW to the cooling capacity placed on the market annually.

Figure 1: Cooling capacity sold in 2008 (total 19 GW)



Sales of chillers comprise air- and water-cooled systems. Sales of air conditioning and heat pumps comprise packaged units, split units (ducted and unducted, mono and multiple split) and variable refrigerant flow systems. Per region in Europe the division may be different with air conditioners being more popular in southern countries and chillers more popular in mid-EU countries.

Not shown in the table above are sales of gas fired heat pumps and cooling products. The market for these products is currently still a niche market with approximate annual sales in order of 5 000 units and some 10 000 units installed in Europe in 2011[7].

Still, both types of products (gas driven and oil driven) are relevant for the creation of a 'level playing field'.

Assumptions regarding the volume of sales and stock of air heating products and cooling products made during the preparatory studies, will be re-assessed during the Impact Assessment phase.

[7] PROMELLE, J. (GDF SUEZ - Research division), "Gas heat pumps : product overview: Engine driven heat pumps / Thermally driven heat pumps", by GDF SUEZ, 01-12-2011

1.4. Economic significance

The total expenditure for the heating and cooling products combined is some 57 billion euro, of which the running costs make up for some 40 billion euro (some 70% of the total).

1.5. Market Structure

The scope of the product group air heating products and cooling products covers a very diverse range of products, each with distinct market characteristics. These are discussed below.

1.5.1. Warm air heaters

Most of the gas and liquid fired warm air heaters placed on the EU market are produced within Europe with production facilities located primarily in countries with developed gas grids such as UK (e.g. Ambi-Rad, Johnson & Starley), Italy (e.g. Apen Group) and Netherlands (e.g. Brink, Winterwarm).

Sales are mainly from manufacturer directly to installer, who sells it to the final costumer.

Warm air heater manufacturers are represented on EU level by EURO-AIR[8]. Large national associations are found in Germany (FIGAWA[9]) and the UK (ICOM[10]). The relevant technical committee is CEN/TC 180 on "Decentralized gas heaters".

Regarding electric warm air heaters, these can be considered a household or similar electrical appliance, thus being covered by CENELEC TC 59C on performance of household and similar electrical appliances (heating products).

The preparatory studies did not indicate the share of SME's[11] involved in design and manufacturing of these products.

1.5.2. Chillers, heat pump heaters and air conditioners

Although some large production facilities for chillers (comfort and process cooling), air conditioners and heat pumps exists in the EU (e.g. Daikin, Belgium) most of the manufacturing is located outside the EU, in Japan, South Korea and the USA.

Sales are from manufacturer to distributor (importer) to installer to final costumer. Most equipment is specified by specialised energy consultants (in case of new built or large renovation of buildings or process cooling) or trained installers (in case of replacement) because of the complexity of specification and installation, especially for larger size equipment.

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8 See www.euro-air.com. Radiant heaters are represented by ELVHIS (www.elvhis.com), but are discussed in the Working Document on Local Space Heaters

9 See www.figawa.de

10 See www.icomenergyassociation.org.uk

11 SMEs are defined as companies with less than 250 employees (see: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm)

Chiller, air conditioner and heat pump manufacturers are represented on EU level by EPEE, Eurovent, EHPA and EHI. ASERCOM is the association for component manufacturers within the European HVAC/R industry. For fuel driven products specifically Marcogaz is the main representative association.

The relevant technical committees are CEN/TC 113 on "Heat pumps and air conditioning units", CEN/TC 299 on "Gas-fired sorption appliances, indirect fired sorption appliances, gas-fired endothermic engine heat pumps and domestic gas-fired washing and drying appliances" and CEN/TC 228 on "Heating systems in buildings".

The preparatory studies did not indicate the share of SME's involved in design and manufacturing of these products.

1.6. Environmental significance

The preparatory studies have shown that for all products within scope energy consumption during use is the single most significant environmental parameter. The studies also showed that greenhouse gas emissions caused by fugitive emissions of refrigerants are also a significant contributor to total greenhouse gas emissions from such equipment.

The energy consumption of products providing space heat is estimated to be some 1040 PJ primary energy. Warm air heaters are responsible for some three quarters of this energy consumption in 2010, being 767 PJ , which is expected to decrease to 415 PJ in 2030 mainly due to a drastic reduction of the stock of installed appliances. Heat pumps are responsible for an energy consumption of 30 TWh electric (or 273 PJ primary energy) in 2010 increasing up to 41 TWh electric in 2030. The combined consumption in 2010 represents some 8% of the overall 13 000 PJ energy consumption for heating as estimated in the Part 1 report on the review of the methodology for ecodesign of energy-using products[12].

According to the analysis used for this impact assessment cooling products (chillers and air conditioners) have a consumption of energy resources in 2010 of close to 53 TWh electricity (or 473 PJ primary energy of which approximately one third is by air conditioners and two thirds by chillers). This consumption represents some 27% of the total electricity consumption allocated to space cooling equipment.

High temperature process gas chillers are estimated to consume some 88 TWh electric energy (or 790 PJ primary energy), increasing to 171 TWh electric energy in 2030.

The combined consumption for space heating and cooling of 2385 PJ represents some 3% of overall EU energy consumption.

The overall combined greenhouse gas emissions in 2010 by warm air heaters, heat pumps, chillers and air conditioners was estimated to be some 107 Mt CO_{2eq} of which some 12% is estimated to originate from refrigerant leakage from comfort chillers.

Other environmental impacts are some 14 Mton emissions to air of acidifying substances (NO_x, expressed as SO_x equivalents) from fuel driven equipment. Also noise emissions are a relevant environmental impact for some products.

[12] Methodology for Ecodesign of energy-related products "MEErP 2011", Methodology report, Part 1: Methods, page 61, by VHK, November 2011.

1.7. Improvement potential

The preparatory studies have identified various improvement options that would result in lower overall energy consumption and related emissions realisable at no excessive life cycle costs for the products within scope. Other improvement options relate to use of refrigerants, NO_x emissions and noise emissions. Therefore this working document proposes ecodesign minimum energy efficiency requirements for these products.

The proposed ecodesign requirements presented in this document are based on the strictest scenario's developed in the preparatory studies and further analysis during the preparatory stages of this document.

Implementation of these measures would result in the following annual energy savings:

- For chillers and air conditioners some 2 TWh electricity (20 PJ primary energy) in 2020 and 5 TWh electricity (45 PJ primary energy) in 2030;
- For warm air heaters: some 25 PJ in 2020 and 68 PJ in 2030;
- For heat pump air heaters some 2 TWh electricity (18 PJ primary energy) in 2020 and 4 TWh electricity (36 PJ primary energy) in 2030;
- For high temperature process chillers some 2 TWh (17 PJ primary energy) in 2020 and 8 TWh electricity (76 PJ primary energy) in 2030.

Greenhouse Gas emissions for all products involved will increase from a level of 107 Mton CO_2 equivalent in 2010 and 110 Mton in 2030, whereas business-as-usual would lead to an increase of emissions to 120 Mton in 2030. Therefore the measures reduce the emissions by some 10 Mton in 2030.

Emissions of NO_x (expressed as SO_x equivalents) will be reduced by 0.4 Mton SO_x equivalent per year in 2020 and 0.6 Mton SO_x equivalent per year in 2030.

The above sections on economic and environmental significance, and improvement potential have been summarised in the table below.

Table 2: Estimated annual impacts and savings

Impact		Unit	BAU (PJ)			WD option (PJ)		savings (PJ)	
		year	2010	2020	2030	2020	2030	2020	2030
Energy	Comfort chillers	PJ/yr	294	340	302	329	276	-11	-26
		TWh_electric	33	38	34	37	31	-1	-3
	AC (cooling)	PJ/yr	179	186	151	177	132	-9	-19
		TWh_electric	20	21	17	20	15	-1	-2
	HP (heating)	PJ/yr	273	394	367	376	332	-18	-36
		TWh_electric	30	44	41	42	37	-2	-4
	Warm Air Heaters	PJ/yr	767	564	415	538	348	-25	-68
		TWh_electric	2	2	1	2	1	0.0	-0.1
	HT chillers	PJ/yr	790	1102	1535	1085	1459	-17	-76
		TWh_electric	88	122	171	121	162	-2	-8

	Total	PJ/yr	2385	2687	2861	2602	2629	-85	-232
GHG	Total	Mton CO2eq./yr	106,9	115,6	119,7	111,9	109,7	-3,7	-9,9
NO_x	Total	Mton SOxeq,/yr	14	8,0	4,1	7,7	3,5	-0,4	-0,6
Expenditure	Total	billionEUR/yr	57	68	76	60	64	-8,5	-12,1
	acq. costs	billionEUR/yr	11	16	19	17	21	1,7	1,6
	energy costs	billionEUR/yr	40	46	49	35	35	-10,2	-13,7

The overall trend in primary energy consumption shows an increase, mainly caused by expected increase of sales of chillers (in particular high temperature chillers), air conditioners and heat pumps. Only for warm air heaters the energy consumption is in decline, due to dwindling sales and a reduced installed base.

From the above it can be concluded that the proposed measures will help to curb that trend of increasing energy consumption by products in the scope. The measures are estimated to level out the overall energy consumption from 2020 onwards.

The calculations presented in this document are partly based on the preparatory studies, partly on additional analysis. The savings on energy consumption, emissions and savings will be verified and scrutinised during the Impact Assessment following the consultation of the Working Document.

1.8. Existing legislation

The product group of air heating products and cooling products is currently not subject to product specific European environmental legislation, although relevant European legislation in the field of safety, both mechanical and electrical, applies and harmonised standards have been issued for this purpose.

Directive 2009/142/EC of the European Parliament and of the Council of 30 November 2009 relating to appliances burning gaseous fuels[13] (Gas Appliance Directive, GAD) sets out essential requirements regarding the rational use of fuel (energy efficiency) and products of combustions (emissions). These requirements are to be applied through harmonised standards. In practice this means where no specific ecodesign requirements are set, the standards harmonised under the Gas Appliance Directive may set specific requirements.

Regulation No 305/2011/EU of 9 March 2011 laying down harmonised conditions for the marketing of construction products[14] (Construction Products Regulation) sets out basic requirements for construction works ('buildings') and does not pose minimum energy efficiency requirements or mandatory information requirements to products within scope.

Directive 2010/31/EU of 19 May 2010 on the Energy Performance of Buildings[15] (EPBD) stipulates that Member States shall set system requirements in respect of the

[13] OJ L 330, 16.12.2009, p. 10.

[14] OJ L 88, 4.4.2011, p. 5.

[15] OJ L 153, 18.6.2010, p. 13.

overall energy performance, the proper installation, and the appropriate dimensioning, adjustment and control of heating and air conditioning systems (technical building systems) which are installed in existing buildings. Member States may also apply these system requirements to new buildings. This Directive may indirectly affect the energy efficiency of products being installed, but does not set specific requirements as this is the prerogative of internal market based legislation. The EPBD does require Member States to lay down measures for regular inspection of heating systems and air conditioning systems, including reporting

Directive 2006/842/EC of 17 May 2006 on certain fluorinated gases[16] (F-Gas Directive) is under review. The proposed regulation regulates the placing on the market and the proper use and removal of refrigerants used in chillers, air conditioners and heat pumps. The proposal currently discussed identifies smaller HVAC (heat pumps and air conditioning) equipment as priority group for which substance bans could be issued. For larger air conditioning equipment no such bans have been proposed, mainly due to difficulties in applying alternative refrigerants. These difficulties are a.o. related to a higher refrigerant charge and safety aspects of alternative refrigerants (flammability of hydrocarbon refrigerants, toxicity of ammonia).

The F-Gas Directive is currently being reviewed, the impacts of such review on the current proposals shall be analysed once the final version of the Directive is published.

Other environmental legislation that may affect the products within scope are Directive 2002/95/EC of 27 January 2003on the restriction of the use of certain hazardous substances in electrical and electronic equipment[17] (RoHS Directive) and Directive 2002/96/EC of 27 January 2003on waste electrical and electronic equipment[18] (WEEE Directive). Although the RoHS Directive does not apply directly to HVAC products, the electronics in many HVAC products are in compliance with this Directive due to "spill over" effects (through the implementation of the Directive in the general product portfolio of suppliers). The WEEE Directive also does not apply directly to HVAC products, but as most products represent economically significant scrap value, most products will be taken up in existing (metal) recycling loops.

1.8.1. At Member State level

Many Member States face challenges in fulfilling the Directive 2001/81/EC of 23 October 2001 on national emission ceilings for certain atmospheric pollutants[19] (National Emissions Ceilings Directive) and Directive 2008/50/EC of 21 May 2008 on ambient air quality and cleaner air for Europe[20] (Air Quality Directive)[21] and this has led them to take a closer view of their emission inventory in order to find further means to comply.

Liquid fuel (oil driven) stationary combustion engines may be regulated by national emissions regulations that vary from country to country or even location by location,

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16 OJ L 161, 14.6.2011, p.1.

17 OJ L 37, 13.2.2002, p.19.

18 OJ L 37, 13.2.2002, p. 24.

19 OJ L 309, 27.1.2001, p. 22.

20 OJ L 152, 11.6.2008, p. 1.

21 2001/81/EC addresses SO_2, NO_x, VOC and NH_3) and Directive 2008/50/EC addresses sulphur dioxide, nitrogen dioxide and oxides of nitrogen, particulate matter, lead, benzene and carbon monoxide.

whereas non-road mobile oil driven (diesel) engines are regulated through the NRMM Directive 97/68/EC[22].

As regards gaseous fuel fired engines, as these emit NO_x a.o., they may also be subject to national regulations.

The preparatory study has only identified few applicable regulations in certain Member States as regards emissions of fuel driven equipment. Scope of products regulated and minimum emission limits may vary per Member State.

Voluntary labelling schemes exists in the Scandinavian countries (Nordic Swann ecolabel for heat pumps), Germany (Blue Angel ecolabel for heat pumps). Certification and product endorsement schemes for heat pumps exist in the UK (Energy Saving Recommended scheme and enhanced capital allowance), Netherlands, Sweden and France.

Outside the EU there are minimum energy efficiency requirements and labelling schemes for heat pumps in the USA, Canada, Australia/New-Zealand.

1.9. Proposed measures

This Working Document proposes requirements for minimum energy efficiency, maximum NO_x emissions, maximum noise emissions and information requirements for the following types of equipment:

- Warm air heaters (fuel fired or electric);
- Comfort chillers (water- and air-cooled), based on vapour compression;
- Air-to-air air conditioners (includes reversible heat pumps in cooling mode) , based on vapour compression;
- Air-to-air heat pump air heaters (includes reversible air conditioners in heating mode) , based on vapour compression;
- High temperature process chillers.

Information requirements are required for the following products:

- Sorption cycle based chillers, heat pumps and air conditioners;
- Water/brine-to-air heat pumps and air conditioners;
- Condensing units;

For fan coil units only noise requirements are set. No requirements apply to heat rejection units such as cooling towers.

[22] OJ L 59, 27.2.98, p. 1.

Table 3: Overview of parameters covered per product type.

Product type	Product category	Parameter				
		$\eta_{S,C}$	$\eta_{S,H}$	NO_x	Noise	Information
warm air units	fuel fired		✓	✓		✓
	electric		✓			✓
vapour compression cycle electric motor driven	water cooled chiller	✓			✓	✓
	air cooled chiller	✓			✓	✓
	air-to-air air conditioner (for cooling)	✓			✓	✓
	air-to-air heat pump (for heating)		✓		✓	✓
	water/brine-to-air air conditioner					✓
	water/brine-to-air heat pump					✓
	condensing units					✓
	high temperature process chiller	✓(SEPR)				✓
vapour compression cycle fuel engine driven	air cooled chiller	✓		✓	✓	✓
	air-to-air air conditioner	✓		✓	✓	✓
	air-to-air heat pump		✓	✓	✓	✓
sorption cycle, gas driven,	chillers and heat pumps					✓
Terminal equipment	fan coil units				✓	

The minimum energy efficiency requirements relate to the seasonal energy efficiency of the products, in order to align the proposals with other products within scope for which also a seasonal efficiency is the basis for requirements and products outside the scope of this Working Document (as in proposals for products covered under Lot 1, lot 15 and Lot 20).

The DG ENTR Lot 6 preparatory study on comfort cooling (and - when reversible- air heating) products also included improvement options as regards the GWP of the refrigerants used.

The proposed measure does not set requirements on maximum GWP values of refrigerants, effectively banning certain substances from products to be placed on the market, as this is the prerogative of the F-gas Regulation. Instead the measure aims to provide incentives to manufacturers for applying low GWP refrigerants by introducing less strict energy efficiency requirements for these products, similar as applied in Regulation 206/2012 with regard to ecodesign requirements for air conditioners and comfort fans.

In order to promote the uptake of refrigerants with a lower GWP than current average, the minimum efficiency requirements for comfort chillers, air conditioners and heat pumps are set less stringent by a factor of 10% if the product uses a low GWP refrigerant (GWP 675 or less).

For process chillers such a bonus was not considered, as the much longer operating hours (indicatively over 80% of annual hours) place much more emphasis on indirect emissions to be reduced through higher energy efficiency than on direct emissions.

1.10. Consistency with other policies and objectives of the Union

The Ecodesign Framework Directive 2009/125/EC is an important instrument for achieving the objective of 20 % energy savings compared with projections for 2020, and its implementation is one of the priorities in the Commission's Communication on Energy 2020 and Energy Efficiency Plan 2011. Furthermore, implementation of the Directive 2009/125/EC will contribute to the EU's target of reducing greenhouse gases by at least 20 % by 2020, or 30 % if there is an international agreement that commits other developed countries to comparable emissions reductions. The proposed Regulation is a concrete contribution to this process and is in line with the Commission Action Plan on Sustainable Consumption and Production and Sustainable Industrial Policy.

Complementary to this proposal, Member States shall set requirements on air heating and/or cooling systems under the Energy Performance of Buildings Directive 2010/31/EU. Such requirements should consider the building context of the products and may take into account other technical means resulting in lower energy use by air heating and cooling products, such as measures to reduce excess solar heat gain, measures to minimise the necessary heat energy input, and measures to take into account options related to the use of renewable energy sources (solar energy, ambient energy, wind energy and biomass).

1.11. Limitations of scope due to other ecodesign studies and measures

Commission Regulation No 206/2012 of March 6 implementing Directive 2009/125 of the European parliament and of the Council with regard to ecodesign requirements for air conditioners and comfort fans establishes requirements for both heating and cooling energy efficiency of so-called 'room air conditioners'. The scope of this Directive is limited to products of maximum 12 kW rated capacity (cooling, or heating if no cooling function is provided), using air as heat transfer medium at the condenser and/or evaporator side, so any product using a different medium as heat sink or source (water or brine) is outside the scope . The products outside the scope of Regulation No 206/2012 that use water at the condenser and/or evaporator side, as well as products that do use air at the condenser side (when heating) or evaporator side (when cooling) but with a rated capacity exceeding 12 kW are covered by the proposed Regulation.

Process chillers using medium and low (leaving water) temperatures are covered by ENTR Lot 1 on refrigerating and freezing equipment[23] and will be dealt with in a separate measure. High temperature process chillers have been included in the scope of this measure as they may be technically very similar or even identical to chillers for comfort cooling as these have a similar leaving temperature: between +2°C and +15°C, with the reference point at +6°C. Where chiller products provide in a dual function (placed on the market for both process cooling and comfort cooling) the product is required to meet both sets of requirements applicable to their performance under these functions.

Overlap of the intended scope of this Working Document with heating products covered under "Lot 1" is avoided by limiting the scope to air heating products only thereby excluding heat generators that heat water as medium for distribution of heat. Reversible chillers may be covered by both "Lot 1" regarding their performance in heating mode,

[23] Low temperature chillers apply leaving temperatures between -25°C and -8°C, with the reference point at -25ºC, medium temperature chillers apply leaving temperatures between -12°C and +3°C, with the reference point at -8ºC.

supplying heat to a hydronic system, and by the proposed measure in this document when providing space cooling. As the scope of "Lot 1" is limited to 400 kW heat output, and the chillers covered by the scope of the proposed measure may extend up to 2 MW cooling power, the reversible chillers > 400 kW cooling power are now only covered by the proposed measure, as regards the energy efficiency of their cooling performance [24].

Overlap with products using solid fuels is avoided by excluding products using this type of fuel from the scope.

Overlap with the working document on local space heaters (ENER Lot 20) is avoided by excluding air heating products of which a significant amount of heat is released in the space the products is installed, with the exception of decentralised warm air heaters as defined in this document.

Air heating or cooling products that also heat water for sanitary purposes and as such can be designated as 'combination' heaters (or coolers) were not explicitly covered by the preparatory studies as their economic and environmental significance was considered too low. The Working Document has adopted this conclusion and does not address the hot water performance of possible combination products. They may be part of the scope, as there is no exclusion from the scope of products that combine both the heating or cooling function with provision of sanitary hot water.

1.12. Form of implementing measures

The working document describes implementing measures in the form of a Regulation setting minimum ecodesign requirements.

The ecodesign requirements relate to the energy efficiency of products, the refrigerants they use and emissions from fuel combustion and/or electricity consumption. In addition there are ecodesign requirements relating to noise emissions and the provision of supplementary product information. It is proposed to give the implementing measures the form of directly applicable Regulations.

A delegated Commission Regulation for energy labelling of the products within scope is considered to be inappropriate as most if not all of these products are bought on specifications of trained personnel.

2. LEGAL ELEMENTS OF THE PROPOSAL

2.1. Definition of the scope of the proposed regulation

The scope of the proposed ecodesign Regulation includes air heating products with a minimum heating capacity of 12 kW if the product is covered by Regulation No 206/2001 or 0 kW for other air heating products, and a maximum heating capacity up to 1 MW, and cooling products with a minimum rated cooling capacity of 12 kW if the product is covered by Regulation No 206/2001) or 0 kW for other cooling products, and a maximum cooling capacity up to 2 MW, and fan coil units (with an electric input power exceeding 30 W). The proposed Regulation also covers high temperature process chillers.

24 It should be mentioned that the sales are relatively low.

The products may use gaseous or liquid fuels, including from biomass to some extent, electricity and/or heat from ambient sources. Products using solid or predominately biomass fuels are not included in the proposed Regulation.

The definitions of air heating products and cooling products follows a hierarchy, as in the Lot 1 proposal, starting with the primary function of the products. Nested definitions will refer to performance or technological characteristics of products.

Typical products that are covered by the proposed definitions are:

Air heating products, such as:

- Warm air heaters (both central[25] and decentralised, for domestic or commercial use);
- Heat pumps (which may also be reversible air conditioners) , both electric and fuel driven, outside the scope of Regulation 206/2011.

Cooling products, such as:

- Chillers, both air and water cooled, both electric and fuel driven;
- Air conditioners (which may also be reversible heat pumps), both electric and fuel driven, outside the scope of Regulation 206/2011;
- High temperature process chillers;
- Water-to-air heat pumps and air conditioners[26] (for information only);

Terminal equipment, such as:

- Fan coil units;

The scope primarily intends to cover warm air heaters (ducted or decentralised) and products that can provide in cooling or air heating on the basis of a compressor driven vapour compression cycle using either an electric motor of fuel driven engine.

Products that can provide in space cooling and air heating through the use of a sorption process (absorption or adsorption) are included in the scope but for information requirements only, as these products occupy a market niche that is different to products using vapour compression cycles using a compressor.

Although the intended scope includes 'water-/brine-to-air' air conditioners or heat pumps only information requirements will be set for these products as the sales and installed base are not significant and possible ecodesign requirements will not significantly change the end results of the measures as regards overall energy saving and emissions.

Included in the scope for noise and information requirements only is terminal equipment allowing heat transfer of a working fluid (such as water) to indoor or outdoor air, such as

25 Which in this context means the warm air is spread though ducts.

26 The designation "water-to-air" refers to the heat exchange between the refrigerant and heat sink/source media of respectively the outdoor heat exchanger (this case water) and the indoor heat exchanger (this case air).

fan coils. As these products are primarily heat exchangers only, and offer little potential for significant energy savings (savings are mainly achieved at product system level, relating to system operating temperatures a.o.) only ecodesign requirements related to noise emissions have been set.

There are products on the market that incorporate two heat generators, e.g. an electric heat pump and a gas fired warm air heater as back up or peak load heater. As these products use ambient energy (from water/brine or air) the products meet the definitions for heat pumps and shall be assessed as such.

2.2. Staged implementation of ecodesign requirements

Minimum seasonal space heating energy efficiency, minimum seasonal space cooling energy efficiency, maximum sound power level, maximum emissions of nitrogen oxides and information requirements for manufacturers are proposed to enter into force as follows:

2.2.1. Minimal seasonal space cooling efficiency

Cooling products shall correspond to requirements for minimum seasonal space cooling energy efficiency as indicated below:

Table 4: Minimum space cooling efficiency requirements

Seasonal space cooling efficiency				**1st Tier : 1st January 2017**		**2nd Tier : 1st January 2019**	
				GWP > 675	**if GWP < 675**	**GWP > 675**	**if GWP < 675**
Chillers	electric	air-to-water	<400 kW	157%	141%	161%	145%
	electric	air-to-water	>400 kW	173%	156%	185%	167%
	electric	water-to-water	<400 kW	196%	176%	200%	180%
	electric	water-to-water	>400 kW	256%	230%	272%	245%
	fuel driven	air-to-water		142%	128%	147%	132%
Air conditioners	electric	air-to-air		181%	163%	189%	170%
	fuel driven	air-to-air		167%	150%	177%	159%

A reduction of the minimum required seasonal space cooling efficiency by 10% is applicable if the product uses a refrigerant the GWP of which is below 675 kg CO_2 eq./100 year.

The GWP threshold of 675 kg CO_2 eq. is proposed in the preparatory study on air conditioning. It originates from the GWP of the refrigerant R-32. Of the low GWP refrigerants, R-32 is the one with the highest GWP. It could become an interesting alternative to R-410A and R-407C, since it has a low GWP and a possible performance increase. The main barrier to the ban of high GWP refrigerant fluids is that R-32 and low GWP refrigerants (HFOs, natural refrigerants) are flammable, to a more or less great extent.

For high temperature process chillers, the requirements are as follows:

Table 5: Minimum SPER requirements

Seasonal space cooling efficiency				1st Tier : 1st January 2017	2nd Tier : 1st January 2019
high temperature process chillers	electric	air-to-water	<400 kW	4.5	5.0
			≥400 kW	5.0	5.5
	electric	water-to-water	<400 kW	6.5	7.0
			≥400 kW & < 1000 kW	7.5	8.0
			≥ 1000 kW	8.0	8.5

High temperature process chillers, have different usage patterns than comfort chillers and air conditioners. They are used during the whole year and at high load. In consequence the requirements are to be based on the Seasonal Energy Performance Ration (SPER) of the products.

In addition, no bonus for using low GWP refrigerants is applied. As the high temperature process chiller is typically used for more than 80% of annual, indirect greenhouse gas emissions are much higher than direct emissions related to the refrigerant leakage. It is therefore not recommended to introduce a bonus that lowers requirements for energy efficiency in spite of using low GWP refrigerants.

2.2.2. Minimal seasonal space heating efficiency

Air heating products shall correspond to requirements for minimum seasonal space heating energy efficiency as indicated below:

Table 6: Minimum space heating efficiency requirements

Seasonal space heating efficiency	1st Tier : 1st January 2017	2nd Tier : 1st January 2019
Warm air heaters using gaseous or liquid fuel	72%	78%
Electric warm air heaters	30%	32%
Electric air-to-air heat pumps	141%	146%
Fuel driven air-to-air heat pumps	137%	142%

No reduction of the minimum required seasonal space heating efficiency is applicable if the product uses a refrigerant the GWP of which is below 675 kg CO_2 eq/100 year. This is because the preparatory study showed that only a very small bonus (max 5%) would already result in overall greenhouse gas emissions that exceed those of products that do not use this bonus. This is mainly because of the higher overall energy consumption associated with heating (a reduction in heating energy efficiency weighs more heavily on the total emissions).

2.2.3. Maximum NO_x emissions

Air heating products and cooling products within scope that rely on combustion of gaseous or liquid fuels shall correspond to requirements for maximum NO_x emissions as indicated in below:

Table 7: Maximum NO_x emissions mg/kWh GCV

Maximum NOx emissions (mg/kWh GCV)	1st Tier : 1st January 2017
Warm air heaters using gaseous fuels	70
Warm air heaters using liquid fuels	120
Heat pumps, comfort chillers, high temperature chillers and air conditioners, equipped with external combustion engines using gaseous fuels	70
Heat pumps, comfort chillers, high temperature chillers and air conditioners, equipped with external combustion engines using liquid fuels	120
Heat pumps, comfort chillers, high temperature chillers and air conditioners, equipped with internal combustion engines using gaseous fuels	240
Heat pumps, comfort chillers, high temperature chillers and air conditioners, equipped with internal combustion engines using liquid fuels	420

The requirements take into account the emissions achievable by different principles of combustion. The emissions of NO_x are on the basis of mg/kWh fuel input, calculated on basis of the GCV of the fuels.

2.2.4. Maximum sound power levels

Air heating products and cooling products shall correspond to requirements for maximum sound power levels (L_{WA}) as indicated below:

Table 8: Sound power levels proposed for outdoor side of comfort chillers, air-to-air air conditioners, air-to-air heat pumps and fan coil units

Maximum sound power level	1st Tier : 1st January 2017	2nd Tier : 1st January 2019
Outdoor side		
rated output < 6 kW	64	63
rated output > 6 kW and < 12 kW	69	68*
rated output ≥ 12 kW and < 30 kW	74 / 79*	73 / 78*
rated output ≥ 30 kW and < 70 kW	84	83
Non-ducted Indoor side**		
rated output < 6 kW	59	58
rated output > 6 kW and < 12 kW	64	63
rated output ≥ 12 kW and < 30 kW	69	68
rated output ≥ 30 kW and < 70 kW	79	78
Ducted Indoor side **		
rated output < 6 kW	59	58
rated output ≧ 6 kW and < 12 kW	64	63
rated output ≥ 12 kW and < 17.5 kW	69	68
rated output ≥ 17.5 kW and < 40 kW	79	78
rated output ≥ 40 kW and < 70 kW	84	83

* for packaged products the value is increased by 5 dB

** indoor noise requirements shall not apply to chillers

Requirements have been set for chillers (outdoor side only), air conditioners and heat pumps (outdoor side, non-ducted indoor side or ducted indoor side) and fan coil units (non-ducted indoor side or ducted indoor side).

2.3. Product information requirements

Product information requirements apply to all products for which specific ecodesign requirements related to energy efficiency and/or NO_x emissions have been set, these being:

- Air-cooled chillers using vapour compression and driven by electric motors or fuel driven engines;
- Water-cooled chillers using vapour compression cycles and driven by an electric motor;
- Air-to-air air conditioners using vapour compression cycles and driven by electric motors or fuel driven engines;
- Air-to-air heat pumps using vapour compression technology and driven by electric motors or fuel driven engines;

. Additionally, information requirements will apply to products for which no specific ecodesign requirements on energy efficiency or NO_x have been set, notably:

- Air or water cooled chillers using sorption technology;
- Water/brine-to-air air conditioners using either vapour compression cycles or sorption cycles;
- Water/brine-to-air heat pumps using either vapour compression cycles or sorption cycles;

The combined requirements aim at realising the potential to reduce the use-phase energy consumption, emissions of nitrogen oxides, sound power level and product information.

2.4. Measurements and calculations

Measurements and calculations of the relevant product parameters should be performed taking into account the generally recognised state-of-the-art calculation and measurement methods. In this context, manufacturers may apply reliable, accurate and reproducible measurement and calculation methods and harmonised standards set up in accordance with Article 10 of Directive 2009/125/EC, as soon as they are made available and published for that purpose in the Official Journal of the European Union. Requirements for calculation and measurement methods are specified in Annex III.

For the purposes of the calculations of seasonal space heating or cooling energy efficiency, consumption of electricity shall be multiplied by the conversion coefficient of 2,5 to represent the average equivalent primary energy input. The coefficient reflects the estimated 40 % average EU generation efficiency, as established in Directive 2012/27/EU of 25 October 2012 on energy efficiency.[27]

27 OJ L 315, 14.11.2012, p. 1.

2.5. Conformity assessment

As required in Article 8 of Directive 2009/125/EC the proposed Regulation specifies the applicable conformity assessment procedures, which should be based on an internal design control or a management system as described in Annexes IV and V of Directive 2009/125/EC. Other conformity assessment procedures of those described in Annex II of Decision 768/2008/EC[28] are considered not duly justified and proportionate to the risk.

For the purposes of conformity assessment, the technical documentation shall contain the product information set out in point xx of Annex II and the results of the measurements and calculations set out in Annex III.

2.6. Verification procedure for market surveillance purposes

When performing the market surveillance checks referred to in Article 3 (2) of Directive 2009/125/EC, the authorities of the Member States shall apply the following verification procedure for the requirements set out in Annex II.

The authorities of the Member State shall test one single unit and provide the information about testing results to the authorities of the other Member States.

The model is considered to comply with the provisions set out in the proposed Regulation, if the value declared by the manufacturer meets the requirements set out in Annex II and if the measured values meet the value declared by the manufacturer within tolerances defined by Annex VI. These tolerances are 8 % for energy efficiency parameters, 2 dB for sound power level and 20 % for emissions of nitrogen oxides.

If the result referred to in point b) is not achieved, the market surveillance authority shall randomly select three additional units for testing and provide the information about testing results to the authorities of the other Member States and to the Commission within one month of the testing.

The model is considered to comply with the provisions set out in the proposed Regulation, if the value declared by the manufacturer meets the requirements set out in Annex II and if the average of the measured values for the three additional units meet the value declared by the manufacturer within the above mentioned tolerances.

If the results referred to in point d) are not achieved, the model shall be considered not to comply with the proposed Regulation.

The verification tolerances relate only to the verification of the measured parameters by Member State authorities and shall not be used by the manufacturer or importer as an allowed tolerance to establish the values in the technical documentation.

2.7. Information requirements

In order to facilitate compliance checks, manufacturers are requested to provide information in the technical documentation referred to in the conformity assessment procedures.

[28] OJ L 218, 13.8.2008, p. 82.

2.8. Benchmarks

Based on the currently available technologies, benchmarks for high energy efficiency, low sound power levels and low emissions of nitrogen oxides are provided for best performing products.

2.9. Date for evaluation and possible revision

The main issues for a possible revision of the proposed Regulation are:

the appropriateness of setting ecodesign requirements for greenhouse gas emissions attributable to refrigerant leakage;

the appropriateness of setting stricter ecodesign requirements for air heating products or cooling products related to energy efficiency , sound power level and emissions of nitrogen oxides;

the appropriateness of setting ecodesign requirements for air heating products or cooling products specifically designed for using predominantly biomass fuels;

the validity of the value of the conversion factor for electricity.

Taking into account the time necessary to collect, analyse and complement the data in order to properly assess the technological progress on air heating products and cooling products, a review can be presented to the Consultation Forum five years after entry into force of the proposed Regulation.

2.10. Derogation

For the requirements on emissions of nitrogen oxides the proposed Regulation allows during the first three years after the entry into force of the proposed Regulation the placing on the market and/or putting into service of products (to discuss: prolongation of derogation for heat pump products) which are in conformity with the national provisions on nitrogen oxide emissions in force upon adoption of the proposed Regulation.

2.11. Legal basis

The proposed Regulation is an implementing measure pursuant to Directive 2009/125/EC, in particular its Article 15(1). The Directive is based on Article 95 of the Treaty.

2.12. Subsidiarity principle

The adoption of ecodesign measure for air heating products and cooling products by individual Member States' legislation would lead to obstacles to the free movement of goods within the Community. Such measures must therefore have the same content throughout the Community. In line with the principle of subsidiarity, it is thus appropriate for the measure in question to be adopted at Community level.

Proportionality principle

In accordance with the principle of proportionality, this measure does not go beyond what is necessary in order to achieve the objective. It offers requirements which act as an incentive for technology leaders to invest in high-efficiency heater technology. It also

leads to higher savings than any other conceivable option with minimum administrative costs.

2.13. Entry into force

The Regulation is proposed to enter into force on the twentieth day following that of its publication in the Official Journal of the European Union.

The Regulation shall be binding in its entirety and directly applicable in all Member States.

2.14. Choice of instruments

Proposed instruments: Regulation.

Other means would not be adequate for the following reason(s):

The proposed form of action is a Commission Regulation implementing Directive 2009/125/EC, because the objectives of the action can be achieved most efficiently by fully harmonised requirements throughout the EU (including the date for entry into force), thus ensuring the free movement of complying air heating products and cooling products .No costs arise for national administrations for transposition into national legislation.

2.15. Impact on other EU legislation

No EU legislation focusing specifically on energy efficiency and/or emissions of air heaters has been identified.

The measures proposed in this working document will help to harmonise these limit values as this is one of the goals of the Directive 2009/125/EC, Article 1(1).

3. BUDGETARY IMPLICATION

The proposal has no implications for the Community budget.

4. ADDITIONAL INFORMATION

4.1. Review clause/revision/sunset clause

The proposal includes a review clause.

4.2. European Economic Area

The proposed act concerns an EEA matter and should therefore extend to the European Economic Area.