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COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 22.7.2009
SEC(2009) 1016 final

COMMISSION STAFF WORKING DOCUMENT

Accompanying document to the

PROPOSAL FOR A COMMISSION REGULATION
implementing Directive 2005/32/EC with regard to Ecodesign requirements for circulators

FULL IMPACT ASSESSMENT – PART 1

{C(2009) 5677}
{SEC(2009) 1017}

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PROPOSAL FOR A COMMISSION REGULATION implementing Directive 2005/32/EC with regard to Ecodesign requirements for circulators

FULL IMPACT ASSESSMENT

Lead DG: TREN

Associated DG: ENTR

Other involved services: SG, LS, ENV, COMP, ECFIN, INFSO, MARKT, SANCO, TRADE, RTD

SECTION 1: PROCEDURAL ISSUES AND CONSULTATION OF INTERESTED PARTIES

1.1 Organisation and timing

This implementing measure is one of the priorities of the Action Plan on Energy Efficiency[1], and is part of the 2008 Catalogue of actions to be adopted by the Commission for the year 2008.[2] This proposal is part of the European Commission commitment announced in the European Economic Recovery Plan to draw up measures for products, which offer very high potential for energy savings.

The proposed implementing measure is based on the Directive 2005/32/EC of the European Parliament and of the Council establishing a framework for the Commission to set Ecodesign requirements for energy-using products[3], in the following abbreviated as "Ecodesign Directive". An energy-using product, or a group of energy-using products, shall be covered by Ecodesign implementing measures, or by self-regulation (cf. criteria in Article 19), if the Ecodesign represents significant sales volumes, while having a significant environmental impact and significant improvement potential (Article 15). The structure and content of an Ecodesign implementing measure shall follow the provisions of the Ecodesign Directive (Annex VII).

Article 16 provides the legal basis for the Commission to adopt implementing measures on this product category.

Consultation of stakeholders is based on the Ecodesign Consultation Forum as foreseen in Article 18 of the Directive (see next section for details), including the consultation of stakeholders during a preparatory technical study from March 2006 till February 2008 in order to assist the Commission in analysing the likely impacts of the planned measures.[4]

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1 COM(2006)545 final.
2 COM(2008)11 final.
3 OJ L 191 of 22.7.2005, p. 29.
4 A. de Almeida, *Motors*, EuP preparatory study for Lot 11, University of Coimbra, 18.2.2008.

Article 19 of the Directive 2005/32/EC, amended by Directive 2008/28/EC[5] foresees a regulatory procedure with scrutiny for the adoption of implementing measures. Subject to qualified majority support in the regulatory committee and after scrutiny of the European Parliament, the adoption of the measure by the Commission is planned by the end of 2009.

The Commission has carried out a study on circulators[6] in preparation of the implementing measure. On 29 May 2007 a meeting of the Ecodesign Consultation Forum established under Article 18 of the Ecodesign Directive was held (details are provided below). Article 19 of the Ecodesign Directive foresees a regulatory procedure with scrutiny for the adoption of ecodesign implementing measures. If both the Article 19 Committee and the European Parliament give a favourable opinion on the draft implementing measure and impact assessment, the adoption of the measure by the Commission is planned in 2009.

1.2 Impact Assessment Board

The main comments of the Impact Assessment Board (Opinion 11.02.2009) were that the report included all necessary elements of the analysis of impacts. However, further clarification of the problem definition, baseline scenario and a number of methodological choices, such as assumptions on employment impacts was requested, and the analysis of problems was to be more closely related to the policy options, including further information on the voluntary policy options. Also, compliance aspects were requested to be further treated.

1.3 Transparency of the consultation process

External expertise was gathered in particular in the framework of a study providing a technical, environmental and economic analysis (in the following called "preparatory study") carried out by external consultants[7] on behalf of the Commission's Directorate General for Energy and Transport (DG TREN). The preparatory studies followed the structure of the "MEEuP" ecodesign methodology[8] developed for the Commission's Directorate General for Enterprise and Industry (DG ENTR). MEEuP has been endorsed by stakeholders and is used by all ecodesign preparatory studies.

The preparatory study has followed the structure of the Ecodesign methodology (MEEuP) "Methodology Study Ecodesign of Energy-using Products"[9] developed for the Commission's Directorate General for Enterprise and Industry (DG ENTR). MEEuP has been endorsed by stakeholders and is used by all Ecodesign preparatory studies.

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5 Directive 2008/28/EC of the European Parliament and of the Council of 11 March 2008 amending Directive 2005/32/EC establishing a framework for the setting of ecodesign requirements for energy-using products, as well as Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC, as regards the implementing powers conferred on the Commission, OJ L 81, 20.3.2008, p. 48

6 Technical/economic ecodesign study on electric motors, water pumps (in commercial buildings, drinking water pumping, food industry, and agriculture), circulators in buildings and on fans for ventilation in non residential buildings was conducted on 6 March 2006 – 6 February 2008 by an external consultant AEA Technology plc (UK) in partnership with ISR University of Coimbra (Italy) and Fraunhofer Institute for Systems and Innovation Research (Germany): http://www.ecomotors.org/.

7 EuP preparatory studies "Lot 11: Motors, by A. de Almeida, final report of 28 Feb. 2008; documentation available on the ecodesign website of the Commission's Directorate General Energy and Transport http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm.

8 "Methodology for the Ecodesign of Energy Using Products", Methodology Report, final of 28 November 2005, VHK, available on DG TREN and DG ENTR ecodesign websites:
http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm
http://ec.europa.eu/enterprise/eco_design/index_en.htm

9 Methodology Report, final of 28 November 2005, VHK, available on DG TREN and DG ENTR Ecodesign websites

The circulator preparatory study has been developed in an open process, taking into account input from relevant stakeholders including manufacturers and their associations, environmental NGOs, consumer organizations, EU Member State experts, experts from third countries and international organizations as e.g. the International Energy Agency (IEA). The preparatory study provided a dedicated website[10] where interim results and further relevant materials were published regularly for timely stakeholder consultation and input. The study website was promoted on the Ecodesign-specific websites of DG TREN and DG ENTR.

Three open stakeholder meetings were organised on 29.06.2006, 21.11.2006, and 24.10.2007 in which the progress of the study was discussed in detail. The circulator study was also discussed within the European umbrella organisation Europump in its Joint Working Group, which gathers the circulator and pump industry around one table (cooperation of Europumps Technical and Standards Commissions). The Working Group provided industry input on technical and economic issues.

On 29 May 2008 a meeting of the Ecodesign Consultation Forum (established under Article 18 of the Ecodesign Directive) was held (details are provided below). The Commission services presented a working document suggesting ecodesign requirements related to circulators. One month before the meeting the working document was sent to the members of the Consultation Forum and to the secretariat of the European Parliament for information of ENVI and ITRE committees. The working document was published on the TREN Ecodesign website, and it was included in the Commission's CIRCA system alongside the stakeholder comments received in writing before and after the meeting.

1.4 Preliminary results of stakeholder consultation

The main input from the stakeholder consultation was a wide variety of comments from all relevant stakeholders in Europe and beyond during the technical/economic study and the Consultation Forum meeting. It also provided additional detailed technical and market data.

The general approach to set mandatory minimum requirements in the framework of Ecodesign is largely supported by Industry Associations but the level of requirements and the timing were questioned.

While industry preferred lower minimum energy efficiency levels with slower introduction, environmental NGOs and several Member States requested higher levels and faster implementation than proposed.

If a large quantity of the 6.5 million standalone circulators (small and large), and 7.5 million integrated circulators sold per year (2005) would have to be converted to more efficient ones, some industry would need time to gain more experiences with their processes and materials and to install new production lines, if necessary. However, it would be easier for the industry if the requirements came into force with slightly different introductory dates for standalone and boiler integrated circulators, which might be the outcome of the process given that the efficiency calculation method for boiler integrated circulators is still under development.

Environmental and consumer NGOs (and some Member States) requested information requirements to be added in form of an indication of the 'best-in-class' product or information about the products EEI (Energy Efficiency Index) level on or near the product name plate, in the product packaging and documentation.

[10] http://www.ecomotors.org/

Specific issues that were raised include the scope of the implementing measure. Several member States and NGOs requested the scope to include both standalone circulators, boiler integrated circulators and drinking water circulators. For the circulator pump industry it is particularly important that level playing field is ensured with comparable requirements on all types of circulators in order to avoid running production lines for circulators of different efficiency and design. However, requirements could be set stepwise in order to allow enough time for the necessary redesign and investments. The European boiler industry, EHI, opposes ecodesign requirements on boiler integrated circulators, mainly based on arguments related to the difficulty of measuring the efficiency of boiler integrated circulators. Finally questions were raised regarding the energy efficiency calculation method used.

For further details, see Section 4.

SECTION 2: PROBLEM DEFINITION

The report focuses on standalone and boiler integrated circulators, as a separate technical study is needed on drinking water circulators due to strict hygienic requirements and different materials used. Also, no harmonised energy efficiency measurement method exists on these circulators.

The underlying problem can be summarized as follows: although energy efficient products and technical solutions exist on the market leading to lower power consumption of standalone and boiler integrated circulators without negatively affecting their functionality or cost, the market penetration of such circulators equipment remains limited.

As requested by Article 15 of the Ecodesign Directive, the preparatory study identified the environmental aspects in relation to circulators:

(1) they have a significant environmental impact within the Community;

(2) they present significant potential for improvement without entailing excessive costs;

(3) they are not addressed properly by market forces (market failure);

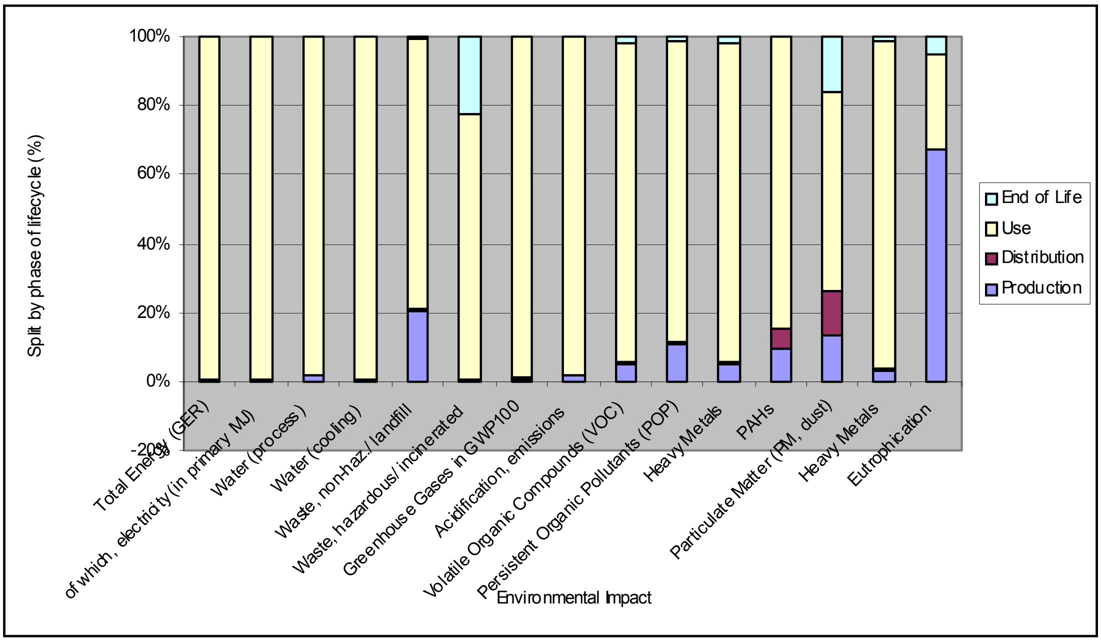
(4) they are not sufficiently addressed by other relevant Community legislation (see part on existing legislation).

2.1 Environmental impact

According to the technical/economic study on circulators[11], the dominating environmental impact of circulators is energy consumption in use, as show in figure 1. Further significant aspects are related to hazardous substances, and waste. Those aspects are already addressed by related Community legislation (see below).

[11] Technical/economic ecodesign study on electric motors, water pumps (in commercial buildings, drinking water pumping, food industry, and agriculture), circulators in buildings and on fans for ventilation in non residential buildings was conducted on 6 March 2006 – 6 February 2008 by an external consultant AEA Technology plc (UK) in partnership with ISR University of Coimbra (Italy) and Fraunhofer Institute for Systems and Innovation Research (Germany): http://www.ecomotors.org/.

Figure 2.1: Environmental impact by phase of life-cycle of a small standalone circulator (65 W)[12]



The results for large standalone and boiler integrated circulators are similar.

2.2 Improvement potential

The following table 3 illustrates the savings potential of circulators with or without the proposed policy. The action taken by the Member States under the Energy Performance of Buildings Directive will ensure that there is in principle no increase in energy consumption of circulators through the requirements on system efficiency. However, it will not lead to energy efficiency improvements of circulators as products and the energy consumption is expected to remain high without the proposed policy.

Table 2.2 Projected energy consumption and saving potential for stand alone and boiler integrated circulators.

	No-policy TWh	Policy* TWh	Improvement potential TWh
2010	52.2	51.2	1.0
2020	55.3	28.7	26.6

* *Related to scenario analysis sub-option 3.*

12 Although negligible in the light of the total environmental impacts, the seemingly high eutrophication value in the production process is due to the use of stainless steel, which contains nickel (18 %) and chromium (8 %) and in overall follows a different route from carbon steel. Replacing stainless steel with carbon steel would add other environmental impacts.

2.3 Market failures

The main market barriers hampering a larger market penetration of energy efficient circulators were identified in the preparatory study and are as follows:

1. Negative externality

Negative externality related to energy use: not all environmental costs are included in electricity prices. That is why consumer (and producer) choices are made on the basis of lower electricity price not reflecting environmental costs for the society.

2. Split incentives

The budget manager responsible for the purchase cost will not be inclined to have an interest in savings shown in budgets for running cost.

3. Asymmetric information

The purchase price is well visible and is typically higher for energy efficient circulators. On the other hand, information on running costs/cost savings is not explicit and can be obtained only with difficulties**.** The circulator market is largely an OEM (Original Equipment Manufacturer) market for boiler integrated circulators or installer market for stand alone circulators, in which OEM/installer purchases represent most part of the sales. OEM manufacturers and installers tend to base their purchases on purchase cost instead on life cycle cost, since they will not pay the circulator operating costs. Additionally, consumers are not able to demand efficient circulators, as they are not aware of their impact on energy consumption and the bill paid, despite of several information and voluntary actions taken at national levels. As a result, manufacturers or installers have no incentive to reduce the energy consumption of circulators, even though this could be done at reasonable additional cost to the manufacturer and would bring significant savings to the consumer and reduced CO_2 emissions.

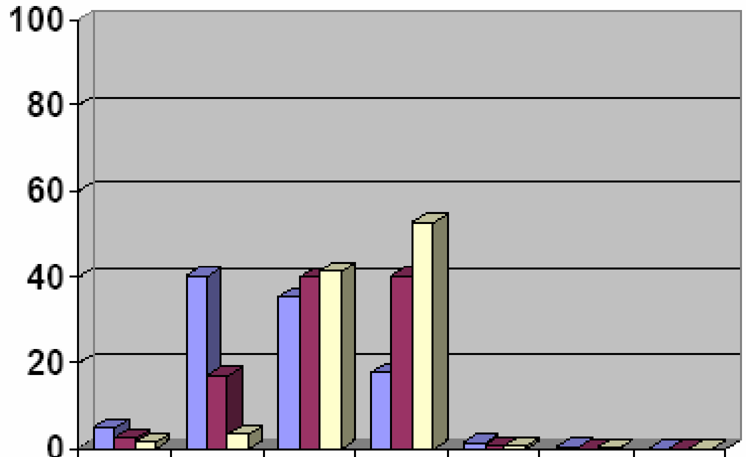
There have been energy efficient circulators on the market for a long time, but their market share has so far been low despite of an industry voluntary action to promote energy efficient circulators. Circulators included in the Europump energy labelling scheme (since January 2005) are only those used in residential and commercial heating systems within the European Union. Although the scheme has helped to ensure market transformation from the very low-efficiency circulators towards the standard circulators, it has had close to no impact on the sales of the high-efficient circulators.

2.4 Existing legislation and other relevant initiatives

There is no specific EU legislation or voluntary agreements on circulators. The action taken by the Member States under the Energy Performance of Buildings Directive is expected to ensure that energy consumption of circulators will not increase due to the requirements on system efficiency. However, energy consumption of circulators is expected to remain high without the proposed policy.

Europump voluntary energy labelling scheme (Since January 2005) includes only standalone circulators used in residential and commercial heating systems within the European Union. Although the scheme has helped to ensure market transformation from the very low-efficiency circulators towards the standard circulators (see below figure), it has only to a limited extent helped to increase the sales of the high-efficient circulators (Class A and above).

Figure 2.4.1: Market share of A-G standalone circulators in the period 2004-2006[13]

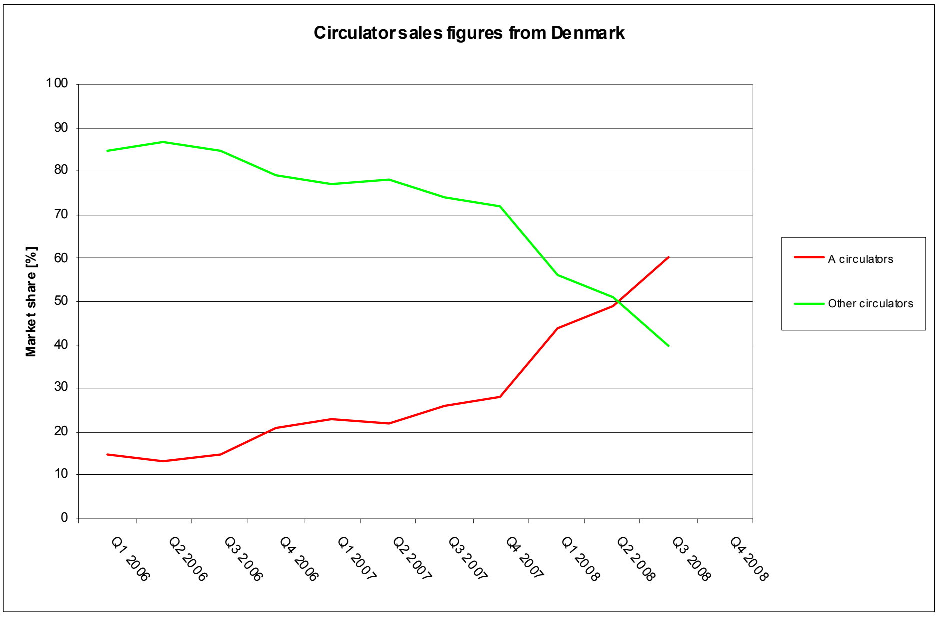


	A	B	C	D	E	F	G
2006	5	40.2	35.4	17.7	1.3	0.3	0.1
2005	2.6	17	39.8	40.2	0.8	0.1	0
2004	1.6	3.3	41.3	52.8	0.8	0.2	0

In Germany there is an eco-labelling scheme called 'Der Blaue Engel' on standalone circulators with a maximum size of 250 W. Also, several initiatives have been launched in Member States to raise awareness for (mainly) standalone circulators electricity consumption. For example, in Denmark the Danish Electricity saving Trust has in 2007 and 2008 carried out an information campaign for A-labelled pumps and circulators. In relation to this campaign the Danish Energy Association carried out an information homepage for energy efficient pumps and circulators (both glanded and glandless), with a list of specific pumps and circulators with energy labels. The Danish campaign for A-labelled circulators has resulted in a market share of A-labelled circulators on 60 % with a rising tendency.

13 A = EEI ≤ 0.3.

Figure 1.4.2: Market share of A pumps and B-G pumps in Denmark in the period 2006-2008.



The below tables show examples of the impact of the market failure to demonstrate the life-cycle cost of a small standalone 65 W circulator, a large standalone 450 W circulator and a boiler integrated circulator, respectively.

Table 2.4.1: Life-cycle cost to consumer of a small standalone circulator (65 W).[14]

	Purchase price incl. installation (EUR)	Life-time running cost (EUR) *	Total life-time cost (EUR)	Savings over life-time (EUR)
Average circulator (2005)	210	259	469	-
EEI=0.23	302	105	406	62

** Including maintenance.*

The most energy efficient small circulator is 62 EUR cheaper for the consumer over the life-cycle than the average small circulator.

14 Based on 2005 prices without inflation, with an estimated average running hours of 5000 hours/a over 10 years with electricity cost of 0.135 EUR/kWh), maintenance and repair cost excluded.

Table 2.4.2: Life-cycle cost to consumer of a large standalone circulator (450 W).[15]

	Purchase price incl. installation (EUR)	Life-time running cost (EUR)*	Total life-time cost (EUR)	Savings over life-time (EUR)
Average circulator (2005)	490	2163	2653	-
EEI=0.23	560	1019	1578	1075

** Including maintenance.*

In the case of large circulators (450 W) the estimated saving is 1075 EUR for the energy efficient circulator compared with average circulator.

Table 2.4.3: Life-cycle cost to consumer of boiler integrated circulators (90 W).[16]

	Purchase price incl. installation (EUR)	Life-time running cost (EUR)*	Total life-time cost (EUR)	Savings over life-time (EUR)
Average circulator (2005)	210	382	592	-
EEI=0.23	295	161	456	136

** Including maintenance.*

In the case of boiler integrated circulators (90 W) the estimated saving is 136 EUR for the energy efficient circulator compared with the average circulator. This market being close to totally an OEM[17] market, it is expected that the market failure will persist without intervention.

2.5 Baseline scenario for electricity consumption of circulators

In order to carry out a technical, environmental and economic analysis the preparatory study provided a classification of circulators and their usage patterns with a detailed analysis of representative base case models of each category. In particular the study has, amongst others, provided the following key elements:

– definitions to differentiate between the circulators included in this implementing measure and those excluded from its scope;

– the installed base ("stock"), annual sales, and the typical lifetime. Since Eurostat does not provide separate statistics for this particular product group, the figures have been established in a combination of data gathered from manufacturers and retailers. Estimates

[15] Based on 2005 prices without inflation, with an estimated average running hours of 5000 hours/a over 10 years with electricity cost of 0.135 EUR/kWh), maintenance and repair cost excluded.

[16] Based on 2005 prices without inflation, with an estimated average running hours of 5000 hours/a over 10 years with electricity cost of 0.135 EUR/kWh), maintenance and repair cost excluded.

[17] An original equipment manufacturer (OEM) is typically a company that uses a component made by a second company in its own product, or sells the product of the second company under its own brand.

on market trends and figures have been crosschecked with the results of the preparatory studies on Lots 1, 2 and 11;

– electricity consumption of circulators and usage patterns of these devices. The usage patterns are a key element for determining the gross electricity consumption of circulators, since these devices tend to be running permanently, regardless of whether there is a demand for hot water or not. An assumption, with the agreement of all stakeholders, regarding the operating conditions of circulators was made -70 % of the domestic circulators are typically running 5000 hours/a;

– technologies and efficiency levels yielding reduced electricity consumption and the additional costs for applying them compared to the current 'market average';

– potential trade-offs between electricity consumption and material related environmental impacts. (No trade offs were identified);

On the basis of the above mentioned elements and without taking further policy measures, the energy consumption of circulators will be 55.3 TWh (stand alone and boiler integrated circulators) in 2020. The proposed policy measure will allow reducing this consumption to about 26.6 TWh (stand alone and boiler integrated circulators). It should be noted that the scope of the policy option proposed by the preparatory study included standalone circulators, not boiler integrated circulators, which explains the difference in energy savings between the preparatory study and this Impact Assessment.

2.5.1 Electricity consumption of circulators in 2005

The preparatory study comes to the conclusion that the large penetration rate of circulators leads to very important overall electricity consumption.

For the year 2005 the preparatory study estimates the installed base of standalone circulators to 140 million and that the electricity consumption of the stock corresponds to approximately 29 TWh in EU-25 corresponding to electricity costs of about 4 bln Euro[18], and approximately 13 Mt of CO_2 emissions (see Annex 5). The impact of standalone and boiler integrated circulators is summarised in the below table.

Table 2.5.1: Electricity consumption, electricity expenditure and CO_2 emissions in 2005, 2010, 2020 and 2025 (BaU)

	2005	**2010**	**2020**	2025
Energy [TWh]	49.7	52.2	55.3	57.0
Total consumer expenditure [EUR]*	10.0	12.2	17.3	20.5
CO_2 emission [Mt CO_2]	22.8	23.9	25.3	26.1

** Purchase-, installation-, energy- and maintenance costs.*

18 average electricity price in the EU 2005: 0.136 €/kWh

2.5.2 Electricity consumption of circulators in 2020

Building on the technical, environmental and economic analysis, the baseline scenario for estimating the future evolution of the electricity consumption related to circulators on 2020 has been developed under the following conditions:

– The market trend as developed in the preparatory study leads to a slight increasing penetration rate of circulators, and, assuming typical life/usage times, the installed base of equipment will increase to approx. 175 million products in 2020

On the other hand:

– Awareness rising campaigns aiming at increasing the demand for energy efficient circulators, were rare in the EU Member States and led only in a very limited extent to to increased sales of high efficient circulators. Nevertheless the Legislator has identified circulators as being part of priority ecodesign measures, because the market failure is likely to remain unresolved since it is difficult and time consuming to address the underlying problem laid out above by promotional/awareness rising approaches aimed at individual consumers, who are not the primary customers of circulators.

– It is assumed that the aggregated circulator electricity consumption of households and tertiary sector will not be reduced by sporadic initiatives as described above.

Under these assumptions, it is expected that electricity consumption of circulators will rise to approx. 55.3 TWh per year in 2020.

2.6 Benchmarks and level of ambition

The preparatory study has shown that, depending on the functionality provided, existing cost effective technical solutions allow for circulator electricity consumption levels lower than the current market average.

Benchmarks achievable by best available technology

The preparatory study and additional input from stakeholders in the Consultation Forum has shown that the highest achievable efficiency ("benchmark") with technology currently available on the market for circulators corresponds to EEI = 0.20. However, this is subject to the application for which the circulator is designed. See more in Chapter 5.

Level of ambition

According to the Ecodesign Directive requirements on energy consumption in use should aim at the life-cycle cost minimum for the end-user. The preparatory study concludes that efficiency level of EEI ≤ 0.23[19] can be achieved for circulators with technologies, which reduce the life-cycle cost for the end-user. For some circulators higher efficiency levels can be achieved and may lead to a further reduction of life-cycle cost.

It is concluded that the efficiency level of EEI ≤ 0.23 is the appropriate level of ambition for the circulator regulation.

The technologies for achieving these efficiency levels are available, but the majority of products on the market do not meet them. In order to take into account the effects on both circulator and boiler manufacturers, it will be argued in Section 5 that the appropriate intensity of ecodesign requirements corresponds to the introduction of ecodesign requirements in two tier as follows:

[19] Corresponds to EEI ≤ 0.3 under the old calculation method used in the preparatory study.

- Tier 1, effective 2 years after entry into force of the regulation (1 January 2012); minimum energy consumption requirements on standalone circulators: EEI ≤ 0.23 and information requirement on the display of the actual efficiency of the appliances in comparison with the benchmark;
- Tier 2, effective 5 years after entry into force of the regulation; minimum energy consumption requirements on standalone and boiler integrated circulators: EEI ≤ 0.23 and information requirement on the display of the actual efficiency of the appliances in comparison with the benchmark.

2.7 EEI values – Europump calculation method

Europump developed a calculation method for the Europump voluntary agreement on energy labelling of standalone circulators that has been in use since January 2005. The method was also used in the preparatory study and in the Commission Staff Working Document to the Consultation Forum. However, stakeholders requested Europump to revise the calculation method, which now has been done; EEI values of the new calculation method are used in this Impact Assessment and in the Regulation, except if otherwise is mentioned.

The calculation method allows the calculation of the energy performance of the circulator under real life operating conditions and the classification of its performance in seven classes (A-G) with noted values of the energy efficiency index (EEI) ranging from ≤0.30 to ≥1.05. Values of EEI greater than 0.30 generally imply the use of standard induction motor technology while values of EEI less than 0.30 generally refer to permanent magnet motor technology. No further levels were defined for permanent magnet motors between 0.3 and the benchmark of 0.20.

The old calculation method included a 'distortion' factor, which showed the efficiencies of large circulators for non-domestic use being lower than their normal performance in order to avoid customers over-sizing circulators. However, the disadvantage of the distortion factor was that big circulators seemed to be abnormally inefficient against the physical nature of appliances. This was inappropriate for the purposes of the planned ecodesign requirements. Consequently, the calculation method was reviewed with new efficiency values defined for the full efficiency range of circulators. The calculation method is explained in detail in Annexes 5 and 6.

2.8 Legal basis for EU action

The Ecodesign Directive[20] and, more specifically, its Article 16 provides the legal basis for the Commission to adopt an implementing measure addressing the environmental impact of circulators.

SECTION 3: OBJECTIVES

As laid out in Section 2, the preparatory study has confirmed that a large cost effective potential for reducing the electricity consumption of circulators exists but the potential is not tapped. The general objective is to develop a policy which corrects the market failure, and which:

I) Reduce energy consumption and related CO_2 and pollutant emissions due to circulators following Community environmental priorities, such as those set out in

[20] Ecodesign Framework Directive 2005/32/EC

Decision 1600/2002/EC or in the Commissions European Climate Change Programme (ECCP);

II) Promote energy efficiency and contribute to the security of supply in the framework of the Community objective of saving 20% of the EU's energy consumption by 2020;

The Ecodesign Directive, Article 15 (5), requires that Ecodesign implementing measures meet the following criteria:

a) there shall be no significant negative impacts on the functionality of the product, from the perspective of the user;

b) health, safety and the environment shall not be adversely affected;

c) there shall be no significant negative impact on consumers in particular as regards affordability and life cycle cost of the product;

d) there shall be no significant negative impacts on industry's competitiveness;

e) in principle, the setting of an ecodesign requirement shall not have the consequence of imposing proprietary technology on manufacturers;

f) no excessive administrative burden shall be imposed on manufacturers.

SECTION 4: POLICY OPTIONS

4.1 Option 1: No EU action

This option is discarded for the following reasons:

– The market penetration of energy efficient circulators will remain limited despite the existence and cost-effectiveness of such products on the market;

– Some Member States, for instance Denmark, have in the light of the large cost effective savings potential for circulators asked the Commission to implement ambitious binding minimum energy efficiency requirements for circulators. If no harmonized action is taken it is to be expected that Member States would want to take individual, non-harmonized action on circulators. This would hamper the functioning of the internal market and add administrative burdens for manufacturers and costs for consumers, in contradiction to the goals of the Ecodesign Directive;

– There is a risk of competitive disadvantages for manufacturers designing their products to meet high-efficiency standards vis-à-vis competitors manufacturing cheaper low-efficient circulators;

– The specific mandate of the Legislator would not be respected.

4.2 Option 2: Self-regulation

This option is discarded for the following reasons:

– No initiative for self-regulation has been brought forward by the manufacturers of circulators, as they prefer minimum Ecodesign requirements due to the level playing field created. This is in particular in the light of possible imports by manufacturers not belonging to a voluntary scheme.

– A voluntary EU Energy Label scheme launched by Europump in January 2005 was discontinued by the industry in 2008 due to no impact on higher efficiency classes of circulators and in search for ecodesign requirements that are considered to better ensure level playing field. Furthermore, after the implementation of ecodesign requirements, there would be no room for the definition of the necessary energy efficiency classes under a self-regulation scheme.

– The specific mandate of the Legislator would not be respected

4.3 Option 3: Energy labelling of circulators

Energy labelling under the European energy labelling directive 92/75/EEC is discarded for the following reasons:

Two of the main objectives of labelling schemes (e.g. pursuant to 92/75/EEC) are to provide incentives for innovation and technology development, and to increase the market penetration of energy efficient products. The first aspect is not relevant, because technologies for reducing the energy consumption of circulators are largely available.

In principle labelling could be suitable to increase the market penetration of equipment with low energy consumption, and the Energy Labelling Framework Directive 92/75/EEC[21] could provide the legislative framework to target the energy consumption of circulators. However, due to the nature of markets with high share of circulators bought by installers (particulary standalone) and OEM manufacturers (particularly boiler integrated), ecodesign 'best-in-class' information requirement will be more cost-efficient, as requested by stakeholders. Also, after the implementation of the minimum efficiency requirements it would not be technically possible to distinguish seven energy efficiency classes above the set IEE levels.

Europump launched a voluntary EU Energy Label scheme for circulators in January 2005 but announced in 2008 that the voluntary scheme be discontinued. In theory, the voluntary labelling scheme could be made mandatory. However, the voluntary scheme only had an impact on the lower efficiency classes where price differences are insignificant (between B and D classes, corresponding to $0.30 < EEI < 0.45$ and $0.60 < EEI < 0.75$[22] respectively. The voluntary scheme has also been discontinued by the industry in search for ecodesign requirements. After the implementation of ecodesign requirements, there would be no room for the definition of the necessary energy efficiency classes under an energy labelling scheme.

4.4 Option 4: Ecodesign implementing measure on circulators

This option aims at improving the environmental impact of circulators, i.e., setting maximum levels for their power consumption. This sub-section contains details of the rationale for the elements of the corresponding regulation, as listed in Annex VII of the ecodesign framework directive.

The preparatory study and stakeholder comments lead to following 4 sub-options[23]:

1. EEI ≤ 0.30 mandatory by 2015-01-01;
2. EEI ≤ 0.23 mandatory by 2012-01-01;
3. EEI ≤ 0.27 mandatory for standalone circulators by 2012-01-01 and EEI ≤ 0.23 mandatory by 2015-08-01;
4. EEI ≤ 0.23 mandatory for standalone circulators by 2012-01-01 and EEI ≤ 0.19 mandatory by 2015-08-01.

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21 OJ L 297 of 13.10.1992, p. 16.

22 EEI values as in the new calculation method.

23 Annex 3

4.4.1 *Definition of the types of energy-using products covered*

The devises covered by the ecodesign measure on circulators (standalone and boiler integrated circulators) are in line with the scope of the preparatory study but broader than the policy options finally proposed by the study or the Commission Staff Working Document, which included standalone ('small' and 'large') circulators only. Boiler integrated circulators were added into the measure based on the request of stakeholders, in particularly by the boiler industry (Europump).

Standalone circulators have the primary function of ensuring the circulation of hot water for space heating purposes mainly in central heating systems. The electrical power consumption of these devises does not exceed 2500 W (in the case of twin pumps, this is the rating of each individual pump). The circulators covered by this impact assessment are so called wet running (glandless) meaning that the motor is running in the fluid that is being pumped and they are of centrifugal design.

Boiler integrated circulators have the same primary function as standalone circulators. In addition, they are also often designed for a specific boiler, and so will be fitted with a unique manifold. They are frequently rated at higher heads than standalone circulators to enable the use of (cheaper) higher resistance heat exchangers.

4.4.2 *Implementation of ecodesign requirements*

According to the 2005/32/EC, the target levels for measures should be set at least life cycle cost (LLCC), which presumes that at some point the price of the product increases so much with extra design options to save energy that the life cycle costs (purchase price plus running costs) will start to rise again. Staged introduction of requirements is necessary mainly due to the different impact on circulator and boiler manufactures. The preparatory study has shown that the proposed level is cost-effective and can be achieved with current or expected state-of-the-art technology.

Power levels

The proposed requirements on circulators are based on the revised Europump EEI calculation method with maximum power level introduced in one stage as follows:

- Two years (on 1. January 2012) after the implementing measure has come into force standalone circulators with power range from 1 W to 2500 W placed on the market should meet the following energy consumption maximum limit: EEI $\leq$ 0.27
- Five years (on 1. August 2015) after the implementing measure has come into force standalone and boiler integrated circulators with power range from 1 W to 2500 W placed on the market should meet the following energy consumption maximum limit: EEI $\leq$ 0.23.

Comments on the implementation of the Ecodesign requirements

The implementing measure is based on the revised EEI calculation method, which currently only apply to stand alone circulators and must be updated to include also other types of circulators. This work has been started by Europump.

The energy consumption maximum limits are based on the function performed by a circulator up to maximum 2500 W. The proposed minimum energy performance requirements and the timing for their introduction have been set taking into consideration:

– The least life-cycle cost of the product in accordance with Annex II of Directive 2005/32/EC.

- The expected market and technology developments. The requirements will be applicable two years after the measure has entered into force and will correspond to the available circulator technology for decreased energy use.
- Time is needed for manufacturers to redesign and manufacture new devices or to reinforce/start their operations in the OEM market in purchasing the necessary permanent magnet technology from the industry that already produce this technology. The redesign cycle from the standard motor technology to permanent magnet technology is estimated by Europump to be 5 years or more (compromise from all members of the Association). Since (1) the necessary technology has already been on the market for several years, the technology can (2) alternatively be purchased on the OEM market and as (3) most circulator manufacturers already produce permanent magnet technology, the timeframe of two years is considered to be enough. Also, as most manufacturers already produce energy efficient circulators, it is mainly a question increasing the production capacity and in gaining more experiences with processes and materials rather than in developing new products.
- As boiler manufacturers need more time to adapt to the circulator requirements, the first stage requirements should not apply on boiler integrated circulators. The more ambitious second stage requirements can apply both on standalone and boiler integrated circulators.
- Increased production series are expected to further reduce the production and purchase price. It should also be considered that discussions with the affected industry started in 2006, so the coming of the measure has been know for several years by now.
- The change in technology when moving from standard circulators (base case: EEI ≤ 0.45) to permanent magnet motor technology (the efficiency level above which 95% of currently existing PM variable speed circulators are, is EEI ≤ 0.26)[24]. Two years is given for the circulator industry to adapt to the new situation and five for the boiler industry.

Further to the comments from several Consultation Forum members that the limit value could be EEI ≤ 0.15 or lower[25], an inquiry with circulator manufacturers has been carried out and a technical explanation has been requested from Europump with verification by an expert responsible for the preparatory study, as detailed in Annexes 5 and 6. The inquiry shows that not all circulators can reach even the EEI ≤ 0.18 level and lower levels seem not physically possible for most circulators. Currently, the most efficient circulators on the market achieve the BAT level of EEI ≤ 0.20.

4.4.3 Ecodesign parameters for which no Ecodesign requirements are necessary

In accordance with Directive 2005/32/EC and the methodology used in the preparatory studies, all environmental impacts of circulators have been considered. It has been concluded that the energy consumption in the use phase is, by far, the biggest environmental impact of these devices.

Other than energy-use, an environmental aspect of circulators which has to be considered is their recyclability. Circulators contain cast iron, steel and copper and so have both a positive scrap value. It is to the professional installer's advantage (in most cases, the replacement,

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[24] Permanent magnet motor technology is explained in "Preparatory studies for Ecodesign Requirements of Ecodesigns – Lot 11 on Motors, 8 April 2008, available on Eco Motors website http://www.ecomotors.org/files/Lot11_Motors_1-8_280408_final.pdf. See also Annexes 5 and 6.

[25] Minutes of the seventh meeting of the Ecodesign Consultation Forum on 29 May 2008 - Possible Ecodesign Implementing Measures on Circulators under the Directive on Ecodesign of Energy-Using Products (2005/32/EC)

repair and disposal or recycling of circulators is managed by the installer) to send old circulators to scrap and avoid a disposal cost. The preparatory study assumes, together with the stakeholders, that due to their high value all of the metallic components are recycled. The non-metallic components are considered as not recycled. Although circulators are not covered by WEEE or RoHS, all existing circulator designs appear to be compliant with these Directives according to the preparatory study.

At this moment the possibilities to enhance the recyclability of circulators through better design are very limited. The value of the materials used and the competition in the circulator market makes manufacturers optimise material use and recyclability.

4.4.4 Measurement standard and method for estimation of the energy efficiency

The products falling within the definition set out in this implementing measure should follow the measurement standard for the measurement of the efficiency of the circulator as defined in EN 1151-1:2006 on pumps – rotor dynamic pumps – circulation pumps having a rated power not exceeding 2500 W for heating installations and domestic hot water installations. Tolerances to be used in the context of the EN1151-1:2006 and Europump method of classifying circulator performance should correspond to bands in ISO9906 grade 1, as applied in the revised and extended EN1151 work item.

The Europump method of classifying circulator performance is defined in the so-called energy efficiency index (EEI). The lower the value of the EEI is the more efficient is the circulator.

The present EEI on which this scheme is based is calculated as follows[26]:

1) Reference power consumption for the particular mechanical power consumption is found from a defined reference curve.

2) The (electrical) energy consumption of the particular circulator is calculated using the “energy weighted” method that takes account of the energy consumption of the circulator at the 25 %, 50 %, 75 % and 100 % flow points, as determined by a standard time-flow profile curve.

In the Consultation Forum meeting, Europump was requested to revise the equation for the calculation of the EEI values. This is because it used to artificially worsen the apparently higher performance of large circulators in order to avoid customers over-sizing circulators. The relation between the old and the new calculation method is explained in Annexes 5 and 6. The new classification method and efficiency values will be used in this Impact Assessment and in the Regulation.

4.4.5 Information to be provided by manufacturers

In order to facilitate compliance checks manufacturers are requested to provide information in the technical documentation referred to in Annexes IV and V of Directive 2005/32/EC in so far as they relate to the requirements laid down in this implementing measure.

Furthermore manufacturers are requested to declare the actual EEI value of the circulator on the name plate or near the name plate of the product. Also, the EEI value together with the benchmark value must be indicated in the product packaging and documentation.

[26] "Preparatory studies for Requirements of Ecodesigns – Lot 11 on electric motors, water pumps, circulators in buildings and fans for ventilation in non-residential buildings. Appendix 7: Lot 11 - ‘Circulators in building’ 8 April 2008, available on Eco Motors website http://www.ecomotors.org/files/Lot11_CirculatorsInBuildings_DraftFinalReport.pdf

Manufacturers are requested to declare the EEI value two years after the date of the entry into force of the Regulation.

4.4.6 Date for evaluation and possible revision

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

– appropriateness of the product scope;

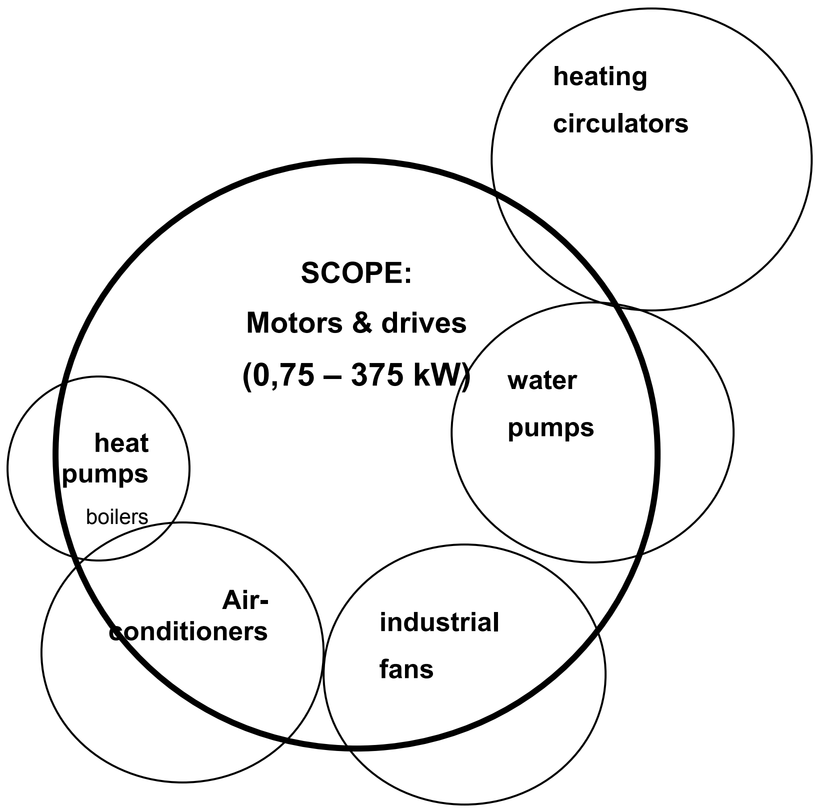
– appropriateness of the levels for the ecodesign requirements for the efficiency of allowed circulators.

The ecodesign requirements for boiler integrated and stand alone circulators become effective two years after entry into force of the Regulation. With a view to the level of requirements proposed and the still immature market for new technologies, a review can be presented to the Consultation Forum five years after entry into force of the regulation.

4.4.7 Interrelation with other ecodesign implementing measures – implications on scope

There is no overlap in environmental impact between circulators and the other industrial appliances, such as motors or their drives, as these circulators (glanded) include an integral motor that is part of the total efficiency of the circulator. The figure below shows the overlap in environmental impacts of various motor products. This overlap has been estimate to be about 30%. The overlap will be considered, when setting ecodesign requirements on (glandless) circulators/ pumps driven by an external motor.

Figure 4.4.7: on estimated overlap in energy consumption and saving potential of various motor



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SECTION 5: IMPACT ANALYSIS

Given that options 1-3 have been discarded in Section 4, this section looks into the impacts of option 4 and its sub-options. An assessment of possible sub-options as regards the "intensity" of the measure - the combination of the levels of requirements and the timing for the levels pursuant to Article 15(4f) of the Ecodesign Directive - was carried out.

This assessment follows the criteria set out in Article 15(5) of the Ecodesign Directive, and includes impacts on manufacturers in particular SMEs. The aim is to find a balance between a quick implementation for achieving the appropriate level of ambition and the associated benefits and potential burdens related e.g. to an un-planned re-design of equipment for achieving compliance with ecodesign requirements, while avoiding negative impacts for the user, in particular as related to affordability and functionality. The methodology of the analysis is explained in Annex 2.

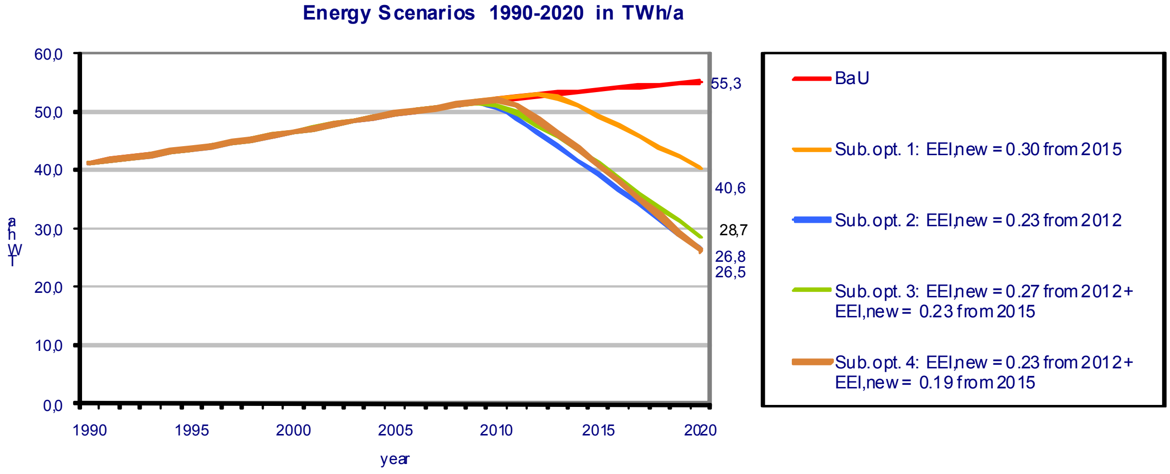
It has been shown in the technical study that the shortest possible deadline for the introduction of such requirements is two years for circulator manufacturers, who indicate that the design and manufacturing cycle is 5 years or more to upgrade from standard to permanent magnet technology. However, most manufacturers already produce permanent magnet technology and will not need such a redesign time. Circulator manufactures not yet producing this technology can either redesign or broaden their operations in the existing OEM market in purchasing the necessary motor technology while using their existing expertise on the hydraulics of the pump. The timing for the proposed requirements is also based on the fact that the ecodesign process on circulators already started in 2006. This is why it is proposed that the ecodesign requirements for standalone circulators come into force 2 years after the entry into force of the Regulation, that is, at the beginning of 2012. However, more time is needed for boiler manufacturers to adapt boilers to the circulator requirements. This is why up to 5 years is given for boiler manufacturers to adapt to the second stage circulator requirements, which are higher than the first stage requirements on standalone circulators. Both types of circulators must comply with the second stage requirements.

The sub-options and their technical feasibility were considered as discussed with stakeholders.

5.1 Economic impacts

The table and figure below shows the electricity consumption of the BAU and 4 sub-options. The BAU is an expected natural development in higher efficiency levels on 0.4 %-points per year. The 4 sub-options are compared with BAU and are further explained in Annex 3.

Figure 5.1.1: Electricity consumption of sub-options for circulators (standalone and boiler integrated)



The most important conclusions are that:

In BAU, energy consumption shows an increase from 49 TWh/year in 2005 to 55.3 TWh/year in 2020. The sub-option 2 provides the highest energy savings of 28.5 TWh.

Electricity savings per type of circulator are presented in Annex IV.

5.1.1 Consumer economics and affordability

The implementation of ambitious minimum energy efficiency requirements will increase the consumer purchase costs. However the consumer costs in the life time of the circulator will be decreased. The calculations are made for circulator with life time of 10 years. In many situations, the life time of a circulator will be longer, which will further increase the consumer benefits of choosing energy efficient circulators. The sub-option 2 provides the biggest savings of €4.3 billion.

Figure 5.1.2: Expenditure scenarios 1990-2020 for circulators (standalone and boiler integrated)

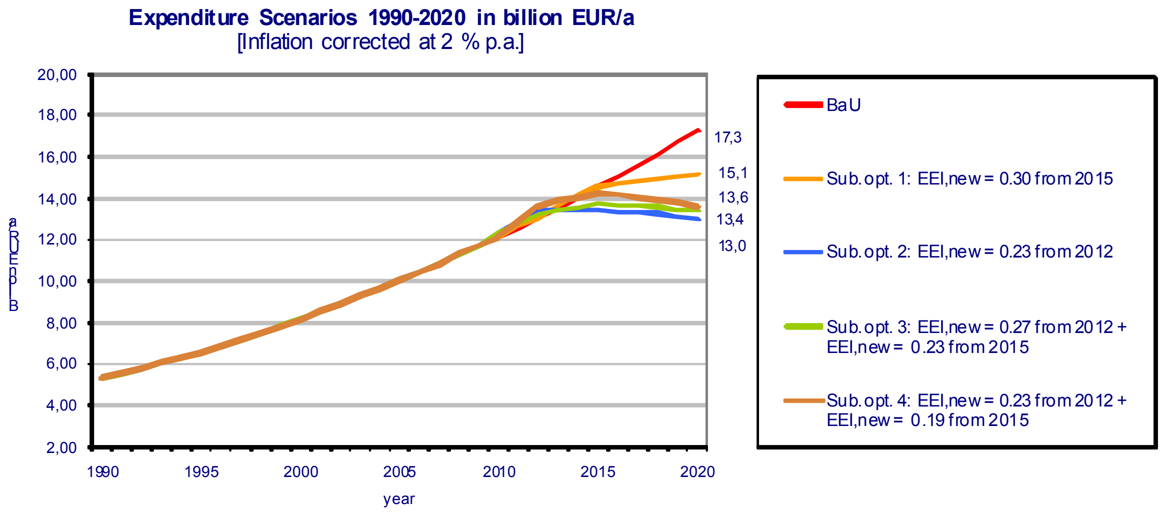


Table 5.1.1: Impact on consumers for circulators (stand alone and boiler integrated) in 2020[27]

Circulator energy efficiency class	Purchase Cost* (billion EUR)	Typical running cost (billion EUR)	Total life-cycle cost (billion EUR)	Consumer savings over total life cycle Compared to BAU (billion EUR)
BAU	5.3	11.9	17.3	-
Sub-option 1	6.3	8.8	15.1	2.2
Sub-option 2	7.1	5.9	13.0	4.3
Sub-option 3	7.1	6.3	13.4	3.9
Sub-option 4	7.8	5.8	13.6	3.7

Affordability would be lower in the low-GDP Member States but no significant impact was identified by the technical/economic study or by stakeholders; circulators are purchased only once every ten years for each system and its purchase price is very low in comparison with the heating systems in which they operate.

The average costs per product (including installation costs) in the second sub-option would be increased by 100 EUR (from 230 to 330 EUR). However, the preparatory study shows that the price of energy efficient circulators will fall by some 30 % thanks to the increased production and sales of high-efficient circulators due to the minimum ecodesign requirements.

Table 5.1.2: Average product purchase costs inclusive installation in Euros per product (inflation corrected)[28]

Avg. Purchase cost (incl. install) for year of purchase (not inflation corr.) [EUR/unit]	1990	1995	2000	2005	2010	2015	2020
Freeze 2005	305	277	253	230	208	188	170
BaU	305	277	253	230	209	190	173
Sub. opt. 1: EEI,new ≤ 0.30 from 2015	305	277	253	230	209	226	205
Sub. opt. 2: EEI,new ≤ 0.23 from 2012	305	277	253	230	232	253	230
Sub. opt. 3: EEI,new ≤ 0.27 from 2012 + EEI,new ≤ 0.23 from 2015	305	277	253	230	226	253	230
Sub. opt. 4: EEI,new ≤ 0.23 from 2012 + EEI,new ≤ 0.19 from 2015	305	277	253	230	209	277	251

It is seen that all numbers are the same for each year until 2005, as no regulation has been enforced yet. In the calculation method it is assumed that the two previous years is used as a phase-in of the regulation and hence more and more products will meet the requirements until the impact year when all products will meet the requirements.

5.1.2 Business economics and competitiveness

As inputs to determine variables for the calculation, a number of key (socio-) economic characteristics of the stakeholders were taken into account.

27 Typical running cost calculated over 10 years of life-time based on 5000 hours/a continuous operation and electricity cost of 0.135 EUR/kWh.

28 For sub-options 3 and 4, values can be considered only as theoretical based on the results of the stock model.

5.1.3 Manufacturers

Circulators are rarely used outside Europe, with all major manufacturers based in Europe. Two European manufacturers dominate the market with over 80 % market share of. Therefore a European regulation is not expected to have any effect on market shares of the European vs. non-European manufacturers. According to Europump the number of circulator manufacturers is 12 of which 5 – 6 are evaluated to be medium sized SMEs or maybe just above the employment and turnover limits in the current definition of SME's. No real small-sized SME circulator manufacturing companies exist in Europe.

Based on manufacturer web pages (see Table A.3.7 in Annex 3), five medium-size and three big manufactures already produce permanent magnet (PM) technology corresponding to the A class in the Europump voluntary scheme. Two medium-size manufacturers do not produce A class circulators (EEI ≤ 0.4) but they are part of the two biggest European circulator produces with access to PM technology. The two big manufactures represent some 80% of the total circulators market in the EU.

The strategies of individual manufacturers can be divided as follows:

- companies that produce PM motors for their own circulators;
- companies that do not produce PM motors but are part of a group/Corporate, which produces PM motors for these companies;
- companies that purchase PM motors for their circulators in the OEM market;
- companies that only produce circulators with induction motors and that must invest in designing PM circulators. The relative cost for these companies is biggest. However, an alternative strategy is to purchase the PM motor in the already existing OEM market.

Companies that do not produce A class circulators employ less than 1000 people but since these companies produce a wide range of pumps other than standalone circulators only a part of the working staff will be affected, if the company would not be able or willing to redesign its products, or purchase the necessary PM motor in the OEM market, in order to comply with the proposed ecodesign requirements.

Europump estimate for the investment cost for the industry is € 150 million in sub-option 1 and € 400 million in sub-option 2, including investment on the development of new products, modification of existing products and the depreciation of old products and machinery. The cost will be lower, if the alternative strategy of purchasing the PM motor in the OEM market is used by individual manufacturers that do not yet produce PM motors. Given the wide availability of the permanent magnet technology, the already existing OEM market, important savings and the relatively low investment cost it is considered that proposed measure is very cost-effective.

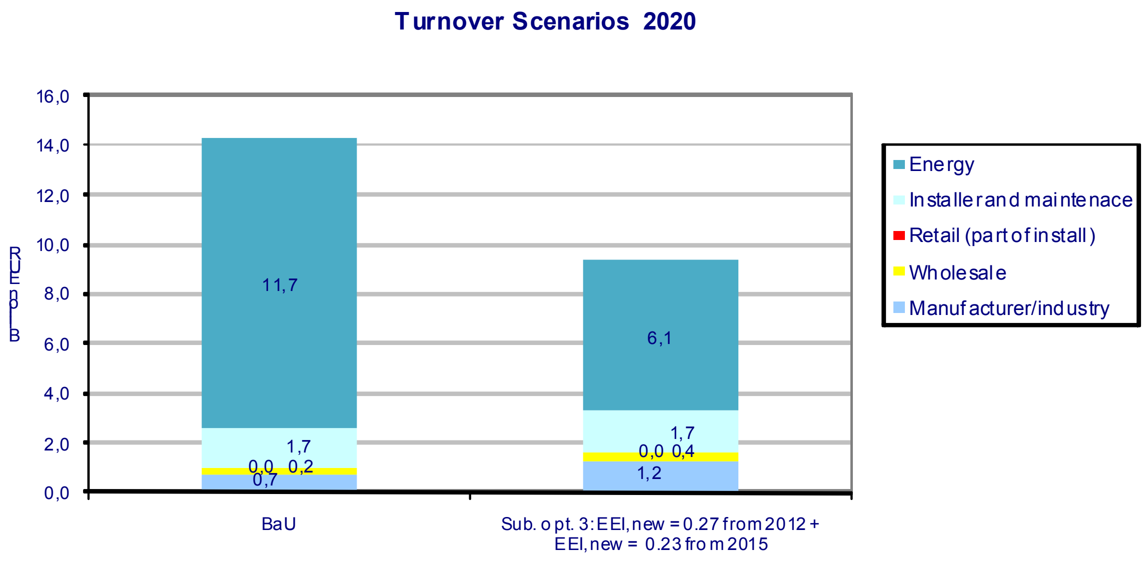
While there is no major problems in introducing ecodesign requirements, which would lead to an alleviation of the standard circulator technology, as agreed in the preparatory study and in the Consultation Forum, including in setting the minimum requirements at EEI ≤ 0.23 level, there were varying views on the feasibility of the ecodesign requirements a lower EEI value, such as EEI ≤ 0.15 or lower. The technical feasibility of a measure at EEI ≤ 0.15 or lower was verified after the Consultation Forum. The result was this level is not yet technically possible for all circulators, the BAT level being EEI ≤ 0.20. The results are explained in more detail in Annexes 5 and 6.

The second issue that came up during the impact assessment was the redesign cycle and cost for boiler industry. As a large amount of boilers can not yet use the high efficiency circulators and as the redesign cycle of a boiler is longer than the redesign cycle of a circulator, boiler industry needs more time to adapt to the circulator requirements. Requirements introduced too soon on boiler integrated circulators would thus risk phasing out several boiler manufacturers and cause serious market disturbances.

Turnover

The figure below shows the effect of the sub-options on the turnover of the various stakeholders. Only sub-option 3 is shown for reference.

Figure 5.1.7: Turnover scenarios 2020 for standalone and boiler integrated circulators



It appears that the sub-option will increase the turnover of all manufacturers, wholesalers and installers compared to the BAU. However, the energy producers will decrease turnover as a result of lower energy consumption.

The increased turnover in the product related sectors is due to increased sales of high-efficient circulators and to higher prices of the energy efficient products. The price increase will create an extra room for the necessary investments in mass production facilities and development of energy efficient circulators.

The additional manufacturer turnover in the period from 2012 – 2020 (9 years in total) is estimated to be around 4.4 billion EUR.

5.1.4 Administrative cost

The form of the proposed legislation is a regulation, which is directly applicable in all Member States. This ensures that there are no costs for national administrations due to the transposition of the implementing legislation into national legislation. The use of a regulation also provides level playing field for the industry, as the measure comes into force simultaneously in an identical form across all the Member States.

With the entry into force of new requirements, manufacturers will need to adapt the design of products not complying with the new requirements. This in general implies the need for re-assessing the conformity of products with the legal requirements. The conformity assessment is usually part of the normal internal design control of the manufacturer (or management system as in Annex V of the Directive) to ensure that the product will meet the legal requirements. Only in exceptional case (to be justified as laid down in Annex VII of the Directive) can the implementing measure require third party testing. The cost of assessing conformity of circulators is very small as this is already done as a part of standard measurements for catalogue data and CE-marking. The Europump EEI-value for a specific circulator can be calculated from just one energy measurement. As an information requirement, only the actual efficiency and the benchmark level for the circulator is requested from the manufacturer. The information that is requested on disassembly, recycling, or disposal at end-of-life of components and materials or on how to install, use and maintain the circulator are part of standard information provided by most circulator manufacturers already today. This is why no EU Standard Cost Model for administrative cost has been considered necessary for the estimation of compliance costs. Moreover:

– all manufacturers are affected by the need for a conformity assessment, because the proposed regulation creates a level playing field;

– costs for assessing conformity as a consequence of redesign are occurring only once upon introduction of the regulation;

– manufacturers/importers of circulators already now have to assess conformity of circulators, compile technical documentation and affix "CE" marking, therefore this particular measure will only marginally increase the cost of conformity assessment;

– the cost of assessing conformity is not a direct function of the volume of production, therefore the cost for assessing conformity is proportionally higher for SMEs with lower sales. However the order of magnitude of the cost involved cannot be considered as affecting their competitiveness vis-à-vis high volume producing manufacturers.

5.1.5 Impact on trade

The process for establishing Ecodesign requirements for circulators has been transparent. Before the proposed regulation is adopted by the Commission a notification under WTO-TBT[29] will be issued. Competitive disadvantages for EU manufacturers exporting affected products to third countries are not expected due to the fact that circulator markets are mainly European.

5.1.6 Other possible costs

The products required under the minimum requirements are already produced by a majority of manufacturers, but not on a large scale and not as their main product. It is assumed that the extra design and development investment will be limited but time for the start up of the large scale production is needed. There might be some problems for some (smaller) manufactures.

The timing and levels of proposed Ecodesign requirements will allow manufacturers to launch mass production of this technology, which will decrease prices from their present level.

Although the necessary technology will be available at no additional cost, some additional cost could arise by:

– redesign of products currently not compliant with the proposed requirements;

– possible adaptation of the production line.

It has to be noted that the redesign cycle in this product group requires some years for those manufacturers who do not yet produce permanent magnet motor technology. However, as an alternative business strategy, these circulators manufacturers have option of purchasing the

[29] The Technical Barriers to Trade Agreement under the World Trade Organisation aims at ensuring that regulations, standards, testing and certification procedures do not create unnecessary obstacles.

necessary permanent magnet motor technology from manufacturers already producing this technology, as this OEM industry already exists.

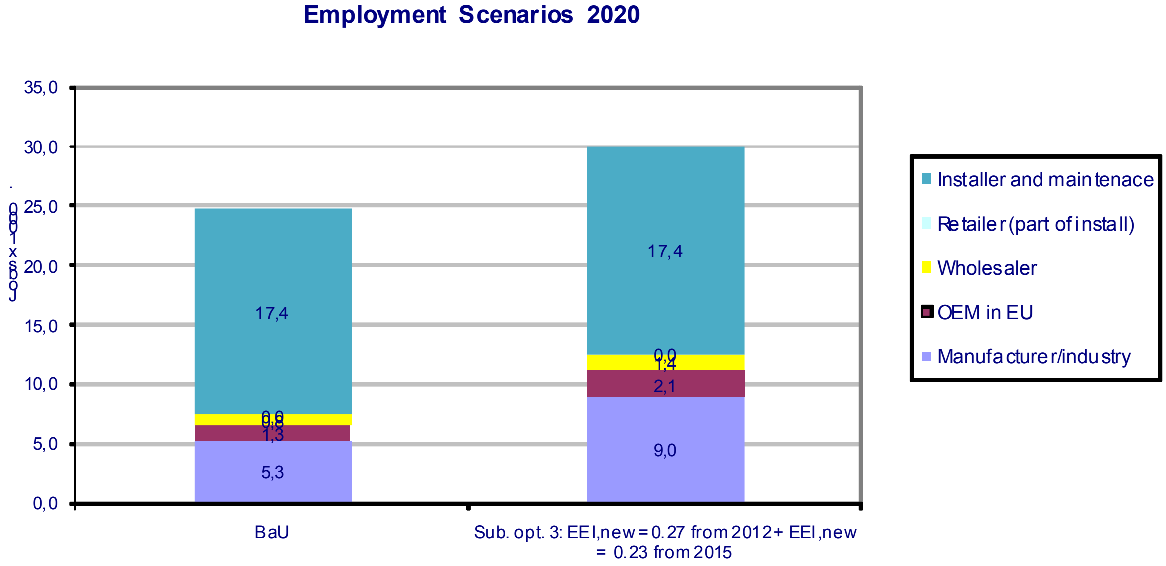
5.2 Social impacts

For analysis of employment, the ratio of turnover per employee for the manufacturer and an OEM factor typical of the sector is used. The manufacturer turnover is based on data from four circulator producers. However, as these companies account for about 85 % of the circulator sales, the data is considered sufficiently good for the needs of this impact assessment. No information from the other manufacturers has been made available for this impact assessment.

The total number of employed people with relation to circulators (standalone and boiler integrated) is estimated to be around 24,800 in 2020 with respect to the BAU. Some of the increased employment is due to an assumed increase of the circulator sale by 1.4 % per year but the job increase primarily corresponds to the increased product selling price.

The risk for a loss of jobs is considered to be very low. Results of the analyses summarised in below figure shows that the measures in the policy is expected to increase the number of jobs in manufacturing companies at installer and wholesale level.

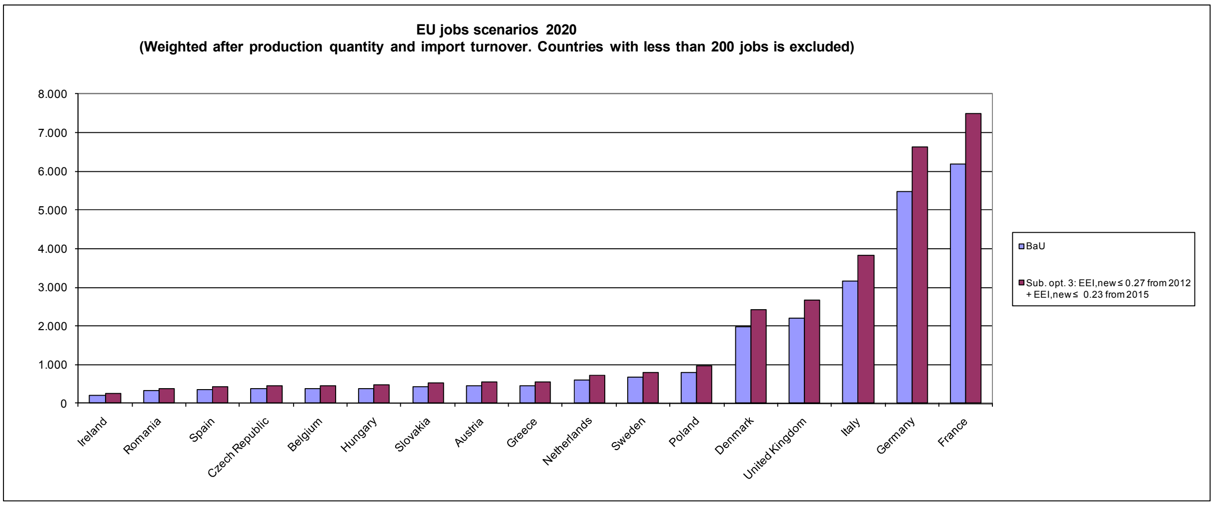
Figure 5.2.1: Employment scenarios 2020 for standalone and boiler integrated circulators



New jobs will continue to be created as a result of the proposed ecodesign requirements resulting in 5,000 new jobs in 2020.

The figure below shows the geographical distribution of jobs in several EU countries. The number of jobs is mainly dependent on the number of circulators in the various countries and existence of manufacturing facilities.

Figure 5.2.2: EU jobs scenarios 2020 standalone and boiler integrated circulators.



Health and safety

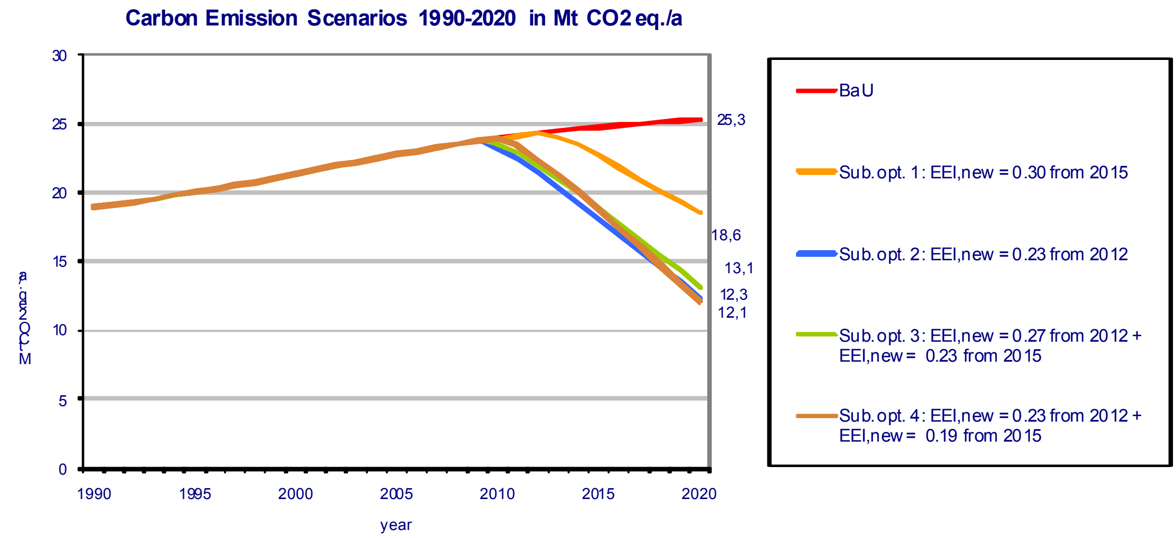
The new energy efficient technology proposed does not have any negative effects on health, safety and environment. According to the preparatory study an efficient circulator (permanent magnet type) has, despite the additional electronics used, a lower environmental impact (concerning heavy metals etc.) than the base case circulator.

In the use phase there are no differences according to health and safety aspects.

5.3 Environmental impacts

The tighter the requirements are and the sooner they become effective, the higher the accumulated electricity savings and the related CO2 emissions. The accumulated CO2 savings for sub-options 1-4 by 2020 are shown in below graph. As mentioned in the previous chapter, the carbon emission of the use phase is dominant.

Figure 5.3.1: Carbon emissions of various sub-options



By implementation of ambitious minimum energy efficiency requirements it is possible to achieve a substantial reduction of the carbon emissions and the reduction of other related environmental impacts (e.g. SO_2, NO_x, heavy metals, and nuclear waste). These benefits will peak together with the stock of circulators and will gradually decrease to vanish completely when these devices are replaced in about 10 years from the introduction of the requirement.

It should be noted that these savings relate only to the direct energy consumption of circulators. As part of central heating systems, their correct use and control has a significant impact on the energy consumption of boilers and heating systems. The savings per type of circulator are show in Annex III.

5.4 Conclusion on economic, social and environmental impacts

The below tables give an overview of impacts.

Table 5.4.1: Main impacts summarised

MAIN IMPACTS (as Art. 15, sub. 4., subsub e. of 2005/32/EC)							
			Scenario's 2020				
ENVIRONMENT							
			1	**2**	**3**	**4**	**5**
			BaU	**Sub. opt. 1: EEI,new ≤ 0.30 from 2015**	**Sub. opt. 2: EEI,new ≤ 0.23 from 2012**	**Sub. opt. 3: EEI,new ≤ 0.27 from 2012 + EEI,new ≤ 0.23 from 2015**	**Sub. opt. 4: EEI,new ≤ 0.23 from 2012 + EEI,new ≤ 0.19 from 2015**
	ENERGY	PJ/a	**199**	**146**	**97**	**103**	**95**
	GHG	Mt CO2 eq./a	**25**	**19**	**12**	**13**	**12**
	ENERGY	TWh/a	**55**	**41**	**27**	**29**	**26**
			Scenario's 2020				
CONSUMER							
			1	**2**	**3**	**4**	**5**
			BaU	**Sub. opt. 1: EEI,new ≤ 0.30 from 2015**	**Sub. opt. 2: EEI,new ≤ 0.23 from 2012**	**Sub. opt. 3: EEI,new ≤ 0.27 from 2012 + EEI,new ≤ 0.23 from 2015**	**Sub. opt. 4: EEI,new ≤ 0.23 from 2012 + EEI,new ≤ 0.19 from 2015**
EU totals*	expenditure	€ bln./a	**17.3**	**15.1**	**13.0**	**13.4**	**13.6**
	purchase costs	€ bln./a	5.3	6.3	7.1	7.1	7.8
	running costs	€ bln./a	11.9	8.8	5.9	6.3	5.8
per product*	product price	€	173	205	230	230	251
	install cost	€	90	90	90	90	90
	energy costs	€ /a	64	38	29	29	24
	discount rate payback ***	years	reference	**1.3**	**1.7**	**1.7**	**2.1**
*=all money amounts in EUR 2005 (inflation corrected)							
			Scenario's 2020				
BUSINESS							
			1	**2**	**3**	**4**	**5**
			BaU	**Sub. opt. 1: EEI,new ≤ 0.30 from 2015**	**Sub. opt. 2: EEI,new ≤ 0.23 from 2012**	**Sub. opt. 3: EEI,new ≤ 0.27 from 2012 + EEI,new ≤ 0.23 from 2015**	**Sub. opt. 4: EEI,new ≤ 0.23 from 2012 + EEI,new ≤ 0.19 from 2015**
EU turnover	manufacturers	€ bln./a	**0.7**	**1.0**	**1.2**	**1.2**	**1.4**
	whole-salers	€ bln./a	**0.2**	**0.3**	**0.4**	**0.4**	**0.4**
	installers	€ bln./a	**1.7**	**1.7**	**1.7**	**1.7**	**1.7**
EMPLOYMENT							
employment (jobs)	industry EU (incl OEM)	'000	6.6	9.1	11.1	11.1	12.8
	industry non-EU	'000	0.3	0.4	0.5	0.5	0.6
	whole-sale	'000	0.8	1.2	1.4	1.4	1.6
	installers	'000	17.4	17.4	17.4	17.4	17.4
	TOTAL	'000	**25.1**	**28.1**	**30.5**	**30.4**	**32.5**
	of which EU	'000	24.8	27.7	30.0	29.9	31.8
	EXTRA EU jobs	'000	reference	**2.9**	**5.2**	**5.1**	**7.0**
	of which SME**		reference	1.4	2.6	2.5	3.5
**= partitioning 50% industry, 50% wholesalers and 80% installers							

The below table summarizes the considerations on the impacts of the four main options and assesses them on a relative scale: +, ++, +++[30].

Table 5.4.2: Summary of impacts per sub-option				
	Sub-option 1	**Sub-option 2**	**Sub-option 3**	**Sub-option 4**
IMPACTS	EEI ≤ 0.30 from 2015	EE I ≤ 0.23 from 2012	EE I ≤ 0.27 from 2012 + EE I ≤ 0.23 from 2015	EE I ≤ 0.23 from 2012 + EE I ≤ 0.19 from 2015
Economic	+	+++	++	++
Social	+	++	++	+++
Environmental	+	+++	++	++
Industry	+++	-	++	-

The analysis shows that the sub-option 3 provides the best balance between benefits and cost.

5.5 Comparison of sub-options for introductory dates

This chapter considers the impact, if the implementation year is moved back or postponed by one year for all sub-options. The comparative figures and tables for the implementation of requirement one year earlier vs. later are provided in Annex 3.

The analysis shows that earlier implementation leads to a very small additional increase in electricity and CO2 emissions savings by 2020 and the savings will be realized one year later in any case. The risk with boiler manufacturers not yet being familiar with the use of permanent magnet technology increase, when the time period for the entry into force of the circulator requirements shortens.

The analysis also shows that slower implementation leads to a small decrease in electricity and CO2 emissions savings by 2020. However, two years is considered enough for the seven manufacturers already producing the necessary technology to fine-tune its performance, if necessary, and to increase production. Also, for the five manufacturers with less experiences with permanent magnet technology, two years is considered to be long time enough to redesign the circulator production, or alternatively to purchase the necessary technology in the OEM market. However, boiler industry needs more time to adapt.

5.6 Sensitivities considered

Sensitivities are considered for two variables:

- an decreased electricity price;
- an increased product price.

All analyses are performed for the year 2020.

The impact of ecodesign requirements on the affordability of products would in principle require an assessment of income structure of the users of circulators. The purchase cost increases against the life cycle cost reduction of circulators in the light of the proposed policy measure, as shown in the below table. Given the minor cost impact of a circulator in relation to the heating system of which it is part of, and the considerable savings in the use phase, affordability is not expected to be negatively affected even for low income households. The tables below show the impacts, if the electricity price is doubled.

[30] Based on Article 15 of 2005/32/EC, there should be no 'negative' impacts.

In the reference situation the discount rate payback[31] is used as indicator in the following table. The discount rate is set to 4 %.

			Scenario's 2020				
CONSUMER							
			1	**2**	**3**	**4**	**5**
			BaU	**Sub. opt. 1: EEI,new ≤ 0.30 from 2015**	**Sub. opt. 2: EEI,new ≤ 0.23 from 2012**	**Sub. opt. 3: EEI,new ≤ 0.27 from 2012 + EEI,new ≤ 0.23 from 2015**	**Sub. opt. 4: EEI,new ≤ 0.23 from 2012 + EEI,new ≤ 0.19 from 2015**
EU totals*	expenditure	€ bln./a	**17.3**	**15.1**	**13.0**	**13.3**	**13.5**
	purchase costs	€ bln./a	5.3	6.3	7.1	7.1	7.8
	running costs	€ bln./a	11.9	8.8	5.9	6.2	5.8
per product*	product price	€	173	205	230	230	251
	install cost	€	90	90	90	90	90
	energy costs	€ /a	64	38	29	29	24
	discount rate payback ***	years	reference	**1.3**	**1.7**	**1.7**	**2.1**
*=all money amounts in EUR 2005 (inflation corrected)							
*** payback is inflation and discount rate corrected							

Table 5.6.1: Simple payback period (SPP) when decreased electricity price by 50 %

			Scenario's 2020				
CONSUMER							
			1	**2**	**3**	**4**	**5**
			BaU	**Sub. opt. 1: EEI,new ≤ 0.30 from 2015**	**Sub. opt. 2: EEI,new ≤ 0.23 from 2012**	**Sub. opt. 3: EEI,new ≤ 0.27 from 2012 + EEI,new ≤ 0.23 from 2015**	**Sub. opt. 4: EEI,new ≤ 0.23 from 2012 + EEI,new ≤ 0.19 from 2015**
EU totals*	expenditure	€ bln./a	**11.4**	**10.8**	**10.2**	**10.3**	**10.8**
	purchase costs	€ bln./a	5.3	6.3	7.1	7.1	7.8
	running costs	€ bln./a	6.1	4.5	3.0	3.2	3.0
per product*	product price	€	173	205	230	230	251
	install cost	€	90	90	90	90	90
	energy costs	€ /a	32	19	15	15	12
	discount rate payback ***	years	reference	**2.7**	**3.6**	**3.6**	**4.4**
*=all money amounts in EUR 2005 (inflation corrected)							
*** payback is inflation and discount rate corrected							

The below table shows the impact on consumers, if product price is increased.

[31] As described in Annexes to Impact Assessment Guidelines, 15 Januar 2009

Table 5.6.3: Simple payback period (SPP) when increased product price (increased product price from 0.6 EUR/%-point to 1.2 EUR/ %-point).

			Scenario's 2020				
CONSUMER							
			1	**2**	**3**	**4**	**5**
			BaU	**Sub. opt. 1: EEI,new ≤ 0.30 from 2015**	**Sub. opt. 2: EEI,new ≤ 0.23 from 2012**	**Sub. opt. 3: EEI,new ≤ 0.27 from 2012 + EEI,new ≤ 0.23 from 2015**	**Sub. opt. 4: EEI,new ≤ 0.23 from 2012 + EEI,new ≤ 0.19 from 2015**
EU totals*	expenditure	€ bln./a	**17.3**	**16.2**	**14.9**	**15.2**	**16.1**
	purchase costs	€ bln./a	5.4	7.4	9.0	8.9	10.3
	running costs	€ bln./a	11.9	8.8	5.9	6.3	5.8
per product*	product price	€	175	240	290	289	333
	install cost	€	90	90	90	90	90
	energy costs	€ /a	64	38	29	29	24
	discount rate payback ***	years	reference	**2.7**	**3.6**	**3.6**	**4.4**
*=all money amounts in EUR 2005 (inflation corrected)							
*** payback is inflation and discount rate corrected							

In summary, halfing electricity price shows a discount rate payback time between 2.7 and 4.4 years for the considered sub-options while strong increase in product price leads to a similar variation in discount rate payback time between 2.7 and 4.4 years. All payback periods are cost-efficient solutions for a product having a lifetime of at least 10 years. It is therefore considered that the proposed regulation is very advantageous for consumers; there are no negative impact of the measure on consumer even in possible very strong product or electricity price increase.

SECTION 6: CONCLUSIONS

It has been concluded that Ecodesign implementing measure on circulators (sub-option 3) should become effective two and five years after entry into force of the proposed Regulation (on 1. January 2012 vs. 1. August 2015). The second introductory date is aligned with the heating season in order to cause the minimum of disturbances on the circulator and boiler markets. This would provide the appropriate balance between an improved environmental impact of circulators, including technical feasibility, and cost benefits for the user/consumer (due to reduced electricity consumption), on the one hand, and possible additional burdens for manufacturers (in particular due to unplanned re-design) on the other hand. In particular:

- cost-effective reduction of electricity losses in the circulator motor;
- a payback time of two year ensures that the requirements are affordable to the consumers;
- correction of market failures and proper functioning of the internal market;
- no significant administrative burdens for manufacturers or retailers;
- increased purchase cost, including economies of scale for effective technologies, which would be largely overcompensated by savings during the use-phase of the product;
- that the specific mandate of the Legislator is respected;
- reduction of the electricity consumption of about 26.6 TWh, corresponding to savings of 3.9 billion EUR and 12.2 Mt of CO_2 by 2020 compared to the "no action" option.

- a clear legal framework for product design which leaves flexibility for manufacturers to achieve the energy efficiency levels already before the coming into force of the measure;
- costs for re-design and re-assessment upon introduction of the regulation, which are limited in absolute terms, and not significant in relative terms (per product);
- fair competition by creation of a level playing field;
- no significant impacts on the competitiveness of industry, and in particular SMEs due to fact the most manufacturers already manufacturer circulators based on permanent magnet technology;
- positive impact on employment;
- no identified impact on trade.

SECTION 7: MONITORING AND EVALUATION

The main monitoring element will be the tests carried out for new product conformity as indicated in the description of the policy option 2. Products placed on the Community market have to comply with the requirements set by the proposed regulation, as expressed by the CE marking. Monitoring of the impacts is mainly done by market surveillance carried out by Member State authorities ensuring that the requirements are met.

The appropriateness of scope, definitions and concepts will be monitored by the ongoing dialogue with stakeholders and Member States. Input is also expected from work carried out in the context of upcoming Ecodesign activities on further product categories, and related activities. Contributions are also expected from international cooperation as e.g. in the framework of the IEA Implementing Agreement for Energy Efficiency End-Use Equipment.

The main issues for a possible revision of the proposed regulation are

– the appropriateness of the levels for the specific Ecodesign requirements;

– the appropriateness of the product scope;

– the possibility to enhance other environmental impacts than energy in the use phase.

Taking into account the time necessary for collecting, analysing and complementing the data and experiences in order to properly assess the technological progress, a review can be presented to the Consultation Forum no later than 5 years after entry into force of the regulation.

EN

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 22.7.2009
SEC(2009) 1016 final

COMMISSION STAFF WORKING DOCUMENT

Accompanying document to the

PROPOSAL FOR A COMMISSION REGULATION
implementing Directive 2005/32/EC with regard to Ecodesign requirements for circulators

FULL IMPACT ASSESSMENT – PART 2

{C(2009) 5677}
{SEC(2009) 1017}

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EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENERGY AND TRANSPORT

DIRECTORATE D - New and Renewable Energy Sources, Energy Efficiency & Innovation
Energy efficiency of products & Intelligent Energy – Europe

Brussels, 22.09.2008

SUMMARY MINUTES

Possible Ecodesign Implementing Measures on Circulators under the Directive on the Ecodesign of Energy-Using Products (2005/32/EC)

Seventh meeting of the Ecodesign Consultation Forum (27th May 2008)

Centre Albert Borschette (CCAB), Room OA, Rue Froissart 36, 1049 Brussels

EC Participants: André BRISAER (Chairman), Ismo GRÖNROOS-SAIKKALA (TREN/D3), Villo LELKES (TREN/D3),

Introduction

The Chairman welcomed the group and introduced Hugh Falkner who was responsible for the Eco-design preparatory study on circulators.

The Commission Staff Working Document (CSWD) on possible eco design requirements for standalone glandless circulators was presented (see presentation circulated together with these draft minutes). The CSWD was available 4 weeks prior to the meeting on http://ec.europa.eu/energy/demand/legislation/eco_design_en.htm#consultation_forum.

The CSWD covers circulators for clean water and proposes that if a circulator can be used either as a standalone product or fitted inside a boiler, then it is covered under the proposed implementing measure. The Europump classification scheme used for circulators is currently being updated. The efficiency levels of the scheme correspond to the existing Europump voluntary labelling scheme. It has been considered that there is no need for further labelling schemes after the introduction of the proposed requirements.

Least life cycle cost considerations allow setting requirements at the level of EEI 0.2 for all sizes of circulators (pending revision of the reference calculations underpinning the Europump classification scheme, as it affects larger circulators). As cost issues also need to be looked at, it was suggested to give industry three years to adapt.

The plan will be to review the requirements no longer than 5 years after the measures come into force.

Europump presentation

Europump presentation explained the existing voluntary Europump A - G labelling scheme (see presentation circulated together with these draft minutes). EN standard 1151 is the only common standard for fixed speed circulators and is currently being revised, with an extended scope to include variable speed circulators under 200 W. There is also a standard covering 200 W – 2500 W circulators under development. The Europump classification scheme is also being revised with the aim of having an EEI value that presents the same technological challenge for all sizes of circulators.

Stakeholder's views:

When asked how the proposed measures and the efficiency levels on which the voluntary labelling scheme is based could fit together, Europump explained that the **Europump classification scheme**, when it was developed in 2001, gave a handicap to the bigger circulators, as they tend to be more efficient, and Europump did not want people choosing oversized circulators just for the sake of efficiency.

ECOS (representing environmental NGO's) does not support the non-linearity of the classification scheme, as there is no physical logic to separate the two circulator sizes. ECOS would like to see just one efficiency line. Europump stated they are just calibrating the scheme to the market today. The starting points were different in 2001 for both sizes; there was more room for improvement for the smaller circulators so the label and the classification scheme took that into account.

Commission asked if the target should be EEI < 0.2, if the technology exists to reach such levels, as it would still be below LLCC level. Europump feels that once the methodology is updated it will be possible also for bigger circulators to meet the "A*" (EEI < 0.3) level. The first priority is to get the classification scheme right.

Germany was concerned about the level of ambition in the CSWD, as legal requirements are based on an outdated scheme (A - G from 2001) that is under revision. Also, there is no agreed standard yet and Germany would like to see the classification scheme included in the implementing measure. Germany stressed that before a vote is taken in the Committee the classification scheme will have to be clear.

ECOS commented that higher targets (EEI < 0.2) for smaller circulators could be reached sooner with a different approach. The transparency of the classification scheme also needs to be improved. The level of ambition and the methodology should be looked at separately.

The **scope** of the envisaged implementing measure was discussed. **Boiler integrated circulators** are considered in Lot 1 study. ECOS reiterated the position that a coordinated approach for ambition and methodology across Lots was essential. However, boiler integrated circulators can have different functions and the classification scheme might need to be adjusted for boiler integrated circulators. ECOS requested to consider the inclusion of boiler integrated circulators, including considerations on drinking water circulators, into the scope of the proposed measure.

The Chairman asked if there was a consistent approach to the measurement of both types of circulators. EHI replied that certain approaches used in the measurement of standalone circulators are not used in boiler integrated circulators, which could give a misleading advantage to standalone circulators.

The Chairman commented that it would make sense to cover all types of circulators and the requirements could be adjusted according to different calculation/measurement methods. There would be more consistency in terms of types of circulators and timing. ECOS agreed more coordination would be important. Europump and EHI supported.

The UK supported consistency but was concerned that, in a Lot 1 stakeholder's meeting a week earlier, boiler integrated circulators were told to be dealt with under Lot 11. The Chairman assured that circulators will be dealt with adequate consistency. Mr. Falkner supported the idea of dealing with all relevant types of circulators within one measure, as far as possible.

Commission asked how much work would be needed to develop efficiency levels for boiler integrated and drinking water circulators and how quickly an updated method could be developed. Mr. Falkner assured that the basis is already established and there are no big barriers to having the necessary method and efficiency levels in place for boiler integrated circulators on time. Europump agreed that it can be ready in the autumn. ECOS welcomed this and suggested that the final requirements could contain more transparent information and reiterated that ECOS would like to see two tiers and a coordinated methodology for all circulators.

The Chairman asked about **impacts for industry**. In principle, costs can be passed on to end-users. The study shows that when the purchase price of a more efficient circulator increases the life cycle cost gets slower. This means that the lower running cost compensate the extra investment cost by the industry. If the higher production cost of the more efficient circulators is below the least life cycle cost (LLCC) level, industry investment is not a problem for other stakeholders, as the increased cost is paid by the consumer, who will benefit from reduced life cycle cost, particularly as the cost of a circulator is minor for a household. Europump agreed that the real issue was capacity. Many of the 6.5 million standalone circulators sold per year would have to be converted to more efficient ones; time for development for testing and manufacturing is needed.

Lithuania asked how much investment cost would be required to comply with the proposed requirements. Europump estimated this would involve shifting to permanent magnet motor technology with an estimated total cost of 150 million Euro for the European industry.

ECOS and the Netherlands had queries on the data behind the presented 150 million cost for industry, which was considered excessive. Mr. Falkner confirmed that the cost calculation to the consumer is based on current prices. Furthermore, when sales of high-efficient circulators increase, the cost for industry will come down with higher production volume.

ECOS commented that they do not find the requirements dynamic, as there is only one requirement and they would like to see a second mandatory tier introduced at the level of EEI < 0.2.

The Chairman asked if targeting a second tier would make the capacity issue more difficult. Europump clarified that only a few small circulators reach the EEI below 0.2 and that the challenge is a change in technology. The Chairman concluded that bigger circulators (sales of 1 million per year) are the main problem, not due to physics but due to the distorted classification scheme. When the scheme is updated, the outlook for equal treatment of circulators of different sizes is positive.

The Netherlands queried how useful **energy labelling,** on top of tough minimum requirements, would be and commented that it would be important to display the energy efficiency index on the circulator pump. ECEEE agreed that the index or other similar indicator should be provided and displayed.

Europump noted that a lot of information is already given on the products and in product documentation and felt it is important not to mix up legal and voluntary requirements. The index is not helpful as the tolerance level needs to be taken into account, it is best to display the efficiency in terms of A or B or C.

Sweden commented that labelling will not have a big role to play after the introduction of the proposed minimum requirements. There will probably only be one premium class and Sweden asked how best to encourage purchasing of this class. Possibly include procurement requirements for premium pumps? ECOS called for mandatory information requirements to aid purchasing.

The Chairman clarified that it is not possible under the current framework to impose procurement rules and the Energy Labelling Framework Directive would have to be revised in order to do this.

France asked for the industry position on **standby** mode with regard to circulators. Europump clarified that for the majority of circulators, standby is not an issue. Usually circulators are either switched on or switched off but in a small number of cases they can be found in BMS systems for security, for example.

End of summary minutes.

ANNEX 2: IMPACT ASSESSMENT METHODOLOGY

The impact analysis uses the scenario and variable **inputs** as defined in the following paragraphs.

The **calculation method** for the scenario analysis is a so-called **Stock Model,** which means that it is derived from accumulated annual sales and waste figures for circulators over the period 1990-2020 (with a start-up period 1960-1990).

The stock-model sets the pace for the sub-options. The direction is determined by trends in terms of increase/decrease in

- number of households,
- ownership (number of circulators per households)
- consumer behaviour, e.g. running hours per year
- and
- energy efficiency

The first three are a given and derived from statistics and trends as described in the preparatory study. The main variable in the various sub-options is energy and its derived parameters.

Outputs for each sub-option are:

- Energy consumption in PJ/a (conversion 1 TWh= 3.6 PJ);
- Carbon emission in Mt C02 equivalent/a, and the values from EcoReport in the preparatory study;
- Consumer-related economical parameters: purchase price, energy expenditure, maintenance costs and total expenditure in € bln./a. [2005 Euro, inflation-corrected at 2 %/a];
- Business-related economical parameters: turnover per sector (industry, wholesale, retail, etc.);
- Employment: calculating job creation/loss using the sector-specific turnover per employee.

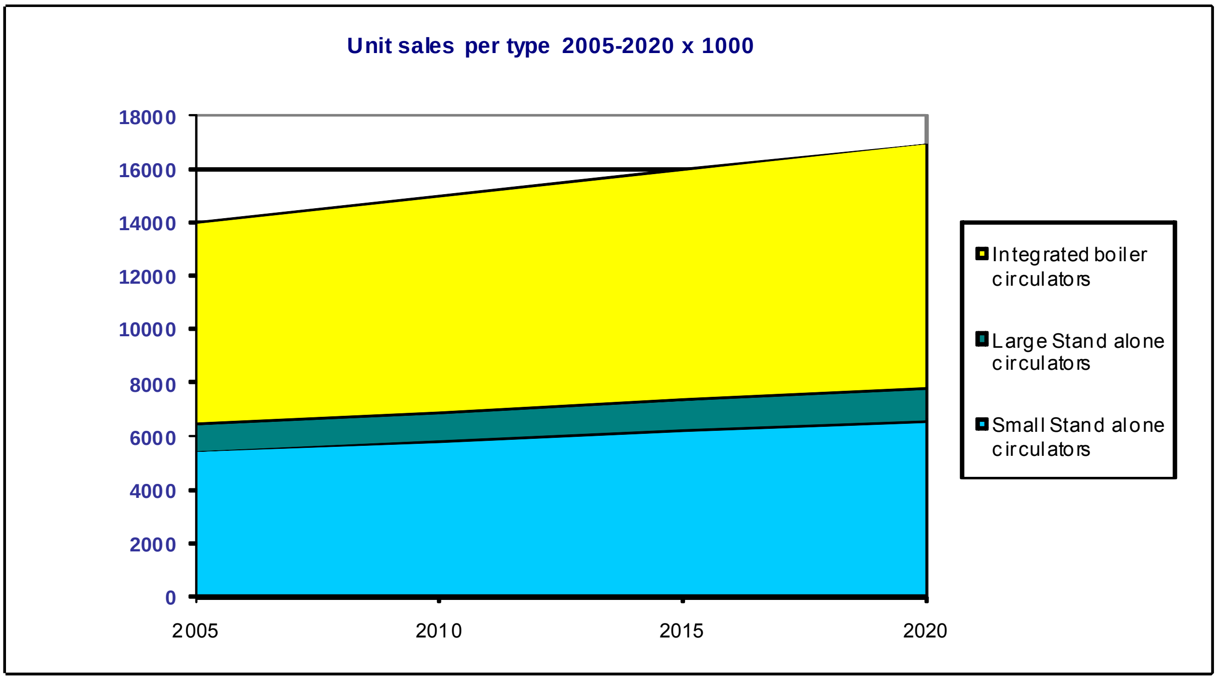
Final outcomes are presented at aggregation level (totals), but in the intermediate stages a distinction is made by the typology and by size.

For economic calculations, an average energy price in €/ kWh primary energy is built from:

- Electricity rates per kWh primary energy in the base-year 2005. E.g. electricity € 0.15/kWhe (→ € 0,060/kWh primary);
- Annual (long-term 2000-2006 average) price rate increase of the individual energy sources. E.g. 2 % for electric.

The preparatory study has found rather large discrepancy between Eurostate sales data for EU 27 and circulator sales data provided by Europump. The Eurostate sales data does not distinquish clearly enough between different types of pumps (glanded and glandless vs. water pumps and other pumps). The study chooses to use the Europump data. The Europump data are used also in this impact assessment. However it is important to notice that there is a certain margin of uncertainty in the sale and stock data used in the analysis.

Figure A.1. Annual circulator sale in the period from 2005 to 2020 (x1000)



ANNEX 3: BAU OPTION, BASE CASE AND TABLES ON COMPARIONS OF INTRODUCTORY DATES

BAU and base case 2005

The base case represents the average product sold in the reference year 2005. The 2005 circulator unit sales amount to about 14 million circulators, of which 6.500 million units are standalone (small and large) and 7.500 million units are boiler integrated circulators.

The BAU (and other sub-options) is carried out for three typical circulator sizes, which are considered being the representative size of circulators within the groups of small and large standalone circulators and boiler integrated circulators. Data on circulators size, price and sales in 2005 is shown in table below.

The selection of base case and the price and sales data are based on the preparatory study. According to the study there is a margin of uncertainty in the sales data, which causes a corresponding uncertainty in the stock data used in the analysis.

Table A.3.1. Main data for circulator base cases (in 2005)

Type of circulator	**Typical rated capacity** Watt	**Selected base case size** Watt	**Price** Euro/unit	**Price including installation** Euro/unit	**Estimted sales** 1000 Units in 2005
Small standalone	40 - 250	65	120	210	5,500
Large standalone	< 2,500	450	400	490	1,000
Boiler integrated	90 - 120	90	120	210	7,500

The aggregated scenario for all three types of circulators is carried on the basis of an average weighted energy consumption (average of standalone small and large and boiler integrated circulators taking into account the number of each circulator type). The average weighted energy consumption for small and large standalone and boiler integrated circulators is estimated to be 410 kWh per year in 2005.

The values for the period from 1990 until 2025 appear from table 12 (products in the stock) and 13 (products on the market/for sale).

The annual unit sale and the estimated size of the stock in the period from 1990 until 2025 are shown in table below. The annual sale and the stock are assumed to be the same in all sub-options.

Table A.3.2. Total circulator sales, stock, and average weighted energy consumption of circulator stock (BAU).

Energy, sales and stock	1990	1995	2000	2005	2010	2015	2020
Energy per unit in the stock (BaU) kWh/a	362	355	348	341	335	328	321
Sales units (000)	10220	11480	12740	14000	14980	15960	16940
Stock units (000)	106370	114550	126280	140140	153160	164780	175560

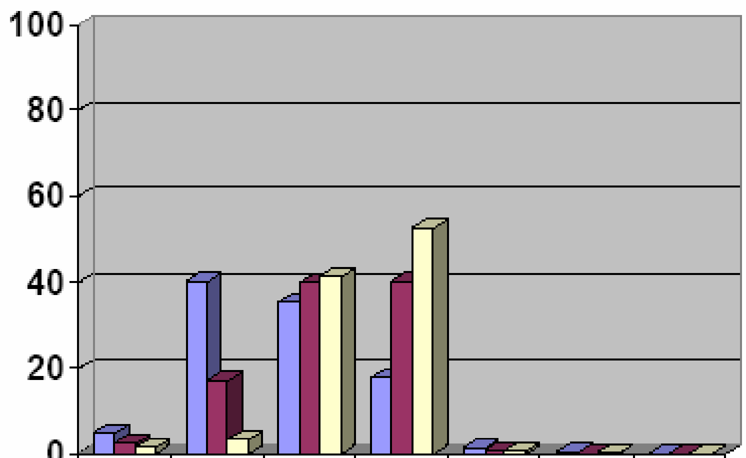
According to the BaU, the 2005 energy consumption of all installed standalone and boiler integrated circulators amounts to about 49.7 TWh/a.

Table A.3.3. Energy consumption of products on the market (net load) and energy consumption of sold products per year (BAU).

Average net load in kWh/a	1990	1995	2000	2005	2010	2015	2020
Small Stand alone circulators	203	200	196	192	188	184	180
Large Stand alone circulators	1699	1667	1635	1603	1571	1538	1506
Integrated boiler circulators	300	294	289	283	277	272	266
kWh/a	**362**	**355**	**348**	**341**	**335**	**328**	**321**

The energy consumption of the average products on the market in the base case year (2005) is estimated according the Europump calculation method for P_{ref} and a distribution of circulator sale on various energy classes as shown in figure 1.

Figure A.3.1: Distribution of circulator sale in 2005 (according to Europump)



	A	B	C	D	E	F	G
2006	5	40.2	35.4	17.7	1.3	0.3	0.1
2005	2.6	17	39.8	40.2	0.8	0.1	0
2004	1.6	3.3	41.3	52.8	0.8	0.2	0

Not only in terms of energy, but also in terms of emissions, the use phase is dominant, mainly because of the emissions from power generation. The carbon emissions are set at 0.458 kg CO2 equivalent/kWh electric, which results in 28 Mt CO2 equivalents[1]. Acidificying agents at 0.0027 kg/kWh electric account for 329 kt of SO2-equivalent in the use phase.[2] At 0.7 litre

[1] Compare EU-15 energy-related CO2 equivalent 2005 is 3357 Mt, so ca. 1,5 % (Kyoto-relevance). For EU-27 ca. 4000 Mt (1,3 %).

[2] Compare EU-15 total in 2005: 10.945 kt SOx equivalent (2,6 %). Gothenburg-relevance (also NEC Directive).

process water and 28 litre cooling water per kWh electric the water use from electricity in the use phase amounts to 0.85 mln. m³ process water and 34 mln. m³ cooling water. The production phase is the most relevant for the waste generation.

BAU trends 1990 -2020

Using base case 2005 as an anchor point, the projections 2005-2020 are based on the following assumptions and trend (for all types of circulators):

- Population increase 2005- 2020: 8 %;
- Annual sales growth: 1,4 percent pro anno;
- Average product life: 10 years;
- Circulator running hours per year: 5000 hours;
- Installation costs 90 Euros (3 hours of 30 Euros);
- Circulator stock in 2005 according to the study 140 mln.

The data set for 1990 – 2005 is based mainly on the preparatory study and also the estimated increase in the sale (1.4 % per year) is similar to the assumptions used in the study.

In the BAU without any new policy measures only a small increase in the energy efficiency is expected to happen until 2020. Since a slight increase in the circulator energy efficiency has appeared in the last few years this trend is assumed to continue in the BAU. The energy efficiency trend assumed in the BAU appears in table below.

Tabel A.3.4. Energy efficiency trends (BAU).

Weighted efficiency (for load and sales)							
	1990	1995	2000	2005	2010	2015	2020
Small Stand alone circulators	94%	96%	98%	100%	102%	104%	106%
Large Stand alone circulators	94%	96%	98%	100%	102%	104%	106%
Integrated boiler circulators	94%	96%	98%	100%	102%	104%	106%

General considerations

Because labelling is not considered as an appropriate measure for circulators only sub-options evaluating the impacts of various eco design ambition levels and timing for minimum energy efficiency requirements are carried out. The preparatory study has shown that the point of least life cycle costs (LLCC) for all three types of circulators appears for the best available technology (BAT). The BAT technology is circulators with variable speed permanent magnet motors with an EEI ≤ 0.20. Table below summarise main information on the three types of circulators considered.

Table A.3.5. Average price, life-time running costs and total life cycle costs (including purchase and installation) for circulators with EEI=0.45, EEI=0.23 and EEI=0.19 respectively (per product).

Base case	EEI~0.45	Price average (incl. install.)	Life-time running cost	Total LCC
Small Stand alone circulators	100 %	210	259	469
Large Stand alone circulators	100 %	490	2163	2653
Integrated boiler circulators	100 %	210	382	592
Improved technology	**EEI=0.23**	Price average (incl. install.)	Life-time running cost	Total LCC
Small Stand alone circulators	248%	302	105	406
Large Stand alone circulators	212%	560	1019	1578
Integrated boiler circulators	237%	295	161	456
BAT	**EEI=0.20 (BAT)**	Price average (incl. install.)	Life-time running cost	Total LCC
Small Stand alone circulators	297%	332	87	420
Large Stand alone circulators	257%	588	841	1428
Integrated boiler circulators	286%	326	133	459

In total, sub-option 2 represents higher savings over the life cycle of the product than sub-option 3.

Sub-option 1 (EEI ≤ 0.30)

Requirements are implemented on standalone and boiler integrated circulators in 1 stage on 2015 at EEI ≤ 0.30, as proposed by the industry. Requirements are implemented in one stage only based on circulator industry request; two stages were considered useless by circulator manufacturers as the redesign and production of products would anyway be done based on the level of the second stage. Due to the fact that there are no circulators, except two, between the EEI level 0.30 and 0.26, the impact of the considered EEI level would only start de facto at the level of EEI ≤ 0.26, except if manufactures, after the potential coming into force of the measure, would lower the efficiency of circulators, which would be possible for 95% of PM variable speed circulators currently on the market.

Sub-option 2 (EEI ≤ 0.23)

Requirements are implemented on standalone and boiler integrated circulators in 1 stage based on the recommendations of the preparatory study. The requirement would come into force on 2012. The level of the requirement also corresponds to the proposal made by the Commission Staff Working Document to the Consultation Forum.

Sub-option 3 (EEI ≤ 0.23 + EEI ≤ 0.15)

Requirements are implemented in two stages at levels as follows:

In 2012: EEI ≤ 0.23 on standalone circulators;

In 2015: EEI ≤ 0.15 on standalone and boiler integrated circulators.

This sub-option is an additional option developed by the Commission services after the request of the fourth sub-option (below) by environmental NGOs and some Member States and after the request by the boiler industry to have more time for the redesign of boilers to comply with the circulator requirements. The sub-option 3 allows considering a 'dynamic' measure between the second and the fourth sub-option in terms of the level of requirements. The two stages address the impacts of the planned measure on the boiler industry too in providing enough time to adjust to the requirements. The second requirement is introduced in August at the beginning of the heating season in order to minimise any possible distortions on circulator and boiler markets.

The implementation of efficiency requirements for products put on the market in 2012 and 2015 result in a higher relative efficiency and a lower average energy consumption of product sold after 2012 and 2015 compared to the BAU.

Sub-option 4 (EEI ≤ 0.19 + EEI ≤ 0.13)

The requirement of EEI ≤ 0.19 is implemented in 2012 and a second stage requirement of EEI ≤ 0.13 in 2013, as requested by environmental NGOs and some Member States during the Consultation Forum.

An overview of the sub-options is shown in the below figure.

Introduction of MEPS – policy options to be considered

Sub-option	Organisation	2010	2011	2012	2013	2014	2015
1	Industry						≤ 0.30
2	CSWD backed by preparatory study			≤ 0.23			
3	Commission II			≤ 0.23 Standalone			≤ 0.15 Standalone and boiler integrated
4	Stakeholders (ECOS, MSs)			≤ 0.23	≤ 0.19		

The sub-options 2-4 require a complete change from standard circulator technology to variable speed permanent magnet motor technology. Sub-option 1 would allow a few big circulators to be developed on the basis of standard induction motor technology just below the 0.30 level; the complete technology change is estimated to happen at about EEI ≤ 0.26 level from which the PM technology products with variable speed operation start. That is, sub-options 2-4 set also a minimum requirement on the performance of this technology.

Table A.3.6. Development in energy efficiency and unit energy consumption after implementation of ambitious minimum energy efficiency requirements

Efficiency (100 % = base case) [%]							
	1990	1995	2000	2005	2010	2015	2020
BaU	94%	96%	98%	100%	102%	104%	106%
Sub. opt. 1: EEI ≤ 0.30 from 2015	94%	96%	98%	100%	102%	175%	176%
Sub. opt. 2: EEI ≤ 0.23 from 2012	94%	96%	98%	100%	144%	229%	232%
Sub. opt. 3: EEI ≤ 0.27 from 2012 + EEI ≤ 0.23 from 2015	94%	96%	98%	100%	130%	228%	230%
Sub. opt. 4: EEI ≤ 0.23 from 2012 + EEI ≤ 0.19 from 2015	94%	96%	98%	100%	102%	275%	278%

Energy consumption per unit [kWh/a/unit]							
	1990	1995	2000	2005	2010	2015	2020
BaU	385	370	355	341	328	315	303
Sub. opt. 1: EEI ≤ 0.30 from 2015	385	370	355	341	328	188	182
Sub. opt. 2: EEI ≤ 0.23 from 2012	385	370	355	341	233	143	139
Sub. opt. 3: EEI ≤ 0.27 from 2012 + EEI ≤ 0.23 from 2015	385	370	355	341	252	144	139
Sub. opt. 4: EEI ≤ 0.23 from 2012 + EEI ≤ 0.19 from 2015	385	370	355	341	328	119	116

Original Equipment Manufacturers (OEM)

Circulator manufacturers produce most of the necessary components (including the motor technology) in house. Therefore, the OEM factor is relatively low. However there are still some OEM activities for production of material used in components etc. An OEM factor of about 0.3-0.4 is considered being realistic. About 20 % of these OEM activities is estimated to take place the EU (ExtraEUFrac=0.2). The main part that is traded, and can easily be traded on the OEM market, is the motor (induction or permanent magnet).

Almost 100 % of the circulator manufacturers are European (EU-27). 80 % of the European market is dominated by two major circulator manufacturers.

Table A.3.7: List of manufacturers and information on size, employment and turnover

Manufacturer	Size	Production of energy efficient circulators	Employee and turnover	Homepage
Grundfos	Very Large	Yes A-pump + permanent magnet	Employees: 16,457 Turnover: 2,257 mln. EUR (2007)	Denmark www.grundfos.com
Wilo	Very Large	Yes A-pump + permanent magnet	Employees: 5,821 Turnover: 927 mln. EUR (2007)	Germany www.wilo.com
Smedegaard	Medium/Large	Yes A-pump	No information available	Denmark www.smedegaard.com
Calpeda	Medium	Yes A-pump + permanent magnet	Employees: 250 Turnover: No information available	Italy www.calpeda.com
Circulating pumps	Small/Medium	No but part of the Wilo Group	Employees: 150 Turnover: 18 mln. EUR	UK www.circulatingpumps.net
Dab pumps SpA	Medium/Large	No but part of the Grundfos Group	Employees: 500 Turnover: No information available	Italy www.dabpumps.com
Imp-pumps	Small/Medium	Yes A-pump + permanent magnet	No information available	Slovenia www.imp-pumps.com
Laing	Medium/Large	Yes A-pump + permanent magnet	Employees: 500 (worldwide) Turnover: No information available	Germany www.laing.de
Salmson	Part of Wilo	Yes A-pump + permanent magnet	No information available	Member of Wilo group No homepage
Askoll Sei	Large	Yes A-pump + permanent magnet	Employees: 3000 Turnover: No information available	Italy www.askoll.com
Biral	Medium	Yes A-pump + permanent magnet	No information available	Switzerland www.Biral.Ch
Richard Halm GmbH & Co.KG	Medium	Yes A-pump	Employees: > 300 Turnover: No information available	Germany http://www.halm.info/en

Wholesale and retail

The wholesale margin on the manufacturer selling price is estimated to be 30 %. Most circulators are sold by installers. Only about 1 % of the products are sold by retailers (on the DIY market) and this sale is considered to be negligible. The preparatory study assumes 1% sales increase (21% in total) of standard circulators mainly, that is, employment effects are minor as the share of permanent magnet motor technology is not expected to expand.

Installer

The installer marking on the product whole sale price is estimated to be 20 %.

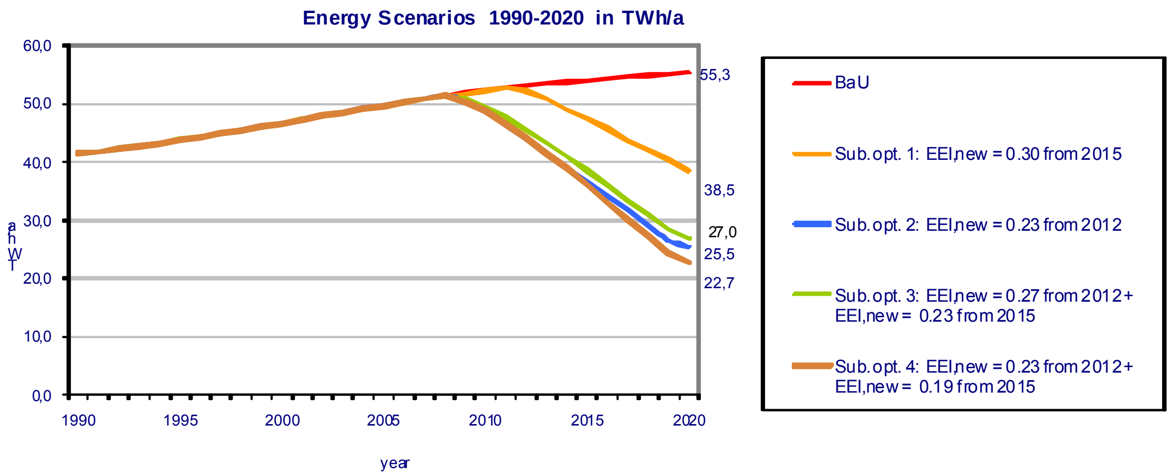
The below table shows the variables used in the socio economic analysis.

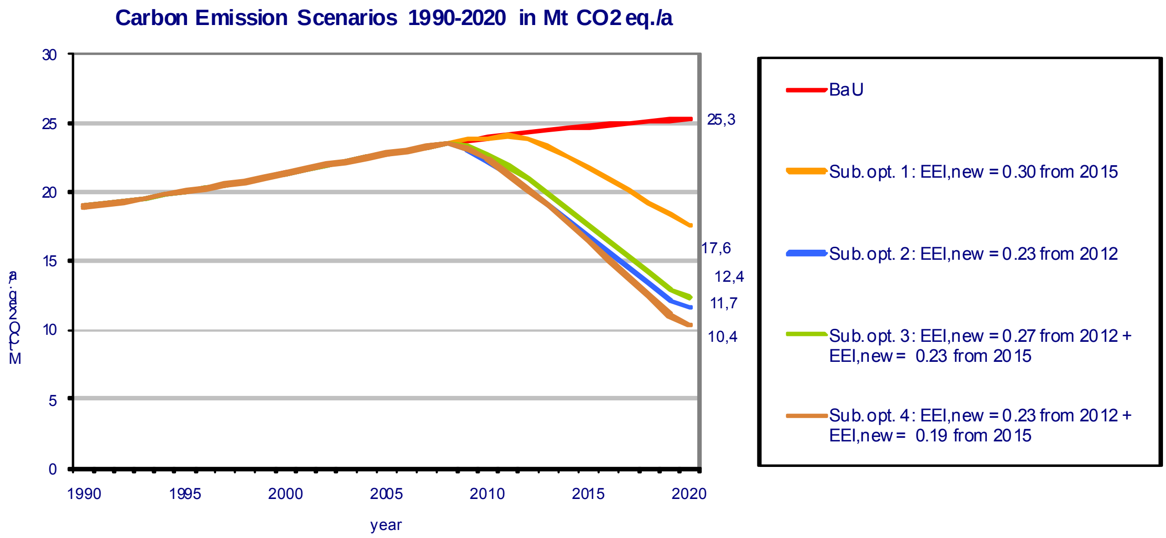
Variables used for the calculation of employment, turnover etc. <u>ECONOMICS</u>		
Baseprice	230.0	Consumer product price incl. installation in year 2005 [€]
PriceInc	0.62	Price increase per efficiency %-point [€/ %]
Rel	0.135	Electricity rate 2005 [€/ kWh electric]
Rgas	0.047	Gas rate 2005 [€/ kWh primary GCV] (NOT USED)
Roil	0.061	Oil rate 2005 [€/ kWh primary GCV] (NOT USED)
Rmaint	0.7	Annual maintenance costs [€/ a]
CO2el	0.458	CO2 emission for electricity [Mt CO2/TWh]
Relinc	1%	Annual price increase electricity [%/ a]
Rgasinc	2%	Annual price increase gas [%/ a] (NOT USED)
Roilinc	2%	Annual price increase oil [%/ a] (NOT USED)
Rmaintinc	1%	Annual cost increase maintenance [%/ a]
PriceDec	2%	Annual product price decrease [%/ a]
InstallDec	0%	Annual installation cost decrease [%/ a]
ManuFrac	51.5%	Manufacturer Selling Price as fraction of Product Price [%]
WholeMargin	30%	Margin Wholesaler [% on msp]
RetailMargin	20%	Margin Installer on product [% on wholesale price]
VAT	19%	Value Added Tax [in % on retail price] (NOT USED)
ManuWages	0.136	Manufacturer turnover per employee [bln. €/ a]
OEMfactor	0.3	OEM personell as fraction of manufacturer personnel [-]
WholeWages	0.261	Whole seller turnover per employee [bln. €/ a]
RetailWages	0.1	Installer turnover per employee [bln. €/ a]
ExtraEUfrac	0.2	Fraction of OEM personnel outside EU [% of OEM jobs]
Inflation	-2%	Inflation rate [%/ a]
DiscountRate	4%	Discount rate [%/a]
ProductLife	10	Product Life [years]

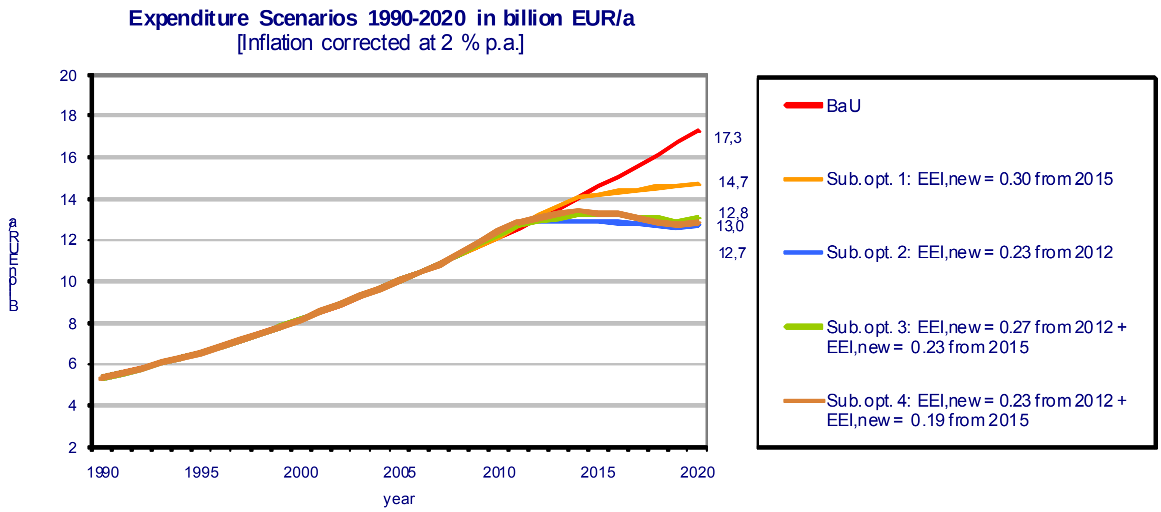
<u>Tables on comparison of introductory dates</u>

Comparison of sub-options for introductory dates:

Figures A.3.1: Implementation of requirements one year earlier







The results of the graphs are summarized in the below tables.

Table A.3.8a: Impact on electricity consumption by 2020, if requirements introduced one year earlier

Electricity consumption in 2020 [TWh/year]	Sub-option 1	Sub-option 2	Sub-option 3	Sub-option 4
As per proposed timing	40.6	26.8	28.7	26.5
One year earlier	38.5	25.5	27.0	22.7
Further savings in 2020	2.1	1.3	1.7	3.8

Table A.3.8b: Impact on CO2 emissions by 2020, if requirements introduced one year earlier

CO_2 emissions in 2020 [Mt CO_2]	Sub-option 1	Sub-option 2	Sub-option 3	Sub-option 4
As per proposed timing	18.6	12.3	13.1	12.1
1 year earlier	17.6	11.7	12.4	10.4
Further savings in 2020	1	0.6	0.7	1.7

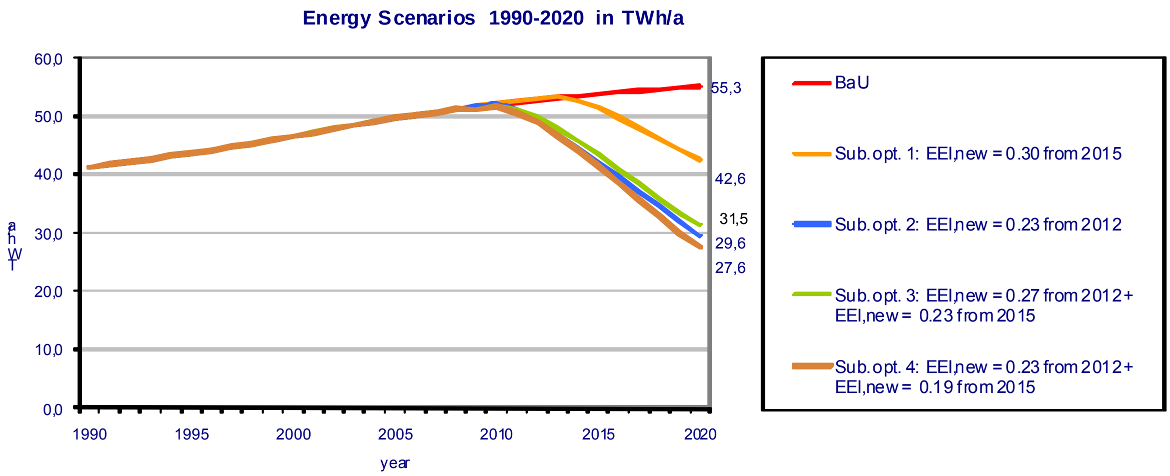
Table A3.8c: Impact on consumer expenditure in 2020, if requirements introduced one year earlier

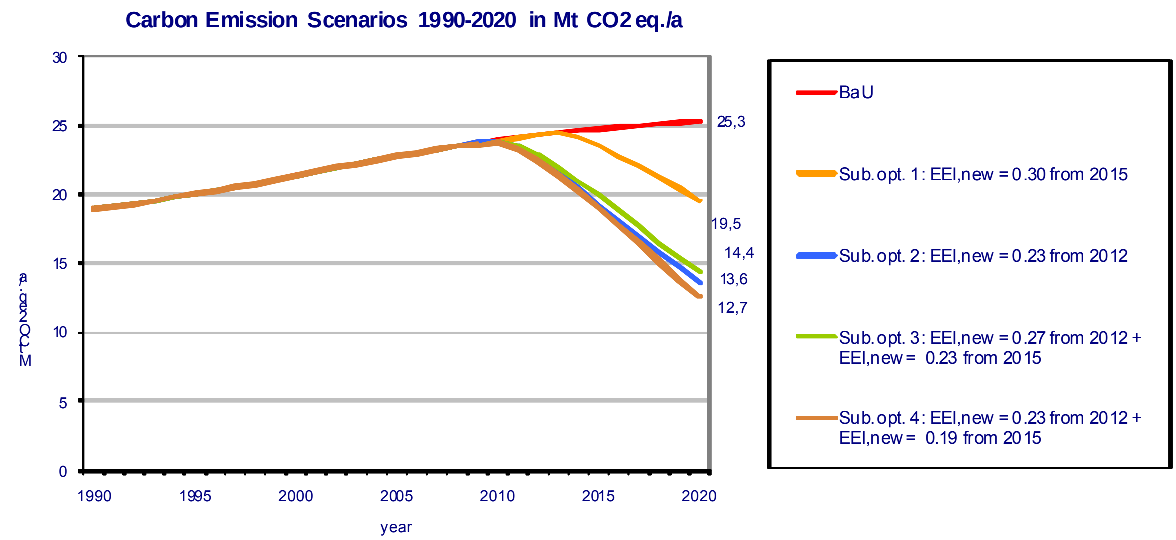
Consumer expenditure in 2020 [Bln. EUR/year]	Sub-option 1	Sub-option 2	Sub-option 3	Sub-option 4
Proposed timing	15.1	13.0	13.4	13.6
1 year earlier	14.7	12.7	13.0	12.8
Further savings in 2020	0.4	0.3	0.4	0.8

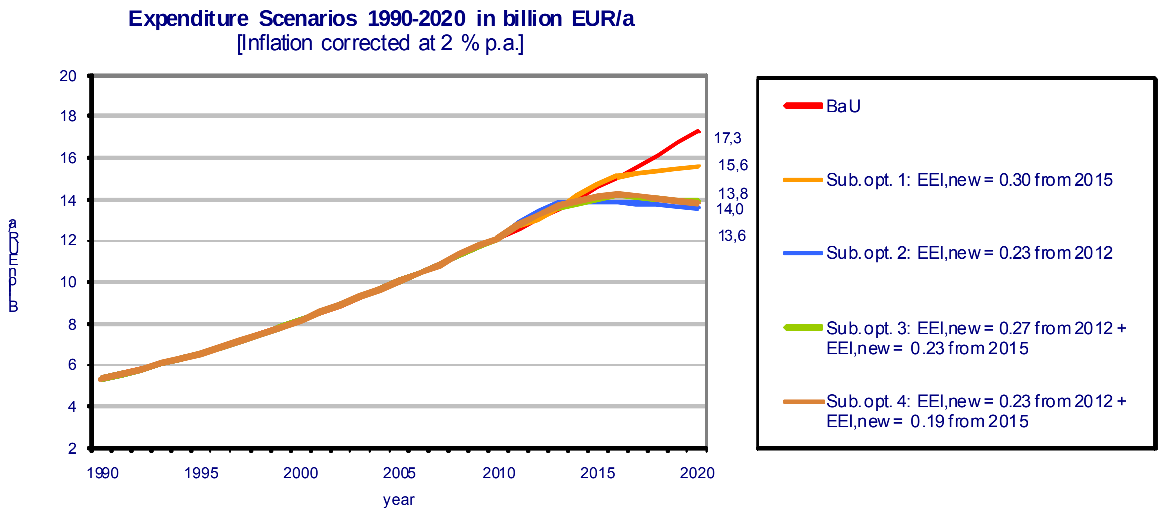
The analysis shows that earlier implementation leads to a very small additional increase in electricity and CO2 emissions savings by 2020 and the savings will be realized one year later in any case. The risk with some of the manufacturers not yet being very familiar with the production of permanent magnet technology increase, when the time period for the entry into force of the requirements shortens; in the case of sub-option 2 it is not considered to be long time enough for the redesign of circulator and boiler production, or for the adoption of the production through purchase of the necessary technology in the OEM market. In the case of sub-option 1, the shortening of this time period is considered to be appropriate but this would lead to considerably lower savings than sub-option 2.

Below, the impacts are compared, if the implementation year is postponed by one year for all sub-options.

Figures A.3.2.: Implementation of requirements one year later







The results of the graphs are summarized in the below tables.

Table A.3.9a: Impact on electricity consumption by 2020, if requirements introduced one year later

Electricity consumption in 2020 [TWh/year]	Sub-option 1	Sub-option 2	Sub-option 3	Sub-option 4
As per proposed timing	40.6	26.8	28.7	26.5
One year later	42.6	29.6	31.5	27.6
Increase in 2020	2	2.8	2.8	1.1

Table A.3.9.b: Impact on CO2 emissions by 2020, if requirements introduced one year later

CO_2 emissions in 2020 [Mt CO_2]	Sub-option 1	Sub-option 2	Sub-option 3	Sub-option 4
AS per proposed timing	18.6	12.3	13.1	12.1
1 year later	19.5	13.6	14.4	12.7
Increase in 2020	0.9	1.3	1.3	0.6

Table A.3.9.c: Impact on consumer expenditure in 2020, if requirements introduced one year later

Consumer expenditure in 2020 [Bln. EUR/year]	Sub-option 1	Sub-option 2	Sub-option 3	Sub-option 4
Proposed timing	15.1	13	13.4	13.6
1 year later	15.6	13.6	14.0	13.8
Increase in 2020	0.5	0.6	0.6	0.2

ANNEX 4: IMPACTS CONSIDERED SEPARATELY ON STANDALONE AND BOILER INTEGRATED CIRCULATORS

In regard to the criteria established by Article 15(2) of the Ecodesign Directive, the Impact Assessment has established the following results for circulators in the EU:

Table A 4.1: Standalone circulators

Article 15 (2a):	Annual sales volume in the Community	6.5 million units in 2005 8.2 million units in 2020
Article 15 (2b):	Environmental impact: energy consumption of circulators (BaU)	27.7 TWh in 2005 30.8 TWh in 2020
Article 15 (2c):	Improvement potential (savings applying cost effective existing technology)	0 TWh in 2005 14.8 TWh in 2020

The latest Europump data on sales volume from 2005 shows an annual sales volume of 6.5 million units. A relative small increase on 1.4 % p.a. in the sales volume is expected, which gives a sales volume of 8.2 million units in 2020.

Table A.4.2: Boiler integrated circulators

Article 15 (2a):	Annual sales volume in the Community	7.5 million units in 2005 9.4 million units in 2020
Article 15 (2b):	Environmental impact: energy consumption of circulators (BaU)	22.1 TWh in 2005 24.5 TWh in 2020
Article 15 (2c):	Improvement potential (savings applying cost effective existing technology) (sub-option 2)	0 TWh in 2005 11.8 TWh in 2020

The latest Europump data on sales volume from 2005 shows an annual sales volume of 7.5 million units. A relative small increase on 1.4 % p.a. in the sales volume is expected, which gives a sales volume of 9.4 million units in 2020.

Impacts per type of circulator

Economic impacts

The graphs below show the electricity consumption of the various sub-options per type of circulator.

Figure A.4.1: Electricity consumption of sub-options by standalone circulators

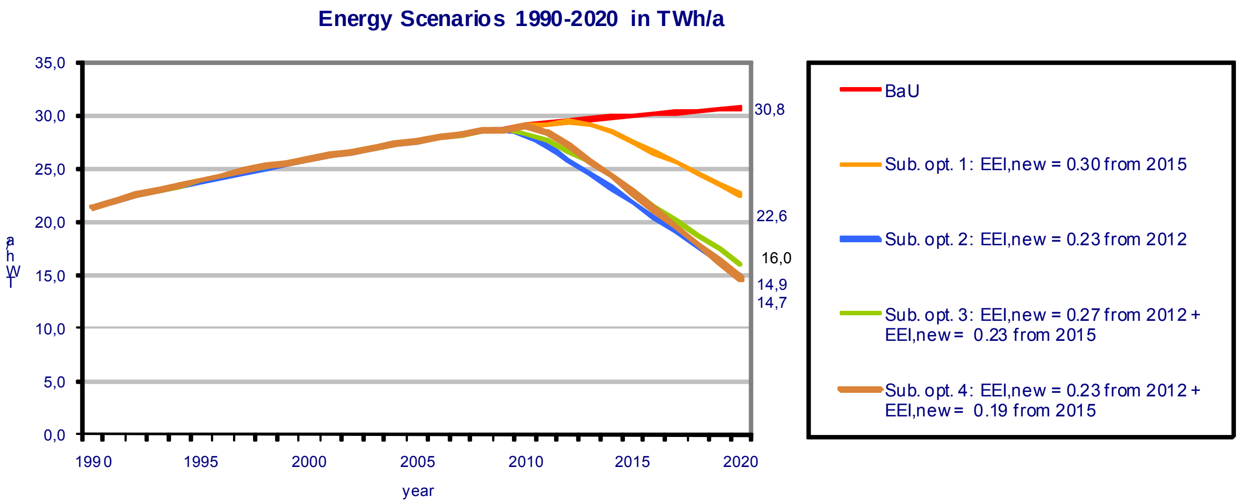
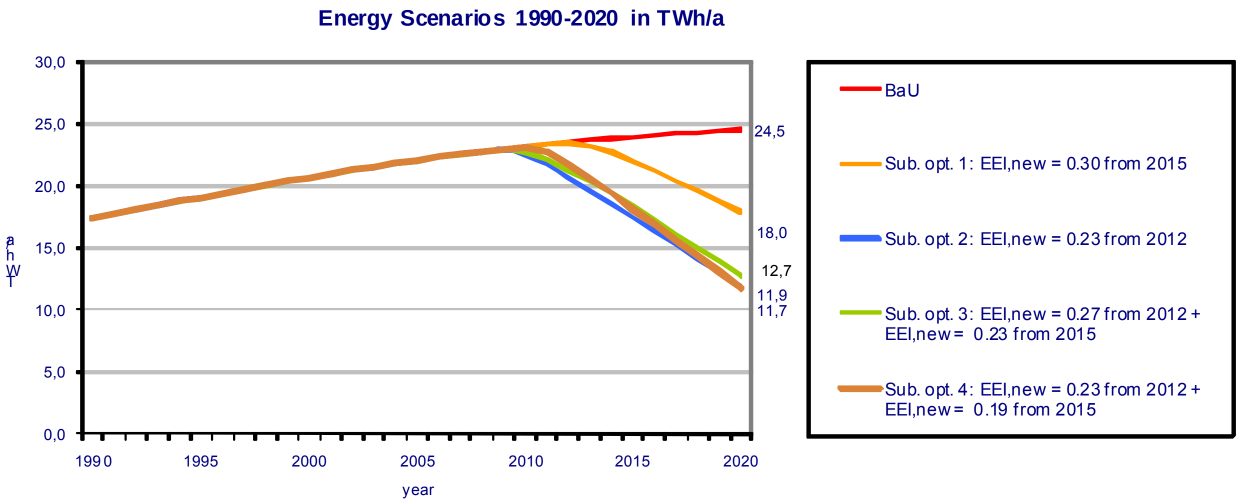


Figure A.4.2 Electricity consumption of sub-options by boiler integrated circulators



Consumer economics and affordability

The below tables show the expected savings from the sub-options per type of circulator.

Figure A.4.3: Expenditure scenarios 1990-2020 for standalone circulators

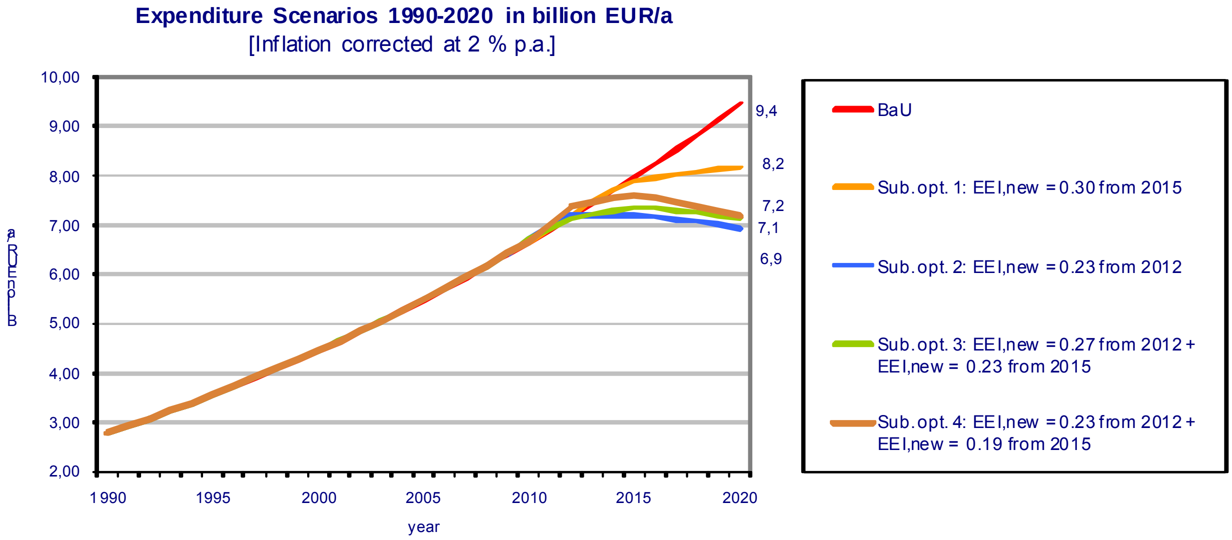
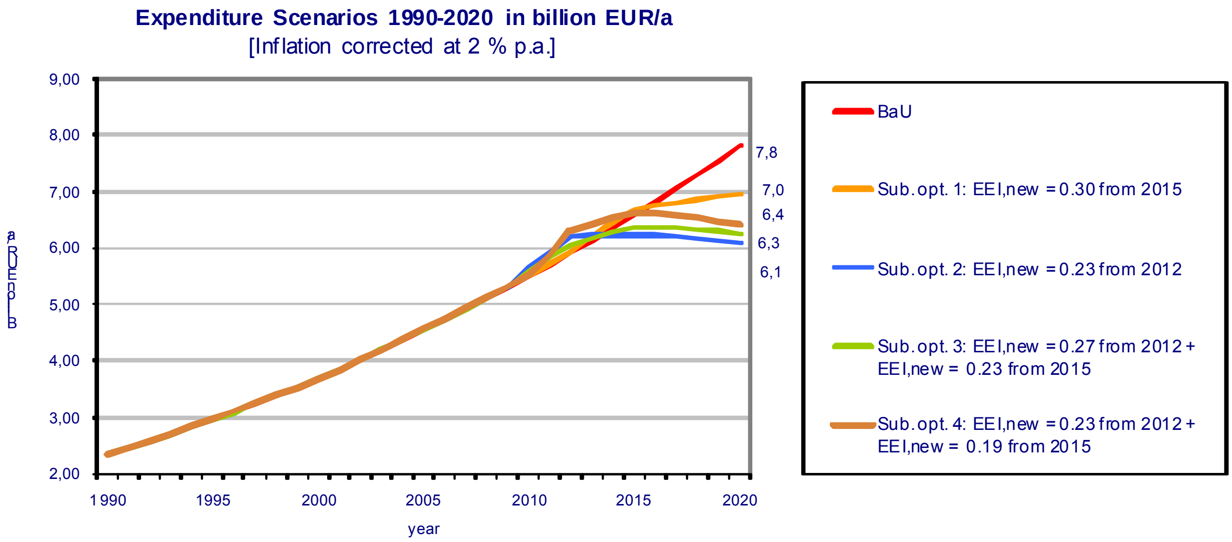


Figure A.4.4 Expenditure scenarios 1990-2020 for boiler integrated circulators



Environmental impacts

The below tables show carbon emissions of various sub-options per type of circulator.

Figure A.4.5 Carbon emissions of sub-options by standalone circulators

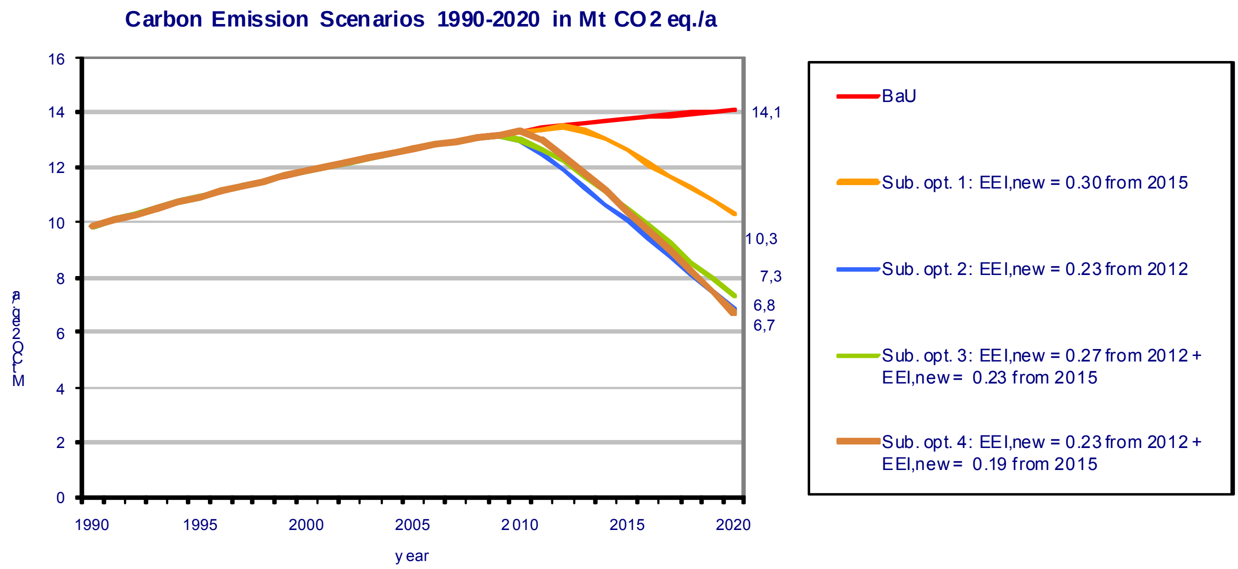


Figure A.4.6 Carbon emissions of sub-options by boiler integrated circulators

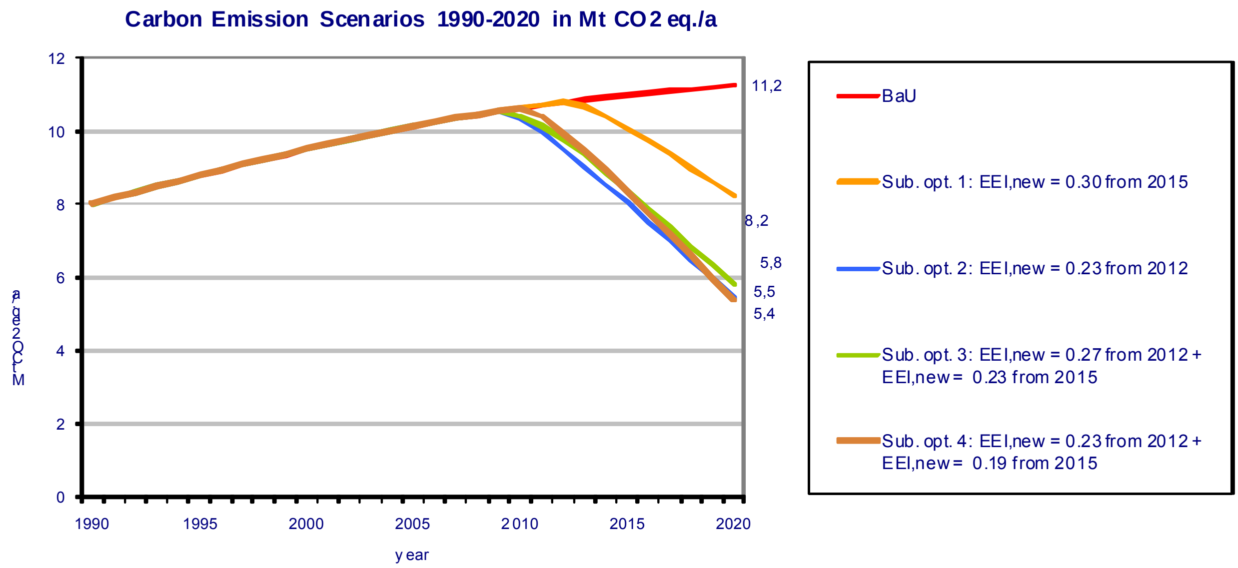


Table A.4.3 Energy consumption BAU and sub-option 3

	BAU			Sub-option 3			Savings sub-option 3compared to BAU		
	Total	Stand-alone	Boiler integrated	Total	Stand-alone	Boiler integrated	Total	Stand-alone	Boiler integrated
2005	49.8	27.7	22.1	49.8	27.7	22.1			
2010	52.7	29.3	23.4	51.2	28.5	22.7	1.5	0.8	0.7
2020	55.3	30.8	24.5	28.7	16.0	12.7	26.6	14.8	11.8

Table A.4.4 CO2 emissions BAU and sub-option 3

	BAU			Sub-option 3			Savings sub-option 3compared to BAU		
	Total	**Stand-alone**	**Boiler integrated**	**Total**	**Stand-alone**	**Boiler integrated**	**Total**	**Stand-alone**	**Boiler integrated**
2005	22.8	12.7	10.1	22.8	12.7	10.1			
2010	23.9	13.3	10.6	23.4	13.0	10.4	0.5	0.3	0.2
2020	25.3	14.1	11.2	13.3	7.3	5.8	12.2	6.8	5.4

Table A.4.5 Consumer expenditures BAU and sub-option 3

	BAU			Sub-option 3			Extra costs sub-option 3compared to BAU		
	Total	**Stand-alone**	**Boiler integrated**	**Total**	**Stand-alone**	**Boiler integrated**	**Total**	**Stand-alone**	**Boiler integrated**
2005	10.1	5.5	4.6	10.1	5.5	4.6			
2010	12.1	6.6	5.5	12.3	6.7	5.6	-0.2	-0.1	-0.1
2020	17.2	9.4	7.8	13.4	7.1	6.3	3.8	2.3	1.5

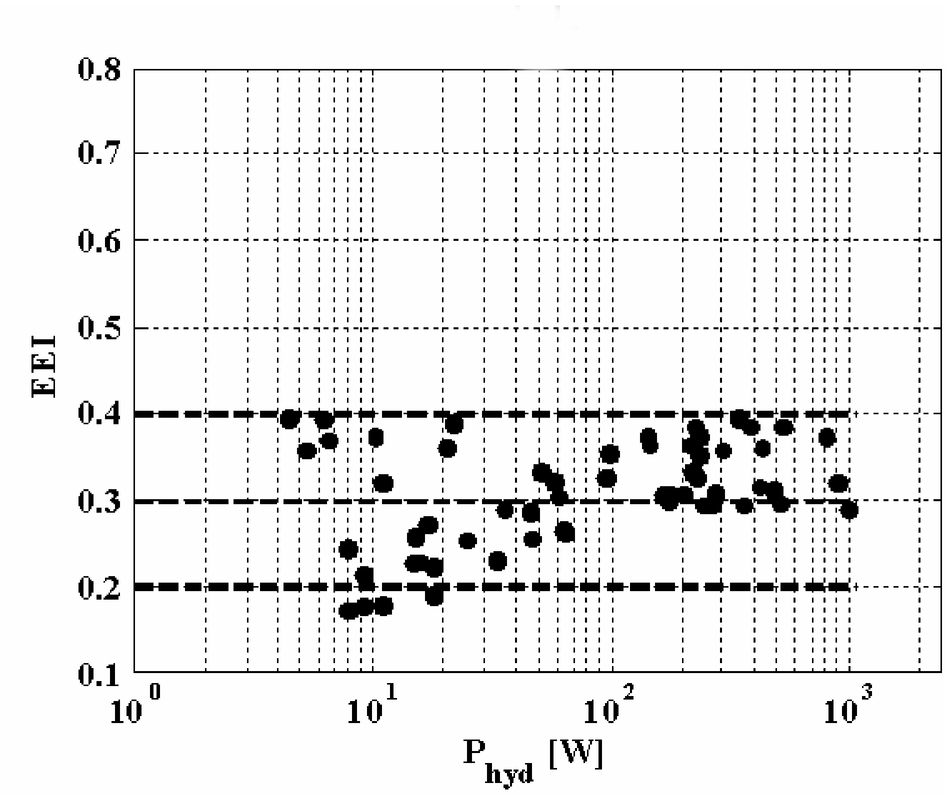
Negative values correspond to savings in costs.

ANNEX 5: EEI CALCULATION METHOD AND FEASIBILITY OF EEI ≤ 0,15

This Annex briefly explains the Europump energy efficiency index (EEI) calculation method, including the impact of its update on 2008 and the feasibility of achieving the efficiency level EEI ≤ 0.15 or below. The Annex 6 provides the technical details on the update of the Europump calculation method.

The below figure shows the EEI values for circulators classed above the A Class efficiency (EEI ≤ 0.4) under the old calculation method.

Figure A.5.1: EEI values under the old calculation method



The update of EEI levels is done via a new P_{ref} curve, as follows:

$$EEI = \frac{P_{Lavg}}{P_{ref}}$$

The weighted average power P_{Lavg} is unchanged and still measured according to the revised EN1151-1.

The current P_{ref} curve is defined as follows:

$$P_{ref,old} = 2.21 \cdot P_{hyd} + 55 \cdot \left(1 - e^{-0.39 \cdot P_{hyd}}\right), \quad 0W \le P_{hyd} \le 2500\ W$$

A new P_{ref} curve was calculated by Technical university of Darmstadt* based on A-rated circulator on the market in 2008, as follows:

$$P_{ref,new} = 1.7 \cdot P_{hyd} + 17 \cdot \left(1 - e^{-0.3 \cdot P_{hyd}}\right), \quad 1\ \mathrm{W} \leq P_{hyd} \leq 2500\ \mathrm{W}$$

Calculation of updated EEI levels is made as follows:

$$EEI_{old} = \frac{P_{Lavg,old}}{P_{ref,old}}$$

$$EEI_{new} = \frac{P_{Lavg,new}}{P_{ref,new}} \cdot C_{20\%}$$

This gives the final formula as follows:

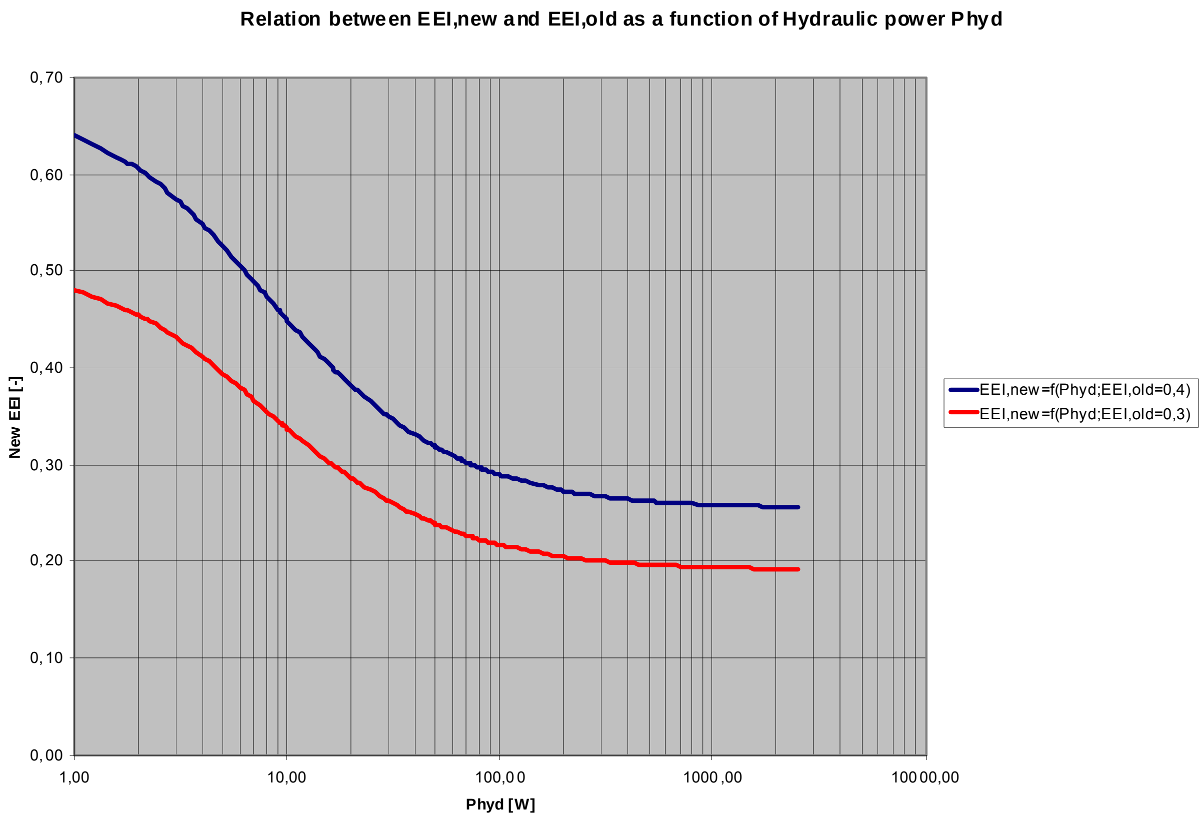
$$P_{Lavg,new} = P_{Lavg,old}$$

$$\boxed{EEI_{new} = EEI_{old} \cdot \frac{P_{ref,old}}{P_{ref,new}} \cdot C_{20\%}}$$

The reason for updating the calculation method is that the EEI circulator classification used for Europump voluntary A-G energy labelling is based on the state of art efficiency levels of circulators on the market in 2001. The classification also included a factor, which gave bigger circulators lower EEI values than they would otherwise have. Due to significant efficiency improvements of small circulators since 2001, the distortion in the EEI classification scheme has further amplified. Consequently, the EEI levels were updated based on A-rated circulators (EEI ≤ 0.40 according to the old method and EEI ≤ 0.30 according to the new methtod) on the market in 2008. Due to the distortion, the technical limit in EEI levels was around 0.3 for large and around 0.2 for small circulators. The distribution of circulators per efficiency can be seen in figure A.5.1 (under the old scheme) and in figure A5.4 (under the new scheme).

The below figure shows the relation between the old and the new EEI as a function of hydraulic power (Phyd)

Figure A.5.2: Relation between the old and the new EEI curve.

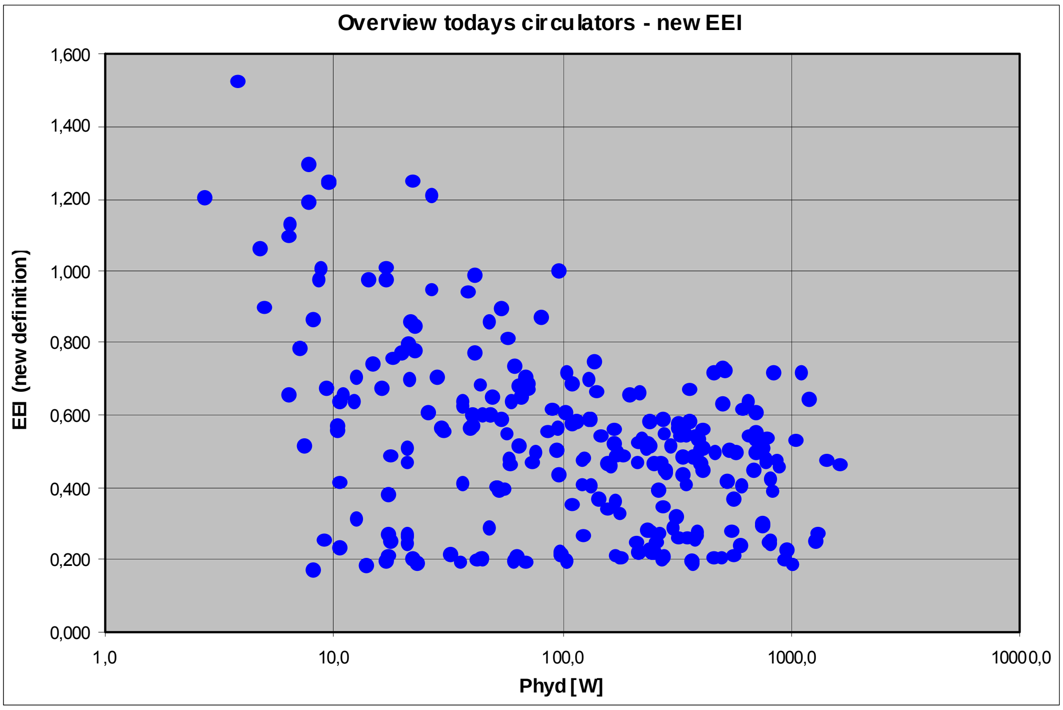


The below figure shows the theoretical minimum EEI values. The theoretical minimum EEI value with 100% efficiency is 0.13.

Figure A.5.3: Theoretical minimum EEI values of circulators under the new calculation method.

The below figure shows the EEI values of all circulators under the new calculation method.

Figure A.5.4: EEI values under the new calculation method



The next figure shows the numerical values behind plots in the above figure.

Figure A.5.5: Table on numerical values per old/new calculation method.

$P_{hydr,100\%}$ [W]	EEI (Eta=100%)	Pref,old	Pref,new	Pref,old/ Pref,new	EEI,new=f(Phyd;EEI,old=0,4)	EEI,new=f(Phyd;EEI,old=0,3)
1,00	0,029	19,972	6,106	3,271	0,64	0,48
2,00	0,032	34,208	11,070	3,090	0,61	0,45
3,00	0,035	44,560	15,188	2,934	0,58	0,43
4,00	0,038	52,283	18,680	2,799	0,55	0,41
5,00	0,040	58,225	21,707	2,682	0,53	0,39
6,00	0,043	62,962	24,390	2,581	0,51	0,38
7,00	0,046	66,883	26,818	2,494	0,49	0,37
8,00	0,048	70,251	29,058	2,418	0,47	0,36
9,00	0,051	73,246	31,158	2,351	0,46	0,35
10,00	0,053	75,987	33,154	2,292	0,45	0,34
20,00	0,069	99,177	50,958	1,946	0,38	0,29
30,00	0,078	121,300	67,998	1,784	0,35	0,26
40,00	0,083	143,400	85,000	1,687	0,33	0,25
50,00	0,086	165,500	102,000	1,623	0,32	0,24
50,00	0,086	165,500	102,000	1,623	0,32	0,24
70,00	0,090	209,700	136,000	1,542	0,30	0,23
73,92	0,091	218,363	142,664	1,531	0,300	0,225
80,00	0,092	231,800	153,000	1,515	0,30	0,22
90,00	0,093	253,900	170,000	1,494	0,29	0,22
100,00	0,094	276,000	187,000	1,476	0,29	0,22
200,00	0,098	497,000	357,000	1,392	0,27	0,20
300,00	0,100	718,000	527,000	1,362	0,27	0,20
400,00	0,101	939,000	697,000	1,347	0,26	0,20
500,00	0,101	1160,000	867,000	1,338	0,26	0,20
600,00	0,102	1381,000	1037,000	1,332	0,26	0,20
700,00	0,102	1602,000	1207,000	1,327	0,26	0,20
800,00	0,102	1823,000	1377,000	1,324	0,26	0,19
900,00	0,102	2044,000	1547,000	1,321	0,26	0,19
1000,00	0,102	2265,000	1717,000	1,319	0,26	0,19
2000,00	0,103	4475,000	3417,000	1,310	0,26	0,19
2500,00	0,103	5580,000	4267,000	1,308	0,26	0,19
10000000000,00	0,103					

The key values, from the point of view of the Regulation, are shown in the below table.

Table A.5.1: Comparison of key EEI values between old and new calculation method.

Old	New
0.60	0.45
0.40	0.30
0.33	0.25
0.30	0.22
0.27	0.20
0.25	0.19
0.20	0.15
0.15	0.11
0.13	0.10

An A-rated circulators (EEI ≤ 0,40 according to the old method and EEI ≤ 0,30 according to the new method) had a market share of 6.7% in 2007.

Technical feasibility

The reachable efficiency of a circulator depends on its operating point (Flow and Head = specific speed). The specific speed n_q is defined as follows:

$$n_q = n \frac{\sqrt{Q}}{H^{0.75}}$$

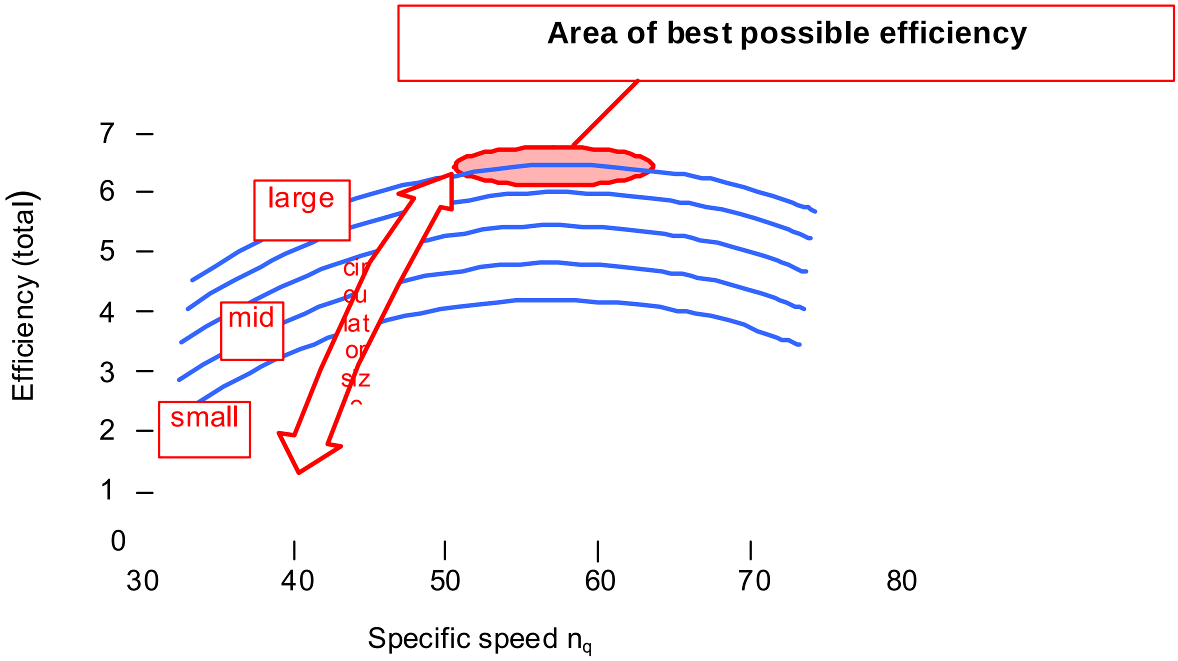
n = speed

Q = flow

H = head

Maximum efficiency of a circulator can be reached within a limited area of operating points, as shown in the below figure.

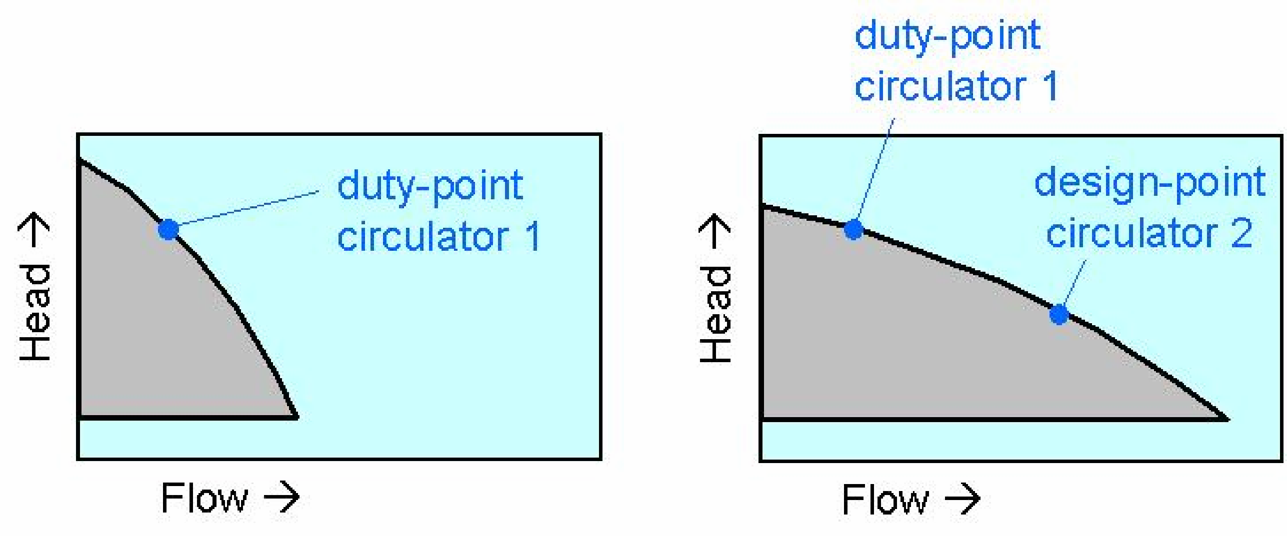
Figure A.5.6: Area of best possible efficiency



It has been confirmed by the industry that the technical level of 0.15 can today not be achieved. Although the BAT level is achievable technically, it may not be achieved by all pumps, as for some duties where there is a particularly high ratio of head to flow, the circulator will have an impeller that is narrow but with a large diameter. This leads to higher internal friction losses than for circulators of similar rated power (head times flow). The ratio of head to flow is known as the specific speed of a pump, with low specific speed pumps being unable to achieve as high an efficiency as that of a higher specific speed pump of the same technology. This is demonstrates in the below figure. The precise relationship between flow, head and specific speed is explained in detail in the preparatory study on pumps[3].

[3] Page 206, http://www.ecomotors.org/.

Figure A.5.7: Circulator 1 with low flow and high head (but not optimal nq) and circulator 2 (with optimal nq in the design point)



The reachable efficiency and the level of EEI depends on the design point (Flow/Head relation = specific speed) of the circulator. Circulators with optimal specific speed value can reach EEI ≤ 0.20 level but as the design point depends on the requirements of the application, not every single circulator on the market can reach the level EEI ≤ 0.20. However, the solution in these rare applications, on which no detailed explanation has been received for this impact assessment, is to use a bigger pump.

For this reason, the setting of the minimum efficiency requirement above EEI ≤ 0.23 would be counterproductive. However, as EEI ≤ 0.20 is met by several existing pumps on the market, it is suggested that EEI ≤ 0.20 is set as a benchmark value.

It can also be mentioned that:

EEI ≤ 0.30 would allow the lowering of the efficiency of permanent magnet variable speed circulators currently available on the market, as the efficiency level for 95% of these circulators starts at around EEI ≤ 0.26.

EEI ≤ 0.23 introduces a minimum efficiency requirement also on circulators based on variable speed permanent magnet technology with **0.03** EEI points (difference between EEI 0.23 and 0.26).

EEI ≤ 0.20 as BAT is introduced with **0.03** EEI points above the minimum energy performance requirement (difference between EEI 0.18 and 0.23).

 EN

COMMISSION OF THE EUROPEAN COMMUNITIES

Brussels, 22.7.2009
SEC(2009) 1016 final

COMMISSION STAFF WORKING DOCUMENT

Accompanying document to the

PROPOSAL FOR A COMMISSION REGULATION
implementing Directive 2005/32/EC with regard to Ecodesign requirements for circulators

FULL IMPACT ASSESSMENT – PART 3

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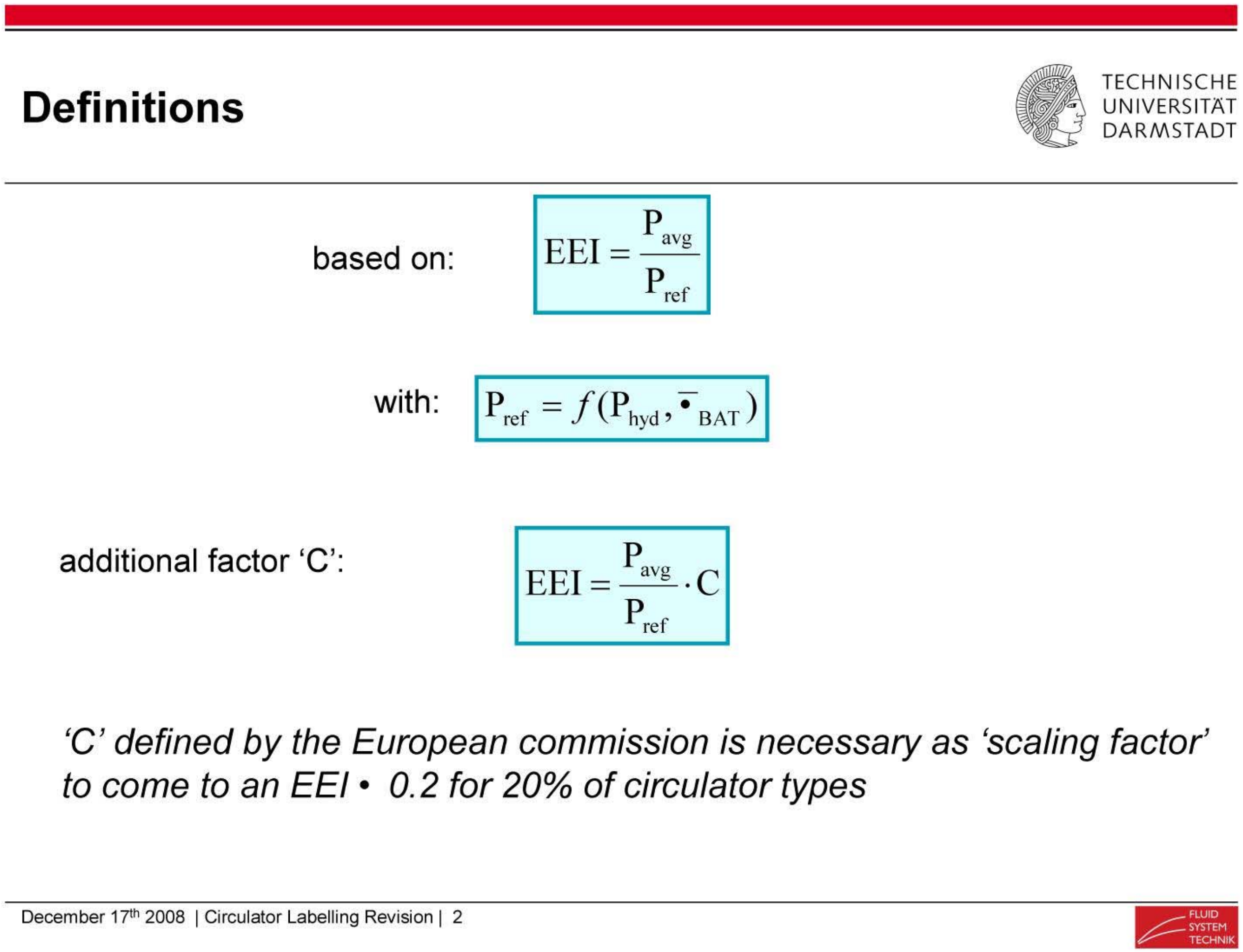
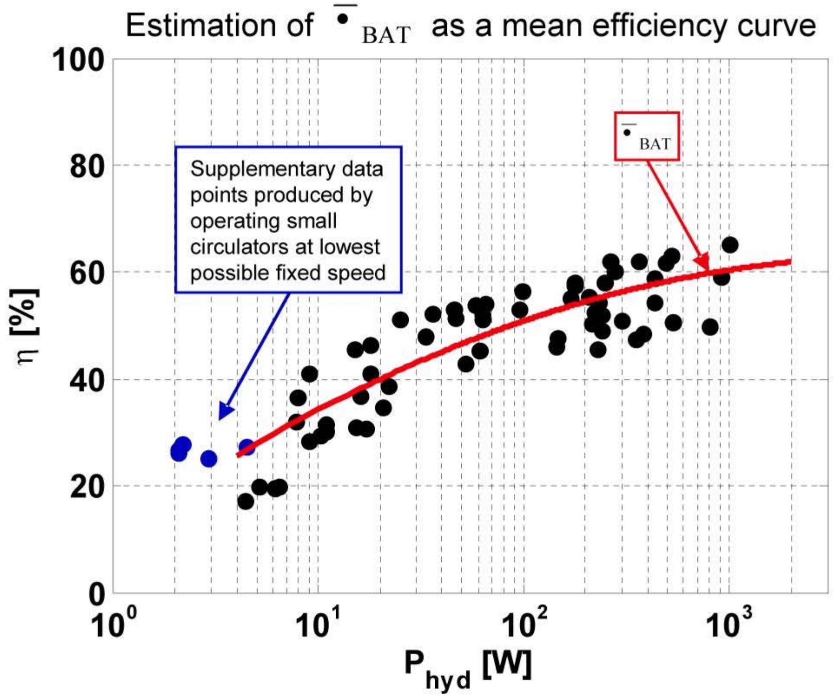
<u>ANNEX 6: EEI CALCULATION METHOD – TECHNICAL BACKGROUND TO THE UPDATE</u>

This Annex explains the technical background to the update of the Europump calculation scheme, which was used as the basis for the voluntary energy labelling of circulators.



Efficiency curve based on data received from 8 pump manufacturers (the inquiry was send to 12 companies)

TECHNISCHE UNIVERSITÄT DARMSTADT



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FLUID SYSTEM TECHNIK

Comparison
of P_{ref} old, P_{ref} new and P_{ref} new-refined

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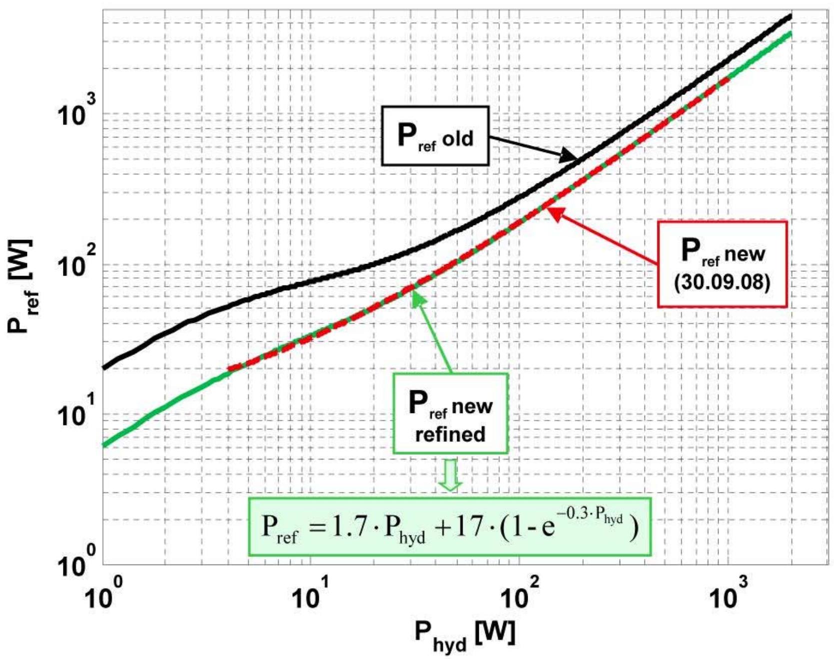

FLUID SYSTEM TECHNIK

New refined mathematical relationship P_{ref} as a function of P_{hyd} (100)

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$$P_{ref} = 1.7 \cdot P_{hyd} + 17 \cdot (1 - e^{-0.3 \cdot P_{hyd}})$$

The definition above is only valid for stand-alone circulators for heating systems and values of hydraulic power

$$P_{hyd(100)} \geq 1 \text{ W}$$

FLUID SYSTEM TECHNIK

Comparison of data points with P_{ref} new-refined

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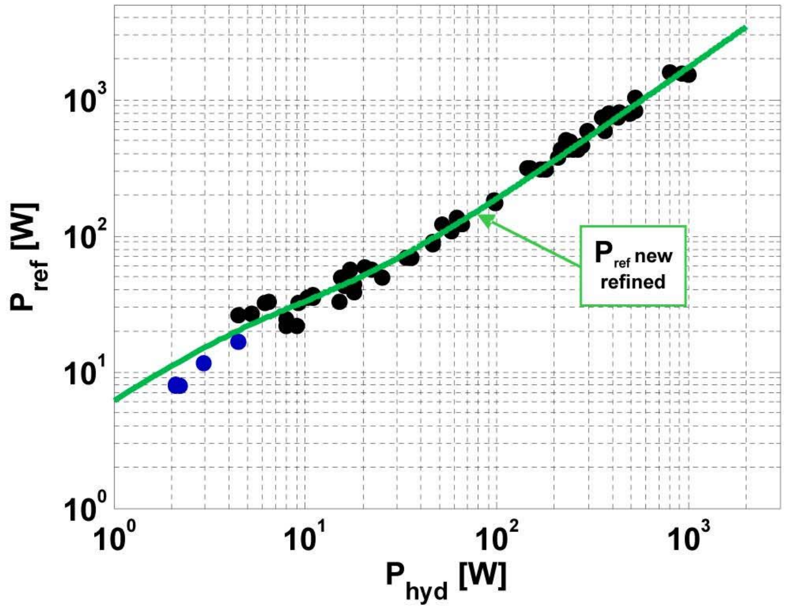

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FLUID SYSTEM TECHNIK

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Brussels, 22.7.2009
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FULL IMPACT ASSESSMENT – PART 4

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Plausibility check

$\overline{\eta}_{BAT}$ recalculated by means of the new P_{ref} curve

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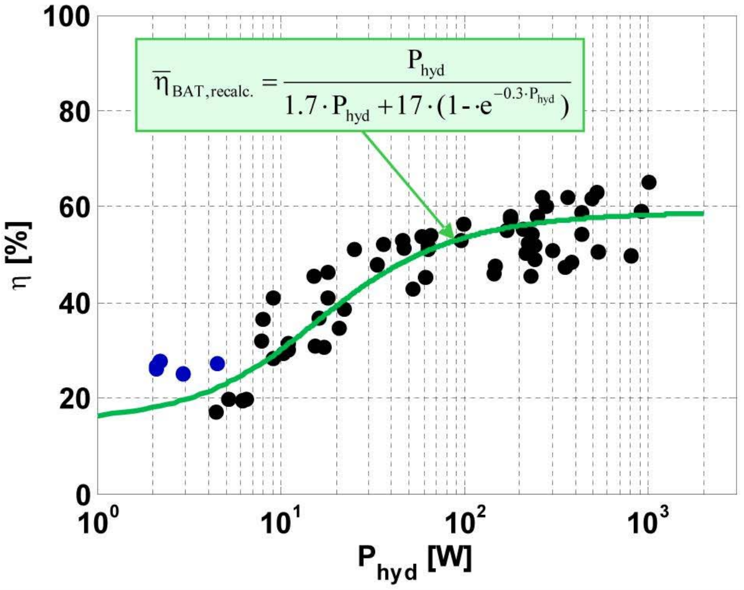

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FLUID SYSTEM TECHNIK

EEI based on P_{ref} new-refined

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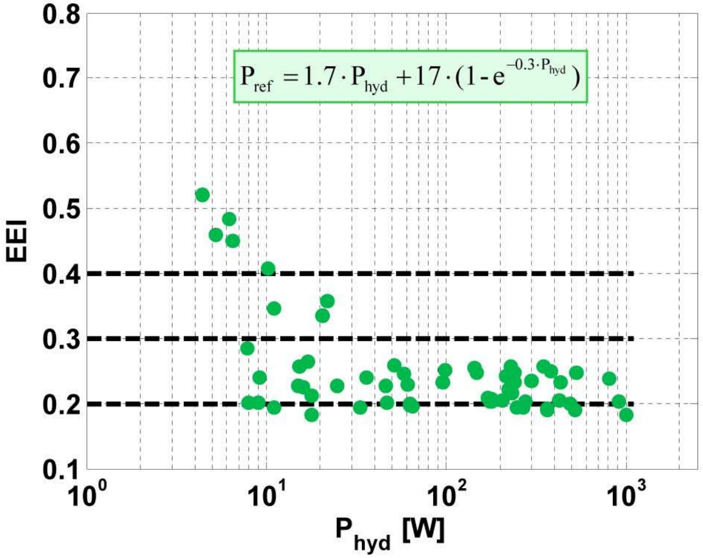

$$EEI = \frac{P_{avg}}{P_{ref}} \cdot C$$

Factor C was fixed to **$C_{20\%}$ = 0.49** in order to achieve EEI values

- 0.2 for 20% of the considered circulators types

Comparison of EEI values
P_{ref} new with P_{ref} new-refined

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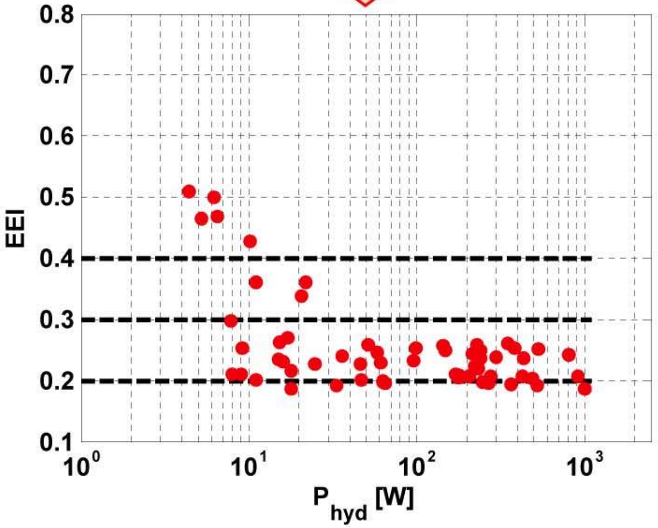
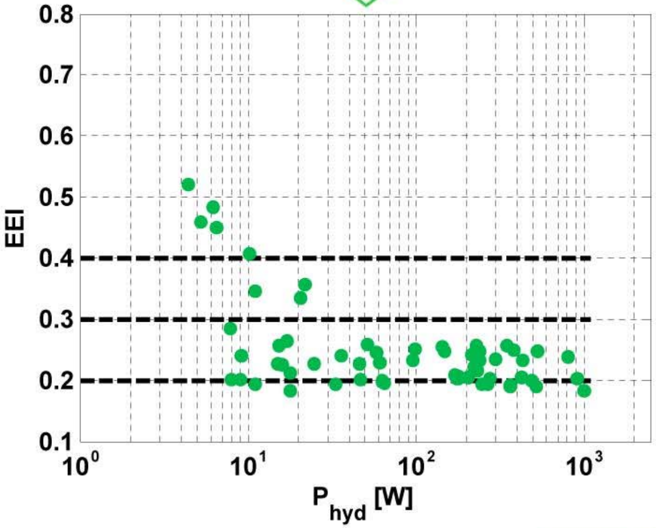
$$P_{ref} = 1.69 \cdot P_{hyd} - 8.06 \cdot e^{-0.07 \cdot P_{hyd}} + 19.09$$

EEI scaled with $C_{20\%}$ = 0.49



$$P_{ref} = 1.7 \cdot P_{hyd} + 17 \cdot (1 - e^{-0.3 \cdot P_{hyd}})$$

EEI scaled with $C_{20\%}$ = 0.49



Comparison of EEI values
P_{ref} old with P_{ref} new-refined

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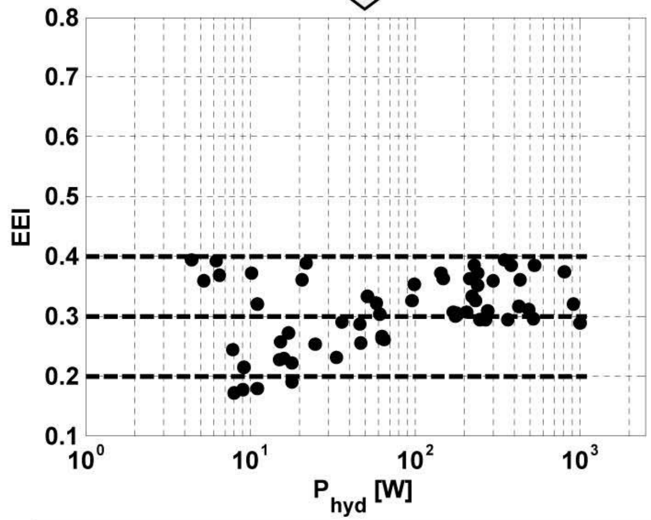
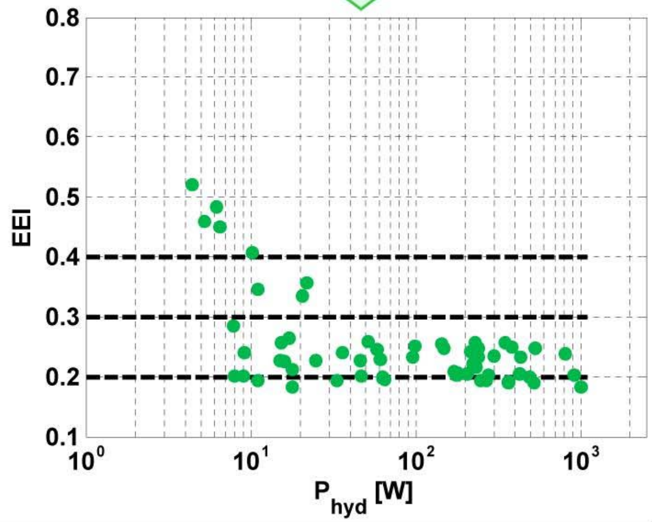
$$P_{ref} = 2.21 \cdot P_{hyd} + 55 \cdot (1 - e^{-0.39 \cdot P_{hyd}})$$

EEI without scaling

$$P_{ref} = 1.7 \cdot P_{hyd} + 17 \cdot (1 - e^{-0.3 \cdot P_{hyd}})$$

EEI scaled with $C_{20\%}$ = 0.49





FLUID SYSTEM TECHNIK

Companies requested for data

TECHNISCHE UNIVERSITÄT DARMSTADT

- Askoll
- Biral
- Circulatingpumps
- DPA Pumps
- Grundfoss
- Halm
- IMP Pumps
- Laing
- Salmson
- Smedegard
- Wilo