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COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

Commission Regulation

implementing Directive 2009/125/EC with regard to ecodesign requirements for computers, servers and displays

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Lead DG: DG ENER

Associated DG: DG ENTR

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

Agenda planning or WP reference:

1. PROCEDURAL ISSUES AND CONSULTATION

1.1 Organisation and timing

The proposed ecodesign implementing regulation is based on the Directive 2009/125/EC of the European Parliament and of the Council establishing a framework for the Commission to set ecodesign requirements for energy-related products[1], in the following abbreviated as "Ecodesign Directive". An energy-related product (ErP), or a group of ErPs, shall be covered by ecodesign implementing measures, or by self-regulation (cf. criteria in Article 19), if the ErP 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).

The Commission has carried out a technical, environmental and economic analysis in preparation of these initiatives, in the following called "preparatory study". The preparatory study was carried out by a consortium of external consultants[2] on behalf of the Commission's Directorate General for Energy and Transport (DG TREN). The preparatory study has followed the structure of the "Methodology Study Eco-design of Energy-using Products"[3] (MEEuP) 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.

On 9 October 2009 a meeting of the Ecodesign Consultation Forum established under Article 18 of the Ecodesign Directive was held (details are provided below). This was followed by subsequent (written) consultation in December 2009.

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1 OJ L 285 of 31.10.2009, p. 10.

2 EuP Preparatory study "Lot 3 –Personal Computers (desktops and laptops) and Computer Monitors", IVF Industrial Research and Development Corporation , Sweden, final report of 27 August 2007 documentation available on the DG TREN ecodesign website http://ec.europa.eu/energy/efficiency/studies/ecodesign_en.htm

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

Article 19 of the Ecodesign Directive, amended by Directive 2008/28/EC[4], foresees a regulatory procedure with scrutiny for the adoption of ecodesign implementing measures. If the Article 19 Committee gives a favourable opinion on a draft measure, and neither European Parliament nor Council oppose adoption, the measure can be adopted by the Commission in 2010.

1.2 Impact Assessment Board

The first opinion of the Impact Assessment Board was given on 21 May 2010. This redrafted impact assessment report reflects its recommendations in the following way:

- The added value of adopting regulatory standards in addition to the existing instruments has been clarified
- The impact analysis of the different options on SMEs has been further developed, and the PC market in the EU has been further described
- The reasons for discarding option 4.2 and 4.3 have been further clarified
- The impact of the different sub-options on the functionality of the equipment, also in light of the fast-evolving technology has been further clarified
- The presentation of cost and benefits and of the impact of the different options has been consolidated and rendered more transparent
- The link between the range established for the potential energy efficiency improvement, the least life cycle cost and the ambition levels of the different sub-options has been clarified
- The scope of the different requirements has been clarified
- The link with ENERGY STAR and the Ecolabel has been further clarified

In addition the impacts of the different options have been recalculated on the basis of latest market data and evidence gathered in the second half of 2010[5] as well as market analysis conducted in other countries implementing the ENERGY STAR Programme (se section 2.4).

1.3 Transparency of the consultation process

External expertise on computers and displays was gathered mainly in the framework of the preparatory study. The 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 for e.g. the International Energy Agency (IEA). The preparatory study provided a dedicated website[6] 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. An open consultation meeting for directly affected stakeholders was organised in the Commission's premises in Brussels on 20 April 2007 for discussing the preliminary results of the study.

During the meeting of the Ecodesign Consultation Forum on 9 October 2009 the Commission staff presented a "working document" with suggestions for ecodesign requirements for computers and displays[7], which are based on the results of the preparatory study. The working

[4] OJ L 81 of 20.3.2008, p. 48.

[5] This work was performed as part of a contract for the monitoring of the impact of the Energy Star Programme

[6] www.ecocomputer.org

[7] Available on DG TREN's ecodesign website

document was published on DG TREN's ecodesign website, and stakeholder comments received in writing before and after the meeting are included in the Commission's CIRCA system. A second working document on computers, servers and displays integrating the comments gathered at the Consultation Forum meeting was sent to stakeholders for written comments on 23 December 2009.

In addition, the initiative was discussed in meetings of Commission staff with third country government representatives as e.g., USA, China, India etc.

1.4 Outcome of the consultation process

The position of main stakeholders on the key features of the Commission services' Working Documents presented in the meeting of the Consultation Forum meeting on 9 October 2009 and in the written consultation in January/February 2010 can be summarised as follows.

The **Member States** support in general the suggested content of the implementing measure. The level of ambition was largely deemed as appropriate. Overall alignment of the Ecodesign regulation specifications with ENERGY STAR 5.0 specifications was endorsed by all Member States, albeit it was signalled that certain adaptations of wording will be necessary. The Member States indicated that a preferred option would by to skip the first tier requirements as these are unlikely to have a big impact on the market, and instead shift backwards the tier 2 and foresee a quick revision date. The scope suggested by the Commission was also accepted, although some Member States would like to include additional products (game consoles[8]), or would like to broaden the requirements so as to better include non-energy aspects. Furthermore, most Member States acknowledged the need to include servers in the scope of the proposal, as a means to quickly achieve energy efficiency gains. Concerning displays, the Member States requested that the wording of the scope be clarified, notably in order to keep notebook displays and other electronic displays such as those found in mobile phones out of the scope, and also to clarify the product boundary between displays and television sets. Several Member States would like a label for electronic displays to be established.

The **Industry** considers the suggested limits as being too stringent and indicates that these may lead to the exclusion from the market of certain high-end products, such as gaming PCs which will not be able to meet the requirements because of the high energy consumption associated with high-quality image processing. With regards to timing, the Industry would like implementation to take place 18 months after entry into force of the measure, instead of 12 months. The Industry would like sleep mode limits to be removed, so as to give producers greater flexibility in the way they take into account power consumption over the typical use of the product. The Industry supports the inclusion of Internal Power Supply limits for Servers but requests a greater transition period. The Industry recommends that high-end displays for special applications be excluded.

NGOs supported several elements of the suggested proposal, such as the inclusion of servers and displays larger than 30 inches in the scope, the 12 months timing for implementation, overall promotion of power management features and the earlier revision date. However, Environmental NGOs do not consider the inclusion of a requirement on information on mercury levels as sufficiently covering non-energy related aspects of ecodesign. As far as consumer information is concerned, Environmental NGOs voiced their concern that web-based information material would not suffice to ensure proper information to consumers.

[8] Ecodesign preparatory study on sound and imaging equipment; AEA, UK; final report on game consoles due September 2010; documentation available on the DG ENTR ecodesign website: http://ec.europa.eu/enterprise/policies/sustainable-business/sustainable-product-policy/ecodesign/product-groups/sound-imaging/index_en.htm

Consumer organisations also call for greater coordination between Ecodesign and Ecolabel as far as benchmarking criteria are concerned in the case of computers. A need for including additional environmental criteria in the measure was also expressed by Consumer organisations.

2. PROBLEM DEFINITION

2.1 Introduction

The underlying problem can be summarised in the following way: cost-effective and energy efficient technologies for computers, servers and displays do exist on the market but their market penetration is lower than it could be. Furthermore, the installed base of these devices is expected to grow significantly in the EU from 2010 to 2020- from 146 to 214 million in the case of desktop computers, from 154 to 252 million in the case of laptops, from 214 to 276 million in the case of monitors and from 14 to 155 million in case of digital photo frames. Change in the use patterns is also expected to have an impact on the energy consumption of these products with a shift to more performing products and their increasing role as centres for entertainment, education and communication.

As requested by Article 15 of the Ecodesign Directive, the preparatory studies identified the environmental aspects in relation to computers and monitors. In order to carry out the technical, environmental and economic analysis the preparatory study has considered representative models for both desktop computers, laptops, cathode ray monitors and flat panel monitors. In particular the study has, amongst others, provided the following key elements:

- power consumption in the different operating modes (on/active, idle, sleep, standby ,off);
- typical usage patterns;
- the bill of materials, weight, packaging etc.;
- the installed base ("stock") and the annual sales for the period until 2020, and the typical life time;
- technologies yielding reduced electricity consumption and the costs effects for applying them compared to the current "market average".

The structure of the methodology of the technical, environmental and economic analysis is displayed in Annex II.

The study concludes that

- they have a significant environmental impact within the European Union
- they present significant potential for improvement without entailing excessive costs
- the following environmental aspects are relevant:
    - energy consumption in the use phase, including power consumption in the different operating modes, power management and the efficiency of the power supply units;
    - hazardous substances – mercury of backlights for LCD displays, laptops and integrated computers , flame retardants, content of chemicals in the batteries of laptops;
    - waste;

The most significant aspect for improving the environmental performance of computers, servers and displays is the energy consumption the different operating modes, power management and the efficiency of power supply units. Further significant aspects are related to hazardous substances and waste. Those aspects are already addressed by related EU legislation (see below).

2.2 Product scope

It has to be noted that the preparatory study analysed only desktop computers (including integrated desktop computers, i.e. desktop systems in which the computer and the computer display function as a single unit), laptops and computer monitors, whereas the scope of this impact assessment accompanying a draft implementing regulation under the Ecodesign Directive includes also thin clients, workstations, servers and displays, other than computer monitors. Thin clients and workstations are specific computer genres. Thin clients are computers that rely on a connection to remote computing resources (usually located in a server) to perform its tasks. Workstations are high-performance computers typically used for professional tasks, such as software development or financial and scientific applications (technically it support really high-end graphics and for e.g. several processors). It was decided to include these product groups, as well as servers in the scope of a possible regulation under the Ecodesign Directive as a significant share of their energy-saving potential is linked to the efficiency of their internal power supply. Since the technical specifications of internal power supplies for these devices are the same as for desktop computers (and these were analysed in detail in the framework of the preparatory study) it was concluded that these products could be included in the scope of the regulation, provided the applicable requirements apply only to the internal power supply efficiency. This approach was broadly endorsed by stakeholders. The decision to include displays other than computer monitors in the draft regulation was linked to recent market developments, with the arrival on to the market of displays that are neither a computer monitor (since they can generate their own content), nor a TV set (since they don't have a TV tuner). These devices have the same technical specifications as computer monitors and are used both in the domestic (e.g. digital photo frames) and tertiary (e.g. displays in shops) sectors. The technical background related to workstations, thin clients and servers was based on the ENERGY STAR Programme and the technical background on displays other than computer monitors was based on the ENERGY STAR Programme and on a subsequent Ecodesign preparatory study[9].

2.3 Market failures

Major barriers for the market uptake of computers, servers and displays with low energy consumption exist which are largely due to the following market failures:

1. **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. **Incomplete information** on running costs/cost savings: information on running costs/cost savings is not explicit and can be obtained only with difficulty. This aspect is to some extend however addressed by the voluntary labelling ENERGY STAR Programme (described below) which pulls the market towards more efficient solutions.

[9] Ecodesign preparatory study on sound and imaging equipment, AEA, UK; final report on digital photo frames of January 2010, documentation available on the DG ENTR ecodesign website: http://ec.europa.eu/enterprise/policies/sustainable-business/sustainable-product-policy/ecodesign/product-groups/sound-imaging/index_en.htm

Energy efficiency of computers, servers and displays until now has not been an important purchasing criterion, and the awareness for the implications of the energy consumption for the electricity bill are limited. In general these market failures are due to the fact that the product features and performance are, arguably, much more important for these devices than, in the case of for e.g. white goods.

Moreover, energy consumption until now has played only a minor role for the design of computers, servers and displays. Their design and the endless drive towards more performance and functionality often imply trade-offs with the energy consumption. Due to little demand for products with improved energy efficiency, little incentives exist for manufacturers to optimise the energy consumption of computers, servers and displays. This specific market failure can be exemplified by latest generations of chips (Pentium 4) consuming 38 more times energy than early chips (i486) while delivering performance only eight times better[10].

3. **Split incentives.** Procurement experts are often not responsible for infrastructure and energy costs and hence have little interest in buying energy-efficient products.

2.4 Related initiatives on European Union and Member State level

Both on EU and on Member State level initiatives have been launched which aim at improving the environmental impact of computers, servers and displays. These initiatives include European Union legislation on an energy efficiency labelling programme for office equipment (the "ENERGY STAR Programme")[11], on waste ("WEEE")[12], on hazardous substances ("RoHS")[13], on standby/off-mode power consumption[14], on the power consumption of external power supplies,[15] and the and the eco-label for computers and displays[16], the TCO, Blue Angel and Nordic Swan labelling schemes, and The Code of Conduct for Data Centres.

ENERGY STAR is the most relevant initiative addressing the energy efficiency of computers, displays and servers. The voluntary labelling programme has been applied to a number of product groups in the Unites States since 1992 and for office equipment since 2000 also in the European Union. In the framework of an international agreement between the Government of the Unites States and the European Union[17], the US Environment Protection Agency and the

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10 Gadgets and Gigawatts - Policies for Energy Efficiency Electronics © OECD/IEA, 2009, [figure 127], [page 287], quoting Grochowski, E. and M.Annavaram (2006), Energy per Instruction Trends in Intel Microprocessors, Technology@Intel Magazine, March 2006.

11 Regulation (EC) No 106/2008 of the European Parliament and of the Council og 15 January 2008 on a European Union energy-efficiency labelling programme for office equipment

12 Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on waste electrical and electronic equipment (WEEE); OJ L 37, 13.2.2003, p. 24.

13 Directive 2002/96/EC of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment; OJ L 37, 13.2.2003, p. 19.

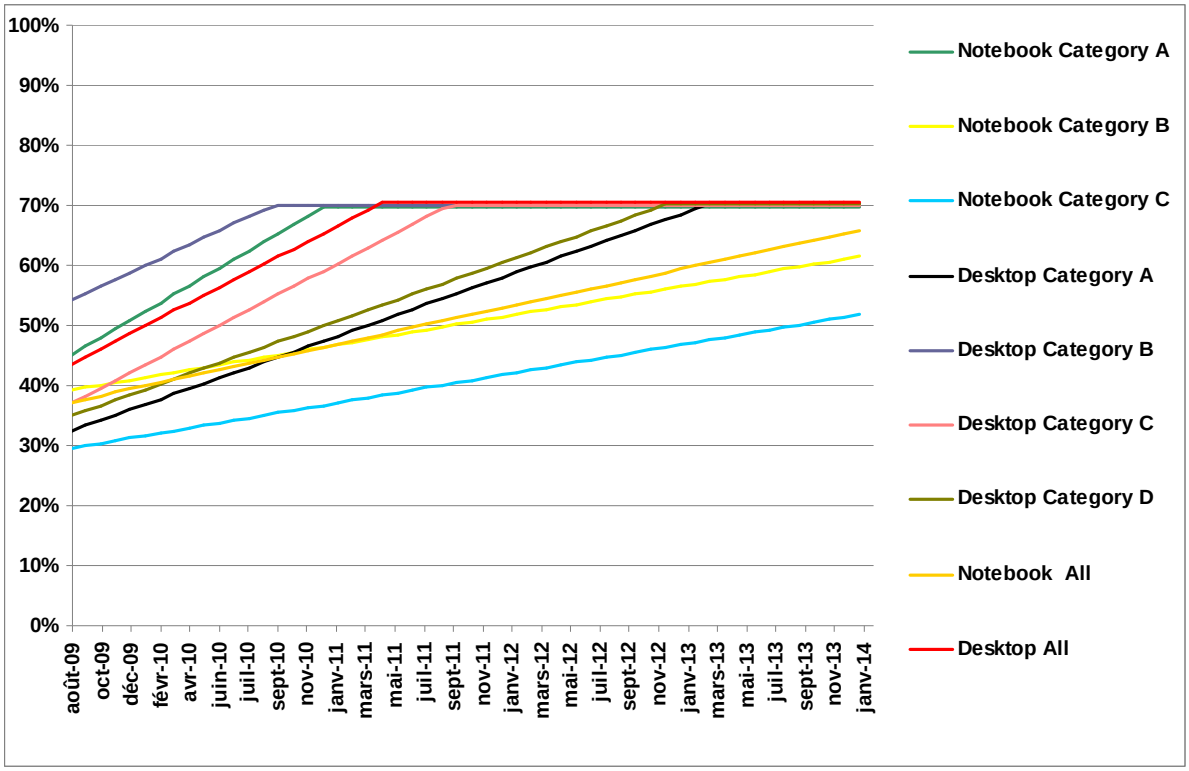
14 Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment; OJ L ….

15 Commission Regulation (EC) No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies; OJ L ….

16 Commission Decision of … establishing the ecological criteria for the award of the European Union eco-label to computers

17 Agreement between the Government of the United States of America and the European Community on the coordination of energy-efficiency labelling programmes for office equipment, 28.12.2006, OJ L 381, p.26

European Commission (assisted by Member States) cooperate on the development of specifications for office equipment which are then introduced almost simultaneously on both territories. The criteria for office equipment are revised and tightened regularly in order to adjust for market and technology developments. Since the start of the Programme in the EU the criteria for computers and displays were already revised two times (the current version bears the number 5 to account for the earlier ones that were applied only in the US), and the first criteria for servers are about to enter into force. The criteria are set in such a way so that when they enter into force, they correspond approx. to the 25% most energy-efficient equipment on the market. The criteria are adjusted to the different market segments for e.g. by giving a higher energy allowance for more performing products (in the case of computers depending on the number of physical cores, the performance of the graphics processing unit and the amount of internal storage). Although the programme is voluntary it is very popular with manufactures, and one of the reasons is that since 2008 all central authorities of Member States have to specify public procurement criteria not less demanding than the latest ENERGY STAR specifications[18]. The graph below illustrates the expected increase in the percentage of computers and displays in the EU meeting the current ENERGY STAR criteria.



Graph 1 – Potential ENERGY STAR v5.0 Coverage Rates Across all Computers to January 2014[19]

Although the ENERGY STAR Programme is an effective policy instrument, there is a strong rationale for considering complementing it with additional policy measures, such as minimum efficiency requirements. Firstly the impact of ENERGY STAR is largely limited to the office

18 Regulation (EC) No 106/2008 of the European Parliament and of the Council of 15 January 2008 on a Community energy-efficiency labelling programme for office equipment, OJ L 39, p. 1

19 This estimate is based on quarterly reports submitted as part of a Survey of the market penetration of energy-efficient office equipment under the Energy Star Programme. The final report is to be published in December 2010. The assumption that the penetration of Energy Star equipment will not exceed 70% is based on the quarterly reports received so far, input from the industry, and the quoted analysis that was carried out in Australia.

segment due to the link with public procurement. This can be observed on Graph 1 – the fastest increase of compliance with ENERGY STAR can be observed in products used in offices (i.e. low specification/simple configuration – Cat A and B), whereas in richly-configured products used by private consumers (Desktop Category D, notebook category C) these percentages remain relatively low. It has to be noted that according to industry data the size of the private consumer vs office market is currently 2:1 (Graph 1 shows the progress within product categories, and does not indicate the relative size of these categories). Secondly ENERGY STAR is a typical 'pull' policy instrument, stimulating developments in the first market tier (first market tier in terms of energy efficiency, not performance), but failing to impact the last tier. An analysis performed last year in Australia[20] found out that although 25% of the tested models complied with the latest version of ENERGY STAR specifications, as much as 45% did not meet the specifications introduced 9 years earlier. This confirms that the programme' impact on certain segments of the market remains limited and therefore these segments should be addressed with complementary instruments. For that reason ENERGY STAR can be reinforced with mandatory minimum efficiency requirements. The two combined would constitute a classical market transformation policy mix, including both 'pull' and 'push' mechanisms. At the same time since the definitions, test methods and criteria developed by ENERGY STAR are widely recognised by the industry and policy-makers it is sensible to base the possible mandatory ecodesign requirements on these criteria, albeit with several necessary adjustments.

WEEE addresses the computers, servers and displays' environmental impact of waste. It provides incentives/obligations for manufacturers to facilitate design for recycling by setting a minimum reuse/recycling rate for these devices of 65% and a minimum recovery rate of 75%. The actual approach to recycling, reuse and recovery and organisation of the material flows – such as thermal treatment, automatic shredding with subsequent material separation and recycling, manual disassembly or reuse – depends on national specificities.

No particular difficulties for the implementation of WEEE for computers and displays are reported in the 2008 WEEE review[21], which could be relevant for possibly complementary ecodesign requirements. The recycling percentages analysed in this review[22] show that the recycling, reuse and recovery rates are fulfilled for computers and displays. Even though cathode ray tube (CRT) recycling is the actual display recycling issue, it can be assumed that the targets under the WEEE directive will further encourage display manufacturers to take that into account in their business strategy and perform liquid crystal display (LCD) recycling and reuse whenever feasible from a business perspective. The review also shows that waste treatment patterns of electronic waste have changed over the last ten years. For example, manual disassembly is rather replaced by effective shredding and separation technologies or the economic focus has shifted from design for recycling costs to the cost-efficient maximization of the overall environmental performance[23]. Furthermore there has been a trend of newer equipment containing fewer hazardous materials and components and in lower amounts than their older counterparts. A positive trend from the point of view of both hazardous substances and waste is the gradual vanishing from the market of CRT displays.

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20 Computers and energy efficiency in Australia, A report on testing of 56 randomly selected computers', Department of Environment, Heritage, Water and the Arts, Canberra.

21 See 2008 Review of Directive 2002/96 on Waste Electrical and Electronic Equipment (WEEE), Final Report, United Nations University, Bonn, Germany et al., Contract No: 07010401/2006/442493/ETU/G4, ENV.G.4/ETU/2006/0032, 05 August 2007, http://ec.europa.eu/environment/waste/weee/studies_weee_en.htm

22 Table 120 of [21].

23 Section 5.9 "Times have Changed" of [21]

RoHS sets restrictions for the use of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB) and polybrominated diphenyl ethers (PBDE), which are periodically under review, and also apply to computers and displays.

The ecodesign implementing regulation on standby/off-mode power consumption sets ecodesign requirements for standby/off-mode electricity consumption of electrical and electronic household and office equipment, including computers (non-professional) and displays. In line with this measure computers and displays have to consume a maximum of 1 Watt in standby/off mode as of January 2009 and, this will be further decreased to 0,5 Watt in January 2013. It is considered that this timing is appropriate and should be maintained. At the same time the definition of off mode should be adjusted to the specificity of these product to ensure for e.g. that conditions providing power level detector after completion of battery charging in a notebook are still considered as being 'off' mode. The other regulation relevant for these products is the one that sets requirements for the energy efficiency of external power supplies. External power supplies convert power input from the mains power source into lower voltage output, and they are used by displays and notebooks. Together these two measures and the ENERGY STAR Programme will address between 60 and 70% of the saving potential of computers, servers and displays. The measure assessed in this impact assessment will complement it by minimum efficiency requirements placed on the other operating modes and relevant components, such as internal power supplies.

A number of complementary voluntary initiatives aim at fostering the energy efficiency and other environmental parameters of the equipment analysed in this impact assessment. The Code of Conduct for Data Centres is a voluntary initiative led by the DG JCR to improve energy efficiency in data centres (including servers). It provides a platform that brings together European stakeholders including the data centres owners and operators, equipment manufacturers, vendors, consultants and utilities to agree on voluntary actions and share best practice. The TCO, the Ecolabel, the Nordic Swan and the Bleu Angel are all voluntary labels aiming at fostering the environmental performance of computers and displays. However these labels have only a limited impact on the market- for e.g. in December 2009 only 15 models of notebooks and desktops were registered with the Ecolabel, whereas in the case of ENERGY STAR it was more than 800.However the Ecolabel doesn't aim at a full market transformation but rather at stimulating the demand for the best not-yet available products in terms of environmental performance. The criteria for energy efficiency are very stringent[24] and products need to include a given percentage of recycled materials, not include mercury etc. In addition to these initiatives Ecma International, an industry association dedicated to the standardization of Information and Communication Technology (ICT) and Consumer Electronics (CE) is actively developing performance, and measurement standards for this equipment. In parallel to these initiatives which aim at decreasing the environmental impact at product level, the Commission has recently engaged in a number of initiatives that aim at using ICT as an enabler of energy efficiency by setting tasks, targets and timelines for industry, stakeholders and Member States to accelerate progress in such areas a eCommerce, eGovrenement, teleworking and grid computing[25].

2.5 Baseline Scenario

The electricity consumption of computers, servers and displays will be approx. 75 TWh in 2010 in EU-27. For 2020 the electricity consumption is estimated to be 96 TWh in EU27. It

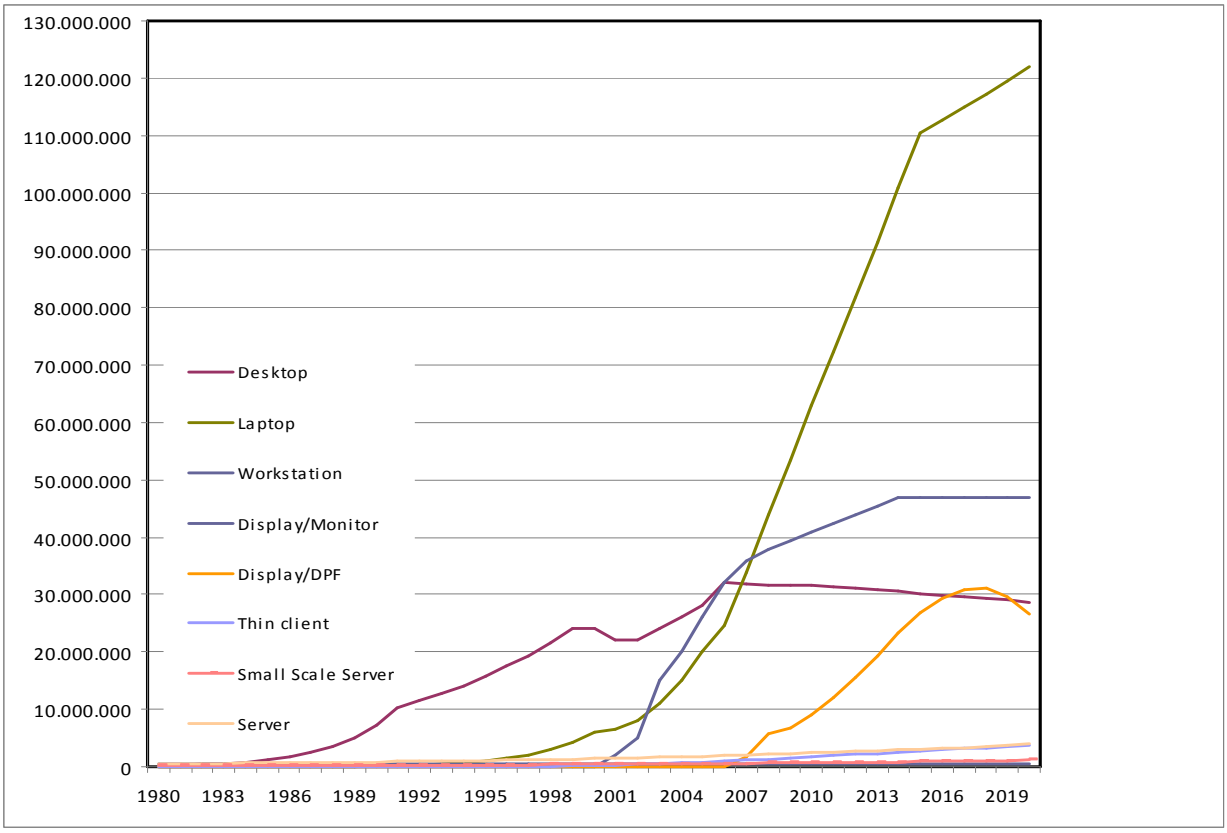
[24] The current Ecolocabel refers to the latest Energy Star criteria but it is planned to introduce in the new specifications requirements for 'Energy Star – X%'.

[25] "Mobilising Information and Communication Technologies to facilitate the transition to an energy-efficient, low-carbon economy", COM (2009) 111 of 12 March 2009

has to be noted that without the existing measures described in the previous section, notably the ENERGY STAR Programme and the Ecodesign implementing measures (Baseline 2) this electricity consumption in 2020 would be as high as 130 TWh. Existing policies will decrease it thus by as much as 26%.

This baseline scenario is based on the following predictions and assumptions.

– It is predicted that sales of computers will be 150 million, of displays will be 75 million and of servers will be 4 million in 2020 increasing from today respectively by 60, 25 and 2,5 million. Within the computer product group laptops will see the most dramatic increase in sales, whereas the market of desktops should stabilise at fewer than 30 million sales per annum.

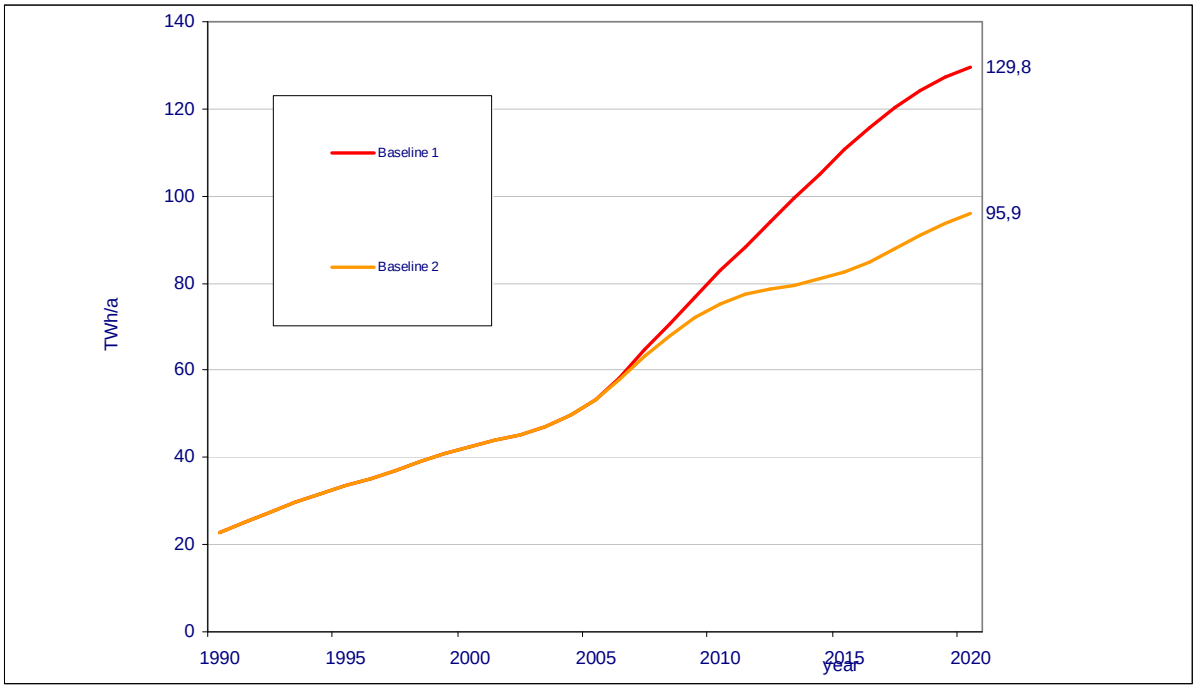


Graph 2: Development of IT equipment sales up to 2020

– The average economic lifetime is assumed to be 6 years for desktop computers, 5 years for notebooks and 6 years for displays. The prime driver for replacement is the software (both operating systems and application software).

– It is assumed that the usage patterns for computers is roughly 37% off mode, 36% sleep and 26% idle (on) in the case of office use and 49% off mode, 33% sleep and 18% idle in the case of home use; the assumed usage patter of displays is similar, the assumed usage pattern of displays generating their own content (such as digital photo frames) is 41% in on mode and 59% in off/standby mode.

– It is assumed that the unit efficiency of the products covered will be increasing due to the impact of ENERGY STAR and the ecodesign regulation on standby/off mode and external power supplies. As a result although the market penetration will be increasing and usage patterns will be evolving towards longer using hours the overall energy consumption will increase only by 31% by 2020.



Graph 3: Development of electricity consumption of computers, displays and servers until 2020 under a 'no-policy' scenario (Baseline 1) and 'current policy' scenario (Baseline 2)

2.6 Legal basis for EU action

The Ecodesign Directive and, more specifically, its Article 16 provides the legal basis for the Commission to adopt an ecodesign implementing measure for computers, servers and displays.

2.7 Improvement potential

The preparatory study has shown that existing cost-effective technical solutions allow for improvement of the energy efficiency of computers and displays. In the case of displays thanks to power management and efficient power supplies the primary energy consumption can be reduced by 40% (reducing the life-cycle cost to the consumer by 40 euro for home users and 70 euro for office users); in the case of desktop computers improved power management, efficient power supplies, the installation of dual core processors and adaptive clocks can reduce the energy consumption by 50% (reducing the life-cycle cost to the consumer by 50 euro for home users and 100 euro for office users). For laptops similar improvement options lead to a decrease of energy use by 35% and savings of about 30 euro for office users.[26]

3. OBJECTIVES

As laid out in Section 2, the preparatory study has confirmed that a large cost-effective potential for reducing electricity consumption of computers and displays exists. This potential is not captured, as outlined above. The general objective is to develop a policy which corrects the market failures, and which:

I) Reduces energy consumption and related CO2 and pollutant emissions due to computers, displays and servers and drives following Community environmental

[26] Based on 2007 data as in the Preparatory study- so impact of standby regulation was not factored in the base cases but still- off mode assumed around 2 W and only a third of the time in office and half at home

priorities, such as those set out in Decision 1600/2002/EC or in the Commissions European Climate Change Programme (ECCP);

II) Promotes energy efficiency hence contribute to security of supply in the framework of the Community objective of saving 20% of the EU's energy consumption by 2020.

The policy should specifically aim at:

– creating incentives for manufacturers to design energy efficient models,

thereby

– transforming the computer, server and display market towards products with improved energy performance,

– inducing significant reductions of the environmental impact related to electricity consumption of these devices,

– inducing cost savings for the end-user.

Furthermore, the objective is to satisfy the provisions of the Ecodesign Directive, and in particular its Article 15 (5), which requires that ecodesign implementing measures meet all 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.

4. POLICY OPTIONS

4.1 Option 1: No new EU action

This option would have the following implications:

– the barriers for realizing the potentials to improve the energy efficiency of computers, servers and displays would persist. Although as demonstrated in Section 2 the existing EU policy tools have a significant impact on the market transformation across these product groups, they do not address the full cost-effective energy-saving potential and do not succeed in impacting all market segments.

– it is to be expected that Member States would want to take individual, non-harmonized action. This would hamper the functioning of the internal market and lead to high administrative burdens and costs for manufacturers, in contradiction to the goals of the Ecodesign Directive.

– the specific mandate of the legislator would not be respected.

4.2 Option 2: Self regulation

No initiative for self-regulation on computers, server and displays pursuant to Annex VIII of the Ecodesign Directive has been brought forward. Past experience on voluntary agreements on such products as white goods and televisions indicates that sectors with a fragmented manufacturing structure have difficulties to gather sufficient support among market operators. Therefore even if the industry tabled a proposal for self-regulation on computers it would probably not meet some of the criteria listed in Annex VIII of the Directive, such as the condition to represent a large majority of the sector. A fragmented market structure increases the transaction costs of self-regulation and exposes potential signatories to competition from 'free-riders'. This PC sector with an approx. 30% market share of SMEs is a case in point here.

Therefore this option is discarded from further analysis.

4.3 Option 3: Mandatory energy labelling for computers, servers and displays under Directive 2010/30/EC

The ENERGY STAR Programme providing for the labelling of office equipment is effective in pulling the market towards the most efficient products. Although the ENERGY STAR label is not widely recognised by consumers in the EU and the scheme is voluntary, the strength of this programme stems from the fact that the procedure for setting and updating requirements as well as registering products is relatively flexible and fast, and manufacturers have a strong incentive to acquire the label due to the associated provisions on public procurement. Nevertheless as it is voluntary it does not sufficiently impact all market segments, hence the rationale for complementing it with a 'market push instrument', i.e. with mandatory minimum requirements.

The application of mandatory labelling to computers, servers and displays does not seems sensible for the following reasons:

– There exists already a labelling scheme that 'pulls' the market towards greater efficiency. A simultaneous application of two labels could be confusing for consumers, and potentially negatively impact the effectiveness of the ENERGY STAR Programme, and its associated advantages, such as a common EU framework for public procurement, and a common EU-US policy framework.

– The A-G labelling scheme under Directive 2010/30/EC would not be appropriate in the case of computers and servers due to the multitude of existing configurations and functionalities, and the associated difficulty to establish an energy efficiency index which could be applied across all product categories.

– In the case of displays the introduction and an A-G labelling scheme would not be in line with Article 11 of the Directive which stipulates that the steps of the energy classification shall correspond to significant energy and cost savings from the end-user perspective. The display market is still largely dominated by display sizes for which the different classification grades would not correspond to significant energy and cost savings. As an example, in the case of a 17 inch display consuming 17 W in on mode (among the best currently available) which would be graded 'B', and assuming a 'heavy' usage pattern (8 hours a day in on, 5 days a week), the difference between 'B' and ' A' (11 W in on in order to qualify) the annual electricity cost saving would be about 2 euro, which is not a significant cost savings.

Therefore this option is discarded from further analysis.

However given the expected technology and market developments towards bigger displays which could in the future be used increasingly to watch TV broadcasts, and taking into

consideration that an A-G label will be applied to TV sets, this issue should be reviewed in due course, for e.g. as part of the review of Regulation (EC) 642/2009 setting ecodesign requirements for televisions (scheduled for 2012). This review will have to aim in particular at developing a common metric for measuring the power consumption of displays and TV sets which would enable a common regulatory approach for these two product groups.

4.4 Option 4: Ecodesign requirements

This option aims at improving the environmental impact of computers, servers and displays, 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 the consideration of 3 sub-options. These sub-options vary according to three variables- limit values for energy consumption, implementation phases, and scope. Regarding the limit values the aim is to set them at a level providing for the highest energy savings while ensuring no negative impact on the functionality and affordability of the products. Regarding implementation phases the aim is to ensure that the cost-effective potential is realised the earliest possible while ensuring that the industry has sufficient time to redesign the affected products.

The 3 sub-options are outlined below (their full details are provided in Annex II):

Sub-option 1 can be summarised as follows:

- Scope excludes thin clients, workstations, small-scale servers and servers
- Limit values for TEC[27] and functional adders are from 30 to 45% higher (less stringent) than in sub-option 2 (second tier) and sub-option 3
- The implementation time ranges from 18 to 24 months after the regulation comes into force
- High-end computers (Category D with graphics category G4 and above) are excluded for the power consumption limits
- This sub-option corresponds to the industry proposals presented at the Consultation forum on 9 October 2009 and in subsequent consultations

Sub-option 2 can be summarised as follows:

- It sets ecodesign requirements essentially in two stages. The first stage gives relatively high limit values which are based on the previous version of ENERGY STAR specifications (version 4.0) which was in force since 2007. The first stage is applicable already 6 months after the entry into force of the regulation. The second stage is based on the current ENERGY STAR specifications (version 5.0) and enters into force 18 months after the entry into force of the regulation.
- Limits on the typical energy consumption are also applied to computers which were not analysed in the preparatory study, namely workstations and thin clients. As it is assumed that the redesign of these products will need more time than the other types of computers the implementation time is extended (18 months in the case of thin clients and 30 in the case of workstations)

[27] 'Typical Energy Consumption (TEC)' means the electricity consumed by the device while in various modes during a representative period of time

– This sub-option corresponds to the content of the Working Document that was presented by the Commission services at the Consultation Forum on 9 October 2009 with the subsequent addition of requirements on the server power supply efficiency

Sub-option 3 can be summarised as follows:

– It sets ecodesign requirements essentially in two stages. The core of requirements is applicable 12 moths after the entry into force of the regulation although additional time is given to high-end products (category D desktops and category C notebooks, requirements on the efficiency of the internal power supply for servers).

– As compared to sub-option 2 it gives additional allowances in a very limited and well-targeted number of cases (e.g. extra allowances for high-performing graphics processing units and displays with in-plane switching technology)

– High-end computers (Category D with graphics category G4 and above) are excluded for the power consumption limits

– This sub-option is the result of consultations with Member State and industry experts after the Consultation Forum of 9 October 2009

4.5 Definition of computers, servers and displays covered by ecodesign

The scope and definitions used in the ecodesign implementing regulation build on the well established ENERGY STAR categories, as recommended by the preparatory study. The category of computers includes desktop computers, notebook computers, integrated desktop computers, workstations (high-performance computers used for professional applications), thin clients (computers relying on a connection to remote computing resources to perform its functions) and small-scale servers. Servers include all server categories except for certain server categories which have not been yet dealt with under the ENERGY STAR Programme, such as blade systems or fully fault tolerant servers. Computer servers with more than four processor sockets are not included under the scope of this regulation. The category of displays includes computer monitors with a viewable diagonal screen size bigger than 30.5 cm (12 inches) and displays able of generating their own content (e.g. digital photo frames). Displays are fundamentally differentiated from TV sets by their primary function, i.e. displaying input from a PC or displaying TV broadcast..

4.6 Level of ambition of ecodesign requirements

According to the Ecodesign Directive 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. The tables below show the calculation of the LLCC of the improvement options for desktops, laptops and displays (office use pattern).

Table 1: Impacts and costs per product and improvement option (one by one) for office desktops.

Base cases Life cycle impact/cost	Base case	Power manage-ment	Dual core processor	Adaptive clock	80+ PSU	Replace ment laptop
Total Energy, GER (MJ)	16165	10166	13085	14080	13542	5663
Greenhouse Gases (kg CO2eq)	761	500	627	670	647	281
Product price (Euro)	620	620	630	620	625	1242
Electricity (Euro)	163	90	126	138	131	51
Repair & maintenance costs (Euro)	117	117	117	117	117	118
Total Euro	900	827	872	875	873	1411

Table 2: Impacts and costs per product and option, one by one, for office laptops.

Base cases Life cycle impact/cost	Base case	Power manage-ment	Dual core processor	80+ PSU	LED-screen
Total Energy, GER (MJ)	7200	4973	6554	5895	6831
Greenhouse Gases (kg CO2eq)	348	250	319	291	331
Product price (Euro)	1242	1242	1257	1247	1292
Electricity (Euro)	70	43	62	54	65
Repair & maintenance costs (Euro)	118	118	118	118	118
Total Euro	1430	1403	1437	1419	1475

Table 3: Impacts and costs per product and option one by one for LCD-screens in offices.

Base cases Life cycle impact/cost	Base case	Power manage-ment	80+ PSU	LED instead of LCD
Total Energy, GER (MJ)	7231	4498	6102	5824
Greenhouse Gases (kg CO2eq)	336	217	287	275
Product price (Euro)	201	201	206	251
Electricity (Euro)	73	40	59	56
Repair & maintenance costs (Euro)	0	0	0	0
Total Euro	274	241	265	307

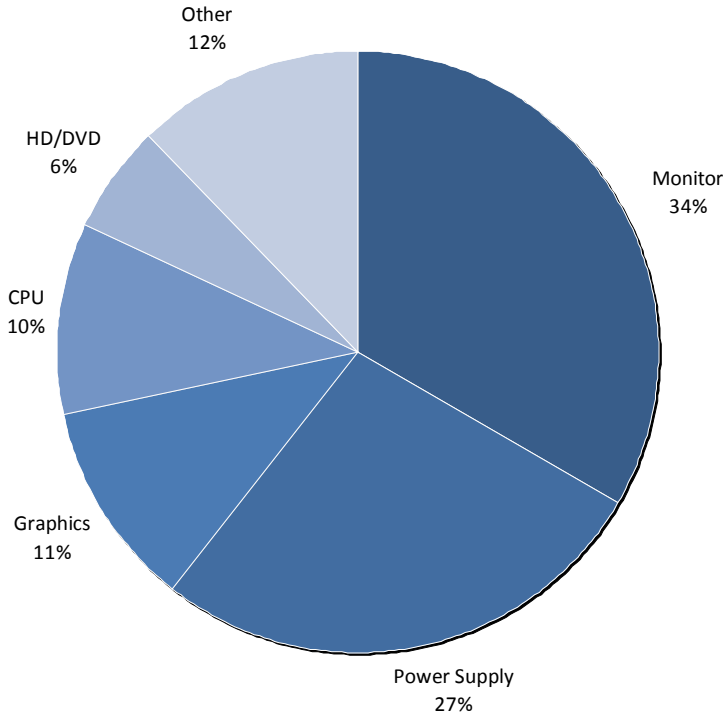
The calculations indicated in the tables above indicate that:

– In the case of desktops the LLCC (least life cycle cost) can be achieved by using efficient power supplies, power management, decreasing the overall power consumption of the system (possible with a series of options such as dual core or adaptive processor intensity). Therefore possible ecodesign requirement should target these three elements. Total primary energy can be more than halved, while reducing the cost to the consumer by nearly 100 Euro.

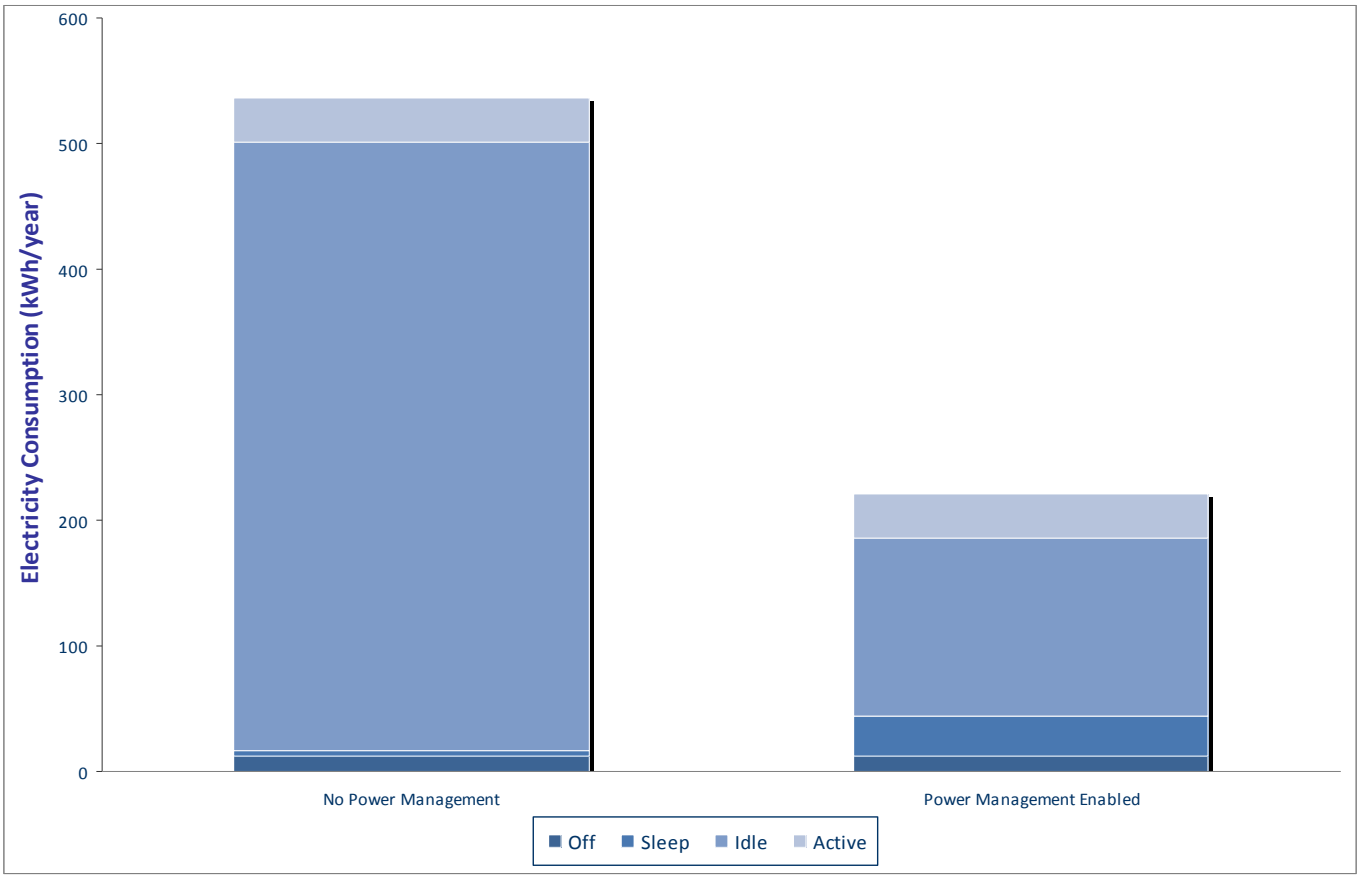
– In the case of laptops and displays the LLCC can be achieved by using efficient power supply units and power management at the same time. Total primary energy would then be reduced by 35%, while reducing the cost to the consumer by approximately 30 Euro for laptops and 70 euro for standard-size displays. Although the use of improved processors is

slightly above LLCC and LED, instead of LCD is clearly above LLCC, since the conclusion of the study the price of these technologies has decreased.

Graph 4 below shows the estimated distribution of power among components in a typical desktop PC with LCD monitor. It shows the importance of addressing the efficiency of power supply but also of power management, since the power drawn by both the central processing unit (CPU) and graphics processing unit (GPU) can be reduced the most effectively through power management. The effectiveness of this policy option is shown on graph 5.



Graph 4. Estimated distribution of power among components in a typical desktop PC with LCD monitor.
Source: Gadgets and Gigawatts - Policies for Energy Efficiency Electronics © OECD/IEA, 2009



Graph 5: Estimated annual electricity consumption of desktop PC and monitor with and without power management;
Source: Gadgets and Gigawatts - Policies for Energy Efficiency Electronics © OECD/IEA, 2009

The cost-effective improvement potential for computers and displays ranges from 30% to 50% compared to the current market average, and ecodesign requirements limiting the energy use in the different operating modes and optimising power management should be set.

The appropriate level of ambition for ecodesign requirements for the power consumption is therefore a 30% to 50% reduction of the typical energy consumption as compared to the current market average. At the same time it should be ensured that there is no negative impact on the functionality of the products in line with Article 15 (5a) of the Ecodesign Directive. To this end a solution, which optimally satisfies the provisions of the Ecodesign Directive will be searched for in Section 5, notably taking into account the needed capability adjustments. Moreover, the appropriateness of the level of ambition should be re-assessed in the short term, because new technologies may come onto the market that both may drive the power consumption of these devices up and may offer possibilities for additional power cuts.

The corresponding impact for power consumption and the life-cycle costs should be analysed and, if appropriate, the level of ambition should be revised. After consultation of stakeholders and Member States, the appropriate timing for such a revision is considered to be three to four years and should be coordinated with the planned work around the revision of the ENERGY STAR specifications.

4.7 Energy efficiency levels and power management requirements

The improvement options listed above have to be addressed while ensuring that there is no negative impact on the functionality of the product (i.e. that certain high-end product can still meet the requirements) and the industry has sufficient time to redesign the products and place

them on the market. Taking these elements into account it is concluded (as analysed in Section 5) that the appropriate approach is to set minimum requirements for the typical energy consumption (computers), the on and sleep modes power consumption (displays, computers), power management (computers, displays) and the efficiency of internal power supplies (computers, servers) in two stages, as shown in the following table. This corresponds the sub-option 3 analysed in section 5.

TEC power consumption- computers (excluding work stations, thin clients and small-scale servers, excluding Category D desktops with GPU G4 and above)
a) Desktops (A,B,C)/laptops (A,B) – 12 months after Regulation comes into force ENERGY STAR 5.0 levels b) Desktops (D)/laptops (C) – 18 months after Regulation comes into force ENERGY STAR 5.0 levels c) Capability adjustments- 12 months after Regulation comes into force same ENERGY STAR 5.0 levels
Sleep mode power consumption –computers (excluding work stations, thin clients and small-scale servers)
Desktops/laptops – 12 months after Regulation comes into force 6 W
Off mode power consumption – computers (excluding work stations and small-scale servers)
Same as in the Standby Regulation (1275/2008)

Internal power supply efficiency – computers, servers
a) Computers 12 months after the entry into force in line with ENERGY STAR 5.0 levels b) Servers 18 months after the entry into force in line with ENERGY STAR 1.0 levels (servers)
Power management – computers (excluding thin clients, work stations and small-scale servers)
12 months after this Regulation has come into force: Desktops/integrated computers/notebooks shall: – be shipped with a sleep mode which is set to activate within 30 minutes of user inactivity. – reduce the speed of any active 1 GB/s Ethernet network links when transitioning to Sleep or Off when WOL enabled. Computers shall also: – be shipped with the display sleep mode set to activate within 10 minutes of user inactivity.
On power consumption - displays
12 months after Regulation enters into force all displays same as ENERGY STAR 5.0
Sleep power consumption -displays
1 W 12 months after Regulation in force
Off power consumption- displays
Same as in the Standby Regulation (1275/2008)
Power management -displays
a) 12 months monitors- Same as in ENERGY STAR- 15 minutes after last interaction able to support APD b) Displays generating their own content 12 months after this Regulation has come into force: Must have at least one mechanism enabled by default that allows the display to automatically enter sleep or off mode after a period of 4 hours of user inactivity. For instance, data or network connections must support powering down the display according to standard mechanisms, such as Display Power Management Signalling.

Capability adjustments beyond ENERGY STAR 5.0 (computers, displays)
Additional power budget for displays with colour gamut> 90%
Reclassifications of graphics processing units into 5 distinct categories with power budgets adjusted to performance, instead of two as in ENERGY STAR 5.0

Table 4. Overview of the proposed requirements

These requirements aim at realizing the cost-effective electricity consumption improvement potential/level of ambition discussed in Section 2 for all computers, servers and displays, while fulfilling the criteria for ecodesign implementing measures set out in Section 3.

The requirements are largely based on the latest ENERGY STAR specifications for computers and displays. These specifications took effect in the EU in July 2009 for computers and October 2009 for displays (the next ones are expected in late 2011). The principles of establishing minimum efficiency requirements under the Ecodesign Directive and ENERGY STAR specifications differ. While the former are based on the principle of least life-cycle cost, the latter aim at capturing the 25% most efficient products on the market at the time of setting the specifications. The preparatory study concluded however that although ENERGY STAR is a voluntary programme, its specifications are suitable for mandatory minimum requirements, while it has to be ensured that this doesn't lead to the exclusion from the market of high-performance computers and hence a negative impact on the functionality of the products as required by Article 15 (5a) of the Ecodesign Directive. This is why sub-option 3 includes additional capability adjustments indicated in the last row in the table above. This is further discussed in Section 5. The advantage of basing these requirements on the latest ENERGY STAR specifications is that by the time of their expected entry into force (Tier 1- March 2012, Tier 2- September 2012) a significant share of the products placed on the market (between 40 and 70% depending on the category as showed on graph 1) would have been compliant hence the components needed to make the necessary redesigns will be available in bulk quantities. Furthermore ENERGY STAR established a world-wide standard of energy efficiency requirements for this equipment therefore any regulatory approach that would depart from ENERGY STAR, would be opposed by the industry as the cost and complexitiy of establishing compliance would increase.

In addition to the possible impact on the functionality of the equipment, it needs to be considered whether requirements based on ENERGY STAR will meet the LLCC principle. Establishing an LLCC level for computers is difficult due to the many configurations of the equipment and the widely-varying use patters. However the tables in section 4.6 indicated that the three improvement options which allow to achieve this level are the limitation of the energy consumption across the different modes, power-management and efficient power supplies, which are the very elements addressed under the ENERGY STAR programme. As will be showed in section 5.1.1. the cost of reaching ENERGY STAR v 5.0 levels is minimal and by far inferior to the associated energy cost savings. Although such requirements will be cost effective, it cannot be ensured that their level will be exactly at the LLCC. This is a minor concession to the need of ensuring consistency between the different policy instruments.

The level of requirements and the timing for their entry into force is adapted to the performance of computers and the needs for redesign to meet these requirements. Computers are differentiated (category A, B, C laptops, category A, B, C, D desktops, workstations, thin

clients) according to their performance defined against such parameters as the amount of system memory, the amount of physical cores and the performance of the graphics processing units (GPU). The higher-specification computers (category D desktops and integrated computers and category C notebooks) are given 6 more months than the other categories to meet the requirements. The allowances for the power consumption of displays are a function of the screen size and resolution. The requirements linked to products that were not analysed in the preparatory study (workstations, thin clients, small-scale servers and computer servers) are limited to a particular component (the internal power supply) which has the same technical characteristics and functions as desktop computers.

The additional capability adjustments concern the following elements (this is further discussed in section 5):

– Additional power budget for displays with colour gamut> 90%

– Reclassifications of graphics processing units into 5 distinct categories with power budgets adjusted to performance, instead of two as in ENERGY STAR 5.0

4.8 Measurements

The appropriate method for measuring the power consumption of computers, displays and the internal power supplies of servers was developed under the ENERGY STAR Programme and are available in the applicable Commission decisions[28] which will be referenced in the Ecodesign implementing regulations. As a significant share of computers are placed on the market without and operating system (OS) that supports power management, the measurement method will specify that computers have to be tested with a fully operational OS.

4.9 Verification procedure for market surveillance purposes

A verification procedure for market surveillance purposes will be specified with measurement uncertainties adapted for these specific measures. The verification procedure will be indicated in the applicable Ecodesign implementing regulation.

4.10 Information to be provided by the 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 on the TEC/on/sleep/off (as applicable) power consumption and the efficiency on the internal power supplies.

In addition, for the purposes of providing consumer information manufacturers are requested to publish the above information in an openly available website. Manufacturers are also requested to provide consumers with information on the content of mercury in displays, with the aim of complementing the provisions of the RoHS Directive.

4.11 Date for evaluation and possible revision

The appropriateness of ecodesign requirements should be re-assessed in short term. The main issues for a possible revision of the ecodesign regulation are :

– the appropriateness of the levels for the ecodesign requirements in the light of new technologies entering the market, ;

– the appropriateness of the product categorisation in the light of new technologies and functionalities entering the market

[28] Commission Decision 2009/489/EC

– the appropriateness of the product scope, in particular with a view to market developments such as "merging" of displays and TV sets, ;

– the appropriateness of the environmental aspects covered by ecodesign requirements.

Taking into account the time necessary for collecting, analysing and complementing the data and experiences related to the second stage in order to properly assess the technological progress on the one hand, and the need to ensure timely entry into force of a revised measure, if appropriate, on the other hand, a review should be presented to the Consultation Forum by the end of 2013 (3 years after entry into force of the regulation).

4.12 Interrelation with the ecodesign regulation for standby/off-mode

Commission Regulation (EC) No 1275/2008 has set minimum requirements for the standby and off mode electric power consumption of electrical and electronic household and office equipment. For information technology equipment, this corresponds to class B equipment as set out in EN 55022:2006 (non-professional equipment). It is proposed the leave the scope and timing as in Regulation (EC) No 1275/2008.

5. IMPACTS ANALYSIS

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

The assessment is done with a view to the criteria set out in Article 15(5) of the Ecodesign Directive, and the impacts on manufacturers, including SMEs. The aim is to find a balance between the quick realization for achieving the appropriate level of ambition and the associated benefits for the environment and the user (due to reduction of life-cycle costs) on the one hand, and potential burdens related for e.g. to unplanned redesign of equipment for achieving compliance with ecodesign requirements on the other hand, while avoiding negative impacts for the user, in particular as related to affordability and functionality. The methodology of the analysis is explained in Annex I.

In a first step several sub-options for the intensity of ecodesign requirements are considered, and the appropriate intensity which optimally fulfils the requirements of the Ecodesign Directive is identified. In a second step, the expected impact of the preferred sub-option by 2020 is analysed and compared with the other two sub-options. The ambition of the ecodesign requirements for stages 1 and 2 has been defined above. The following impacts are analysed:

In order to assess the impact of the sub-options, the following factors are taken into account:

Economic impacts

Costs:

– costs related to improved technology (e.g. for additional and/or more expensive components) and production, re-design of models not complying with the requirements, and supply chain

– assessment of administrative burden, namely the conformity with ecodesign requirements and re-assessment of conformity with further requirements (safety etc.)

Savings:

– accumulated electricity cost savings until 2020

– annual electricity cost savings by 2020

Social impacts

– jobs related to the production of affected equipment and impacts on SMEs

– affordability of equipment

Environmental impacts

– accumulated electricity savings and reductions of CO2 emissions until 2020

– annual electricity savings and reduction of CO2 emissions by 2020

5.1 Economic impacts

The design and manufacturing of computers and displays placed on the EU market is often a shared operation between Europe, the US and South East Asia. The integrated circuits and other components are produced mainly in South East Asia. For Laptops and Displays the whole production is located to South East Asia, while Desktops due to the more modular design, very often are assembled close to the market in Europe, from parts produced in South East Asia. A general trend observed in the operations of big manufacturers over recent years was a shift of production to South-East Asia with the EU operations focused on marketing and research.

The Western European market was dominated by the following companies:[29]

Company	Units sold (in millions)
Acer Inc. (Taïwan)	15,996
Hewlett-Packard (USA)	14,402
Dell Inc. (USA)	6,777
Asus (Taïwan)	4,125
Toshiba (Japan)	4,023
Other companies – including leading companies Apple (USA) and Samsung (Korea)	20,207

The dominating suppliers of office Desktops seem to be Dell and HP. For Desktops in home use, Packard Bell has a market share similar in size with HP and Dell. Apple, Lenovo (former IBM), Acer and NEC are also present. For laptops, HP, Toshiba and Dell are dominating the office market, while the home market is shared between HP, Toshiba, Dell, Packard Bell and Sony. NEC has a relatively small market share. In the LCD-monitor market, Dell, Acer, Samsung and HP all have a market share above 10%. Philips, Fujitsu-Siemens and LG have market shares around 5% each.

Worldwide PC shipments rose by 5,2% in 2009 compared to 2008, to reach 306 millions units. This final figure eclipses earlier, gloomier forecasts (Gartner expected a 9,2% drop in March 2009, revised to a 2,8% drop in November 2009). Gartner now forecasts a 12,6% increase in 2010 worldwide, and a 10% increase for the EMEA market specifically. The overall increase in sales was boosted by a 390% increase in the specific netbook computer

[29] Data collected and recombined from Gartner's four quarterly market analysis for Western Europe.

market. In terms of revenue, however, 2009 saw a sharp decrease compared to 2007 and 2008 levels, mostly due to a computer average selling price declining by 23%, down to 581 EURO.

Yet, chip manufacturers have experienced an increase in revenue (e.g. Intel posted a 28% jump in revenue in 2009 compared to 2008).[30]

A significant share of the EU PC market is dominated by SMEs; the description of this market segment and the possible impacts on it of the different sub-options is provided in section 5.2.1.

5.1.1 Costs related to improved technology and production, re-design and supply chain

Sub-options 1 and 3 would necessitate similar redesign solutions, also in terms of cost. Sub-option 2 would necessitate a more significant investment from the industry as the achievement of that level of efficiency across all products would necessitate the development of open industry standards for power-managing graphics processing units (GPUs). However this element is not considered to be costly for the industry therefore the aspects differentiating them are the speed of introducing the requirements (and hence the time allocated for redesign) and the possible impact on the functionality of the products.

The improvement in all sub-options is achieved with readily-available technology involving minimum or no additional cost. The technology for implementing sub-option 2 is readily-available but the problem is that at the moment it is proprietary and therefore could not be easily implemented across all platforms. According to the industry the creation of an open-standard that would address this could take 4 years or more with additional time needed to implement it across all platforms worldwide (as it would de factor become w world wide standard). The implementation of sub-option 2 within the proposed timeframes could therefore create certain compatibility problems and disruptions in the manufacturing process.

An overview of cost adders linked to the different improvement options is presented in tables 1, 2 and 3. The three main improvement options are linked to power management, efficient power supplies and limiting the power consumption in the idle mode through a number of options at component level, such a dual core processors, the power-management of motherboards, hybrid graphics and efficient hard drives.

In principle power-management does not imply any cost adder as it implies a mere adaptation of software programming. Under sub-options 1, 2, 3 a computer will be required to power-down to the 'sleep' mode after 30 minutes of user inactivity. Additionally in option 2 and 3 the computer will be required to go into a low-power sleep mode after the shortest possible period of time appropriate for the intended use of the equipment. The goal here is ensuring that the computer is in the lowest possible consumption mode without leading to such situation as long start-up times or the loss of data. In the past power-management usually involved the saving of all data on the disk which was cheaper than saving the data in the RAM but implied a longer wake-up time therefore was often not used by consumers. Today it is no longer the case- the option 'suspend to RAM' does not bring a cost adder.

Efficient power-supplies are the second improvement option. The efficiency of the main power supply can be designed to a high standard. With modern technology of switched power supplies the efficiency can be as high as 90%. A typical PC with a power consumption of 80 W in idle mode can reduce the needed power by 20 % using an “80-plus” power supply compared to an old (2005) power supply with 65% efficiency, for as little as 2 to 5 Euros extra cost.

[30] Gartner, quoted in Wall Street Journal, January 31st, 2010

Limiting the idle power consumption of PCs can be achieved through a number of options at component level. Hybrid graphics is a functionality, currently found in some notebook PCs, which allows discrete GPUs (graphics processing unit) to be powered down when not in use and so reduced on-idle power requirements. The inclusion of an integrated graphic processing unit into a desktop PC is not expected to add considerable cost to a high specification product. Alternatively, discrete GPUs themselves may offer the equivalent low power/low performance set-up of an integrated graphics chipset. Rapid price deflation of these components means that this will be achieved at no additional cost to today's position, although discounting may not be as deep as it was historically. Another option for reducing on-idle power consumption is replacing 3.5 inch hard drives with 2.5 inch drives. Furthermore, Solid State Disks (SSD) use considerably less power again than hard drives when not in use. The price of 2.5" HDDs is already on a par with 3.5" HDDs and SSD prices are expected to fall over the next 2 years and would therefore likely not add a significant price premium to a high specification desktop or notebook PC. However this can hardly be considered as additional cost since this range of products will need this type of drive anyway to stay at the top end of the market. Yet another option involves developments linked to the Central Processing Unit (CPU). A new range of CPUs already developed and expected on the market in 2010 will likely use less power in on-idle than current CPUs. A reduction in transistor size (moving to 32nm) on the new chips will increase overall energy efficiency. An increased number of on-chip components such as GPU, PCI and memory controllers is also expected to help reduce overall power consumption of desktop and laptop PCs.According to figures from the U.S. Bureau of Labour Statistics, microprocessor prices fell 49% a year between 2000 and 2006. According to Mercury Research, for the last decade the price difference of comparable CPUs produced by different manufacturers was about 45 percent for a comparable CPU. The prices on several processors have been considerably reduced (more than 40% on some units) earlier this year. It is therefore expected that this improvement option will not add cost.

In the case of monitors power-management and efficient power-supplies will offer energy savings which largely offset the upfront cost adder A big potential is associated with LED technology (light emission diode) LED technology have, according to several monitor manufacturers, an energy saving potential of approximately 25 % compared to LCD technology but the cost adder is still significant although constantly decreasing.

The cost adder of efficient power supplies for servers, workstations and thin-clients is similar as in the case of desktop computers and is well within the LLCC.

5.1.2 Costs related to assessment of conformity with ecodesign requirements and re-assessment of conformity with further requirements

In general assessing the conformity with ecodesign requirements implies costs for manufacturers. Based on stakeholder feedback it is estimated that the cost for assessing the conformity with ecodesign requirements of order 500€ (self-certification as foreseen by the applicable conformity assessment procedure) to 1000€ (external laboratory) per sample product/model.

Furthermore, conformity with further applicable requirements ("Low Voltage Directive"[31], "EMC Directive"[32]) for models that are already being sold in the EU may have to be re-

[31] Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits, OJ L 374, 27.12.2006, p. 10.

assessed. It is estimated that assessing conformity with all requirements applicable to computers and displays (ecodesign, low voltage/safety, EMC) implies costs of order ten thousand EURO (external laboratory).

Such costs may be relatively insignificant for products that are produced in large batches of thousands of products for each model. This is the case of the vast majority of computers and for almost the entirety of displays. This cost could be problematic for manufacturers who produce or rather assemble products in smaller batches, often custom-made. This is why the test procedure provides for the testing at product family level – a manufacturer/integrator may choose to test at a level of higher products aggregation provided he reports the values of the highest-consuming model within that product family.

Administrative costs defined as the cost of providing information in order to meet legal obligations is expected to be negligible (in the order of 1 euro per model) therefore the Standard Cost Model is not applied.

5.1.3 Impact on SMEs

Input received from the industry indicates that around 35%, of the market for Desktops is held by so called "White boxes", that is more or less temporary suppliers operating often without a brand. The White boxes are more common on the domestic market. This figure can be used as a proxy for estimating the share of small integrators in the EU, which are usually SMEs. The business of these SMEs is centred either around building PCs from components sourced locally, or adding value to the value chain (e.g. creating software for specialised applications), or simply reselling products bought outside of the EU. Due to the limited scale of their operations these companies do not compete with the big multinationals on price but rather on creating customised solutions adapted to the local market. Therefore the bulk of revenues of these companies often come not from selling hardware but servicing it.

Although SMEs have found a niche where they have a comparative advantage over the major manufacturers, they still heavily depend on the latter as market changes are primarily driven by modifications of hardware and operating systems, areas dominated by big, international players. That being said SMEs are often better prepared for technology or market change than big companies. Thanks to a greater flexibility and knowledge of local markets they create value by creating customised solutions on the basis of the changes occurring in the primary market drivers mentioned above. Once these primary market drivers become mature (be it hardware or operating systems), SMEs loose their comparative advantage since the main competition factor becomes price. The above description is reflected in the structure of partners in the EU Energy Star Programme (on which the proposed minimum requirements are based), with about 2/3 of participating companies employing less then 250 staff. Therefore setting minimum efficiency requirements can be advantageous for SMEs as it would result in energy efficiency being a market differentiator, and this is an element in which SMEs have a tack record of innovation and achievements and therefor an advantage over big companies, as opposed to price.

On the other hand it needs to be ensured that these minimum requirements are not based on proprietary technology; if it would have been the case SMEs would be the hardest hit, as their performance on the market depends to a large extend on the availability of open standards (further details in Section 5.2.3).

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[32] Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC, OJ L 390, 31.12.2004, p. 24.

Although SMEs are present in all market segments, a part of them competes in the low price market segment and their profit margin can be relatively low (around 5%). With such low profit margins there is a risk that any cost adders linked to the need to redesign products could place such companies at a disadvantage as compared to the big OEMs being able to better absorb such adders. As indicated in section 4.6 the proposed levels can be usually achieved without any cost adders. One exception are efficient power supplies, where the extra price of high power factor power supplies is about 2-5 EURO. This adder is relatively small and is expected to be driven down due to economies of scale induced by the ecodesign measure. However it cannot be excluded that during a short period certain companies will be placed at a disadvantage compared to others. It is therefore essential to provide enough time for the market availability of such power supplies in bulk quantities. An observation of the market impact of the Ecodesing implementing Regulation on External power supplies indicates that the 12 months provided in sub-option 3 are sufficient, but the implementation of sub-option 2 could lead to a temporary risk for SMEs who could have problems with sourcing the efficient power supplies.

5.1.4 Administrative costs for Member States

The form of the legislation is a regulation which is directly applicable in all Member States. This ensures no costs for national administrations for transposition of the implementing legislation into national legislation.

The costs for carrying out the verification procedure for market surveillance purposes depends on the product price (assuming that an authority purchases the product sample), and the possible need for a second test on a sample of three additional products in the case that the power consumption levels established in the first test are excessive. The resulting costs are expected to be of order 10000 € maximum.

Administrative costs defined as the cost of providing information in order to meet legal obligations is expected to be negligible (in the order of 1 euro per model) therefore the Standard Cost Model is not applied.

5.1.5 Impacts on trade

The process for establishing ecodesign requirements for computers, servers and displays has been fully transparent, and a notification under WTO-TBT was issued 60 days prior to the vote by the Regulatory Committee.

Manufacturers affected by the regulation, in particular European Union based SMEs, have not pointed out any risks of competitive disadvantages for exporting affected products to third countries.

5.2 Social impacts

5.2.1 Job creations

For sub-options 1 and 3 the risk of job losses is expected to be very low, because the staged approach is expected to allow manufacturers to adapt timely to ecodesign requirements. Sub-option 2 provides for the introduction of the first requirements already 6 months and according to the industry this would not provide sufficient time for the development of open-standards necessary for the achievement of the required power consumption limits. The technology for achieving it exists but at the moment is proprietary therefore certain market segments depending on open-source standards could be negatively affected.

5.2.2 Affordability of equipment

In principle significant price increase due to technology required to achieve ecodesign requirements are not expected for sub-options 1, 2 and 3, although option 2 creates a certain risk of shortages in the supply chain due to short implementation time of first stage requirements . In general, the IT equipment market is very competitive, and prices are not expected to change to an extent that affordability could be negatively affected. In the case of desktops the maximum price adder is estimated at 15 euros, which should be offset by electricity cost savings of 38 euro and above. For laptops and displays these figures are estimated at 5 and 15 euros respectively.

5.2.3 Impact on the functionality of equipment

The ENERGY STAR programme is voluntary therefore it has to be ensured that using it as the basis for an ecodesign measure does not lead to the exclusion from the market of certain products with very specific functionalities. The products that could have difficulties in meeting these requirements include high-end computers, used for professional applications and for gaming, as well as high-end displays, using such technologies as in-plane switching providing for a very good image quality. It was therefore considered necessary to make certain adjustments in sub-option 3 (the details are shown in Annex III). Computers used in professional applications are essentially workstations therefore their exclusion from the scope of the measure (except for the requirement on the efficiency of power supplies) will ensure that the functionality of these products is not negatively affected. Outside of professional applications the computers necessitating a special consideration are gaming PCs. Indeed the recent progress in the design of graphics processing units has led to a dramatic increase of their capabilities but also of their power consumption. In order to address this issue it is proposed to reclassify graphics processing units into 5 distinct categories in line with the latest industry standard Ecma-383 (instead of two as in the case of ENERGY STAR 5.0 specifications). In order to determine the appropriate power adders for the different categories a review of current discrete graphics cards on the market was conducted and the proposed levels for the different categories are the based on the average values obtained for these categories. On the basis of this review it is proposed that under sub-option 3, PCs with top-end graphics (i.e. Category D desktops with GPUs Category G4) be excluded fro the minimum efficiency requirements. This group of products is not expected to exceed a 5% market share within the next 3-4 years, while the setting of power limits in this top-end segment could potentially hamper new technological developments, such as the shift of computing functions from the central processing unit (CPU) to the graphics processing unit (GPU). Finally for high-end displays characterised by high resolution and colour gamut a power adder is foreseen. With these three adjustments sub-option 3 presents a low risk of negatively affecting functionality, similarly to sub-option 1.

5.4 Environmental impacts

The accumulated electricity savings and the reduction of CO_2 emissions depend on the timing. Qualitatively, the sooner the requirements become effective and the shorter the delay between first and second stage, the higher the accumulated electricity savings and the related CO_2 emissions. Therefore the positive impact of the sub-options is becoming lower for longer delays. The CO_2 savings for sub-options 1-3 are shown in Section 5.5.3 below. The measure will result in the abatement of CO_2 emissions but also of other electricity production-related environmental impacts (e.g. SO_2, NO_x, heavy metals). Furthermore the measure is expected to reduce the amount of mercury used in displays, notebooks and integrated computers. Indeed the efficiency requirements will stimulate the uptake of LCD screens using light-emitting

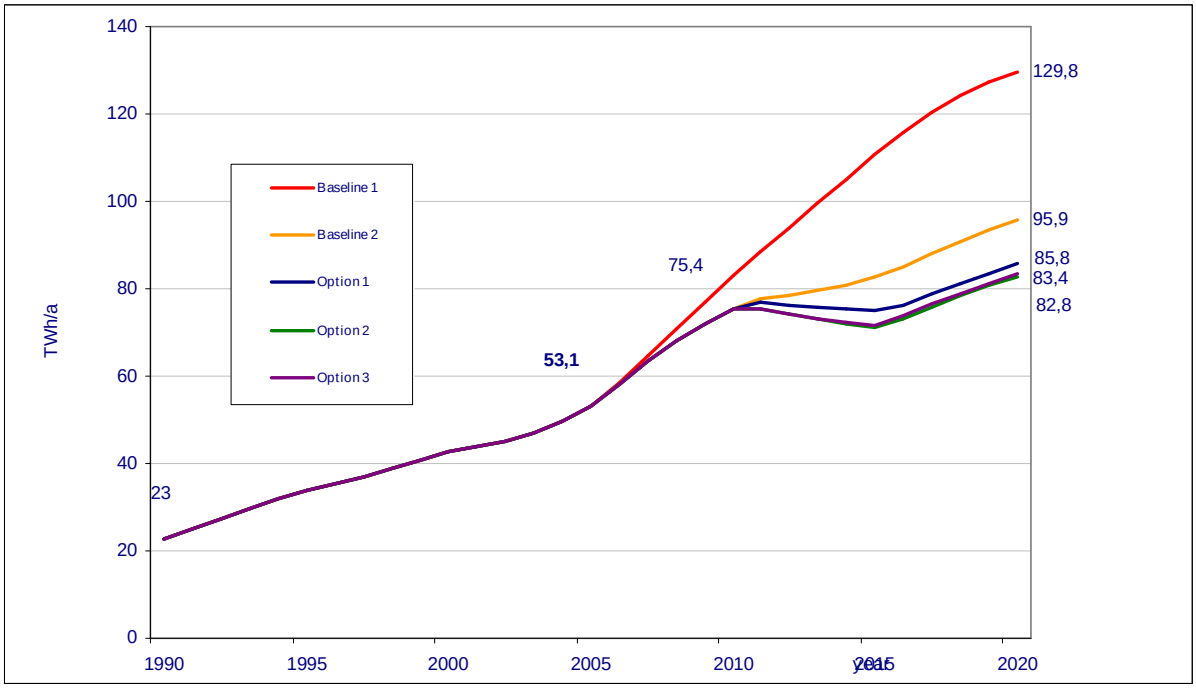
diodes (LED) backlights (which have a high energy efficiency), instead of cold cathode fluorescent lights which contain mercury.

5.5 Annual electricity, electricity cost and CO2 emission savings by 2020

5.5.1 Electricity savings

Graph 6 shows the development of the electricity consumption of computers, servers and displays until 2020:

Implementing ecodesign requirements according to sub-option 3 does not lead to the biggest energy savings but the difference with implementing sub-option 2 is negligible. The policy framework that is in place will have to biggest impact on the electricity savings from computers, servers and displays reducing their annual electricity consumption by 33,9 TWh by 2020 (26%). Setting ecodesign requirements along the lines of sub-option 3 will add to it 12,5 TWh annually by 2020.



Graph 6: EU27 Electricity Scenarios 1990-2020 in TWh/a (electric)

Table - Electricity Savings 2020 vs. BaU:			
	Use	**Savings**	
	TWh/a	**TWh/a**	**%**
No policy (Baseline 1)	129,8		
Business-as-usual/current policy (Baseline 2)	95,9	33,8	26,1%
Option 1	85,8	44,0	33,9%
Option 2	82,8	46,9	36,2%
Option 3	83,5	46,3	35,6%

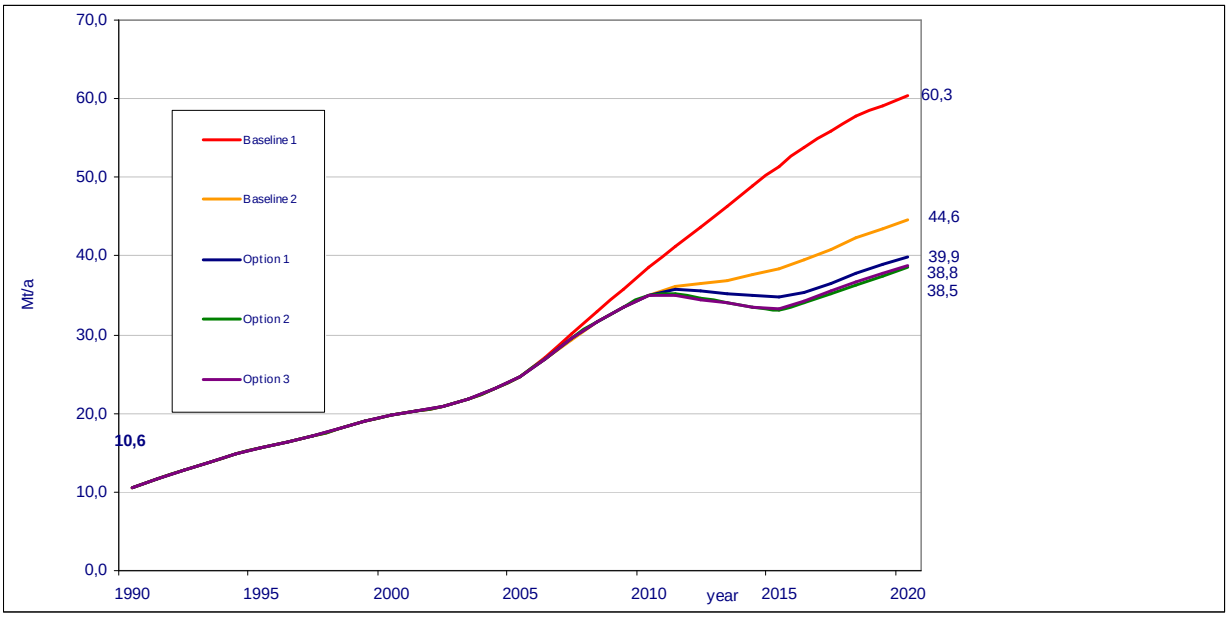
Table 5: development of electricity consumption of computers, servers and displays for several scenarios until 2020.

5.5.2 Electricity cost savings by 2020

The annual electricity savings of 12,5 TWh expected by 2020 correspond to savings of electricity costs of 2 bln EURO;

5.5.3 *Annual reduction of CO_2 emissions by 2020*

The annual electricity savings of 12,5 TWh expected by 2020 correspond to annual CO_2 emission savings of 4,2 mln tons[33], and reductions of further electricity production-related environmental impacts (e.g. SO_2, NO_x, heavy metals).



Graph 7: EU27 CO_2 Scenarios 1990-2020 for computers, displays and servers

Table - Carbon (CO2 eq) Savings 2020 vs. BaU			
	Use	**Savings**	
	CO2 eq/a	**CO2 eq/a**	**%**
No policy (Baseline 1)	60,3		
Business-as-usual/current policy (Baseline 2)	44,6	15,7	39,4%
Option 1	39,9	20,4	51,2%
Option 2	38,5	21,8	54,7%
Option 3	38,8	21,5	54,0%

Table 6: development of carbon emission over the life-cycle of computers, servers and displays for several scenarios until 2020.

5.5.4 *Accumulated electricity cost savings through ecodesign requirements*

The accumulated electricity cost savings for the products placed on the market from October 2011 until 2020 triggered by ecodesign depend on the timing of first and second stage. Qualitatively, the sooner ecodesign requirements become effective, the shorter the delay between first and second stage, and the more stringent they are, the higher the accumulated electricity cost savings.

Table 4 gives an overview of the accumulated electricity savings, the corresponding cost savings and avoided CO2 emissions over a period between 2011 and 2020:

[33] assuming the specific CO2 emissions of 2003 (see footnote 38) which, however, is expected to change e.g. due to the European Union's strategy for promoting renewable energy sources

	Accumulated electricity consumption (TWh)	Accumulated electricity savings (TWh)	Accumulated electricity cost savings[34] (billion EURO)	Accumulated avoided CO2 emissions[35] (Mt)
No policy (Baseline 1)	1197	-	-	-
Business-as-usual/current policy (Baseline 2)	928	270	43.2	125
Sub-option 1	860	338	54	157
Sub-option 2	832	365	58.4	170
Sub-option 3	835	362	57.9	168

Table 4: accumulated electricity and cost savings, and avoided CO2 emissions for the products placed on the market from October 2011 until 2020 for sub-options 1-3.

The above table indicates that the policies that are already in place (Baseline 2) have the biggest impact; however the additional impact of setting Ecodesign requirements is considerable. These proportions will change if we assume a smaller impact of current policies as indicated in the sensitivity analysis further down. Although Option 3 foresees higher allowances for certain groups of products as well as longer implementation times than Option 2, their impact is similar. The impact of Option 1 with much higher allowances and long implementation times is much smaller.

5.6 Comparison of the sub-options

The following table summarizes the considerations on the impacts of the sub-options compared to the baseline scenario, and assesses them on a relative scale from 1 (low) to 4 (high):

	Economic impact (costs)	Environmental impact (electricity/CO_2/electricity cost savings)	Social impact (risk for Job losses in SMEs)
Sub-option 1	1	1	1
Sub-option 2	2	4	3
Sub-option 3	1	4	1

Table 7: summary and assessment of sub-options 1-3

It is concluded that sub-option 3 is the preferred option for the intensity of ecodesign requirements, achieving the appropriate balance between positive environmental impacts and electricity cost savings, and possible risks related to jobs and additional costs. Sub-option 2

[34] Assumption: 0.16€/kWh

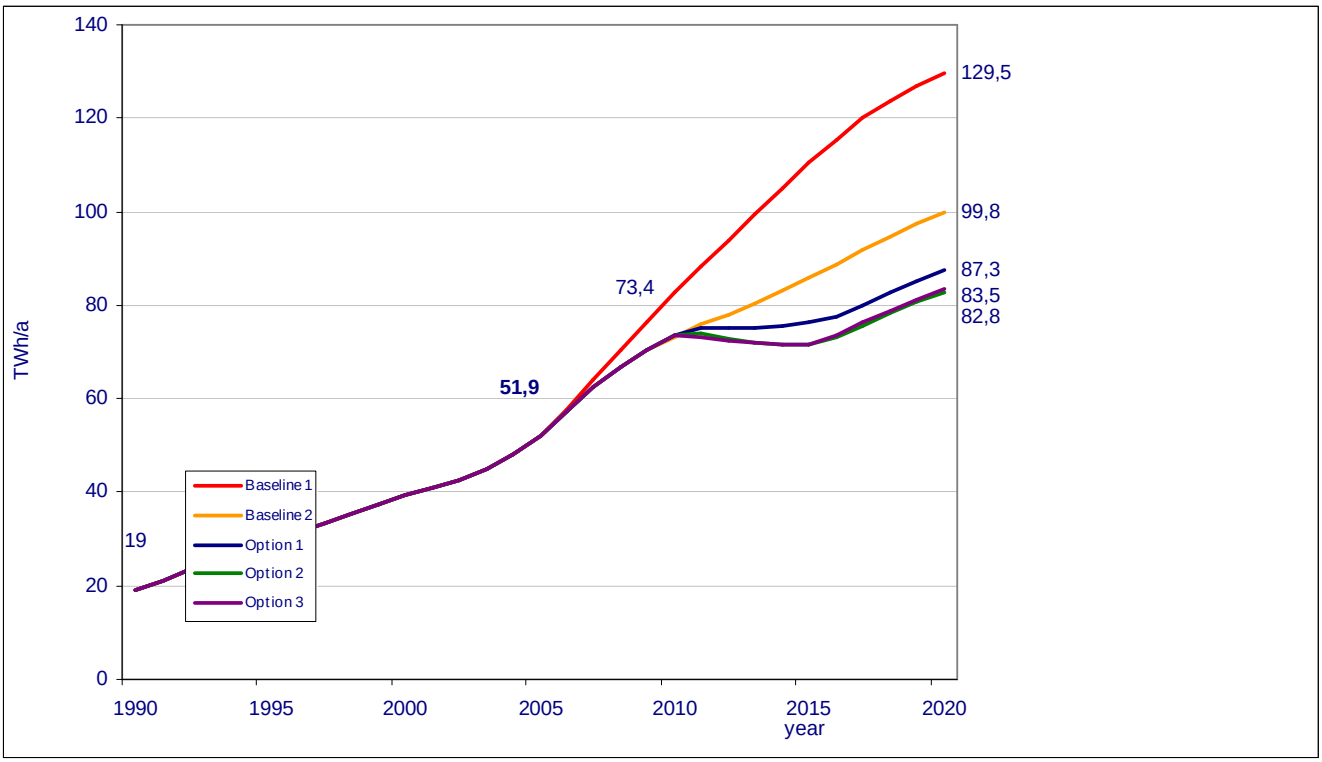
[35] Assumption: 0.4 kg CO2/kWh

would lead to slightly higher electricity/CO_2/electricity cost savings, while implying somewhat higher burdens on manufacturers. Sub-option 1 does not present any risk for manufacturers and does not create additional costs but also its impact on electricity/CO_2/electricity cost savings is minimal.

5.7 Sensitivity analysis

It has to be noted that any projections linked to the evolution of such a dynamic product group have to be treated with caution. In the short term it is expected that the major trend will be to use new technology to enhance performance in existing formats. On the one hand the increase in the energy efficiency of these devices will be driven by growing connectivity (will put increased pressure on battery longevity) and by a shift toward LED-backlights used in displays. On the other hand the demand for ever-increasing performance, capacity and speed could lead to a significant increase of energy consumption. In the longer term computers may take over the functions of other products (TV, telephone) necessitating to be permanently 'on' to maintain connectivity. Future trends may also lead to a shift of energy consumption from computers to servers with the development of 'cloud computing' in which IT capabilities would be provided to users as a service and would be stored in data centres.

Not all of these matters can be quantitatively factored in the sensitivity analysis therefore the focus is on the assumed percentage of products complying with the ENERGY STAR Programme. Figure 1 shows this prediction which is an extrapolation of past trends into the future. A part of the industry questioned theses figures indicating the compliance in the future might be much lower. Therefore we have assumed in the sensitivity analysis a lower progress in compliance with the latest ENERGY STAR criteria (50% of the market). This results in a higher impact of the proposed Ecodesign regulation as compared to baseline 2 (current policies) which can be seen on the graph below. In this scenario policies that are already in place will result in a reduction of electricity consumption by 29,7 TWh annually by 2020, whereas minimum efficiency requirements based on sub-option 3 will add to it 16,3 TWh annually by 2020.



Graph 8: EU27 Electricity Scenarios 1990-2020 in TWh/a (electric), assuming lower progress in compliance with the latest ENERGY STAR criteria (50% of the market)

Table - Electricity Savings 2020 vs. BaU:			
	Use	Savings	
	TWh/a	TWh/a	%
No policy (Baseline 1)	129,5		
Business-as-usual/current policy (Baseline 2)	99,8	29,7	22,9%
Option 1	87,3	42,2	32,6%
Option 2	82,8	46,8	36,1%
Option 3	83,5	46,0	35,5%

Table 8: development of electricity consumption of computers, servers and displays for several scenarios until 2020,), assuming lower progress in compliance with the latest ENERGY STAR criteria (50% of the market)

6. CONCLUSION

Following the principle of proportionality in the analysis effort, policy options 1 to 3 were discarded at an earlier phase of the analysis. The analysis of several sub-options for the intensity of an ecodesign regulation on the power consumption shows that sub-option 3 optimally fulfils the objectives as set out in Section 3. In particular, the regulation/sub-option 3 implies :

- cost-effective reduction of electricity consumption from 12,5 TWh to 16,3 TWh by 2020 compared to the baseline (2) scenario, corresponding to electricity cost savings of 2-2,6 billion EURO, and 5-6,5 mln tons avoided CO_2 emissions;
- compatibility and complementarily with existing policy instruments, namely the ENERGY STAR Programme, the Ecodesign regulations on standby/off mode and external power supplies (energy-efficiency), and the RoHS Directive (mercury) is achieved
- correction of market failures and improvement of the functioning of the internal market;
- no significant administrative burdens for manufacturers or retailers;
- insignificant, if any, increase of the purchasing cost, which would be largely overcompensated by savings during the use-phase of the product;
- that the specific mandate of the Legislator is respected;
- a clear legal framework for product design
- no significant impacts on the competitiveness of industry and employment, and in particular in the SMEs sector due to the small absolute costs related to product re-design and re-assessment;

7. MONITORING AND EVALUATION

The appropriateness of scope, definitions and limits will be reviewed after maximum 3 years from the adoption of the measure (as required by Annex VII.9 of the Ecodesign Directive and laid down in the implementing measure). Account will be taken also of speed of technological development and input from stakeholders and Member States. Compliance with the legal provisions will follow the usual process of "New Approach" regulations as expressed by the CE marking.

Compliance checks are mainly done by market surveillance carried out by Member State authorities ensuring that the requirements are met. Further information from the field as e.g. complaints by consumer organisation or competitors could alert on possible deviations from the provisions and/or of the need to take action.

Input is also expected from work carried out with international partners, e.g. in the framework of the IEA Implementing Agreement for Energy Efficiency End-Use Equipment.

ANNEX I
Minutes of the Consultation Forum meetings

Subject: Ecodesign of EuPs Consultation Forum – Computers and Displays
Place: Centre de Conférence Albert Borchette, Brussels
Chairman: André BRISAER (TREN/D3)
EC Participants: Jacek TRUSZCZYNSKI (TREN/D3),
Kerstin LICHTENVORT (ENTR/B1),
Martin Buechele (ENV/G1)

Consultation Forum – Computers and Displays
9 October 2009, 10:00 – 13:00

1. Welcome and introduction

The Chairman welcomed the participants and presented the agenda and the participants from the Commission.

2. Adoption of the agenda

The agenda was adopted without changes.

3. Working document on possible ecodesign requirements for Computers

The Commission services presented the main aspects of the working document and the rationale of the approach for discussion (see presentation circulated together with these draft minutes). It was explained that the aim would be to align as much as possible minimum ecodesign requirements with Energy Star. Practically, it is suggested to introduce requirements in two steps, with a first tier based on Energy Star 4.0 and a second tier based on Energy Star 5.0 entering into force in 2013 (with several adjustments).

Scope

At the request of ANEC/BEUC the Commission services clarified that no size limit was included in the definition of netbooks, which are covered under the notebook definition.

AT indicated that Energy Star did not include provisions regarding notebook screens, and asked whether these should be included in the Commission's proposal. The Commission services and MTP (The UK Market Transformation Programme providing support on this project) acknowledged that important work would be needed on furthering Energy Star test-methods for notebook screens. It was suggested that this element should be driven by Energy Star.

Workstations and thin-clients were not included in the initial study and workstations have a very limited compliance rate with Energy Star at the moment. These two product group should be excluded from the scope given that it would be difficult for such high-end products to comply with the proposed requirements and also considering that these represent less than 10% of the computers market. The effect might be that high-end products will be assembled by the consumer from parts bought separately (DIGITALEUROPE).

ECOS enquired about a potential preliminary study on servers. The Commission services indicated that it is still being considered what additional studies could be launched. In the short term however it should be considered to include servers in the measure on computers with a requirement on the efficiency of the internal power supply. This would be technically feasible, cost-effective and would capture the majority of the energy-saving potential for this product group. AT supported such an approach in the short term but further work on the other aspects should be done in the future.

Although it is necessary to harmonise possible ecodesign requirements as much as possible with Energy Star simply importing the specifications from one of the Energy Star versions would lead to a situation where requirements for some product categories would be much less stringent than others therefore further adjustments would be needed (DK).

At the request of BE the Commission services indicated that it was legally possible to have a higher level of stringency of ecodesign requirements than those specified in Energy Star but that this will be further consulted with the Commission Legal Service.

Definitions

The Commission services suggested that definitions be drawn directly from Energy Star albeit with the necessary adjustments.

The product group should be taken out of the scope of the 'Standby regulation' as the definitions of 'standby' and 'off mode' in the 'Standby regulation' are not suitable for computers. The mode definitions should be drawn from Energy Star. It is acknowledged that the presence of two different definitions of 'off mode' in two regulations within one single framework directive might prove problematic (Commission services).

'Off mode' as defined in Regulation 1275/2008 is suitable for computers and the other operating modes which don't correspond to the definitions laid out in Regulation 1275/2008 should be clearly defined in the product-specific legislation. The definitions that will be drawn-up in a future measure on 'networked standby' should be anticipated. The definitions of the 'off mode' proposed in the Working Document were inspired from the 'old definitions' of the IEC standard which gives a lot of scope for interpretation and which is currently being revised towards an approach where 'off mode' means 'no function provided' (NL). The definitions under Regulation 1275/2008 are horizontal and, in line with the approach in standardisation can be adapted for product-specific needs. It is important to be coherent in that respect with the Energy Star Programme since it relates to exactly the same product (IT). With 'wake-on-lan' (WOL) disabled 'off mode' as defined in Regulation 1275/2008 is suitable for computers (DIGITALEUROPE). If 'off mode' for computers is defined as in Regulation 1275/2008 WOL would need to be treated as a separate functionality (Commission services).

The computer measure should be harmonised as much as possible with Regulation 1275/2008 and this product group should not be taken out of the scope of the Regulation. This should be complemented with additional product-specific definitions in the product-specific regulation (DK, UK, DE). WOL should be switched off as default (DK).

AT enquired about the possibility to extend the scope of Regulation 1275/2008 to office equipment. AT remarked that standby levels for computers as described in the horizontal regulation would be equivalent to 'S4' according to SCPI, which is not yet covered by either Energy Star or the horizontal regulation. DIGITALEUROPE clarified that 'domestic' did not mean 'at home' per se, but rather, relates to levels of radiations acceptable in offices and at home, as opposed to computer rooms for example.

Having all product-specific requirements in product-specific regulations gives legal clarity (NL). The Chairman stated that the goal was to provide a legislation that is both comprehensive and user-friendly.

In line with the comments provided by Member States definitions taken from Energy Star will need to be adjusted and any requirements should be included in the annexes of the regulations (Commission services).

Timeline

The Commission services presented the proposed timeline for the entry into force of the requirements as well as the underlying assumptions regarding the levels of compliance with the Energy Star criteria.

DIGITALEUROPE asked for clarification on the expected future Energy Star compliance rates included in the Working Document and asked whether non-standard equipment configurations were factored in these figures. NL asked for a clarification whether these figures factored in the fact that office equipment (i.e. the one registered under Energy Star) might have different configurations than home equipment. The Commission services and MTP clarified that the said figures originated from the Environment Protection Agency data and a survey by IDC. These were partially based on sales percentages therefore included also home (i.e. higher specification) equipment.

Tier 1 requirements should be applicable 12 to 18 months after entry into force of the regulation, so as to give the industry enough time to redesign products (DIGITALEUROPE)

The second tier should be introduced earlier than proposed in the Working Document (AT, NL, UK, SE, DK). It would be preferable to base first tier requirements on Energy Star 5.0. These should be applicable 1 year after the entry into force of the regulation followed by a tier 2 based on Energy Star 6.0 requirements when these are released (ECOS, ANEC/BEUC). The revision should be carried earlier than proposed and be harmonised with the entry into force of Energy Star 6.0 (SE).

Ecodesign requirements

The Commission services outlined the content of the proposal.

Requirements on product components such as the internal power supplies (IPS) should be avoided. Furthermore seeking improvements on internal power supplies energy efficiency was not always necessary, considering that certain products already achieve targets without requiring modified internal power supplies. In the case of low-end computers forcing a requirement on internal power supplies' energy efficiency would result in higher prices for SMEs and marginal energy efficiency gains. This should be factored in the impact assessment of the proposal (DIGITALEUROPE). The Chairman remarked that IPS represent a significant and cost-effective saving potential and applying specific requirements on components makes sense for equipment assembled by users.

In this particular case there is a strong rationale for placing a requirement on IPS. The price difference between efficient and inefficient IPS is small and is expected to decrease to almost null once these requirements become mandatory (SE, DK, DE, AT, UK, NL, ANEC/BEUC).

Requirements for the different operating modes should be maintained beyond the first tier. The TEC approach for ecodesign might be not appropriate as usage-patterns vary greatly (AT).

The introduction of idle limits (be in n the mode approach or through the TEC) would be problematic especially for the segment of high-performance PCs. This was supported by the findings of the preparatory study (DIGITALEUROPE). A first assessment indicates that cost-effective solutions to limit the idle consumption across the whole range of products do exist but this matter will be investigated further as part of the impact assessment (Commission services).

Other environmental impacts

This measure should be complement by specific limits related to the content of mercury under the RoHS Directive by establishing requirement on according information (in mg) at the point

of sale and marketing materials. Cold cathode-fluorescent lighting (CCF) used for LCD screens should be removed from the exceptions list under the RoHS Directive, as this would stimulate the uptake of LED technology offering energy savings as well as not containing mercury . This should be done in coordination with the specific committee working in the framework of the RoHS Directive (SE, BE, UK, EEB).

Issues related of waste and dangerous materials should be dealt with under the relevant legislation, and not Ecodesign. The problem doesn't originate from the design of computers but from the way the recycling industry handles the products (DIGITALEUROPE).

RoHS and WEEE requirements are not sufficient. Other environmental impacts of computers, including PVC, plastics, use of metals, upgradeability of computers, energy embedded in production processes could be addressed through generic ecodesign requirements (ECOS, ANEC/BEUC). There exist standards that could be used as a basis for it (UK). Since the Article 4 of the WEEE draft recast refers no longer to recycling, but to recovery, there is a need to include requirements linked to recycling in the Ecodesign regulations (EEB).

Information requirements

The Commission services introduced the elements related to information requirements.

There will be always a difference between benchmark models and market average therefore there is a rationale for informing consumers about energy consumption. Even though an 'A to G label' might not be feasible basic information (TEC or mode consumption) could be displayed at the point of sale and websites (ECOS). The TEC might be misleading as the usage patterns very greatly (AT).

The Chairman reminded the participants about the Council Decision of 18 December 2006 on the coordination on energy efficiency labelling programs for office equipments between the EC and the US. This agreement does not prevent the setting-up of new schemes in addition to Energy Star. It should be however considered whether a new scheme for such equipment would add value and would not undermine the current scheme. It is uncertain if an Energy label would be justified in terms of the differences in the energy consumption of equipment on the market (especially for displays).

Energy Star and a possible Energy label have different target groups. It has to be also noted that Energy Star is also moving in the direction of a comparative label with a 'golden star' for the best 10% (NL). The UK and AT supported in principle the introduction of a possible Energy label for displays.

An accumulation of labels would entail a risk of confusing consumers (DIGITALEUROPE).

Revision

The Commissions services acknowledged that is should be brought forward. The revision date should be harmonised with the work on new Energy Star criteria (NL).

Benchmarks

Eco-label criteria should be introduced for the other environmental aspects in the benchmark (SE, ANEC/BEUC).

4. Working document on possible ecodesign requirements for Displays

The Commission services presented the main aspects of the working document and the rationale of the approach for discussion (see presentation circulated together with these draft minutes). The aim is to align the requirements with Energy Star as much as possible. Tier 1

requirements (based on Energy Star 4.1) would enter into force six months after entry into force of the directive. Second stage would kick-in from October 2013 based on Energy Star 5.0. The requirements for 'off mode' would be aligned with Regulation 1275/2008.

Scope

Screens above 30 inches to be included in the scope as such monitors (e.g. signalling screens) are already present on the market and there is no technical justification for excluding them notwithstanding what kind of requirements are suitable for such screens (NL, ECOS).

Definitions

'Off mode' should be defined as in Regulation 1275/2008 and this should be used consistently across product-specific implementing measures (NL).

DE enquired about the relationship with the television product group, notably whether a display with an HDMI interface would be considered as a TV set. The Commission services acknowledged that this issue needs further analysis.

The Chairman asked the participants for suggestions on how to best differentiate displays from TV sets. This could be solved by placing an upper limit for the size of displays falling under the draft measure (DIGITALEUROPE).

Timeline of requirements

Tier 1 requirements should start to apply twelve months after the entry into force of the Regulation to allow for redesign (DIGITALEUROPE).

While harmonization with Energy Star would be a positive move, strictly following each and every specification would not be the best approach (DK, ANEC/BEUC).

The deadline for the implementation of Tier 1 should be set earlier (ANEC/BEUC). Tier 1 should be removed and Tier 2 deadlines to be advanced (ECOS).

Moving from a voluntary scheme (Energy Star) to mandatory requirements would entail serious consequences on the market, leading potentially to the exclusion of some types of products and functions from the market (DIGITALEUROPE). Consistency between these two tools would reinforce both of them (Chairman).

It can be envisaged to move straight to the current Tier 2 and a second tier possibly based on Energy Star 6.0 when the latter is available (UK).

87% of the monitors in EU Energy Star database consume less than 1 watt in sleep mode so it would be possible to make this mandatory in the first tier (DK). This figure to remain at 2W as some monitors would have difficulties to meet this threshold (DIGITALEUROPE).

Specific requirements

The auto-power down (APD) of digital photo frame could be set after 2 hours of user inactivity, instead of 4 as proposed in the Working Document. This should be preceded by warning message (ANEC/BEUC). The APD should be set as default and it should be impossible to disable it (as in the regulation on simple set-top boxes). It should be ensured that consumers are informed about the energy consumption of these devices (ECOS). Retailers need to have digital photo frames on for several hours therefore there has to be a possibility to disable this function (DIGITALEUROPE).

Energy Star 5.0 includes provisions for automatic brightness control and that option should be included in the regulation (DIGITALEUROPE). Tests had shown that this option provided for limited savings only (Commission services, MTP).

Other environmental impacts

SE reiterated its comments from the morning session related to mercury and cold cathode-fluorescent lighting in displays.

DIGITALEUROPE stated the industry would discuss these issues internally and suggest possible options for better design in that respect.

Information requirements

Adding new labels to existing ones would add cost and would not be beneficial for the consumer (DIGITALEUROPE). ECOS pointed out that DIGITALEUROPE was supportive on the Energy label for TVs. The introduction of an Energy label for displays would be useful, also taking into account the similarity of this product group with TVs and the fact that that TVs and displays are evolving in the same direction (NL, SE, ECOS, ANEC/BEUC).

The Energy Efficiency Index (EEI) under the Energy labelling measures should have a progressive component which would make it more difficult for bigger devices to have the highest energy classes (SE). The formula used under Energy Star 5.0 makes it rather difficult for big screens to achieve high energy efficiency indexes (NL). In the labelling measure on TVs it was decided to have a linear, as opposed to a progressive approach (Chairman). A progressive approach is not needed as consumers understand the difference between different size products (IT). This discussion cannot be applied to displays because for practical reasons (e.g. size of the desk) there will not be a move towards eve-bigger displays (DIGITALEUROPE).

At the request of SE, DIGITALEUROPE reported a 10% to 15% increase in energy efficiency of notebooks following a replacement of backlighting by LEDs.

ANNEX II
Structure of the methodology used for establishing the technical, environmental and economic analysis

Following the "Methodology Study Eco-design of Energy Using Products" ("MEEuP"), the tasks listed below are carried out for developing the technical, environmental and economic analysis referred to in Annex II of the Ecodesign Directive:

Task 1: Product definition, existing standards and legislation

Task 2: Economics and market analysis

Task3: Analysis of consumer behaviour and local infrastructure

Task 4: Technical analysis of existing products

Task 5: Definition of base case ("average" model) and related environmental impact

Task 6: Technical analysis of best available technology

Task 7: Improvement potential

Task 8: Policy, impact and sensitivity analysis

ANNEX III
Detailed overview of the three sub-options

Option 1	Option 2	Option 3
Scope (expl.: computers means desktop computer, integrated computer, laptop/notebook, thin client, workstation and small scale-server)		
• Desktop computers • Notebook computers • Integrated Desktop computers • Displays	• Desktop computers • Notebook computers • Integrated Desktop computers • Workstations • Thin clients • Small-scale servers • Servers (excluding Blade Systems including Blade Servers and Blade Chassis, Fully Fault Tolerant Servers, Server Appliances, Multi-Node Servers, Storage Equipment including Blade Storage, and Network Equipment) • Displays	• Desktop computers • Notebook computers • Integrated Desktop computers • Workstations • Thin clients • Small-scale servers • Servers (excluding Blade Systems including Blade Servers and Blade Chassis, Fully Fault Tolerant Servers, Server Appliances, Multi-Node Servers, Storage Equipment including Blade Storage, and Network Equipment) • Displays

<table>
<tr><th colspan="3">1. TEC/Idle- computers</th></tr>
<tr>
<td>a) Desktops/integrated computers -18 months after this Regulation has come into force:

The TEC (kWh/y) shall not exceed:
- Category A = 194.00
- Category B = 240.00
- Category C = 304.00
- Category D = 320.00
The following Capability Adjustments apply:
<u>Memory</u>
- 1.0 kWh per GB over base
where base memory is:
- Category A/B/C = 2 GB
- Category D = 4 GB
<u>Premium Graphics (for Discrete GPUs with specified Frame Buffer BandWidth {FB_BW}, expressed in GB/sec)</u>
<table>
<tr><th>Discrete Graphics (kWh)</th><th>G1</th><th>G2</th><th>G3</th><th>G4</th></tr>
<tr><td>CAT A</td><td>70</td><td>70</td><td>95</td><td>140</td></tr>
<tr><td>CAT B</td><td>70</td><td>70</td><td>95</td><td>140</td></tr>
<tr><td>CAT C</td><td>NA</td><td>NA</td><td>32</td><td>77</td></tr>
<tr><td>CAT D</td><td>NA</td><td>NA</td><td>32</td><td>77</td></tr>
</table>
Where:
G1: FB_BW ≤ 16 GB/S
G2: 16 GB/S< FB_BW ≤ 32 GB/S
G3: 32 GB/S <FB_BW ≤ 64 GB/S
G4: 64 GB/S <FB_BW ≤ 128 GB/S
G5: FB_BW > 128 GB/S
<u>Multiple Discrete Graphics (G1-G5) installed in system - EXEMPT</u>
- Additional Internal Storage = 40 kWh

Category D products meeting the</td>
<td>a) Desktops/integrated computers – 6 months after Regulation comes into force:

The idle power consumption shall not exceed:
Category A = 50.00 W
Category B = 65.00 W
Category C = 95.00 W</td>
<td>a) Desktops/integrated computers – 12 months after this Regulation has come into force:

The TEC (kWh/y) shall not exceed:
- Category A = 148.00
- Category B = 175.00
- Category C = 209.00
- Category D (additional 6 months to comply) = 234.00
The following Capability Adjustments apply:
<u>Memory</u>
- 1 kWh per GB over base, where base memory is 4 GB
<u>Premium Graphics (for Discrete GPUs with specified Frame Buffer Widths)</u>
<table>
<tr><th colspan="6">GPU Card KWh/Year</th></tr>
<tr><th>Category</th><th>G1</th><th>G2</th><th>G3</th><th>G4</th><th>G5</th></tr>
<tr><td>A</td><td>22</td><td>43</td><td>69</td><td>100</td><td>138</td></tr>
<tr><td>B</td><td>22</td><td>43</td><td>69</td><td>100</td><td>138</td></tr>
<tr><td>C</td><td>NA</td><td>NA</td><td>23</td><td>55</td><td>76</td></tr>
<tr><td>D</td><td>NA</td><td>NA</td><td>23</td><td>55</td><td>76</td></tr>
</table>
Where:
G1: FB_BW ≤ 16 GB/S
G2: 16 GB/S< FB_BW ≤ 32 GB/S
G3: 32 GB/S <FB_BW ≤ 64 GB/S
G4: 64 GB/S <FB_BW ≤ 128 GB/S
G5: FB_BW > 128 GB/S
<u>Additional Internal Storage</u>
- 25 kWh

Category D products meeting the following technical parameters are exempt from this requirement:</td>
</tr>
</table>

following technical parameters are exempt from this requirement: • At least one G4 discrete GPU • Memory ≥6 GB • PSU Rating ≥750 W		• At least one G4 discrete GPU • Memory ≥6 GB • PSU Rating ≥750 W

<table>
<tr><th colspan="3">1. TEC/Idle- computers - continued</th></tr>
<tr>
<td>b) Laptop – 18 months after this Regulation has come into force:

The TEC (kWh/y) shall not exceed:
- Category A = 45.00
- Category B = 62.00
- Category C = 168.00

The following Capability Adjustments apply:
<u>Memory</u>
- 0.50 kWh per GB over base
where base memory is:
- Category A/B/C = 4 GB
<u>Premium Graphics (for Discrete GPUs with specified Frame Buffer BandWidth {FB_BW}, expressed in GB/sec)</u>
<table><tr><th>Discrete Graphics (kWh)</th><th>G1</th><th>G2</th><th>G3</th><th>G4</th></tr><tr><td>CAT B</td><td>NA</td><td>8</td><td>20</td><td>32</td></tr><tr><td>CAT C</td><td>NA</td><td>NA</td><td>NA</td><td>16</td></tr></table>G5: FB_BW > 128 GB/S – exempt from regulation
<u>Multiple Discrete Graphics (G1-G5) installed in system - EXEMPT</u>
- Additional Internal Storage = 4 kWh</td>
<td>b) Notebook - 6 months after this Regulation has come into force:

The idle power consumption shall not exceed:
- Category A: = 14.00 W
- Category B: = 22.00 W
- Category C: = 31.00 W</td>
<td>b) Laptop – 12 months after this Regulation has come into force:The TEC (kWh/y) shall not exceed:

- Category A: = 40.00
- Category B: = 53.00
- Category C (additional 6 months to comply): = 88.50

The following Capability Adjustments apply:
<u>Memory</u>
- 0.4 kWh (per GB, over 4 GB)
<u>Premium Graphics (for Discrete GPUs with specified Frame Buffer Widths)</u>
<table><tr><th colspan="6">GPU Card KWh/Year</th></tr><tr><th>Category</th><td>G1</td><td>G2</td><td>G3</td><td>G4</td><td>G5</td></tr><tr><td>A</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td><td>NA</td></tr><tr><td>B</td><td>NA</td><td>8</td><td>20</td><td>32</td><td>44</td></tr><tr><td>C</td><td>NA</td><td>NA</td><td>NA</td><td>16</td><td>22</td></tr></table>Additional Internal Storage = 3 kWh</td>
</tr>
</table>

1. TEC/Idle- computers - continued		
	c) Desktops/integrated computers – 18 months after this Regulation has come into force: The TEC (kWh/y) shall not exceed: - Category A = 148.00 - Category B = 175.00 - Category C = 209.00 - Category D = 234.00 The following Capability Adjustments apply: Memory - 1 kWh per GB over base where base memory is: - Category A/B/C = 2 GB - Category D = 4 GB Premium Graphics (for Discrete GPUs with specified Frame Buffer Widths) - Category A/B (FB Width ≤ 128-bit)=35 kWh - Category A/B/C/D (FB Width > 128-bit)= 50 kWh Additional Internal Storage = 25 kWh	

1. TEC/Idle- computers - continued		
	d) Laptop – 18 months after this Regulation has come into force:The TEC (kWh/y) shall not exceed: - Category A: = 40.00 - Category B: = 53.00 - Category C: = 88.50 The following Capability Adjustments apply: Memory - 0.4 kWh (per GB, over 4 GB) Premium Graphics (for Discrete GPUs with specified Frame Buffer Widths) - Category B (FB Width > 64-bit): 3 kWh Additional Internal Storage = 3 kWh	
	e) Thin clients -18 months after the Regulation comes into force: The idle power consumption shall not exceed: - Category A: = 12.00 W - Category B: = 15.00 W	
	f) Workstations- 30 months after the Regulation comes into force shall not exceed: **P_{TEC} = 0.28* [Pmax + (# HDD * 5)]** where all Px are power values in watts and #HDD = number of hard disk drives	

2. Sleep mode - computers		
/	a) Desktops/integrated computer – 6 months after Regulation comes into force, the sleep mode power consumption shall not exceed 4 W (an additional limit of 1.7 W for Wake on Lan)	a) Desktops/integrated computer – 12 months after Regulation comes into force, the sleep mode power consumption shall not exceed 6 W
	b) Notebook - 6 months after Regulation comes into force, the sleep mode power consumption shall not exceed 2 W (an additional limit of 0.7 W for Wake on Lan)	b) Notebook - 6 months after Regulation comes into force the sleep mode power consumption shall not exceed 3 W
	c) Thin-client – 18 months after this regulations comes into force, the sleep mode power consumption shall not exceed: - 2.00 W but with an additional allowance of 0.70 W for WOL, where the product is shipped with WOL enabled.	
3. Off – computers (excluding work stations and small-scale servers)		
Same as in Regulation 1275/2009	Same as in Regulation 1275/2009	Same as in Regulation 1275/2009
4. Internal power supply efficiency		
a) Computers 18 months after this Regulation has come into force: All internal power supplies shall not perform at less than: - 85% efficiency at 50% of rated output - 82% efficiency at 20% and 100% of rated output - Power Factor = 0.9 at 100% of rated output.	a) Computers- 6 months after this Regulation has come into force: All internal power supplies shall not perform at less than: - 85% efficiency at 50% of rated output - 82% efficiency at 20% and 100% of rated output - Power Factor = 0.9 at 100% of rated output.	a) Computers- 12 months after this Regulation has come into force: All internal power supplies shall not perform at less than: - 85% efficiency at 50% of rated output - 82% efficiency at 20% and 100% of rated output - Power Factor = 0.9 at 100% of rated output.

4. Internal power supply efficiency - continued		
	b) Servers - 12 months after this Regulation has come into force: All Multi output (AC-DC, DC-DC) power supplies shall not perform at less than: - 85% efficiency at 50% of rated output - 82% efficiency at 20% and 100% of rated output All Multi-output (AC-DC) power supplies shall perform at not less than: - Power Factor 0.8 at 20% of rated output - Power factor 0.9 at 50% of rated out put - Power factor 0.95 at 100% of rated output All single output (AC-DC, DC-DC) power supplies with rated outputof not more than 500W shall not perform at less than: - 70% efficiency at 10% of rated output - 82% efficiency at 20% of rated output - 89% efficiency at 50% of rated output - 85% efficiency at 100% of rated output All single output (AC-DC) power supplies with rated output of not more than 500W shall not perform at less than: - Power Factor 0.8 at 20% of rated output - Power Factor 0.9 at 50% of rated output - Power Factor 0.95 at 100% of rated output	b) Servers 18 months after this Regulation has come into force: All Multi output (AC-DC, DC-DC) power supplies shall not perform at less than: - 85% efficiency at 50% of rated output - 82% efficiency at 20% and 100% of rated output All Multi-output (AC-DC) power supplies shall perform at not less than: - Power Factor 0.8 at 20% of rated output - Power factor 0.9 at 50% of rated out put - Power factor 0.95 at 100% of rated output All single output (AC-DC, DC-DC) power supplies with rated output of not more than 500W shall not perform at less than: - 70% efficiency at 10% of rated output - 82% efficiency at 20% of rated output - 89% efficiency at 50% of rated output - 85% efficiency at 100% of rated output All single output (AC-DC) power supplies with rated output of not more than 500W shall not perform at less than: - Power Factor 0.8 at 20% of rated output - Power Factor 0.9 at 50% of rated output - Power Factor 0.95 at 100% of rated output

4. Internal power supply efficiency - continued		
	All single output (AC-DC, DC-DC) power supplies with rated output greater than 500W but not more than 1000W shall not perform at less than: - 75% efficiency at 10% of rated output - 85% efficiency at 20% and 100% of rated output - 89% efficiency at 50% of rated output All single output (AC-DC) power supplies with rated output of not more than 500W shall not perform at less than: - Power Factor 0.65 at 10% of rated output - Power Factor 0.8 at 20% of rated output - Power Factor 0.9 at 50% of rated output - Power Factor 0.95 at 100% of rated output All single output (AC-DC, DC-DC) power supplies with rated output of more than 1000W shall not perform at less than: - 80% efficiency at 10% of rated output - 88% efficiency at 20% and 100% of rated output - 92% efficiency at 50% of rated output All single output (AC-DC) power supplies with rated output of not more than 500W shall not perform at less than: - Power Factor 0.8 at 10% of rated output - Power Factor 0.9 at 20% of rated output - Power Factor 0.9 at 50% of rated output - Power Factor 0.95 at 100% of rated output	All single output (AC-DC, DC-DC) power supplies with rated output greater than 500W but not more than 1000W shall not perform at less than: - 75% efficiency at 10% of rated output - 85% efficiency at 20% and 100% of rated output - 89% efficiency at 50% of rated outputAll single output (AC-DC) power supplies with rated output of not more than 500W shall not perform at less than: - Power Factor 0.65 at 10% of rated output - Power Factor 0.8 at 20% of rated output - Power Factor 0.9 at 50% of rated output - Power Factor 0.95 at 100% of rated output All single output (AC-DC, DC-DC) power supplies with rated output of more than 1000W shall not perform at less than: - 80% efficiency at 10% of rated output - 88% efficiency at 20% and 100% of rated output - 92% efficiency at 50% of rated output All single output (AC-DC) power supplies with rated output of not more than 500W shall not perform at less than: - Power Factor 0.8 at 10% of rated output - Power Factor 0.9 at 20% of rated output - Power Factor 0.9 at 50% of rated output - Power Factor 0.95 at 100% of rated output

5. Power management		
a) 18 months after this Regulation has come into force: Desktops/integrated computers/notebooks shall: - Be shipped with a sleep mode which is set to activate within 30 minutes of user inactivity. - Reduce the speed of any active 1 GB/s Ethernet network links when transitioning to Sleep or Off when WOL enabled. Computers shall also: - Be shipped with the display sleep mode set to activate within 10 minutes of user inactivity.	a) 6 months after this Regulation has come into force: Computers shall: - Be shipped with a sleep mode which is set to activate within 30 minutes of user inactivity. - Reduce the speed of any active 1 GB/s Ethernet network links when transitioning to Sleep or Off when WOL enabled. Computers shall also: - Be shipped with the display sleep mode set to activate within 10 minutes of user inactivity.	a) 12 months after this Regulation has come into force: Desktops/integrated computers/notebooks shall: - Be shipped with a sleep mode which is set to activate within 30 minutes of user inactivity. - Reduce the speed of any active 1 GB/s Ethernet network links when transitioning to Sleep or Off when WOL enabled. Computers shall also: - Be shipped with the display sleep mode set to activate within 10 minutes of user inactivity.
	b) By 07 January 2013 (as in Regulation 1275/2008): When the computer is not providing the main function, or when other energy-using product(s) are not dependent on its functions, it shall offer a power management function, or a similar function, that switches equipment after the shortest possible period of time appropriate for the intended use of the equipment, automatically into: - 'Off mode-with-WOL', or - another condition which does not exceed the applicable power consumption requirements for 'off-with –WOL' mode when the equipment is connected to the mains power source. The power management function shall be activated before the placing on the market of the product.	b) By 07 January 2013 (as in Regulation 1275/2008): When the computer is not providing the main function, or when other energy-using product(s) are not dependent on its functions, it shall offer a power management function, or a similar function, that switches equipment after the shortest possible period of time appropriate for the intended use of the equipment, automatically into: - 'Off mode-with-WOL', or - another condition which does not exceed the applicable power consumption requirements for 'off-with –WOL' mode when the equipment is connected to the mains power source. The power management function shall be activated before the placing on the market of the product.

Displays		
1. On		
a) 12 months after this Regulation has come into force: The on mode power consumption of a display with resolution MP (megapixels) and viewable screen area A (expressed in dm2) shall not exceed the following limit PO : - Screen Resolution ≤ 1.1 MP: PO = 6*(MP) + 0.775*(A) + 3 - Screen Resolution > 1.1 MP PO = 9*(MP) + 0.775*(A) + 3 Excluded from this requirement are high-end displays >= 24” for special applications (e.g. medical applications, CAD, image processing, process controlling and presentations). These displays must not exceed the following maximum active power consumption equation for X >= 1 megapixel: Y=28X. Y is expressed in watts and rounded up to the nearest whole number and X is the number of megapixels in decimal form (Energy Star 4.1 Tier 2).	a) 6 months after this Regulation has come into force: The on mode power consumption of a display with resolution X (number of megapixels in decimal form1) shall not exceed the following limit Y (expressed in watts and rounded up to the nearest whole number): 1. Screen Resolution < 1 MP: Y = 23 2. Screen Resolution > 1 MP: Y = 28X	a) 12 months after this Regulation has come into force: The on mode power consumption of a display with resolution MP (megapixels) and viewable screen area A (expressed in dm2) shall not exceed the following limit PO: - Screen Resolution ≤ 1.1 MP: PO = 6*(MP) + 0.775*(A) + 3 - Screen Resolution > 1.1 MP PO = 9*(MP) + 0.775*(A) + 3 The power-consumption of high-end displays >= 24” for special applications shall be calculated according to the following formula: [to be determined]

Displays		
1. On - continued		
	b) 18 months after this Regulation has come into force: The on mode power consumption of a display with resolution MP (megapixels) and viewable screen area A (expressed in dm2) shall not exceed the following limit PO: - Screen Resolution ≤ 1.1 MP: PO = 6*(MP) + 0.775*(A) + 3 - Screen Resolution > 1.1 MP PO = 9*(MP) + 0.775*(A) + 3	
2.Sleep mode		
a) 12 months after this Regulation has come into force: The sleep mode power consumption shall not exceed 1W	a) 6 months after this Regulation has come into force: The sleep mode power consumption shall not exceed 2.00 W	a) 12 months after this Regulation has come into force: The sleep mode power consumption shall not exceed 1W
	b) 18 months after this Regulation has come into force the sleep mode power consumption shall not exceed 1.00 W	
3. Off mode		
Same as in Regulation 1275/2008	Same as in Regulation 1275/2008	Same as in Regulation 1275/2008

4. Power management		
a) 12 months monitors- Same as in E*- 15 minutes after last interaction able to support APD	a) 12 months monitors- Same as in E*- 15 minutes after last interaction able to support APD	a) 12 months monitors- Same as in E*- 15 minutes after last interaction able to support APD
b) Displays generating their own content 12 months after this Regulation has come into force: Must have at least one mechanism enabled by default that allows the display to automatically enter sleep or off mode after a period of 4 hours of user inactivity. For instance, data or network connections must support powering down the display according to standard mechanisms, such as Display Power Management Signalling.	b) Displays generating their own content 12 months after this Regulation has come into force: Must have at least one mechanism enabled by default that allows the display to automatically enter sleep or off mode after a period of 4 hours of user inactivity. For instance, data or network connections must support powering down the display according to standard mechanisms, such as Display Power Management Signalling.	b) Displays generating their own content 12 months after this Regulation has come into force: Must have at least one mechanism enabled by default that allows the display to automatically enter sleep or off mode after a period of 4 hours of user inactivity. For instance, data or network connections must support powering down the display according to standard mechanisms, such as Display Power Management Signalling.