

# ADDITIONAL ASSESSMENT IN THE FRAME OF THE REVIEW STUDY ON COMMISSION REGULATION (EC) NO. 278/2009 EXTERNAL POWER SUPPLIES

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Final Report





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**Prepared by:** Catriona McAlister and Jan Viegand

**Prepared to:** European Commission - Directorate-General for Energy

**Quality Assurance:** Annette Gydesen

**Approved by:** Jan Viegand

**Viegand Maagøe**

Nr. Farimagsgade 37

1364 Copenhagen K

Denmark

Telephone: +45 33 34 90 00

[www.viegandmaagoe.dk](http://www.viegandmaagoe.dk)

## Summary

This document summarises work carried out on “Additional assessment in the frame of the Review study On Commission Regulation (Ec) No. 278/2009 External Power Supplies”.

The work was requested by the European Commission to carry out more detailed studies in areas of interest identified as an outcome of the Consultation Forum meeting held in April 2013. The policy scenario evaluated has been refined since that time, as shown in the table below. This report details the final outcomes of the work.

Savings (TWh per year in 2025)	Ambition			Basic tier savings	High power EPS	multiple voltage output	wireless chargers	10% loading	Total TWh 2025
	Tier 1	Tier 2	Tier 3						
Original draft report to CF	X	X	X	1.461	0.002	0.839	0.538	0.125	2.97
Post CF report	X	X	X	1.461	0.002	0.40	0.538	0.125	2.53
Final report	X	X		0.95		0.40			1.35

Table 1 - Evolution of policy scenarios evaluated for a review of the EPS regulation

The policy scenario considered for revision of the regulation was a tier 1 in 2016 harmonised with US DOE rulemaking requirements, and a tier 2 in 2018 harmonised with tier 2 of the EU Code of Conduct (with the exception of 10 % load efficiency requirements). Potential savings of nearly 1 TWh in 2025 are expected for the first tier, and an additional nearly 40 % for a second tier (including an expansion of scope to cover multiple voltage output EPS). The US DOE rulemaking on EPS was finalised on February 10, 2014. The EU CoC version 5 was finalised on October 31, 2013 and valid from January 1, 2014. Suggested timing for revised European requirements is: February 2016 for Tier 1 and February 2018 for Tier 2.

If a harmonised tier 1 requirement with the US DOE rulemaking were not put in place, there is a risk that the poorer efficiency products that could no longer be sold in the US would increase presence in the EU market. Industry supports a harmonised requirement with the US DOE despite the fact that this is where the majority of redesign costs will be incurred. A tier 2 harmonised with the EU CoC tier 2 means that additional savings of nearly 40 % in 2025 can be achieved. The tier 2 requirements would place little additional cost on manufacturers (above what would already have been required for tier 1) and would only require an additional 5 % of EPS to be redesigned.

Requirements related to wireless charging and high power EPS are not in scope of the suggested revisions but would require to be analysed in more detail at the next legislative review. Requirements for multiple voltage output EPS have been suggested for inclusion in line with US DOE requirements.

The definition of “low voltage” EPS was considered for reassessment due to an issue with an existing exemption from the standby measure (1275/2008) for products with low voltage EPS as defined in 278/2009. It appeared that unintended products were falling into the “low voltage” definition and therefore exempt from the requirements of the standby measure. After an

assessment of the options it was found that removal of the exemption would be a practical means of resolving the issue, although discussions with stakeholders favoured a postponement on addressing the issue until the subsequent review of 278/2009 or a review of regulation 1275/2008.

It was recommended that information requirements on efficiency at 10 % load were included, and requirements considered at a subsequent review. Collection of this data for all EPS was considered pertinent as a requirement could ensure a higher efficiency across the entire low load range, which would be beneficial even for smart phones.

The lifecycle costing analysis undertaken to evaluate the proposed requirements took feedback from a range of stakeholders into account to refine base cases, usage profiles and cost inputs. Results showed that lifecycle savings (electricity savings minus total costs for redesign etc.) were achieved for all EPS except for the highest-powered notebook EPS, for which costs were likely overestimated and volumes were very small. For a typical home with varying quantities of EPS, positive overall savings were shown.

A sensitivity analysis addressed a range of potential variations in input assumptions. It was concluded that if the EU average electricity price were to drop from 0.19 to below 0.13 Euro cents per kWh for a sustained period, there could be issues with the measure breaking even. However, this was considered highly unlikely taking into account expected increases in world prices of the fossil fuels that make up 80 % of the EU's primary energy consumption and maintained or increased national electricity taxes. Variations in usage and moderate increases in consumer mark up still resulted in positive lifecycle savings for the majority of products.

There was considerable difference of stakeholder and expert opinion regarding no load costs for the second tier. Sensitivity analysis showed that this was only an issue for notebook EPS, and some stakeholders did not believe these costs were present. Taking into account the saving potential related to the harmonisation with the EU CoC tier 2 requirements it was recommended that the tier 2 no load requirements be retained.

It was found that whilst the production time for some custom EPS has traditionally been quite long, up to 5 – 7 years, the majority of EPS follow a continuous process of re-engineering and optimisation – with EPS seldom remaining unchanged for more than a year. Redesign times (time to market) could be between 12 months to 3 years depending on the changes required. For the EPS requiring more changes or with longer design cycles, it was noted that it would be important to provide clear signposting of the second tier well in advance so that this could be integrated in design cycles as soon as possible.

An analysis related to resource efficiency explored a range of options. All had their challenges and would require further study to finalise as requirements, but they also represented an opportunity for further savings to be achieved. In particular, voluntary approaches aiming to reduce the number of EPS shipped with products due to a universal EPS standard had promise, as they could achieve savings more quickly than regulation whilst allowing for frequent updating of requirements. Measures encouraging design for disassembly had the largest saving potential. Whilst a weight requirement was possible, due to the range of potential drivers for variation in weight, and the risk that a preparatory study would find that a requirement on weight were inappropriate, an information requirement on weight was not recom-

mended. It was considered that the wider lifecycle impacts of EPS could be best addressed via other initiatives such as a memorandum of understanding or code of conduct approach.

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# 1 Project Scope

This project scope focused on the Commission Regulation (EC) No 278/2009 of 6 April 2009 with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies (EPS). The scope was informed by the European Commission as a Request for Services under the Framework Contract ENER/C3/2012-418-Lot 2.

This report focuses on additional assessments in the frame of the review study. It follows a first review study where the scope was initial analysis of key documents, updating of knowledge of products in the area, assessing the scope, need for clarification and further improvement potential of the regulation. It included attendance at Consultation Forum in April 2013. A final report was submitted in September 2013. A need for further assessments was identified, which lay the foundations for the current project.

In the following list, we present the scope defined by the European Commission and below each scope item, we state how we treat the item in this report:

- Assess the impacts of the approaches proposed at the Consultation Forum in further depth, in particular with regard to additional costs and the need for re-design, and identify Least Life Cycle Costs. This should be done in a way that other scenarios than the one proposed can be established and compared within this contract.
  - Chapter 5, 6 and 7 contains all the cost analyses including the Least Life Cycle Cost analyses and sensitivity analyses. Chapter 4 contains the definition of base cases and usage profiles used for the cost analyses. Chapter 8 contains the need for re-design and ease and speed of redesign and re-sourcing.
- Assess last versions of the EU CoC and the DOE rules that were not available at the time of the Consultation Forum and provide clarity on the degree of harmonisation between EU and DOE requirements.
  - Chapter 2 contains this assessment and a calculation of saving potentials for them
- Assess the contributions and comments received from Member States and stakeholders before, during and after the Consultation Forum.
  - We mention and assess the contributions and comments received in connection to each individual topic treated in this report.
- Assess open aspects with regard to the scope; in this, pay particular attention to the issues of the definition of Low voltage external power supplies and testing methods for multiple voltage output.
  - Chapter 3 contains these assessments.
- Explore and sketch the general feasibility and usefulness towards setting a requirement on product weight in view of the next review (data needs, potential complexity, potential in terms of material savings, potential negative impacts on product design, industry and consumers) and assess any relevant aspects linked to the setting of an information requirement at this stage.

→ Chapter 9 contains assessments on resource efficiency related requirements including requirements on product weight.

As part of the work we also undertook:

- Further data gathering, principally through DIGITALEUROPE as a central partner in the stakeholder contact.
- Re-evaluation of potential regulatory requirements as discussed at consultation forum and via stakeholder consultation.
- Definition of base cases and usage profiles.
- Compilation of cost data and calculation of cost impacts of meeting each energy efficiency and no load target for each base case.
- Implementation of sensitivity analysis including analysis of a case study for the average home.
- Evaluation of ease and speed of redesign and re-sourcing.

The deliverables were:

- Attendance at an expert meeting in Brussels on 30<sup>th</sup> September 2013 including preparation of inputs and comments,
- Intermediate report regarding the above stated tasks,
- Final report by 31 December 2013 (draft, revised version by 17<sup>th</sup> March 2014),
- Technical assistance such as for discussion with stakeholders, inter-service consultation and discussions in the Regulatory Committee.

## 2 Scenario calculation based on updates of EU CoC and US DOE rulemaking

The policy scenario for revision of the regulation is based on the final versions of the EU CoC (EU Code of Conduct) for EPS version 5, and the US DOE (US Department of Energy) EPS rulemaking as finalised at February 2013. Requirements were aligned with these initiatives, taking into account reduced scope as discussed in the Consultation Forum.

Scenario modelling was re-run in order to assess the saving potentials using a model developed by the organisation CLASP ([www.clasponline.org](http://www.clasponline.org)) and modified to reflect the detail of scope.

The CLASP model uses the NRCan (Natural Resources Canada) database comprising 4600 data points. It is a stock-based model with lag applied to account for gradual uptake in compliant products.

The calculations include:

- Average efficiency and no load levels
- Pass or fail for each data point for each scenario
- kWh per EPS adapted for compliance with each scenario
- Total average kWh per EPS to calculate savings.

### 2.1 US DOE Rulemaking on External Power Supplies and Battery Chargers

The US DOE rulemaking covers both battery chargers and EPS (bundled together), establishing minimum efficiency requirements. It was finalised on February 10<sup>th</sup> 2014, with no major changes from the previous draft. A two year compliance period is likely from the point of US DOE requirements being finalised, so requirements would come into effect in around February 2016.

Wireless charging is not part of the most recent proposal, but something that will be considered in the future due to the developments within wireless charging,

DIGITALEUROPE expressed a preference for an approach harmonising with the US DOE requirements. They initially suggested the requirements come into force from June 2016<sup>1</sup>, but later changed their position to request enforcement from 1<sup>st</sup> January 2016<sup>2</sup>.

There are differences in the definitions and scope between US and EC approaches, which have not been assessed in detail - the assumption being that the EC definitions will continue to apply. A harmonisation with US definitions (particularly with reference to direct and indirect power supplies) would result in a shrinking of scope of the regulation coverage, require a

<sup>1</sup> "Response to the Consultation Forum for the review of regulation 278/2009 on External Power Supplies (EPS)", DIGITALEUROPE DIGITALEUROPE, 27 May 2013

<sup>2</sup> Presentation from September 30th 2013 Technical Expert Meeting with DIGITALEUROPE "DIG EUR WORKSHOP Sep 30th 2013 - Energy Requirement\_SR edit"

more detailed review assessment, and have a negative impact on the calculated savings. Furthermore, harmonisation with US definitions is not considered appropriate, due to the fact that battery chargers are not addressed by regulation in Europe. For a fuller discussion of the definition issue, please see the Appendix.

There is a risk that if requirements in Europe do not harmonise with US DOE requirements around the same time, the EU market could become saturated with poorly performing EPS that can no longer be sold in the US.

## 2.2 European Code of Conduct on External Power Supplies

The EU Codes of Conduct (CoC) are voluntary initiatives involving for industry, experts and Member States. They provide a mechanism for setting ambitious commitments on energy efficiency, through an ongoing dialogue on market developments and product and system performance. The goal is for the CoCs to provide more ambitious targets than would be proposed in legislation, so that the best performing companies can gain recognition for their efficient products.

The final version of the Code of Conduct, Version 5 from 31 October 2013 includes requirements for no load power consumption, four-point average efficiency in active mode, and efficiency at 10% load of full rated output current, in two tiers (January 2014 and January 2016).

## 2.3 Harmonisation between EU CoC and US DOE requirements

There is no harmonisation of four-point average efficiency requirements in active mode between the EU Code of Conduct and the US DOE rulemaking. The two sets of requirements relate to one another as shown in the chart below.

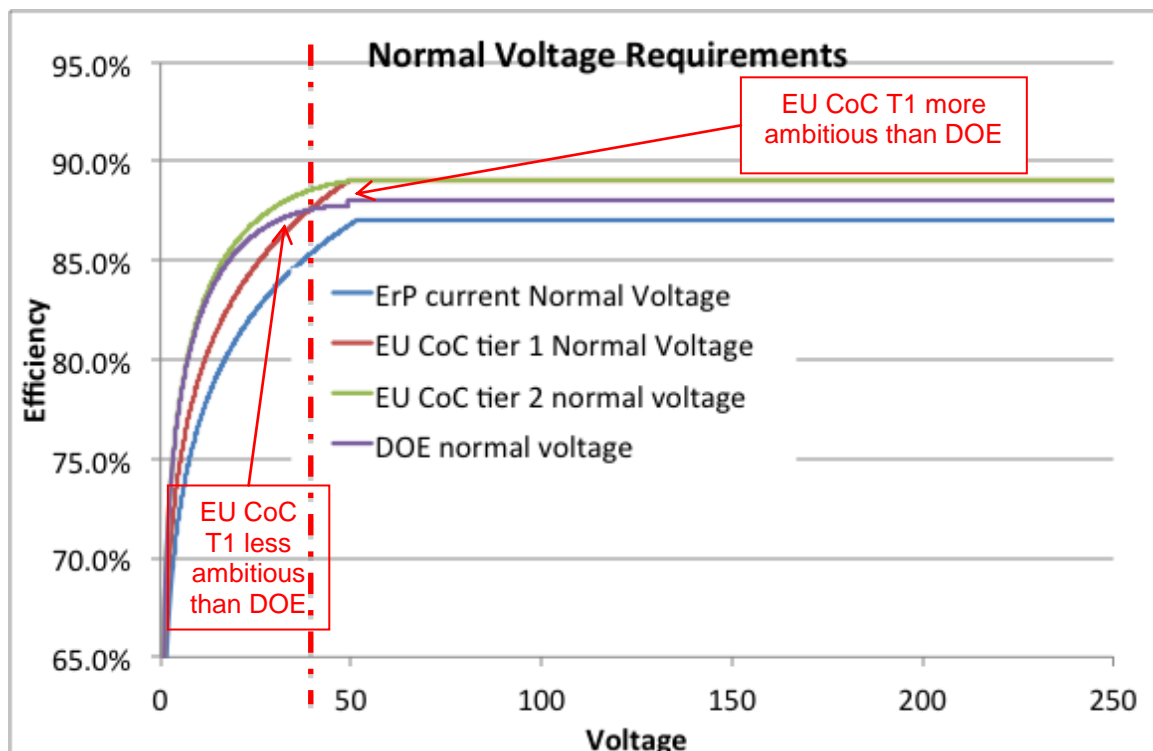


Figure 1 - Comparison of requirements between EU CoC and US DOE<sup>3</sup>. The vertical red line is indicating the voltage level where the EU CoC tier 1 and the US DOE requirement lines are crossing.

It can be observed that both the EU CoC and US DOE efficiency requirements are more ambitious than the current ErP efficiency requirements. It should be noted that tier 1 of the EU CoC is less ambitious than the DOE requirements for EPS below around 40 Volts, and more ambitious than the US DOE requirements above this level. The EU CoC Tier 2 requirements are consistently more ambitious than the US DOE requirements.

In terms of the no load levels, requirements between the two initiatives are close, but not harmonised, as shown in the table below.

No-load Power (not to exceed Wattage) – Standard Voltage			
Nameplate Output Power ( $P_{no}$ )	EU CoC tier 1 2014	EU CoC tier 2 2016	US DOE 2015
> 0.3 W and < 49 W <sup>4</sup>	0.150 W	0.075 W	0.100 W
> 49 W and < 250 W	0.250 W	0.150 W	0.210 W
250 W < $P_{no}$	N/A	N/A	0.500 W
No-load Power (not to exceed Wattage) – Low Voltage <sup>5</sup>			
> 0.3 W and < 49 W	0.075 W	0.075 W	0.100 W
> 49 W and < 250 W			0.210 W
250 W < $P_{no}$	N/A	N/A	0.500 W

Table 2 - No load requirements.

The EU CoC tier 1 no-load requirements are more ambitious than the US DOE rulemaking for low voltage EPS, but less ambitious for standard voltage EPS. The tier 2 EU CoC requirements are consistently more ambitious than the US DOE requirements.

## 2.4 Scenario assessed

The following scenario was modelled, both in terms of total savings and lifecycle costings:

Tier 1:

- Harmonisation with power and efficiency requirements in the final version of US DOE EPS rulemaking
- 2016 introduction
- Multiple voltage output included in tier 1

Tier 2:

- Harmonisation with EU CoC EPS tier 2 version 5 power and efficiency requirements,
- 2018 introduction
- No 10 % load efficiency requirements (except for information)

<sup>3</sup> This chart is for normal voltage EPS. The chart for low voltage EPS is similar

<sup>4</sup> In the current version of EU CoC (Version 5), the nameplate power output is defined as  $\geq 0.3$  W and < 49 W, for comparison purposes we defined it as > 0.3 W and < 49 W.

<sup>5</sup> In the current version of EU CoC (Version 5), the requirement of no load consumption for low voltage EPS is categorized as mobile handled battery driven and < 8 W.

Three tiers had been considered previously, but there was a general consensus at the Consultation Forum that a third tier was not appropriate to a fast-track approach. Therefore, in this later analysis, a third tier has not been assessed.

Requirements at 10 % load were also excluded as there was insufficient data on which to evaluate levels<sup>6</sup>, and a general consensus that as it was not an established or harmonised approach (i.e. not addressed in US DOE rulemaking) it was not appropriate to include these requirements at this review.

## 2.5 Summary of compliance against current EPS

Initial analysis showed that tier 1 requirements aligned with EU CoC tier 1 in place of the US DOE rulemaking would require less EPSs to be changed, but industry comments indicated that they favoured harmonisation with US DOE as a means of reducing costs. Therefore a first tier based off the US DOE requirements is analysed.

Scenario	Tier Level	# passing	Fail	Pass
Business as usual		4608	0 %	100 %
Policy Scenario	Tier 1	563	88 %	12 %
	Tier 2	310	93 %	7 %

Table 3 – Impact on the market of the potential requirements based on the CLASP/NRCAN dataset.

The table above indicates that 88 % of the CLASP data set would fail to meet the US DOE requirements – requiring a combination of resourcing and redesign. Feedback from DIGITALEUROPE indicating that they are in agreement with harmonisation with the US DOE requirements, suggests that they would therefore accept this level of resourcing or redesign. In fact, in stakeholder feedback, whilst DIGITALEUROPE was not able to provide detailed information on redesign costs, the information they provided supported the stance that full redesign would not be necessary in the majority of cases:

*“In general, technical solutions for more efficient EPS, without limiting the performance of the EPS, are available in the market and provided by the EPS and/or component manufacturers.”<sup>7</sup>*

Whilst DIGITALEUROPE did not support a second tier of requirements, our analysis shows that the addition of a tier 2 would require only an additional 5 % of EPS to be redesigned or resourced. The grounds for the DIGITALEUROPE objection were mainly based of a statement from the initial review study carried out prior to the CF that tier 2 would require 92 % of products to be redesigned. This was not correct, i) as the solution would be a combination of redesign and resourcing of products (at much lower cost), and ii) as the US DOE requirements would already result in a change in 88 % of the market there would only be the need for an additional change in a very small additional proportion of the market.

<sup>6</sup> It has since been highlighted that the ITU has tested 200 EPSs at 10 % load, and may be able to provide this data if required.

<sup>7</sup> Written comment from “DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant”, 11 November 2013

## 2.6 Summary of potential savings

Table 4 shows that including a second tier in line with the EU CoC Tier 2 results in significant additional savings of nearly 40 % in 2025 compared to a single tier based on US DOE alone, and would only require changes (in terms of redesign or resourcing) to approximately 5 % of the market, and relatively low additional costs in most cases above the costs already incurred in tier 1 (see LLCC section).

<b>Savings</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
(TWh/year)			
Tier 1 (based on US DOE)	0.93	0.99	0.99
Tier 2 (based on EU CoC Tier 2)	1.19	1.35	1.36

Table 4 – Savings potentials for the scenarios analysed.

It is likely that if the rated power of mobile phone EPS were to increase, as has been suggested by manufacturers, the savings would be even greater.

## 2.7 Timings

Industry requested that requirements in line with US DOE requirements to be introduced in January 2016.

The US rulemaking would come into effect in the US in around February 2016, and so an introduction date of February 2016 (slightly later than the most recent industry suggestion) for the EU tier 1 requirements is considered appropriate. Following this, a second tier in line with EU CoC tier 2 could be introduced in February 2018.

Such an approach is also consistent with the bi-annual start-of-year timing of the tiers of the EU CoC itself.

## 2.8 Testing

The European test standard EN 50563:2011 covers no-load power and average efficiency of active modes for external ac-dc and ac-ac external power supplies. As it has been referenced in the OJEU, it can now be considered the appropriate standard for testing of products under scope of EC Regulation No 278/2009. It specifies an arithmetic average of efficiencies at 25%, 50%, 75% and 100% load, and was based the first draft on the Australian MEPs and the previously referenced EPRI test method.

The US test standard is “2011-06-01 Energy Conservation Program for Certain Consumer Appliances: Test Procedures for Battery Chargers and External Power Supplies; Final rule.”<sup>8</sup> Whilst the two sets of test standards with published in the same year, insights from experts involved in the process suggest that the two standards groups did not coordinate on standard development, and that in fact the EU test standard group was not aware of the US DOE work. However, it was considered unlikely that there would be a considerable difference in approaches as both based their work on a similar foundation of the original EPRI test method

<sup>8</sup> <http://www.regulations.gov/#!documentDetail;D=EERE-2009-BT-TP-0019-0020>

previously referenced under ENERGY STAR. Both approaches use the loading points of 25, 50, 75 and 100%. Differences include the fact that the US approach includes a method to test multiple voltage output EPS, and to specifically address external power supplies that communicate with their loads.

In terms of alignment of measurement standards, historically there has been a good degree of harmonisation, even prior to these standards being established. A CLASP report in 2011, stated:

*“There is currently a uniform global approach to the testing of external power supplies for energy efficiency. The only regional variations are the some programs do not require dual input voltage testing of all products for some regional markets... There is excellent harmonisation in the testing of external power supplies for energy efficiency as most of the programs in force use the same internationally agreed test method.”<sup>9</sup>*

Whilst a detailed comparison between the two testing approaches has not been implemented within this study, expert consultation suggests that there are not likely to be substantive differences in approach, but that where there are gaps in the European standard, the US DOE test procedure is likely to be able to fill them.

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<sup>9</sup> “Opportunities for Success and CO2 Savings from Appliance Energy Efficiency Harmonisation”, Paul Waide, Navigant Consulting for CLASP 2011: Chapter 12, [http://www.clasponline.org/en/Resources/Resources/StandardsLabelingResourceLibrary/2011/~/\\_media/Files/SLDocuments/2011-03\\_HarmonizationStudy/HarmonizationStudy-Part2/CLASP\\_HarmonizationStudyP2\\_Ch12.pdf](http://www.clasponline.org/en/Resources/Resources/StandardsLabelingResourceLibrary/2011/~/_media/Files/SLDocuments/2011-03_HarmonizationStudy/HarmonizationStudy-Part2/CLASP_HarmonizationStudyP2_Ch12.pdf)



## 3 Scope and definitions

This section addresses additional assessments of possible changes in scope and definitions based on comments from stakeholders and new data and analysis in relation to scope and definitions.

Additional data was obtained by the following means:

- Desk research,
- Stakeholder submitted feedback,
- Teleconferences with experts and stakeholders,
- An expert meeting organised by DIGITALEUROPE and attended by a small selection of manufacturers, Member States, NGOs and the consultant for this review study at the end of September 2013,
- A questionnaire to manufacturers to gather data on usage profiles, costs, supply chain and redesign considerations, inventory issues, market profile (redesign vs supply chain changes etc.), cost reflection to consumer, time to market etc.

The additional data gathering supplemented the already collected data and information from the first review study.

### 3.1 Scope

#### 3.1.1 Multiple voltage output EPS

There is a general consensus that extending coverage to multiple voltage output EPS (EPS that simultaneously output at different voltage levels) is acceptable, as it is a simple addition resulting in savings due to extending the coverage to more EPSs, with a test method available from the US DOE. The US DOE indicated that there are no outstanding issues related to this test method<sup>10</sup>.

In order to include multiple voltage output EPS, the following statement would need to be removed:

“(b) it is able to convert to only one DC or AC output voltage at a time”

Note that EPS, providing the same voltage via multiple output connections, and EPS with several voltage levels where only 1 voltage is drawn at a time are currently included within scope of the regulation.

#### 3.1.2 High power EPS (> 250 W)

There is a consensus that the inclusion of high power EPS (> 250 W) should be delayed until the next review, when a more detailed analysis of these products can be carried out. Potential savings related to these products were low.

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<sup>10</sup> Test methods is available at: <http://tinyurl.com/p9ppocx>. Each output is loaded proportionally according to nameplate values, reduced proportionally if total load exceeds the EPS total maximum load.

### 3.1.3 Wireless chargers

There is a consensus that requirements for these should be delayed to the next revision. Whilst there is a good potential for savings, the test methods for these products are still being defined by the Wireless Power Consortium. As a result there is very little data on which to base requirements, and incorporating information requirements into the regulation would be problematic. Wireless chargers would require a more detailed study at the next review, which could also consider the potential to include chargers in general in the next revision.

### 3.1.4 Other

The scoping of some other EPS types has been discussed during this study and the review study, and the following can now be considered confirmed in scope as per the current wording of the regulation:

- Indirect Operation EPS (not capable of powering a consumer product without the assistance of a battery).
- EPS with integrated backup batteries
- USB adaptor plugs

## 3.2 Definitions

The focus of discussion and investigation has been related to the exemption of low voltage EPS products from regulation No 1275/2008 (standby measure) on the basis of the definition in the current EPS regulation (No 278/2009).

Initially, this definition was intended to capture mobile phones, which it was not felt should need to comply with the standby mode requirements if their EPS were already efficient (in line with the EPS regulation). However, it has been highlighted more recently that the definition:

- Does not apply to only mobile phones:** There are some other products that are not required to comply with the standby measure as a result of the exemption, but which should actually be in scope. These include some modem / router EPS, tablet EPS, charging stands and security cameras. However, based upon technical data regarding these EPS, it is unlikely that these products would have any problem meeting the network standby amendment and the standby requirements as they currently stand. This means that whilst there may be a lack of consistency, the lost savings are not significant.
- Does not apply fairly across all mobile phones:** The definition is now out-dated as it no longer covers the range of mobile phone EPS. For example, a number of current mobile phone EPS would be considered standard rather than low voltage and be required to comply with the standby measure requirements (Nokia 108, Nokia Asha 210, Nokia Asha 501 with AC-11, 5 V, 450 mA, 2.25 W specification supplies), whilst others would still fall under the exemption (Nokia 301, Nokia 515, Nokia Lumia 520 with AC-20, 5 V, 750 mA, 3.75 W specification supplies).

As can be observed, the current exemption does not apply in a consistent way to the market. In order to resolve the issue, the following three options have been explored:

- Option 1: Upper current or power limitation. Considerations:

- Thresholds are likely to become irrelevant quickly, especially taking into account the new USB standard (v3.0) which will allow dynamic adaptation to a range of powers much higher than previously possible.
- Option 2: Improved definition to ensure exemption only applies to mobile products – options suggested by stakeholders include:
  - Cross reference to computer measure for definitions: Defining ‘mobile’ specifically is problematic due to issues with product convergence with tablets etc.<sup>11</sup>
  - Clarify low voltage EPS as used with products only connected to the mains for battery charging purposes.
  - Clarify low voltage EPS as excluding EPS used with products that are intended to be continuously connected to the mains.
  - Clarify low voltage EPS as being used with products that are designed to operated off a battery
- Option 3: Remove exemption. Considerations:
  - To measure standby, the product needs to be connected to the mains, so this is essentially irrelevant for mobile products as long as EPS is addressed.
  - In the stakeholder meeting, a major mobile phone manufacturer stated that mobile products would not have a problem meeting the standby requirements. The issue for them was bureaucratic in terms of the paperwork related to their inclusion in another directive, although the testing will need to be carried out for the EPS regulation anyway, and is already being done for mobile phones that fall outside the current definition.
  - Some non-mobile products currently benefitting from the exemption may need to be changed.

Whilst there are clear reasons for the exemption, the least problematic solution would be its removal. This would add a small additional burden on the mobile phone manufacturers, and may require small volumes of some non-mobile products benefitting from the exemption to be changed. Research suggests that the volumes of products that would be impacted would be low. Based on a desk research on larger online shops such as Amazon and Ebay, we estimate that there are potentially 30 % of router products, 60 % of tablet products and approximately 4 % of notebook EPS products that could currently be benefitting from the exemption, but most of these products would already be able to meet the standby and network standby requirements. Requirements coming into place in 2016 would provide ample time for any product design changes to be made.

Discussions with stakeholders favoured a postponement on addressing this issue until the subsequent review or a review of regulation 1275/2008.

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<sup>11</sup> The computer regulation (COMMISSION REGULATION (EU) No 617/2013) has been examined, but does not assist in defining these “mobile” products. It aims to exclude mobile products via an exclusion of any products fitting the notebook definition but with a screen size less than 9 inches. However, with the rapid rate of technology development, screen size is an inexact approach to definitions of mobile products.

### 3.3 Information requirements – efficiency at 10 % load

Whilst efficiency requirements at the 10 % loading level were discounted for this revision, the Consultation Forum discussions suggested that an information requirement on active efficiency at 10 % load could be appropriate for the following reasons:

- In order to evaluate how severe the tail off in efficiency is at the 10 % loading level.
- In order to provide the necessary data set on which to base future revisions.
- In order to address the low network availability standby modes of many products, and the increasing trend of ICT products toward operation at the 10-30 % load range<sup>12</sup>
- For consistency with the EU Code of Conduct.

Consultation with experts suggests that 10 % load requirements are important for all applications. 10 % load is important not just for products that operate around 10 % of the EPS rated capacity in certain modes. A 10% efficiency requirement ensures a higher efficiency across the entire low load range, from 1 % to 25 % load, which will be beneficial even for smart phones, for example when they reach the most common 90 % - 100 % charging zone. This is explained in the chart below.



Figure 2 – Low load efficiency variation for two EPS at 230V.<sup>13</sup>

<sup>12</sup> EU CoC meeting minutes from September 2012 meeting.

<sup>13</sup> Natural Resources Defense Council 'Input on the Review Study on the External Power Supply Regulation (EC) No 278/2009', Delforge & Horowitz - October 31, 2013

A four point average efficiency requirement does not guarantee good efficiency in the low load range, or even at 25 %: due to using the average of four load points (25 %, 50 %, 75 %, 100 %). As shown in the chart above, the variation possible across the low load range is considerable without a 10 % requirement.

The introduction of requirements at 10% loading would need a more in depth assessment of a greater body of data than is currently available, and therefore it is recommended, in line with the conclusions of the consultation forum, that an information requirement for efficiency at 10 % load is included in the revision of the EPS requirements. Expert consultation indicates that there would be a marginal extra test burden by increasing the load conditions for measurements from 5 to 6, and that some of the manufacturers would in any case also test at 10 % in order to comply with the EU CoC. Therefore, it is considered that the benefit of a 10 % load efficiency information requirement outweighs any potential testing cost.

## 4 Definition of base cases

In order to carry out a lifecycle cost analysis it was necessary to develop a series of base cases, with corresponding usage profiles.

### 4.1 Base case specification

Base cases for EPS were initially defined based upon the US DOE rulemaking in order to analyse the lowest life cycle costing. DIGITALEUROPE provided alternative base cases to those initially considered<sup>14</sup>. See the table below.

Initial base case	DIGITALEUROPE proposal	Final base case selection
2.5 W low voltage EPS for a smart phone	3.5 W low voltage EPS (mobile phone charger)	Evidence from additional sources suggested a potential increase in mobile phone EPS rated power, so the industry suggested specification was adopted.
18 W EPS for a modem	18 W normal voltage EPS (router/gateway)	The only change was to average in-use power. Industry suggested level was used for savings calculations.
60 W EPS for a notebook computer	40 W normal voltage notebook computer EPS	Whilst a trend toward lower power laptop EPS may occur, it was important to evaluate the cost impacts of the range of larger power products. The 60 W base case was retained.
120 W EPS for a notebook computer	No case provided	As above – the base case was retained.
Multiple voltage output EPS for a game console	Multiple voltage output EPS (Game console)	Industry suggested that the rated voltage was now lower – adopted.
Low usage profile EPS for an electric shaver	Low usage EPS (electric shaver)	Specification was adapted slightly in light of industry suggestions (from standard to low voltage EPS)
	10 W tablet EPS	It was not possible to take into account an additional base case at the late stage in the process at which feedback was received. Industry calculations showed a lifecycle saving so no urgent need for analysis.

Table 5 - Base case consideration

<sup>14</sup>“DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant”, 11 November 2013

In support of DIGITALEUROPE's suggestion of a 40 W notebook base case in place of a 60 W notebook base case, the removal of a 120 W notebook base case and the addition of a 10 W tablet base case, DIGITALEUROPE stated that:

*“The distribution of EPS per output power from the 2007 preparatory study showed that approximately 3-4 % of the EPS have a rated power > 50 W. To a large extent this is related to laptops/notebooks. Based on the changes in PC market it can be assumed that current market has lower percentage of EPS with rated power > 50 W. Tablets typically use EPS with a rated power of 10 W”*

This was corroborated to some degree by comments from a power supply component manufacturer:

*“We are definitely seeing a reduction in output power requirements. There are two groups emerging – full-featured notebooks are remaining in the 90 W range. New ultra books are coming down from 65 W into the 40 W range. 40 W could be a representative base case.”*

It was decided that in light of the wealth of US DOE data available for the 60 W and 120 W base cases, and the fact that they evaluated the higher rated (assumed as the potentially worst case) extremes of the market, these base cases would be retained, although it is noted in particular that the 120 W base case would be very low volume.

## **4.2 Rated and in use average power**

Whilst average power in use is necessary for savings calculations, efficiency requirements need to be calculated using rated power. Useful feedback from DIGITALEUROPE was obtained regarding rated and in use power for modems/routers/gateways and multiple voltage EPS. The corrected average power values were used in the savings calculation<sup>15</sup>. Assumptions were developed, see Table 6.

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<sup>15</sup> Note: Values for average power were not provided by DIGITALEUROPE for all cases, so assumptions had to be made. There was an error in their provided calculations where the efficiency requirements were calculated from the average in use rather than rated power.

EPS EXAMPLES	MODEL	Name-plate output power (P <sub>o</sub> ) (W)	Average in use power (W)	Ratio average to rated power	comments
a.	3.5 W low voltage EPS (mobile phone charger)	3.5	2.6	75 %	Increased rate power, assumed ratio of rated to average in line with game console
b.	18 W normal voltage EPS (router)	18.0	10.0	56 %	Kept rated power at 18, in use power in line with DIGITALEUROPE suggestion.
c.	60 W normal voltage EPS (notebook computer)	60.0	33.3	56 %	Assumed ratio of rated to average in line with gateway/router.
d.	120 W normal voltage EPS (notebook computer)	120.0	66.7	56 %	Assumed ratio of rated to average in line with gateway/router
e.	Multiple voltage output EPS (Game console)	120.0	90.0	75 %	Reduced rated power and average in use in line with industry
f.1	Low usage profile EPS (electric shaver)	5.0	3.8	75 %	Used ratio of rated to average power in line with game console

Table 6 - Rated and in use average power.

### 4.3 Efficiency levels

Due to DIGITALEUROPE feedback, efficiency requirements were recalculated for electric shaver EPS, as they had previously been assumed to be standard voltage rather than low voltage EPS.

In addition, DIGITALEUROPE feedback was provided on the efficiency levels of game console EPS. However, the data provided was not referenced (in terms of year of study etc.) and related assumptions and calculations contained errors<sup>16</sup>. It also conflicted with well-referenced US DOE data, so could not be taken into account. US DOE figures showed that an average multiple voltage game console EPS efficiency was 86.2 % and the requirements were for efficiency of 86 %, and therefore no costs due to efficiency requirements were assumed.

### 4.4 Usage

For the purposes of the analysis, average usage profiles (active/charge and standby time) and lifetimes were defined for each EPS type. The data used as a foundation for this came from the US DOE analysis. Further feedback from industry (DIGITALEUROPE and also directly from some product manufacturers) suggested a number of alternative usage assumptions. An analysis of all the usage data was carried out, and as a result of taking into account industry feedback, the usage profiles were adapted to the following:

<sup>16</sup> DIGITALEUROPE assumptions could not be taken into account – they assumed a current ErP requirement of 92 %, when no requirement exists for multiple voltage EPSs, and subsequent requirements of US DOE 86.4 % and EU CoC tier 2 of 83.4 % (when no EU CoC requirement exists)



EPS MODEL EXAMPLES	Hours per day			Years life	Comments
	No load	On charge	Un-plugged		
a. 3.5W low voltage EPS (mobile phone charger)	17.38	2.00	4.62	4.00	Assumes 70 % users don't unplug from mains, and assume charge time an average of the three sources to approach a middle ground between the two extremes that accounts for i) quicker charging regimes ii) some users charging multiple times per day. 4 years life in line with Nokia. Not accounted for is that some users may have several chargers for the same phone, effectively increasing time in no load.
b. 18 W normal voltage EPS (router)	-	24.00	-	4.00	
c. 60 W normal voltage EPS (notebook computer)	11.21	7.98	4.81	5.00	Assumes 70 % of users don't unplug from mains after charging. Time spent in modes adapted between US DOE and DIGITALEUROPE extremes. Uses industry suggested lifetime.
d. 120 W normal voltage EPS (notebook computer)	11.21	7.98	4.81	5.00	As above.
e. Multiple voltage output EPS (Game console)	20.58	3.42	-	5.00	On time adapted between DIGITALEUROPE and DOE extremes.
f. Low usage profile EPS (electric shaver) - DOE usage	5.43	0.60	17.98	7.00	On and no load times adapted between feedback received from DIGITALEUROPE, directly from manufacturers and DOE levels. Shaver manufacturer suggested lifetime used.

Table 7 – Usage and lifetime assumptions input.

## 5 Compilation of cost data for base cases

### 5.1 Included Costs

Detailed 2010 data for incremental cost (in terms of manufacturer selling price or MSP) of achieving a range of efficiency and no load levels was available from charts produced in the US DOE Rulemaking analysis<sup>17</sup> DOE considered the range of manufacturer costs, including direct materials, direct labour and overhead costs associated with production to arrive at the MSP (see Figure 3 below). They also determined potential values for a further mark-up to account for non-production costs based on research of revenues vs. the cost of goods sold for several domestic companies, as well as insights on further retailer mark-up to determine the final product price. They estimated the typical mark up to be between 1.2 and 2.1<sup>18</sup>. The final consumer product price, along with a population weighted sales tax, generated the cost used in the US DOE's National Impact Analysis (NIA) and the Life Cycle Cost (LCC) analysis to determine payback periods and net present value (NPV).

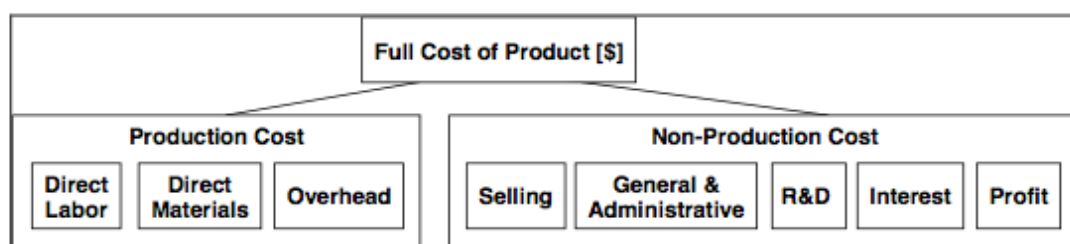


Figure 3 - Full cost of product breakdown: Production and non-production costs from DOE figure 5.11 of technical analysis document.

It has not been possible to clarify if the US DOE markup takes into account considerations such as approbation, changes in packaging, marking etc. – it may be that these were considered to be included in the “general and administrative” costs, or would not be reflected to the consumer.

DIGITALEUROPE members, EPS component manufactures, parties involved in the EU Code of Conduct, and Member State representatives were consulted on the costing data contained in the DOE analysis, and the analysis approach of the EC consultants, and further information was requested on costs of approbation etc. DIGITALEUROPE provided some detailed feedback on costs per EPS base case (discussed later), and some general thoughts on mark ups, but no detailed per-EPS cost figures for approbation etc. were available from stakeholders to further quantify these costs. It was therefore assumed that the DOE approach, backed up by an extensive study, was the most representative, and that these other

<sup>17</sup> Figures 5.40 and 5.41 for Multiple Voltage Output, figures 5.30 to 5.37 for normal EPS, and tables 5.24 to 5.32 of the “Technical Support Document: Energy Efficiency Program For Consumer Products And Commercial And Industrial Equipment: Battery Chargers And External Power Supplies” March 2012, US DOE

<sup>18</sup> Table 5-50 of their technical analysis document

costs were negligible in terms of their reflection to the consumer (otherwise figures would be more readily available).

Costs were determined from the US DOE analysis by reading off each costing curve to the matching or nearest-higher plotted data point on the chart for the requirement level. Each data point represented a Candidate Standard Level product (CSLs) that DOE had specifically analysed. This approach was taken as stakeholder consultation suggested it was a more accurate approach than linear interpretation of the charts, taking into account the fact that technology may operate in step changes.

## 5.2 Discount rates and reduction in costs over time

DOE costs were collected in 2010 as part of the initial rulemaking data collection effort, but according to stakeholder feedback, power conversion IC suppliers claim that component prices in the power conversation industry generally decrease by 3-5 % annually. Correspondence with the US DOE<sup>19</sup> highlighted that:

*“It is certainly possible that costs have decreased for achieving the DOE proposed standards in the time that has passed since we originally gathered the data (2010 – 2011)...it is possible that newer IC controllers provide disjointed improvements to the no-load and active-mode efficiency such that a manufacturer using a particular IC today can already meet the no-load standard, but not the average active-mode efficiency standard. In this case, the manufacturer would incur no additional cost to meet the no-load standard.”*

The DOE calculations also included a discount factor *“based on real discount rates of 3 % and 7 % to discount future costs and savings to present values.”*

DIGITALEUROPE feedback<sup>20</sup> stated that there would already have been some improvements as a result of the Californian Battery Charger rule, which meant that the *“recent energy improvements have not been taken into account and therefore the potential savings are most probably lower”*. If improvements have already taken place, this would also mean that the costs of the measures would be reduced.

Whilst discount rates were not accounted for in this simplified analysis, it was decided that DOE prices should at least be reduced accordingly for the 2016 and 2018 implementations from the 2010 datum accounting for a 4 % reduction each year.

Possible electricity price increases were also not included.

As a whole, the cost analyses with the above assumptions are considered a sound reflection of savings versus the costs of achieving the savings.

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<sup>19</sup> Jeremy Domm, Building Technologies Office, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy, 29<sup>th</sup> October 2013.

<sup>20</sup> “DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant”, 11 November 2013

### 5.3 Mark ups

A mark up of 2 was used in the calculations, based upon a very detailed US DOE analysis<sup>21</sup>. This mark up was also used in calculations provided via stakeholder feedback from DIGITALEUROPE in order to:

*“take(s) into account that manufacturers and retailers might not be able to directly translate the cost uplift entirely into an increased consumer selling price<sup>22</sup>.”*

However, DIGITALEUROPE also stated that higher mark ups of 3 or even 4 would be more realistic, but provided no supporting evidence to enable these mark ups to be considered for the base case modelling. They stated that:

*“In the longer run cost increases are however translated into increased consumer selling price to ensure profitability and survival of business.”*

In contrast, the US DOE usually assumes a reduction in costs of 3 to 5 % per annum, and a power supply component manufacturer stated:

*“Historically, we have not seen EPS BOM cost dramatically increase due to gains in efficiency in order to meet new efficiency standards. This is primarily due to the ability of power conversion IC manufacturers to creatively implement solutions in silicon that don't require additional components (and in some cases reduce the number of circuit components required).”*

Therefore, a higher mark up was assessed in the sensitivity analysis, but the evidence-based mark up of 2 used in the baseline analysis.

### 5.4 No load costs

The no-load power limit in the current ecodesign regulation is 0.3 W. The US DOE requirement, depending on the product group, sets a minimum requirement of 0.1 W, and the EU CoC tier 2 requires a 0.075 W no-load for EPS with rated power < 50 W and low voltage EPS. Industry stakeholder feedback from a number of sources highlighted that the US DOE costings for no load changes were likely to be overestimated, and in fact there would be no cost for no load changes in line with US DOE requirements.

There was more debate around the greater stringency of the EU CoC tier 2 requirements. DIGITALEUROPE claimed for following costs would apply due to the change from 0.1 W to 0.075 W<sup>23</sup>:

EPS type	No-load cost uplift
Personal audio devices	\$ 1.5
Digital imaging products e.g. camcorder	\$ 2, not including the initial cost of redesign and approbation.
PC/notebook with single voltage output	~\$ 1-2 factory selling price, due to redesign, circuit change (development of control IC of

<sup>21</sup> Chapter 6 – Markups Analysis, Technical Support Document: Energy Efficiency Program For Consumer Products And Commercial And Industrial Equipment: Battery Chargers And External Power Supplies, Us Doe March 2012

<sup>22</sup> "DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant", 11 November 2013

<sup>23</sup> "DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant", 11 November 2013

	low power consumption, maintenance of re-boot speed or a load response) and the increase of the chassis volume by the increase of circuit area - representing a cost increase of approximately 30 %.
Mobile phones	\$ 0 - EPS for mobile phone products are far lower than the proposed limits - instead of the no-load limit of 0.3 W, most EPS are designed for a no-load of < 0.03 W, (10 times better than regulation).
Shaving and grooming devices	5 eurocent factory selling price for additional electric circuitry.

Table 8 - Additional no load costs provided by DIGITALEUROPE.

However, a power supply component manufacturer strongly disagreed with these costs. They explained that very low no-load power demand is achieved primarily through the integrated circuit (IC) controller design and the frequency switching techniques employed by the controller (implemented in silicon), and requires no additional components. They explained that:

*“The cost increase to reduce the no-load consumption in the EPS should be nothing if the correct IC controller is used. There are multiple sources on the market currently available to accomplish this.”*

There are currently power conversion control ICs on the market that can achieve 75 mW or lower no-load without additional cost. For EPS above 50 W output, the US DOE no-load requirement of 210 mW could also be met with no additional cost, as could a level as low as 100 mW.

Taking into account the potentially zero cost of these changes, and the additional time allowed to meet these levels, it was decided that the proposal to harmonise with tier 2 of the EU CoC was a reasonable one, and the tier 2 no load level of 0.075 W was retained in the baseline analysis. In order to address the concerns of DIGITALEUROPE, a scenario was included in the sensitivity analysis to evaluate the impacts of their proposed costs for tier 2 no load.

## 5.5 Efficiency costs

DIGITALEUROPE provided alternative costs that they stated were based on the US DOE analysis<sup>24</sup>, although it is not clear how these costs were determined as many of their proposed base cases had different power ratings from those evaluated by the US DOE, and in some cases the in use power, rather than the rated power had been used to calculate requirement levels. The table below summarises the differences between US DOE and DIGITALEUROPE cost assumptions.

<sup>24</sup> "DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant", 11 November 2013

**DE assumptions****US DOE data point costs (used in this study)**

<b>EPS MODEL EXAMPLES</b>	<b>Tier 1 Efficiency (from ErP)</b>	<b>Tier 2 Efficiency (from ErP)</b>	<b>Tier 1 Efficiency (from ErP)</b>	<b>Tier 2 Efficiency (from ErP)</b>
a. Low voltage EPS (mobile phone charger) (2.5 W DE, 3.5W DOE)	N/A	€ 0.39	€ 0.13	€ 0.13
b. 18 W normal voltage EPS (router/gateway) (10 W DE, 18 W DOE)	N/A	€ 1.56	€ 0.13	€ 0.52
c. Normal voltage notebook computer EPS (40 W DE, 60 W DOE)	N/A	€ 1.37	€ 1.33	€ 1.33
d. Normal voltage notebook computer EPS (No DE case provided, 120 W DOE)	N/A	N/A	€ 4.63	€ 4.63
e. Multiple voltage output EPS for game console (90 W DE, 203 W DOE)	N/A	€ 2.78	€ 0.00	€ 0.00
f. Low usage EPS (electric shaver)	N/A	€ 0.30	€ 0.33	€ 0.33
Extra base case – 10 W tablet EPS	N/A	€ 0.78	N/A	N/A

Table 9 - Pre mark up costs for each tier.

It was decided that due to the variation in base cases, the errors in the DIGITALEUROPE analysis, and the more detailed breakdown available for both tiers from the US DOE data, US DOE figures would be used for the relevant base cases. It is interesting to note from the difference between the tier 1 and tier 2 US DOE values that there are only additional efficiency costs for tier 2 for the 18 W router/gateway EPS. For other EPS, by the time they have reached the tier 1 requirements via a step technology change, they are already capable of achieving the tier 2 levels at no relative additional cost.

## 5.6 Alternative scenario timings

It was suggested by DIGITALEUROPE that other scenarios be considered, such as a later introduction of ErP requirements and a bringing forward of US DOE requirements. As resources and the CLASP model used as a basis for this analysis were limited, it was not possible to evaluate the impact of a variation in scenario timings. Instead, the most likely timings have been adopted, and our modelling assumes that because industry anticipates the requirements, there is a gradual shift toward the levels prior to them coming into effect.

## 5.7 Evaluating costs

DIGITALEUROPE suggested that as per the US evaluation approach, the standard should only be justified if the additional cost to consumer is less than 3 times the value of the energy

savings in the first year<sup>25</sup>. However, this evaluation is based off the EU methodology for assessment not the US approach, hence we consider the lowest lifecycle cost.

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<sup>25</sup> "DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant", 11 November 2013

## 6 Implementation of LLCC analysis

A standardised spreadsheet was created for lifecycle cost calculations for each EPS base-case. In light of detailed industry (DIGITALEUROPE) analysis, the industry inputs were fed into the calculations alongside the assumptions for the policy scenario for the purposes of comparison. Industry calculations were corrected for differences between rated and in use power, and to take into account their proposed no load as well as efficiency costs.

Lifecycle savings with mark up	DE assumptions	Policy scenario (US DOE assumptions)	
EPS MODEL EXAMPLES	Tier 2 Savings (from ErP)	Tier 1 Savings (from ErP)	Tier 2 Savings (from ErP)
a. Low voltage EPS (mobile phone charger) (2.5 W DOE, 3.5 W DE)	-€ 0.06	€ 0.99	€ 1.13
b. 18 W normal voltage EPS (router/gateway) (10 W DE, 18 W DOE)	€ 2.99	€ 4.26	€ 4.14
c. Normal voltage notebook computer EPS (40 W DE, 60 W DOE)	€ 1.38	€ 0.25	€ 1.82
d. Normal voltage notebook computer EPS (No DE case provided, 120 W DOE)	€ -	-€ 3.70	-€ 0.55
e. Multiple voltage output EPS for game console (90 W DE, 203 W DOE)	-€ 3.29	€ 4.68	€ 4.68
f. Low usage EPS (electric shaver)	-€ 0.56	€ 0.14	€ 0.24
Extra base case – 10 W tablet EPS	€ 0.37	N/A	N/A

Table 10 – Summary results of lifecycle costing analysis.

The analysis shows that lifecycle savings were achieved for all EPS except for the 120 W notebook EPS. This EPS case was highlighted by industry as a minority a product, and the cost is likely to be overstated as due to a lack of data points for this EPS the cost for the 93.5 % efficiency level had to be used, instead of the 89 % level that is actually the requirement.

The results projected by DIGITALEUROPE are different due to variations in usage profile, base cases, estimated costs, errors in savings calculations (costs calculated for tier 2, compared against savings for tier 1 requirements) etc. For a detailed explanation of why DIGITALEUROPE assumptions were not used in all cases, please refer to the previous chapter.

As mentioned previously, the jump to tier 2 from tier 1 is small in terms of costs according to the US DOE data – the majority of costs are already incurred in reaching the tier 1 levels.



## 7 Implementation of sensitivity analysis

It became clear during the lifecycle cost analysis that there are various areas of uncertainty that should be analysed to determine the impact variation in these variables have on the results.

The sensitivity analysis addressed the following:

- Variation in energy price
- Variation in mark up
- Variation in usage profile
- Variation in cost of no load for tier 2
- Analysis of a case study for the average home

### 7.1 Variation in energy price

Manufacturers and Member States raised concerns regarding the use of an assumed energy price, as the kWh consumer price variation within EU was considered very large.

In order to address this, a sensitivity analysis was carried out on maximum and minimum energy prices.

The MEERP methodology references the EU-27 electricity prices across the EU for January 2011 (from Eurostat). Use of these rates in all preparatory studies is recommended, including an adjustment of a 4 % per annum increase. European Commission impact assessments take a similar approach.

This resultant electricity price for 2013 is € 0.19 per kWh, as shown in the table below:

2011 Eurostat average household electricity price	€ 0.18	per kWh
2013 equivalent (following MEERP)	€ 0.19	per kWh
May 2013 max EU energy price (source: <a href="http://www.energy.eu">www.energy.eu</a> for Denmark)	€ 0.30	per kWh
May 2013 min EU energy price (source: <a href="http://www.energy.eu">www.energy.eu</a> for Bulgaria)	€ 0.09	per kWh
May 2013 average EU energy price (source: <a href="http://www.energy.eu">www.energy.eu</a> )	€ 0.18	per kWh

*Table 11 – Electricity price variation.*

Use of the minimum energy price of € 0.09 resulted in negative lifecycle savings in the LLCC analysis for 60 W and 120 W notebook EPS, and for the shaver EPS:

Lifecycle savings with mark up of 2 and electricity price of 0.09 EUR	Policy scenario (US DOE assumptions)	
	Tier 1 Savings (from ErP)	Tier 2 Savings (from ErP)
<b>EPS MODEL EXAMPLES</b>		
a. Low voltage EPS (mobile phone charger) (2.5W DOE, 3.5W DE)	€ 0.36	€ 0.43
b. 18W normal voltage EPS (router/gateway) (10W DE, 18W DOE)	€ 1.91	€ 1.57
c. Normal voltage notebook computer EPS (40W DE, 60W DOE)	-€ 0.98	-€ 0.15
d. Normal voltage notebook computer EPS (No DE case provided, 120W DOE)	-€ 5.57	-€ 3.77
e. Multiple voltage output EPS for game console (90W DE, 203W DOE)	€ 2.22	€ 2.22
f. Low usage EPS (electric shaver)	-€ 0.20	-€ 0.13

Table 12 – Sensitivity analysis on electricity price variation

Electricity price in a range of 0.19 to 0.13 was found to result in costs only for the 120 W product in Tier 2, as per the original base case, showing a resilience in savings related to the measure for a reasonable variation in electricity price.

It can be concluded that if the EU average electricity price were to drop below 0.13 for a sustained period, there could be issues with the measure breaking even. However, this is considered highly unlikely taking into account expected increases in world prices of oil, gas and coal that make up 80 % of the EU's primary energy consumption<sup>26</sup> and maintained or increased national electricity taxes.

## 7.2 Variation in mark up

The original DIGITALEUROPE results showed lifecycle savings in many cases with their mark up assumption of 2. They stated that a mark up of 3 or 4 would be more realistic. Our analysis was re-run with a mark up for 3 and a mark up of 4. The results are shown in the table below:

Lifecycle savings with mark up variation	Policy scenario (US DOE assumptions)		Policy scenario (US DOE assumptions)	
	Mark up of 3		Mark up of 4	
<b>EPS MODEL EXAMPLES</b>	<b>Tier 1 Savings (from ErP)</b>	<b>Tier 2 Savings (from ErP)</b>	<b>Tier 1 Savings (from ErP)</b>	<b>Tier 2 Savings (from ErP)</b>
a. Low voltage EPS (mobile phone charger) (2.5 W DOE, 3.5 W DE)	€ 0.89	€ 1.03	€ 0.78	€ 0.93
b. 18 W normal voltage EPS (router/gateway) (10 W DE, 18 W DOE)	€ 4.16	€ 3.76	€ 4.06	€ 3.39

<sup>26</sup> "Saving energy: bringing down Europe's energy prices for 2020 and beyond" Ecofys by order of: Friends of the Earth Europe and Climate Action Network Europe, 2013.

c. Normal voltage notebook computer EPS (40 W DE, 60 W DOE)	-€ 0.80	€ 0.86	-€ 1.84	-€ 0.10
d. Normal voltage notebook computer EPS (No DE case provided, 120 W DOE)	-€ 7.32	-€ 3.88	-€ 10.94	-€ 7.22
e. Multiple voltage output EPS for game console (90 W DE, 203 W DOE)	€ 4.68	€ 4.68	€ 4.68	€ 4.68
f. Low usage EPS (electric shaver)	-€ 0.12	€ 0.01	-€ 0.37	-€ 0.23

Table 13 – Sensitivity analysis on mark up variation.

The results show that even with a mark up of 4, lifecycle savings are still observed for mobile, router/gateway and game console EPS. Lifecycle costs occur for notebook and shaver EPS with a mark up of 4, but for a mark up of 3 there are only tier 2 costs shown for the 120 W EPS.

No evidence has been provided to support mark ups higher than 2, but the analysis suggests that as long as tier 2 was retained, even with a mark up of 3 the proposed levels would still result in lifecycle savings.

### 7.3 Variation in usage

Stakeholders suggested a number of alternative lifetimes and usage profiles. Whilst efforts were made to define the most representative usage profile accounting for variations between the different sources, it was also decided to check the outcome if the DIGITALEUROPE defined usage profiles were used:

Lifecycle savings with mark up of 2 and DIGITALEUROPE usage profile	Policy scenario (US DOE assumptions)	
	DE usage profile	
EPS MODEL EXAMPLES	Tier 1 Savings (from ErP)	Tier 2 Savings (from ErP)
a. Low voltage EPS (mobile phone charger) (2.5 W DOE, 3.5 W DE)	€ 0.38	€ 0.45
b. 18 W normal voltage EPS (router/gateway) (10W DE, 18 W DOE)	€ 4.26	€ 4.14
c. Normal voltage notebook computer EPS (40 W DE, 60 W DOE)	-€ 0.43	€ 0.74
d. Normal voltage notebook computer EPS (No DE case provided, 120 W DOE)	-€ 4.73	-€ 2.31
e. Multiple voltage output EPS for game console (90 W DE, 203 W DOE)	€ 4.22	€ 4.22
f. Low usage EPS (electric shaver)	€ 0.51	€ 0.66

Table 14 –EPS usage variation – LLCC results for DIGITALEUROPE usage profiles.

As can be observed in the above table, whilst the savings are reduced with the alternate industry specified usage profile, they are still positive for the majority of products – the exception being notebook EPS. The DIGITALEUROPE assumptions were 8 hours per day, 5 days per week, assuming 50 % unplugging the EPS after charging. It is difficult to have certainty on

notebook usage profiles, as usage can vary considerably between domestic and commercial models, but the assumption of 50 % of notebooks being used unplugged after charging was considered highly optimistic.

#### 7.4 Variation in cost of no load for tier 2

As previously discussed, industry proposed values for tier 2 no load costs that were considerably higher than those provided by other sources. Putting these values into the analysis, the results are as follows:

Lifecycle savings with mark up of 2 and DIGITALEUROPE no load costs for tier 2	Policy scenario	
	Tier 1 Savings (from ErP)	Tier 2 Savings (from ErP)
<b>EPS MODEL EXAMPLES</b>		
a. Low voltage EPS (mobile phone charger) (2.5 W DOE, 3.5 W DE)	€ 0.99	€ 1.03
b. 18 W normal voltage EPS (router/gateway) (10 W DE, 18 W DOE)	€ 4.26	€ 1.97
c. Normal voltage notebook computer EPS (40 W DE, 60 W DOE)	€ 0.25	-€ 0.34
d. Normal voltage notebook computer EPS (No DE case provided, 120 W DOE)	-€ 3.70	-€ 2.71
e. Multiple voltage output EPS for game console (90 W DE, 203 W DOE)	€ 4.68	€ 2.52
f. Low usage EPS (electric shaver)	€ 0.14	€ 0.17

Table 15 - Sensitivity analysis for variation of tier 2 no load costs

Once again, it is the notebook EPS where an issue would arise if the costs were this high – but there seem to be no issues for the other EPS types.

If the DIGITALEUROPE proposal<sup>27</sup> for less stringent standby requirements in the second tier, the savings of a measure would be reduced to only an additional 25 % in 2025 (in place of 40 %, as shown in the table below), but still require changes to a similar proportion of the market.

<sup>27</sup> "DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant", 11 November 2013

<b>Savings</b>	<b>2020</b>	<b>2025</b>	<b>2030</b>
(TWh/year)			
Tier 1 (based on US DOE)	0.93	0.99	0.99
Tier 2 (based on EU CoC Tier 2)	1.19	1.35	1.36
Tier 2 (based on EU CoC Tier 2 but with lesser standby requirement)	1.08	1.23	1.24

Table 16 – Impact of reduced ambition no load requirements on savings.

The costs proposed by DIGITALEUROPE have been refuted by other stakeholders. The savings potential of the more stringent proposal to harmonise with the EU CoC Tier 2 no load requirements is considerable. Therefore it is recommended that the EU CoC tier 2 no load requirements be retained.

#### 7.4.1 Balance of costs in a typical home

Accounting for how costs of the base scenario would balance in the typical portfolio of EPSs in the home, an “example home” was modelled, and total costs calculated.

	Basic scenario	Alternate Scenario
<b>EPS MODEL EXAMPLES</b>	<b>Number of EPS</b>	<b>Number of EPS</b>
a. Low voltage EPS (mobile phone charger) (2.5 W DOE, 3.5 W DE)	2	4
b. 18 W normal voltage EPS (router/gateway) (10 W DE, 18 W DOE)	1	1
c. Normal voltage notebook computer EPS (40 W DE, 60 W DOE)	1	1
d. Normal voltage notebook computer EPS (No DE case provided, 120 W DOE)	1	1
e. Multiple voltage output EPS for game console (90 W DE, 203 W DOE)	1	2
f. Low usage EPS (electric shaver)	3	10
<b>Total</b>	<b>9</b>	<b>19</b>

Table 17 – Assumptions for sensitivity analysis on costs for a typical home.

		Basic scenario	Alternate scenario
<b>Potential cost per hh</b>	<b>Tier 1</b>	€ 11.48	€ 15.47
	<b>Tier 2 (total)</b>	€ 11.14	€ 14.81
<b>Total net savings per hh</b>	<b>Tier 1</b>	€ 7.88	€ 15.50
	<b>Tier 2 (total)</b>	€ 13.08	€ 21.72

Table 18 – Sensitivity analysis – overall totals per household.

The typical home example was modelled for a low volume EPS (basic) and high volume EPS (alternate) scenario. The results show that depending upon the number of EPS in the home, even in the worst case scenario there can still be no net lifecycle cost.

## 8 Evaluation of ease and speed of redesign and re-sourcing

Based upon stakeholder feedback, for manufacturers that buy in EPS, it is difficult to define a typical re-sourcing approach and related costs as there are so many different variables. However, in stakeholder feedback, whilst DIGITALEUROPE was not able to provide detailed information on redesign costs, they made statements suggesting that redesign would not be necessary in the majority of cases:

*“In general, technical solutions for more efficient EPS, without limiting the performance of the EPS, are available in the market and provided by the EPS and/or component manufacturers.”<sup>28</sup>*

Consultation with the industry indicates that whilst the production time for some custom EPS has traditionally been quite long, up to 5 – 7 years, the majority of EPS follow a continuous process of re-engineering and optimisation – with EPS seldom remaining unchanged for more than a year.

Redesign time will vary between manufacturers depending upon the initial EPS design, but a typical "redesign to launch" period for an improved efficiency EPS (including quality and related testing) has been indicated to be around 12 months, although it could even be quicker, depending on the changes required and the manufacturer's qualification cycle. If a new controller IC needs to be designed, then the redesign to launch time would be closer to three years. For the EPS requiring more changes or with longer design cycles, it would be important to provide clear signposting of the second tier so that this could be integrated in design cycles as soon as possible.

It was indicated that for manufacturers who buy in EPS, they frequently (1-2 times a year) redefine the EPS specifications provided to their EPS manufacturers, so costs of re-sourcing are not likely to be substantial in addition to the price difference of the alternative EPS. The EPS manufacturers themselves revise their designs on an on-going basis, and have a varying range of EPS to offer product manufacturers across a range of efficiencies.

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<sup>28</sup> "DIGITALEUROPE Input To The EU EPS Discussion And Feedback Towards The EU Consultant", 11 November 2013

## 9 Resource efficiency related requirements

There was strong support for resource efficiency requirements from a number of Member States and NGOs – in terms of a renewed MOU (with supporting CENELEC mandated standards) and commitments to the formal integration of resource efficiency requirements (including requirements for universal power supplies for all portable devices) at the next revision of the regulation. Recycling and weight requirements were also suggested by some stakeholders.

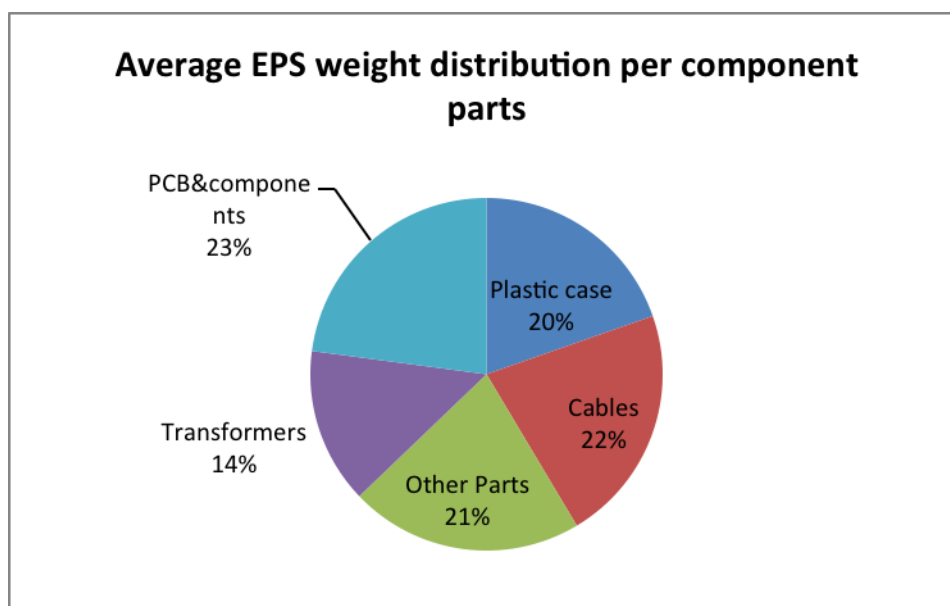
A number of aspects of resource efficiency have been considered:

- i) A weight-based requirement on all EPS including an information requirement
- ii) Extension of initiatives on universal power supply from data enabled phones to other portable products.
- iii) A mobile network service provider EU Code of Conduct or similar on removal of EPS from shipped products.
- iv) Improved design for disassembly and recyclability.
- v) Recycled content requirement.
- vi) Standardisation of power supplies to facilitate reuse.

The potential for a detachable cable was not evaluated as a specific scenario, as it was considered that this would be addressed under a universal EPS (MOU) approach.

### 9.1 Weight-based requirement

An ITU report<sup>29</sup> compiled detailed EPS data including details of weight and volume. Their data set showed that EPS have the following average distributions of weight between their component parts, Figure 4.



<sup>29</sup> "An energy-aware survey on ICT device power supplies", ITU and GeSI 2012



Figure 4 - Weight distribution between component parts of EPS.

Note: Data used to create this chart are from the ITU Appendix report<sup>30</sup>. Data is for power supplies ranging from low to high power, covering 14 EPSs, and excluding linear EPSs which were in the original data set. It has been suggested by industry that the ITU report could benefit from a wider industry consultation.

A basic analysis of the full ITU data set (around 307 EPS data points) shows that it would be possible to specify a maximum weight requirement for EPS without adversely affecting the market. The goal would be only to exclude the worst performing EPS whilst still ensuring a range of EPS in each power level.

Weight distribution charts against rated power suggest a reasonably linear scatter in weight against power. Our analysis suggests that requirements could take the following potential approaches, for example:

1. A limit of 320 grams maximum (excluding the worst performing 20 % of EPS)
2. A formula approach based upon the following requirement:

$$[\text{Maximum weight (g)} = 0.55 \times \text{rated power} + 200 \text{ g}]$$

This approach provides an increasing allowance for more powerful EPS (excluding the worst performing 21 % of EPS).

These approaches are illustrated in the chart in Figure 5 against the full ITU/GeSI data set.

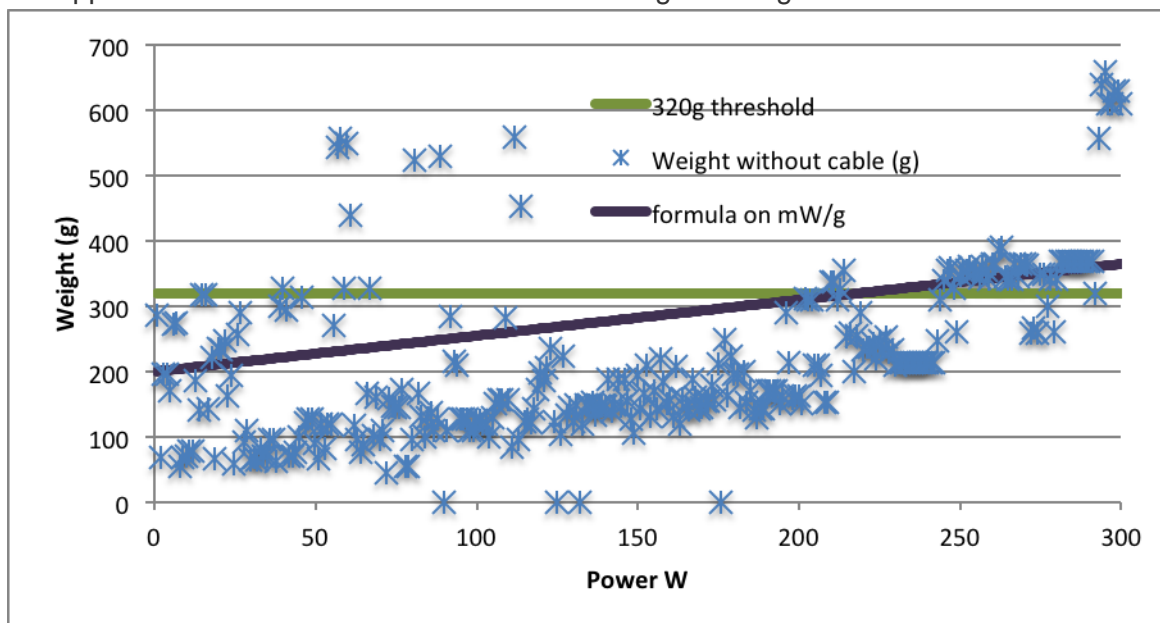


Figure 5 - Potential weight requirements against EPS data set.

<sup>30</sup> “Life Cycle Assessment Methodology Applied To Power Supplies For Customer Premises Equipment” by Politecnico di Torino and Studio Ingegneri Associati (Studio LCE)

The ITU report assumed that if all products weighed the same as the best in class, then there would be around 30 % material savings. In reality, savings with a MEPS approach would be much less than this level. A basic calculation<sup>31</sup> suggests savings shown in Table 19.

Impact type	Potential savings as a result of Requirements	
	Materials	21,482
Disposed	11,301	tonnes
Recycled	10,169	tonnes
ENERGY (GER)	12,069	TJ
Waste non hazardous	51,796	tonnes
Waste hazardous	9,796	tonnes

Table 19 - Potential savings due to a weight requirement on EPS.

Weight is already a parameter that manufacturers frequently gather information and report on – it is frequently provided on websites where EPS products are sold. However, in the case of EPS, design variations such as cable length and casing quality need to be taken into consideration.

The reasons for variations in EPS weight are not always clear. There are some natural drivers toward weight reduction, such as the need to reduce material costs or the trend toward miniaturisation in new more efficient components. Reasons for variation in EPS weight could be:

- **Age:** Older EPS are likely to be larger as they contain older components and have not been subject to more recent production improvements – they would likely leave the market anyway when revised efficiency requirements came in.
- **Design:** Some EPS incorporate the additional function of a stand for docking purposes or similar.
- **Safety/durability:** Larger units will require a thermal specification which may require greater size / weight. Waterproofing using insulating resin (for outdoor use) could also increase weight. Products that weigh more may be made from more durable materials to ensure a longer life.

A focus on EPS weight without taking into account other factors could have some risks – for example in terms of shifts toward more toxic materials, reductions in EPS life or safety related issues. Weight based requirements would also not be harmonised with other initiatives as neither the EU CoC nor the US DOE requirements include these.

Discussions in the Consultation Forum showed support for an information requirement on EPS weight, as it could provide a useful input to a preparatory study further analysing the area. It would be prudent for an information requirement to specify the weight “without cable” to enable easy comparison between EPS, however this may require re-measurement where figures are already available.

However, more work on definitions is needed before including a weight information requirement e.g. variations of EPS for different mains plug markets and EPS with delivered with

<sup>31</sup> Assumes that 20 % of EPS would experience a 37 % reduction in weight, with similar reductions for energy (manufacture) and waste, not accounting for any impacts of the in use phase.

changeable mains plugs. Therefore, our conclusion is that weight as a specific information requirement is an unnecessary inclusion at this stage.

## **9.2 Extension of the initiatives on universal power supply from data enabled phones to other portable products**

Three main initiatives have addressed the concept of a common charger for mobile phones – an industry-led memorandum of understanding (MoU), a CENELEC task force on standards for common charging, and input to the revision to the Radio Equipment directive.

In 2009 an EU memorandum of understanding (MoU) was established between the mobile phone manufacturers and the European Commission on compatibility of new data-enabled mobile phones with a common EPS interface agreed by the signatories.

The goal was that the MoU would reduce the need for individual EPS to be placed on the market with mobile devices - reducing the wider lifecycle impacts of EPS (reducing production of redundant chargers), as well as being more convenient for users. The agreement expired at the end of 2012. In order to establish the technical standards to act as a foundation for the MoU, the European Commission issued a standardisation mandate to CEN, CENELEC and ETSI on a common "Charging Capability for Mobile Telephones." The following progress was then made on standards:

- A CENELEC task force was created to develop the specifications, and they were published in December 2010 as EN 62684:2010, "Interoperability specifications of common external power supply (EPS) for use with data-enabled mobile telephones."<sup>32</sup> This standard defines the common charging capability and specifies interface requirements for the EPS.
- The International Electrotechnical Commission (IEC) released its version of the standard as IEC 62684:2011 in January 2011<sup>33</sup>,
- The IEEE working group (WG/P1823) are addressing this area.
- The International Telecommunication Union (ITU) published high level smart universal power adapter standards in June 2012<sup>34</sup>

Discussions with industry (DIGITALEUROPE) at the end of September 2013 revealed that whilst the standardisation activity was considered a success, they intend to work further in the area via the standardisation route (IEC/EN 62684) rather than via further industry agreements.. They also suggested that the resource efficiency savings had not yet materialised. DIGITALEUROPE stated that it was likely that there were “close to zero” mobile products shipped without an EPS as a result of the MOU.

Separating the EPS from the product under a voluntary universal power supply approach may result in some issues for manufacturers in terms of a lack of transparency on product charge performance. The product manufacturer would have a lack of control over the EPS used with their products, which could impact service considerations or the speed of charge (non-optimised charging). This is particularly an issue where the voluntary rather than regula-

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<sup>32</sup> "New standard for common mobile chargers". cenelec.eu, [http://www.cenelec.eu/pls/apex/f?p=WEB:NEWSBODY:3695278126835242::NO::P300\\_NEWS\\_ID:21](http://www.cenelec.eu/pls/apex/f?p=WEB:NEWSBODY:3695278126835242::NO::P300_NEWS_ID:21)

<sup>33</sup> "One size-fits-all mobile phone charger: IEC publishes first globally relevant standard". International Electrotechnical Commission. <http://www.iec.ch/newslog/2011/nr0311.htm>

<sup>34</sup> ITU-T Recommendations L.1001 and L.1000 for a universal charger solution for mobiles, <http://www.itu.int/ITU-T/recommendations/rec.aspx?rec=11348>

tory approach is chosen, as it would still be possible for poorly performing EPS that did not meet the standards to be placed on the market. Manufacturers could combat this issue to some degree by provision of information to users on how to achieve optimal charge i.e. only using EPS that meet the standards.

A separate study to investigate the potential for a widened voluntary approach for EPS standardisation was been launched by the European Commission, DG Enterprise, last year to give more detailed insights on the potential for scope extension of the MOU or standards to other small portable devices. A basic calculation of potential savings as a result of a widened MoU (addressing more than just mobile phone products) suggests the savings could be approximately as follows in Table 20.

Impact type	Potential savings as a result of requirements	
	ENERGY (GER)	25,728
of which electricity	1,000	TJ
Waste non hazardous	194,503	tonnes
Waste hazardous	39,329	tonnes
Greenhouse gases in GWP 100	1,841,392	tonnes CO2 eq
Heavy metals	1,470	kg Hg/20

Table 20 - Potential savings due to an extended MOU on EPS<sup>35</sup>

However, since this analysis was implemented, it has become apparent that developments at least in the mobile phone area may proceed in a regulatory rather than voluntary direction. Requirements for common chargers have come under discussion within a proposed revision to the Radio Equipment directive<sup>36</sup>, in particular, the following sections of the initial proposal for revision reference common chargers:

- P7\_TC1-COD(2012)0283 (12) states “A renewed effort to develop a common charger for particular categories or classes of radio equipment is necessary, in particular for the benefit of consumers and other end-users; this Directive should therefore include specific requirements in that area. In particular, mobile phones that are made available on the market should be compatible with a common charger.”
- Article 3 (3a) states that radio equipment shall be so constructed that it complies with the essential requirements to interwork with accessories, in particular with common chargers.
- Article 47 on review and reporting (2e) states that reporting on the review of the directive should examine how the regulatory framework should be developed in order to “ensure that portable radio equipment interworks with accessories, in particular with common chargers”

<sup>35</sup> Costs of an MOU have not been evaluated. Costs related to standardisation of EPS, requiring a separate connector cable, could be around 30 Euro cents according to industry sources. Savings due to mobile phone EPS are not included as the MOU was not thought to have resulted in efficiency savings to date. The improvements are assumed proportional to the “doubling lifetime” scenario assessed in the EPS preparatory study, based on notebook and game console EPS types.

<sup>36</sup> “European Parliament legislative resolution of 13 March 2014 on the proposal for a directive of the European Parliament and of the Council on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment” P7\_TA-PROV(2014)0246 Radio Equipment / COM(2012)0584 – C7-0333/2012 – 2012/0283(COD), 13 March 2014

The proposal is in the form of a draft law that will need to be approved by the European Council. Once approved, European member states would then have until around 2016 to translate the regulation into national laws and manufacturers would then have 12 months to complete any necessary transition to updated designs.

### 9.3 A service provider EU CoC or similar on removal of EPS from shipped products

In the previous scenario, it was not possible to evaluate the potential savings due to the inclusion of mobile phones in a revised MOU, as the initiative to date has not succeeded in decoupling the EPS from the shipped product to result in any savings.

This suggests that for mobile phones at least, an alternative approach is required. The mobile phone supply chain offers the opportunity to engage at the network provider level. If a voluntary initiative were to encourage network providers to commit to shipping phones without EPS, this would provide driver to the phone manufacturers and enable real savings to be achieved.

Such an initiative could take a form similar to the EU code of conduct for digital television, whereby service providers and manufacturers would sign up to make commitments relating to their products.

This scenario is based on the same assumptions as the previous one, assuming real resource savings are achieved, but only accounts for savings due to mobile phones. The analysis shows the following potential savings in Table 21.

Impact type	Potential savings as a result of requirements	
ENERGY (GER)	23,754	TJ
of which electricity	862	TJ
Waste non hazardous	78,433	tonnes
Waste hazardous	-10,932	tonnes
Greenhouse gases in GWP 100	1,862,843	tonnes CO2 eq
Heavy metals	840	kg Hh/20

Table 21 - Potential savings due to a network provider voluntary agreement on EPS

### 9.4 Improved design for disassembly and recyclability

The potential for ecodesign requirements for improved design for disassembly and recyclability has been explored in a series of JRC reports<sup>37</sup>, in which indices and guidance notes were developed. This information provides a comprehensive foundation for requirements in this area, but is at a much greater level of detail than the data sets available for EPS. Therefore, it was decided to take a broader-brush approach and apply a simple savings factor to esti-

<sup>37</sup> "JRC Technical Report EUR 25654 EN - Integration of resource efficiency and waste management criteria in European product policies – Second phase" Final Executive Summary with logbook of comments from stakeholders, Fulvio Ardente, Fabrice Mathieux December 2012 and " Integration of resource efficiency and waste management criteria in European product policies – Second phase, Deliverable 3 – Development of guidance documents ", Ardente Fulvio, Fabrice Mathieux

mate the potential for requirements in this area. Whilst the EPS preparatory study did not estimate savings as a result of improved disassembly and recyclability, other preparatory studies did take this into account. As a basic indication, the savings assumptions of the SSTB preparatory study were used as inputs<sup>38</sup>, with the resultant estimated savings in Table 22.

Impact type	Potential savings as a result of requirements	
	ENERGY (GER)	130,474
Waste hazardous	96,640	tonnes
Greenhouse gases in GWP 100	3,112,123	tonnes CO2 eq
Heavy metals	-7,369	kg Hh/20

Table 22 - Potential savings due to improved recyclability and disassembly<sup>39</sup>

Requirements could address design for disassembly of the printed circuit board and key parts, for example via the following approaches:

- Disassembly time
- Product information on efficient disassembly approaches.
- Ease of separability of materials.
- Marking of plastic parts
- Recyclability rate targets

There are some issues with including requirements on ease of disassembly:

- The need to achieve a real reduction in environmental impacts at end of life.
- The need to not only address the way in which the product is designed and manufactured, but also to oblige recyclers to make use of the improved disassembly capability of the product, and the need to account for variations in recycler processes.
- The need to account flexibly for developments in recycling processes, new materials, and product technology innovations.
- The need for flexibility to enable uptake of innovative materials with longer term potential for improved recycling.
- The need for balance – for example between the provision of dismantling information to users, or reduction of flame retardants, against product safety.
- The need for verification of requirements and the proportionate administrative burden.

## 9.5 Recycled content requirement

Based upon the JRC report<sup>40</sup>, an average 9 to 18 % saving in terms of materials disposed of could be achieved through requirements around recycled content.

<sup>38</sup> Preparatory Studies for Eco-design Requirements of EuPs Lot 7 Battery chargers and external power supplies, 2007

<sup>39</sup> Costs of an MOU have not been evaluated. Costs related to standardisation of EPS, requiring a separate connector cable, could be around 30 Euro cents according to industry sources. Savings due to mobile phone EPS are not included as the MOU was not thought to have resulted in efficiency savings to date. The improvements are assumed proportional to the “doubling lifetime” scenario assessed in the EPS preparatory study, based on notebook and game console EPS types.



Basing assumptions at the lower end of the scale, the savings in Table 23 could potentially be achieved for EPS.

Impact type	Potential savings as a result of requirements	
	Disposed	13,744
Recycled	-12,368	tonnes

Table 23 - Potential savings due to recycled content requirement<sup>41</sup>

Issues with this approach:

- The need for manufacturer education on recycled content - although several companies have started using a certain amount of recycled content in their products, there may still be a lack of detailed knowledge in general on these materials.
- Availability of good-quality recycled content - ability to ensure equivalent cosmetic and mechanical properties of post-consumer recycled plastics
- Cost of meeting other regulations when using recycled content - ability to achieve REACH and RoHS compliance for recycled plastics (could be cost prohibitive).

## 9.6 Definition of “Standard” types of power supplies to facilitate reuse

Apart from mobile phone EPS, there is a lack of standardisation of EPS connectors. Some power supplies with very different output voltages often make use of the same type of connector and others that could be designed to be interchangeable feature design variations that inhibit reuse. An ITU report<sup>42</sup> identified the opportunity to standardise types of power supplies to facilitate easier reuse.

The standardization of a set of connectors and output voltages could facilitate reuse and part replacement and reduce environmental impacts if manufacturers stopped shipping EPS with their products.

Work has been commenced in this area by the IEC, who after creating the Standard for a universal charger for data enabled mobile phones in 2011, launched in December 2013 a specification for a single external charger for a wide range of notebook computers and laptops (IEC Technical Specification 62700). Notebook EPS can weigh between 300 to 600 grams, and are usually designed for specific use with a particular notebook model. The IEC Technical Specification details standards for connectors, plugs, safety, interoperability, performance and environmental considerations for notebook EPS. This enables a potential reduction in e-waste by providing the opportunity for notebook manufacturers to ship the prod-

<sup>40</sup> "JRC Technical Report EUR 25654 EN - Integration of resource efficiency and waste management criteria in European product policies – Second phase" Final Executive Summary with logbook of comments from stakeholders, Fulvio Ardenete, Fabrice Mathieux December 2012

<sup>41</sup> Costs of an MOU have not been evaluated. Costs related to standardisation of EPS, requiring a separate connector cable, could be around 30 Euro cents according to industry sources. Savings due to mobile phone EPS are not included as the MOU was not thought to have resulted in efficiency savings to date. The improvements are assumed proportional to the “doubling lifetime” scenario assessed in the EPS preparatory study, based on notebook and game console EPS types.

<sup>42</sup> "An energy-aware survey on ICT device power supplies", Global e-Sustainability Initiative (GeSI) and International Telecommunication Union (University of Genoa, Italy), 2012 [http://www.itu.int/dms\\_pub/itu-t/oth/4B/01/T4B010000070001PDFE.pdf](http://www.itu.int/dms_pub/itu-t/oth/4B/01/T4B010000070001PDFE.pdf)

uct without the EPS, allowing consumers to use a single EPS with a wide range of notebooks and facilitating easier reuse and replacement.

This standardisation approach could be rolled out to other EPS types. Savings have not been calculated for this scenario, but will depend on the product manufacturer removing the EPS from the shipped product for substantial savings to be realised.

## 9.7 Conclusions on resource efficiency

The table below summarises the results of the estimated potential savings of a number of resource efficiency options. The design for disassembly scenario appears to be associated with the largest savings, although the easier to implement option is the extension of the MOU.

	2025 savings				
	Scenario i weight	Scenario ii common charger initiatives extended	Scenario iii Mobile Network CoC	Scenario iv Design for disassembly	Scenario v Recycled materials
Materials (tonnes)	21,482	-	30,683	-	-
Disposed	11,301	-	17,012	-	13,744
Recycled	10,169	-	13,671	-	-12,368
ENERGY (GER, TJ)	12,069	25,728	23,754	130,474	-
of which electricity	-	1,000	862	-	-
Water (cooling - hundred thousand litres)	-	3,842	2,442	-	-
Waste non hazardous (tonnes)	51,796	194,503	78,433	-	-
Waste hazardous (tonnes)	9,796	39,329	-10,932	96,640	-
Greenhouse gases in GWP 100 (tonnes CO2 eq)	852,952	1,841,392	1,862,843	3,112,123	-
Heavy metals (kg Hg/20)	-	1,470	840	-7,369	-

Table 24 – Summary of resource efficiency analysis



## 10 Overall conclusions

There is an opportunity for harmonisation of active efficiency and no load requirements with the US DOE rulemaking and EU Code of Conduct. Potential savings of nearly 1 TWh in 2025 could be achieved for a first tier harmonising with US DOE requirements. A second tier in line with the EU Code of Conduct Tier 2, could result in additional savings of nearly 40 % (an additional 0.36 TWh saving in 2025) for a minimal additional cost, requiring only around an additional 5 % of EPS to be redesigned. These savings include an expansion of scope to cover multiple voltage output EPS. This proposal was supported by the cost analysis showed that lifecycle savings were possible with the majority of EPS types, even when markups were increased, when there were substantial reductions in energy prices, and when more extreme usage scenarios were applied. For a typical home with varying quantities of EPS, positive overall savings were shown.

A table summarising the scenarios assessed is shown in Appendix A. As a result of the analysis and consultation carried out, the following conclusions have been drawn:

- Wireless EPS and high voltage EPS are more suitable for assessment prior to a subsequent revision.
- Removal of the exemption of “low voltage” EPS from the standby measure (1275/2008) would be a pragmatic means of resolving issues with unintended products benefitting from the exemption, although a postponement on addressing the issue until the subsequent review of 278/2009 or a review of regulation 1275/2008 is suggested.
- It would be of benefit to include information requirements on efficiency at 10 % load in a revised EPS revision, with efficiency requirements being considered at the subsequent review.
- If the EU average electricity price were to drop from 0.19 to below 0.13 for a sustained period, there could be issues with the measure breaking even, but this scenario is considered highly unlikely.
- No load costs for the second tier are considered acceptable taking into account the saving potential, and therefore it is recommended that the tier 2 no load requirements harmonising with the EU Code of Conduct Tier 2 be retained.
- With regard to resource-efficiency related requirements, voluntary approaches aiming to reduce the number of EPS shipped with products due to a common charger EPS standard were considered to have promise, as they could achieve savings more quickly than regulation whilst allowing for frequent updating of requirements. Measures encouraging design for disassembly had the largest saving potential, and whilst a weight requirement was possible, an information requirement on weight was not recommended at this revision.

## Appendix A – Summary of Scenarios Assessed

Scenario analysed	2025 savings	Assumptions	Lifecycle costing comments	Pros	Cons	Assessment of feasibility
<b>ENERGY REQUIREMENTS</b>						
Revised requirements, two tier approach	1.35 TWh in-use energy	Based on US DOE (Tier 1) and EU CoC Tier 2 (Tier 2), scope widened to include multiple voltage output EPS	Lifecycle costing evaluation shows savings achieved in all but the very worst case scenarios.	Harmonisation of tier 1 with US requirements, reducing compliance costs to industry.	Low voltage EPS definition issue not resolved, leaving open a loop-hole.	Easy
<b>RESOURCE EFFICIENCY REQUIREMENTS</b>						
i) Weight-based requirement	12,069 TJ lifecycle energy, 21,482 tonnes materials, 51,796 tonnes non haz waste, 9,796 tonnes haz waste.	20% of EPS would experience a 37% reduction in weight, with similar reductions for energy (manufacture) and waste, not accounting for any impacts of the in use phase	Not evaluated.	Could be a relatively simple metric.	Needs further study to understand the reasons for greater weight and mitigate against greater impacts elsewhere. May impact durability. Non-harmonised requirement.	Medium complexity
ii) Common charger initiatives extended to other portable products.	25,728 TJ lifecycle energy, 194,503 tonnes non haz waste, - 17,351 tonnes haz waste	Savings due to mobile phone EPS are not included as the MOU was not thought to have resulted in efficiency savings to date. The improvements are assumed proportional to the "doubling lifetime" scenario assessed in the EPS preparatory study, based on notebook and game console EPS types.	30c per detachable cable. Not evaluated in detail. Voluntary so no obligation to incur cost.	A voluntary approach is quicker to put in place and can be kept updated more easily with technological developments.	Careful consideration would be required to evaluate which products were relevant for a widened scope (may not be relevant for products that are left connected).	Relatively easy
iii) Mobile network service provider EU Code of Conduct	23,754 TJ lifecycle energy, 78,433 tonnes non haz waste, - 10,932 tonnes haz waste	As per "doubling lifetime" scenario of EPS preparatory study.	Not evaluated. Voluntary so no obligation to incur cost.	Ensures savings are achieved	Only useful approach where there is strong service provider supply chain.	Relatively easy

Scenario analysed	2025 savings	Assumptions	Lifecycle costing comments	Pros	Cons	Assessment of feasibility
iv) Improved design for disassembly and recyclability.	130,474 TJ lifecycle energy, 96,640 tonnes hazardous waste	Assumes % savings assumptions of the SSTB preparatory study.	Not evaluated.	Various ways to approach in terms of requirements	Could be difficult to have flexibility to enable uptake of innovative materials with longer term potential for improved recycling. Other drivers such as product safety may conflict. Verification of requirements needs to be robust and the administrative burden proportionate. Needs a mechanisms to ensure delivery of savings by obliging recyclers to act on improvements made.	Medium-High complexity
v) Recycled content requirement.	13,744 tonnes materials not disposed of.	Assumes % material savings based upon the JRC report, at 9%.	Not evaluated.	Reduced implications in terms of material extraction and use.	Still a relatively unknown material area, Need to ensure availability of good-quality recycled content (cosmetic and mechanical properties), may result in greater cost to achieve other legislative requirements.	Medium-High complexity

## Appendix B – Definition considerations

### Scope of the US rulemaking:

Note: The US DOE refers to a number of alphabetical classes of EPS. These classes are unrelated to the European EMC regulation classes.

As per previous drafts, the final US rulemaking applies to all direct operation External Power Supplies and includes, in addition to what the US DOE term Class A power supplies (those currently covered by the EC regulation, and previously covered by 2007 rulemaking), power supplies that have not previously been subject to DOE regulations, such as multiple-voltage EPSs, EPSs with nameplate output power greater than 250 watts, and some EPSs that charge the battery of a product that is fully or primarily motor operated.

### Differences between EU and US definitions:

There are major differences in the way that the US DOE defines external power supplies and battery chargers. The US definition of “battery charger” includes all devices that include a rechargeable battery, such as mobile phones and laptops. This means that their figures for EPS could be underestimated when compared against the EU definition.

The US DOE approach also exempts indirect EPS from the updated requirements – whilst analysis showed it would be cost effective to include them under the same requirements, the intention of this exemption was to prevent EPS that operated as part of a battery charger from being subject to double regulation due to the upcoming battery charger regulation. The US DOE identifies whether or not an EPS is indirect based upon the results of a test<sup>43</sup>. They estimate that just over 20% of what they categorise as EPS are indirect. However, some questions have been raised about the effectiveness of the US DOE test to identify whether an EPS is direct or indirect test method<sup>44</sup>. It is foreseeable that this market percentage of products being classified as indirect could increase considerably if US manufacturers found a no or low cost means of identifying their products as indirect EPS in order to avoid more

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<sup>43</sup> The US DOE approach classifies an indirect operation EPS as an EPS associated with a product that only functions when drawing power from a battery. US DOE considers such EPS in a different class (US DOE defines this as a class N) because the EPS must first deliver power and charge the battery before the end-use product can function as intended. Conversely, if the battery’s charge status does not impact the product’s ability to operate as intended, and the product can function using only power from the EPS, that device is considered a direct operation EPS. US DOE defines products that are usable from a state of no battery charge within a 5 second period of being plugged in as being direct, and those that are usable outside this time window (i.e. dependent on basic battery charge before they can be used) as being indirect.

<sup>44</sup> NRDC suggested to the US DOE that there was a risk that the approach to indirect operation EPS “incorrectly captures products, such as mobile, smart phones and MP3 players, that have firmware delays on [detection of a] dead battery, but are otherwise capable of operating without the battery. Some partial improvements to the test approach were made by US DOE in light of these comments, but it was not clear at the time of writing how effective these were. Correspondence with Pierre Delforge, Natural Resources Defense Council, 11th February 2014.

stringent requirements – for example by adjusting the firmware to meet the requirements of the test method.

As the current Commission Regulation (EC) No. 278/2009 does not regulate battery chargers, and considers the likes of mobile phone and laptop EPS are within scope, the separation of direct and indirect EPS is not relevant. It is therefore recommended that whilst harmonising on requirement levels with the US DOE be considered, the European Commission avoid a harmonisation with US DOE definitions.