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Preparatory Study on Light Sources
for Ecodesign and/or Energy Labelling Requirements
('Lot 8/9/19').

Final report, Task 0

Assignment, Methodology, First screening

Energy

Prepared by:

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Contents

EXECUTIVE SUMMARY

This is the Task 0 report of the "Preparatory Study on Light Sources for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19')" for the European Commission DG ENER C3.

The document is part of an Interim Report that also covers MEErP Task 1 and a major part of MEErP Task 2. MEErP Tasks 3 through 7 are not covered at this stage.

The scope of the study is to carry out a study on lighting products for the preparation of further and/or more advanced ecodesign and/or labelling requirements, building on and integrating as much as possible the existing (delegated) regulations with aim of setting more ambitious targets.

Previously not regulated lighting controllers, either as part of a luminaire or as an independent product, and other lighting products (e.g. lamps having a luminous flux above 12.000 lm) should be included in the study.

The definitions of special purpose products should be reviewed and updates proposed with a view to minimise the possible misuse while keeping otherwise regulated products for use in special applications exempt from ecodesign and/or labelling requirements.

The study should fulfil the legal review requirements of Commission Regulation (EU) No 1194/2012 and Commission Delegated Regulation (EU) No 874/2012, and it should provide a detailed market assessment of mains voltage filament lamps, as required by Regulation 1194/2012, Annex III 1.1.

The findings of the so-called "Stage-6 Review" and "Omnibus Review" studies should be taken into account and the study shall be carried out following the MEErP [1], extended in scope if necessary to fulfil the review requirements.

Signature date of the contract was 23 December 2013 and work began in January 2014. Final deliverables are due 23 December 2015 but preferably sooner (ideally October 2015). Interim reports are due in August 2014 and April 2015, with the second interim report followed by a stakeholder meeting. The draft review report of the 2012 lighting regulations as well as the market assessment of mains voltage filament lamps are due 1 May 2015.

The report gives the context of the assignment with details of current legislation and most recent studies.

The initial scope of the study is proposed and discussed in Chapter 5 and regards all light sources, lamps, ballasts and lamp control gears according to the definitions provided. Following the intention of the Commission, this scope is very wide and includes not only the lighting products currently regulated but also those currently exempted. It is proposed to include lighting controls and luminaires in the scope of the Lot 8/9/19 study only as regards their interaction with the lamps and light sources (compatibility issues). For the remainder, these topics will be handled in the parallel Lot 37 preparatory study on Lighting Systems.

The scope of the study will be restricted in future MEErP tasks, mainly on the basis of the criteria from article 15 of the Ecodesign Directive.

[1] MEErP 2011, Methodology for Ecodesign of Energy-related Products, part 1: Methods and part 2: Environmental policies and data, René Kemna (VHK) November 28th 2011

1. ASSIGNMENT

This document is the Task 0 report on the "Preparatory Study on Light Sources for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19')" according to Specific Contract No ENER/C3/2012-418 LOT1/07/SI2.668526, implementing Framework Contract No ENER/C3/ 2012-418-Lot 1 [2].

The document has been prepared for the European Commission DG ENER.C.3 by the consortium specified on the cover page, more in particular by VHK and VITO with the collaboration of JeffCott Associates.

The current document is part of an Interim Report that covers MEErP task 1 and a major part of MEErP task 2. MEErP tasks 3 through 7 are NOT covered at this stage.

In accordance with the tender specifications [3]:

- The scope of this Preparatory Study is to carry out a study on lighting products for the preparation of further and/or more advanced ecodesign and/or labelling requirements.

- The study should build upon and advance Commission Regulation (EC) No 244/2009, Commission Regulation (EC) No 245/2009, Commission Regulation (EU) No 1194/2012 and Commission Delegated Regulation (EU) No 874/2012, including all amendments and corrigenda thereof.

- The study should fulfil the legal review requirements of Commission Regulation (EU) No 1194/2012 and Commission Delegated Regulation (EU) No 874/2012,

- The study should provide a detailed market assessment of mains voltage filament lamps, as required by Regulation 1194/2012, Annex III 1.1 [4].

- The study should aim at setting more ambitious targets for all lighting products currently regulated under Ecodesign and Energy Labelling, including luminaires (either with or without built-in light sources such as LED modules).

- Lighting controllers previously not regulated, either as part of a luminaire or as an independent product, should be included in the study.

[2] The original title refers to 'Lighting Systems' rather than to 'Light Sources'. In order to avoid confusion with the Lot 37 Preparatory study that is performed in parallel to the Lot 8/9/19 study and that actually focuses on 'Lighting Systems', it has been preferred to use 'Light Sources' for the Lot 8/9/19 study.

[3] Request for Services N°ENER/C3/2012-418 LOT 1/07, Ares N°3834255, in the context of the multiple framework contract N°ENER/C3/2012-418 LOT N°1, dated November 28th 2013

[4] Annex III 1.1 of Regulation 1194/2012 requires a maximum Energy Efficiency Index of 0.95 in Stage 3 for mains voltage filament lamps. This requirement shall apply only if no later than 30 September 2015, evidence is produced by the Commission through a detailed market assessment and communicated to the Consultation Forum that there are mains voltage lamps on the market that are:
— compliant with the maximum EEI requirement in stage 3;
— affordable in terms of not entailing excessive costs for the majority of end-users;
— broadly equivalent in terms of consumer-relevant functionality parameters to mains voltage filament lamps available on the date of entry into force of this regulation, including in terms of luminous fluxes spanning the full range of reference luminous fluxes listed in Table 6 ($\Phi_{90°}$ from 160 to 785 lm);
— compatible with equipment designed for installation between the mains and filament lamps available on the date of entry into force of this regulation according to state-of-the-art requirements for compatibility.

- An analysis of the lighting products not yet regulated should be carried out (e.g. lamps having a luminous flux above 12.000 lm), identifying other lighting products to be included into this study.

- The definitions of special purpose products should be reviewed and updates proposed with a view to minimise the possible misuse while keeping otherwise regulated products for use in special applications exempt from ecodesign and/or labelling requirements.

- The feasibility of unifying all four regulatory measures into one regulation should be explored (or only the three ecodesign regulations into one if this has been identified as the only possible option) [5].

- The study should take into account the findings of the so-called "Stage-6 Review" and "Omnibus Review" studies under framework contract ENER/C3/2012-418-Lot 2.

- The study shall be carried out following the MEErP [6], extended in scope if necessary to fulfil the review requirements.

In addition, as discussed during the Kick-Off meeting [7] for the study:

- The projections for past and future lighting energy use have to be harmonized between the Lots [8]. For now, VHK data will be used but both VHK and VITO will try to further subdivide the 'non-residential' part in several sectors (offices, health care, etc.).

[5] See LE-comments in Annex B: in principle LightingEurope (LE) supports this ambition of integration, but is concerned about the complexity.

[6] MEErP 2011, Methodology for Ecodesign of Energy-related Products, part 1: Methods and part 2: Environmental policies and data, René Kemna (VHK) November 28th 2011

[7] VITO document ENES/1310465/2014-0001 of January 29th 2014, with minutes of the kick-off meeting for the Lot 8/9/19 and Lot 37 studies. Restricted distribution.

[8] In parallel to the Lot 8/9/19 study a Lot 37 study on Lighting Systems is being performed by VITO and VHK

2. HISTORY AND CONTEXT OF THE STUDY

Table 1 provides a historical overview of the regulations and some relevant related documents regarding lighting products. For more detailed descriptions and references, see the following subparagraphs.

Date	Document	Short Description
Non-directional Household Lighting		
Oct. 2008	Preparatory Study Lot 19 part 1 (VITO)	Ecodesign Preparatory Study on NDLS for domestic lighting
Mar. 2009	Full Impact Assessment (EC)	EC document accompanying regulation 244/2009
Mar. 2009	Commission Regulation (EC) No 244/2009	Main lamp-types regulated: **CFLi, HL, GLS**
Sep. 2009	Commission Regulation (EC) No 859/2009	Amendment on 244/2009 for some UV-requirements
Feb. 2013	CLASP study	Indication of main points for the review of regulation 244/2009
Jun. 2013	Stage 6 Review Study (VHK)	Review of stage 6 requirements of 244/2009 for MV-HL lamps
Apr. 2014	Omnibus Study (VHK)	(Preliminary) Review of regulation 244/2009
Tertiary Lighting		
Jan. 2007	Preparatory Study Lot 9 (VITO)	Ecodesign Preparatory Study on Public Street Lighting
Apr. 2007	Preparatory Study Lot 8 (VITO)	Ecodesign Preparatory Study on Office Lighting
Mar. 2009	Full Impact Assessment (EC)	EC document accompanying regulation 245/2009
Mar.2009	Commission Regulation (EC) No 245/2009	Main lamp-types regulated: **LFL, CFLni, HID** incl. related ballasts and luminaires
Apr. 2010	Commission Regulation (EU) No 347/2010	Amendments on regulation 245/2009
Feb. 2013	CLASP study	Indication of main points for the review of regulation 245/2009
Apr. 2014	Omnibus Study (VHK)	(Preliminary) Review of regulation 245/2009
Directional Lighting		
Nov. 2009	Preparatory Study Lot 19 part 2 (VITO)	Ecodesign Preparatory Study on Directional lamps
Mar. 2011	Follow-up study (ECEEE, DEFRA)	Support study for preparation of regulation on directional lamps
Dec. 2012	Impact Assessment (EC)	EC document accompanying regulation 1194/2012
Dec. 2012	Commission Regulation (EU) No 1194/2012	Main lamp-types regulated: **Directional lamps, LEDs** and related equipment
Labelling for Lighting		
Sep. 1992	Directive 92/75/EEC	Framework, legal basis for labelling of light sources (now repealed)
Jan. 1998	Directive 98/11/EC	Labelling of household light sources (now repealed)
May 2010	Directive 2010/30/EU	Framework, legal basis for labelling of light sources (repealing 92/75/EEC)
Jul. 2012	Commission Delegated Regulation (EU) No 874/2012	Labelling of electrical lamps and luminaires (repealing 98/11/EC)

Table 1 Survey of Regulations and related documents on Lighting

2.1. Commission Regulation (EC) No 244/2009 and related documents on Non-Directional Household Lighting

In October 2008 part 1 'Non-Directional Light (**NDLS**)' of the **Preparatory Study Lot 19 on Domestic Lighting** [9] was issued.

In March 2009 this preparatory study was followed by the **Full Impact Assessment for Non-Directional household lamps** [10].

In the same month the corresponding **Commission Regulation (EC) No 244/2009** was published [11]. In Article 3, this Regulation sets requirements for Non-Directional Light Sources (NDLS), specified in Annex II of the Regulation, in 6 stages.

The **first 4 stages**, with requirements applying from the 1st of September 2009, 2010, 2011 and 2012, eliminate low-efficacy ('incandescent') lamps in subsequently lower lumen output-levels[12]. After Stage 4 of 1 September 2012 that also phased out lamps with output <450 lumen– **all general purpose incandescent lamps with output >60 lm should have been phased-out from the EU market**.

Stage 5, which applies from 1 September 2013, is the second stage (after Stage 1) in setting minimum functionality requirements. Most significantly, Stage 5 further tightens the requirements for the service life and lifetime functionality.

For CFLs the survival factor at 6000 h goes from ≥0.5 to ≥0.7, lumen maintenance at 2000 h is increased by 3%-points and specified at 6000 h (≥70%), the number of switches-before-failure is doubled or tripled, starting time should be 50-100% faster, the maximum heat-up time to reach 60% of lumen output is reduced from 60 to 40s (with some allowance for CFLs with mercury in the form of amalgam where it should only be <100 s) and the lamp power factor should improve from ≥0.5 to ≥0.55 (at P <25W).

For non-CFLs/LEDs, e.g. mainly NDLS halogen lamps, **Stage 5** requires that from 1 September 2013 the rated lamp lifetime will go from ≥1000 h to ≥2000 h.

In **Stage 6**, that is currently set to apply from 1 September 2016, the Regulation sets more stringent efficacy requirements for clear lamps. Instead of the maximum rated power Pmax (in W) being 0.8 * (0.88√Φ+0.049Φ), where Φ is the rated luminous output (in lm), the rated power of clear lamps will then have to be less than a Pmax of 0.6 * (0.88√Φ+0.049Φ), which equals the lower limit value of the 'B' energy label class.

[9] Preparatory Studies for Eco-design requirements of EuPs, Final Report, Lot 19: Domestic lighting, Study for the European Commission DGTREN unit D3, contact Andras Toth, by VITO in cooperation with Bio Intelligence Service, Energy Piano and Kreios, October 2009, Contract TREN/07/D3/390-2006/S07.72702, available through 'eup4light.net'

[10] Commission Staff Working Document, accompanying document to the Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps, Full Impact Assessment, Brussels, 18.3.2009, SEC(2009) 327, available as http://ec.europa.eu/energy/efficiency/ecodesign/doc/legislation/ sec_2009_327_impact_assesment_en.pdf

[11] Commission Regulation (EC) No 244/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps, Official Journal of the European Union, L76/3, 24.3.2009, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:076:0003:0016:en:PDF

[12] 'low-efficacy' intended here for lamps where the rated power P exceeds the maximum rated power Pmax (in W) at a given rated luminous flux (Φ, in lm) with for non-clear lamps Pmax=0.24√Φ+0,0103Φ and for clear lamps in stages 1 to 5 Pmax= 0.8 * (0,88√Φ+0.049Φ).

The combination of the Stage 5 and Stage 6 requirements potentially presents a problem, because for filament lamps there is a distinct technical relationship between on one hand the current through the filament and the lifetime (more current, lower life expectancy) and on the other hand the current and the luminous output (more current, more lumen). As a consequence, **mains voltage ('MV') halogen lamps might be phased out by Stage 6**, but this was not the intention of the legislator. This potential problem has been addressed in the so-called "Stage 6 Review", see par. 2.6.

The **exceptions to Stage 6** requirements are **clear lamps with type G9 and R7s cap**. A 'G9' is a 2-pin cap, with heart-to-heart distance 9 mm, for use in a mains voltage (220-240V in the EU) halogen lamp, typically of reduced dimensions. An 'R7s lamp' is double-capped mains voltage linear halogen lamp where the lamp caps are cylindrical with a diameter of 7 mm (see Figure 1). The rationale for this exception was explained in the lot 19 preparatory study, i.e. in 2009 there were no Stage 6-conform halogens lamps available for all luminaires with G9 and R7s sockets. High-efficiency halogen lamps as known in 2008 relied on a low voltage transformer and such compact shapes (G9, R7s) did not allow incorporating it in a retrofit solution.

Other exemptions in the product scope of the regulation include the 'special purpose lamps', coloured (not 'white') lamps, directional light sources (DLS), commercial lamps that are covered by other legislation (LFLs, High Intensity Discharge HID lamps and non-integrated CFLs), lamps with lumen output below 60 or above 12000 lumen, low voltage incandescent lamps with E14/E27/B22/B15 caps. Exemptions are addressed in more detail in Task 1.

Figure 1.Stage 6 exceptions: R7s lamp (left) and G9 lamp (right)

Regulation 244/2009 was **amended** by Commission Regulation (EC) 859/2009 [13], which removed the UVC-requirements from table 5 of 244/2009, to avoid phasing out mains voltage halogen lamps with G9 and R7s caps and extra low voltage halogen lamps by 1st of September 2009. Such a phase-out was not the intention of the legislator.

The 2011 Evaluation-study of the Ecodesign Directive by CSES[14] indicates that regulation 244/2009 appears to be successful in phasing out the least efficient light sources from the market and concludes that *'the EU can expect an increased effect in the coming years as more requirements come into force. Despite a switch to halogens which seems slightly stronger than expected there are currently no major indications that the policy targets will not be met.'*

[13] Commission Regulation (EC) No 859/2009 of 18 September 2009 amending Regulation (EC) No 244/2009 as regards the ecodesign requirements on ultraviolet radiation of non-directional household lamps. Official Journal of the European Union, L247/3, 19.9.2009, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:247:0003:0005:EN:PDF

[14] Centre for Strategy & Evaluation Services CSES, *Evaluation of the Ecodesign Directive (2009/125/EC)*, Final Report, March 2012. available at http://ec.europa.eu/enterprise/policies/sustainable-business/ecodesign/review/files/ecodesign_evaluation_report_part1_en.pdf

Article 7 of regulation 244/2009 stipulates that the '*Commission shall **review** this Regulation in light of technological progress no later than five years after entry into force and present the result of this review to the Consultation Forum*.'

The date of entry into force is 13 April 2009 (20 days after publication in the OJ, 24.3.2009) and thus the review date is 13 April 2014.

Aspects of such a review were addressed in the "Stage 6 Review" (see par. 2.6) and in the so-called "Omnibus Review" (see par. 2.7).

For this reason the present study does not include a mere review of Commission Regulation (EC) No 244/2009 but should '*build upon and advance*' this regulation and take into account the two cited reviews (see par. 1).

2.2. Commission Regulation (EC) No 245/2009 and related documents on Tertiary Lighting

In January 2007 the **Preparatory Study Lot 9 on Public Street Lighting** [15] was issued.

In April 2007 the **Preparatory Study Lot 8 on Office Lighting** [16] was issued.

In March 2009 these two preparatory studies were followed by a single **Full Impact Assessment for fluorescent lamps without integrated ballast (LFL, CFLni), for high intensity discharge lamps (HID), and for ballasts and luminaires able to operate such lamps** [17].
In the same month the corresponding **Commission Regulation (EC) No 245/2009** was published [18]. In Article 3 and Annex III, this regulation sets ecodesign requirements in three stages and an additional intermediate stage.

The possible phasing out is based upon achieving performance criteria like:

- colour rendering (Ra)
- efficacy (lm/W)
- lamp lumen maintenance factor
- lamp survival factor

[15] Preparatory Studies for Eco-design requirements of EuPs, Final Report, Lot 9: Public Street lighting, Study for the European Commission DGTREN unit D3, contact Andras Toth, by VITO in cooperation with Laborelec and Kreios, January 2007, Contract TREN/D1/40-2005/LOT9/S07.56457, available through 'eup4light.net'

[16] Preparatory Studies for Eco-design requirements of EuPs, Final Report, Lot 8: Office lighting, Study for the European Commission DGTREN unit D3, contact Andras Toth, by VITO in cooperation with Laborelec and Kreios, April 2007, Contract TREN/D1/40-2005/LOT8/S07.56452, available through 'eup4light.net'

[17] Commission Staff Working Document, accompanying document to the Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council, Full Impact Assessment, Brussels, 18.3.2009, SEC(2009) 324, available as http://ec.europa.eu/smart-regulation/impact/ia_carried_out/docs/ia_2009/sec_2009_0324_en.pdf

[18] Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and of the Council, Official Journal of the European Union, L76/17, 24.3.2009, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:076: 0017:0044:EN:PDF

For HID lamps, only the lamps that have an E27, E40 or PGZ12 cap are within the scope of the regulation.

In the first stage (2010):

- **Halophosphate Fluorescent Lamps (T8 linear, U shaped, T9 circular, T4 linear) were phased out**.
- Standby losses less or equal to 1 W per ballast
- Fluorescent ballasts for current lamps in the market shall fulfil at least EEI = B2
- The term ballast efficiency was introduced
- Also several information requirements were introduced such as fluorescent lamp rated lamp efficacy at 25°C and 35°C (T5) at 50 Hz (where applicable) and High Frequency.
- Extract on lamp efficacy requirement: LFL T8-36 W requires 93 lm/W (25°C)
  LFL T5-28 W requires 93 lm/W (25°C)
  LFL T5-39 W requires 73 lm/W (25°C)
- Extract on fluorescent ballast efficiency requirement:
  - T8-36 W class B2 ≥ 79.3 %
  - T8-36 W class A2 ≥ 88.9 %
- On ballasts for fluorescent lamps the regulation contains rated/typical wattage for 50 Hz and HF operation. This also reflects the typical efficacy gain found for HF operation compared to 50 Hz, e.g. for the same lumen output a T8 '36 Watt' lamp needs typically 36 W at 50 Hz and 32 W at HF. HF power supply can only be provided with electronic ballasts.

In the second stage (2012):

- **Halophosphate Fluorescent Lamps (T10, T12) were phased out.**
- For High Pressure Sodium and HPS / Metal Halide MH Lamps (E27/E40/PGZ12):
  - Set up established performance criteria for MH E27/E40/PGZ12 lamps.
  - **Standard HPS E27/E40/PGZ12 were phased out, this means that HPS lamps need an enhanced Xenon**.
- Extract on lamp efficacy requirement:
  - HPS 70 W clear ≥ 90 lm/W
  - HPS 70 W not clear lamp ≥ 80 lm/W
  - MH 70 W clear ≥ 75 lm/W
  - MH 70 W not clear lamp ≥ 70 lm/W
- Standby losses less or equal to 0.5 W per fluorescent ballast.
- Minimum efficiency for HID ballast, e.g. a 70 W HID lamp requires 75 % efficiency.
- Introduction of minimum HID ballast efficiency and the obligation to make them available.

In an intermediate stage (2015) the following lamps:

- **High pressure mercury lamps are expected to be phased out.**
- **High pressure Sodium-Plug-in/Retrofit lamps (HPM replacement) expected phased out.**
  Extract on lamp efficacy requirement: other HID 50 W ≥ 50 lm/W [19]

[19] Note: Regulation 244/2009 on household lamps is much stronger for CFLi lamps, e.g. a 50 W requires about 64 lm/W and CRI≥80 in Regulation 244/2009, while Regulation 245/2009 requires only 50 lm/W for other 50 W HID.

In the third stage (2017):

- Low performing MH E27/E40/PGZ12 lamps are phased out; in practice, this means that **'quartz' MH lamps are phased out in favour of 'ceramic' discharge tube MH lamps** [20].
- **Compact Fluorescent Lamps with 2 pin caps and integrated starter switch** (Reason: these lamps are phased out in stage 3 as they in practice do not operate on A2 class ballasts).
- Ballasts for fluorescent lamps without integrated ballast shall have the efficiency: ηballast ≥ EBbFL, where EBbFL = Plamp/(2*sqrt(Plamp/36)+38/36*Plamp +1) for 5 < Plamp < 100 Watt.
    - For example: a 36 W T8 lamp ballast should have ηballast ≥ 87.8 %. This is far above the minimum class B1 requirement from stage 1 and is **likely to commercially phase out magnetic ballasts in low cost applications**. A side effect of phasing out magnetic fluorescent ballasts is an increase in efficacy gain for those lamps on HF operation. More efficient magnetic ballasts require more copper and are expected to become too expensive for the market.
- More strict minimum efficiency for HID ballast, e.g. 70 W HID lamp requires 85 % efficiency.

Commission Regulation (EC) No 347/2010 [21] is **amending** Commission Regulation (EC) No 245/2009, '*in order to avoid unintended impacts on the availability and performance of the products covered by that Regulation*'. The amendments also intend to '*improve coherence, as regards the requirements on product information between Regulations 244/2009 and 245/2009*'. Regulation 347/2010 introduces some changes in the exemptions and a large number of changes to the tables in Annex III of 245/2009.

Article 1 of Regulation 245/2009 specifies the **exemptions**, see Task 1 for details.

Article 8 (Revision) of Commission Regulation (EC) No 245/2009, states that 'The *Commission shall **review** this Regulation in light of technological progress no later than five years after the entry into force and present the result of this review to the Consultation Forum*.'

The date of entry into force is 13 April 2009 (20 days after publication in the OJ, 24.3.2009) and thus the review date is 13 April 2014.

Aspects of such a review were addressed in the so-called "Omnibus Review" (see par. 2.7).

For this reason the present study does not include a mere review of Commission Regulation (EC) No 245/2009 but should '*build upon and advance*' this regulation and take into account the Omnibus review (see par. 1).

[20] See LE-comments in Annex B: the LE opinion is that 'we have to keep the high efficient quartz MH technology in the market – because no retrofit with ceramic MH possible, in general.'

[21] Commission Regulation (EC) No 347/2010 of 21 April 2010 amending Commission Regulation (EC) No 245/2009 as regards the ecodesign requirements for fluorescent lamps without integrated ballast, for high intensity discharge lamps, and for ballasts and luminaires able to operate such lamps, Official Journal of the European Union, L104/20, 24.4.2010, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:104:0020:0028:EN:PDF

2.3. Commission Regulation (EU) No 1194/2012 and related documents

In November 2009 part 2 'Directional lamps (**DLS**) and household luminaires' of the **Preparatory Study Lot 19 on Domestic Lighting** [22] was issued.

Between July 2010 and March 2011, a **follow-up study was performed by ECEEE and DEFRA** to supplement the Preparatory Study and in support of the then ongoing European Commission's work evaluating possible ecodesign requirements for directional lamps. This follow-up study also took into account the state-of-the-art from the fast developing LED sector. The results of this study are presented in six separate reports. The first four reports have been published by DEFRA [23]; the last two by ECEEE [24].

In December 2012 the preparatory study and the follow-up study resulted in the **Impact Assessment for directional lamps, light emitting diode lamps and related equipment** [25].

In the same month the corresponding **Commission Regulation (EU) No 1194/2012** was published [26].

As specified in its Article 1, the regulation applies to:

- Directional lamps (DLS) [27];
- Light-emitting diode (LED) lamps (both directional and non-directional);

[22] Preparatory Studies for Eco-design requirements of EuPs, Final Report, Lot 19: Domestic lighting, Study for the European Commission DGTREN unit D3, contact Andras Toth, by VITO in cooperation with Bio Intelligence Service, Energy Piano and Kreios, October 2009, Contract TREN/07/D3/390-2006/S07.72702, available through 'eup4light.net'

[23] Task 1. International Directional Lamp Regulatory Review, May 2010.
Task 2. Beam Angles and Directional Lamps, May 2010.
Task 3. Review of Sales and Inventory Estimates, June 2010.
Task 4. Domestic and Tertiary Sectors in the Preparatory Study, July 2010.
All 4 reports prepared by Navigant Consulting Europe for UK's Department for Environment, Food and Rural Affairs (DEFRA), the Swedish Energy Agency and the European Council for an Energy Efficient Economy (ECEEE). Available through: http://efficient-products.ghkint.eu/cms/eup-directional-lighting-technical-support-reports-2/index.html

[24] Task 5. Technology prospects for directional lamps, July 2010
Published by ECEEE and prepared in support of the European Commission's work evaluating possible ecodesign requirements for directional lamps'. Prepared by Conway & Silver, Energy Associates LLC, Nassau, NY, USA for the European Council for an Energy Efficient Economy (ECEEE) with funding of the European Climate Foundation. The report was developed in cooperation with UK's Department for Environment, Food and Rural Affairs (DEFRA) and the Swedish Energy Agency. Available as: _http://www.eceee.org/ecodesign/products/directional_lighting/technology_prospect_report/Directional_lamp_technology_prospects.pdf
Task 6. Evaluating the potential of halogen technologies, March 2011;
As task 5, but prepared by ECOS, Durango, Colorado, USA. Available as: http://www.eceee.org/ecodesign/products/directional_lighting/halogen_technologies_report/eceee_report_halogen_technologies

[25] Commission Staff Working Document, accompanying document to the Commission Regulation implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment, Impact Assessment, Brussels, 2012, available as http://ec.europa.eu/smart-regulation/impact/ia_carried_out/ docs/ia_2012/swd_2012_0418_en.pdf

[26] Commission Regulation (EU) No 1194/2012 of 12 December 2012 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements directional lamps, light emitting diode lamps and related equipment, Official Journal of the European Union, L342/1, 14.12.2012, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:342: 0001:0022:EN:PDF

[27] In popular terminology also referred to as *reflector lamps* or *spotlights*, and which direct most of their light (at least 80%) in an angle of 120˚ or smaller. Most available DLS technologies direct their light with the help of a built-in reflector. Some LED lamps do not require a separate reflector, as the diodes already provide light in a given direction.

- Equipment designed for installation between the mains and the lamps, including lamp control gear, control devices and luminaires (other than ballasts and luminaires for fluorescent and high-intensity discharge lamps);

including when they are integrated into other products.

In Article 3, and more specifically in Annex I, the regulation sets out **information requirements for Special Purpose Products (SPP)**. What is intended by Special Purpose is defined in Article 2 point (4), see also the Task 1 report.

For lamps with specified 'non-white' chromaticity coordinates, these coordinates shall be stated in the lamp documentation with the indication that this makes the lamp a SPP.

For all SPP it shall be clearly indicated what characteristics make the lamp a SPP, what is the intended use, and that the lamp is not suitable for household room illumination.

In Article 3, and more specifically in Annex III, Regulation 1194/2012 sets **ecodesign requirements in three stages**:

- First stage, entry into force in September 2013
- Second stage, entry into force in September 2014
- Third stage, entry into force in September 2016

Annex III point 1.1 sets **Energy Efficiency Requirements for Directional lamps** by prescribing a maximum Energy Efficiency Index (EEI) [28]:

- For **Mains Voltage filament lamps**
  - Stage 1 (Sep. 2013): EEI< 1.75 if Φ_{use} > 450 lm
  - Stage 2 (Sep. 2014): EEI< 1.75 (for all Φ_{use})
  - Stage 3 (Sep. 2016): EEI< 0.95 (for all Φ_{use}) (label class B, see par. 2.4)

  The Stage 3 requirement will be applicable only if no later than September 2015 evidence is produced that there are suitable mains voltage lamps (or alternative lamps) on the market. **This market research is one of the explicit tasks of the present study** (see par. 1).

  These requirements apply to GLS-R (incandescent) and HL-MV-R (HW&LW, halogen-incandescent). Stages 1 and 2 aim to eliminate the worst behaving lamps from the market. Stage 3 is the actual target that will **phase-out GLS-R lamps**. **For HL-MV-R lamps to meet the Stage 3 criterion, the current lamps have to be improved** (use of xenon, optimized filament wire design, anti-reflective coating, infrared coating, integrated MV-to-LV transformer). As it is not certain that such improved lamps or suitable replacements will exist by 2016, the application of Stage 3 is made to be dependent on a market research.

- For **Other filament lamps**
  - Stage 1 (Sep. 2013): EEI< 1.20 if $\Phi_{use} \leq$ 450 lm; EEI< 0.95 if Φ_{use} > 450 lm
  - Stage 2 (Sep. 2014): EEI< 0.95 (for all Φ_{use})
  - Stage 3 (Sep. 2016): EEI< 0.95 (for all Φ_{use}) (label class B, see par. 2.4)

  These requirements apply in particular to HL-LV-R (low voltage halogen-incandescent) and aim to eliminate the worst behaving lamps from the market.

[28] EEI = (Prated*CorrectionFactor) / Pref. The CorrectionFactor is taken from table 1 of Annex III of the Regulation 1194/2012 and takes into account the efficiency of the control gear or special lamp features. Pref is the reference power obtained from the useful luminous flux of the lamp (Φuse; inside a 90˚ or 120˚ cone). For Φuse<1300 lumen: Pref = 0.88*sqrt(Φuse)+0.049*Φuse. For Φuse ≥1300 lumen: Pref = 0.07341*Φuse.

- For **High-Intensity Discharge (HID) lamps**
  - Stage 1 (Sep. 2013): EEI< 0.50
  - Stage 2 (Sep. 2014): EEI< 0.50
  - Stage 3 (Sep. 2016): EEI< 0.36 (label class A, see par. 2.4)

  The main intention is to promote Ceramic Metal-Halide lamps.

- For **Other lamps**
  - Stage 1 (Sep. 2013): EEI< 0.50
  - Stage 2 (Sep. 2014): EEI< 0.50
  - Stage 3 (Sep. 2016): EEI< 0.20 [29] (upper part of label class A, see par. 2.4)

  These requirements apply to CFLi-R (compact fluorescent with integrated ballast and reflector) and to LEDs.

Annex III point 1.1 sets **Energy Efficiency Requirements for Lamp Control Gear**:

- **"No-Load" power** for a control gear intended for use between the mains and the switch for turning the lamp on/off [30]
  - Stage 1 (Sep. 2013): no requirement
  - Stage 2 (Sep. 2014): < 1.0 W
  - Stage 3 (Sep. 2016): < 0.5 W [31]
- **"Standby" power** [32] for a control with built-in switching function
  - Stage 1 (Sep. 2013): no requirement
  - Stage 2 (Sep. 2014): no requirement
  - Stage 3 (Sep. 2016): < 0.5 W
- **Efficiency** of a control gear for a halogen lamp (during lamp operation)
  - Stage 1 (Sep. 2013): no requirement
  - Stage 2 (Sep. 2014): > 0.91 at 100% load
  - Stage 3 (Sep. 2016): remains as in stage 2

Annex III point 2.1 table 3 sets **Functionality Requirements for Compact Fluorescent Lamps (CFL)** [33]:

- Lamp Survival Factor at 6000 h [34]
  - Stage 1 (Mar. 2014): ≥ 0.5
  - Stage 3 (Sep. 2016): ≥ 0.7
- Lumen Maintenance
  - Stage 1 (Sep. 2013): ≥ 80% at 2000 h
  - Stage 3 (Sep. 2016): ≥ 83% at 2000 h; ≥ 70% at 6000 h
- Number of switching cycles before failure
  - Stage 1 (Sep. 2013): ≥ lamp lifetime (h) * 0.5

[29] See LE-comments in Annex B: limit of 0.2 to be verified for LED with high performance.

[30] "No-load mode" means the condition of a lamp control gear where it is connected to the supply voltage and where its output is disconnected in normal operation from all the primary loads by the switch intended for this purpose (a faulty or missing lamp, or a disconnection of the load by a safety switch is not normal operation).

[31] For control gear output powers P > 250 W the 1.0 and 0.5 limits are multiplied by P/250.

[32] "Standby mode" means a mode of lamp control gear where the lamps are switched off with the help of a control signal under normal operating conditions. It applies to lamp control gear with a built-in switching function and permanently connected to the supply voltage when in normal use.

[33] In Stage 2 there are no new requirements, implying that Stage 1 requirements continue to apply.

[34] See LE-comments in Annex B: a 6000 h testing period is too long.

≥ 10000 h if lamp starting time > 0.3 s
- Stage 3 (Sep. 2016): ≥ lamp lifetime (h) * 1.0
≥ 30000 h if lamp starting time > 0.3 s

- Starting Time
  - Stage 1 (Sep. 2013): < 2.0 s
  - Stage 3 (Sep. 2016): < 1.5 s if P < 10 W
< 1.0 s if P ≥ 10 W
- Lamp warm-up Time to 60% of Φ_{use}
  - Stage 1 (Sep. 2013): < 40 s
< 100 s for lamps containing mercury in amalgam form
  - Stage 3 (Sep. 2016): same as for Stage 1
- Premature Failure Rate
  - Stage 1 (Sep. 2013): ≤ 5 % at 500 h
  - Stage 3 (Sep. 2016): ≤ 5 % at 1000 h
- Power Factor for lamps with integrated control gear (CFLi)
  - Stage 1 (Sep. 2013): ≥ 0.50 if P < 25 W; ≥ 0.90 if P ≥ 25 W
  - Stage 3 (Sep. 2016): ≥ 0.55 if P < 25 W; ≥ 0.90 if P ≥ 25 W
- Colour Rendering (Ra)
  - Stage 1 (Sep. 2013): ≥ 80
≥ 65 if lamp intended for outdoor or industrial application
  - Stage 3 (Sep. 2016): same as for Stage 1

- If the lamp cap is a standardised type also used with filament lamps, then as from Stage 2, the lamp shall comply with state-of-the-art requirements for compatibility with equipment designed for installation between the mains and filament lamps.

Annex III point 2.1 table 4 sets **Functionality Requirements for Other Directional Lamps (excluding LED, CFL, HID)** [35] [36]:

- Rated lamp lifetime at 50% lamp survival
  - Stage 1 (Sep. 2014): ≥ 1000 h [37]
  - Stage 3 (Sep. 2016): ≥ 2000 h [38]
- Lumen Maintenance
  - Stage 1 (Sep. 2013): ≥ 80% at 75% of rated average lifetime
- Number of switching cycles before failure
  - Stage 1 (Sep. 2013): ≥ lamp lifetime (h) * 4
- Starting Time
  - Stage 1 (Sep. 2013): < 0.2 s
- Lamp warm-up Time to 60% of Φ_{use}
  - Stage 1 (Sep. 2013): < 1.0 s
- Premature Failure Rate
  - Stage 1 (Sep. 2013): ≤ 5 % at 100 h
- Power Factor for lamps with integrated control gear (CFLi)
  - Stage 1 (Sep. 2013): ≥ 0.50 if P ≤ 25 W; ≥ 0.90 if P > 25 W

[35] Applies to incandescent GLS-R lamps and all types of DLS Halogen-Tungsten type of lamps (MV/LV, HW/LW).

[36] If not specified otherwise, in Stage 2 and/or Stage 3 the same requirements apply as in Stage 1.

[37] ≥ 2000 h for extra low voltage lamps not complying with stage 3 filament lamp efficiency requirement

[38] ≥ 4000 h for extra low voltage lamps

Annex III point 2.2 table 5 sets **Functionality Requirements for Non-Directional and Directional LED lamps** [39] [40]:

- Lamp Survival Factor at 6000 h [41]
  - Stage 1 (Mar. 2014): ≥ 0.9
- Lumen Maintenance
  - Stage 1 (Mar. 2014): ≥ 80% at 6000 h
- Number of switching cycles before failure
  - Stage 1 (Sep. 2013): ≥ 15000 h if rated lamp life ≥ 30000 h
    ≥ lamp lifetime (h) * 0.5 if rated lamp life < 30000 h
- Starting Time
  - Stage 1 (Sep. 2013): < 0.5 s
- Lamp warm-up Time to 95% of Φ_{use} [42]
  - Stage 1 (Sep. 2013): < 2.0 s
- Premature Failure Rate
  - Stage 1 (Sep. 2013): ≤ 5 % at 1000 h
- Power Factor (PF) for lamps with integrated control gear
  - Stage 1 (Sep. 2013):

P = 2 W:	no requirement
2 W < P ≤ 5 W:	PF > 0,4
5 W < P ≤ 25 W:	PF > 0,5
P > 25 W:	PF > 0,9

- Colour Rendering (Ra)
  - Stage 1 (Sep. 2013): ≥ 80
    ≥ 65 if lamp intended for outdoor or industrial application
- Colour Consistency
  - Stage 1 (Sep. 2013): Variation of chromaticity coordinates within a six-step MacAdam ellipse or less [43].

- If the lamp cap is a standardised type also used with filament lamps, then as from Stage 2, the lamp shall comply with state-of-the-art requirements for compatibility with equipment designed for installation between the mains and filament lamps.

Annex III point 2.3 sets **Functionality Requirements for equipment designed for installation between the mains and the lamps**:

- As from Stage 2 (Sep. 2014), equipment designed for installation between the mains and the lamps shall comply with state-of-the-art requirements for compatibility with lamps whose energy efficiency index[44] is at most:

[39] If not specified otherwise, in Stage 2 and/or Stage 3 the same requirements apply as in Stage 1.

[40] These requirements cover large part of the functional concerns related to using LED light sources as the only type of NDLS allowed. Nonetheless, considering that all CFLs and halogen NDLS would be phased out by Regulation 244/2009, there are currently still concerns on: dimmability, high temperatures, dimensions and lock-in effects, power supply compatibility, driver longevity, and colour rendering. See also details in the Omnibus Review, par. 2.7.

[41] The intention is to ascertain a minimum product life (lumen maintenance >70%) of around 20 000 h. The period of 6000h at the mentioned parameters values was defined to limit costs for compliance testing.

[42] As commented by LE: this is not compatible with point 3.1.2(e) and Table 9 of the regulation, which uses 60%.

[43] Ellipse-shaped color region in a chromaticity diagram where the human eye cannot see the difference with respect of the color at the center of the ellipse. MacAdam ellipses are used e.g. in standards for describing acceptable color deviation between LED lamps/luminaires of the same model (1 step=1 ellipse area; 2step=2 concatenated ellipse areas, etc.)

  - 0.24 for non-directional lamps (assuming that Φ_{use} = total rated luminous flux)
  - 0.40 for directional lamps

- When a dimming control device is switched on at its lowest control setting for which the operated lamps consume power, the operated lamps shall emit at least 1 % of their luminous flux at full load [45].

- When a luminaire is placed on the market and intended to be marketed to the end-users, and lamps that the end-user can replace are included with the luminaire, these lamps shall be of one of the two highest energy classes [46], according to Commission Delegated Regulation (EU) No 874/2012, with which the luminaire is labelled to be compatible [47].

Annex III point 3 sets **Product Information Requirements** for Directional lamps and for LED lamps replacing fluorescent lamps without integrated ballast. Amongst others, this includes a definition of the conditions under which it may be claimed that a lamp is equivalent to a lamp that it is intended to replace [48]. For details on information requirements see Regulation 1194/2012, Annex III, point 3.

Article 7 (Revision) of Commission Regulation (EC) No 1194/2012, states that '*The Commission shall **review** this Regulation in the light of technological progress no later than three years after its entry into force and shall present the results of that review to the Consultation Forum.'*

The date of entry into force is 3 January 2013 (20 days after publication in the OJ, 14.12.2012) and thus the review date is 3 January 2016.

According to the introductory considerations point (23) of Regulation 1194/2012:

' *A review of this Regulation should take particular note of the trend in sales of special-purpose lamp types in order to make sure that they are not used outside special applications, and of the development of new technologies such as LED and organic LED. It should assess the feasibility of establishing energy-efficiency requirements at class A level as defined in Regulation (EU) No 874/2012, or at least at class B level for directional mains voltage halogen lamps (taking into account the criteria set out below in Table 2 in point 1.1 of Annex III). It should also assess whether the energy-efficiency requirements for other filament lamps can be significantly tightened. The review should also assess the functionality requirements regarding colour rendering index for LED lamps*.'

The current study explicitly also has the task to fulfil the review requirements for Regulation 1194/2012 (see par. 1).

[44] Calculated for both directional and non-directional lamps in accordance with the method set out in point 1.1 of Annex III of Regulation 1194/2012, see also note 28.

[45] Even if not completely clear in the Regulation this most likely applies as from Stage 2.

[46] Too stringent according to LE, see comments in Annex B.

[47] Even if not completely clear in the Regulation this most likely applies as from Stage 2.

[48] LE asks to correct / update Table 6 of 1194/2012, see comments in Annex B

2.4. Commission Delegated Regulation (EU) No 874/2012 and related documents

In September 1992 **Council Directive 92/75/EEC** was published [49]. Although not the first one regarding energy labelling [50], this Directive is the legal base for the labelling of lighting sources. Article 1 of the Directive states:

*'The purpose of this Directive is to enable the harmonization of national measures on the publication, particularly by means of labelling and of product information , of information on the consumption of energy and of other essential resources, and additional information concerning certain types of household appliances , thereby allowing consumers to choose more energy-efficient appliances . This Directive shall apply to the following types of **household appliances**, even where these are sold for non-household uses: (…)'.*

In the list of appliances that follows, amongst others, "*lighting sources*" are cited.

In January 1998 **Commission Directive 98/11/EC** was published [51]. This directive implements the framework directive 92/75/EEC, introducing a labelling for (household) light sources. Article 1 of the Directive clarifies the scope of application:

*'This Directive shall apply to **household electric lamps supplied directly from the mains** (filament and integral compact fluorescent lamps), **and to household fluorescent lamps** (including linear, and non-integral compact fluorescent lamps), even when marketed for non-household use.'*

'The following lamps shall be excluded from the scope of this Directive:

(a) those with a luminous flux of more than 6 500 lumens;
(b) those with an input power of less than 4 watts;
(c) reflector lamps;
(d) those marketed or commercialised primarily for use with other energy sources, such as batteries;
(e) those not marketed or commercialised primarily for the production of light in the visible range (400 to 800 nm);
(f) those marketed or commercialised as part of a product, the primary purpose of which is not illuminative. However, where the lamp is offered for sale, hire or hire purchase or displayed separately, for example as a spare part, it shall be included.'

In Annex I the directive defines the layout, graphics and contents of the label. In Annex IV it defines Energy Efficiency classes ranging from A (most energy efficient) to G (least efficient).

[49] Commission Directive 92/75/EEC of 22 September 1992 on the indication by labelling and standard product information of the consumption of energy and other resources by household appliances, Official Journal of the European Union, L297/16, 13.103.1992, available as http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L:1992:297:FULL&from=EN

[50] Directive 92/75/EEC refers to a preceding Directive 79/530/EEC, OJ No L145, 13.06.1979, p.1, which had more or less the same aims, but which is stated not to have been effective and thus needed replacing. That directive is being repealed by Directive 92/75/EEC.

[51] Commission Directive 98/11/EC of 27 January 1998 implementing Council Directive 92/75/EEC with regard to energy labelling of household lamps, Official Journal of the European Union, L71/1, 10.03.1998, available as http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31998L0011&rid=1

According to the Impact Assessment that accompanies Regulation 244/2009 [52] the labelling for domestic lamps according to Directive 98/11/EC did not have the expected effect:

> *'The Energy labelling of household lamps Directive has not achieved until now the desired market transformation towards more efficient lamps, as ten years after adoption of the label, class E, F and G incandescent lamps continue to catch the highest market share in terms of volume against the class A "energy saving lamps". The following factors are likely to have played a role in this:*
>
> - *the relatively low visibility of the lamp energy label to the consumers (most often black and white outline, displayed only on the packaging, at the rear when scoring poorly and often in very small size due to the size of the packaging itself;)*
> - *the purchase price difference (0.6 euros for an incandescent lamp versus at least 4 euros for a compact fluorescent lamp) constitutes a psychological barrier to consumers who do not realise the substantial life cycle cost saving of buying a more efficient lamp;*
> - *compatibility and functionalities issues with the compact fluorescent lamps when compared to incandescent lamps.'*

In May 2010 **Directive 2010/30/EU** was published [53]. This directive repeals the above mentioned directive 92/75/EEC and essentially has the same function, i.e. to provide a framework for more specific labelling regulations for particular product groups. In line with directive 2009/125/EC [54] the scope was expanded to include not only household appliances but all energy-related products, with the exception of, for example, '*means of transport for persons or goods*'. According to Article 1:

> *'This Directive establishes a framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products.*
>
> *This Directive shall apply to energy-related products which have a significant direct or indirect impact on the consumption of energy and, where relevant, on other essential resources during use.'*

In Article 10.4(d) the directive specifies that the classification using letters from A to G shall be maintained, but that additional classes A+, A++ and A+++ may be added if required by technological progress. A maximum of seven classes shall be distinguished, unless more classes are effectively populated.

In July 2012 **Commission Delegated Regulation (EU) No 874/2012** was published [55]. This is an implementation of Directive 2010/30/EU for electrical lamps and luminaires.

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[52] See note 10.

[53] Directive 2010/30/EU of the European Parliament and of the Council of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products, Official Journal of the European Union, L153/1, 18.06.2010, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0001:0012:en:PDF

[54] Directive 2009/125/EC of the European Parliament and of the Council of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast), Official Journal of the European Union, L285/10, 31.10.2009, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:285:0010:0035:en:PDF

[55] Commission Delegated Regulation (EU) No 874/2012 of 12 July 2012 implementing Directive 2010/30/EUC of the European Parliament and of the Council with regard to energy labelling of electrical lamps and luminaires, Official

With respect to the previous labelling Directive 98/11/EC that applied to household lamps only, and that is repealed by 874/2012, this new regulation considerably expands the scope of application, covering also: *directional lamps, extra low voltage lamps, light-emitting diodes, and lamps used predominantly in professional lighting, such as high-intensity discharge lamps*.

In addition, the regulation applies to luminaires in order to: '*ensure that consumers are informed about the compatibility of the luminaire with energy-saving lamps and about the energy efficiency of the lamps included with the luminaire'*.

According to Article 1, the regulation applies to filament lamps, fluorescent lamps, high-intensity discharge lamps, LED lamps and LED modules, and luminaires designed to operate these lamps. Article 1.2 provides a list of excluded products, see Task 1 for details.

In Annex I the regulation defines the layout, graphics and contents of the labels for the lamps and for the luminaires. Some examples have been included in Annex E of the Task 1 report.

In Annex VI the regulation defines Energy Efficiency Classes ranging from A++ (most energy efficient) to E (least efficient). With respect to Directive 98/11/EC the classes A++ and A+ have been added to accommodate more efficient lighting technology (e.g. LED) while classes F and G are no longer defined. The total number of classes remains seven, as requested by Directive 2010/30/EU.

The Energy Efficiency Class of a lamp is determined on the basis of its Energy Efficiency Index (EEI) according to Table 2. A lower EEI indicates a more energy-efficient lamp. Note that there are different 'scales' for directional and non-directional lamps, which reflects the difference in efficiency between the two types (e.g. reflectors induce losses) and the difference in definition of useful luminous flux, see below.

Energy efficiency class	Energy efficiency index (EEI) for non-directional lamps	Energy efficiency index (EEI) for directional lamps
A++ (most efficient)	EEI ≤ 0,11	EEI ≤ 0,13
A+	0,11 < EEI ≤ 0,17	0,13 < EEI ≤ 0,18
A	0,17 < EEI ≤ 0,24	0,18 < EEI ≤ 0,40
B	0,24 < EEI ≤ 0,60	0,40 < EEI ≤ 0,95
C	0,60 < EEI ≤ 0,80	0,95 < EEI ≤ 1,20
D	0,80 < EEI ≤ 0,95	1,20 < EEI ≤ 1,75
E (least efficient)	EEI > 0,95	EEI > 1,75

Table 2 Energy Efficiency Classes for lamps according to Commission Delegated Regulation (EU) No 874/2012, Annex VI, table 1.

The EEI has to be determined in accordance with Annex VII point 1 of the regulation as:

*EEI = (Rated Power * Correction Factor) / Reference Power*

where the Correction Factor reflects the efficiency of the control gear (if any) and is taken from Annex VII, table 2 of the regulation (see also Annex E of the Task 1 report).

The Reference Power (P_{ref}) is computed using:

Journal of the European Union, L258/1, 26.09.2012, available as http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri= OJ:L:2012:258:0001:0020:EN:PDF

- For models with $\Phi_{use} < 1300$ lumen: $P_{ref} = 0{,}88\sqrt{\Phi_{use}} + 0{,}049\Phi_{use}$
- For models with $\Phi_{use} \geq 1300$ lumen: $P_{ref} = 0{,}07341\Phi_{use}$

For non-directional lamps, the useful luminous flux (Φ_{use}) is the total rated luminous flux (Φ in lm). For directional lamps Φ_{use} is the flux in a 120 degree cone (non-filament lamps with beam angle ≥90° and warning that they are not suitable for accent lighting) or a 90 degree cone (other directional lamps).

Annex E of the Task 1 report provides further details on Commission Delegated Regulation (EU) No 874/2012, and also contains some derived graphs that clarify the practical implications of the Energy Efficiency Classes.

The definition of the Energy Efficiency Index in Regulation 874/2012 is identical to the one in Regulation 1194/2012 (par. 2.3).

According to Article 10 of Commission Delegated Regulation (EU) No 874/2012, it shall apply from 1 September 2013, except some transitional provisions listed in Article 9. Until that date the requirements of Directive 98/11/EC continue to apply.

Article 7 (Revision) of Commission Delegated Regulation (EU) No 874/2012 states that '*The Commission shall **review** this Regulation in the light of technological progress no later than three years after its entry into force. The review shall in particular assess the verification tolerances set out in Annex V'.*

These tolerances regard the verification procedure for market surveillance purposes. Annex V states that: '*The model shall be considered to comply with the requirements (….) if the model's energy efficiency index corresponds to its declared energy efficiency class and if the average results of the batch do not vary from the limit, threshold or declared values (including the energy efficiency index) by more than 10 %.*' [56]

The date of entry into force is 16 October 2012 (20 days after publication in the OJ, 26.09.2012) and thus the review date is 16 October 2015.

The current study explicitly also has the task to fulfil the review requirements for Regulation 874/2012 (see par. 1).

In addition, the current study '*should aim at setting **more ambitious targets** for all lighting products currently regulated under Ecodesign and Energy Labelling, including luminaires (both with or without built-in light sources such as LED modules)*' (see par. 1).

In March 2014 Regulation 874/2012 was amended by Regulation 518/2014, that prescribes information requirements and energy label display for the sale of lamps on the Internet [57].

In June 2014, Ecofys issued a report [58] containing an evaluation of the 2010/30/EU framework directive. This report indicates the following strategic priorities regarding labelling:

[56] See LE-comments for page 21 in Annex B.

[57] COMMISSION DELEGATED REGULATION (EU) No 518/2014 of 5 March 2014 amending Commission Delegated Regulations (EU) No 1059/2010, (EU) No 1060/2010, (EU) No 1061/2010, (EU) No 1062/2010, (EU) No 626/2011, (EU) No 392/2012, (EU) No 874/2012, (EU) No 665/2013, (EU) No 811/2013 and (EU) No 812/2013 with regard to labelling of energy-related products on the Internet, OJ L147/1 17.5.2014, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014R0518&from=EN

[58] "Evaluation of the Energy Labelling Directive and specific aspects of the Ecodesign Directive", Final Technical Report, 3 June 2014, Ecofys, ENER/C3/2012-523. http://www.energylabelevaluation.eu/tmce/Final_technical_report-Evaluation_ELD_ED_June_2014.pdf

- Revise the energy label: use classes A-G; no classes A+, A++, A+++; avoid empty classes at the bottom,
- Address market surveillance: increase cooperation; set up product compliance database; increase size and impact of activities; more funding needed,
- Increase support for rulemaking process: common work plan for Energy Labelling (ELD) and Ecodesign (ED); dedicated guidance documents for stakeholders; increased resources for preparatory studies;
- Update the MEErP: refine methodology; inclusion of more raw materials in Ecoreport to properly address non-energy aspects; evaluation step after Task 4 to check if gathered data are sufficient,
- Postpone scope extension for ELD and ED until above points have been dealt with.

Considering that the evaluation is not specific for lighting, no further details on this study are provided here, see the reference.

2.5. CLASP study

In February 2013 CLASP, supported by ECEEE, issued a report that examines the upcoming revisions to existing regulations under the Ecodesign and Energy Labelling directives [59] [60].

As stated in the Executive Summary, CLASP and ECEEE hope that this paper will contribute to the discussion among member states, stakeholders and in the Commission about how best to organise the considerable workload associated with the Ecodesign and Energy Labelling directives in a way that yields the greatest energy savings and CO_2 emission reductions.

The paper provides an assessment of the additional energy savings potential from seven product groups where the existing implementing measures were coming up for review before the end of 2014. Among these are tertiary lighting (scope of Regulation 245/2009) and non-directional household lamps (scope of Regulation 244/2009).

The study developed a **new stock model** for each product group enabling a projection of sales and stock to 2030, assuming three different policy scenarios. Different from the Impact Assessment studies [61] this model also considered the market penetration of LED lighting technologies, based on the methodology followed in the US DOE energy savings forecast of solid state lighting [62].

An economic assessment of the assumed technologies was not included, by lack of time.

The study **identifies the two lighting groups** (together with household refrigerating appliances) **as those with the greatest potential for additional energy savings** by 2030: 12.1-18.3 TWh/yr for tertiary lighting and 16.0-18.6 TWh/yr for non-directional lighting.

[59] CLASP (2013) Estimating potential additional energy savings from upcoming revisions to existing regulations under the ecodesign and energy labelling directives: a contribution to the evidence base. Available: http://www.eceee.org/all-news/press/2013/2013-02-19/eceee-clasp-report-estimating-potential

[60] In comments on a draft version of this report, LightingEurope objected to the presence of this paragraph in the report because the information is not balanced by that from other Stakeholders. There are also several LE-comments on the contents of the CLASP study. See details in annex B.

[61] See notes 10 and 17.

[62] Energy Savings Potential of Solid-State Lighting in General Illumination Applications, Prepared for: Solid-State Lighting Program; Building Technologies Program Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy; Prepared by: Navigant Consulting, Inc. January 2012. Available: http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/ssl_energy-savings-report_jan-2012.pdf

The study also reviewed the product groups from the points of view of:
1. the adequacy of the scope of coverage of existing implementing measures;
2. the integrity of existing implementing measures *(*correction factors; definitional ambiguities);
3. the communicative effectiveness of the energy label.

Tertiary Lighting is discussed in paragraph 4.5 and Annex E of the report.
Non-directional Household Lighting is discussed in paragraph 4.6 and Annex F of the report.
Paragraph 4.7 provides some additional considerations on lighting.

Selected comments / findings from the study follow below.

As regards **Tertiary Lighting** (Commission Regulation (EC) No 245/2009):

- The regulation does not include some HID lamp base types, certain halogen lamps and LED technology. The scope of coverage of the regulation should be reviewed, **including at least LEDs**.

- The efficacy values of HPM and HPS lamps are not expected to improve. **MH lamps, and more specifically ceramic MH lamps, are continuing to improve in efficacy** as well as light quality, manufacturability and lamp life (unsaturated ceramic MH lamp). The study observes that the final regulatory measure of Regulation 245/2009 will take effect in 2017 but that levels of ambition for MH-lamps in that year (from 65 to 90 lm/W depending on power rating and clear/non-clear) are significantly lower than many MH products in the market already today (CLASP states 120 lm/W). According to appendix E of the report, 2012-marketed MH-lamps are already from 24 to 85% more efficient than the 2017 requirement of Regulation 245/2009. The CLASP scenarios therefore consider a 20% efficiency requirement increase for MH-lamps by 2018 [63]and additional 10-15% increases both in 2020/2021 and 2022/2023.

- For **fluorescent lamps,** there are still possibilities for some performance improvements: further phosphor improvements, enhanced fill gas, improved cathode coatings and UV-reflective glass coatings. Some of these improvements may not be commercialised because this would require investments that are now mainly dedicated to LED lamps. According to appendix E of the report, 2012-marketed T5 and T8 LFL-lamps are already from 4 to 18% more efficient than the 2017 requirement of Regulation 245/2009. The CLASP scenarios consider a 5-10% efficiency requirement increase for T8 and T5 LFL lamps and CFLni lamps by 2018 and an additional 5-10% increase by 2022/2023.

- The CLASP scenarios consider an **increase in LED efficacy** from 50 lm/W in 2010, 120 lm/W in 2015, 180 lm/W in 2020, 195 lm/W in 2025 to 203 lm/W in 2030.

- During the **review of Regulation 245/2009** it would be appropriate to assess verification tolerances and the possibilities for removing or reducing the values of existing correction factors. There may also be opportunities for additional energy savings by addressing electronic ballasts and tertiary luminaires, not currently in the scope of the ecodesign implementing measure.

[63] See LE-comments in Annex B: the LE opinion is that 'we have to keep the high efficient quartz MH technology in the market – because no retrofit with ceramic MH possible, in general.'

- The Minamata Convention on Mercury adopted in early 2013 [64] includes certain types of CFLs and fluorescent lamps and is thus of relevance to the review of EC No 245/2009.

- Across the EU, tertiary lighting is projected to consume 214 TWh of electricity in 2020 and 166 TWh by 2030. The **energy savings estimat**e from CLASP Scenario 2 is 14.5 TWh/yr (-6.8%) in 2020, and 14.8 TWh/yr (-8.9%) in 2030.

As regards **Non-directional Household Lighting** (Commission Regulation (EC) No 244/2009):

- Attempts to promote incandescent lamps as space heating appliances ("**heat balls"**) and to promote sales of incandescent lamps intended for industrial applications ("**rough service lamps**") to the household market, may be mainly a matter of enforcement at the member state level, or may raise issues of scope and definitions in the implementing measure. The topic should be included as part of the review.

- The **CLASP BAU Scenario for NDLS household lamps** shows a rapid decline in the remaining special-purpose incandescent lamp sales, reaching zero by 2021. Halogen becomes a popular replacement for incandescent, however it starts to decline around 2015 and trends downward in response to 244/2009 Stage 6 in September 2016 which requires halogen lamps to achieve energy label B rating. CFLs peak in 2012 and then decline as the most suitable sockets for CFLs will then have long-life CFLs installed and consumers are expected not to fully embrace the technology due to warm-up time, mercury content and other issues. LEDs start to gain market-share, surpassing CFLs on a unit basis in 2015 and halogens in 2017. However, LEDs have a very long life, thus once installed the socket is not available for replacement in the domestic setting for many years – leading to peak in LED replacement lamp sales around 2020 and a gradual decline and levelling off by 2030 at around 200 million unit LED lamp sales per annum.

- The **energy savings scenarios** developed by CLASP for non-directional household lamps all assume that new ecodesign regulations come into effect in two steps – a Tier 1 requirement with an EEI of 0.24 (energy label class A, see par. 2.4) and a Tier 2 requirement with an EEI of 0.17 (energy label class A+). The difference between the scenarios is essentially the timing of when the regulation becomes effective. Since halogen is not able to achieve a class A or A+, the scenarios are effectively **phasing out halogen lamps** in favour of more efficient alternatives. It is the removal of halogen from the market coupled with the projected performance improvement of LED that contributes significantly to the energy savings estimates.

- According to CLASP, a **review of Regulation 244/2009** should focus on:
  1) verification that special purpose lamps are not used for general lighting purposes;
  2) taking note of the development of new technologies such as LED;
  3) assess the feasibility of establishing energy efficiency requirements at the 'A' class level;
  4) assess verification tolerances and the possibilities for removing or reducing some of the correction factors.

[64] Minamata Convention Agreed by Nations: Global Mercury Agreement to Lift Health Threats from Lives of Millions WorldWide, United Nations Environment Programme (UNEP), Geneva, Switzerland, 19 January 2013. See link: http://www.unep.org/newscentre/Default.aspx?DocumentID=2702&ArticleID=9373&l=en

- Across the EU, NDLS household lighting is projected to consume 89 TWh of electricity in 2020 and 80 TWh by 2030. The **energy savings estimate** from CLASP Scenario 2 is 18.6 TWh/yr (-21%) in 2020, and 17.4 TWh/yr (-22%) in 2030.

As regards **Lighting in General**, CLASP recommends to review all lighting regulations (244/2009, 245/2009, 1194/2012 and 874/2012) together and to try to integrate them. The recommendation is to do this in two steps:

Step 1: Reassess the appropriateness of final stage requirements for EC No 244/2009 (non-direction household lamps) and EC No 245/2009 (tertiary lighting) with a view to potentially reducing the ambition of the former (Stage 6 review for halogen lamps), and increasing the ambition of the latter (CFL and MH-lamps).

Step 2: Conduct the review and revision of all four lighting implementing measures simultaneously as part of the same process to ensure synergies and reductions in overall resources required.

Most of the findings of the CLASP study are reflected in the assignment for the current study (par. 1), in the Stage 6 review study (par. 2.6) and the Omnibus review study (par. 2.7).

2.6. Stage 6 Review

In June 2013 VHK and VITO presented a report to the European Commission containing a Review on the Stage 6 requirements of Commission Regulation (EC) No 244/2009 [65].

As described in more detail in par. 2.1, Regulation 244/2009 Stage 6, that is currently set to apply from 1 September 2016, sets more stringent efficacy requirements for clear lamps, implying that they should be of the 'B' energy label class (0,24 < EEI ≤ 0,60 for NDLS, see par. 2.4).

This Stage 6 efficacy requirement, combined with the Stage 5 requirement of increased lifetime (>2000 h instead of >1000 h), potentially presents problems for mains voltage halogen lamps (HL-MV).

The report explains the reason for the timely review as:

> *'… to provide planning security for industry and consumers (i.e. for buying luminaires designed for halogens). Different from expectations at the time of the conception of Stage 6 there are currently no mains voltage (MV) halogen lamps on the market that would meet the Stage 6 requirements and it is highly uncertain whether halogen lamps meeting the qualification will be on the market when Stage 6 will apply, i.e. by 1 September 2016. As it was not the intention of the legislator to phase-out mains voltage halogen lamps [66] –a popular replacement of the*

[65] "Review study on the stage 6 requirements of Commission regulation (EC) No 244.2009 Final Report", VHK (pl) / VITO for the European Commission, Delft/Brussels 14.6.2013, SPECIFIC CONTRACT No ENER/C3/ 2012-418 LOT 2/01/SI2.645913 Implementing Framework Contract No ENER/C3/2012-418-Lot 2. http://www.eup-network.de/fileadmin/user_upload/Technical_Review_Study_by_VHK_VITO.pdf?PHPSESSID=a60a9114e01af59471374f5814656e0c

[66] LE asks to highlight this intention and to use it as base for future policy. See also other LE-comments regarding the stage 6 review and the phase-out of MV-HL lamps, in Annex B.

phased-out incandescent lamp for various reasons– the basis of the decision-making on Stage 6 in 2008-2009 needs to be evaluated against the latest insights today, in the beginning of 2013.'

In its technical analysis the Review Study clarifies that the Stage 6 requirements have a potential impact both on low voltage non-directional halogen lamps (HL-LV) and mains voltage non-directional halogen lamps (HL-MV) [67].

"Stage 6 conform" (class B) halogen low voltage lamps (HL-LV) are broadly available. As explained in detail in the Review Study, **HL-LV lamps** generally have better efficiency than HL-MV lamps, thanks to their lower voltage. In addition, HL-LV lamps are able to fully exploit the benefits of infrared coating that further enhances efficiency.

The study also concludes that at the moment there are no **HL-MV lamps** on the market that can achieve the Stage 6 requirements.

The conclusions from the technical analysis were:

- It is technically feasible to produce "Stage 6 conform" low voltage (LV) halogen lamps at competitive production prices.
- It is technically feasible to produce "Stage 6 conform" mains voltage (MV) halogen lamps for the EU, but only with an integrated transformer (MV to LV) or at high lumen outputs (equivalent to output of >250-300W incandescent bulbs).
- It is perhaps technically feasible to produce "Stage 6 conform" MV halogen lamps for the EU in lower lumen outputs in an ideal production environment and top technology (IRC, quartz, perfect envelope, ultrathin and strong filament).
- It is not technically feasible to produce "Stage 6 conform" MV halogen lamps for the EU at a competitive price, i.e. consumer price would be comparable to LEDs, and at a reasonable investment level.
- There are possible loopholes for Stage 6 enforcement on MV-HL lamps, such as G9 adapters [68] and special purpose incandescent lamps. The relevance for enforcement, i.e. the probability of consumers using these loopholes, will depend on the price difference between "Stage 6 conform" lamps and current MV halogen lamps.
- Most experts agree that LED (possibly OLED) is the designated future replacement for MV-HL technology, but, at the time of the Stage 6 review study, there are a number of technical/functional aspects such as colour rendering, dimmability, etc. and –most importantly– the LED price that are potential barriers for consumer acceptance. These barriers are expected to be lowered to an acceptable level somewhere in the future, but the timing of forcing MV LED retrofits upon consumers is important.

The Review Study estimates a total EU-27 **stock of MV-HL lamps in 2014 of 1350 million units/sockets**. It introduces two scenarios:

- **Keeping the Stage 6 requirements**
  Stage 6 requirements are enforced in September 2016 and can only be fulfilled by an expensive MV-HL alternative with transformer at around 10 euros (if there is an industry

[67] Except those with caps G9 and R7s that have been exempted from Stage 6 of Regulation (EC) No 244/2009.

[68] Regulation 244/2009 exempts lamps with G9 caps from the Stage 6 requirements because of lack of suitable alternatives. The Review Study shows the existence of an adapter with E27 or E14 screw-base socket that accepts G9 lamps. This adapter would allow the continued use of low-efficiency G9 lamps, thus undermining the intention of the Regulation.

willing to produce them). Many people will switch to LEDs, G9 adapters, special purpose lamps or –for the higher lumen outputs and even if it is not a clear lamp—CFLs. In that case, a split-up LED/G9 adapter/special purpose/CFL of 60/10/10/20% is assumed

- **Abolishing the Stage 6 requirements**
  In case the Stage 6 requirement is abolished, there will still be a large influence of LEDs replacing MV-HL lamps, but the transition is expected to be more moderate. Around 40-50% of the 1350 million sockets mentioned earlier will have been filled by LEDs in 2020. The other half is filled by MV-HL lamps, generating replacement sales. Sales of MV-HL lamps will diminish by 20-30% annually due to competition with LED, until it will be (close to) zero in around 2024-2025 [69].

The study estimates that **keeping the stage 6 requirements will save 35 TWh of electricity** over the period 2016-2060 (CO_2 abatement of 12.2 $MtCO_2$). The largest difference between the two scenarios is in the year 2020 and amounts to 9.4 TWh/yr saving when keeping Stage 6.

As regards unemployment aspects, the study estimates that **6800 MV-HL-related jobs are at risk** in the EU by the end of 2016 when keeping Stage 6. However, also in the case of abolishing Stage 6 these jobs will gradually disappear anyway over the 2016-2025 period (due to the competition of LEDs), but industry would have more time to try to save some of these jobs by moving to other products or to relocate production of sites from outside the EU back to the EU.

In a **wider context** the study points out that the strategy of Japan is to completely ban all non-LED lamps, including linear and compact fluorescents, by 2020. In the United States "Solid-state lighting" (SSL: LED and OLED) is an important part of energy policy and also China and Korea have far reaching plans in promoting LED lighting.

In addition, the original Stage 6 decision was also taken in a global context where a large number of countries around the world committed themselves to realizing energy efficient lighting.

In either way, keeping or abolishing the Stage 6 requirements, the decision will set an example for other sectors that are or will be subject to Ecodesign measures.

The scenario calculation in the Review Study shows a **saving of consumer expenditure** of around 7.5 billion euros (in constant 2016 euro) or almost 11% over the 2016-2060 period when keeping the Stage 6 requirements.

In October 2013 the Stage 6 review study as described above was followed by a working document of the European Commission [70], which evolved in a draft regulation in April 2014 [71] (see also par. 1.4.1.5 of the Task 1 report). These documents propose a postponement of the entry into force of the Stage 6 requirements to September 2018 [72].

[69] LE-comment on draft report: "LEDs are the future. By forcing over the necessary any shift from HALO to LED will introduce only specific concerns and will not make a change in targets for savings", see also related comments in Annex B.

[70] Commission Staff Working Document, "Report to the Ecodesign Consultation Forum on the Review of the Stage 6 Requirements of Commission Regulation (EC) No 244/2009", Brussels 21 October 2013, available as: http://www.endseurope.com/docs/131024a.pdf

[71] Working Document on amending Commission Regulation (EC) No 244/2009 with regard to ecodesign requirements for non-directional household lamps and Commission Regulation (EU) No 1194/2012 with regard to ecodesign requirements for directional lamps, light emitting diode lamps and related equipment http://www.eup-network.de/fileadmin/user_upload/Working_document_on_draftreegulation_amndt_244_2009_-_to_CF.pdf?PHPSESSID=a99e47f748aa05ed88829181fc43bfd0

[72] Industry association LightingEurope would prefer 2020.

As requested by the Commission in the assignment (par. 1) the current Preparatory Study will take into account the findings of the Stage 6 Review Study.

2.7. Omnibus Review

In April 2014 VHK, VITO, Viegand Maagøe and Wuppertal Institut presented a report to the European Commission containing the so-called "*Omnibus Review Study*" [73].

This study is an exploratory analysis to provide a prioritisation and indication of extensiveness of review activities related to Ecodesign and Energy Labelling measures that currently exist for eight product groups, among which *Lighting products* (non-directional, tertiary, and 'special purpose').

The analysis focused on possible energy savings as basis for prioritisation, but also considered resource efficiency aspects (material aspects in the case of lighting products) insofar feasible.

Although the report contains a review of Commission Regulations (EC) No 244/2009 (non-directional light sources) and 245/2009 (tertiary lighting), it is underlined that this is a first exploratory review and that follow-up studies are necessary for a full review.

The study identified lighting products as "high priority", requiring extensive/comprehensive further study, because they have the largest energy savings potential of the eight examined product groups (non-directional: 18 TWh/year in 2030, tertiary: 18 TWh/year in 2030). A horizontal approach (combining several existing measures) should be considered. The missed energy savings from "misuse" of special purpose lamps for general lighting varies between 0.3 to 1.3 TWh/year, depending on the alternative that consumers would have bought instead (halogen or CFL) [74].

As regards **Non-Directional Light Sources** (NDLS, Commission Regulation (EC) No 244/2009) the conclusions from the study are as follows:

- NDLS represent an economically and environmentally significant product group, with annual sales of 1.4 billion units (2010) and an electricity consumption that is currently 4% of total EU demand.
- The energy savings potential, beyond what will be realised through the existing regulation, is still an extra 20% (18 TWh/year) in the years 2020 and 2030.
- This saving is technically feasible through setting targets that are ultimately at the energy label level "A+" in 2020/2021. This would phase out CFLs and halogen technology and implies that from 2020/2021 the NDLS-technology is to be based on LEDs (and possibly OLEDs at a later stage).
- If LED lamps meet current industry projections for 2020, the payback period of the average LED lamp with respect to the cheaper alternative of a mains voltage halogen lamp will be around 1.5 years at the mentioned target level.

[73] "Omnibus Review Study on Cold Appliances, Washing Machines, Dishwashers, Washer-Driers, Lighting, Set-top Boxes and Pumps Final Report", VHK (NL) / VITO (B) / Viegand Maagøe A/S (DK) / Wuppertal Institut für Klima, Umwelt, Energie GmbH (D), Brussels/Delft 01.04.2014, prepared for the European Commission DG-ENER-C3, SPECIFIC CONTRACT No ENER/C3/2012-418 LOT2/03/SI2.654805 Implementing Framework Contract No ENER/C3/2012-418-Lot 2.

[74] According to LE-comments, this is around 11 TWh/year, see annex B.

- There are considerable uncertainties when and how a revision of the existing regulation should be implemented in order to minimise possible negative impacts in terms of functionality, affordability and industry's competitiveness.
- Addressing these uncertainties, in consultation with stakeholders, would require a comprehensive follow-up study.
- Such a follow-up study could also look into the possibility of a holistic approach whereby the regulations for all lighting products (including 245/2009 and 1194/2012) are treated in a single piece of legislation.

As regards **Tertiary Lighting** (Regulation 245/2009) the conclusions from the study are as follows:

- New T5 fluorescent lamps with higher efficacy came on the market compared to the existing legislation, especially for the least efficient HO lamps; therefore raising the minimum requirements has to be reconsidered.
- It is also recommended to verify these declared fluorescent lamp performances and in this context to check if and how the permissible tolerance of 10 % in annex IV is or is not used in practice.
- The current state of art of HID lamps, available from different manufacturers, is well above Stage 3 requirements in Table 10 of the regulation. Savings of up to 25 % are realistic and raising the future HID lamp target in the regulation can therefore be considered.[75]
- In relation to HID lamps there is a risk of imposing proprietary technology. [76] This needs to be further investigated as many of these lamps came only recently on the market, more in particular the manufacturing of special shape ceramic arc tubes and MH combinations.
- The regulation does not address all improvement potential available at system level, e.g. luminaires, installation and LED technology retrofits.
- Much energy can be saved by only replacing the lamp ballast; however, this is not as obvious as retrofitting a lamp. Therefore, it is advisable that more specific and supporting requirements are elaborated for luminaires with respect to this.
- The aforementioned conclusions confirm that technical savings of +5% up to +20% compared to BAU are technically feasible, therefore additional savings in the order of magnitude of 18 TWh [77] in 2030 are feasible by increasing efficacy requirements.
- There are still uncertainties when and how a revision of the existing regulation should be implemented in order to minimise possible negative impacts in terms of affordability and industry's competitiveness functionality.

[75] Lighting Europe (LE) comments that for HID lamps >=400 W users need quartz-MH lamps because there are no suitable ceramic-MH alternatives. Thus LE believes quartz-MH should be kept. (Note taken from Omnibus Review study)(see also related comments in Annex B)

[76] LightingEurope confirms that there is a danger of monopoly situations for new high efficiency stand-alone systems (proprietary technology) and no lamp retro fitting is possible (specific control gear needed). (Note taken from Omnibus Review study)

[77] CLASP, 2/2013, 'Estimating potential additional energy savings from upcoming revisions to existing regulations under the ecodesign and energy labelling directives', see also par. 2.5.

- Addressing these uncertainties, in consultation with stakeholders, would require a comprehensive follow-up study.
- Such a follow-up study could also look into the possibility of a holistic approach whereby the regulations for all lighting products (including 244/2009 and 1194/2012) are treated in a single piece of legislation. This was abandoned in 2009 due to lack of time but still makes sense. This allows also integrating other elements such as dimming requirements and luminaires that are currently not in the regulation.

As regards **Special Purpose Lamps** (SPL) the conclusions from the study (as far as available information allowed) are as follows:

- There is a realistic EU-market of 8 million shockproof lamps per year.
- On top of that, there are around 16 million units/year [78] that are abusively sold for general lighting services, mostly from extra-EU imports.
- The energy saving that is lost through the abuse varies between 0.32 to 1.3 TWh/year, depending on the alternative that consumers would have bought instead (halogen or CFL).
- The projected savings from Commission Regulation (EC) No 244/2009 were 32 TWh/year and thus the EU misses out on 1 to 4% of these projected savings.

The misuse of special purpose lamps is not insignificant and undermines the credibility of the measures. It is not considered large enough to warrant the administrative burden of an immediate change of the legislation for this purpose only, but should be tackled at a general review of the relevant legislation. In the meanwhile, a large part of the solution may be found by not changing the legislation but simply increasing the market surveillance by Member States.

Options for the review of the legislation include:

- Explicitly lifting the exemption for rough service lamps, because there are enough compliant alternatives, or
- Restricting the distribution of these lamps only to the professional channels, e.g. password-protected online sales or sales through shops that are accessible only for professionals and not the general public.
- Requirements for a specific declaration on the lamp packaging of the technical characteristics that would make a lamp "special purpose".

More in general, the definitions of special purpose lamps in lighting related ecodesign and labelling legislation should be made clearer and more consistent. Within the restricted resources and timeframe of the Omnibus project, it was not proven possible to make a comprehensive technical proposal on this subject.

This work would require a comprehensive follow-up study.

As requested by the Commission in the assignment (par. 1) the current Preparatory Study will take into account the findings of the Omnibus Review Study.

[78] LightingEurope comments that this should be 294 million pieces.

2.8. Lot 37 study on Lighting Systems

In parallel to the current "Lot 8/9/19 Preparatory Study on Light Sources" a "Lot 37 Preparatory Study on Lighting Systems" [79] is being performed.

This Lot 37 study is not a full preparatory study, being limited to MEErP [80] tasks 0, 1, 2, 3, 4 and 7. It was preceded by an "exploratory report on Lighting Systems" [81] that was issued in March 2014 by VITO to the European Commission and that explored MEErP tasks 0, 1 and 7.

The objectives of this limited preparatory study are:

- to explore the feasibility of ecodesign, energy labelling for lighting systems, and/or energy performance of buildings requirements;
- to provide an argumentative overview of the market segments where - certain elements of - a system approach in lighting could be deemed successful. This will result into a proposal as to which lighting controllers previously not regulated should be included, either as part of a luminaire or as an independent product, in the unified regulatory measures.

This study will look at configurations of light source, luminaires, gears and control components that would be able to efficiently deliver the right light at the right place and at the right time. In principle, this can cover any intelligent lighting systems for the home, workplace and public space featuring:

- Occupancy-sensing, from simple on-off detection of human presence to intelligent multi-sensor traffic analysis systems;
- Adaptation to available daylight, not only in intensity but also in subtle colour management of the artificial light source to create a healthy psychological balance;
- Adaption to the real performance taking into account surface reflection levels, aging of the light source, pollution, shading, etc.;
- Optimisation of available daylight through filters, light guidance systems, smart sun screens, windows with special optics to improve the reach of the light indoors, trade-off between the thermal and optical performance of windows;
- Smart task lighting that "knows" when and how it is needed;

[79] "Preparatory study on lighting systems, including lighting schemes, luminaires and lighting controls for intelligent systems, for Ecodesign, Energy Labelling, and/or Energy Performance of Building requirements ('Lot 37') ", project leader VITO, in cooperation with VHK and with Paul Waide. Started January 2014, study for the European Commission DG-ENER-C3, SPECIFIC CONTRACT No ENER/C3/2012-418 LOT1/06/SI2.668525 Implementing Framework Contract No ENER/C3/2012-418-Lot 1.

[80] Methodology Study Ecodesign of Energy-related Products, MEErP Methodology Report, December 2011, VHK BV, Netherlands and COWI, Belgium, for the European Commission, specific contract SI2.581529 under framework contract, TREN/R1/350-2008 Lot 3: "Technical Assistance for the update of the Methodology for the Ecodesign of Energy-using Products (MEEuP)" http://www.meerp.eu/

[81] "Exploratory study on lighting systems, including lighting schemes, luminaires and lighting controls for intelligent systems, for Ecodesign, Energy Labelling, and/or Energy Performance of Building requirements ('Lot 37') Final Report", VITO reference 2014/ETE/R/036, March 2014, prepared for the European Commission DG-ENER-C3, SPECIFIC CONTRACT No ENER/C3/2012-418 LOT1/05/SI2.660099 Implementing Framework Contract No ENER/C3/2012-418-Lot 1. Restricted Distribution.

- Interactive lighting control interfaces at individual (smartphone, tablet) and/or centralised (smart building or home automation) level taking the user in the control loop;
- Flexible luminaire systems capable of varying light intensity, colour temperature, direction of the light and light patterns, employing new technologies such as LEDs, laser- or OLED (organic LED) based systems;
- Effective luminaire lay-out and positioning, optimised for optimal performance, visual comfort and energy efficiency;
- Introduction of maximum illumination levels related to existing minimum comfort levels in standards EN12461-X;
- Inclusion of energy efficiency calculations during the planning (e.g. EN15193-1, prEN13201-5). This could be related to the EPB directive;
- Measures in outdoor illumination to avoid inflated illumination levels and/or light pollution, e.g. introduction of city light planning;
- Smart metering and billing requirements for lighting circuits to create awareness of lighting energy consumption;
- Enable maintaining minimum illumination levels in the case of electricity shortage, which could be a smart grid use case;
- New developments of car/bicycle headlights could be more streamlined with road illumination requirements.

The Lot 37 study will thus be complementary to the Lot 8/9/19 study, the former concentrating on the wider perspective of entire Lighting Systems and the latter on the Light Sources used inside those systems. As both VITO and VHK are involved in both studies, coordination between the two studies is ensured.

3. PROJECT SCHEDULE AND REPORTING

The specific contract for the study was signed by the European Commission and by the Consortium led by VITO on 24 December 2013.

A kick-off meeting between the European Commission (Ruben Kubiak), VITO (Paul van Tichelen and Arnoud Lust) and VHK (René Kemna) was held on 29 January 2014.

At the kick-off meeting, the Commission explained aims at a Regulatory Vote on Lot 8_9_19 in the summer of 2016. Taking into account the preceding procedural steps, this means that ideally a draft Final Report on Lot 8_9_19 should be ready in October 2015. The Commission is aware that this date is considerably earlier than foreseen in the contract and cannot be enforced. Nevertheless, it would like to have it noted. The study team acknowledged the wish and will do its best, but at this point cannot commit to early delivery; much will depend on the resistance or collaboration of stakeholders.

Actual work on the study in VITO and VHK started in February 2014, but was intensified after the official public announcement of the study on 8 April 2014 [82]. At that point, also Jeffcott Associates was officially involved in the project.

The study foresees two interim reports (target dates 23 August 2014 and 23 April 2015), with the 2nd interim report followed by a stakeholder meeting. A Draft Review Report for Commission Regulation (EU) No 1194/2012 and Commission Delegated Regulation (EU) No 874/2012 including the detailed market assessment is foreseen for 1 May 2015. The final deliverables are due 23 December 2015.

[82] In the documentation accompanying the invitation for the Ecodesign Consultation Forum of May 5th 2014.

4. TASKS

4.1. Overview

The work for this Preparatory study has been organised as prescribed by the MEErP [83]. This methodology for Energy-related Products (ErP) identifies the following sub-tasks (for a more detailed description see the reference).

0. First product screening: re-group or narrow the product scope (optional)
1. **Scope**
   - 1.1 Product Scope: define products, identify existing codification
   - 1.2 Standards: identify and shortly describe standards relevant for the products
   - 1.3 Legislation: identify and shortly describe legislation relevant for the products
2. **Markets**
   - 2.1 Generic Economic Data: EU production, imports and exports
   - 2.2 Market and Stock Data: Sales (replacement, new), Stock, growth rates, product life, etc.
   - 2.3 Market Trends: trends (sales, design, features), manufacturers, marketing channels …
   - 2.4 Consumer Expenditure Base data: prices, costs, tariffs …
   - 2.5 Recommendations: refined product scope, barriers or opportunities for Ecodesign
3. **Users**
   - 3.1 System Aspects, ErP with direct energy consumption: efficiency, emissions, important usage parameters, product in technical system, product in functional system
   - 3.2 System Aspects, ErP with indirect energy consumption: e.g. lighting influence on heating / cooling demands
   - 3.3 End-of-Life behaviour: stock life, repair and maintenance, collection rates …
   - 3.4 Local infra-structure: e.g. physical environment for products, know-how of installers …
   - 3.5 Recommendations: refined product scope, barriers or opportunities for Ecodesign
4. **Technologies**
   - 4.1 Technical Product description: existing products, BAT, BNAT (work towards base cases)
   - 4.2 Production, Distribution, End-of-Life: BOM in EcoReport, packaging
   - 4.3 Recommendations: refined product scope, barriers or opportunities for Ecodesign, timing
5. **Environment & Economics**
   - 5.1 Product-specific inputs
   - 5.2 Base-Case Environmental Impact Assessment
   - 5.3 Base-Case Life Cycle Costs for consumer
   - 5.4 EU-totals
6. **Design Options**
   - 6.1 Options: identify and describe (clusters of) design options
   - 6.2 Impacts: use EcoReport tool to assess environmental improvement per option
   - 6.3 Costs: assess / estimate price increase due to design options
   - 6.4 Analysis LLCC and BAT (and BNAT)
7. **Scenarios**
   - 7.1 Policy Analysis: stake-holder comments, barriers/opportunities, pro's/cons
   - 7.2 Scenario Analysis: BAU scenario and ECO-options scenarios
   - 7.3 Impact Analysis Industry and Consumers

[83] Methodology Study Ecodesign of Energy-related Products, MEErP Methodology Report, in particular part 1: Methods, December 2011, VHK BV, Netherlands and COWI, Belgium, for the European Commission, specific contract SI2.581529 under framework contract , TREN/R1/350-2008 Lot 3: "Technical Assistance for the update of the Methodology for the Ecodesign of Energy-using Products (MEEuP)" http://www.meerp.eu/

7.4 Sensitivity Analysis of the main parameters
7.5 Summary

The following paragraphs give more details for each task.

4.2. MEErP Task 1: Scope, standards and legislation

4.2.1. Product Scope

- Identify relevant
  a- Prodcom category or categories (Eurostat);
  b- Categories according to EN- or ISO-standard(s);
  c- Labelling categories (EU Energy Label or Eco-label), if not defined by the above.
- Define preliminary product scope, including preliminary product definitions, taking into account that categorisation shall preferably be linked to primary performance parameter (the "functional unit") if needed sub-categorisation can take place on the basis of secondary performance parameters and for indirect ErPs the affected energy system(s)

4.2.2. Standards

- Identify and shortly describe
  - EN or ISO/IEC test standards
  - Mandates issued by the European Commission to the European Standardisation Organisations (ESOs)
  - If applicable, test standards in individual Member States
  - Where relevant, third country test standards (e.g. ASHRAE, ANSI, JIS, etc.) regarding the test procedures for
    a primary and secondary functional performance parameters under 1.1
    b resources use (energy and materials, incl. waste) and emissions
    c safety (flammability, electric safety, EMC, stability, etc.)
    d noise and vibrations (if applicable)
    e other product-specific test procedures possibly posing barriers for Ecodesign measures
- Do a comparative analysis for overlapping test standards on performance, resources use and/or emissions
- Analyse and report on
  a new test standards being developed (describe major changes)
  b possible problems on accuracy (tolerances), reproducibility and to what extend the test standards reflect real-life; draft outlines of mandate(s) to the ESOs as appropriate.
  C differences between standards covering the same subjects (comparative analysis)

4.2.3. Legislation

Identify and shortly describe the relevance for the product scope of
1.3.1 EU legislation (legislation on resources use and environmental impact, EU voluntary agreements, labels)
1.3.2 Member State legislation (as above, for legislation indicated as relevant by Member States), including a comparative analysis.
1.3.3 Third country legislation (as above, for third country legislation), including a comparative analysis

4.3. MEErP Task 2: Markets

4.3.1. Generic Economic data

Identify and report
a. EU Production;
b. Extra-EU Trade;
c. Intra-EU Trade;
d. EU sales and trade= production + import - export.
Data should relate to the latest full year for which at least half of the Member States have reported to Eurostat.
Preferably, data should be in physical volume (e.g. units) and in money units and split up per Member State.
Information for this subtask should be derived from official EU statistics so as to be coherent with official data used in EU industry and trade policy.

4.3.2. Market and Stock data

In physical units, for EU-27, for each of the categories as defined in task 1.1 and for reference years
a. 1990 (Kyoto and "20-20-20" reference);
b. 2010 (or most recent real data);
c. 2013-2016 (forecast, presumable entry into force of measures);
d. 2020-2030-2050 (forecast, years in which all new ecodesigns of today will be absorbed by the market).

The following parameters are to be identified:
a. Installed base ("stock") and penetration rate;
b. Annual sales growth rate (% or physical units);
c. Average Product Life (in years), in service, and a rough indication of the spread (e.g. standard deviation);
d. Total sales/ real EU-consumption, (also in euros, when available);
e. Replacement sales (derived);
f. New sales (derived).

4.3.3. Market Trends

2.3.1. General market trends (growth/ decline, if applicable per segment), trends in product-design and product-features;
2.3.2 Market channels and production structure; identification of the major players (associations, large companies, share SMEs, employment);
2.3.3 Trends in product design/ features, illustrated by recent consumer association tests (valuable, but not necessarily fully representative of the diversity of products put on the market).

4.3.4. Consumer Expenditure base data

For each of the categories defined in subtask 1.1, determine:
a. Average EU consumer prices, incl. VAT (for consumer prices; street price)/ excl. VAT (for B2B products), in Euro;
b. Consumer prices of consumables (detergent, toner, paper, etc.) (euros/kg or euros/piece);
c. Repair and Maintenance costs (euros/product life);
d. Installation costs (for installed appliances only);
e. Disposal tariffs/ taxes (euros/product);

For electricity, fossil fuel, water, interest, inflation and discount rates use values for Jan. 2011 in MEErP Chapter 2, including the average annual price increases mentioned there.
For regional differentiation of consumer prices (for sensitivity analysis), also see Chapter 2.

4.3.5. Recommendations

Make recommendations on
2.5.1 refined product scope from the economical/ commercial perspective (e.g. exclude niche markets)
2.5.2 barriers and opportunities for Ecodesign from the economical/ commercial perspective

4.4. MEErP Task 3: Users

4.4.1. System aspects Use phase, for ErP with Direct energy consumption

Identify, retrieve and analyse data, report on the environmental & resources impacts during the use phase for ErP with a direct energy consumption effect, with impact levels subdivided in
3.1.1 a strict product/ component scope (e.g. steady state efficiency and emissions at nominal load, as in traditional standards)
3.1.2 an extended product approach: considering that the ErP will be subject to various loads/user demands; the product scope could extend to controllability (flexibility and efficiency to react to different load situations, e.g. modulating burner, variable speed drive, "inverter"), the quality of possible controls (sensors, actuators, central processing unit) and/or the quality of auxiliary devices that may or may not be part of the ErP as placed on the market (e.g. separate heat recovery devices such as PFHRD)
Examples of possibly important factors to consider, depending on the nature of the ErP, are:
- Load efficiency (real load vs. nominal capacity);
- Temperature- and/or timer settings;
- Dosage, quality and consumption of auxiliary inputs (detergents, paper- and toner use, etc.);

- Frequency and characteristic of use (e.g. hours in on, standby or off mode);
- Identification of use of second hand auxiliary inputs during product life (e.g. toner, recycled paper);
- Power management enabling-rate and other user settings;
- Best Practice in sustainable product use, amongst others regarding the items above.

3.1.3 a technical systems approach: considering that the ErP is part of a larger product system and –through certain features of the ErP—can influence the functional performance and/or the resources use and emissions of that of that larger product system. E.g. central heating boiler regulation influencing indoor temperature fluctuation (discomfort), thus increasing heat demand. Other example: combination and possible synergy from combining strict ErP with other ErP (consumer electronics TV/ PC/ phone/camera; combi-boiler with both space and hot water heating; hybrid boiler combining gas boiler with heat pump, etc.). Note that this still considers solutions of which the ErP is a physical part.

3.1.4 a functional systems approach: considering that often there are several ways to realize the basic function. E.g. water-based (hydronic) heating systems versus air-based heating systems, various modes of food preparation, etc.. This analysis will often not directly affect a single Ecodesign legislation, but it is of strategic interest to guarantee coherence and consistency between the various ErP being regulated.

4.4.2. System aspects Use phase, for ErP with Indirect energy consumption

Identify, retrieve and analyse data, report on the indirect environmental & resources impacts during the use phase for ErP with an indirect energy consumption effect (e.g. windows, insulation material, shower head, water taps), specifically

3.2.1 describe the affected energy system(s), i.e. the systems/products whose energy consumption in the use phase of the ErP is influenced by features of the ErP

3.2.2 repeat Tasks 1.2, 1.3 (relevant standards, legislation) and Task 2 (economic and market analysis) for the affected energy system, but only related to technical parameters that relevant for the aforementioned interaction with the ErP and only in as much as they are not already taken into account in Task 1 and 2 for the ErP.

3.2.3 information retrieval and analysis of the use phase energy consumption of the affected energy system (repeat 3.1 but only for the use phase of the affected energy system).

3.2.4 assess the interaction between the ErP and the affected energy system: describe the basic physical/chemical or other parameters and mechanisms behind the interaction, possible backed-up by statistical data or field trial or laboratory data.

3.2.5 quantify the energy use and the energy-related resources & environmental impacts during the use phase of the affected energy system(s) that is influenced by the ErP, following the outcomes of the relevant parts of Tasks 4 to 7 for the affected energy system.

4.4.3. End-of-Life behaviour

Identify, retrieve and analyse data, report on consumer behaviour (avg. EU) regarding end-of-life aspects. This includes:

3.3.1 Product use & stock life (=time between purchase and disposal);
3.3.2 Repair- and maintenance practice (frequency, spare parts, transportation and other impact parameters);
3.3.3 Collection rates, by fraction (consumer perspective);
3.3.4 Estimated second hand use, fraction of total and estimated second product life (in practice);
3.3.5 Best Practice in sustainable product use, amongst others regarding the items above.

4.4.4. Local Infra-structure

Identify, retrieve and analyse data, report on barriers and opportunities relating to the local infra-structure regarding

3.4.1 Energy: reliability, availability and nature
3.4.2 Water (e.g. use of rain water, possibilities for “hot fill” dishwashers);
3.4.3 Telecom (e.g. hot spots, WLAN, etc.);
3.4.4 Installation, e.g. availability and level of know-how/training of installers;
3.4.5 Physical environment, e.g. fraction of shared products, possibilities for shared laundry rooms, etc.

4.4.5. Recommendations

Make recommendations on

3.5.1 refined product scope from the perspective of consumer behaviour and infrastructure
3.5.2 barriers and opportunities for Ecodesign from the perspective of consumer behaviour and infrastructure

4.5. MEErP Task 4: Technologies

4.5.1. Technical product description

Illustrated with data on performance, price, resources/emissions impact of
4.1.1 Existing products (working towards definition of Base Cases)
4.1.2 Products with standard improvement (design) options
4.1.3 Best Available Technology BAT (best of products on the market)
4.1.4 Best Not yet Available Technology BNAT (best of products in field tests, labs, etc.)

4.5.2. Production, distribution and end-of-life

4.2.1 Product weight and Bills-of-Materials (BOMs), preferably in EcoReport format (see Task 5)
4.2.2 Assessment of the primary scrap production during sheet metal manufacturing
4.2.3 Packaging materials
4.2.4 Volume and weight of the packaged product
4.2.5 Actual means of transport employed in shipment of components, sub-assemblies and finished products
4.2.6 Materials flow and collection effort at end-of-life (secondary waste), to landfill/ incineration/ recycling/ re-use (industry perspective)
4.2.7 Technical product life (time-to-failure of critical parts)

4.5.3. Recommendations

4.3.1 refined product scope from the technical perspective (e.g. exclude special applications for niche markets)
4.3.2 barriers and opportunities for Ecodesign from a technical perspective
4.3.3 the typical design cycle for this product and thus approximately appropriate timing of measures

4.6. MEErP Task 5: Environment & Economics

4.6.1. Product-specific Inputs

Choose from the previous tasks the most appropriate information
From all tasks 1 to 4: Definition of the base case(s) (from all previous Tasks 1 to 4) with per Base Case
Task 1: The most appropriate test standard for performance and consumption data
Task 2: EU-27 annual unit sales 2010
EU-27 unit stock 2010
Purchase price, the installation costs (specify end-of-life disposal costs comprised in product price)
Repair and maintenance costs
Unitary rates for energy, water and/or other consumables
Discount, inflation, interest rates to be applied
Product service life
Task 3 Annual resources consumption (energy, water, consumables, from Task 3.1) and emissions caused during product life (from Task 3.2);
Product use & stock life, if appropriate (i.e. if deviates substantially from product service life)
As appropriate, multiplier(s) to transform standard test data to real-life consumption data
Average user demand/ load
Collection rate at end-of-life (per fraction if applicable)
Task4 Product weight and Bill Of Materials (BOM), preferably in EcoReport format (from Task 4)
Primary scrap production during sheet metal manufacturing (avg. EU);
Volume and weight of the packaged product avg. EU;
Selected EU scenario at end-of-life of materials flow for:
- o Disposal (landfill, pyrolytic incineration);
- o Thermal Recycling (non-hazardous incineration optimised for energy recovery);
- Re-use or materials recycling scenario.

4.6.2. Base Case Environmental Impact Assessment

Using the EcoReport and the above inputs calculate emission/resources categories in MEErP format for
Raw Materials Use and Manufacturing;
Distribution;
Use phase;

End-of-Life Phase.
Furthermore, if more than one type of resource is used in the use phase, make a split-up between resources and their individual impacts.

4.6.3. Base Case Life Cycle Costs for consumer

Combining the results from tasks 2 and 3 for the Real-Life Base-Case determine the Life Cycle Costs
LCC = PP + PWF * OE + EoL, where LCC is Life Cycle Costs, PP is the purchase price, OE is the operating expense,
PWF (Present Worth Factor) is PWF= {1 – 1/(1+ r) N }/r , in which N is the product life and r is the discount rate minus the growth rate of running cost components (e.g. energy, water rates) and EoL the End-of-Life costs

4.6.4. EU Totals

Aggregate the Real-Life Base-Case environmental impact data and the Life Cycle Cost data (subtask 5.3 and 5.4) to EU-27 level, using stock and market data from task 2, indicating
5.4.1. The life cycle environmental impact and total LCC of the new products designed in 2010 or most recent year for which there are reliable date (this relates to a period of 2010 up to 2010+product life);
5.4.2 The annual (2010) impact of production, use and (estimated) disposal of the product group, both in terms of the annual environmental impacts and the annual monetary costs for consumers.

4.7. MEErP Task 6: Design Options

4.7.1. Options

Identify and describe (aggregated clusters of) design options to be taken into account (from Task 4, typically 4 to 8 design options are appropriate).

4.7.2. Impacts

Assess quantitatively the environmental improvement per option using the EcoReport tool. Compare the outcomes and report only on impacts that change significantly with the design options.

4.7.3. Costs

Assess/ estimate price increase due to implementation of these design options, either on the basis of prices of products on the market and/or by applying a production cost model with sector-specific margins.

4.7.4. Analysis LLCC and BAT

6.4.1 Rank the individual design options by LCC (e.g. option 1, option 2, option 3);
6.4.2 Determine/ estimate possible positive or negative ("rebound") side effects of the individual design measures;
6.4.3 Estimate the accumulative improvement and cost effect of implementing the ranked options simultaneously (e.g. option 1, option 1+2, option 1+2+3, etc.), also taking into account the above side-effects;
6.4.4 Rank the accumulative design options; draw LCC-curves (1st Y-axis= LLCC, 2nd Y-axis= impact (e.g. energy), X-axis= options); identify the Least Life Cycle Cost (LLCC) point and the point with the Best Available Technology (BAT);
6.5 Long-term targets (BNAT) and systems analysis
Discussion of long-term technical potential on the basis of outcomes of applied and fundamental research, but still in the context of the present product archetype;
Discussion of long-term potential on the basis of changes of the total system to which the present archetype product belongs: Societal transitions, product-services substitution, dematerialisation, etc.

4.8. MEErP Task 7: Scenarios

4.8.1. Policy Analysis

7.1.1 Describe stakeholder consultation during preparatory study
7.1.2 Describe barriers (and opportunities) for improvements environmental impact; opportunities for ecodesign measures (from Tasks 1-4)
7.1.3 Describe pros and cons of (combinations of) ecodesign measures and other policy instruments (e.g. self-regulation, energy label, EPBD); identify and describe overlaps with existing legislation

7.1.4 Select policy measures for further analysis, including timing and target levels, notably the options should
- Be based on the exact definition of the products, according to subtask 1.1 and modified/confirmed by the other tasks;
- Provide ecodesign requirements, such as minimum (or maximum) requirements (ecodesign requirements should always address improvements in terms of environmental performance, not in terms of Technologies)
- Be complemented, where appropriate, with (dynamic) labelling and benchmark categories linked to possible incentives, relating to public procurement or direct and indirect fiscal instruments. In case of energy labelling, labelling categories should be proposed;
- Where appropriate, apply existing standards or propose needs/ generic requirements for harmonised standards to be developed;
- Provide measurement requirements, including measurement standards and/or methods;
- Consider possible self-regulation, such as voluntary agreement or sectorial benchmarks initiatives;
- Provide requirements on installation of the product or on user information.

4.8.2. Scenario Analysis

7.2.1 Set up a stock model for the baseline (Business As Usual, BAU); calculate for the period 1990-2030, preceded by an appropriate built-up period (product life), for the following parameters per year X (X=1990-2030):

a. annual sales in X (from Task 2, with actual and interpolated values), subdivided in new (incl. 1st time users) and replacement sales;

b. annual stock of product (from Task 2)= accumulative sales in X and preceding L-1 years (L=product life) minus products discarded in actual year (=sales in year X-L);

c. annual stock (number) or impact (e.g. in kWh) of the affected energy system (for indirect ErP);

d. annual net performance demand per unit (from Task 3), including growth rate if appropriate;

e. for significant impacts only: average unitary impact(s) (e.g. kWh energy and/or g emissions per performance unit, directly or indirectly) for products sold; this is the (set of) parameter(s) to be regulated;

f. total impact= stock units x performance demand per unit x unitary impact;

Report in a table showing 5 year intervals

Check the calculated total impact against values from this MEErP report (when available) or other sources for consistency. Deviations of ± 15% are "normal"; larger deviations require an explanation and possible adjustment of the stock model.

7.2.2 Calculate for the period 1990-2030 (with qualitative discussion of 2030-2050) for each of the options identified in 7.1.4 a scenario for total annual and accumulative impact of the policy mix, at the given timing and target level(s) (graphs and labels per impact type).

If no other data are available, the following values may be assumed:

For the unitary impacts in the years of ('entry into force' minus 1-2 years) and 'implementation of (first) target' use interpolated values between baseline and (first) target.

Unitary impact levels in periods after target implementation, the impact depends on the policy mix: In the time period after minimum requirements alone, the market is usually assumed to pick up the baseline trend after 1 year; when combined with other measures (e.g. labelling) the trend stays more positive than baseline for at least 5 years. Timely revision of labelling may prolong that period by ca. 3 years

4.8.3. Impact Analysis industry and consumers

7.3.1 Introduce economic parameters in the stock model:

a. Introduce baseline product price (from previous tasks), in Net Present Value for a reference year (e.g. 2010), taking into account inflation rates as given in MEErP

b. Introduce unitary energy, water, consumable rates, annual repair and maintenance costs.

c. Introduce dynamic parameters: inflation rate, growth rate unitary prices (energy, water, etc.)

d. Simplify the relationship between a product's unitary impacts and product purchase price: determine a linear price elasticity from known anchor points (Base Case, LLCC, BAT) for price and unitary impact.

e. Determine the turnover rate per employment (from Task 2)

f. Determine the cost and margin built-up for the average product (%), with relative shares for OEMs, Manufacturer, Wholesale, Retail, VAT and other tax.

g. Introduce variables and mathematical relations in the stock model as appropriate (see also sensitivity analysis)

7.3.2 Calculate for the period 1990-2030 (with qualitative discussion of 2030-2050) for each of the options identified in 7.1.4 a scenario for total impact of the policy mix, at the given timing and target level(s) (graphs and labels per impact type)

a. EU-27 running costs including and excluding taxes (indicator of utility income and government income from energy/ water/etc. VAT and other tax) in Euro2010, 1990-2030

b. EU-27 consumer expenditure, 1990-2030

c. EU-27 annual revenue industry, wholesale, retail, product VAT and other taxes (million euros) in Euro2010, for reference years 2020 and 2030 (or 2050 instead of 2030 for construction products)
d. indicative share of SMEs, share in industry revenue; qualitative discussion of possible effect
e. employment (no. of jobs) industry, wholesale, retail/installers for reference years 2020 and 2030

4.8.4. Sensitivity Analysis of the main parameters

Recalculate selected scenarios for variation in
a. higher and lower (50%) energy prices;
b. higher and lower (50%) elasticity between product price and unitary impact parameter;
c. new target levels or differences in timing as indicated by the Commission services;
d. life cycle costs including societal LCC **:**
Extend the calculation of the base-case Life Cycle Costs for the end-user with the societal costs for emissions indicated in Chapter 6, using the outcome of Task 5.2 (emissions in mass per product over product life) and the monetary values per emission (in euros/unit of mass) in Chapter 7 and report on the in-/decrements (in tables).

4.8.5. Summary

7.5.1 Summarise the main policy recommendations per product
7.5.2 Summarize the main outcomes of the scenarios for Baseline, 2020 and 2030 (2050 for construction products)
7.5.3 Summarize the risk of possible negative impacts on health, safety, etc. in one +/- table

5. MEErP Task 0: First Product Screening

According to the MEErP the aim of this task is to:

> *'In case of large or inhomogeneous product groups, it is recommended to carry out a first product screening, considering the environmental impact and potential for improvement of the products as referred to in Article 15 of the Ecodesign Directive. The objective is to re-group or narrow the product scope, as appropriate from an ecodesign point of view, for the subsequent analysis in tasks 1-7.'*

In addition to '*all lighting products currently regulated under Ecodesign and Energy Labelling*', the assignment for this preparatory study (see par. 1) explicitly requests an analysis of '*the lighting products not yet regulated*'. This is also related to the Commission's request to review the definitions of special purpose lamps and to propose updates.

This implies that, at least for the initial scope, all lighting products that are now exempted from the regulations and all lamps now considered as special purpose lamps have to be included in the study.

Considering the following definitions (taken from the Task 1 report):

'*Light source*' means a surface or object designed to emit mainly [84] visible optical radiation produced by a transformation of energy [85]. The term 'visible' refers to a wavelength of 380-780 nm.

'*Lamp*' means a unit whose performance can be assessed independently and which consists of one or more light sources. It may include additional components necessary for starting, power supply or stable operation of the unit or for distributing, filtering or transforming the optical radiation, in cases where those components cannot be removed without permanently damaging the unit.

'*Ballast*' means lamp control gear inserted between the supply and one or more discharge lamps, which, by means of inductance, capacitance or a combination of inductance and capacitance, serves mainly to limit the current of the lamp(s) to the required value.

'*Lamp control gear*' means a device located between the electrical supply and one or more lamps, which provides a functionality related to the operation of the lamp(s), such as transforming the supply voltage, limiting the current of the lamp(s) to the required value, providing starting voltage and preheating current, preventing cold starting, correcting the power factor or reducing radio interference. The device may be designed to connect to other lamp control gear to perform these functions. The term does not include:

- control devices
- power supplies within the scope of Commission Regulation (EC) No 278/2009.

the initial scope for the study can be formulated as:

"The study regards all light sources, lamps, ballasts and lamp control gears according to the definitions provided above".

[84] The word '*mainly*' is not an exact definition but anyway indicative. In case of doubt if this '*mainly*' applies, the product will be considered in the scope.

[85] The wording '*produced by a transformation of energy*' excludes for example mirrors and guides for natural sun light. Discussion is possible as to whether this also excludes for example photo-luminescent and tritium exit signs. In case of doubt, the product will be considered in the scope.

As expressed by the assignment, luminaires and lighting controllers are also in the scope of the study. However, in principle, aspects related to Lighting Systems and to Lighting Control are excluded from the current study because they will be handled in the parallel Lot 37 study (see par. 2.8).

This does not exclude that some lighting control aspects are relevant for the current study, in particular as regards the integration of control devices in the lamps (smart lamps), and the compatibility of the lamps with certain types of dimmers or control devices.

Luminaires will predominantly be handled in the Lot 37 study, but integrated LED-luminaires are considered included in the current study, and the compatibility of retrofit lamps with existing luminaires is also in the scope.

The scope for the study as described above is to be considered as an initial scope. According to the philosophy of the MEErP, this scope can be further restricted as the study proceeds and additional information is gathered.

In principle, the reasons for further restriction have to be derived from the Ecodesign Directive [86], and in particular from article 15 of this directive that gives the conditions under which a product is eligible for ecodesign measures. The criteria of article 15.2 are given here:

a) the product shall represent a significant volume of sales and trade, indicatively more than 200000 units a year within the Community according to the most recently available figures;

b) the product shall, considering the quantities placed on the market and/or put into service, have a significant environmental impact within the Community, as specified in the Community strategic priorities as set out in Decision No 1600/2002/EC; and

c) the product shall present significant potential for improvement in terms of its environmental impact without entailing excessive costs, taking into account in particular:
   (i) the absence of other relevant Community legislation or failure of market forces to address the issue properly; and
   (ii) a wide disparity in the environmental performance of products available on the market with equivalent functionality.

In addition, if a product is eligible for ecodesign measures according to the above criteria, an implementing measure shall meet the following criteria (article 15.5):

a) there shall be no significant negative impact on the functionality of the product, from the perspective of the user;
b) health, safety and the environment shall not be adversely affected;
c) there shall be no significant negative impact on consumers in particular as regards the affordability and the life cycle cost of the product;
d) there shall be no significant negative impact on industry's competitiveness;
e) in principle, the setting of an ecodesign requirement shall not have the consequence of imposing proprietary technology on manufacturers; and
f) no excessive administrative burden shall be imposed on manufacturers.

[86] DIRECTIVE 2009/125/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 October 2009 establishing a framework for the setting of ecodesign requirements for energy-related products (recast, repealing Directive 2005/32/EC), (Ecodesign Directive) OJ L285/10 31/10/2009, http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri= CELEX:32009L0125&from=EN

Furthermore, Article 1 sub 3 the Ecodesign Directive explicitly excludes '*means of transport for persons or goods*'. However, this exclusion regards only the means themselves and not the products used inside or on those means.

REFERENCES

See footnotes in text

LIST OF FIGURES

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ACRONYMS

a	Annum, year
BAT	Best Available Technology
BAU	Business As Usual
bn / bln	Billion (10^9)
BNAT	Best Non-Available Technology
BOM	Bill Of Materials
CCFL	Cold-Cathode Fluorescent Lamp
CDR	Commission Delegated Regulation
CFL	Compact fluorescent lamps
CFLi	CFL with integrated ballast
CFLni	CFL without integrated ballast
cor	corrected
CRI	Colour Rendering Index
DLS	Directional light sources
DEFRA	UK Department for Environment, Food and Rural Affairs
E14, E27	Screw-type lamp caps for general purpose lamp
EC	European Commission
ECEEE	European Council for an Energy Efficient Economy
ECO	Scenario considering ecodesign or energy labelling measures
ED	Ecodesign / Ecodesign Directive
EEI	Energy Efficiency Index

ELC	European association of lighting manufacturers, now part of Lighting Europe
ELD	Energy Labelling Directive
EoL	End of Life
ErP	Energy related Product
ESO	European Standardisation Organisation
EU	European Union
G4, GY6.35	Low voltage halogen lamp types, 2 pin cap, single ended
G9	Mains voltage halogen lamp, 2-pin cap, single ended
GLS	General Lighting Service (a.k.a. incandescent lamp)
h	Hour
HF	High Frequency
Hg	Mercury
HID	High-Intensity Discharge
HL	Halogen
HPM	High-Pressure Mercury
HPS	High-Pressure Sodium
HW	High Wattage
Hz	Hertz
IR, IRC	Infrared, Infrared coating
LE	LightingEurope (lighting manufacturers association)
LED	Light Emitting Diode
LFL	Linear Fluorescent Lamp
LCC	Life Cycle Cost
LLCC	Least Life Cycle Cost
LOR	Light Output Ratio
lm, Φ	Lumen, unit of luminous flux Φ
LV	Low Voltage (typical 12V)
LW	Low Wattage
max	maximum
MEErP	Methodology for Ecodesign of Energy-related Products
MH	Metal Halide
min	minimum
mn / mln	Million (10^6)
MOCVD	Metal Oxide Chemical Vapour Deposition
Mt	Mega tonnes (10^9 kg)
MV	Mains Voltage (typical 230V)
NDLS	Non-directional light sources
OJ	Official Journal of the European Union
OLED	Organic Light Emitting Diode
P	Rated power
par	paragraph
-R	Reflector

R	Electrical Resistance
R7s	Mains voltage linear halogen lamp, double ended
Ra	Colour rendering index, unit
ref	reference
s	Second (as unit for time)
SCHER	Scientific Committee on Health and Environmental Risks
SCENHIR	Scientific Committee on Emerging and Newly Identified Health Risks
SPL	Special Purpose Lamp
SPP	Special Purpose Product
SSL	Solid-State Lighting
TBC	To Be Confirmed
TBW	To Be Written / To Be Worked
TWh	Tera Watt hour (10^12)
UK	United Kingdom
US(A)	United States of America
UV	Ultraviolet (subtypes UVA, UVB, UVC)
V	Volt
VHK	Van Holsteijn en Kemna
VITO	Vlaamse Instelling voor Technologisch Onderzoek
W	Watt
yr	year

ANNEXES

Annex A. STATEMENT OF CONTRACTOR ON RIGHT TO DELIVERED RESULT

I, Dirk Fransaer, representing the "Consortium of VITO NV, VHK BV, Viegand & Maagøe ApS, Wuppertal Institute for Climate, Environment and Energy GmbH, and ARMINES", party to the contract 'Preparatory Study on Lighting Systems for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'), specific contract No. ENER/C3/2012-418 LOT1/07/SI2.668526 implementing framework contract No. ENER/C3/2012-418-Lot 1', warrant that the Contractor holds full right to the delivered Task 0 report of the 'Preparatory Study on Lighting Systems for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19')', which is free of any claims, including claim of the creators who transferred all their rights and will be paid as agreed within 30 days from the receipt of confirmation of acceptance of work.

Mol, Belgium,

Date:

Signature:

Dirk Fransaer

Managing Director VITO NV

Annex B. LIGHTINGEUROPE COMMENTS ON DRAFT TEXT

An early draft version of the Task 0 report was commented by LightingEurope. These comments are listed below, together with the text from the report to which they apply. In some cases, a reply of the study team is also included (in *green italic*). [87]

Page	Text in report ***Reply of study team to comments from LE***	Comment from LightingEurope
4	Previously not regulated lighting controllers, either as part of a luminaire or as an independent product, and other lighting products (e.g. lamps having a luminous flux above 12.000 lm) should be included in the study.	Where such lamps are used? Are there suitable replacements, in case of need? Sport Venue
4	The definitions of special purpose products should be reviewed and updates proposed with a view to minimise the possible misuse while keeping otherwise regulated products for use in special applications exempt from ecodesign and/or labelling requirements.	Proposal from LE regarding the revision of Reg. 244/2009
4	The study should fulfil the legal review requirements of Commission Regulation (EU) No 1194/2012 and Commission Delegated Regulation (EU) No 874/2012, and it should provide a detailed market assessment of mains¬voltage filament lamps, as required by Regulation 1194/2012, Annex III 1.1. *Regulation 518/2014 was added in par. 2.4 of the report*	and 518/2014 *(Authors: same comment on missing reference to 518/2014 was made also on other pages)*
5	The scope of this Preparatory Study is to carry out a study on lighting products for the preparation of further and/or more advanced ecodesign and/or labelling requirements.	Existing Labelling requirements <u>for luminaires</u> are not suitable for end user to choose the right product
6	The feasibility of unifying all four regulatory measures into one regulation should be explored (or only the three ecodesign regulations into one if this has been identified as the only possible option). *Footnote added to the report.*	*(Authors: two different comments from LE, both are reported here)* (1) At the present Reg. 245, 1194 are complicated as a single Regulation, concerns arise from the suggestion for having a single "Omni" Regulation. (2) If possible LE should support this option of one regulation, which still can have different chapters of course. But still communication on one regulatory measure is much more convenient than referring to 4 different ones. As LE we should support this ambition.
8	*(244/2009)* Stage 5, which applies from 1 September 2013, is the second stage (after Stage 1) in setting minimum functionality requirements. Most significantly, Stage 5 further tightens the requirements for the service life and lifetime functionality.	several complains have been received regarding the different light distribution between the "new" CFLi and the incandescent lamps used previously the entry into force of Regulation 244/2009
9	As a consequence, mains-voltage ('MV') halogen lamps might be phased out by Stage 6, but this was not the intention of the legislator. *Footnote added in report on page 25.*	Sometimes this point is not clear enough in the discussion about these matters *(Authors: same or similar comment also on other pages)*
10	For HID lamps, only the lamps that have an E27, E40 or PGZ cap are within the scope of the regulation. *PGZ correction implemented in the report; in the meantime directive had already been replaced by regulation.*	Correct to PG(Z)12 Change directive in regulation
11	*(footnote)* Note: Regulation 244/2009 on household lamps is much stronger for CFLi lamps, e.g. a 50 W requires about 64 lm/W and CRI≥80 in Regulation 244/2009, while Regulation 245/2009 requires only 50 lm/W for other 50 W HID.	*(Authors: Internal question LE)* is this a problem for us ?

[87] As the report has slightly changed with respect to the commented version (also in reaction to the comments themselves) the references to page numbers is approximate.

Page	Text in report ***Reply of study team to comments from LE***	Comment from LightingEurope
11	Low performing MH E27/E40/PGZ12 lamps are phased out; in practice, this means that 'quartz' MH lamps are phased out in favour of 'ceramic' discharge tube MH lamps. Compact Fluorescent Lamps with 2 pin caps and integrated starter switch (Reason: these lamps are phased out in stage 3 as they in practice do not operate on A2 class ballasts). *Footnote added with LE-opinion, also on page 23*	LE has a different interpretation. MH quartz lamps should remain and 2 pin lamps alled in after sales market (relamping)
14	*(1194/2012)* The Stage 3 requirement will be applicable only if no later than September 2015 evidence is produced that there are suitable mains-voltage lamps on the market. *Correction implemented in the report*	Lamps -> alternative types of lamps
14	*(1194/2012)* Stage 3 is the actual target that will phase-out GLS-R lamps. For HL-MV-R lamps to meet the Stage 3 criterion, the current lamps have to be improved (use of xenon, optimized filament wire design, anti-reflective coating, infrared coating, integrated MV-to-LV transformer). As it is not certain that such improved lamps or suitable replacements will exist by 2016, the application of Stage 3 is made to be dependent on a market research.	LE example: a Rumanian worker can't afford the exchange of 20 HAL GU10 against dimmable LEDr, with same high light quality and same dimension.
14	*(1194/2012, Other lamps)* Stage 3 (Sep. 2016): EEI< 0.20 *Footnote added to report.*	please check if 0,2 is really a suitable limit also for COB LEDs with high performance (e.g. high colour rendering index >95); maybe 0,25 should be relevant to High CRI LED modules and lamps
14	"Standby" power for a control with built-in switching function	to be further checked the definition for all types of lamp control gears and for luminaires (having on board switches) or control devices when emitting small light for identification purposes (in the dark)
15	Lamp Survival Factor at 6000 h *Footnote added to report.*	it is a too long time period for testing *(Authors: same comment on 6000h testing being too long was made also on other pages)*
15	*(1194/2012, CFL)* If the lamp cap is a standardised type also used with filament lamps, then as from Stage 2, the lamp shall comply with state-of-the-art requirements for compatibility with equipment designed for installation between the mains and filament lamps.	what does 'state-of-the-art' mean? If not (practically) compatible with, what happens? Then not applicable. *(Authors: same comment was made also on other pages)*
16	*(Functionality, LED)* Lamp warm-up Time to 95% of Φ_{use} *Footnote added to the report, signalling the inconsistency*	to be aligned with 3.1.2 and table 9 (60%)
16	*(Functionality, LED)* The intention is to ascertain a minimum product life (lumen maintenance >70%) of around 20 000 h. The period of 6000h at the mentioned parameters values was defined to limit costs for compliance testing.	Lifetime and relevant compliance in Table 9 is not clear enough
16	*(Functionality, LED)* Variation of chromaticity coordinates within a six-step MacAdam ellipse or less *This paragraph is a summary of 1194/2012 requirements, not of VHK tasks. Entry not deleted.*	variation between what?: 1 – between initial coordinates and coordinates after xx h of operation, or 2 – between declared value (initial) and initial value of products placed on the market. This is a task for the TF Guide not for VHK, please delete Is 6-step ellipse still proper?
17	When a luminaire is placed on the market and intended to be marketed to the end-users, and lamps that the end-user can replace are included with the luminaire, these lamps shall be of one of the two highest energy classes *Footnote added to the report*	It is too stringent requirement and it causes a lot of problems/changes when updating providers of lamps; furthermore it is still a limitation of free movement of goods within EU market!! Practically impossible
17	*(1194/2012)* Annex III point 3 sets Product Information Requirements for Directional lamps and for LED lamps replacing fluorescent lamps without integrated ballast. Amongst others, this includes a definition	Table 6 shall be corrected / updated / implemented possible to include candelas and removing comparison with lumen output only.

Page	Text in report *Reply of study team to comments from LE*	Comment from LightingEurope
	of the conditions under which it may be claimed that a lamp is equivalent to a lamp that it is intended to replace. *Footnote added to the report*	Min and max limits needed. Very important discussion within LE Here we need a more detailed definition. Wattage comparisons are still made for Tube LED lamps.
17	A review of this Regulation should take particular note of the trend in sales of special-purpose lamp types in order to make sure that they are not used outside special applications, and of the development of new technologies such as LED and organic LED.	"handle with care": this subject may be critical and it should be managed to prevent problems on the development of this technology. Freedom for development/evolution needed
18	According to the Impact Assessment that accompanies Regulation 244/2009 the labelling for domestic lamps according to Directive 98/11/EC did not have the expected effect	because it is lm/w only; also other characteristics are fundamental in choosing lamps, such as light distribution and quality of colours
19	*(874/2012)* This Directive establishes a framework for the harmonisation of national measures on end-user information, particularly by means of labelling and standard product information, on the consumption of energy and where relevant of other essential resources during use, and supplementary information concerning energy-related products, thereby allowing end-users to choose more efficient products	So also in the new Directive there is a misleading target, still focussing on lm/W only!!
20	*(874/2012)* According to Article 1, the regulation applies to filament lamps, fluorescent lamps, high-intensity discharge lamps, LED lamps and LED modules, and luminaires designed to operate these lamps. Article 1.2 provides a list of excluded products, see Task 1 for details.	It should be improved in clarity
20	*(874/2012)* In Annex I the regulation defines the layout, graphics and contents of the labels for the lamps and for the luminaires.	Not all cases are covered; no rule for Luminaires having multiple sockets and with/for different lamp types That's why LE issued a specific chapter on LE Q&A in conjunction with LE Guide on EEL
21	*(874/2012)* These tolerances regard the verification procedure for market surveillance purposes. Annex V states that: 'The model shall be considered to comply with the requirements (….) if the model's energy efficiency index corresponds to its declared energy efficiency class and if the average results of the batch do not vary from the limit, threshold or declared values (including the energy efficiency index) by more than 10 %.' *Footnote added to the report, referring to LE-comments*	To note that tolerance are relevant to limits and shall not be considered as including the measurement uncertainties of MS Authorities labs. Any test carried out by MS Authorities shall be done according to future EN 13032-4 and it means that a specific budget of uncertainties shall be calculated before producing the test results
21	As above, specific for '(including the energy efficiency index)'	This should be deleted because the EEI is a combination of two other parameters both with 10% tolerance. The tolerance on EEI is therefore less than 10%. This part was added in the regulatory committee meeting at the last moment without proper considerations to the effects and validity.
21	In addition, the current study 'should aim at setting more ambitious targets for all lighting products currently regulated under Ecodesign and Energy Labelling, including luminaires (both with or without built-in light sources such as LED modules)'	WHAT DOES IT MEAN? Is there any study in progress on e.g. on Reference Power for each type of luminaires (according to applications?). It would require a deep analysis and study... and time. Or the reference power will be only one and the more shielded screen / louvered luminaire will be the worst?
21	Revise the energy label: use classes A-G; no classes A+, A++, A+++; avoid empty classes at the bottom	it is not feasible to change every 5 years the scale of EEL
21	Update the MEErP: refine methodology; inclusion of more raw materials in Ecoreport to properly address non-energy aspects;	"handle with care"..

Page	Text in report *Reply of study team to comments from LE*	Comment from LightingEurope
	evaluation step after Task 4 to check if gathered data are sufficient	
21	Postpone scope extension for ELD and ED until above points have been dealt with.	agreed
22	Paragraph on CLASP study *Footnote added to text stating the LE-opinion and referring to all LE-comments on this paragraph.* *The LE-position is anyway reflected in their comments on the draft Task 0 and Task 1 reports that were fully presented. LE had a privileged position in the possibility of providing comments at such an early stage.*	This a "study" from a single stakeholder and it has a CLASP position paper inside... It should be removed from the this Preparatory study because it is not balanced by other documents from other Stakeholder (such as LightingEurope position papers)
22	Paragraph on CLASP study *See previous point.*	The clasp report makes completely unrealistic conclusions – no lighting experts. Is too much irritating and should be deleted from Task 0 Report. The most higher efficient products are based on a complete new system and are no retrofit lamps.
22	The paper provides an assessment of the additional energy savings potential from seven product groups	but not considering all items for having a proper alternative lighting service with more efficient solutions
22	this model also considered the market penetration of LED lighting technologies, based on the methodology followed in the US DOE energy savings forecast of solid state lighting	based on "old" LED solutions not having quality inside
22	The study identifies the two lighting groups (together with household refrigerating appliances) as those with the greatest potential for additional energy savings by 2030: 12.1-18.3 TWh/yr for tertiary lighting and 16.0-18.6 TWh/yr for non-directional lighting. *Reference is made to the scopes of the two regulations, 245/2009 (tertiary) and 244/2009 (non-directional). Although not strictly correct, 245/2009 is often referred to as being for 'tertiary lighting'.*	Non directional group is not comparable with tertiary group; tertiary group includes partially non-directional lighting and vice-versa
23	The efficacy values of HPM and HPS lamps are not expected to improve.	HPM will be phased out in 2015
23	levels of ambition for MH-lamps in that year (from 65 to 90 lm/W depending on power rating and clear/non-clear) are significantly lower than many MH products in the market already today (CLASP states 120 lm/W)	*The 120 lm/W is* Only valid for some products which have been in the development line since approx 4 years. Means not true in general. Often new system, inclusive new ballast. Almost all new investments go into LED technology.
23	The CLASP scenarios therefore consider a 20% efficiency requirement increase for MH-lamps by 2018 and additional 10-15% increases both in 2020/2021 and 2022/2023. *Footnote added with LE-opinion, also on page 11*	In reality impossible. And we have to keep the high efficient quartz MH technology in the market – because no retrofit with ceramic MH possible, in general.
23	The CLASP scenarios consider an increase in LED efficacy from 50 lm/W in 2010, 120 lm/W in 2015, 180 lm/W in 2020, 195 lm/W in 2025 to 203 lm/W in 2030.	Which are the products considered? What kind of performances have been considered? Again, lm/W only?
23	During the review of Regulation 245/2009 it would be appropriate to assess verification tolerances	What does it means? To note that tolerance are relevant to limits and shall not be considered as including the measurement uncertainties of MS Authorities labs. Any test carried out by MS Authorities shall be done according to future EN 13032-4 and it means that a specific budget of uncertainties shall be calculated before producing the test results
23	During the review of Regulation 245/2009 it would be appropriate to assess verification tolerances and the possibilities for removing or reducing the values of existing correction factors.	Table 6?? Why?

Page	Text in report *Reply of study team to comments from LE*	Comment from LightingEurope
23	Across the EU, tertiary lighting is projected to consume 214 TWh of electricity in 2020 and 166 TWh by 2030. The energy savings estimate from CLASP Scenario 2 is 14.5 TWh/yr (-6.8%) in 2020, and 14.8 TWh/yr (-8.9%) in 2030.	Are confirmed data? If yes, from Who?
23	Attempts to promote incandescent lamps as space heating appliances ("heat balls") and to promote sales of incandescent lamps intended for industrial applications ("rough service lamps") to the household market, may be mainly a matter of enforcement at the member state level, or may raise issues of scope and definitions in the implementing measure. The topic should be included as part of the review.	This should be part of the present amendment
24	However, LEDs have a very long life, thus once installed the socket is not available for replacement in the domestic setting for many years – leading to peak in LED replacement lamp sales around 2020 and a gradual decline and levelling off by 2030 at around 200 million unit LED lamp sales per annum.	This is a theoretical exercise and it is not considering the lack of market surveillance so poor products are not really prevented from EU market and the lifetime of such lamps maybe shorter than expected.
24	Across the EU, NDLS household lighting is projected to consume 89 TWh of electricity in 2020 and 80 TWh by 2030. The energy savings estimate from CLASP Scenario 2 is 18.6 TWh/yr (-21%) in 2020, and 17.4 TWh/yr (-22%) in 2030.	Are confirmed data? If yes, from Who?
25	As it was not the intention of the legislator to phase-out mains-voltage halogen lamps *Footnote added in report, also with reference to other LE comments*	please highlight and use this as base for future policy
25	The study also concludes that at the moment there are no HL-MV lamps on the market that can achieve the Stage 6 requirements.	and beyond
25	It is technically feasible to produce "Stage 6 conform" mains-voltage (MV) halogen lamps for the EU	only for efficacy but not providing all features as MV halo (e.g. dimming)
25	It is not technically feasible to produce "Stage 6 conform" MV halogen lamps for the EU at a competitive price, i.e. consumer price would be comparable to LEDs, and at a reasonable investment level.	not comparable but probably higher
26	There are possible loopholes for Stage 6 enforcement on MV-HL lamps, such as G9 adapters and special purpose incandescent lamps. The relevance for enforcement, i.e. the probability of consumers using these loopholes, will depend on the price difference between "Stage 6 conform" lamps and current MV halogen lamps.	at the present the market share for such solution is very small and there would not be reason for an increased share if MV Halo lamps (e.g. E27 cap) will still remain for enough time to have good LED retrofit alternative solution.
26	Most experts agree that LED (possibly OLED) is the designated future replacement for MV-HL technology, but, at the time of the Stage 6 review study, there are a number of technical/functional aspects such as colour rendering, dimmability, etc. and –most importantly– the LED price that are potential barriers for consumer acceptance.	amount of lumen output, light distribution similar to filament lamps, dimensions, weight, etc.
26	Sales of MV-HL lamps will diminish by 20-30% annually due to competition with LED, until it will be (close to) zero in around 2024-2025 *Footnote added in report, also with reference to other LE comments*	LEDs are the future. By forcing over the necessary any shift from HALO to LED will introduce only specific concerns and will not make a change in targets for savings
27	removing the current loophole by extending the Stage 6 requirements to halogen lamps with G9 and R7s socket; *Footnote added in report*	it is not a loophole; it simple cover the need for millions of citizens in having a proper lamp replacement!
27	and introducing a provision that luminaires sold after 1 September 2015 should be compatible with LED technology to prevent future obstacles to efficient lighting.	too short timeline
27	and introducing a provision that luminaires sold after 1 September 2015 should be compatible with LED technology to prevent future obstacles to efficient lighting.	LEDs now are efficient but are not fully retrofit solution because of still open issue on dimmability (standardization activity in progress) and amount of light emission (and quality of light) is not comparable yet.

Page	Text in report *Reply of study team to comments from LE*	Comment from LightingEurope
		Conclusion: the LED solutions now available are not enough for luminaire manufacturers to produce and offer to users a sufficient range to cover all application of today.
27	The missed energy savings from "misuse" of special purpose lamps for general lighting varies between 0.3 to 1.3 TWh/year, depending on the alternative that consumers would have bought instead (halogen or CFL). *Footnote added in report*	Wrong number, reference to LE Oettinger letter 11,…TWh/year and 294 mio pieces
28	The current state of art of HID lamps, available from different manufacturers, is well above Stage 3 requirements in Table 10 of the regulation. Savings of up to 25 % are realistic and raising the future HID lamp target in the regulation can therefore be considered.	Attention: no one by one replacement possible – new system
29	On top of that, there are around 16 million units/year that are abusively sold for general lighting services, mostly from extra-EU imports.	Correct number is 294 mio pieces
29	In the meanwhile, a large part of the solution may be found by not changing the legislation but simply increasing the market surveillance by Member States.	Isn't possible, because the Reg. 244 has a loophole