EUROPEAN
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PART 3/3

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT

Accompanying the document

COMMISSION REGULATION (EU) .../... laying down ecodesign requirements for light sources and separate control gears pursuant to Directive 2009/125/EC of the European Parliament and of the Council

and repealing Commission Regulations (EC) No 244/2009, (EC) No 245/2009 and (EU) No 1194/2012

and

COMMISSION DELEGATED REGULATION (EU) .../... supplementing Regulation (EU) 2017/1369 of the European Parliament and of the Council with regard to energy labelling of light sources

and repealing Commission Delegated Regulation (EU) No 874/2012

{C(2019) 1805 final} - {C(2019) 2121 final} - {SEC(2019) 340 final} - {SWD(2019) 358 final}

Annex 5: Minutes of the Ecodesign Consultation Forum

BRUSSELS, 7 DECEMBER 2017

Welcome and Introduction

The Chair welcomed the participants and explained the purpose of the meeting i.e. to discuss the results of the review study regarding Regulations (EC) No 244/2009, (EC) No 245/2009 and (EU) No 1194/2009 for ecodesign and Regulation (EU) No 874/2012 for energy labelling and the proposed draft working documents.

1. ADOPTION OF THE AGENDA AND APPROVAL OF THE MINUTES OF PREVIOUS MEETINGS

The agenda was adopted without any changes.

2. STATE OF PLAY CONCERNING THE COMBINED ECODESIGN AND ENERGY LABELLING CONSULTATION FORUM

The chair explained that in accordance with the new energy labelling framework regulation, a consultation forum for energy labelling needs to be set up, to be combined with that for ecodesign. The aim is to launch the call for interest for this combined consultation forum in the first quarter of 2019. Existing members of the consultation forum (except for the Member States) need to reapply for membership.

3. PRESENTATION OF THE MAIN FINDINGS OF THE REVIEW STUDY

After a presentation by the Contractor (Van Holsteijn en Kemna) of the review study, the ensuing discussion raised the following points:

Timing for the phase out of all non-LED products – **SE** asked for clarification on the fact that the study did not look into the possibility to have a phase out of all non-LED lamps in 2024. **The Contractor** stated that the idea to have all conventional lamps phased out in 2024 was one of the controversial points at the previous Ecodesign Consultation Forum of 2015 and that it was removed from the study to reach compromise.

Incandescent special purposes lamps – PL suggested that the EU could focus on the missed savings from incandescent lamps instead of proposing a phase out of T8 fluorescent lamps. Seeing that incandescent lamps are not part of the study, **PL** stated that although these lamps were banned years ago, they are still a relevant part of the market in the EU because the legislation exempts incandescent lamps for special purposes, also for general use. **AT** added that this situation is true also for other phased out lamps. **The Contractor** stated that incandescent technologies (except halogens) are not considered anymore in the study.

The Commission Services stated that incandescent lamps should not be on the market any longer, except for minor quantities for special purposes as laid down in

the EU legislation and that it is the role of national market surveillance authorities to look at what is placed on the market. On their side, the Commission Services are proposing in the draft texts to tighten the conditions for exemptions, to avoid such loopholes in the future. It would be interesting to have some statistics on the number of lamps on the market.

4. PRESENTATION OF THE WORKING DOCUMENTS

After a presentation by the Commission Services of the working documents the ensuing discussion raised the following points:

4.1. Ecodesign

Article 1 – Scope and Annex I - Exemptions

Placing on the market and Putting into service – CLASP underlined that the concept of "placing on the market" does not imply that users are obliged to replace lamps and systems on the day of application, but that from that day the phased out products would not be allowed to enter the EU market anymore. Lamps in use and in stock can be used with no end date. **UK** pointed to the fact that the regulation would need to include at some point in the scope the "putting into service" of lighting products in addition to "placing on the market", as lighting may well be provided as a service.

Exemptions – IT asked to exempt lamps used in laboratories, which are normally halogens, and to make it more clear which lamps would be exempted following the requirement for max. 1000 lumen per mm² of projected light-emitting surface area (which are listed in the explanatory memorandum). **LightingEurope** stated that they would like to keep many of the current exemptions for special purpose lamps and they will share two drafting options: a list or, preferably, a definition for special purpose lamps that would close the current loopholes especially for the misuse of incandescent lamps. **LightingEurope** also asked to add as an exemption 'works of art' as defined in Directive 2001/84/EU, because these works are handcrafted in small quantities. **PL** and **DE** opposed keeping the exemption for lamps for ambient temperatures below -30º and above 120º, which creates a major loophole for incandescent lamps as any incandescent lamp can satisfy those values. They proposed to add either a max. voltage of e.g. 25V or restrict the exemption based on the length of the lamp. **ECOS** supported this point and was satisfied with the attempt to close the loophole for decorative lamps. **IALD** asked to keep exemptions for theatre lighting, photosensitive people and photosensitive artworks. **DE** supported the exemption for theatre lighting and stated that exemptions should be a clear cut and easily checkable by market surveillance authorities. DE therefore asked to delete the option to allow "other documentation" to exempt products that were "specifically tested and approved" to operate in the contexts listed in Annex I. **CECED** asked to exempt lamps in range hoods because these lamps are already regulated in a separate regulation. **CER** asked to exempt all lamps that are used on trains, including common T8 lamps, as stockpiling would not help because these lamps are replaced every 3-4 years (according to **the Contractor**: every 15 years). **EIM** added that they would be obliged to retrofit stations and platforms on September 2020. The **Commission Services** clarified that today's interpretation is that common lights not specifically designed and tested for trains are not exempt and asked CER to give data on how many lights would be affected, taking into

account the general exemption for means of transport from the ecodesign framework regulation and the specific exemption in Annex I(f) for railway vehicle lighting. The Commission Services clarified to EIM that on September 2020 there would not be new T8 placed on the market, but no station would be obliged to replace them.

Containing products – **AT** stated that it is unclear what a containing product is, supported by **IT,** which also feared that manufacturers/importers of containing products may ignore that they are subject to a requirement that covers a product within their products. **SE** considered that when the lighting products in scope of the regulation are contained in a product, they should satisfy the ecodesign requirements and supported the proposal that the manufacturer of a containing product should give the information on the type of light source used and its energy class. **DK** stated that they feel relatively confident that they can work with having containing products in scope. **IALD** is very concerned about the burden that would be imposed on the producers of containing products. **LightingEurope** stated that, with light sources and control gears in scope, the definition of the scope should make it clear that containing products are not in scope. **Independent Retail Europe** stated that a containing product which is already subject to an energy label, like fridges, should not be required to have a second energy label for the lighting product that it contains. **The Commission** clarified that this will not be the case: the requirement is to inform on the type of light and energy class of the light source contained in the product. **CECED** was happy with this clarification but asked: 1. to exempt containing products which are already covered by energy labelling; 2. to anyway clarify if the date of placement on the market of a lamp in a containing product would be that of the lamp itself or of the containing product; and 3. to exempt lamps which are today used in fridges and similar products, in order to keep replacements available (and avoid to throw away the fridge when the lamp breaks, in line with the "repair as produced principle"). **The Commission Services** asked CECED for evidence and more information on this last point and replied that if the lamp was placed on the market before it is integrated in a containing product, the lamp date stays valid. The **Commission Services** asked for drafting contributions on this point, stating that it is important to agree on the principle.

Article 2 – Definitions and Annex II – Definitions

Merging article 2 and Annex II – SE asked to merge them.

White light definition (chromaticity coordinates x,y) – SE and **DK** showed concern about the narrowing of the white light area that would leave many common products out of scope. In support of this point, **BE** added that having special purpose lamps naturally falling out of the scope, would be a step back for consumers protection, as these lamps will not be subject any longer to information requirements. **CLASP** (supported by **SE**) asked to re-expand the white light area something mid-way and also asked the Commission to consider replacing the x,y space, with the method "u prime, v prime", which is easier to understand and visualise. **UK** would like to know more about the calculations to expand the white light area. **CLASP** will share slides with all participants and **the Commission** will check the "u prime, v prime" method. **The Contractor and the Commission** clarified that the white area is the same than the one already used in two of the three current regulations. The currently bigger white area in the third regulation has required laying down exemptions for many special purpose lamps, whose

verification has been time and resource consuming for market surveillance authorities. With the proposed definition of white area, fewer exemptions would be needed and the administrative burden would be reduced. There is no requirement for products out of scope to prove that they are out of scope. **LightingEurope** welcomed the alignment of the white light area to two of the three current regulations and stated that they would not see risk of loopholes from this. **The Commission** will better investigate how many products would naturally fall out of scope.

Containing product which is itself a light source (*see also the discussion on article 4*) – AT asked to clarify if fully integrated luminaires are in scope or not: the confusion would come from the last sentence of definition (1) "*light source*", which proposes to consider as the light source in scope "the smallest physical unit that can be readily removed from the containing product". **The Commission** reminded that the aim of that sentence, together with the provisions on removability in article 4 supporting a circular economy, is to avoid sealed luminaires. **IT** commented that it is impossible to avoid sealed luminaires (e.g. lights for underwater use) and added that "the smallest physical unit" is confusing (for example, in a LED module, would it be the single LED?). Also in the case of a fridge, what would be the containing product: the fridge or the grid that contains that LED? **CLASP** noted that lights for marine applications are exempt. **DE** stated that without a clear definition for the "smallest physical unit", there could be loopholes. **NL** proposed to delete the last sentence of definition (1) "*light source*", as it is already clear that a fully integrated luminaire is assimilated to a light source and thus it is in scope. **DK** supported the deletion of the sentence but stressed the need to identify a light source for verification purposes: an option is that if it is not possible to remove the lighting product from a containing product, the whole containing product may be tested as a lighting product. **SE** supported the Commission's proposal to have all lights removable. SE added that the ambition in any case should not be lower than having a fully integrated luminaire tested as a light source.

Luminous flux < 1000 lumen per mm² of projected light-emitting surface area – IT stated that this definition is useless and badly written, and would send suggestions to improve the definition.

Luminous flux – SE proposed to lower the minimum level of luminous flux from 60 lumen to 30 lumen, in order to have in scope "cosy" lamps with soft light that are popular in Scandinavia for general lighting needs. **DE** supported this point.

Useful luminous flux/Total luminous flux – CLASP proposed to drop the definition of "useful" luminous flux for directional lamps and use instead the "total" luminous flux, as in a normal environment all forward lumens from a directional lamp are useful and not only those in a cone. Using the total flux would allow market surveillance authorities to use integrating spheres instead of goniophotometers for measuring these light sources, which would lower costs, lead to more market surveillance and simplify the calculation formula proposed in the draft legislation by removing the correction factors. **SE** supported CLASP and confirmed that it is much easier to measure the total flux than the useful flux. **IALD** replied in favour of calculating the useful luminous flux, saying that what counts for the designer is the directionality of lights in order to have the right light at the right place.

Separate control gear – DE asked to clarify the wording for a separate control gear that is part of a containing product.

Fluorescence or fluorescent light source – IT would send suggestions to improve this definition.

Extra low voltage – CECAPI asked to refer to alternate current too and not only to direct current.

Stand-by – NL would send suggestions to align this definition to the standby legislation.

Portable battery-operated product – CECED asked to explain the limitation to 24 V.

Definitions in the energy labelling act – IT asked to check that the same definitions are worded the same in the ecodesign and the energy labelling acts.

Article 3 – Ecodesign requirements

See comments to Annex III.

Article 4 – Removal of light sources and separate control gears

CLASP stated that it is an excellent proposal to have luminaires serviceable and brought the experience of the industry voluntary initiative Zhaga, which published standards on the serviceability of products. **IALD** underlined that we are not in a world of light bulbs anymore, rather in a world of electronic components. As the efficiency of an electronic component is determined by its thermal coupling, making a product dismountable affects its efficiency. IALD suggested limiting the discussion to replaceable control gear, because a chip control gear makes a product fail early. **AT** stated that removability of light sources is a highly important issue, in particular for domestic luminaires where there are many cheap products, and proposed to consider a warranty on the lifetime of office products and systems rather than imposing disassembly given that the professional sector often claims a lifetime of 20 years for lighting systems. **BE** asked: 1. to clarify when this article would apply; 2. if it relates to end of life or repair; 3. to better define "qualified professionals"; 4. to clarify requirements about the availability of spare parts; 5. clarification on safety in case of self-repair; 6. where the instructions would be available; 7 to bring this discussion in the horizontal forum on material efficiency. **The Commission** clarified that article 4 would apply from 1 September 2020 and that the horizontal work on material efficiency does not yet address specific product requirements. **DE** highlighted that this is an important issue but that 2020 is difficult and asked the Commission to lay down a roadmap and to specify the concept, as "removability" is a necessary but not sufficient condition to have a circular economy. **NL** stated that article 4 is a useful article and suggested to add a third step to the removability by the end user or by a professional: the fact that when the light source is not removable, the whole product is considered a light source for the purposes of this regulation. **IT** commented that the principle is fully shareable, but it should be based on a clear idea of what a light source is. IT shared the proposal made by NL and the concerns from IALD on the electronic components. IT also agreed with BE on the need to clarify the safety conditions for removability and

with DE on the need for a roadmap. **ANEC** welcomed article 4, reported that non-removability is a raising trend (in 2016 from a survey on LED luminaires in 40% of the cases removability was not possible – it was 30% in 2015) and asked to expand the concept from "removable" to "replaceable". **EuRIC** supported this article, which would mirror the WEEE directive, and suggested to reconsider the wording "readily removable", as the term "readily" used in the battery directive was identified as lacking concreteness. **LightingEurope** shared the principle and the vision but the timeline is not feasible and there is the need to look into safety issues. An impact assessment on removability would be needed. **CEN TC169** informed on the ongoing work in CEN TC10 on circular economy, where this discussion could be developed. **EEB** expressed strong support and proposed to include a second tier to resolve the concern of timing; EEB considered the safety issue overestimated as we daily replace light bulbs in our homes. As for professional products, EEB suggested, by way of exception, replacing the removability condition with durability, having minimum 40 000 hours lifetime guaranteed. **The Commission Services** replied that further concrete suggestions would be welcome.

Permanent mechanical damage – SE, NL and **DK** asked the permanent mechanical damage requirement to be applied not only to the lighting product but also to the containing product. **NL** added that standards are not needed for this requirement. **DK** specified that the containing product should not be damaged for verification purposes.

Article 5 – Circumvention

Date of application – BE asked when this article would apply. The **Commission Services** replied that they would check and as far as possible harmonise the approach for all regulations that are currently under discussion.

Article 6 – Conformity assessment

Technical documentation – BE asked about the reason to have the technical documentation mentioned in this article. The Commission Services replied that it is a common article with regulations for other products and would check.

Article 7 – Verification procedures for market surveillance authorities

No comments.

Article 8 – Indicative benchmarks

No comments.

Article 9 – Repeal

No comments.

Article 10 – Revision

Review drafts – EEB asked to specify that the text to be presented to the Ecodesign Consultation Forum no later than 1 September 2022 would be the draft legislative text.

Article 11 – Entry into force

Alignment with energy labelling – DE asked that the date of application would be synchronised with the new energy labelling for lighting products. The Commission Services confirmed that this is the intention.

Annex III – Energy efficiency requirements

1. Energy efficiency requirements

Table 1 on light sources in scope – ECOS commented that the end loss factors are too high and may undermine the ambition; they will provide proposals. **IT** asked to expand the line "Other light sources in scope", in order to make clear all the lights that are concerned (especially LED is not mentioned).

Number of tiers – SE asked to add a second tier at 2023 to phase out all non-LED technologies and to consider moving the phase out of T8 to this second tier. **CLASP** supported a second tier, suggesting, as second-best options, to either apply the same approach of Reg. (EU) 1194/2012 (i.e. that the second tier should apply on a specific date only if evidence is produced by the Commission on its feasibility) or setting the tier 2 date later. **NL** agreed that a second tier could be a solution for certain aspects, including the T8 phase out and the removability requirement, but, together with **AT**, opposed setting tiers that would apply after review dates. **ECOS** suggested that a second tier could include the application of article 4 on removability. This was supported by **EEB,** which added the reduction of standby power limit to 0.2 and the phase out of all lamps containing mercury.

Correction factors – IT asked to delete "C" in the column "Bonus on C" in Table 2 because it is redundant. **DK** asked to have the same table in the ecodesign and in the energy labelling acts. **CLASP** repeated its comment made for Article 2/Annex II about using the "total flux" instead of the "useful flux" because this would simplify the calculation formula proposed in the draft legislation, by removing the correction factors.

Energy savings – CER stated that the quality of the lighting should be taken more into account, as energy savings are not always comparable to the watt output.

T8 phase out – LightingEurope stated that a phase out in September 2020 of T8 lamps is too early and proposed to add a tier for this (e.g. at 2023). LightingEurope added that it could be useful to check in which areas the phase out would cause problems and asked the contractor VHK if they made a sensitivity analysis on the phase out timing. **The Contractor** replied that they did so and that for every year of delayed phase out, there would a loss of around 2-3 TWh of energy savings. **CER** and **EIM** stated that the railway sector is one of the problematic areas and that they need more time for the phase out. **SE** stated that they would not be happy with delaying the phase out of T8 and that a business model based on LED technologies would improve security, safety and statics. On the contrary, **PL** stated the delay is necessary because there are no suitable LED replacements for T8 yet when these use controls. Moreover, especially in Eastern countries (which are heavily using T8 lamps) EU funding for energy efficiency has been used recently to install systems with conventional lighting solutions (including e.g. schools) and it would be inefficient to already push end-users to new investment for their replacement. It is

also disputable whether LED retrofit solutions can comply with the legislation for light quality and safety in e.g. offices. PL would share an investigation made by Polish market surveillance authorities on 400 lights. While agreeing that removing T8 is very good ambition that needs to happen, **IALD** supported PL and asked to consider the economic impact when setting the phase-out date, especially for cases that would require changing the lighting system. Lighting control systems recently developed for T8, which are used in Southern and Eastern Europe, would not work well with LED retrofits. **DE** stated that suitable LED replacements are not available for all applications of LFL T8, e.g. in high ambient temperature, in chemically aggressive atmospheres or in applications that require overvoltage protection. DE added that they are analysing areas where the T8 phase out would create problems, according to feedback from German stakeholders; railways, street lighting, chemical atmospheres with high temperatures and those areas where turning machines are used (as they are impacted by the stroboscopic effect from LEDs). In response to other stakeholders DE stated that they do see major opportunities in terms of energy efficiency (especially in office spaces) and that in many cases there are suitable replacements for T8 lamps. DE stated that its position on LFL T8 was not yet final and referred to the written comments. **EEB** stated that the phase out of T8 is a unique opportunity to get rid of lamps containing mercury. **CLASP** supported the proposed phase out of T8 lamps and reported that today most of the new installations are with LED (e.g. the city of Paris has completely converted its metro stations and platforms to LED). CLASP underlined that 2020 is not an early date, because the last time that the EU laid down ecodesign requirement for T8 lamps was in 2010. With reference to the criticism that LED retrofits (which are directional lamps) cannot properly replace T8 lamps (which radiate light 360º), CLASP asked for feedback from LightingEurope in view of the fact that: 1. many members of LightingEurope already today produce LED retrofits of very good quality; 2. there are LEDs today that have double the lumen per watt than T8; and 3. companies like Philips had 68% of their revenue in the third quarter of 2017 from LED. **LightingEurope** confirmed the trend to use LED in new installations and to produce LED retrofits. However, as the phase out of T8 lamps is happening naturally, they consider it superfluous to regulate them and would leave the timing to the market. **AT** stressed that the phase out of T8 needs to be agreed now with a clear timing, as it would represent 90% of the energy savings.

Halogen phase out – LightingEurope suggested eliminating the phase out of halogen lamps like G4 and G9, because it would be a small portion of the energy savings and could go against the principle of circular economy as regards luminaires using halogens that could not be refurbished anymore. As for R7s, LightingEurope asked to raise the limit to 5500 lumen. On the contrary, **SE** and **DK** strongly supported the phase out of halogens proposed by the Commission. If a second tier is added, **AT** suggested to phase out all R7s at that moment; AT also asked the Commission to verify that suitable LED replacements exist for G4 and G9 in September 2020. **DE** proposed for discussion the option to phase out luminaires with G9 and R7s sockets instead of phasing out the lamps.

Colour tuneable lighting – CECED asked to treat differently lighting used for illumination from lighting used for decorative purposes.

Separate control gear – CECED asked to keep in mind that there are applications where the control gear cannot be separated from the overall control board of the appliance and can thus not be measured to check the requirements.

Standby power consumption – DK recommended lower limits, supported by **TOPTEN** which proposed 0.2 for standby and 0.5 including network standby for light sources and 0.2 standby for control gears. **EEB** proposed 0.2 for standby, with the option to have it at the second tier if this is added.

2. Functional requirements

Flicker and temporary light artefacts – UK and **DK** asked for a more ambitious flicker requirement that would cover more than 50% of the population. **DE** and **SE** appreciated the flicker requirement and asked to address another temporary light artefact – the stroboscopic effect – by including at least an information requirement. **CLASP** and **ANEC/BEUC** supported the proposed requirement for flicker and adding the stroboscopic effect. CLASP suggested that in a possible tier 2 these two requirements could become more stringent and ANEC BEUC asked to pay attention to modulation and frequency, and to define better test methods. **IT** and **LightingEurope** asked to remove the requirement for flicker.

The Commission Services replied that the proposed flicker requirement is based on an international standard which is used by Australia and USA and reminded that in 2013 the Commission issued a mandate to CEN-CENELEC to develop standards on flicker and stroboscopic effects but that there is no deliverable yet. According to the latest information, CEN-CENELEC will build the EN standard on the existing international standard (which also covers the stroboscopic effect).

Colour rendering index (CRI) – AT, SE and **DK** suggested expanding the CRI from R8 (with eight colours) to R9 (by adding red); AT asked to consider as well R14 or R99, with 14 and 99 colours respectively. **IALD** and **ANEC/BEUC** supported to use at least R9 (ANEC/BEUC reported that in a recent test they did with R9 and R14, many lamps failed R9). Regarding products with CRI < 80, **DE** considered it important to put on the light source packaging that such light source is not suitable for household/interior use.

Displacement factor – DK suggested keeping it at 0.5 for P between 5 and 25W, which is in line with CEN/CENELEC standards.

Colour consistency – ANEC/BEUC asked to reduce the steps of the MacAdam ellipse from six to two or three, reporting that today almost all light sources satisfy this requirement; with fewer steps, the light quality of the products on the market would increase and this would help keeping the same light effect when replacing a lamp in multiple spotlights. **SE** suggested either setting four steps as an information requirement or applying the "u prime, v prime" method as it was proposed for measuring the white light area.

Lifetime requirement – ANEC/BEUC, EEB and **ECOS** asked to introduce a functional requirement on lifetime of LED, stating that is necessary to avoid poor quality LED on the market that would hinder the energy savings goals and put some control on self-declarations from producers. ANEC/BEUC stated that especially if the mandatory removability in article 4 is weakened, it would be necessary to

inform customers on lifetime. **CLASP** asked to reconsider the introduction of a minimum lifetime requirement for LED without test which could be set at 15 000 hours. **AT** and **IT** stated to be against a lifetime requirement based on declaration only. **LightingEurope** agreed on the importance of a lifetime requirement but was against having a declared value because if this value is not true the lighting company is not legally liable and the whole exercise would be a loss of time for market surveillance authorities. LightingEurope prefers the approach to motivate its members to offer good products and make honest promises to consumers. On this point **AT,** based on their market surveillance experience, commented that at least for the domestic segment this is often not the case, especially for lumen maintenance and light quality. Together with **DE**, **AT** agreed that industry has enough information on the lifetime of their products and the legislation could require this information to be on the packaging.

SE and **DK** stated to be in favour of a lifetime requirement.

The discussion on the methods to measure lifetime continued under Annex V.

Functional requirements for separate control gears – CLASP asked to add a displacement factor and a minimum lifetime requirement.

Dimmable light sources and control gears – CECAPI asked to add a functional requirement for dimmable lighting products.

Power definition in Table 4 – IT asked to specify if it is $P_{on.}$

3. Information requirements

General comments – LightingEurope stated that the number of information requirements increased and asked to keep it at the level of today; they also asked for flexibility on the way that companies should provide information to market surveillance authorities.

Alignment with energy labelling – NL asked to ensure a good alignment with the energy labelling act and that no extra information requirement is imposed on companies. **UK** asked in particular to clarify that only one website would be fine for both acts.

Information on the packaging – ANEC/BEUC called for a verification system as regards what is declared on the packaging of lighting products.

Annex IV – Verification procedures for market surveillance authorities

Procedure – DK asked to specify the purpose of the verification of a single unit in (1) and to reconsider the sequence of the procedure, in particular the steps before the test, which comes only at (4) and which is run if the technical documentation is in order. **DE** supported this point asking to leave flexibility to market surveillance authorities on the order of the procedure (if, for example, they want to test the products before checking the documentation). The **Commission Services** asked for suggestions for improvement, bearing in mind that this procedure runs across all products regulations.

Number of units to be tested – UK, NL and **IT** opposed to test only three units of a product whose acquisition costs exceed 500 euro and asked to have always 10 units to test. **IT** welcomed the reduction from 20 to 10 units to be tested but asked the Commission if the relevance of the tolerance values was verified with the new number (e.g. with a Round Robin test). **BE** proposed to have three units to test in all cases. The **Commission Services** replied that they did not run a Round Robin test or similar check.

Tolerance ranges – SE commented that Table 6 is based on the verification tolerances used in Sweden and proposed the other Member States to discuss it and fine-tune it bilaterally. **LightingEurope** opposed the reduction of the sample units in combination with stricter tolerance ranges, stating that a smaller sample would require higher tolerances, in order to take into account among others the laboratory variability and the production variability. **SE** opposed to take into account production variability in the tolerances and **BE** suggested to add a recital to clarify that tolerance ranges are not meant to take account of production variability. **DK** asked to reconsider the fact to have separate tolerances for Power factor and for Useful luminous flux, because especially in the case of three unit sample, the tolerance would be high (10% + 10%) and could mean a jump of two energy labelling classes. **DE** stated that the tolerance range for the luminous flux is too narrow, asked for consistent wording in Table 6 (exceed, be less, deviate are used as synonymous) and to state that the determined value should prevail on the declared value. **AT** noted that the wording for parameters in Table 6, which as regards information requirements is worded more loosely than the other ecodesign requirements and asked to align it to the most stringent approach ("deviate").

Containing products – LightingEurope asked the Commission to confirm that "without permanent mechanical damage" applies to the light source and control gear versus the containing product, when the manufacturer/importer of a containing product is required to provide instructions to market surveillance authorities on how to dismount the lighting product. The Commission Services confirmed so.

"To be used by" date – for retail bulbs for households, **IALD** proposed to consider to have a date on the product packaging by when the light is guaranteed to keep a good lumen maintenance, as this could save work to market surveillance authorities.

Annex V – Functionality after accelerated endurance testing
(the discussion continued from Annex III on Lifetime)

Reduction of testing time – LightingEurope welcomed the reduction of the 6000 h test to 1000 h, but would favour a 500 h test, to be combined with information requirements on the packaging and the promise of the manufacturer to the consumer. **AT** agreed to reduce the testing time but commented that for household products a test of 500 h is not enough to avoid products of bad quality on the market. **CLASP** proposed two texts that would look at survival and lumen maintenance: the first is based on the EPA Energy Star method ISTMT (In-situ temperature measurement test) + LM80 report which takes two days and is used by industry to test L70. All LEDs manufactured today have an LM80 report, and so the only variable that needs to be established is the LED junction temperature under steady-state operation, which enables a calculation to determine the 70% lumen depreciation point. The second test is LM-84 that lasts 3000 hours. **DK**, **SE** and **NL**

agreed with LightingEurope that the current 6000 h test is too long and a burden for market surveillance authorities, and would be in favour of exploring the shorter options that CLASP mentioned, even though **NL** would not favour tests longer than 1000 h. **DE** asked to keep the 6000 h test because their experience shows that in the first 3000 h of testing no lighting product fails. While agreeing that a test of 6000 h is indeed too long, **IALD** strongly opposed having short tests that could be too easily passed.

Three tests – LightingEurope criticised the complexity of having to do three tests and underlined that the best protection for consumers comes from market surveillance and simplicity is needed to facilitate market surveillance. **ANEC/BEUC** asked to clarify if the three tests of 1000 h each mean 3000 h in total, if the tests need to run in sequence and if 10 units per test are needed (for a total of 30 units). **NL** stated that 30 units would be too many. The **Commission Services** replied that the tests require 30 units but they are open to reconsider the whole structure of the tests.

Temperature cycling test (test (1)) – LightingEurope believed that very few market surveillance authorities have a climate chamber with the required temperature variation available. **CLASP** stated that it is an expensive test and proposed to remove it.

Switching cycle test (test (2)) – AT proposed to combine/integrate the switching cycle test (test (2)) with the life test (test (3)) because from their experience, at least for household lamps, the switching test alone is not useful. **CLASP** supported this and asked to verify in the wording if 1000 h refers to lifetime or to the switching cycle.

Accelerated operation life test (test (3)) – CLASP supported this test as a valuable tool to avoid loopholes for lamps that claim to be exempt for high temperature operation.

Annex VI – Benchmark
No comments.

4.2. Energy Labelling

Article 1 - Subject matter and scope

Luminaires – ANEC/BEUC and **TOPTEN** stated to be against the removal of the label for luminaires because consumers would miss information on the contained light source and its removability, which should be kept especially if the proposed article 4 on removability in the ecodesign text may be reconsidered. The **Commission Services** replied that the label would be discontinued but information requirements on the light source apply as required in Annex V.3.2 and that if there would be any change to the proposed article 4 in ecodesign, the information requirements will be adapted accordingly in order to keep at least the same level of information on removability.

Article 2 – Definitions and Annex II – Definitions

Consistency with the definitions in ecodesign – IT reiterated their request to use the same wording for the same definitions in ecodesign.

Final owner – IT asked to delete this definition.

Light source – BE asked to confirm that the definition of light source in the ecodesign and energy labelling is the same. The **Commission Services** confirmed, adding that the exemptions are different.

Article 3 - Obligations of suppliers & Article 4 - Obligation of dealers

Suggestions for improvement – DE asked to double check the wording to avoid repetitions of the general obligations laid down in the framework regulation.

Sticker for relabelling – DE agreed with the Commission's proposal and stressed the importance of avoiding concurrent labels, in the spirit of the new framework regulation. On the contrary, **NL** and **IT** stated that applying a sticker to every product is not a feasible solution: as the framework regulation provides the opportunity to apply other solutions for those products that have the label printed on the packaging, they asked to consider as a compliant solution to not physically relabel every single product; **NL** stated that a good information campaign could be a solution. **IALD** stated that, while they see the difficulty to sticker every product, it is necessary to give consumers the right information, especially because lighting products stay on the market for very long (even up to ten years). **CLASP** observed a contradiction with what was said for lifetime (that a long test for lifetime does not make sense because products on the shelves have a quick turnover). **LightingEurope** confirmed that a new generation of LED is placed on the market every half year. **Independent Retail Europe** and **EuroCommerce** opposed stickers and proposed to have panels/signs on the shelves informing consumers on the rescaling for lamps. **LightingEurope** disagreed with the Commission's proposal.

Side for the label – IT asked to remove the obligation to have the label printed on the side that would face the consumer in the shop, because they find it confusing and a verification burden for surveillance authorities.

Label for business-to-business – LightingEurope asked to have the physical label only at final points of sale for business-to-business customers. The **Commission Services** confirmed that this is the intention.

Suppliers of containing products – NL and **CECED** asked to confirm that suppliers of containing products are not subject to the obligations laid down in article 3.1 but only to article 3.2. In addition **DK** asked to confirm that Annex V.4 on EPREL does not apply to containing products. The **Commission Services** confirmed on both points that this is the intention, reminding that only the information on the contained light source goes into the EPREL database and it is the responsibility of the manufacturer/importer of the lighting product to comply with this. **IT** asked what happens if a containing product that is subject to EPREL (e.g. fridges for domestic use) changes the type of lamp: would the manufacturer/importer of the fridge need to update the technical documentation in EPREL just for the light? The **Commission Services** replied that this is true for all components of a fridge that would bring changes in the technical documentation.

Eco-lamps – EEB asked to retain the possibility that is in the current legislation to call a lamp "eco-lamp", but making the conditions more stringent.

Article 5 – Measurement methods

No comments.

Article 6 – Verification procedure for market surveillance purposes

No comments.

Article 7 – Revision

No comments.

Article 8 – Repeal

No comments.

Article 9 – Entry into force and application

Derogation to 30 days – DE stated to be against and asked to apply the standard 14 days laid down in the framework regulation. **Independent Retail Europe** and **EuroCommerce** stated instead that minimum six months would be needed and asked if 30 days are working days. **NL** shared the concerns of Independent Retail Europe and EuroCommerce.

Annex I – Exemptions

Range hoods – CECED requested to exempt range hoods, as these products already have a label for the contained light source.

Annex II – Definitions

See Article 2.

Annex III – Label for light sources

QR code – IT and **EEB** asked to make it clear that the QR should link to EPREL. **LightingEurope** asked not to make the QR code mandatory, as over time the link could be broken or the information moved elsewhere; moreover if the printed link links to EPREL it would not be appropriate for products that are sold also outside the EU. The **Commission Services** confirmed that the QR code would link to EPREL and acknowledged that products with that QR code could be sold outside the EU where the label is not mandatory. The Commission Services also clarified that the inclusion of a QR code cannot be on a voluntary base and stated that it is intended to be a useful tool for consumers.

Standby consumption – TOPTEN proposed to eliminate the consumption per 1000 h and to put instead the actual consumption, including the standby consumption, and for the luminaire label (once it is decided to continue it), the control gear consumption. **DK** asked to include the standby consumption in the 1000 h value.

Label design – DE stated not to be happy with the proposed design and would share suggestions. **ANEC/BEUC** asked for information about the intention of the Commission to run a consumers' survey that would look into the label design and to be informed about the outcome. **The Commission Services** replied that they will share the terms of reference.

Annex IV – Energy efficiency classes and calculation method

Resulting classes – IT commented that today (not in September 2020) products would all be in classes G or F. **LightingEurope** considered classes A and B too ambitious. **TOPTEN** asked to add standby consumption in the calculation and to add an allowance for "low lumen-low voltage" bulbs, in order to discourage consumers buying high lumen bulbs just because these are in top classes. **CLASP** congratulated the Commission for the proposed classes, reminded that in 2017 a LED bulb with 200lm/W exists (the Dubai lamp) and supported TOPTEN on having standby consumption in the calculation.

Time perspective – UK suggested that a sales estimation after eight years and not after ten years would be more appropriate in view of the review planned after ten years, especially if top classes do not fill up as expected. The **Consultant** replied that estimations are based on data provided by industry and would not find it surprising if the opposite happens (that classes fill up quicker than estimated).

Correction factors – *see comments on correction factors made for Annex III of the ecodesign proposal.*

Annex V – Product information

Content of EPREL – LightingEurope asked that only information on energy labelling should be in EPREL and not on ecodesign, as EPREL is so far thought for labelling only. **EEB** stated that instead it would be a good occasion to have ecodesign and energy labelling information already in one system. The **Commission Services** clarified that the approach of the Commission is to align the requirements in the two texts to avoid duplication when it is the same information.

Luminaires in EPREL – LightingEurope requested to exempt luminaires from EPREL, as in the draft text it is proposed to discontinue the energy label for luminaires. The **Commission Services** stated that EPREL applies from 1 January 2019 which is before the proposed date to discontinue the label for luminaires (1 September 2020) and thus in principle luminaires are in scope of EPREL.

More than one lighting product in a containing product – LightingEurope asked to clarify if, in the case of a containing product such a luminaires with several light sources, the information for all light sources needs to be shown. The **Contractor** replied that making a list of the contained lighting products does not seem to be a big burden.

Information to be put on the packaging of a containing product – LightingEurope opposed to have on the packaging the sentence 3.2(b) about the information on the contained light source, because it would need to be in 24 languages; it would be a burden especially for small packaging and for products containing more than one light source. **DE** suggested replacing the sentence with the

arrow proposed for the front packaging. The **Commission Services** replied that they will look into this issue.

Small packaging – BE asked to remove the last sentence of 3.1 about placing a label in proximity to the packaging in case of small packaging, as this provision would only create confusion.

Annex VI – Information to be provided in the case of distance selling, except distance selling on the Internet
&
Annex VII – Information to be provided in the case of distance selling through the Internet
&
Annex IX – Displaying the energy class and the range of efficiency classes in visual advertisements and in promotional material

Image – DE said that they would send suggestions for the design. **CECED** asked to ensure consistency within all the ecodesign acts and use the same arrow. The **Commission Services** replied that this is the intention.

Annex VIII – Verification procedure for market surveillance authorities

See comments for Annex IV of the ecodesign proposal.

5. AOB

UK asked whether the Commission could already give information on the Ecodesign Consultation Forum meetings that will be held in the first quarter of 2018.

The **Commission Services** replied that there might be a meeting on computers. For EPREL, meetings for each of the three main user groups (i.e. suppliers, market surveillance authorities and public) are scheduled for March 2018.

IT asked the Commission to provide a schedule in one table of all meetings until mid-2018 at one of the next meetings in December 2017. **ECOS** extended the requests for the meetings for preparatory studies.

The **Commission Services** will give indicative information but no dates.

LightingEurope asked information about the open public consultation that the Commission would run according to the Better Regulation procedure.

The **Commission Services** explained the procedure and specified that the consultation would cover all product groups under revision.

IALD asked about the work on lighting systems.

The **Commission Services** replied that it is not their intention to work on lighting systems before the ongoing review for lighting products is concluded.

Comments to the working documents are due by 26 January 2018.

Attendance List

Commission Services	
DG ENER	C.3
DG ENV	B.1

EU Member States	
AT	Austrian Energy Agency
BE	FPS Economy, SME, Selfemployed and Energy
BG	Permanent representation to the EU
CZ	State Energy Inspection Authority
	Ministry of Industry and Trade
DE	Federal Environment Agency
	Federal Institute for Materials Research and Testing
	Federal Ministry for Economic Affairs and Energy
	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
	Bavarian State Ministry for Environment and Consumer Protection
	Baden Württemberg Ministry of Environment, Climate Protection and the Energy Sector
DK	Danish Energy Agency
EE	Estonian Ministry of Economic Affairs and Communications
FI	Energy Authority
FR	Ministère de l'énergie et du développement durable
IE	Enterprise Ireland, Competitiveness
IT	ENEA
NL	Netherlands Enterprise Agency
PL	Ministry of Energy
SE	Swedish Energy Agency
UK	Department for Business, Energy & Industrial Strategy, Sustainable Energy using Products team, Home and Local Energy
	Department of Energy and Climate Change
EEA countries	
CH	Swiss Federal Office of Energy
NO	Norwegian Water Resources and Energy Directorate

Organisations	
AIE	**EIM**
ANEC/ BEUC	**EucoLight**
CECAPI	**EuRIC**
CECED	**EuroCommerce**
CEN/TC 169	**IALD**
CER	**Independent Retail Europe**
CLASP	**LightingEurope**
ECOS	**ORGALIME**
EEB	**TOPTEN**
EFIC	**VHK**

Annex 6: Employment and Market in the lighting sector

Preamble

This Annex groups information regarding enterprises, revenues and employment involved in the lighting business. The intended focus is EU28, but it is not always possible to split revenues and employment in extra-EU amounts and EU-amounts.

Although the lighting regulations also regard some aspects of luminaires, control gears and lighting controls, their main scope is light sources. However, data on enterprises, revenues and employment for light sources in scope are typically mixed with those for light sources out-of-scope, luminaires, control gears, lighting controls, lighting systems and lighting services. It is difficult to exactly relate the scope of the regulations to EU28 revenues and employment figures.

Summary

As for manufacturers of light sources, in 2015, 1.7 billion light sources for general lighting purposes were sold in EU28 with a total estimated purchase cost for consumers of EUR 14.8 billion, leading to EUR 9.7 billion revenues for industry, EUR 2.1 billion for the wholesale sector, EUR 1.9 billion for the retail sector and EUR 1.2 billion governmental tax incomes. Additionally, costs for installation and maintenance were of EUR 3.0 billion and EUR 5.0 billion[1].

In 2015, the total number of jobs (inside and outside of EU28) related to the sale of light sources in EU28 is estimated to be 234 000, of which 194 000 in industry (including manufacturing, OEM and services) and 39 000 in trade (wholesale and retail). Additionally, 30 000 jobs for installers and 50 000 jobs for maintenance are estimated[2].

The EU28 employment is estimated to amount to 95 000 jobs, of which 60 000 jobs in industry (including manufacturing, OEM suppliers and services) and 35 000 in trade. The major suppliers of light sources in EU28 are Philips Lighting[3], Ledvance/Osram, General Electric (GE) Lighting[4] and Feilo-Sylvania. Together, in the EU28 they signify EUR 3 billion of estimated revenue from the sale of light sources for general lighting and 15 000 jobs (manufacturing only)[5].

With the ongoing rapid shift to LED lighting, manufacturers of lighting-related electronics are required to adjust from electronic control gears for classical lighting technologies to drivers for LEDs. Less efficient electro-magnetic control gears are phased out from the market since 2017 and have been replaced by more efficient, high-frequency electronic ones. These manufactures have a dynamic business also for the increasing trend to have ‘smart lights" with new features.

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[1] Data from MELISA model, Impact Assessment study 2018. Business sector revenues are derived from acquisition costs using the sector shares reported in Annex 4 section 3.1.

[2] Jobs are derived from sector revenues using an average turnover per employee:

Industry:	20 jobs / mEUR revenue, EUR 50 000 / employee
	(1/3 manufacturing, 1/3 OEM, 1/3 services)
Wholesale:	4 jobs / mEUR revenue, EUR 250 000 / employee
Retail:	16.7 jobs / mEUR revenue, EUR 60 000 / employee
Installation:	10 jobs / mEUR revenue, EUR 100 000 / employee
Maintenance:	10 jobs / mEUR revenue, EUR 100 000 / employee

[3] The company is now separate from former mother-company Philips and is quoted on the stock exchange. Its name will soon change to ‘Signify’, to reflect the separation from Philips.

[4] Non-American parts of GE have been bought by a Hungarian company in 2018. GE is also selling the rest of its lighting business.

[5] Revenues and employment figures relate to light sources. They do not include the production, sales and installation of luminaires, nor the design and installation of lighting systems in the non-residential sector. In the current regulation, the luminaire manufacturers are in scope of Energy labelling only.

Retailers and wholesalers are faced with a highly dynamic market: first there was the shift from incandescent light bulbs to halogen and fluorescent lamps; now, with the uptake of LEDs, new models are being introduced on the market at a high frequency. Some retailers have decided to sell only LED lamps[6]. Sales on internet are increasing. The European associations for retailers are Independent Retail Europe and EuroCommerce.

Details from modelling

The data regarding revenues and related employment in the lighting business have been derived from the MELISA model for the BAU scenario.

Economic and employment results of MELISA for BAU: EU28 totals and subdivision in Non-LED and LED.

EU28 Totals (all sectors)		1990	2010	2015	2020	2025	2030
Sales	**mln units**	**2112**	**2353**	**1702**	**1737**	**929**	**737**
Of which (o/w) Non-LED		*2112*	*2345*	*1330*	*604*	*288*	*140*
o/w LED		*0*	*8*	*372*	*1133*	*641*	*597*
Stock	**mln units**	**5576**	**10045**	**11360**	**12459**	**13492**	**14635**
o/w Non-LED		*5576*	*10031*	*10615*	*7320*	*4300*	*2709*
o/w LED		*0*	*14*	*745*	*5138*	*9192*	*11926*
Purchase Cost	**mln euros**	**4623**	**10428**	**14849**	**13078**	**8346**	**8264**
o/w Non-LED		*4623*	*10143*	*7099*	*3840*	*2070*	*1100*
o/w LED		*0*	*285*	*7750*	*9238*	*6277*	*7164*
o/w Industry Revenue	mln euros	2886	5980	9703	9306	6308	6438
o/w Non-LED		*2886*	*5788*	*4076*	*2508*	*1451*	*806*
o/w LED		*0*	*192*	*5626*	*6798*	*4857*	*5632*
o/w Wholesale Revenue	mln euros	752	1925	2078	1531	917	853
o/w Non-LED		*752*	*1896*	*1303*	*608*	*289*	*137*
o/w LED		*0*	*28*	*775*	*924*	*628*	*716*
o/w Retail Revenue	mln euros	709	1776	1877	1374	867	827
o/w Non-LED		*709*	*1754*	*1211*	*563*	*271*	*129*
o/w LED		*0*	*22*	*666*	*811*	*596*	*698*
o/w Taxes (VAT)	mln euros	277	747	1192	866	254	146
o/w Non-LED		*277*	*705*	*509*	*162*	*58*	*28*
o/w LED		*0*	*42*	*683*	*705*	*196*	*118*
Installation Cost	**mln euros**	**2524**	**3975**	**3009**	**3067**	**2599**	**2525**
o/w Non-LED		*2524*	*3973*	*2705*	*1964*	*1189*	*651*
o/w LED		*0*	*2*	*304*	*1103*	*1411*	*1873*
Maintenance Cost	**mln euros**	**1852**	**4509**	**4981**	**5611**	**6349**	**7183**
o/w Non-LED		*1852*	*4507*	*4705*	*3815*	*2424*	*1362*
o/w LED		*0*	*1*	*275*	*1796*	*3925*	*5821*
Purchase related Jobs	**thousands**	**73**	**157**	**234**	**215**	**144**	**146**
o/w Non-LED		*73*	*153*	*107*	*62*	*35*	*19*
o/w LED		*0*	*4*	*127*	*153*	*110*	*127*
o/w Industry	thousands	58	120	194	186	126	129
o/w Non-LED		*58*	*116*	*82*	*50*	*29*	*16*
o/w LED		*0*	*4*	*113*	*136*	*97*	*113*
o/w Wholesale	thousands	3	8	8	6	4	3

[6] "IKEA to sell only energy-saving LED lightbulbs" - The Guardian, August 2015

o/w Non-LED		*3*	*8*	*5*	*2*	*1*	*1*
o/w LED		*0*	*0*	*3*	*4*	*3*	*3*
o/w Retail	thousands	12	30	31	23	14	14
o/w Non-LED		*12*	*29*	*20*	*9*	*5*	*2*
o/w LED		*0*	*0*	*11*	*14*	*10*	*12*
Installation Jobs	**thousands**	**25**	**40**	**30**	**31**	**26**	**25**
o/w Non-LED		*25*	*40*	*27*	*20*	*12*	*7*
o/w LED		*0*	*0*	*3*	*11*	*14*	*19*
Maintenance Jobs	**thousands**	**19**	**45**	**50**	**56**	**63**	**72**
o/w Non-LED		*19*	*45*	*47*	*38*	*24*	*14*
o/w LED		*0*	*0*	*3*	*18*	*39*	*58*

An advantage of these figures from the MELISA model is that they are **only for light sources in the scope of the existing regulations**. E.g. special purpose lamps, automotive lamps, luminaires, non-integrated ballasts/controlgears/drivers, lighting controls (switches, dimmers, sensors, etc.), lighting systems, and lighting services are NOT included.
A major drawback of the figures is that they **do not distinguish between jobs inside EU28 and jobs outside EU28**. A significant portion (60-70%) of the industry jobs reported above is expected to be outside EU28.

The above figures regard **only direct jobs**. Indirect effects are not included, e.g. lighting business employees spending their income, or lighting consumers spending the money saved on energy costs (due to higher efficiency lamps) on other products, and thus creating indirect jobs elsewhere. These indirect jobs might well be 3 to 5 times the quantity of direct jobs associated with lighting, but there is no agreed quantification method.

Eurostat Business Statistics

The data in Table 61 have been derived from Eurostat Business statistics for NACE rev.2, group C 274: Manufacture of electric lighting equipment [7].

In 2014, Eurostat reports **7640 enterprises in EU28 that are involved in the manufacture of electric lighting equipment**. The large majority of these (5859) employs 9 persons or less. Only 91 enterprises (> 250 employed) are not SMEs.

These enterprises **employ a total of 152800 persons**, of which slightly less than half (70600) in large enterprises with over 250 employees.

The **annual turnover of these enterprises is 28.6 billion euros**, of which more than half (17.1 billion euros) is realized in the large enterprises.

The advantage of these data is that they **relate only to the EU28**. However, they also include e.g. manufacturing of luminaires, special purpose lamps and automotive lamps, and consequently are **only partly related to the scope of the existing lighting regulations**. It is unknown in how far they include ballasts/control gears/drivers, lighting systems, lighting services and LED lighting products. As there is **no separate NACE code for LED lighting products yet**, their suppliers might not always be included under lighting manufacturers. Some enterprises involved in lighting might have been registered

[7] Annual detailed enterprise statistics for industry (NACE Rev. 2, B-E) [sbs_na_ind_r2], extracted 26.04.2018, http://appsso.eurostat.ec.europa.eu/nui/show.do

under manufacture of electronic products (which form part of the manufacture of computer, electronic and optical products, Division 26).

Another doubt is how companies are handled that have lighting as their main business but also manufacture other products, or companies that have another main business but also produce lighting products.

Table 61: Eurostat statistics for NACE rev. 2 group C 274: Manufacture of electric lighting equipment; (Industry by employment size class (NACE Rev. 2, B-E) [sbs_sc_ind_r2], accessed May 2018)

EU28 totals	2008	2009	2010	2011	2012	2013	2014	2015	variation 2008-2014
Number of enterprises	8610	8197	8360	7900	7545	7265	7640		-11%
o/w with 0-9 employed	6469	6186	6115	5994	5656	5423	5859		-10%
o/w with 10-19 employed	920	809	889	823	831	776	706	768	-23%
o/w with 20-49 employed	691	677	634	598	594	591	596		-14%
o/w with 50-249 employed	417	400		390	374	385	390		-6%
o/w with > 250 employed	106			95	90	89	91	96	-16%
Number persons employed	185600	161600	158700	158500	153900	154800	152841	155553	-18%
o/w with 0-9 employed	17400	16200	15500	15200	15100	14400	15157		-13%
o/w with 10-19 employed	12600	10900	12600	11700	11800	10500	9454		-25%
o/w with 20-49 employed	21200	20100	19600	19200	18700	18400	18056		-15%
o/w with 50-249 employed	42000	41300	38200	39300	38700	40600	39558		-6%
o/w with > 250 employed	92400	73100	72000	73100	69700	70900	70617		-24%
Turnover (mln EUR)	27844	23718	25533	27681	27727	28163	28624	29552	+3%
o/w with 0-9 employed	1556	1378	1206	1488	1500	1320	1506	1375	-3%
o/w with 10-19 employed	1418	1268	1151	1527	1631	1297	1132	1367	-20%
o/w with 20-49 employed	2986	2417	2533	2621	2501	2646	2663	2628	-11%
o/w with 50-249 employed	6076	5249	5118	5668	5987	6204	6238	6560	+3%
o/w with > 250 employed	15808	13407	15454	16377	16107	16696	17085	17622	+8%

Eurostat ProdCom Statistics

Eurostat data up to 2013 [8] regarding production and trade of light sources and ballasts have been extensively reported in the Lot 8/9/19 study [9]. In the meantime 2014 data could be added, and the figures related to the economic values of production, import and export are reported below (for sales quantities in number of units see the reference [154]).

These data are exclusive most automotive lamps. Also Eurostat data do NOT include LED lamps, because there is no specific NACE product code for these lamps yet. In 2014, LED lamps have a significant economic value[10]. Overall, the reliability of these Eurostat data is low and outcomes are hardly comparable to industry data in MELISA.

[8] Eurostat, ProdCom, DS-056120-Sold production, exports and imports

[9] Preparatory Study on Light Sources for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'), Final Report, Tasks 2 Annex C, VHK for the European Commission, October 2015. http://ecodesign-lightsources.eu/documents

[10] Revenues from LED lighting are 30-40% of total revenues according to 2014 data from Philips and Osram.

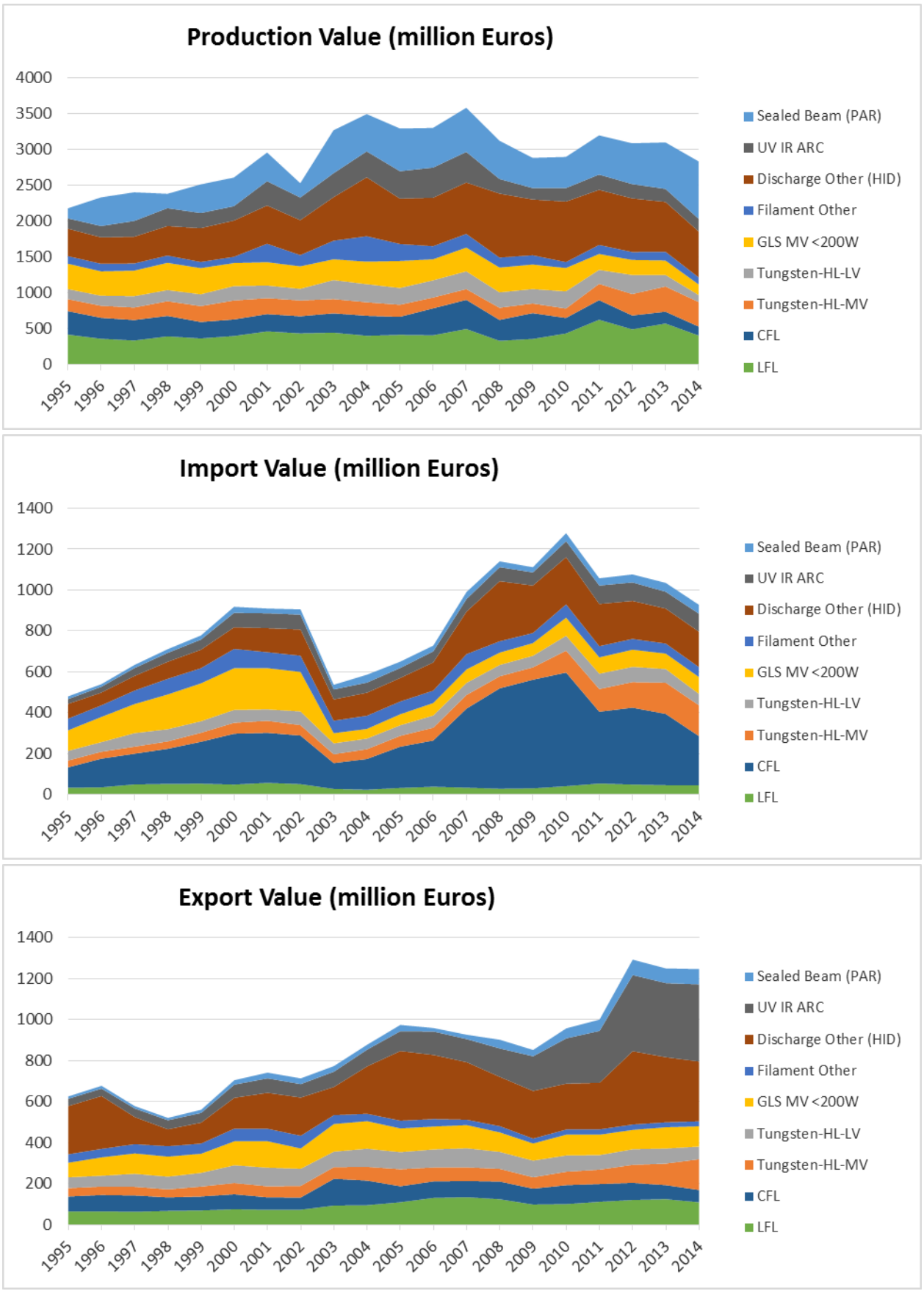


Figure 32 Eurostat ProdCom data for light sources. EU28 total values in mln EUR for production, import and export.

Stage 6 review

In the report on the review of stage 6 of CR 244/2009, the estimated number of European jobs involved in the phase-out of mains-voltage non-directional halogen lamps was estimated around 6800, including a loss of 4200 direct jobs in industry, a loss of 3100 indirect jobs [11] for suppliers and subcontractors and a positive effect around 500 jobs.

Philips Lighting

Philips Lighting is one of the major players on the EU28 lighting market. According to the full annual report over 2015[12], Philips, including Healthcare, Consumer Lifestyle and Lighting, had:

- Sales 24.2 bn EUR worldwide of which (o/w) 7.9 bn in EMEA [13].
- Employed 104 200 persons worldwide o/w 39 903 in EMEA.
    - o/w in Production 44%
    - o/w in R&D 11%
    - o/w Other 32%
    - o/w 3rd party workers 13%

- R&D centres 60 worldwide o/w 28 in EMEA.
- Manufacturing sites 95 worldwide o/w 35 in EMEA.
- R&D expenses 1.9 bn EUR worldwide

Considering only **Philips Lighting**:

- Sales 7.4 bn EUR worldwide of which (o/w) 2.2 bn in Western Europe
    - o/w Light Sources & Electronics 56% [14]
    - o/w Consumer Luminaires 7%
    - o/w Professional lighting solutions 37%

- Sales decline -3% comparable sales 2015 vs. 2014; -3% 2014 vs. 2013
- Employed 33 600 persons worldwide in 2015 (FTE)
- Employment decline-11% in 2015 vs. 2014; -2% 2014 vs. 2013
- R&D expenses 315 mln EUR worldwide

[11] Jobs lost to external contractors (repair and maintenance, catering, manufacturing of machines), to external component suppliers, upstream suppliers of raw materials, etc.

[12] http://www.philips.com/corporate/resources/annualresults/2015/PhilipsFullAnnualReport2015_English.pdf

[13] EMEA: Europe, Russia, Middle-East and Africa

[14] - Light Sources & Electronics: LED, eco-halogen, (compact) fluorescent, high-intensity discharge, incandescent, electronic and electromagnetic gear, modules and drivers.
- Consumer Luminaires: functional, decorative, lifestyle, scene-setting luminaires.
- Professional lighting solutions: controls and luminaires for city beautification, road lighting, sports lighting, office lighting, shop/hospitality lighting, industry lighting

The decline of 3% in comparable sales is due to the decline of conventional lighting. This is compensated for a large part by an increase of 25% in LED-related sales that in 2015 account for 43% of total lighting sales (was 34% in 2014).

The number of persons employed by Philips Lighting in EMEA is not reported but can be estimated around 13 000, assuming the same EMEA/World ratio for Philips Lighting as for Philips as a whole. **In 2015, EU28 employment for Philips Lighting could be around 10 000 – 12 000**.

Philips states that the conventional lamps industry is highly consolidated, with GE and OSRAM as main key competitors. The LED lighting market is very dynamic, with new competition from Asia and new players from the semiconductor and building management sectors. The luminaires industry is fragmented.

Since 2008, many of the Philips lighting factories in Western Europe have reduced personnel, been sold, or closed. Production has moved in particular to Poland, where Philips Lighting employed 9000 persons in 2013 [15], and to Asia (China, Malaysia).

As regards the **Philips Lumileds and Automotive Lighting business**, in January 2016 it was announced that the acquisition of a 80.1% share by a consortium led by GO Scale Capital has been cancelled. The CFIUS (Committee of Foreign Investment in the United States) did not grant clearance for this transaction. Anyway Philips is still actively discussing the sale of this combined business and expects a transaction to be completed in the year 2016.

From February 2016 Philips created a stand-alone structure for Philips Lighting. In the first half of 2016 they expect to announce the separation of the Lighting business. Both initial public offering and a private sale are reviewed options. So, essentially, **Philips wants to get out of the lighting business**.

OSRAM

Osram is one of the major players on the EU28 lighting market, and the main competitor of Philips. The following data have been derived from the OSRAM Licht Group annual report on fiscal 2015[16]:

- Revenue 5.574 bn EUR worldwide
    - Of which (o/w) 2.29 bn EUR in EMEA
    - o/w 0.79 bn EUR in Germany
    - o/w Speciality Lighting (SP) 1.85 bn EUR [17]

[15] http://www.eurofound.europa.eu/observatories/emcc/erm/factsheets/philips-lighting-poland

[16] http://www.osram-group.com/~/media/Files/O/Osram/documents/en/fiscal-year-2015/osram-annual-report-screen.pdf

[17] - SP: Main business automotive lighting (traditional, LED, OLED, laser). Other focus for cinemas, studios, stage lighting. Since 2015 includes OLED. SP is market leader in automotive with competitors Lumileds, Hella, Koito and Stanley Electrics. Main competitor for non-automotive speciality lighting is Ushio.
- OS: LEDs emitting visible light, other opto-semiconductors emitting non-visible light or receiving incoming light and converting into signals. Main demand from automotive, communications, industry. Competitors: Nichia, Lumileds, Cree and Asian companies as Samsung, Epistar, Everlight, LG Innotek, Seoul Semiconductor, Lite-On, Toyoda Gosei.

- o/w Opto Semiconductors (OS) 1.29 bn euros
- o/w Digital Systems (DS) not reported
- o/w Lighting Solutions (LS) 0.96 bn euros
- o/w Lamps (LP) 2.00 bn euros

- Decline -1% comparable sales 2015 vs. 2014

- Employed 33 800 persons worldwide (FTE)
  - o/w 13 800 in EMEA
  - o/w 8 900 in Germany
  - o/w Speciality Lighting (SP) 6 100 persons
  - o/w Opto Semiconductors (OS) 9 200 persons
  - o/w Digital Systems (DS) 3 000 persons
  - o/w Lighting Solutions (LS) 1 900 persons
  - o/w Lamps (LP) 10 100 persons

  - o/w production and service 24 300 persons
  - o/w selling 4 300 persons
  - o/w administration and general 1 800 persons
  - o/w research and development 2 400 persons

- Decline
  - -2.6% employment 2015 vs. 2014
  - -17% employment 2015 vs. 2011[18]

In 2015, earnings were positive for SP (EUR 245 million) and OS (EUR 230 million), but negative for LS (EUR -42 million) and LP (EUR -48 million).

Traditional lamp business contracted by 11.7% while LED lamps business grew by 26.8%.

Under the Osram Push program, the company's target is to **reduce jobs by 7 800 in the period 2014 – 2017** (o/w 2 400 have now been realized), and to reduce costs by 1 EUR

- DS: LED light engines (=LED module+control gear), electronic ballasts for LED and traditional, light management systems. Main competitors are Philips, Zumtobel, Lutron, and Asian manufacturers as Toshiba, Panasonic, Samsung, LG, Delta Electronics. In addition large number of product specialized manufacturers.
- LS: production and sale of luminaires; design and implementation of solutions for internal and external lighting; lighting service business. Focus on street lighting, architectural design, professional interior lighting. Highly fragmented market: 5 leading providers have 30% of market. Main competitors in EU: Zumtobel, Philips, Fagerhult, Trilux, Schreder, Eglo Leuchten.
- LP: General lighting lamp business, both traditional offerings and LED retrofit lamps. Three leading companies Philips, Osram and General Electric have market share over 50%. Regarding LED retrofit, these 3 leaders are joined by large number of medium-sized and small producers, including low-cost suppliers from Asia.

[18] An article in 'Die Welt' of March 2012, reports 41 000 employees for Osram worldwide and 10 100 in Germany. This is based on 2011 company information.
http://www.welt.de/wirtschaft/article13915827/Fuer-tausende-Osram-Mitarbeiter-geht-das-Licht-aus.html

300 mln over the same period. Transformation costs will be EUR 450 mln over the same period.

In part due to this program, but also in earlier years, many of the Osram factories in Western Europe have reduced personnel. An example is the plant producing fluorescent lamps in Augsburg that employed 2200 workers in 2008, 1550 in 2012, 1200 in 2014 and is down to 1023 in November 2015. The plant will probably be split off from the company and sold, maybe into Chinese hands[19]. Other factories in Germany, France and Italy show similar destinies.

The **traditional technology lighting sector of Osram** was as of January 2016 **for sale**, and the company will concentrate on LED lighting. Up to 2020, Osram intends to invest EUR 3 billion in LED lighting, including EUR 2 billion for research and development and EUR 1 billion for a new LED-chip plant in Malaysia [20]. New investments of the Digital Systems division are also being made in Plovdiv, Bulgaria, where a new 900 jobs plant is expected to start functioning in 2017 [21] and in Nitra (Slovakia) [22].

General Electric (GE)

General Electric (US-based) and consolidated affiliates are active in Power, Renewable Energy, Oil & Gas, Energy Management, Aviation, Healthcare, Transportation and Appliances & Lighting. GE is indicated by Philips and by Osram as one of the main competitors in the EU lighting business.

The total 2015 revenue for all these sectors is reported as 109 billion dollars[23], of which Appliances & Lighting covers 8.8 billion. Of the latter, 72% is lighting and 3% of the revenues come from Europe.

Consequently, **GE revenues from lighting in EU in 2015** can be estimated as 8800*72%*3% = 190 mln US dollars = **170 mln euros**[24]. Compared to Philips and Osram that are each around 2 billion euros, this is modest.

In 2015, GE Appliances & Lighting employed 24 000 persons worldwide.

GE's European lighting factories are mainly in Hungary and in 2008 are reported to have employed around 10 000 persons, but this is now probably down to **less than 6 000**. The main plant is in Nagykanizsa and employed 4 200 people in 2015.

[19] http://www.welt.de/wirtschaft/article13915827/Fuer-tausende-Osram-Mitarbeiter-geht-das-Licht-aus.html, http://www.augsburger-allgemeine.de/augsburg/Osram-streicht-mehr-als-800-Stellen-Werk-Schwabmuenchen-auf-der-Kippe-id31374162.html, http://www.br.de/nachrichten/schwaben/inhalt/osram-schwaben-sparprogramm-100.html

[20] http://www.reuters.com/article/us-philips-osram-licht-divestments-idUSKBN0UM1W020160108, http://www.produktion.de/nachrichten/unternehmen-maerkte/osram-will-chiphersteller-werden-277.html

[21] http://www.focus-fen.net/news/2016/03/23/401325/bulgaria-economy-minister-attended-groundbreaking-ceremony-for-osram-factory-roundup.html

[22] http://ww.plusden.sk/regiony/zapadne-slovensko/najprv-vyhadzov-teraz-nabor-novozamocka-firma-chce-zamestnavat.html, http://www.nitralive.sk/vystavba/budovy/24456-osram-planuje-v-nitre-postavit-novy-zavod

[23] General Electric Annual Report 2015, http://www.ge.com/ar2015/assets/pdf/GE_AR15.pdf

[24] Exchange rate of 28/04/2016: 1 dollar = 0.88 euros

Havells-Sylvania

Havells was an India-based company that has its main activities in cables (42% of stand-alone turnover), switchgears, electric consumer durables and Lighting & Fixtures.

The total 2015 net sales (consolidated) are reported as 8569 crores[25] = 1139 mln euros, of which 4072 crores = **EUR 541 mln for Lighting&Fixtures**. Havells itself realized EUR 98 mln of this while affiliate Sylvania was good for EUR 443 mln.

These data are worldwide; no details are reported on revenues from Europe.

In spring 2016 Havells sold the majority of Sylvania shares to Chinese Feilo, so that the companies name is now **Feilo Sylvania**.

Sylvania's main European lighting factories are in Tienen (B), Erlangen (D), Newhaven (UK) and St Etienne (F), employing a **total of 600-800 employees** in 2015. This includes also luminaire production of the Concord and Lumiance brands.

The Tienen plant, producing halogen-, HID- and LED-lamps reduced personnel in recent years, passing from over 600 people in 2008 to the current 300. The Erlangen plant met a similar destiny, passing from 580 people in 2007 to the current 200.

Concluding on revenues

Philips Lighting reports revenue of EUR 2.2 billion in Western Europe of which 56% for light sources and electronics, i.e. EUR 1.23 billion. For the entire EU28, including parts of Central and Eastern Europe, the total revenue from light sources could be around EUR 1.5 billion.

Osram reports a revenue of EUR 2.3 billion in EMEA, of which 50% can be estimated to be related to light sources (LP-division and part of OS-division), i.e. EUR 1.15 billion. For EU28 this will be slightly smaller than for EMEA, around EUR 1.0 billion.

The contribution of GE-Lighting and Sylvania to light source related revenues can be estimated in maximum EUR 0.5 billion.

Summing these contributions, a total EU28 revenue for light sources around EUR 3 billion can be estimated for the four main suppliers, of which around 40% LED-related, i.e. EUR 1.8 billion for conventional light sources and EUR 1.2 billion for LED light sources. Note however that these suppliers only represent a share of the market.

Concluding on employment

Philips Lighting is estimated to employ 10 000 – 12 000 persons in EU28. Osram employment in EU28 is similar (between 8 900 in Germany and 13 800 in EMEA). GE-Lighting and Sylvania can be estimated to employ 7000 persons in EU28.

This sums up to around 30 000 direct industry jobs for the four main suppliers, but probably less than 50% of these (15 000) are related to manufacturing of light sources in the scope of the regulation (others are for e.g. luminaires, lighting systems, speciality lamps, automotive lamps). Assuming that indirect jobs at suppliers, subcontractors, servicers are twice this amount[26], a total of 45 000 industry jobs results for the four main

[25] 1 Crore Rupees = 10 million rupees = 151 000 US dollars = 132 880 EUR(April 2016).

[26] The Lot 8/9/19 study assumed as industry jobs 1/3 manufacturing, 1/3 OEM and 1/3 services.

suppliers. Extending this to all EU28 suppliers of light sources, this could become **around 60 000 jobs in EU28 related to light sources** (excluding luminaires).

Involvement of EU companies in LED light source production

The text and tables presented below have been taken from a 2017 US DoE report[27] on the LED market. This is not a full survey of EU companies involved in production of LED lighting products: only key companies as identified by US DoE are included, but it gives a rough idea of the spread of activities over America, Asia and Europe.

Only few EU companies are involved in manufacturing of basic LED components (dies, packages), and even these have their main production sites in Asia.

The EU share of LED-related activities is larger for production equipment (epitaxial growth; vapour deposition), wafer processing-, test- and inspection-equipment.

From US DoE report:

> *LED, lamp, and luminaire manufacturing are global enterprises with a global supply chain. Some geographical production trends can be identified; however, many of the input materials and semiconductor processing tools are produced worldwide. Table 6.2 and Table 6.3 highlight the global nature of SSL manufacturing by listing some of the key companies in each major geographical region involved in the manufacturing of LED-based SSL products and in the supply of equipment and materials to that market. These tables categorize geographical location based on company headquarter location and may not accurately reflect the balance of manufacturing activity.*

Table 6.2 The LED Supply Chain: LED Die, LED Package, and Luminaire Manufacturers

Supply Chain	North America	Europe	Asia
Die Manufacturing	• Cree • Lumileds • Bridgelux • Soraa • SemiLEDs • Luminus Devices	• OSRAM Opto Semiconductors • Plessey Semiconductors	• Nichia • Toyoda Gosei • Harvatek • Sharp • MLS Lighting • Sanan Opto • Citizen • OptoTech • Epistar • Everlight • Lumens • Kingbright • Samsung • Lextar • LG Innotek • Seoul Semiconductor • Elec-Tech Opto • Edison Opto • HC SemiTek
LED Package Manufacturing	• As above • Xicato	As above and: • Optogan	As above and: • Lite-On • Unity Opto • Refond • Nationstar • Shenzhen Jufei • Honglitronic
Luminaire Manufacturing	• GE Lighting • Eaton • Hubbell Lighting • Soraa • Cree Lighting • Acuity Brands • Lighing Science Group • Digital Lumens • Finelite • Feit • Ecosense Lighting • Ecolite LED	• Philips • Zumtobel • Aura Lighting • Dialight • Fagerhult • Optogan	• Panasonic • Toshiba • Sharp • LG • Samsung • Forest Lighting • LEDVance • Kingsun • Zhejiang Yankon • Shenzhen Changfang • Opple Lighting • PAK Corp • Nationstar • NVC Lighting Tech Corp • FSL

[27] 'Solid-State Lighting, 2017 Suggested Research Topics Supplement: Technology and Market Context', US Department of Energy, September 2017

Table 6.3 The LED Supply Chain: Equipment and Materials Suppliers

Supply Chain	North America	Europe	Asia
Equipment Suppliers			
• Epitaxial growth	• Veeco Instruments	• Aixtron	• Taiyo Nippon Sanso
• Wafer processing	• Plasma-Therm • Lam Research • Ultratech • Kurt J. Lesker Co. • JPSA • Temescal • Applied Materials	• Oxford Instruments • EV Group • SUSS MicroTec • Logitech	• Nikon Corp • Canon Inc. • Ushio Inc. • SAMCO
• LED packaging	• Palomar Tech • Heller • Nordson ASYMTEK	• Besi • Juki	• ASM Pacific Tech • Thinky • TOWA • Disco • Kulicke & Soffa
• Luminaire assembly	• Speedline Tech • Conveyor Tech	• ASM Siplace • Assembleon	• Panasonic • Fuji Machines • Nutek
• Test and inspection	• KLA-Tencor • Cascade Microtech • Orb Optronix • Vektrex • Ocean Optics • Lighting Sciences Inc. • Gamma Scientific • Radiant Zemax • SphereOptics • Daitron • Optest • Nanometrics • Chroma • Rudolph Tech • Labsphere	• Laytec • Bede • Bruker • Instrument Systems • Cameca • SUSS MicroTec • Ismeca	• Quatek • Fittech Co • QMC • Everfine • Shibuya • Panasonic • Fujikom

Annex 7: The Ecodesign and Energy Labelling Framework

The Ecodesign Framework Directive and Energy Labelling Framework Regulation are framework rules, establishing conditions for laying down product-specific requirements in regulations adopted by the Commission. The Commission's role in the implementation of delegated and implementing acts is to ensure a maximum of transparency and stakeholder participation in presenting a proposal, based on generally accepted data and information, to the European Parliament and Council for scrutiny. Figure 33 *gives an overview of the legislative process.*

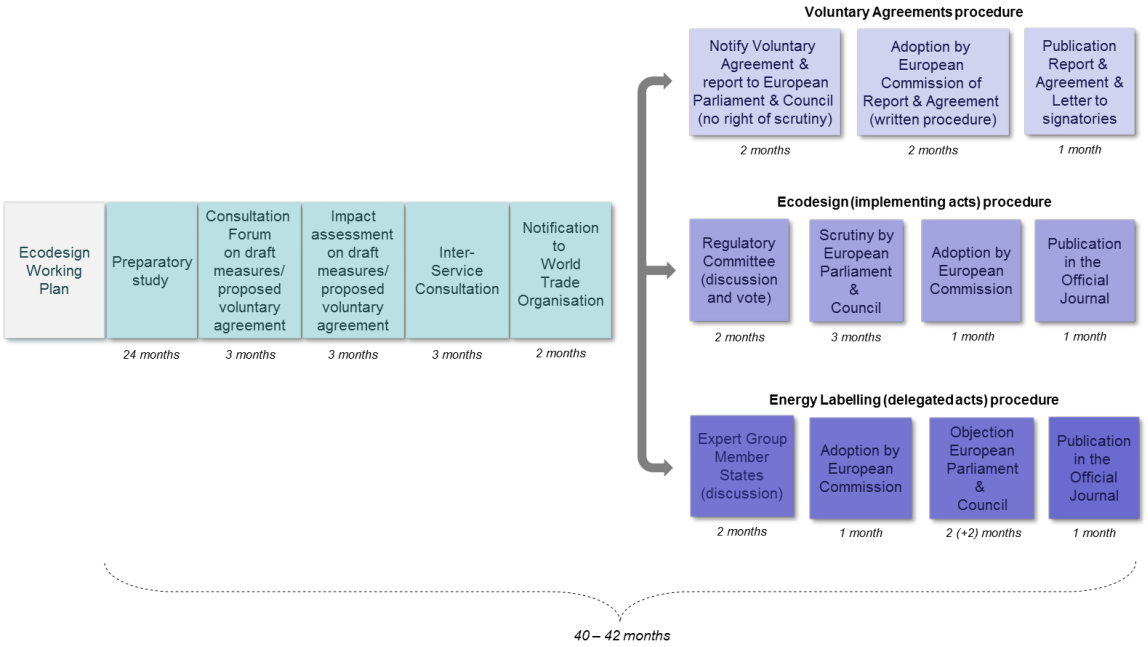


Figure 33: Overview of the legislative process

Energy labelling delegated acts are usually adopted in parallel with ecodesign implementing measures laying down minimum energy efficiency requirements for the same product group. This is done to ensure a coherent impact of the two measures: energy labelling should reward the best performing products through mandatory rating, while ecodesign should ban the worst performers.

The process starts with establishing the priorities for Union action in this area. Priority product groups are selected based on their potential for cost-effective reduction of greenhouse gas emissions and following a fully transparent process culminating in working plans that outline the priorities for the development of implementing measures.

A first list of priority product groups was provided in Article 16 of the Ecodesign Framework Directive in force at that time[28]*. Subsequently, the (first) Ecodesign Working Plan 2009-2011*[29]*, the (second) Ecodesign Working Plan 2012-2014*[30] *and the Ecodesign*

[28] Directive 2005/32/EC of the European Parliament and of the Council of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council. OJ L 191, 22.7.2005

[29] Communication from the Commission to the Council and the European Parliament - Establishment of the working plan for 2009-2011 under the Ecodesign Directive. COM/2008/0660 final. 21 October 2008. (Ecodesign Working Plan 2009-2011)

Working Plan 2016-2019 were adopted by the Commission after consultation of the Ecodesign Consultation Forum (composed of MS and stakeholder experts).

The products listed in the three plans (1st working plan: 1-10; 2nd working plan: 11-18; 3rd working plan: 19-25) can be found in Table 62.

Table 62: Overview of products listed in the 3 Working plans

1. *Air-conditioning and ventilation systems (commercial and industrial)*	14. *Enterprises' servers, data storage and ancillary equipment*
2. *Electric and fossil-fuelled heating equipment*	15. *Smart appliances/meters*
3. *Food preparing equipment (including coffee machines)*	16. *Lighting systems*
4. *Industrial and laboratory furnaces and ovens*	17. *Wine storage appliances (c.f. Ecodesign regulation 643/2009)*
5. *Machine tools*	18. *Water-related products*
6. *Network, data processing and data storing equipment*	19. *Building automation control systems*
7. *Refrigerating and freezing (professional)*	20. *Electric kettles*
8. *Sound and imaging equipment (incl. game consoles)*	21. *Hand dryers*
9. *Transformers*	22. *Lifts*
10. *Water-using equipment*	23. *Solar panels and inverters*
11. *Window products*	24. *Refrigerated containers*
12. *Steam boilers (< 50MW)*	25. *High- pressure cleaners*
13. *Power cables*	

There were also a number of conditional products listed in the 2nd Working Plan that the Commission committed to study closer before deciding to launch full preparatory work (such as thermal insulation, power generating equipment). In the 3rd Working Plan, the Commission committed to assess certain ICT products in a separate track to determine the best policy approach for improving their energy efficiency and wider circular economy aspects and a potential inclusion in the Ecodesign working plan.

Once the product group has been selected, a preparatory study is undertaken by an independent consultant, also involving extensive technical discussions with interested stakeholders. The preparatory study follows the MEERP. Subsequently, the Commission's first drafts of ecodesign and energy labelling measures are submitted for discussion to the Consultation Forum, consisting of MSs' and other stakeholders' representatives.

After the Consultation Forum, the Commission drafts an impact assessment, which after approval of the IAB is taken forward to the inter-service consultation together with draft implementing measures. In this and subsequent steps, the Parliament's functional mailboxes for delegated/implementing acts are copied on each message from the Commission services. After the inter-service consultation, stakeholders are alerted when the draft measures are published in the WTO notification database.

After the WTO notification phase is completed, the two procedures follow different paths. The draft energy labelling delegated act is discussed in a MS Expert Group where opinion(s) are expressed and consensus is sought but no vote is taken. The draft ecodesign measure is submitted for vote to the Regulatory Committee of MS experts.

[30] Commission Staff Working Document Establishment of the Working plan 2012-2014 under the Ecodesign Directive - SWD(2012)434/F1 (Ecodesign Working Plan 2012-2014)

The European Parliament and Council have the right of scrutiny for which a period of up to four months, if requested, is foreseen. Within this time the co-legislators can block the adoption process by the Commission. Parliament committees sometimes discuss draft objections to measures (light bulbs and fridges in 2009) or vote to reject a measure (vacuum cleaners in 2013[31]). On one occasion an objection was even adopted in plenary, blocking the measure for televisions in 2009[32].

Today, 30 Ecodesign Regulations, 17 Energy Labelling Regulations, 3 voluntary agreements and 2 tyre labelling regulations have been implemented. An overview of these measures can be found in Table 63.

Table 63: Overview of applicable measures

Framework legislation	
2017/1369	*Energy labelling Framework Regulation*
2009/125/EC	*Ecodesign Framework Directive*
1222/2009/EC	*European Parliament and Council Regulation on the labelling of tyres with respect to fuel efficiency and other essential parameters*
30 Ecodesign implementing regulations	
1275/2008	*Standby and off mode electric power consumption*
107/2009	*Simple set-top boxes*
244/2009	*Non-directional household lamps (amended by 859/2009/EC)*
245/2009	*Fluorescent lamps without integrated ballast, for high intensity discharge lamps and for ballasts and luminaires (amended by 347/2010/EU)*
278/2009	*External power supplies*
640/2009	*Electric motors (amended by regulation 4/2014/EU)*
641/2009	*Circulators (amended by regulation 622/2012/EU)*
642/2009	*Televisions*
643/2009	*Household refrigerating appliances*
1015/2010	*Household washing machines*
1016/2010	*Household dishwashers*
327/2011	*Fans*
206/2012	*Air conditioning and comfort fans*
547/2012	*Water pumps*
932/2012	*Household tumble driers*
1194/2012	*Directional lamps, light emitting diode (LED) lamps and related equipment*
617/2013	*Computers and servers*
666/2013	*Vacuum cleaners*
801/2013	*Networked standby electric power consumption*
813/2013	*Space heaters*
814/2013	*Water heaters*
66/2014	*Domestic cooking appliances (ovens, hobs and range hoods)*
548/2014	*Power transformers*

[31] This objection was defeated in ENVI committee by 43 votes against and 4 in favour.

[32] The motivation of the objection was that the EP wanted to delay the discussion of the draft labelling measure so that it would have to become a delegated act under the recast post-Lisbon Energy Labelling Directive in 2010. The measure was indeed subsequently adopted as a delegated act.

1253/2014	*Ventilation units*
2015/1095	*Professional refigeration*
2015/1188	*Solid fuel local space heaters*
2015/1189	*Local space heaters*
2015/1189	*Solid fuel boilers*
2016/2281	*Air heating products, cooling products, high temperature process chillers and fan coil units*
2016/2282	*Use of tolerances in verification procedures*
17 Energy labelling supplementing regulations	
1059/2010	*Household dishwashers*
1060/2010	*Household refrigerating appliances*
1061/2010	*Household washing machines*
1062/2010	*Televisions*
626/2011	*Air conditioners*
392/2012	*Household tumble driers*
874/2012	*Electrical lamps and luminaires*
665/2013	*Vacuum cleaners*
811/2013	*Space heaters*
812/2013	*Water heaters*
65/2014	*Domestic cooking appliances (ovens and range hoods)*
518/2014	*Internet energy labelling*
1254/2014	*Domestic ventilation units*
2015/1094	*Professional refrigeration*
2015/1186	*Local space heaters*
2015/1187	*Solid fuel boilers*
2017/254	*Use of tolerances in verification procedures*
3 Voluntary Agreements (Report to the EP & Council)	
COM (2012) 684	*Complex set top boxes*
COM (2013) 23	*Imaging equipment*
COM(2015)178	*Game consoles*
2 tyre labelling amending regulations	
228/2011	*Wet grip testing method for C1 tyres*
1235/2011	*Wet grip grading of C2, C3 tyres, measurement of tyres rolling resistance and verification procedure*
Previous legal acts still in force	
92/42/EEC	*Hot-water boilers efficiency Council Directive (Ecodesign)*
96/60/EC	*Household combined washer-driers (Energy labelling)*
2002/40/EC	*Household electric ovens Commission Directive (Energy labelling) – will be repealed on 1/1/2015*

MSAs, designated by the MSs, will verify the conformity of the products with the requirements laid down in the implementing measures and delegated acts. These can be done either on the product itself or by verifying the technical documentation. The rules on Union market surveillance and control of products entering the Union market are

given in Regulation (EC) No 765/2008[33]. Given the principle of free movement of goods, it is imperative that MSs' market surveillance authorities cooperate with each other effectively.

[33] Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93. OJ L 218, 13.8.2008, p. 30

Annex 8: Existing Policies, Legislation and Standards affecting lighting products

A number of directives and regulations affect lighting products.

1. EU ECODESIGN AND ENERGY LABELLING REGULATIONS

The current Ecodesign Regulations (Commission Regulations (EC) 244/2009, (EC) 245/2009 and (EU) 1194/2012) sets minimum energy efficiency requirements, functional requirements and information requirements for lighting products, mostly for light sources and control gears, and on a lower level for luminaires. Luminaires only have functional requirements (better said: the control gears in the luminaires need to respect those requirements). The light sources in scope of the three Regulations are electrically operated product intended to emit and/or be possibly tuned to emit light with all of the following optical characteristics that define a so-called "white light area":

(a) chromaticity coordinates x and y in the range

$0{,}270 < x < 0{,}530$ and

$-2{,}3172\,x^2 + 2{,}3653\,x - 0{,}2199 < y < -2{,}3172\,x^2 + 2{,}3653\,x - 0{,}1595$;

(b) a luminous flux < 1000 *lm per mm²* of projected light-emitting surface area as defined in Annex II;

(c) a luminous flux between 60 and 82 000 *lumen*;

(d) a colour rendering index CRI > 0 *Ra*;

using incandescence, fluorescence, high-intensity discharge, light emitting diodes or their combinations as lighting technology. High-pressure sodium light sources that do not fulfil condition (a) are considered light sources for the purposes of the Regulations. The "white light area" for special purpose lamps is slightly bigger.

The **current Energy labelling Regulation** sets energy labelling requirements for light sources (lamps) and luminaires, but not for control gears.

Ecodesign and energy labelling regulations on components *- In addition to ecodesign and energy labelling regulations on the final products, some ecodesign requirements might be applicable on the product's components. Components that are regulated under ecodesign and/or energy labelling are the following:*

- *External power supplies (Ecodesign Regulation (EC) No 278/2009[34])*
- *Electric motors (Ecodesign Regulation (EC) No 640/2009[35]);*
- *Circulators (Ecodesign Regulation (EC) No 641/2009[36]);*

[34] Commission Regulation (EC) No 278/2009 of 6 April 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for no-load condition electric power consumption and average active efficiency of external power supplies, OJ L 93, 7.4.2009

[35] Commission Regulation (EC) No 640/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for electric motors. OJ L 191, 23.7.2009

[36] Commission Regulation (EC) No 641/2009 of 22 July 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for glandless standalone circulators and glandless circulators integrated in products. OJ L 191, 23.7.2009, p. 35.

- *Fans (Ecodesign Regulation (EU) No 327/2011[37]);*
- *Water pumps (Ecodesign Regulation (EU) No 547/2012[38]);*

The components of lighting products are not in the scope of these regulations.

Horizontal ecodesign regulations *- In addition to those requirements, some horizontal aspects of energy using products are regulated. Horizontal measures are:*

- *Electric power consumption standby and off mode (Ecodesign Regulation (EC) No 1275/2008[39]);*
- *Networked standby (Ecodesign Regulation (EU) No 801/2013[40]).*

Lighting products are not in the scope of these regulations, although the new legislation proposes to include energy consumption from standby modes.

2. OTHER EU POLICIES

*The **Low Voltage Directive**[41] regulates health and safety aspects including e.g. mechanical, chemical, noise related or ergonomic aspects. Apart from this, the directive seeks to ensure that the covered equipment benefits fully from the Single Market. The LVD covers electrical equipment operating with a voltage between 50 and 1000 V for alternating current and between 75 and 1500 V for direct current. Falling under this category,* lighting products *are covered by the scope of the LVD, but there is no overlapping in terms of the type of requirements.*

*The **WEEE Directive** set requirements on e.g. recovery and recycling of Waste of Electrical and Electronic Equipment to reduce the negative environmental effects resulting from the generation and management of WEEE and from resource use. The WEEE Directive applies directly to* lighting products. *Ecodesign implementing measures can complement the implementation of the WEEE Directive by including e.g. measures for material efficiency, thus contributing to waste reduction, instructions for correct assembly and disassembly, thus contributing to waste prevention and others.*

*The **RoHS Directive**[42] restricts the use of six specific hazardous materials and four different phthalates found in electrical and electronic equipment (EEE).* Lighting

[37] Commission Regulation (EU) No 327/2011 of 30 March 2011 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for fans driven by motors with an electric input power between 125 W and 500 kW. OJ L 90, 6.4.2011, p. 8.

[38] Commission Regulation (EU) No 547/2012 of 25 June 2012 implementing Directive 2009/125/EC of the European Parliament and of the Council with regard to ecodesign requirements for water pumps. OJ L 165, 26.6.2012, p. 28

[39] Commission Regulation (EC) No 1275/2008 of 17 December 2008 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for standby and off mode electric power consumption of electrical and electronic household and office equipment. OJ L 339, 18.12.2008, p. 45.

[40] Commission Regulation (EU) No 801/2013 of 22 August 2013 amending Regulation (EC) No 1275/2008 with regard to ecodesign requirements for standby, off mode electric power consumption of electrical and electronic household and office equipment, and amending Regulation (EC) No 642/2009 with regard to ecodesign requirements for televisions. OJ L 225, 23.8.2013, p. 1.

[41] Directive 2014/35/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits. OJ L 96, 29.3.2014, p. 357. (LVD)

[42] Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment. OJ L 174, 1.7.2011, p. 88. (RoHS Directive)

products, namely light sources when they contain mercury, *are directly covered by the RoHS Directive. There is no overlapping requirement with a proposed ecodesign regulation.*

*The **REACH Directive**[43] restricts the use of Substances of Very High Concern (SVHC) to improve protection of human health and the environment. The REACH Directive applies directly to* lighting products. *There is no overlapping requirement with a proposed ecodesign regulation.*

*The **EMC Directive**[44] sets requirements for the Electro-Magnetic Compatibility performance of electrical equipment to ensure that electrical devices will function without causing or being affected by interference to or from other devices. The EMC Directive applies directly to* lighting products. *There is no overlapping requirement with a proposed ecodesign regulation.*

*The **ETS** sets a cap on the total amount of certain greenhouse gasses that can be emitted by installations. This cap reduces over time, so that the total emissions fall. Within this cap companies receive or buy emission allowances which they can trade with one another as needed. They can also buy a limited amount of international credits. The ETS does not directly apply to* lighting products, *however, it does apply to electricity production. Hence, if the electricity consumption of* lighting products *reduces, the electricity companies will have to trade less or the price of carbon will reduce under the cap system. Consequently, the price of electricity will drop.*

3. NON-EU POLICIES

The Standards & Labelling database www.clasponline.org distinguishes 280 different energy efficiency measures such as minimum efficiency requirements, comparative energy labels and endorsement labels. Countries with active energy efficiency policy tend to address lighting products. Over 50 countries have minimum energy efficiency requirements in the lighting sector.

Many countries have either introduced energy labels based on or inspired by the EU energy label[45], the United States of America (USA) programs or a combination of both.

The International Energy Agency (IEA) Energy Efficient End-use Equipment (4E) Benchmarking programme has made a comparison of the efforts in several countries, based on a normalised kWh/a Annual Unit Energy Consumption, see Figure 34.

[43] Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC. OJ L 396, 30.12.2006, p. 1–849 (REACH Regulation)

[44] Directive 2014/30/EU of the European Parliament and of the Council of 26 February 2014 on the harmonisation of the laws of the Member States relating to electromagnetic compatibility. OJ L 96, 29.3.2014, p. 79 (EMC Directive)

[45] European Commission Conference on Product Policy –Ecodesign & Energy Labelling, 20-21 Feb. 2014, misc. lectures.

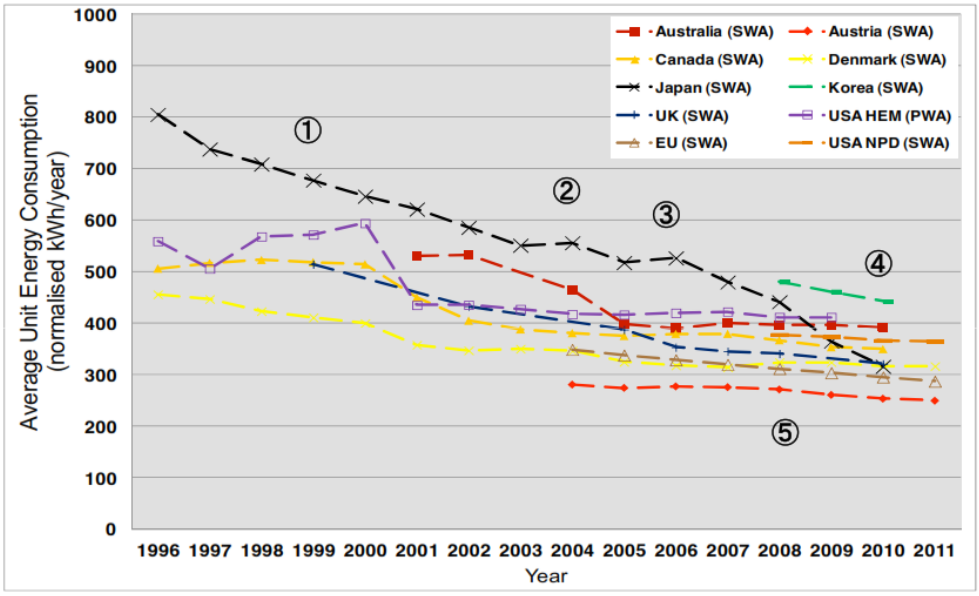
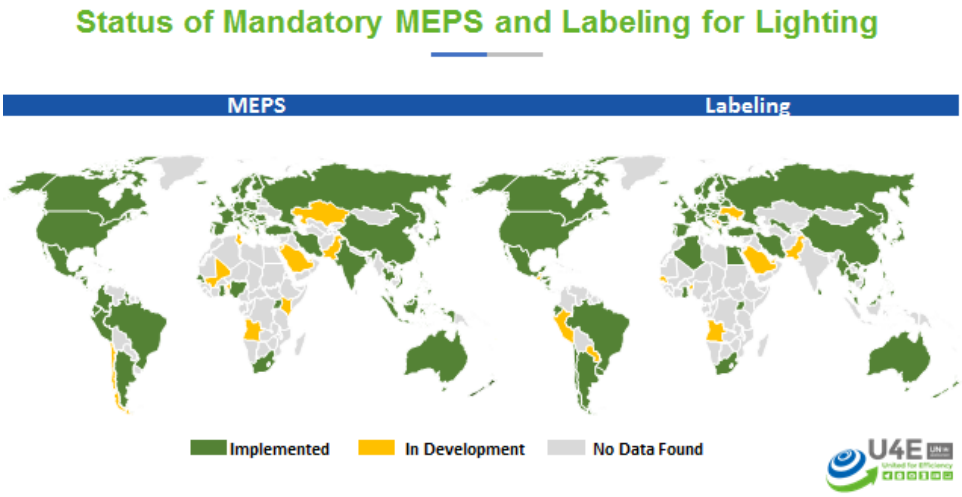


Figure 34: Average Unit Energy Consumption in selected countries and regions (Source: IEA 4E M&B, version 2014)

Figure 34 shows that the EU was still at the forefront in 2011; however, the upcoming reviews in Australia and the USA for lighting products may change this picture.



The picture above shows the around 50 countries that, as of November 2017, had adopted or were adopting minimum ecodesign requirements (MEPS) and/or energy labelling for lighting.

To safeguard competition in the EU, it is important that the EU keeps on distinguishing based on innovation and quality. Up to date requirements will enable this. In addition, the use of the standard, adapted to the EU situations, in ecodesign and energy labelling is essential for global competitiveness.

Annex 9: Evaluation of the Ecodesign and Energy Labelling Regulations for lighting products

In the context of the Better Regulation policy[46]*, the Commission is committed to evaluate all EU activities intended which have an impact on society or the economy in a proportionate way. In the case of ecodesign and energy labelling, the two Regulations establishing the framework for the measures have been evaluated.*
This annex presents the relevant findings of the evaluation of the Ecodesign and Energy Labelling legislation complemented by findings from the Review study 2015 and the impact assessment. *The annex focuses on relevance, effectiveness and efficiency. As for relevance, the evaluation of the framework Regulations has shown that the objectives (increasing energy efficiency and the level of protection of the environment; providing consumers with information that allows them to choose more efficient products; and ensuring the free movement of energy-related products in the European Union) remain very much relevant.*

Summary

The review of the ecodesign and energy labelling for lighting products started in 2015 and several studies were conducted for this purpose, as described in Annex 1. These studies evaluated the impact of the current legislation, as reported in this annex: they also looked at the technological and economic evolution of the sector and at stakeholders' views. Results from the studies have been used directly as input to the problem definition analysis model (see Annex 4).

The main finding from the evaluation of the impact of the current legislation is that electricity savings due to the existing requirements were expected to be 110 TWh in 2020, but according to the latest estimation they will be limited to 70 TWh. The evaluation showed that the gap in energy savings is the result of:

- Insufficient market surveillance by Member States;
- Too many parameters to verify by market surveillance, and too expensive/long verification testing required (e.g. 6000h test for lumen maintenance);
- Unclear definitions for exempted lamp types ("special purpose lamps", as defined in the current legislation), using a description of intended use rather than measurable parameters;
- Tolerances intended for use by market surveillance during verification that have been used also by manufacturers in the declaration of lamp characteristics, with the result to bring on the market products with an efficacy that is lower than the minimum required one;
- Recent appearance on the market of 'fully-integrated luminaires' from which the light source cannot be removed for compliance verification.

Moreover, incandescent lamps, which the ecodesign legislation phased-out from 2009, were expected to be mainly replaced by compact fluorescent lamps. However, many consumers preferred the less energy-efficient halogen lamps. Fluorescent lamps have not

[46] https://ec.europa.eu/info/law/law-making-process/better-regulation-why-and-how_en

been adopted as expected because of (real or perceived) sub-standard performance (e.g. colour rendering and temperature, ignition time, mercury hazards).

Acronyms

AR111	Lamp shape: Wide and flat reflector lamp, 111 mm diameter
CFL	Compact Fluorescent Lamp (all types)
CFLi	CFL with integrated control gear
CFLni	CFL without integrated control gear
CMH	MH-lamp with ceramic technology
DLS	Directional Light Source (light concentrated in a beam, spot light)
E	Cap-type, screw-in
E14	Cap-type, screw with 14 mm diameter
E27	Cap-type, screw with 27 mm diameter
FL	Fluorescent lamp (all types)
G	Cap-type, push-in or push-in and turn
G4	Cap-type with two pins at 4 mm distance for low-voltage
G53	Cap-type with two pins at 53 mm distance for low-voltage
G9	Cap-type with two pins at 9 mm distance for mains-voltage
GLS	Incandescent, non-halogen, filament lamp (classic light bulb)
GLS R	GLS reflector lamp, DLS
GLS X	GLS non-reflector lamp, NDLS
GU4	Cap-type with two pins at 4 mm distance for low-voltage
GU5.3	Cap-type with two pins at 5.3 mm distance for low-voltage
GU10	Cap-type with two pins at 10 mm distance for mains-voltage
GY6.35	Cap-type with two pins at 6.35 mm distance for low-voltage
HID	High-Intensity Discharge lamp (all types)
HL	Halogen lamp (all types)
HL LV C	Halogen Low-Voltage Capsule, with G4 or GY6.35 cap, NDLS
HL LV R	Halogen lamp, Low-Voltage, Reflector type (mirrored), DLS: e.g. MR11-GU4, MR16-GU5.3, AR111-G53
HL MV C	Halogen Mains-Voltage Capsule, with G9 cap, NDLS
HL MV E	Halogen lamp, Mains-Voltage, most with E-cap, NDLS
HL MV L	Halogen lamp, linear, double-ended R7s cap, NDLS
HL MV X	Halogen lamp, Mains-Voltage, Reflector type (mirrored), DLS: e.g. MR16-GU10, R- and PAR-lamps with E14 and E27 caps
HPM	High-Pressure Mercury lamp (type of HID)
HPS	High-Pressure Sodium lamp (type of HID)
LED	Light-Emitting Diode light source
LFL	Linear Fluorescent Lamp (all types)
LFL T5	LFL with diameter of 16 mm (5/8 inch), 14-80W, incl. circular
LFL T8	LFL with diameter of 26 mm (8/8 inch) (all types)
LFL T8t	LFL T8 with tri-phosphor technology
LFL T8h	LFL T8 with halo-phosphor technology
LFL T12	LFL with diameter of 38 mm (12/8 inch)
LFL X	LFL other than T12, T8 and T5 (incl. e.g. T9, special FL, U-shaped, T5 ≤ 13 W)
LV	Low-Voltage (less than 230 V, typically 12 or 24 V)
MH	Metal-Halide lamp (type of HID)(all types)
MR11, MR16	Lamp shape: Small reflector lamps (DLS)
MV	Mains-Voltage (230 V)
NDLS	Non-Directional Light Source (light not concentrated in a beam)
PAR	Lamp shape: Parabolic reflector lamp (DLS)
QMH	MH-lamp with quartz technology
R	Lamp shape: Reflector lamp (DLS)
R7s	Cap-type, with thick pin at each extremity of a tube-shaped lamp

1. BAU 2008 SCENARIO, ASSUMPTIONS

The BAU scenario for the situation without the Ecodesign and Energy Labelling measures taken in 2009 and 2012 was developed during the 2009 and 2012 Impact Assessments and is reported in the Ecodesign Impact Accounting (EIA, version of December 2016). This scenario was based on data available in 2008 and before, and used an analysis model that was far less detailed than the current MELISA model. Hence, the existing BAU2008 scenario for lighting (without effects of existing regulations) is not compatible with the current BAU (indicated as BAU2015 below) and ECO scenarios from MELISA.

In order to enable a better insight in the impacts that current regulations had, a BAU2008 scenario has been developed, using the data and insights now available, and using the same analysis method used in MELISA. A separate, dedicated MELISA version was developed for the BAU2008 scenario, starting from the current BAU scenario and reasoning backwards to what would have happened if the existing lighting regulations would not have been introduced.

The following assumptions have been made to convert the current BAU scenario (BAU2015, with effects of existing regulations) to a BAU2008 scenario[47] (without effects of existing regulations):

LFL T12:

Sales in BAU2015 are decreasing and shifting to LFL T8t because of T12 phase-out due to CR 245/2009. For BAU2008 (without regulation) this phase-out has been slightly slowed down, but minor impact on total because T12 figures are already low.

LFL T8h:

Sales in BAU2015 are decreasing and shifting to LFL T8t because of T8h phase-out due to CR 245/2009. For BAU2008 (without regulation) this phase-out has been slowed down.

LFL T5:

Sales for years 2009-2013: for BAU2008 without CR 245/2009 assume that shift of sales from T12 and T8 to T5 would have been slower → lower T5 sales.
CG-efficiency increase after 2008 partly induced by CR 245/2009: reduce increase for BAU2008.
LS-efficiency increase after 2008 is induced by CR 245/2009: maintain 2008 values for BAU2008.
For LFL T5 non-residential maintain lifetime increase and lumen increase from LightingEurope input.
For T5 the shift towards LED in BAU2015 was already slow: maintain same scenario for BAU2008

LFL T8t:

[47] For details, see a separate note and Excel file, 'Development BAU2008 scenario for Light Sources v20170124' (internal note VHK, 2017)

Sales for years 2009-2013: adapted in function of changes in sales for T12, T8h and T5, such that the total stock for all LFL-applications (incl. LED replacements) remains the same as before.
CG-efficiency increase after 2008 partly induced by CR 245/2009: reduce increase for BAU2008
LS-efficiency increase after 2008 partly induced by CR 245/2009: reduce increase for BAU2008
For LFL T8t non-residential maintain lifetime increase and lumen increase from LightingEurope input.
For T8t the shift towards LED in BAU2015 was already slow, but it has been further slowed down for BAU2008

LFLX:

Impact of this group on totals is low and it is a strange mixed group with few data available: do not change sales.
CG-efficiency increase after 2008 partly induced by CR 245/2009: reduce increase for BAU2008
For LFL X the shift towards LED in BAU2015 was already slow, but it has been further slowed down for BAU2008.

All HID types:

BAU2015 assumed a CG efficiency increase due to 245/2009. This increase has been reduced for the BAU2008 scenario.

HPM:

CR 245/2009 phases out HPM from 2015. In BAU2015 these are substituted by a combination of HPS, MH and LED and HPM disappear completely from 2020
Without CR, it is assumed that HPM phase-out would have occurred anyway due to measures on mercury (RoHS), so shift in sales towards HPS and MH has not been changed up to 2014.
Later years: reduced the speed of shift towards LED, implying that more HPM shift to HPS and MH.
In BAU2008, HPM anyway disappear completely from stock in 2020, just as in BAU2015.

HPS:

Increase in lifetime and lumens agreed with LE has been maintained for BAU2008
MELISA included a LS efficiency increase from 2010. This is assumed to be partly induced by CR 245/2009 and the increase has been reduced for BAU2008
Removed LED replacements before 2014 and added these sales to HPS
Speed of substitution by LEDs was already low, but has been further reduced.

MH:

Increase in lifetime and lumens agreed with LE has been maintained for BAU2008
MELISA included a LS efficiency increase from 2010. This is assumed to be partly induced by CR 245/2009 and the increase has been reduced for BAU2008
Removed LED replacements before 2014 and added these sales to MH

Speed of substitution by LEDs was already low, but has been further reduced.
Substitution of HPS by MH also slightly adapted

CFLi:

In absence of CR 244/2009 there is no phase-out of GLS, and consequently the quantities of CFLi replacing GLS should be lower in BAU2008 than in BAU2015. Until 2005 maintain sales as they are (220 mln in 2005). From 2007-2013 maintain first increasing, then declining trend, but with much lower peak (350 mln instead of 506 mln). After 2013 continue to apply normal MELISA calculation but add a share of sales replacing GLS.
Defined new rate of substitution by LEDs (in early years after 2014 the rate has been 'tailored' to avoid a return of the 2010 CFLi sales peak around 2020. In later years rate stabilizes on 70% of potential CFLi sales being filled in by LED).
CFLi efficiency was not affected by existing regulations, so BAU2015 values maintained.

CFLni:

BAU2015 implemented an efficiency increase for both light sources and control gears from 2009. This increase was induced by CR 245/2009 and has been removed in BAU2008: kept efficiencies on 2009 level.
Assumed that CR 245/2009 did not influence CFLni sales until 2014. Hence kept sales until 2014 same as in BAU2015.
Defined new rate of substitution by LEDs (very low in early years after 2014, then stabilizing on 70%).

GLS Storage:

MELISA considers a 'GLS Storage effect'. This effect takes into account that after the phase-out of NDLS GLS, residential users anyway continue to install such lamps from the stocks they had in house, for a limited time, until stocks are exhausted. This temporarily slows down the shift to HL, CFLi and LED. Without CR 244/2009, so without the GLS phase-out, there would not have been such an effect, so for BAU2008, all GLS storage data have been set to zero (same was done in EIA BAU2008).

GLS X (NDLS):

BAU 2008 implies no forced phase-out of GLS. Until 2007 maintain sales as they are (1356 mln in 2007). From 2007-2013 maintain declining trend, but much less fast than before (down to 1140 mln in 2013 instead of 123 mln). After 2013 impose shift to HL/CFLi and scenario shift to LED in such a way that GLS sales in a year decrease by approximately 10% with respect to previous year. The shift to HL/CFLi decreases from around 100 mln in 2014 to 0 in 2025.
Define new rate of substitution by LEDs (very low in early years after 2014, then stabilizing on 22% of potential GLS sales).
For BAU2008 maintained MELISA lm, W, and lm/W (assumed there was no efficiency increase for GLS due to CR 244/2009; only a phase-out).

GLS R (DLS):

Situation slightly different from GLS (NDLS) due to later entry into force of CR 1194/2012. Impact on of GLS R (DLS) on totals is small.
Anyway followed more or less the same philosophy as for GLS NDLS

For BAU2008 maintained MELISA lm, W, and lm/W (also because this reflects difference between total lumen and lumen in cone (capacity would change considerably).

HL Storage:

MELISA considers a 'HL Storage effect'. This effect takes into account that after the phase-out of NDLS HL, residential users anyway continue to install such lamps from the stocks they had in house, for a limited time, until stocks are exhausted. This temporarily slows down the shift to LED. Without CR 244/2009, so without the HL phase-out, there would not have been such an effect, so for BAU2008, all HL storage data have been set to zero (same was done in EIA BAU2008).

HL MV E (NDLS):

The absence of CR 244/2009 implies no forced phase-out of GLS, so initially HL sales substituting GLS should be lower in BAU2008 than in BAU2015. Until 2007 maintain sales as they are. For 2007-2013 (considering changes made for CFLi, GLS and HL Storage) adapt sales in such a way that the total NDLS stock is maintained on the same level as in BAU2015. After 2013 apply standard MELISA calculation of sales, but adding a contribution for GLS that have to be substituted and are not yet substituted by CFLi, and adding also a contribution that takes into account the 'sales' removed from HL Storage.
Defined new rate of substitution by LEDs (very low in early years after 2014, then stabilizing on 40% of potential HL MV E sales).
MELISA assumed an increase in efficiency to enable lamps to meet the 244/2009 requirements for 2012-2018. The BAU2008 should not consider this, so pre-2012 efficiency has been maintained also in future years. Note that lumens have not been changed (to avoid changes in total load), so that lower efficiency implies higher power.

HL LV C:

CR 244/2009 imposes MEPS that have been taken into account in BAU2015 by increasing efficiencies from 2013 onwards. In BAU2008 such an efficiency increase would not be required, so assume it would not occur: maintain pre-2013 efficiencies. No change in lumens.
Assume that sales in BAU2008 are the same as in BAU2015, but in absence of any regulation stimulating LED development in general, assume a slower shift to LEDs (same as for HL MV E (NDLS).

HL MV C:

CR 244/2009 imposes MEPS that have been taken into account in BAU2015 by increasing efficiencies from 2011 onwards (G9 cap exempted from stage 6 but not from earlier stages). In BAU2008 such an efficiency increase would not be required, so assume it would not occur: maintain pre-2011 efficiencies. No change in lumens.
Assume that sales in BAU2008 are the same as in BAU2015, but in absence of any regulation stimulating LED development in general, assume a slower shift to LEDs (same as for HL MV E (NDLS).

HL MV L:

CR 244/2009 imposes MEPS that have been taken into account in BAU2015 by increasing efficiencies from 2010 onwards (R7s cap exempted from stage 6 but not from

earlier stages). In BAU2008 such an efficiency increase would not be required, so assume it would not occur: maintain pre-2010 efficiencies. No change in lumens.
Assume that sales in BAU2008 are the same as in BAU2015, but in absence of any regulation stimulating LED development in general, assume a slower shift to LEDs (same as for HL MV E (NDLS).

HL LV R and HL MV X (DLS):

Adapted sales in function of changes for GLS R, in such a way that total DLS stock remains the same.
In absence of any regulation stimulating LED development in general, assume a slower shift to LEDs (same as for HL MV E (NDLS).
For HL LV R in BAU2015 efficiencies were increased from 2016, but this increase has been removed for BAU2008 (maintaining same lumens).
As regards LED efficacy and price projections, it is difficult to say how these would have changed with respect to the projections presented for the current BAU (see Annex 5 Section 2.3 on LED efficacy and price projections) if no measures would have been taken in 2009-2012, but it is reasonable to assume that LED development would have somewhat slowed down without these measures. In BAU2008 the same LED projection curves are used as in the current BAU but with a two year delay.

2. IMPACT OF CURRENT REGULATIONS: BAU2008 VS. BAU2015, SALES

The BAU2015 scenario includes the effects of the existing regulations and consequently has the same meaning as an ECO2008 scenario. Comparing the BAU2008 scenario to the BAU2015=ECO2008 scenario thus provides the impact of the existing regulations.

In the BAU2008 scenario, sales for GLS decrease much slower than in BAU2015. Consequently, there are also less sales of HL and CFLi. In BAU2008, on average, light sources have a lower lifetime, requiring more frequent substitution, and consequently sales quantities are much higher than in BAU2015.

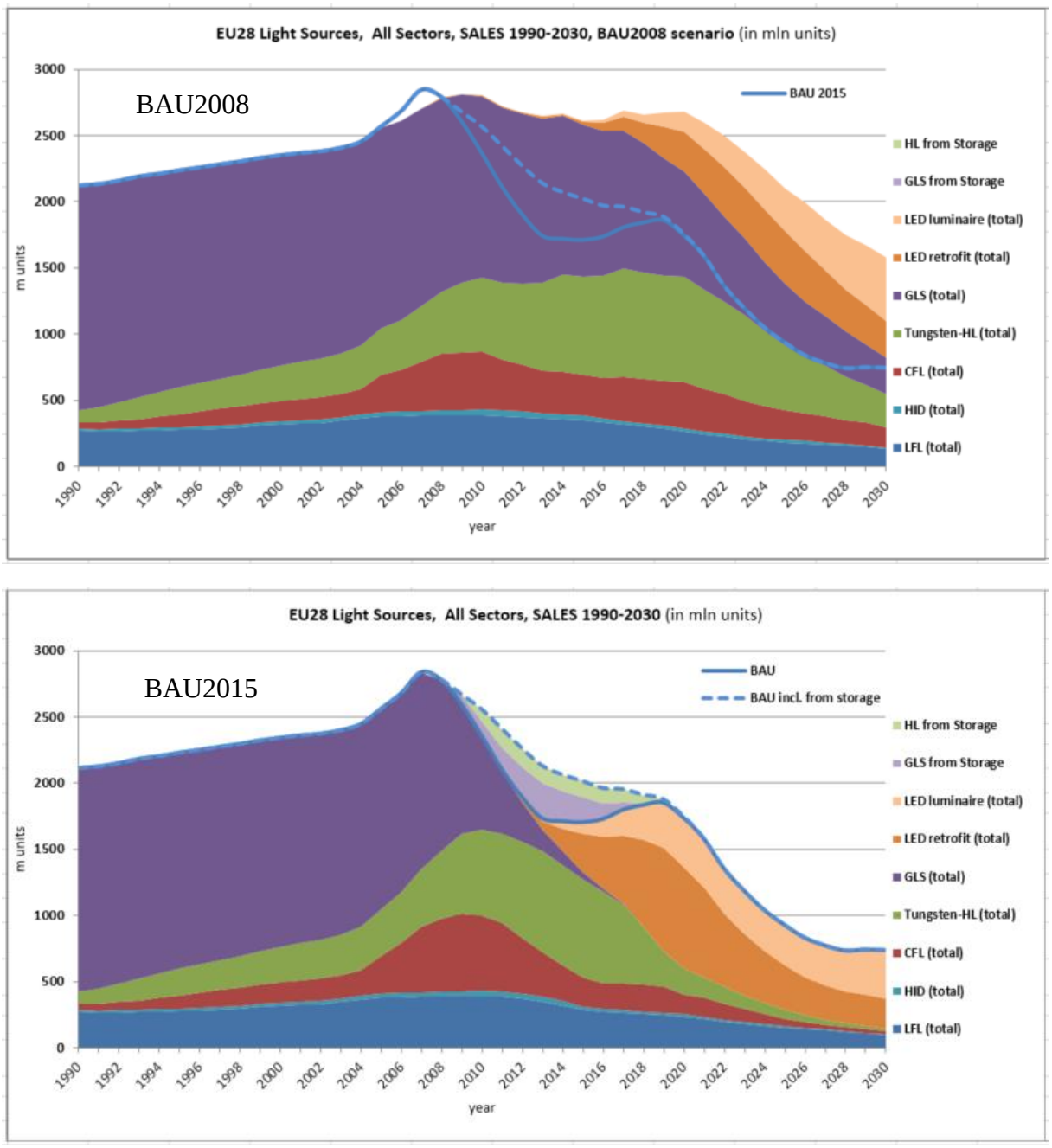


Figure 35 Total EU-28 Sales, in million units, for BAU2008 and BAU2015 scenarios.

3. IMPACT OF CURRENT REGULATIONS: BAU2008 VS. BAU2015, STOCK

The total stock of installed light sources is identical in the BAU2008 and BAU2015 scenarios, but the composition of the stock is different. In BAU2008, more GLS, HL and CFLi remain in the stock while the share of LEDs is much smaller.

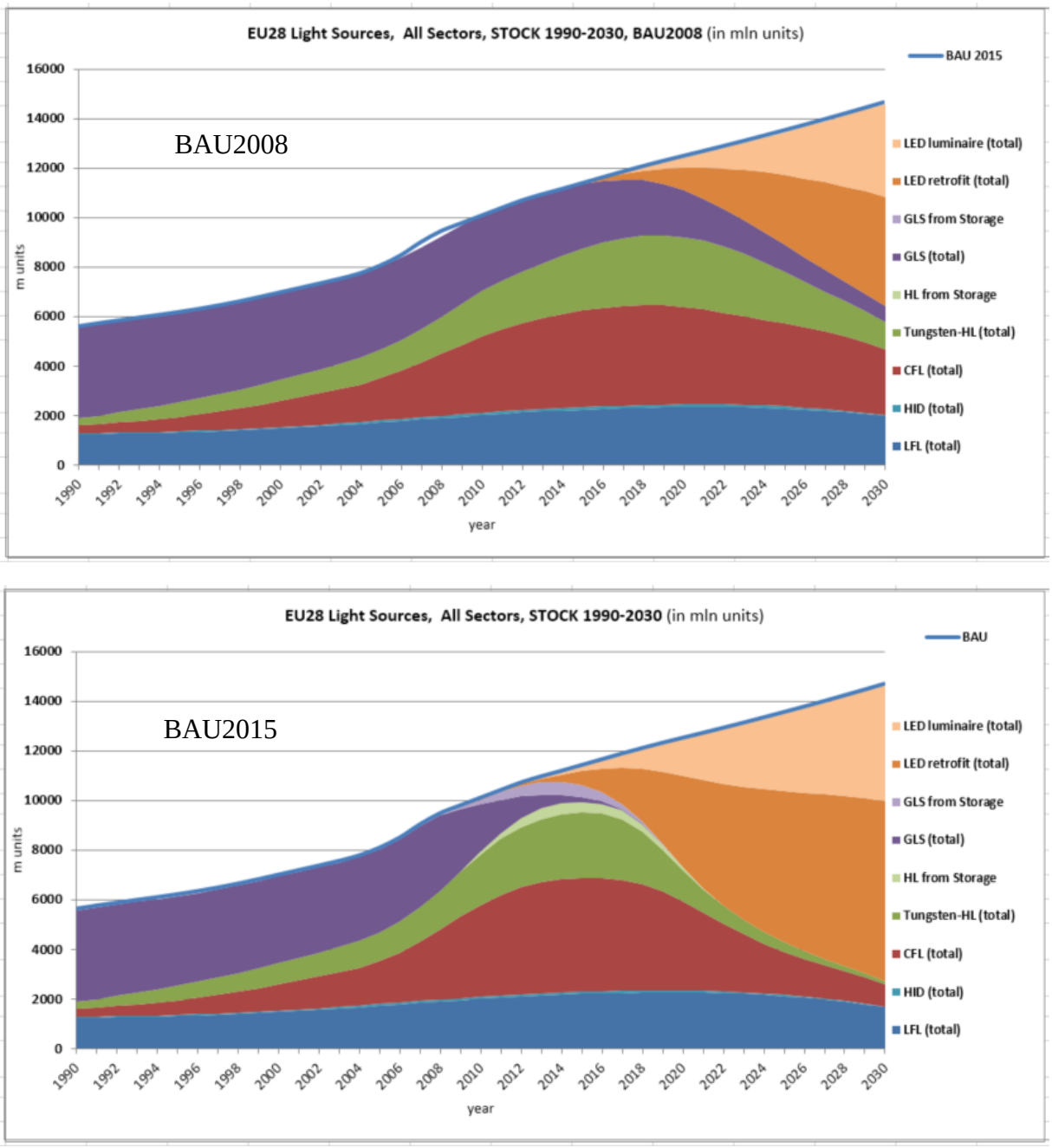
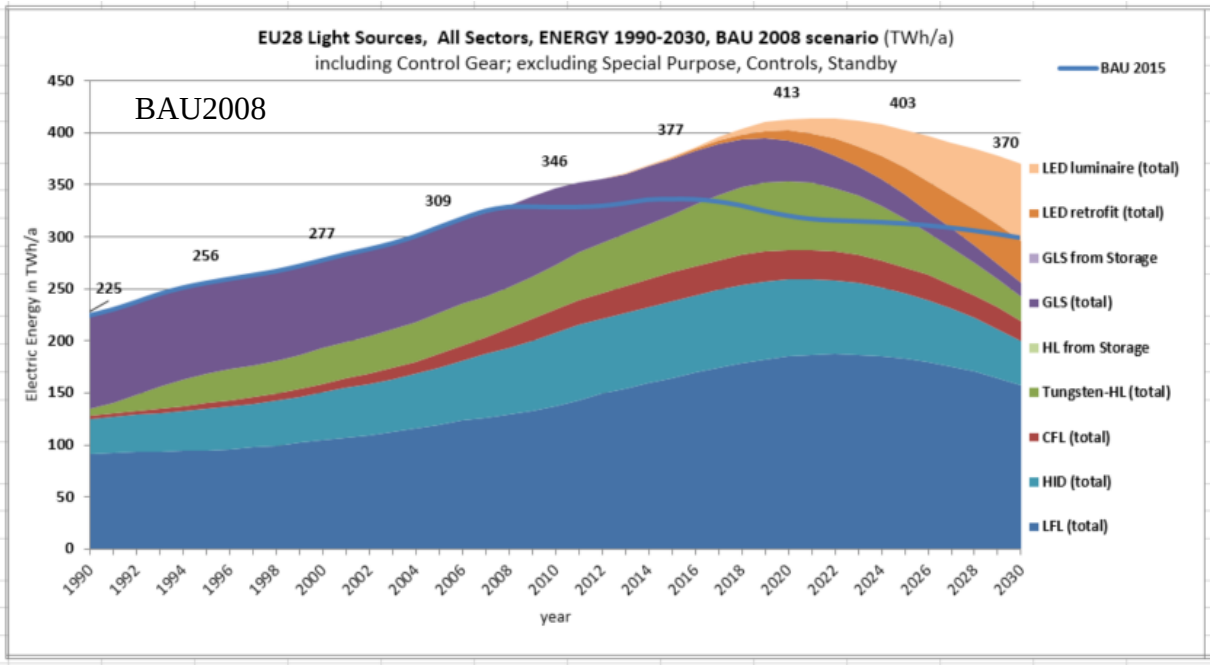
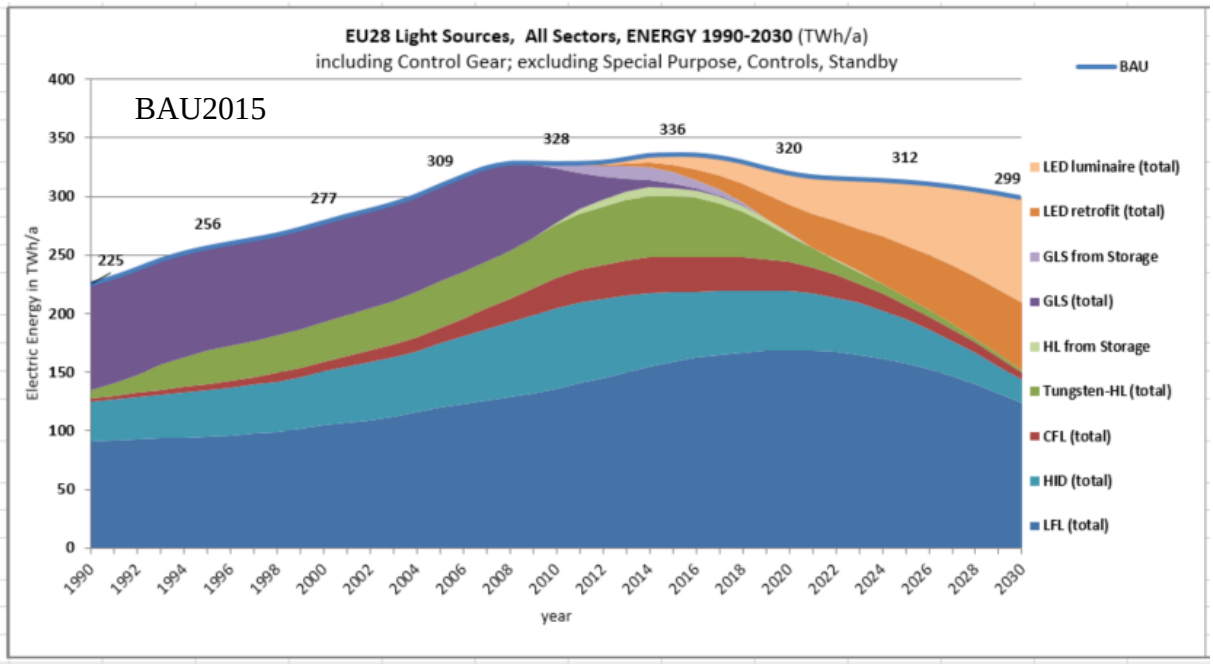


Figure 36 Total EU-28 Stock, in million units, for BAU2008 and BAU2015 scenarios.

4. IMPACT OF CURRENT REGULATIONS: BAU2008 VS. BAU2015, ELECTRICITY

In 2015, existing lighting regulations saved 41 TWh/a of electricity. This is expected to increase to 93 TWh/a in 2020. In later years annual savings would decrease, reaching 71 TWh/a in 2030.





TWh		2005	2010	2015	2020	2025	2030	Cumulative 2005-2030
BAU 2008	Electricity	309	346	377	413	403	370	9752
BAU 2015	saving		-18.1	-40.9	-92.9	-90.2	-71.2	-1415

Figure 37 Total EU-28 Electricity consumption, in TWh/a, for BAU2008 and BAU2015 scenarios.

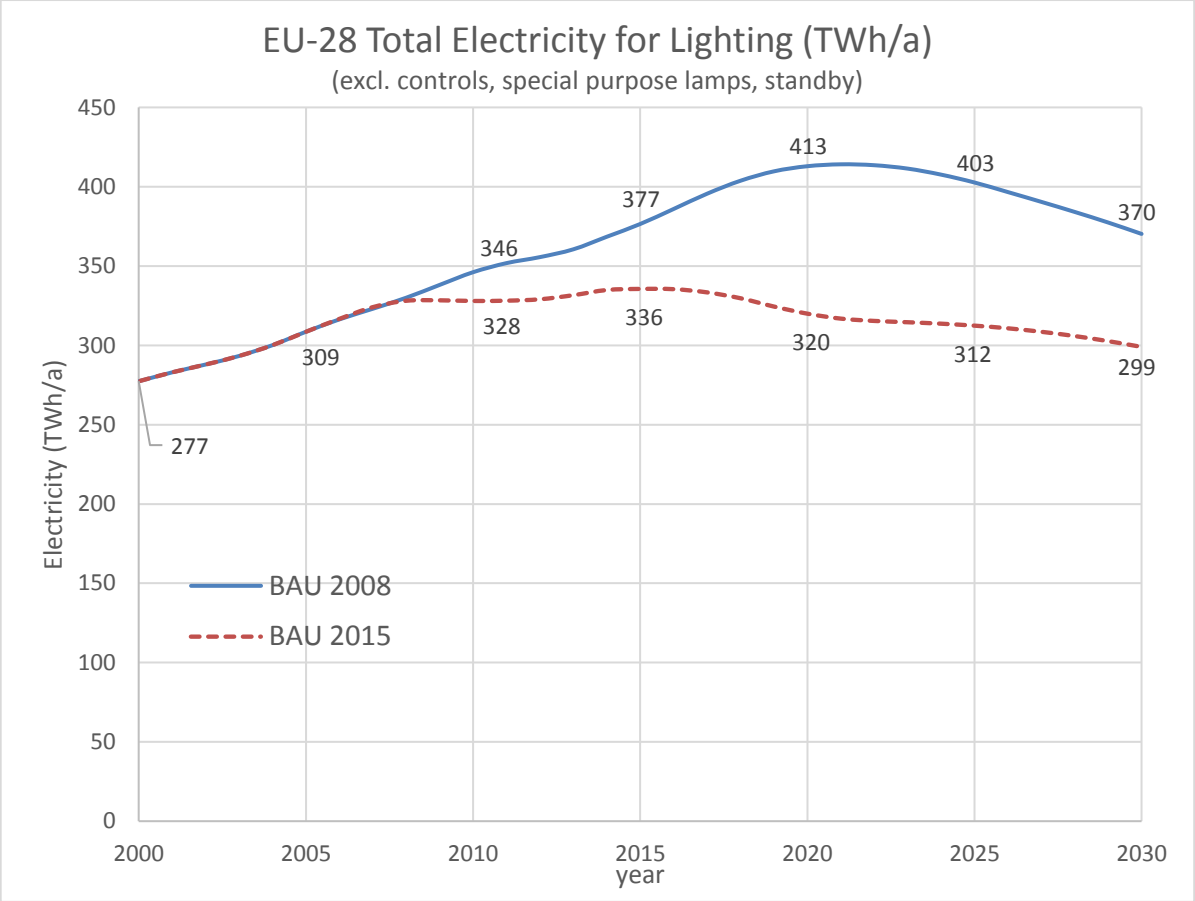


Figure 38 Comparison of the total EU-28 electricity consumption for lighting, in TWh/a, for the BAU2008 and BAU2015 scenarios. The electricity saving of the BAU2015 scenario vs. the BAU2008 scenario is the impact of the existing lighting regulations.

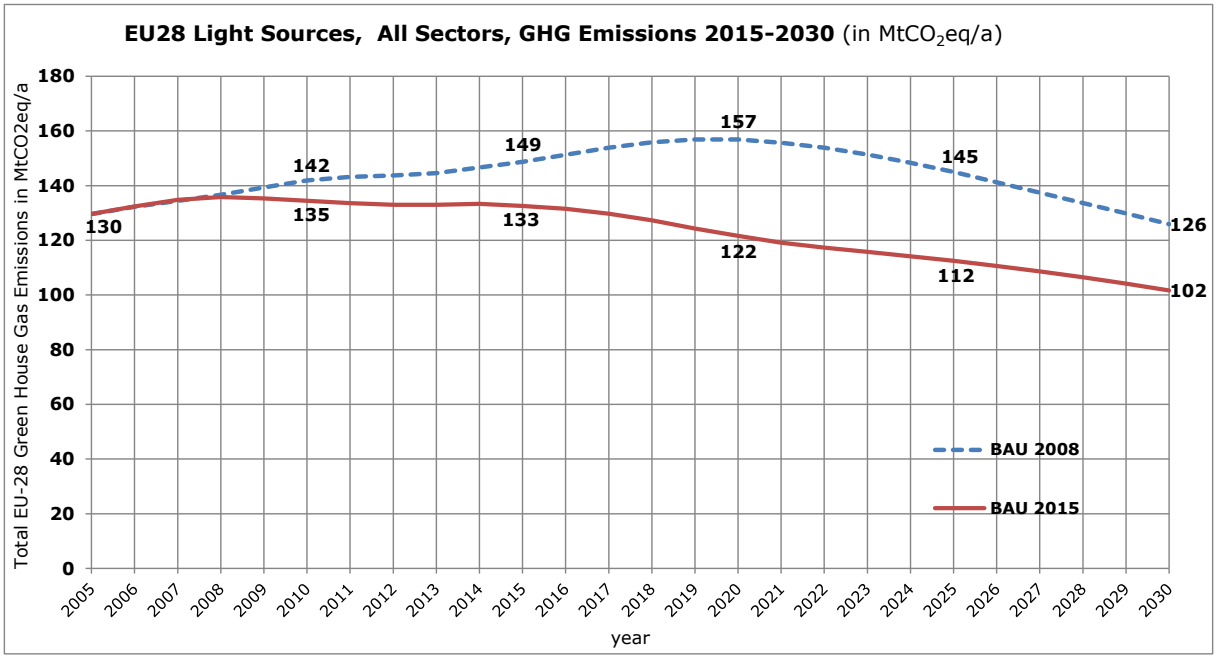
In 2015-2025, the major savings due to existing lighting regulations have been or will be obtained on the NDLS (household) applications. In 2015, 26 of the in total 41 TWh electricity savings (63%) were obtained on NDLS. In 2020 this is expected to be 53 on 93 TWh (57%). Second largest savings are obtained on DLS (household) applications (16 on 93 TWh, 17%, in 2020). Effects of the current regulations on light sources used mainly in the tertiary sector and in industry (FL, HID, CFLni) appear mainly from 2020 onwards.

Table 64 Savings on Electricity Consumption for Lighting, of the BAU2015 scenario vs. the BAU2008 scenario, in TWh/a or TWh cumulative. This is the impact of the existing lighting regulations. Positive value = saving; Negative value = additional electricity

TWh electricity saving BAU2015 vs. BAU2008	2010	2015	2020	2025	2030	cumulative 2005-2030
Total EU-28, all sectors	**18**	**41**	**93**	**90**	**71**	**1415**
total Residential (RES)	12	22	54	43	24	717
total Non-Residential (NRES)	6	18	39	48	48	698
total Classic Technology	18	54	123	126	104	1911
total LED	0	-13	-30	-36	-33	-496
LFL T8t	-5	-18	2	16	24	43
LFL T5 (13-80 W)	0	0	6	8	8	93
other LFL	6	24	8	1	1	207
LED in former LFL-applications	0	-1	-4	-7	-9	-87
Total LFL-applications	**1**	**5**	**12**	**19**	**24**	**256**
HPM	0	0	0	0	0	1
HPS	0	6	10	12	13	188
MH	1	7	13	13	10	205
LED in former HID-applications	0	-10	-14	-13	-10	-211
Total HID-applications	**1**	**4**	**10**	**13**	**13**	**184**
CFLni	0	1	3	4	4	54
LED in former CFLni-applications	0	0	-1	-2	-1	-18
Total CFLni-applications	**0**	**1**	**2**	**3**	**3**	**36**
HL LV R (MR/AR) (GU4,GU5.3,G53)	0	1	5	6	5	72
HL MV (DLS) (GU10 or E-cap)	-3	1	10	7	4	96
GLS (DLS)	-3	4	3	2	1	57
LED in DLS-applications	0	-1	-3	-2	-2	-38
Total DLS-applications	**-6**	**5**	**16**	**12**	**8**	**186**
CFLi	-3	-4	1	8	9	37
HL MV (NDLS, E-cap)	-2	-10	16	19	9	127
GLS (NDLS)	26	36	35	21	12	595
HL LV Capsule (G4, GY6.35)	0	0	1	2	1	20
HL MV Capsule (G9)	0	1	2	2	1	27
HL MV Linear (R7s)	1	5	6	5	2	90
LED in NDLS-applications	0	-1	-9	-12	-10	-142
Total NDLS-applications	**21**	**26**	**53**	**44**	**24**	**754**

5. IMPACT OF CURRENT REGULATIONS: BAU2008 VS. BAU2015, GHG EMISSIONS

In 2015, existing lighting regulations reduced GHG emission due to electricity consumption for lighting by 16 MtCO2eq/a. This is expected to increase to 35 MtCO2eq/a in 2020. In later years annual reduction would decrease, reaching 24 MtCO2eq/a in 2030.

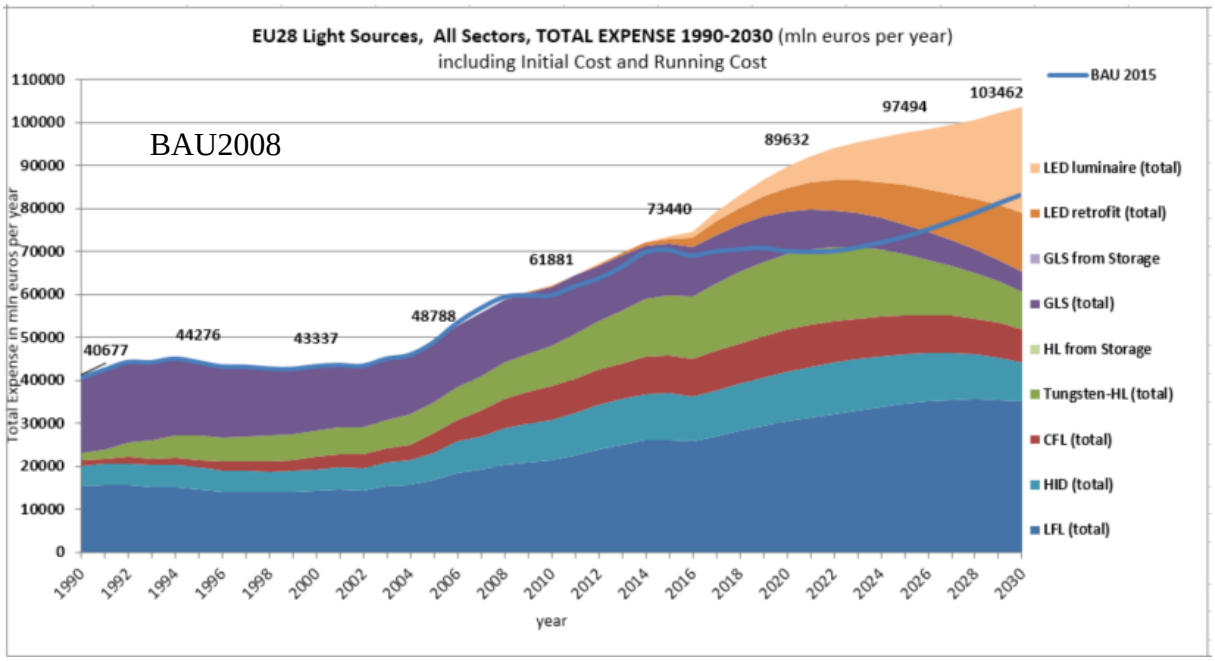


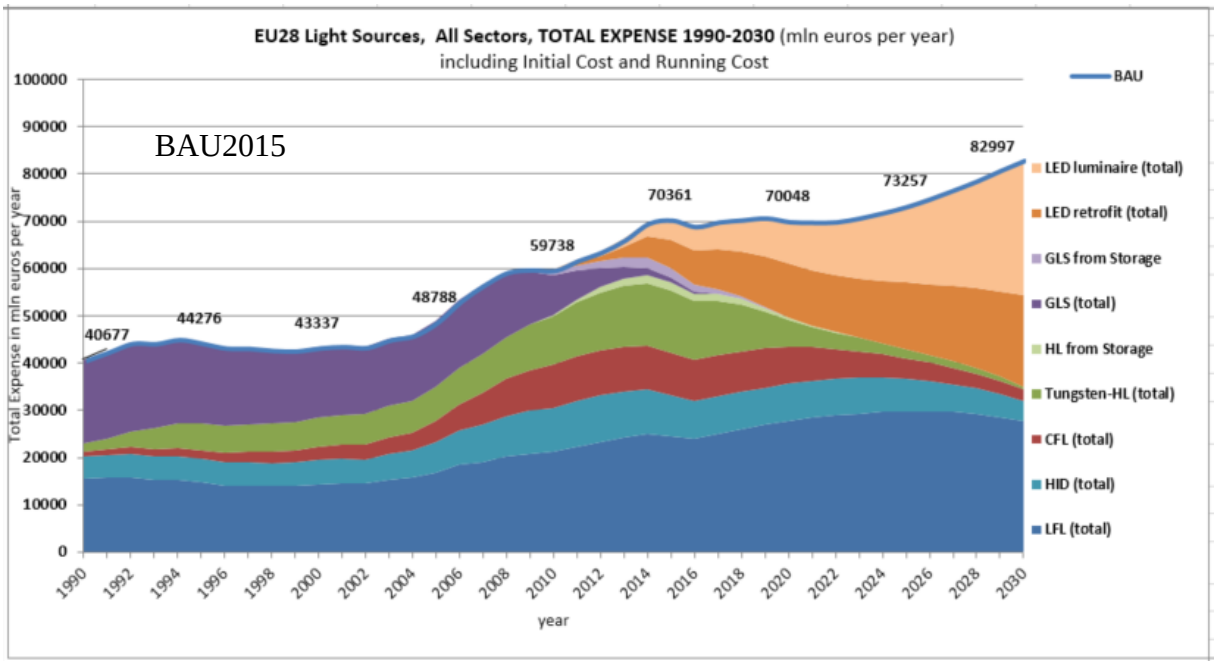
MtCO2eq		2005	2010	2015	2020	2025	2030	Cumulative 2005-2030
BAU 2008	GHG emission	130	142	149	157	145	126	3738
BAU 2015	saving		-7	-16	-35	-32	-24	-525

Figure 39 Comparison of the total EU-28 GHG emissions due to lighting, in MtCO2eq/a, for the BAU2008 and BAU2015 scenarios. The emission reduction of the BAU2015 scenario vs. the BAU2008 scenario is the impact of the existing lighting regulations.

6. IMPACT OF CURRENT REGULATIONS: BAU2008 VS. BAU2015, TOTAL USER EXPENSE

In 2015, the existing regulations made EU-28 users save 3.1 billion EUR/a on their expenses for lighting. By 2020 this is projected to be 19.6 billion EUR/a.





bn euros		2005	2010	2015	2020	2025	2030	Cumulative 2005-2030
BAU 2008	Total User Expense	49	62	73	90	97	103	2078
BAU 2015	saving		-2.1	-3.1	-19.6	-24.2	-20.5	-308

Figure 40 Total EU-28 User Expense for lighting, in bn euros, for BAU2008 and BAU2015 scenarios.

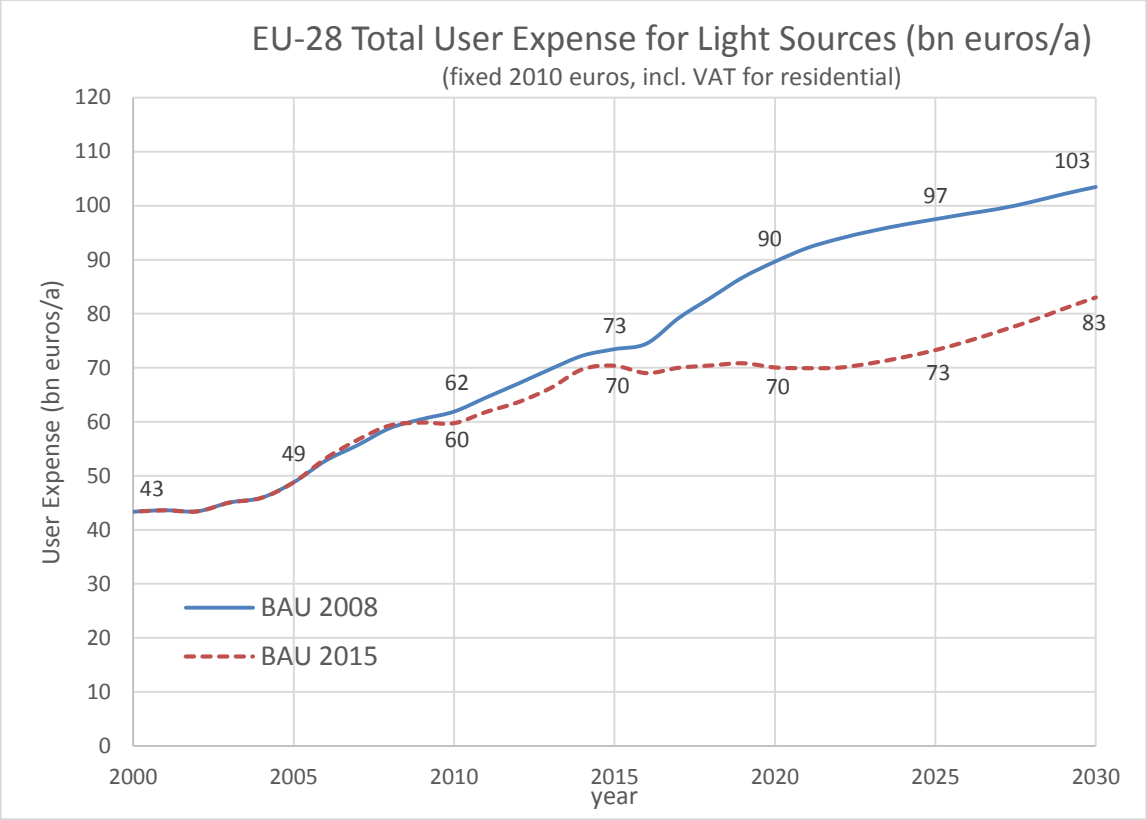


Figure 41 Comparison of the EU-28 total user expense for lighting, in billion EUR per year, for the BAU2008 and BAU2015 scenarios. The savings of the BAU2015 scenario vs. the BAU2008 scenario are the impact of the existing lighting regulations.

In 2015-2025, the major savings due to existing lighting regulations have been or will be obtained on the NDLS (household) applications. In 2020, 12 of the in total EUR 20 billion expense savings (60%) are obtained on NDLS. Second largest savings are obtained on DLS (household) applications (4 on 20 TWh, 20%, in 2020). Effects of the current regulations on light sources used mainly in the tertiary sector and in industry (FL, HID, CFLni) appear mainly from 2020 onwards.

Table 65 Savings on Total User Expense for Lighting, of the BAU2015 scenario vs. the BAU2008 scenario, in bn EUR/a or bn EUR cumulative. This is the impact of the existing lighting regulations. Positive value = saving; Negative value = additional expense

TWh electricity saving BAU2015 vs. BAU2008	2010	2015	2020	2025	2030	cumulative 2005-2030
Total EU-28, all sectors	**2**	**3**	**20**	**24**	**20**	**308**
total Residential (RES)	2	2	14	15	10	194
total Non-Residential (NRES)	1	1	6	9	10	114
total Classic Technology	2	12	30	33	30	471
total LED	71	-9	-10	-9	-10	-163
LFL T8t	-1.2	-2.4	0.3	3.0	5.3	12.1
LFL T5 (13-80 W)	-0.1	0.1	1.0	1.4	1.8	16.9
other LFL	1.4	4.0	1.4	0.3	0.3	37.4
LED in former LFL-applications	0.0	-0.6	-0.8	-1.4	-2.6	-21.7
Total LFL-applications	**0**	**1**	**2**	**3**	**5**	**45**
HPM	0.0	0.0	0.0	0.0	0.0	0.1
HPS	0.0	0.9	1.5	2.2	2.7	30.9
MH	0.1	1.1	2.1	2.5	2.3	36.3

LED in former HID-applications	0.0	-2.8	-2.1	-2.5	-2.4	-44.5
Total HID-applications	**0**	**-1**	**2**	**2**	**3**	**23**
CFLni	0.0	0.3	0.9	1.5	1.5	18.4
LED in former CFLni-applications	0.0	-0.3	-0.7	-0.8	-0.8	-11.2
Total CFLni-applications	**0**	**0**	**0**	**1**	**1**	**7**
HL LV R (MR/AR) (GU4,GU5.3,G53)	0.0	0.3	1.2	1.6	1.7	19.9
HL MV (DLS) (GU10 or E-cap)	-0.4	0.4	3.2	2.5	1.5	33.0
GLS (DLS)	0.3	0.9	0.9	0.6	0.4	14.5
LED in DLS-applications	-0.2	-1.3	-0.9	-0.6	-0.7	-17.4
Total DLS-applications	**0**	**0**	**4**	**4**	**3**	**50**
CFLi	-1.4	-0.5	1.3	3.1	3.7	21.6
HL MV (NDLS, E-cap)	-0.8	-2.7	4.6	5.8	3.4	44.3
GLS (NDLS)	4.3	8.3	8.9	6.3	4.4	150.6
HL LV Capsule (G4, GY6.35)	0.0	0.1	0.3	0.5	0.4	5.5
HL MV Capsule (G9)	0.0	0.2	0.5	0.7	0.5	8.2
HL MV Linear (R7s)	0.1	0.9	1.5	1.3	0.6	21.0
LED in NDLS-applications	0.0	-3.7	-5.5	-3.6	-3.4	-67.7
Total NDLS-applications	**2**	**3**	**12**	**14**	**10**	**183**

7. RESIDENTIAL VS. NON-RESIDENTIAL

Without any measures (BAU2008) residential electricity consumption for lighting in 2020 would have been 103 TWh/a. Due to the existing measures (BAU2015) this is expected to be only 49 TWh/a, a saving of 54 TWh/a (see also Table 40 in Annex 4), i.e. more than 50% saving. This spectacular saving is possible because the residential sector predominantly used incandescent (GLS) lamps with efficacy around 10 lm/W or lower. The replacement lamps have efficacies that are 1.5-2 times higher (halogen), 5 times higher (CFLi) or 10 times higher (LED).

Without any measures (BAU2008) non-residential electricity consumption for lighting in 2020 would have been 310 TWh/a. Due to the existing measures (BAU2015) this is expected to be only 271 TWh/a, a saving of 39 TWh/a (see also Table 40 in Annex 4), i.e. 13% saving. Hence, notwithstanding the much higher electricity consumption in the non-residential sector, savings due to existing regulation have been lower than in the residential sector. This is mainly due to the fact that the non-residential sector already used more efficient light sources than the residential sector. Passing from the old LFL T12 and T8 halo-phosphor to LFL T8 tri-phosphor and T5, passing from mercury lamps (HPM) to other HID lamps (HPS, MH), and replacing electromagnetic control gear by more efficient electronic control gear did increase efficiency, but starting on a higher efficiency level, this increase could not be close to a factor 2 as in the residential sector. The relatively small savings in the non-residential sector do not imply that existing measures were too weak: they did the maximum that was possible when measures were taken (2008-2009).

As a result, in 2020 it is expected that 271 of 320 TWh (85%) of EU lighting electricity is consumed in the non-residential sector, and 121 of these 271 TWh (45%) are consumed by LFL T8. For these LFL T8, LED tube replacements are available that are close to two times more efficient, and hence the main electricity savings opportunity for new measures lies there. The remaining 150 TWh in the non-residential sector is mainly

consumed by LFL T5, HID and CFLni, for which replacement by LED is not yet possible / convenient.

Annex 10: Energy efficiency formula

ECODESIGN

1. Proposal

ENERGY EFFICIENCY REQUIREMENTS for LIGHT SOURCES

The declared power consumption of a light source at full-load P_{on} shall not exceed the maximum allowed power P_{onmax} (in *W*), defined in function of the declared useful luminous flux Φ_{use} (in *lm*) and the declared colour rendering index CRI (in *Ra*) as follows:

$P_{onmax} = C * (L + \Phi_{use} / (F*\eta)) * R$

Where:

The values for threshold efficacy (η in *lm/W*) and end loss factor (L in *W*) are specified in Table 1, depending on the light source type.

Basic values for correction factor (C) depending on light source type, and additions to C for special light source features are specified in Table 2.

Efficacy factor (F) is:

1.00 for non-directional light sources (NDLS, using total flux)

0.85 for directional light sources (DLS, using flux in a cone)

CRI factor (R) is:

0.65 for CRI ≤ 25

(CRI+80)/160 for CRI > 25

Table A: Threshold efficacy (η) and end loss factor (L)

Light source description	**η**	**L**
	[*lm/W*]	[*W*]
LFL T5-HE	**98,8**	**1,9**
LFL T5-HO, 4000≤Φ≤5000 *lm*	**83**	**1,9**
LFL T5-HO, other *lm* output	**79**	**1,9**
FL T5 circular	**79**	**1,9**
FL T8 other than LFL 2-, 4- and 5-foot (incl. FL T8 U-shaped)	**89,7**	**4,5**
FL using magnetic induction, any length/flux	**70,2**	**2,3**
CFLni	**70,2**	**2,3**
FL T9 circular	**71,5**	**6,2**
HPS single-ended	**88**	**50**
HPS double-ended	**78**	**47,7**

MH ≤ 405 *W* single-ended	**84,5**	**7,7**
MH > 405 *W* single-ended	**79,3**	**12,3**
MH ceramic double-ended	**84,5**	**7,7**
MH quartz double-ended	**79,3**	**12,3**
Organic light-emitting diode (OLED)	**65**	**1,5**
HL R7s ≤ 2700 lm	**26**	**13**
Other light sources in scope not mentioned above	**120**	**1,5***

* For connected light sources (CLS) a factor L=2.0 shall be applied.

Table B: Correction factor C depending on light source characteristics

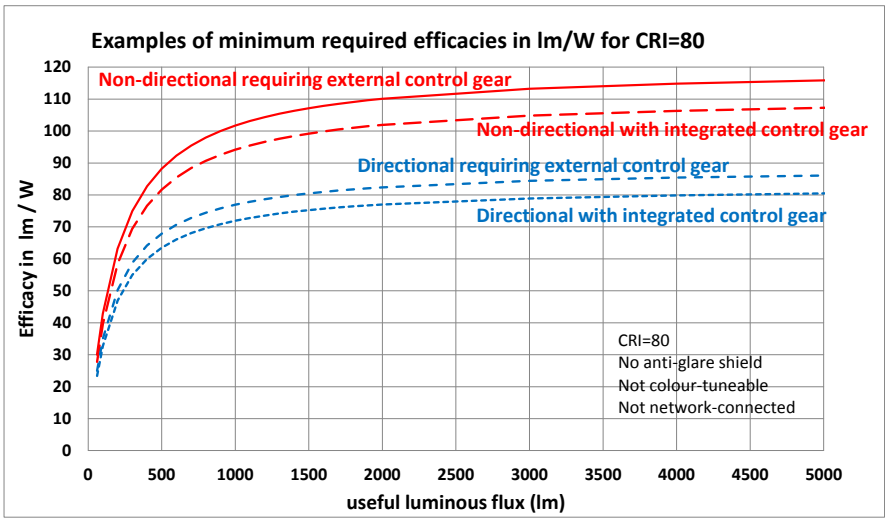
Light source type	**Basic C value**
Non-directional (NDLS) not operating on mains (NMLS)	1
Non-directional (NDLS) operating on mains (MLS)	1,08
Directional (DLS) not operating on mains (NMLS)	1,15
Directional (DLS) operating on mains (MLS)	1,23
Special light source feature	**Bonus on C**
FL or HID with Tc >5000 *K*	+0,1
FL with CRI > 90 *Ra*	+0,1
HID with second envelope	+0,1
MH NDLS >405 W with non-clear envelope	+0,1
DLS with anti-glare shield	+0,2
Colour-tuneable light source (CTLS)	+0,1

Where applicable, bonuses on correction factor C are cumulative.

'Threshold efficacy' and 'end loss factor' are not light source parameters, but constants to be used in the maximum power formula.
The 'threshold efficacy' is not the minimum efficacy that the light source has to meet. This minimum required efficacy is lower than the 'threshold efficacy' and can be derived by dividing the useful luminous flux (lm) by the maximum allowed power (W) resulting from the formula.
Originally, the 'end loss factor' reflected a certain minimum power that would always be required, regardless of the amount of luminous flux emitted. In the course of the development of the maximum power formula, this original meaning has largely been lost. The 'end loss factor' is now just a constant in the formula that has been used, where applicable, to tune the new efficacy requirements such that they correspond closely to the existing requirements. The main effect of the 'end loss factor' is that light sources emitting a high flux are required to have a higher efficacy. If the 'end loss factor' would be set to zero, the required efficacy would be the same for all fluxes.

As an illustration, the required minimum efficacy for 'Other light sources' in Table A (including LEDs) is shown in the graph below. The curves give the minimum required efficacy in lm/W in function of the useful luminous flux, for η=120 lm/W, L=1.5, CRI=80, no special features. The four curves are for non-directional (NDLS) and directional light sources (DLS), requiring an external control gear to operate on the mains power supply, or with integrated control gear (operating directly on the mains power

supply). For light sources with CRI > 80, with anti-glare shield, with network connection, or colour tuneable, required efficacies are lower.



The standby power of a light source P_{sb} shall not exceed 0.5 *W*. The networked standby power of a connected light source P_{net} shall not exceed 0.5 *W*

ENERGY EFFICIENCY REQUIREMENTS for CONTROL GEARS

The minimum energy efficiency requirements shall apply for separate control gear operating at full-load:

Table C: Minimum efficiency for separate control gear at full-load

Declared output power of the control gear (P_{cg}) or declared power of the light source (P_{ls}) in *W*, as applicable	**Minimum efficiency**
Control gear for HL light sources	
all wattages P_{cg}	0,91
Control gear for FL light sources	
$P_{ls} \leq 5$	0,71
$5 < P_{ls} \leq 100$	$P_{ls}/(2*\sqrt{(P_{ls}/36)}+38/36* P_{ls}+1)$
$100 < P_{ls}$	0,91
Control gear for HID light sources	
$P_{ls} \leq 30$	0,78
$30 < P_{ls} \leq 75$	0,85
$75 < P_{ls} \leq 105$	0,87
$105 < P_{ls} \leq 405$	0,90
$405 < P_{ls}$	0,92
Control gear for LED or OLED light sources	
$P_{cg} \leq 10$	0,70
$10 < P_{cg} \leq 25$	0,75

$25 < P_{cg} \leq 50$	0,83
$50 < P_{cg} \leq 100$	0,86
$100 < P_{cg} \leq 300$	0,88
$300 < P_{cg}$	0,90

The no-load power of a separate control gear P_{no} shall not exceed 0.5 *W*. The standby power of a separate control gear P_{sb} shall not exceed 0.5 *W*.

2. Current regulations

See:

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, OJ L76/3, 24.3.2009 and amendments Commission Regulations (EC) No 859/2009 and (EU) 2015/1428;

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, OJ L76/17, 24.3.2009 and amendments Commission Regulations (EC) No 347/2010 and (EU) 2015/1428;

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 for directional lamps, light emitting diode lamps and related equipment, OJ L342/1, 14.12.2012 and amendment Commission Regulation (EU) 2015/1428 (ecodesign regulations).

ENERGY LABELLING

1. Proposal

The energy efficiency class of light sources shall be determined on the basis of the efficacy values expressed in total mains efficacy η_{TM}, which is defined as the total initial luminous flux (in *lm*) divided by mains power input (in *W*) – (*lm/W*).

The total mains efficacy η_{TM} is calculated by dividing the declared useful luminous flux Φ_{use} (expressed in *lm*) by the declared on-mode power consumption P_{on} (expressed in *W*) and multiplying by the applicable factor F_{TM} , i.e.:

$\eta_{TM} = (\Phi_{use} / P_{on}) * F_{TM}$ (*lm/W*).

Factors F_{TM} to be used for determination of $\eta_{TM} = (\Phi_{use} / P_{on}) * F_{TM}$ (lm/W)	
Light source type	**Factor F_{TM}**
Non-directional mains light source (NDLS, MLS)	1.000
Non-directional non-mains light source (NDLS, NMLS)	0.926
Directional mains light source (DLS, MLS)	1.176

Directional non-mains light source (DLS, NMLS)	1.089

2. Current regulation

For the calculation of the energy efficiency index (EEI) of a model, its power corrected for any control gear losses is compared with its reference power. The reference power is obtained from the useful luminous flux, which is the total flux for non-directional lamps, and the flux in a 90° or 120° cone for directional lamps.

The EEI is calculated as follows and rounded to two decimal places:

$EEI = P_{cor}/P_{ref}$

where:

P_{cor} is the rated power (P_{rated}) for models without external control gear and the rated power (P_{rated}) corrected for models with external control gear. The rated power of the lamps is measured at their nominal input voltage.

Power correction if the model requires external control gear

Scope of the correction	**Power corrected for control gear losses (P_{cor})**
Lamps operating on external halogen lamp control gear	$P_{rated} \times 1{,}06$
Lamps operating on external LED lamp control gear	$P_{rated} \times 1{,}10$
Fluorescent lamps of 16 mm diameter (T5 lamps) and 4-pin single capped fluorescent lamps operating on external fluorescent lamp control gear	$P_{rated} \times 1{,}10$
Other lamps operating on external fluorescent lamp control gear	$P_{rated} \times \frac{0{,}24\sqrt{\Phi_{use}} + 0{,}0103\Phi_{use}}{0{,}15\sqrt{\Phi_{use}} + 0{,}0097\Phi_{use}}$
Lamps operating on external high-intensity discharge lamp control gear	$P_{rated} \times 1{,}10$
Lamps operating on external low pressure sodium lamp control gear	$P_{rated} \times 1{,}15$

P_{ref} is the reference power obtained from the useful luminous flux of the model (Φ_{use}) by the following formulae:

For models with $\Phi_{use} < 1\,300$ lumen: $P_{ref} = 0{,}88\sqrt{\Phi_{use}} + 0{,}049\Phi_{use}$
For models with $\Phi_{use} \geq 1\,300$ lumen: $P_{ref} = 0{,}07341\Phi_{use}$

Definition of the useful luminous flux

Model	**Useful luminous flux (Φ_{use})**
Non-directional lamps	Total rated luminous flux (Φ)
Directional lamps with a beam angle ≥ 90° other than filament lamps and carrying a textual or graphical warning on their packaging that they are not suitable for accent lighting	Rated luminous flux in a 120° cone ($\Phi_{120°}$)
Other directional lamps	Rated luminous flux in a 90° cone ($\Phi_{90°}$)

The weighted energy consumption (E_c) is calculated in kWh/1 000 h as follows and is rounded to two decimal places:

$$E_c = \frac{P_{cor} \times 1000h}{1000}$$

Where P_{cor} is the power corrected for any control gear losses.

Annex 11: Exemptions in Ecodesign

Aim of this Annex

The aim of this Annex is to compare the exemptions in the current ecodesign legislation for lighting products with the exemptions proposed in the options of this impact assessment for a reviewed ecodesign regulation (Option 3 ECOEL2021 and Option 4 ECOEL2tiers).

The table at the end of this annex lists the exemptions for each of the three regulations (Commission Regulations (EC) No 244/2009, (EC) No 245/2009 and (EU) No 1194/2012) and presents their status in the proposed review. In the table, the exemptions proposed in the review are split as follows in comparison to the current regulations:

- what remains exempted, divided in what is explicitly exempted and what naturally falls out-of-scope;
- what is not exempted, divided in what remains not exempted and what is no longer exempted.

Another column lists the exemptions for which there is ambiguity in the existing regulations and that the proposed review clarifies.

The last column aims to quantify the variation in energy savings following the change in the ecodesign proposal. Numbers may appear limited, but it should be kept in mind that the savings only relate to the variation from that specific use of the light source (which should be only used as a Special Purpose Lamp, according to the current regulations). In many cases, as described in Section 2 of this impact assessment, Special Purpose Lamps are instead used for general lighting purposes. While it is not possible to estimate per exemption how this has been used as a loophole, and thus quantify the lost energy savings per exemption, the evaluation showed that the ambiguity in the formulation of the exemptions taken together is one of the causes for the gap between the expected and the real energy savings at 2020 presented in Section 2 (70 TWh/y instead of expected 110 TWh/y).

List of exemptions proposed in the review of the ecodesign regulation

The proposed exemptions aim at tackling the ambiguities of the current regulations. The approach is to abandon the principle of "intended use" of a light source and its special purpose and to define exemptions clearly verifiable because based on legislation and/or technical characteristics.

The review proposes three groups of exemptions:

1. The reviewed Regulation should not apply to light sources and separate control gears specifically tested and approved to operate:

(a) in potentially explosive atmospheres as defined in Directive 2014/34/EU of the European Parliament and of the Council;

(b) for emergency use as set out in Directive 2014/35/EU of the Council and the Parliament;

(c) in radiological and nuclear medicine installations, as defined in Article 3 of Directive 2009/71/EURATOM;

(d) in or on military or civil defence establishments, equipment, ground vehicles, marine equipment or aircraft as set out in Member States' Regulations or in documents issued by the European Defence Agency;

(e) in or on motor vehicles, their trailers and systems, components, interchangeable towed equipment and separate technical units intended as set out in Regulation No 661/2009, Regulation (EU) No 168/2013, Regulation (EU) No 167/2013 and their amendments;

(f) non-road mobile machinery intended as set out in Regulation (EU) 2016/1628/EU and their amendments;

(g) in or on civil aviation aircrafts as set out in Commission Regulation 748/2012;

(h) in railway vehicle lighting as set out in Directive 2008/57/EC and its amendments, as well as relevant Member State legislation;

(i) in marine equipment as set out in Council Directive 2014/90/EU and its amendments or recasts;

(j) in medical devices as set out in Council Directive 93/42/EEC and in vitro medical devices as set out in Directive 98/79/EC and their amendments.

For these exemptions, 'specifically tested and approved' means that the light source or separate control gear:

- has been specifically tested for the mentioned operating condition or application, according to the indicated European legislation or related implementing acts, relevant Member State legislation, and/or relevant European or international standards; and
- is accompanied by evidence, in the form of a certificate, a type approval mark, a test report or other documentation, that the product has been specifically approved for the mentioned operating condition or application; and
- is placed on the market specifically for the mentioned operating condition or application, as evidenced at least by the technical documentation, information on the packaging and any advertising or marketing materials.

2. In addition, the reviewed Regulation should not apply to:

(a) double capped fluorescent T5 light sources with power $P \leq 13$ *W*;

(b) electronic displays (e.g. televisions, computer monitors, notebooks, tablets, mobile phones, e-readers, game consoles), including but not limited to displays in scope of Commission Regulation (EU) No 617/2013, Commission Decision (EU) 2015/1402, Commission Regulation (EC) No 642/2009, Commission Decision (EU) 2016/1756, European Commission COM(2015)178;

(c) Range hoods in the scope of Commission Delegated Regulation (EU) No 65/2014;

(d) light sources and separate control gears in battery-operated products, including but not limited to e.g. torches, mobile phones with integrated torch light, toys including light sources, desk lamps operating only on batteries, armband lamps for cyclists, solar-powered garden lamps;.

(e) light sources and separate control gears in bicycles and other non-motorized vehicles.

3. The following light source or separate control gear should comply only with information requirements because they have a specific technical design:

(a) signalling (including, but not limited to, road-, railway-, marine- or air traffic-signalling, traffic control or airfield lamps);

(b) image capture and image projection (including, but not limited to, photocopying, printing (directly or in pre-processing), lithography, film and video projection, holography);

(c) light sources with specific effective ultraviolet power >2 *mW/klm* and intended for use in applications requiring high UV-content;

(d) light sources having the peak radiation around 253.7 nm and intended for germicidal use (destruction of DNA);

(e) light sources emitting 5% or more of total radiation power of the range 250-800 nm in the range of 250-315 nm and/or 20% or more of total radiation power of the range 250-800 nm in the range of 315-400 nm, and intended for disinfection or fly trapping;

(f) light sources having the primary purpose to emit radiation around 185.1 nm and intended to be used for the generation of ozone;

(g) light sources emitting 40% or more of total radiation power of the range 250-800 nm in the range of 400-480 nm, and intended for coral zooxanthellae symbioses;

(h) FL light sources emitting 80% or more of total radiation power of the range 250-800 nm in the range of 250-400 nm, and intended for sun-tanning;

(i) HID light sources emitting 40% or more of total radiation power of the range 250-800 nm in the range of 250-400 nm, and intended for sun-tanning;

(j) light sources with a photosynthetic efficacy >1.2 µmol/J, and/or emitting 25% or more of total radiation power of the range 250-800 nm in the range of 700-800 nm, and intended for use in horticulture;

(k) HID light sources with correlated colour temperature CCT > 7000 *K* and intended for use in applications requiring such a high CCT;

(l) halogen light sources with a beam angle of less than 10˚ and intended for spot-lighting applications requiring a very narrow light beam;

(m) halogen light sources with cap-type G9.5, GX9.5, GY9.5, GZ9.5, G9.5HPL, G16d, GX16, GX16d, GY16, G22, G38, GX38, GX38Q, P28s, P40s, PGJX50, QXL, designed and marketed specifically for scene-lighting use in film-studios, TV-studios, and photographic-studios, or for stage-lighting use in theatres, discos and during concerts or other entertainment events;

(n) Colour-tuneable light sources that can be set to at least the colours mentioned in table below and have for each of these colours, measured at the dominant wavelength, a minimum colour purity index according to table below, and intended for use in applications requiring high-quality coloured light:

Colour	Dominant wave-length range	Minimum colour purity index
Blue	440nm – 490nm	90%
Green	520nm – 540nm	65%
Red	610nm – 670nm	95%

(o) light sources accompanied by an individual calibration certificate detailing the exact radiometric flux and/or spectrum under specified conditions, and intended for use in photometric calibration (of e.g. wavelength, flux, colour temperature, colour rendering index), or for laboratory use during the evaluation of coloured surfaces and materials under standard viewing conditions (e.g. standard illuminants);

(p) light sources provided specifically for use by photosensitive patients, to be sold in pharmacies and other authorised selling points like disability products suppliers on presentation of a medical prescription;

(q) Incandescent light sources (not including halogen light sources) fulfilling all of the following conditions: power ≤40W, length ≤60mm, diameter ≤30mm, declared suitable for operation at ambient temperature ≥300°C, and intended for use in high temperature applications such as ovens;

(r) Halogen light sources fulfilling all of the following conditions: cap-type G4, GY6.35 or G9, power ≤60W, declared suitable for operation at ambient temperature ≥300°C, and intended for use in high temperature applications such as ovens;

(s) Light sources and separate control gears intended for operation at ambient temperatures below -30°C.

General warning for the comparison with the exemptions in the current legislation

It is challenging to make a clear overview of how exemptions will change from the existing regulations to new regulation. One main reason is that the three existing regulations do not have exactly the same scope and do not use the same exemptions.

A second reason is that there are descriptions in the existing regulations that are vague and open to interpretation, and that therefore a list of products being exempted by them is difficult to define and seemingly unlimited. This is the case, for example, of exemptions based on the fact that the primary purpose of a light is not lighting, or when the light source does not provide a general lighting function.

A third reason is that there are overlaps between scope, generic exemptions and specific exemptions, i.e. a given light source may be excluded from the regulation for more than one reason. Hence, dropping an exemption does not always mean that the associated light sources are no longer exempted.

Main exemptions that were discussed among stakeholders

1. Stage lighting: in the current regulations there is an exemption for stage lighting, meaning in theatres, concert stages, TV and similar contexts. The exemption has been widely interpreted, by including all lighting within the perimeter of the location (e.g. lighting of the entrance hall of the theatre). The total consumption for theatre et al. lighting is estimated at 3 TWh/y, of which only 0.075 TWh/y for lighting on stage. The approach to define the exemption has been to identify the specific light sources used only on stage: this was possible looking at the socket types.

2. **Colour tuneable lighting**: this is connected to stage lighting too. The current regulations are ambiguous about having in scope or not colour tuneable lighting. This was a consequence of the slightly wider white light area of one of the three regulations. The proposed review clarifies the exemption for colour tuneable lighting based on the index colour purity.

3. **Handling equipment**: in the current regulation the exemption is quite vague. A specific exemption is proposed based on legislation and per motor vehicle type with the support of the European associations representing manufacturers of handling equipment.

4. Photosensitive patients: the current regulations have a general exemption for photosensitive patients to buy incandescent light sources, which were phased out from 2009. Some Member States reported that incandescent lamps are still present in shops for general lighting uses. Several reports have shown that there is no evidence that other lighting technologies than incandescents cause health effects: however, being a sensitive point, the proposed review keeps the exemption for photosensitive patients but requires to buy the specific light sources in pharmacies and with a medical prescription.

5. Railway platforms and tunnels: some Member States and the railway sector asked to check exemptions to avoid LEDs on tunnels and platforms. At the beginning the request from the railway sector was, like for theatres, to exempt the entire perimeter of the railway area, including offices or passengers corridors (the current regulations could be read as allowing for this). Despite several analysis and conversations with the sector, it was no possible to define an exemption bases on safety or technical requirements set in legislation, or technical require. On the other hand, there are examples of safe use of LEDs, especially in tunnels, already.

Abbreviations in the table:

CC	Chromaticity coordinates
SPL	Special Purpose Lamp
LS	Light source
WD	Proposed Working Document
FLni	Fluorescent lamp without integrated ballast
HID	High-intensity discharge lamp
NDHHL	non-directional household lamps, including when they are marketed for non-household use or when they are integrated into other products, as defined in 244/2009
	‘household lamp’ means a lamp intended for household room illumination; it does not include special purpose lamps;
	'lamp’ means a source made in order to produce an optical radiation, usually visible, including any additional components necessary for starting, power supply or stable operation of the lamp or for the distribution, filtering or transformation of the optical radiation, in case those components cannot be removed without permanently damaging the unit
	‘household room illumination’ means the full or partial illumination of a household room, by replacing or complementing natural light with artificial light, in order to enhance visibility within that space
	The definition of DLS and NDLS in Commission Regulation (EC) No 244/2009 is the same as in the WD

DLS	Directional light source
NDLS	Non-directional light source
244/2009	Commission Regulation (EC) No 244/2009
245/2009	Commission Regulation (EU) No 1194/2012
1194/2012	Commission Regulation (EU) No 1194/2012

Table comparing the exemptions:

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
Out-of-scope or exempted in Commission Regulation (EC) No 244/2009 (Non-directional household lamps)							
NDHHL	The 244/2009 definition leaves ample room for interpretation. In WD the concept of 'household lamp' is no longer used. See subtypes on separate rows					x	
NDHHL in/on means of transport	In 244/2009 assumed implicitly exempted due to text in Directive 2009/125/EC Art.1.3.		x			x	none
LS for use in household appliances other than range hoods and ovens	In 244/2009 these LS have generally been considered to be not NDHHL (not for household room illumination). In WD there is no explicit exemption, because adequate LED retrofit lamps are available.				x		Additional energy saving < 0.6 TWh/a
LS for use in range hoods	In 244/2009 same as above. In WD explicit exemption, to avoid interaction with specific regulation on range hoods.		x			x	none
LS for use in ovens / microwave ovens	In 244/2009 same as above. In addition in 244/2009 high temperature exemption, see further below. In WD exemption for high temperature use.		x			x	none
decorative lamps	In 244/2009 these have sometimes been considered to be not NDHHL (not for household room illumination), or to be SPL because their primary purpose is not lighting. EC interpretation is that 'decorative lamps' were not exempted in 244/2009. In WD there is also no explicit exemption.			x		x	none
directional lamps	Exempted in 244/2009 because covered separately in CR 1194/2012. WD uses same definition for what is DLS/NDLS.			x			none
fluorescent lamps without integrated ballast	Exempted in 244/2009 because covered separately in 245/2009			x			none
high-intensity discharge lamps	Exempted in 244/2009 because covered separately in 245/2009			x			none
non-white lamps, Chromaticity Coordinates x-y	WD has smaller 'white light' area and thus puts more (non-white) LS out-of-scope. This is intentional, to have less need for specific exemptions. In 244/2009 more lamps were in scope but then later exempted with a rather vague description. The overall effect is more or less the same.	several LS exempted in 244/2009 now moved out-of-scope (effect is more or less the same)				x	none
NDHHL with CC x < 0,200	WD: LS with CC x < 0,270						
NDHHL with CC x > 0,600	WD: LS with CC x > 0,530						

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
NDHHL with CC $y < -2{,}3172\ x^2 + 2{,}3653\ x - 0{,}2800$	WD: LS with CC $y < -2{,}3172\ x^2 + 2{,}3653\ x - 0{,}2200$						
NDHHL with CC $y > -2{,}3172\ x^2 + 2{,}3653\ x - 0{,}1000$	WD: LS with CC $y > -2{,}3172\ x^2 + 2{,}3653\ x - 0{,}1595$						
NDHHL with flux < 60 lm	WD identical to 244/2009: same lower limit for flux.	x					none
NDHHL with flux > 12000 lm (relevant mainly for halogen lamps used in studio-/stage-/event-lighting)	WD: uses upper flux limit 82000 lm, used in existing CR for HPS and now applied to all LS types. WD draws into scope e.g. halogen lamps with flux between 12000 and 82000 lm. In part this is possible because adequate LED replacements exist (LED flood lights instead of Halogen R7s). In part these lamps are now exempted based on their cap-type and their use in studio- and stage-lighting.		Halogen with certain cap-types for use in studio/stage lighting		Halogen with flux between 12 and 82 klm now in scope		extra savings on R7s > 12000 lm are < 0.1 TWh/a
NDHHL having 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm	WD: UV lamps continue to be not regulated: or out-of-scope for non-white, or specific exemption.	most UV	some UV				none
NDHHL having the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB)	WD: UV lamps continue to be not regulated: or out-of-scope for non-white, or specific exemption.	most UV	some UV				none
NDHHL incandescent lamps with E14/E27/B22/B15 caps, with a voltage equal to or below 60 volts and without integrated transformer in Stages 1-5 according to Article 3.	No longer relevant from Stage 6 (September 2018). Hence no action on these in WD.			x			none
NDHHL SPL (generic): applications where the primary purpose of the light is not lighting	Some examples of this are mentioned in 244/2009 (see rows below), but as a generic exemption this was very vague. See e.g. separate entry for 'decorative lamps'. This formulation intentionally avoided in WD.					x	expected small, but not quantifiable
NDHHL SPL: emission of light as an agent in chemical or biological processes (such as polymerisation, ultraviolet light used for curing/drying/hardening, photodynamic therapy, horticulture, pet care, anti-insect products)	Most of these lamps are UV. In WD, UV lamps continue to be not regulated: or out-of-scope for non-white, or specific exemption.	most UV, most horticulture	some UV, some horticulture				none
NDHHL SPL: image capture and image projection (such as camera flashlights, photocopiers, video projectors)	Some probably moved out-of-scope for light density criterion. Anyway same exemption also in WD.	some	x				none
NDHHL SPL: heating (infrared lamps)	In WD assumed to be out-of-scope because non-white.	x				x	none
NDHHL SPL: signalling (such as traffic control or airfield lamps)	Same exemption is also in WD.		x				none

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
NDHHL SPL: the spectral distribution of the light is intended to change the appearance of the scene or object lit, in addition to making it visible (such as food display lighting or coloured lamps as defined in point 1 of Annex I), with the exception of variations in correlated colour temperature	In WD, as in 244/2009, coloured lamps are already out-of-scope, but there are more out-of-scope in WD (see separate entry on chromaticity coordinates). For food display lighting, some may be out-of-scope for non-white. For many food lighting applications adequate LED retrofits are available. No specific exemption based on spectral characteristics could be formulated.	most			some		negligible
NDHHL SPL: the spectral distribution of the light is adjusted to the specific needs of particular technical equipment, in addition to making the scene or object visible for humans (such as studio lighting, show effect lighting, theatre lighting)	In WD, there is a specific exemption for halogen lamps with certain cap-types, that intend to cover all halogen lamps used in studio-, stage-, and event-lighting		x			x	none
NDHHL SPL: the scene or object lit requires special protection from the negative effects of the light source (such as lighting with dedicated filtering for photosensitive patients or photosensitive museum exhibits)	LS suppliers are promoting use of LEDs in museums because they have less negative effects. Therefore exemption for museum not continued. Same should partly be true for photosensitive patients, i.e. LEDs permit to fine-tune the spectrum, but uncertain if such LEDs can meet efficiency requirements.		for photo-sensitive patients		for museum exhibits		extra savings for museum lighting < 0.06 TWh/a
NDHHL SPL: lighting is required only for emergency situations (such as emergency lighting luminaires or control gears for emergency lighting)	WD: emergency lighting continues to be exempted		x				None
NDHHL SPL: the lighting products have to withstand extreme physical conditions (such as vibrations or temperatures below – 20 °C or above 50 °C) (however, see limitations on exemption for shock-proof below)	WD: upper temperature limit made more specific for incandescents and halogen used in ovens. Use in range hoods explicitly exempted (see separate entry). In WD, lower limit decreased to -30C (LEDs have no problem at lower temperature). In WD no exemption for shock-/vibration proof (LEDs have good resistance) Limitation on exemption for shock-/vibration resistant introduced in CR 2015/1428, to close some loopholes in 244/2009: *Incandescent lamps longer than 60 mm are not special purpose lamps, if they are resistant only to mechanical shock or vibrations and are not incandescent traffic signalling lamps; or they possess a rated power higher than 25 W and claim to have specific features that are also present in lamps having higher energy efficiency classes according to Regulation (EU) No 874/2012 (such as zero EMC emissions, CRI value higher or equal to 95, and UV emissions less or equal than 2 mW per 1 000 lm)*		LS for extreme temperatures, range hoods		vibration- and shock-resistance	x	negligible
Out-of-scope or exempted in Commission Regulation (EC) No 245/2009 (FL and HID without integrated ballast)							
FLni-HID that are not white light sources as defined in Annex II; this exemption does not apply to high pressure sodium lamps	WD uses the same definition for white light as 245/2009 and makes the same exemption for HPS	x					none

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
FLni-HID that are directional light sources as defined in Annex II	Exempted in 245/2009 because covered separately in CR 1194/2012. WD uses same definition for what is DLS/NDLS.			x			none
blended high intensity discharge lamps having: — 6 % or more of total radiation of the range 250-780 nm in the range of 250-400 nm; and — 11 % or more of total radiation of the range 250-780 nm in the range of 630-780 nm; and — 5 % or more of total radiation of the range 250-780 nm in the range of 640-700 nm	Blended lamp is an incandescent lamp in series with a high-pressure mercury lamp in the same bulb. In WD, blended HID are in scope (combination of technologies). Industry has proposed to apply this exemption to all LS and to consider each condition separately instead of all together, but that would increase risk of abuse, while industry did not demonstrate the actual need to maintain this exemption. Impression is that it is an old technology, no longer necessary. RoHS might also block these lamps for their mercury content. In WD assumed that no specific exemption is necessary in addition to related exemptions and out-of-scope that are already formulated.	non-white UV- and IR-light sources	horticulture LS, several types of UV LS		some types of blended lamps		very small, but not quantifiable
blended high intensity discharge lamps having: — the peak of the radiation between 315-400 nm (UVA) or 280-315 nm (UVB)	See remarks above. There are similar exemptions / out-of-scope in WD, but may be slightly different and not specific for blended lamps	most UV (non-white)	several types of UV		some types of blended lamps		negligible
double capped fluorescent lamps having a diameter of 7 mm (T2) and less	agreed with stakeholders that this exemption is no longer necessary, so no exemption in WD				x		very small, but not quantifiable
double capped fluorescent lamps having a diameter of 16 mm (T5) and lamp power P ≤ 13 W or P > 80 W	The exemption for P < 13W has been maintained in WD. Exemption for > 80W regards very few lamps (if any), and they can meet requirements, so exemption has been discontinued.		T5 ≥ 13 W		T5 > 80 W		none or negligible
double capped fluorescent lamps having a diameter of 38 mm (T12), lamp cap G-13 Medium BiPin base, +/– 5 m (+magenta, –green) colour compensating filter value limit (cc). CIE coordinates x=0,330 y=0,335 and x=0,415 y=0,377	Industry has not been able to indicate where these very specific lamps are being used and why an exemption would still be necessary. Hence, exemption is no longer in WD.				x		none or negligible
double capped fluorescent lamps having a diameter of 38 mm (T12) and equipped with an external ignition strip	agreed with stakeholders that this exemption is no longer necessary, so no exemption in WD				x		very small, but not quantifiable
single capped fluorescent lamps having a diameter of 16 mm (T5), 2G11 4-pin base, Tc= 3200 K with chromaticity coordinates x=0,415 y=0,377 and Tc=5500 K with chromaticity coordinates x=0,330 y=0,335	Industry has not been able to indicate where these very specific lamps are being used and why an exemption would still be necessary. Hence, exemption is no longer in WD.				x		none or negligible
high intensity discharge lamps with Tc > 7 000 K	the same exemption is present in the WD		x				none
high intensity discharge lamps having a specific effective UV output > 2 mW/klm	In WD, following stakeholder comments, this exemption has been extended to all LS, not only HID, because use of LS with UV > 2 mW/klm is not allowed in general lighting applications	several	exemption extended to all LS				none or negligible

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
high intensity discharge lamps not having lamp cap E27, E40, PGZ12	The limitation to certain cap-types has been dropped in the WD because analysis showed that most HID with other cap types also meet requirements. Stakeholders have not protested against this. Many of the concerned LS anyway continue to be out-of-scope because they have a high light density or because they have a flux > 82000 lm. Practically all HID used for studio-,stage- and event-lighting continue to be exempted for these other reasons.	many, with high light density and/or flux > 82000 lm			some, but almost all meet the requirements		none or negligible
FLni-HID in/on means of transport	In 245/2009 assumed implicitly exempted due to text in Directive 2009/125/EC Art.1.3. EC changed interpretation on this. Therefore now explicitly exempted in WD		x			x	none
products intended for use in applications other than general lighting and products incorporated into products which do not provide a general lighting function. Where: 'general lighting' means substantially uniform lighting of an area without provision for special local requirements	This is a sort of generic exemption to cover products for which a specific exemption was forgotten, or not possible to formulate. In part it overlaps with more specific exemptions. In addition it is open to interpretation. This makes it difficult to draw up a list of additional products being exempted by this, but some possible examples of NDLS FLni-HID exempted by this follow on separate rows below. The list cannot be exhaustive. The exemption was considered too vague to be re-used in the WD, but some products have been specifically exempted in WD.					x	see rows below
NDLS FLni-HID used for signalling and signage, e.g. neon and (static) billboards, exit signs	Signalling lamps continue to be exempted in WD. Neon lamps are out-of-scope. Exit signs often use T5 < 13W that are exempted	neon lamps, non-white	signalling, T5 < 13W				none
Aquariums	Industry was not able to define specific measurable criteria for LS used for aquariums. Rather than using a vague exemption based on intended use, it was preferred not to have an exemption.	some non-white	some UV, some T5 < 13W		several		additional saving 0.5 TWh/a
Non-residential appliances (refrigerators, freezers, laundry equipment, range hoods, vending machines, automatic dispensers, machine tools, elevators, escalators; ovens excluded)	For most of these applications adequate LED retrofits are expected to be available. FL T5 and HID remain on the market. In WD no exemption deemed necessary.		some T5 < 13W		several		additional saving 0.5 TWh/a
image capture and image projection	In WD there is an explicit exemption for this		x				none
medical lamps	In WD there is an explicit exemption for this		x				none
HID for studio-, stage-, event-lighting	Practically all HID used for studio-,stage- and event-lighting continue to be exempted for high light density or for flux > 82000 lm. No specific exemption necessary. (See section on 244/2009 for halogen lamps used in these applications)	almost all for >500 lm/mm2 or > 82000 lm	some with CCT > 7000K				none
horticulture lamps	Many non-white or with specific UV > 2 mW/klm. In WD there is anyway also an explicit exemption for horticulture based on spectral characteristics.	many non-white	x				none
UV resulting to be white light (e.g. possibly germicidal, disinfection, fly trapping, ozone generation, coral growth, suntanning)	Most UV expected to be non-white, but where specific spectrum-based exemptions for UV-lights could be defined, these have been inserted in WD.		most		some		negligible

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
food display lighting	Several may be out-of-scope for non-white. For many food lighting applications adequate LED retrofits are available. No specific exemption based on spectral characteristics could be formulated.	several non-white			some		additional saving 0.1 TWh/a
scientific lamps	In WD, there is a specific exemption for calibration lamps. Impossible to find a measurable criterion for exemption of all lamps in this heterogeneous group	some non-white, or high light density	LS with calibration certificate		several		negligible
infrared (IR) and collagen lamps	In WD assumed to be all out-of-scope for non-white.	x					none
electronic displays and backlighting for displays	In WD there is a specific exemption		x				none
data-communication and laser applications	In WD out-of-scope for non-white, or high light density, or flux < 60 lm, or CRI < 0, or technology out-of-scope	x					
lamps covered by the requirements of Directives 94/9/EC or Directive 1999/92/EC	This regards LS for use in potentially explosive atmospheres. The same exemption is present in WD but with reference to up-to-date legislation.		x				none
emergency lighting luminaires and emergency sign luminaires within the meaning of Directive 2006/95/EC	The same exemption is in WD, but with updated reference to legislation		x				none
ballasts intended for use in luminaires defined in paragraph (c) and designed to operate lamps in emergency conditions	The same exemption is in WD, but with updated reference to legislation		x				none
luminaires covered by the requirements of Directive 94/9/EC, Directive 1999/92/EC, Directive 2006/42/EC, Council Directive 93/42/EEC, Council Directive 88/378/EEC and luminaires integrated into equipment covered by these requirements	Directive 94/9/EC, Directive 1999/92/EC regard explosive atmospheres; Directive 2006/42/EC regards Machinery; Council Directive 93/42/EEC regards medical devices; Council Directive 88/378/EEC regards safety of toys. The WD explicitly exempts LS for use in explosive atmospheres and in medical devices. The WD does not refer to the Machinery Directive or the Directive on safety of toys. Note however that WD applies to LS and not to luminaires, so there is no need to exempt certain types of luminaire.		LS for explosive atmosphere, medical devices. Battery-operated LS (e.g. for toys)		luminaires covered by machinery directive, but new regulation does usually not apply to luminaires		none
high pressure sodium lamps with Ra ≤ 60 and power > 605W.	These lamps are not actually exempted, but in 1194/2012 there are no energy efficiency requirements for them. The limit of 605W, with corresponding required efficiency of 135 lm/W (clear lamps) implies 82000 lm. This is the same flux limit as applied in WD for all light sources	HPS with Ra < 60 and flux > 82000 lm				x	none
high pressure sodium lamps with Ra > 60 and power > 405W.	These lamps are not actually exempted, but in 1194/2012 there are no energy efficiency requirements for them. The limit of 405W, with corresponding required efficiency of 85 lm/W (clear lamps) implies 34000 lm. In WD the upper flux limit is 82000 lm, so HPS with Ra>60 and flux between 34000 and 82000 lm are drawn into scope. There are very few models that are affected and they can meet efficiency requirements, so there is no effect.				HPS with Ra>60 and flux between 34000 and 82000 lm	x	none

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
metal-halide lamps with power > 405 W	These lamps are not actually exempted, but in 1194/2012 there are no energy efficiency requirements for them. The limit of 405W, with corresponding required efficiency of 90 lm/W (clear lamps) implies 36000 lm. In WD the upper flux limit is 82000 lm, so MH with flux between 36000 and 82000 lm are drawn into scope. Special efficiency requirements have been set for these LS so that they can stay on the market.				MH with flux between 36000 and 82000 lm	x	none
Out-of-scope or exempted in Commission Regulation (EU) No 1194/2012 (Directional lamps + functional requirements for all LED)							
LED modules marketed as part of luminaires that are placed on the market in less than 200 units per year.	Sales quantities are too difficult for MSA to verify and hence this exemption has not been copied to the WD. Stakeholders have not protested against removal.				x		none
non-white lamps, with range of CC x-y defined in 1194/2012.	Different from 244/2009, in 1194/2012 non-white lamps are not actually exempted, but they are SPL, so subject only to information requirements. In WD, non-white LS are out-of-scope, so also without information requirements. The definition of 'white-light' in 1194/2012 is the same as in the WD.	x					none
(no flux limits)	In 1194/2012 there are no flux limits, while WD puts out-of-scope LS with < 60 lm or > 82000 lm. This change regards very few DLS models, if any. LED NDLS with low flux are affected, and this is intentional.	new: LS with flux < 60 lm or flux > 82000 lm					none
DLS or LED SPL (generic): applications where the primary purpose of the light is not lighting	Some examples of this are mentioned in 1194/2012 (rows below), but as a generic exemption this was very vague. This formulation intentionally avoided in WD.					x	expected small, but not quantifiable
DLS or LED SPL: emission of light as an agent in chemical or biological processes (such as polymerisation, ultraviolet light used for curing/drying/hardening, photodynamic therapy, horticulture, pet care, anti-insect products)	Most of these lamps are UV. In WD, UV lamps continue to be not regulated: or out-of-scope for non-white, or specific exemption	most UV, most horticulture	some UV, some horticulture				none
DLS or LED SPL: image capture and image projection (such as camera flashlights, photocopiers, video projectors)	Some probably moved out-of-scope for light density criterion. Anyway same exemption also in WD.	some	x				none
DLS or LED SPL: heating (infrared lamps)	In WD assumed to be out-of-scope because non-white	x				x	none
DLS or LED SPL: signalling (such as traffic control or airfield lamps)	Same exemption is also in WD		x				none
DLS or LED SPL: the spectral distribution of the light is intended to change the appearance of the scene or object lit, in addition to making it visible (such as food display lighting or coloured lamps as defined in point 1 of Annex I), with the exception of variations in correlated colour temperature	In 1194/2012, coloured lamps are SPL (only info requirements). In WD, coloured lamps are out-of-scope. See also remarks for non-white in 1194/2012 above. For food display lighting, some may be out-of-scope for non-white. For many food lighting applications adequate LED retrofits are available. No specific exemption based on spectral characteristics could be formulated.	most			some		negligible

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
DLS or LED SPL: the spectral distribution of the light is adjusted to the specific needs of particular technical equipment, in addition to making the scene or object visible for humans (such as studio lighting, show effect lighting, theatre lighting)	In WD, there is a specific exemption for halogen lamps with certain cap-types, that intend to cover all halogen lamps used in studio-, stage-, and event-lighting		x			x	none
DLS or LED SPL: the scene or object lit requires special protection from the negative effects of the light source (such as lighting with dedicated filtering for photosensitive patients or photosensitive museum exhibits)	LS suppliers are promoting use of LEDs in museums because they have less negative effects. Therefore exemption for museum not continued. Same should partly be true for photosensitive patients, i.e. LEDs permit to fine-tune the spectrum, but uncertain if such LEDs can meet efficiency requirements.		for photo-sensitive patients		for museum exhibits		extra savings for museum lighting < 0.06 TWh/a (double counted with 244/2009)
DLS or LED SPL: lighting is required only for emergency situations (such as emergency lighting luminaires or control gears for emergency lighting)	WD: emergency lighting continues to be exempted		x				none
DLS or LED SPL: the lighting products have to withstand extreme physical conditions (such as vibrations or temperatures below – 20 °C or above 50 °C) (however, see limitations on exemption for shock-proof below)	WD: upper temperature limit made more specific for incandescents and halogen used in ovens. Use in range hoods explicitly exempted (see separate entry). In WD, lower limit decreased to -30C (LEDs have no problem at lower temperature). In WD no exemption for shock-/vibration proof (LEDs have good resistance)		extreme temperatures, range hoods		vibration- and shock-resistance	x	small, but not quantifiable
DLS or LED SPL: products incorporating lighting products, where the primary purpose is not lighting and the product is dependent on energy input in fulfilling its primary purpose during use (such as refrigerators, sewing machines, endoscopes, blood analysers)	This exemption was considered too vague to be re-used in the WD, but some products have been specifically exempted in WD. No exemption was deemed necessary for e.g. refrigerators and sewing machines because LED retrofits are available there.		LS for medical devices, range hoods, high temperature (ovens), low temperature (freezers)		LS for household appliances (except range hoods, ovens, freezers)	x	small, but not quantifiable
DLS or LED in/on means of transport	In 1194/2012 assumed implicitly exempted due to text in Directive 2009/125/EC Art.1.3. EC changed interpretation on this. Therefore now explicitly exempted in WD		x			x	none
New out-of-scope or exempted in WD, while not clearly exempted in existing regulations							
LS in radiological and nuclear medicine installations, as defined in Article 3 of Directive 2009/71/EURATOM	Precautionary principle; very low energy impact		x				negligible
LS in or on military or civil defence establishments, equipment, ground vehicles, marine equipment or aircraft as set out in Member States' Regulations or in documents issued by the European Defence Agency	Precautionary principle; very low energy impact		x				negligible

		PROPOSED WORKING DOCUMENT					
EXISTING REGULATIONS		**REMAINS EXEMPTED**		**NOT EXEMPTED**			
OUT-OF-SCOPE OR EXEMPTED	**ADDITIONAL INFORMATION**	**MOVED OUT-OF-SCOPE**	**EXPLICIT EXEMPTION**	**REMAINS NON-EXEMPTED**	**NO LONGER EXEMPTED**	**IMPROVED**	**CHANGE IN ENERGY SAVINGS (EXCLUDING DIFFERENT USES)**
light sources and separate control gears in battery-operated products, including but not limited to e.g. torches, mobile phones with integrated torch light, toys including light sources, desk lamps operating only on batteries, armband lamps for cyclists, solar-powered garden lamps	Not feasible/worthwhile to verify for MSA		x				not quantifiable
halogen light sources with a beam angle of less than 10° and intended for spot-lighting applications requiring a very narrow light beam	In general, WD phases-out halogen light sources, but for spots with very narrow beam there are no adequate LED retrofits available yet.		x				small but not quantifiable
colour-tuneable light sources that can be set to at least the colours mentioned in table below and have for each of these colours, measured at the dominant wavelength, a minimum colour purity index according to table below, and intended for use in applications requiring high-quality coloured light:Colour Dominant wave-length range Minimum colour purity indexBlue 440nm – 490nm 90%Green 520nm – 540nm 65%Red 610nm – 670nm 95%	New in WD is the specific treatment of colour-tuneable light sources (CTLS). There are specific requirements for them. However CTLS that work with RGB LEDs cannot produce white light with good efficiency, because they are optimized for coloured lighting. Rather than drawing up a very low efficiency requirement for these, they have been exempted. This does not exempt all CTLS.		x				small but not quantifiable

Annex 12: Glossary

	Meaning or definition
AIE	European Association of Electrical Contractors
ANEC	European Association for the Co-ordination of Consumer Representation in Standardisation (NGO)
APPLiA	Home Appliances Europe, formerly CECED
BAT	Best Available Technology
BAU	Business-as-usual (describing a scenario without any further intervention)
BEUC	European Consumer Organisation (NGO)
bn	billion
CECAPI	European coordinating committee representing the Associations of Manufacturers of Electrical Installation Equipment within the member states of the European Union and the EFTA region
CEN/TC 169	Technical committee n. 169 "Light and lighting" of CEN – European Committee for Standardization
CER	Committee of European Railways
CLASP	Collaborative Labeling and Appliance Standards Program
DG	Directorate General
ECOS	European Environmental Citizens Organisation for Standardisation (NGO)
EEB	European Environment Bureau (NGO)
EEE	Electrical and Electronic Equipment
EEI	Energy Efficiency Index
EFIC	European Furniture Industries Confederation
EIM	European Rail Infrastructures Managers
ETS	Emissions Trading Scheme
EU	European Union
EucoLight	European association of collection and recycling organisations for WEEE lamps and lighting
EUR	Euro currency
EURIC	European Recycling Industries' Confederation
EuroCommerce	European Association for Retail and Wholesale

GfK	Growth from Knowledge
GHG	Greenhouse gas
GWP	Global Warming Potential
IALD	International Association of Lighting Designers
IEA	International Energy Agency
IEC	International Electrotechnical Commission; global standardisation organisation
kg	kilogram
kWh	kilo Watt hour, 10^3 Watt per hour (unit of energy)
LCC	Life cycle cost over the whole lifetime of a product, including purchase cost and energy costs
LLCC	Least life cycle cost; used to determine the energy efficiency requirements that minimise costs of a product for its whole lifetime
M or mln	million
MEErP	Methodology for the Ecodesign of Energy-related Products[48]
MEEuP	Methodology for the Ecdesign of Energy-using Products
MEPS	Minimum Energy efficiency Performance Standards
Mt CO_2 eq.	Mega tonne CO_2 equivalent, 10^9 kg of gas equivalent to potency of CO_2 (unit of GHG emissions)
Mtoe	Million Tonnes of Oil Equivalent
MS	Member State
MSA	Market Surveillance Authority (in charge of enforcing ecodesign regulation in a MS)
NGO	Non-Governmental Organisation e.g. ANEC, BEUC, ECOS, EEB
OEM	Original Equipment Manufacturer
ORGALIME	European Engineering Industries Association
o/w	Of which
R&D	Research and Development
REFIT	Regulatory Fitness and Performance
SME	Small and Medium-sized Enterprises

48 Material-efficiency Ecodesign Report and Module to the Methodology for the Ecodesign of Energy-related Products (MEErP) PART 1: MATERIAL EFFICIENCY FOR ECODESIGN - Final report to the European Commission - DG Enterprise and Industry 5 December 2013.

SVHC	Substances of Very High Concern
TopTen	International program to create a dynamic benchmark for the most energy efficient products
TWh	Tera Watt hour, 10^{12} Watt per hour (unit of energy)
VAT	Value Added Tax
VHK	Consultant company
WEEE	Waste Electrical and Electronic Equipment
Yr or a	Abbreviation used as denominator for units expressed per year (e.g. TWh/yr or TWh/a; EUR/y or EUR/a)

Important Notice: This glossary aims to give non-experts a basic understanding of technical issues in this Impact Assessment report. Explanations are simplified and should not be used for any other purpose.

Lumen

The quantity of light emitted by a lamp is often measured in **lumen (lm)**. A lamp emits a spectrum of electro-magnetic radiation, consisting of different wavelengths (colours), of which a large part cannot be perceived by the human eye. The other part (called light) still consists of different colours, and the sensitivity of the human eye depends on the colour. The lumen-measure takes these different sensitivities into account and consequently can be conceived as the useful amount of emitted light, as perceived by humans.

Input Power

All lamps considered here use electricity as input. The instantaneous amount of electrical input to a lamp is called the **input power, expressed in Watt (W)**.

Efficacy / Efficiency

The efficacy of a lamp is the ratio of the light output (in lumen) and the power input (in Watt) and consequently **expressed in lm/W**. The term 'efficacy' is preferred over 'efficiency' because the latter is typically reserved for the ratio 'output power' / 'input power', while in the case of lamps the output is not a power. The efficacy may or may not include the efficiency of the ballast or control gear (see below in this glossary). This is clarified locally in the report where necessary.

Filament lamps or Incandescent lamps

When an electric current is made to pass through a thin metal wire (the 'tungsten filament'), the metal opposes the current flow (electrical resistance) and as a result heats up and starts to glow (becomes 'incandescent'), emitting electro-magnetic radiation of which a part is visible, called light. The main drawback of these lamps is that they have a low energy efficiency: around 90% of the input electricity is lost as heat. In addition the

filament is slowly consumed during use, leading to a short lifetime (typically 1000-2000 burning hours).

GLS filament lamps

General Lighting Service (GLS) indicates the classical 'Edison' filament lamp design. These lamps dominated the sales until 2008-2010, but have now been phased-out due to Ecodesign regulations (except some special cases). They had an efficacy **around 10 lm/W**.

HL (Halogen) filament lamps

Halogen lamps are a modern version of the filament lamp. The main difference is that the filament is contained in a small capsule (often placed inside a larger bulb) that is filled with a halogen gas. This extends (typically doubles) the lifetime and also allows a slightly higher efficacy. HL are available in mains-voltage (230 V, can be attached directly to the electricity grid) or low-voltage (12 or 24 V, need a voltage transformer). These lamps have typical efficacies **ranging from 12 to 20 lm/W**. In recent years HLs have been popular as substitutes for the legacy GLS, but the current regulation imposes the phase-out of many HL-types in the coming years (2016-2018).

Fluorescent lamps (FL)

In a fluorescent lamp (tube) an electric current is made to pass through a gas that contains a small quantity (some milligrams) of low pressure mercury vapour. This vapour is excited by the current and emits an ultraviolet light, that is then converted to visible white light by a phosphor coating on the inside of the glass tube (fluorescence). The efficacy of fluorescent lamps is **50-100 lm/W**, and thus 5-10 times higher than for filament lamps. Lifetimes for FLs range from 10 000 to 80 000 burning hours. These lamps cannot be connected directly to the electricity grid but **need a ballast (control gear)** to regulate the current. They are considered hazardous waste (separate collection) because they contain a small amount of mercury.

Linear Fluorescent lamps (LFL)

Linear fluorescent lamps are straight tube-like FLs. They are available in different lengths (e.g. 0.9, 1.2 and 1.5 m) and in different diameters (e.g. T12: 38 mm, T8: 26 mm, T5: 16 mm) and often applied for **office lighting**. The older models (T12 and T8 with less efficient halo-phosphor coating and higher mercury content) have now been phased-out due to Ecodesign regulations. LFL T8 with more efficient tri-phosphor coating have an efficacy **around 80 lm/W** (operating on electro-magnetic ballast). They are still widely used, but many have been substituted in recent years by the more modern LFL T5 with efficacy **around 90 lm/W** (operating on more efficient high-frequency electronic ballast).

Fluorescent Tx lamps (including T8)

'T2', 'T5', 'T8', 'T9' and 'T12' means a tubular light source with diameter of approximately 7, 16, 26, 29 and 38 mm respectively, as defined in harmonised standards. The tube can be straight (linear) or bent (e.g. U-shaped, circular).

'LFL T8 2-foot', 'LFL T8 4-foot' or 'LFL T8 5-foot' means a linear T8 fluorescent light source with a length of approximately 600 mm (2 feet), 1200 mm (4 feet) or 1500 mm (5 feet) respectively, as defined in harmonised standards.

Compact Fluorescent lamps (CFL)

Compact fluorescent lamps, often called **energy-saving lamps**, use thinner tubes that come in a spiral-like shape or as a series of short adjacent U-shaped tubes. They have sizes comparable to the classical filament light bulbs and aim to replace them. The efficacy of CFLs ranges from **50-70 lm/W**: 3 to 5 times higher than filament lamps. Lifetimes are around 10 000 hours: 5 to 10 times longer than filament lamps. There are CFLs **with integrated ballast** (**CFLi**) that are mainly used in households and those **without integrated ballast** (**CFLni**) that are typically used in offices. Compared to filament lamps, CFLs have a warm-up time before they reach their rated light output and their colour rendering characteristics are worse. For these reasons they have been less popular as substitutes for GLS-lamps than expected around 2009 when the first lighting regulations were made.

High-Intensity Discharge lamps (HID)

HID-lamps create an electric discharge arc between two electrodes in a quartz or ceramic tube-like enclosure that contains a gas and metal salts. The compositions of the latter can be varied to obtain different characteristics: e.g. intensity, colour, efficiency, lifetime. Compared to other technologies, HID lamps provide the highest light intensity in a compact space. The main application is in **street lighting**. The older, less efficient high-pressure mercury lamps (**HPM**) can no longer be sold since 2015, under the existing regulations. Other types include high-pressure sodium (**HPS**), which often has a characteristic orange light and an efficacy of **90-140 lm/W**, and the most recent metal-halide lamps (**MH**), that produce white light with an efficacy of **80-120 lm/W**. Typical lifetimes range from 8 000 to 20 000 burning hours. Just like fluorescent lamps, HID-lamps **need a ballast** to start and maintain the electric arc. Most HID lamps do not have a good colour rendering and hence are not used for indoor lighting. Most HID lamps contain a small amount of mercury.

Light Emitting Diode lamps (LED)

The light emission by LEDs derives from electrons that fall back from a high-energy state to a low-energy state, emitting the difference in energy as a photon (a small quantity of light). This emission occurs in a solid material consisting of very thin (microns), suitable (p-n) layers of (doped) semi-conductor materials when an electric current is passed in the correct direction. This technology is therefore also referred to as '**solid state lighting (SSL)**'.

There are many variations of the (still evolving) technology, offering a large variety of lighting characteristics. The vast majority of LEDs used for general lighting purposes today uses blue-light-emitting semi-conductor materials, and a phosphor coating to convert this blue light into white (similar to what is done in fluorescent lamps). This technology now (2015) allows efficacies from **80 to 140 lm/W** in commercial products, with over **200 lm/W** already demonstrated in prototypes. An alternative is to use separate red, blue and green (RGB) LEDs and to mix their lights to obtain white (allows creation of lamps with colour-change ability). This technology is expected to provide the highest efficacies in future, up to **250 lm/W** in 2030.

LED lamps only work under a controlled direct current (not alternating) and therefore **need a control gear**, that can be integrated in the lamp or separate. Amongst other functions, this control gear also determines the dimmability of the LED light source.

LEDs and OLEDs

In this Impact Assessment, the term LED will be used to indicate a light emitting diode based on **inorganic materials**, which is the vast majority of LEDs used for general lighting purposes today. LEDs based on **organic materials** are called **organic LEDs or OLEDs**.

Ballasts, Control Gears and Drivers (CG)

Fluorescent lamps, HID-lamps and LED-lamps all need a ballast or control gear or driver between the utility grid (mains, 230 V, 50 Hz, AC) and the light source to create the proper operating conditions. This CG may or may not be integrated in the lamp. Traditionally, ballasts were **electro-magnetic** with typical efficiencies around 80%. Modern ballasts for LFLs are **electronic** with efficiencies over 90%. In addition their high-frequency operation mode can also increase the efficacy of the light source itself. The current lighting regulations already push towards the use of electronic control gears.

Non-directional (NDLS) and Directional (DLS)

Lamps can emit their light all around (non-directional) or more concentrated in a certain direction (spot- or accent-lighting; directional). The current EU regulations make a distinction between NDLS and DLS lamps. A lamp is considered directional if 80% or more of its total light output is emitted within a cone with angle of 120˚. Currently, the light output (lumen) of a DLS lamp is measured in a 90˚ or 120˚ cone; the light output of a NDLS lamp is measured over the full 360˚. DLS lamps typically have a lower efficacy than NDLS lamps of the same input power and consequently minimum efficiency requirements in the current regulations are lower for DLS lamps. For LED-lamps, that have as much problems as being non-directional as directional, the need to distinguish between NDLS and DLS lamps is less obvious (except for small beam angles, see below).

Beam Angle

The light emission of a lamp does not have the same intensity in all directions. Typically the highest intensity is found on the centreline of the lamp. Looking at the lamp along another line, the intensity is lower. The angle between the centreline and the other line where the intensity is half (50%) of the maximum intensity is called the Beam Angle. Lamps with very small Beam Angles (below 20˚, very concentrated light) tend to have lower efficacies. Therefore some stakeholders have argued that the Beam Angle should be taken into account when prescribing minimum efficiency requirements.

Colour Rendering Index (CRI)

The CRI intends to express the ability of the light to faithfully render the real colours of an object. The CRI is currently measured by testing the rendering of 8 standard colours (Ra8). Filament lamps have a CRI=100, which is the maximum (best colour rendering). Other lamp types typically have lower CRI values. For indoor use and general task lighting the current regulations require a CRI of at least 80. Special tasks may require light with a higher CRI. Non-filament lamps (fluorescent, HID, LED) with higher CRI (between 80 and 95) are available but typically have lower efficacy. Therefore the CRI is taken into account when prescribing minimum efficiency requirements.

It is quite commonly accepted that the CRI is not the ideal measure to express colour rendering characteristics. In several cases, in particular for LED lamps, the CRI value does not correspond to how humans perceive the colour rendering. Alternative colour rendering scales have been studied for many years at the level of global standards (CIE) but no consensus has been reached and thus the CRI is still the only alternative.

Colour Temperature (CCT)

The regulations deal with lamps emitting white light, but this still covers several grades, ranging from yellowish warm-white to bluish cold-white. The grade of white is expressed by its (Correlated) Colour Temperature (CCT), which is the temperature of a black body that emits the same type of white light. Confusingly, lower CCTs (e.g. 2700-3000 K) indicate warm-white and higher CCTs (e.g. 5000-6500 K) indicate cold-white. In particular for LEDs, warm-white light sources have lower efficacies than cold-white ones. Therefore some stakeholders have argued that the CCT should be taken into account when prescribing the minimum efficiency requirements.

Lifetime and Lumen deterioration

Filament lamps at a certain moment just fail, i.e. they don’t emit any light anymore. This clearly defines their lifetime. For fluorescent lamps, HID-lamps and LED-lamps the useful lifetime is less clear. These lamps all exhibit a lumen-deterioration, i.e. the amount of light they emit decreases with time. In these cases the lifetime is typically defined as the time over which the amount of light decreases to 70% or 80% of its initial value.