To: **Orsola Mautone, European Commission**
René Kemna and Leo Wierda, VHK
From: **Michael Scholand, CLASP Europe**
Cc: **Marie Baton, CLASP Europe**
Date: **29 January 2018**
Subject: **Comments on the Ecodesign and Energy Labelling draft Implementing Measures for Lighting**

Thank you for this opportunity to provide comments on the draft lighting regulations, both the Ecodesign and Energy Labelling draft Implementing Measures. In general, CLASP is very supportive of the Commission's proposal, however we have some important comments that we wish to share and hope will be taken into account. We have prepared our comments in a brief format; however, more than happy to expand on any of these points and to provide further information or address any questions or clarifications you may have on any of the points given below.

Our comments on the draft implementing measure for Ecodesign:

ED.1) Maintain Phase-Out of Certain T8 Lamps in 2020

CLASP strongly supports the Commission's proposal to phase-out T8 linear fluorescent lamps at Tier 1 in 2020. Our review of the 2017 market shows that there are literally thousands of models of T8 LED replacement lamps, made by very reputable companies (including LightingEurope members) at affordable prices, long life and excellent quality light. There are replacement lamps that operate on ballasts and on mains power. And given that nearly all new luminaires being installed today are LED fixtures, the phase-out in 2020 of certain T8 fluorescent lamps seems entirely reasonable and appropriate. For example, Philips offers a CorePro LED Tube via an on-line UK lamp retailer at £8.59 including VAT. This lamp is 14.5W and replaces a 36W linear fluorescent lamp. If we assume a replacement linear fluorescent lamp costs £3.00, then the payback from installing the LED lamp if it operates for 8 hours per day is 7 months. In 2.5 years when Tier 1 takes effect, the LED lamp will be even more efficient and less expensive – so if Tier 1 is fully cost justified with today's technology, it will be even more compelling in 2020 and there is clearly no need to delay implementation of this phase-out of certain linear fluorescent lamps. Indeed, European companies and European end-users alike will benefit from this measure, not to mention the climate and the Commission's greenhouse gas reduction goals.

ED.2) Add Second Tier and Remove Other Old/Traditional Lamp Types

A second tier is needed in the lighting regulation because the ecodesign requirements that are proposed to take effect in September 2020 do not go far enough to remove the old/traditional technologies from the market (and establishing new requirements from a review completed in September 2022 would take several years, if it were done at all). A second tier would provide medium-term clarity and guidance to the market – particularly LED investors - and could be based on the efficacy trend established by year-on-year improvement in LED light sources of approximately 7.5% per annum (see Annex A for the derivation of this estimate). A second tier would help to ensure that significant CO_2 savings are not lost for lighting products in Europe, which are critical for meeting Europe's COP23 commitments.

CLASP suggests that the Commission to establish a second tier and include it with this ecodesign regulation. There are three options which the Commission may consider and CLASP can clarify or expand on these options, should one or more of them be of interest:

1) *Set Tier 2 for September 2022*. Establish a new table of efficacy values that would take effect in September 2022 and is structured in a similar way to the existing Table 1 in Annex III (i.e., using the same equation, etc.). However, in the Tier 2 table, some of the old / traditional lamp technology types would be removed – e.g., all FL T8, CFLni (see ED.10), all halogen lamps – and those that remain would have slightly higher efficacy requirements, including the LED replacements.
2) *Tier 2 subject to a DG ENER review*. Establish a new table of efficacy requirements, as per option #1 above, but set it to take effect in September 2023 and have DG ENER (i.e., not the Regulatory Committee) conduct a limited review and determination of cost-effectiveness and replacement equivalency in 2021-2022, with a decision published on whether Tier 2 will remain in place in 2023 or be modified. This approach is intended to match exactly what was done by DG ENER in relation to Stage 3 of medium voltage directional halogen lamps under EU No 1194/2012.
3) *Review deadline and back-stop provision*. The regulation would call for a review to be completed in September 2022 with new regulations published in by September 2023 that would take effect in September 2024. If the Commission fails to meet any of those deadlines, then a 'back stop provision' would take effect in September 2024. The back stop provision could be relatively simple, such as removing all halogen and mercury based light sources from the market and increasing the ambition of LED lamps and luminaires.

ED.3) Switch to CIE Uniform Colour Space and Expand Scope of Coverage Slightly

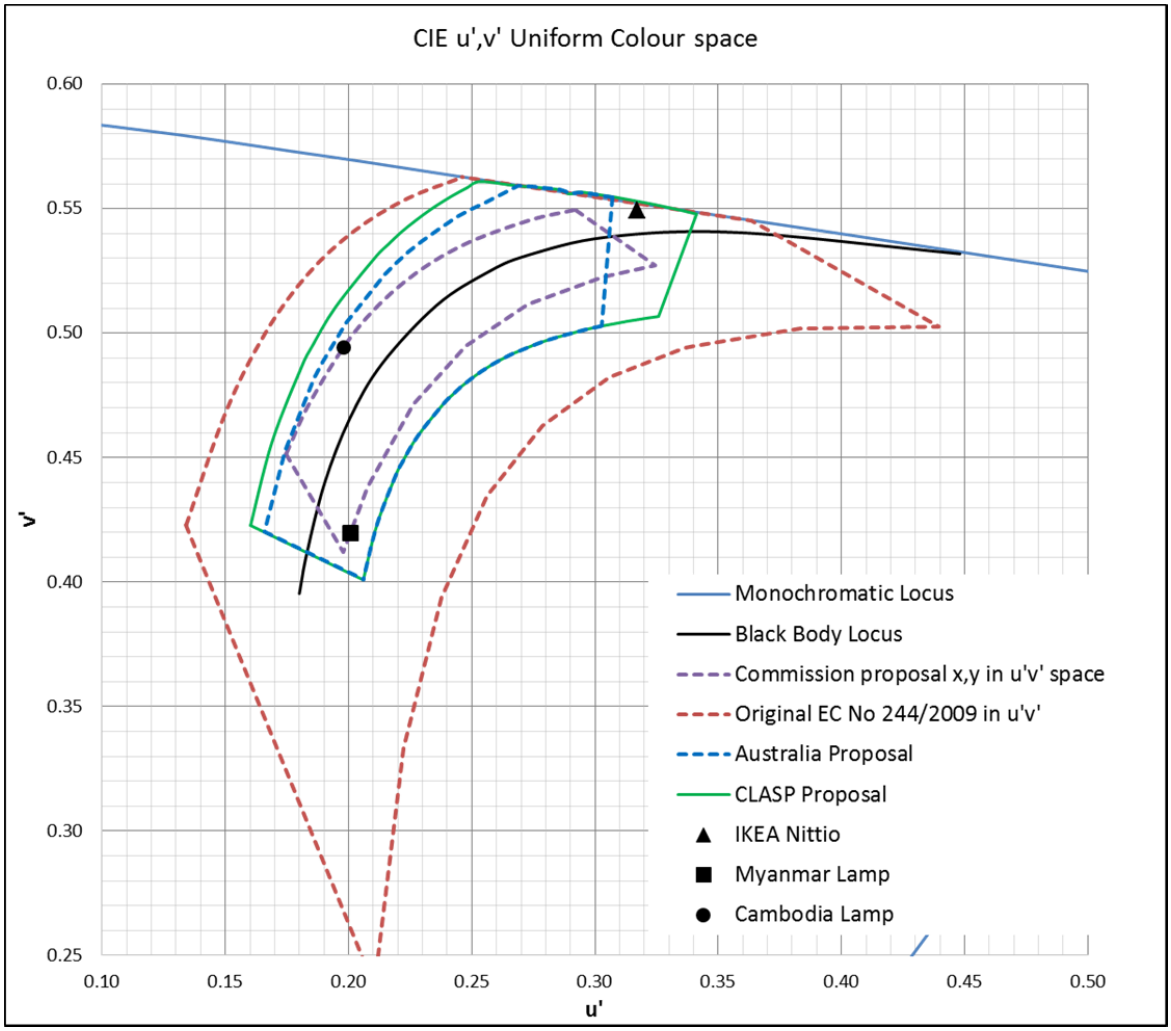
CLASP suggests that for defining white-light sources, the Commission switch from the current (x,y) chromaticity coordinates system to using the more modern and easier to understand CIE Uniform Colour Space. There are several reasons to switch to CIE Uniform Colour Space and at the same time, slightly expand the scope of coverage, particularly at the warm-white end of the black body locus. One of the issues / reasons why it would be good to move to the CIE Uniform Colour space is precisely because the x,y colour space is non-uniform. When the scope of coverage was originally developed with x,y chromaticity coordinates in EC No 245/2009, it made things symmetrical in x,y colour space. In the figure below, this same x,y scope of coverage has been converted to CIE uniform colour space and it shows the scope of coverage at the warm white end of the spectrum (which Europeans tend to like) is less than at the cool white end of the spectrum. In other words, from the figure you can see that the scope of coverage proposed is not equivalent for the warm white lamps as it is for the cool white.

There are two proposals which CLASP is suggesting for the Commission's consideration, both in u'v' colour space: (1) the Australian government proposal (which has been published on their website) and (2) the CLASP proposal (which was circulated to the Consultation Forum on 8 December 2017). The technical expert from Australia was consulted about the CLASP proposal and he said he didn't see any technical impediment to adopting the CLASP proposal.

- the Australian proposal is CCT range: 2000K to 24000K Duv of +0.018 and -0.024; and
- the CLASP proposal is CCT range: 1700K to 24000K Duv of +0.024 and -0.024.

The reason CLASP is proposing to cover very warm white lamps between 2000K and 1700K is because these lamps are popular here in Europe and we are concerned about certain lamps, similar to for example the IKEA Nittio lamp, would simply be excluded from coverage. (Note: this lamp is excluded because its lumen output is very low, but this could easily be manufactured as a 60 lm or more, and then that product would be excluded on the basis of CCT). CLASP also seeks slightly more coverage above the black body locus than was proposed by Australia. Again, here CLASP's concern is that lamps could easily be made just outside the covered gamut area, avoiding the regulation entirely.

The figure below shows the Commission's current proposal (purple dashed line area), based on 245/2009, the Australian proposal (blue dashed line area), the CLASP proposal (green solid line area) and the original definition of white-light from EC No 244/2009 (the red dashed line area). Super-imposed on this graph are three lamps that we are aware of which are commercially available today and are either on the cusp of being exempt or are exempt from the Commission's proposed area of white-light scope of coverage. Only by expanding the scope slightly will the Commission be able to protect against regulatory circumvention through slight modification of CCT values.



ED.4) Product Quality – Temporal Light Artefacts

Industry and stakeholders agree that temporal light artefacts (TLA) can be a problem in LED lighting, however, some stakeholders may be hesitant to establish mandatory requirements because the ideal standard and appropriate limits have not yet been published by the IEC. In a situation like this, the Commission may choose to develop 'transitional measures' in the ecodesign regulation which can serve as some placeholder and/or minimal requirements on TLA's until such time as the international

standardisation process, including recommended levels, has been completed.[1] (Furthermore, we note that the Commission taking action like this may accelerate the IEC process).

TLA's are not a new issue to lighting - most existing regulations and quality specifications for lighting (regardless of light source) already include limits which work to prevent health effects such as migraine, eyestrain, seizures, vertigo, anxiety and fatigue. Due to the highly responsive nature of the LED light sources (unlike any previous light source), LEDs can result in visible and non-visible flicker (called 'stroboscopic effect' emissions and the concomitant human health impacts. CLASP strongly recommends that the Commission adopt two metrics that together would protect end-users against flicker and the stroboscopic effects until such time as the International research is done and the transitional method can be replaced.

The two metrics are – the short term flicker metric, Pst and the stroboscopic visibility metric, SVM. As the research for human sensitivity to LEDs emitting these two types of TLA's is on-going, the levels that are available for consideration at this time are at levels where approximately 50% of the population could detect them. For this reason, the levels CLASP is proposing should be an absolute maximum limit, and the Commission may wish to keep an open mind as to adopting more stringent (lower) values if and when new data becomes available in the coming months.

CLASP welcomes and supports the fact that draft ecodesign regulation sets PstLM as no greater than 1.0, however we strongly recommend that the Commission also add a stroboscopic effect requirement of SVM as being no greater than 1.6. The test standards for these two metrics are IEC TR 61547-1 for PstLM and IEC TR 63158 for SVM. IEC TR 63158 will be published in August 2018, although it was voted and adopted unanimously by the IEC lighting Technical Committee, TC34. Any transitional test method adopted by the Commission may consider being consistent / aligned with these IEC standards.

ED.5) Product Quality – Lifetime Requirements

CLASP strongly recommends that in the interests of consumer protection, LED lifetime testing be reinstated in the draft regulation in three parts: (1) switching cycles; (2) lumen maintenance and (3) premature failure rates. Taken together, these three lifetime tests will protect consumers against poor quality LED lamps and luminaires, translating into energy savings and avoiding spoiling of the LED market. Brief information on these three lifetime tests is provided below – testing quality of the driver, quality of the light source to maintain output over a reasonable length of time and premature failure:

a. **Switching cycles** – intended to test the endurance of the built-in electronics to withstand in-rush current and frequent starting. Using IEC 62612 (section 11.3.3 Supply switching test), lamps are switched on and off for 30 seconds each, for a number of cycles equal to half the rated life in hours, e.g., 7500 cycles for a 15000 hour lamp. 7500 cycles takes 7500 minutes which is only 5.2 days. However, CLASP understands that industry has recently said that this test does not yield useful information, therefore CLASP would be supportive of longer on-times as part of a switching cycle test (with fewer cycles), to allow circuits to heat-up and cool down, resulting in thermal cycling and stressing of the circuits and components. Switching cycles are experienced by

[1] It should be noted that the IEC does not take the lead in promulgating new standards. In general, it lags behind the market and the market regulators working in the most innovative markets – including LED lighting. However, the IEC does eventually develop international standards after some time, offering value in standardised terms, basic measurement methods and a process for each product type to follow. Eventually, governments do adopt IEC standards as baseline requirements – but if something is needed prior to the IEC, then regional or other standards must be considered.

lamps operating in real life, therefore we consider it very important that a switching cycle test is included in the regulation to protect end-users. If new information on switching cycle testing becomes available, CLASP will provide it to the Commission.

b. **Lumen maintenance** – assessing the consistency of light output and avoiding accelerated degradation of LED light sources is another important lifetime measure. CLASP understands the concern raised about the 6000 hour test, although we note that every CFL placed on the market in Europe today is subjected to a 6000 hour test. Therefore, we propose three options here and manufacturers would be allowed to choose from this list when certifying they are compliant to the requirement:
    i. In-situ temperature measurement test + LM80 report – 1-2 days duration
    ii. LM-84 for 3000 hours – 4.2 months duration
    iii. 6000 hours of use – 8.4 months duration

    We would hope that most manufacturers would use the first option of the ISTMT + LM80. All LEDs manufactured today have an LM-80 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.
c. **Premature failure** – this test is based on a single steady-state operation of the product, without switching cycles. CLASP is not opposed to this test, as it could yield some good information about failure rates, however we note that the LED light source is not being subjected to stresses as it would be in a normal domestic or commercial use, thus although very straight-forward and simple, it may not yield the most useful information.

ED.6) Definitions – Drop 'Useful Luminous Flux'

CLASP continues to oppose the definition of useful luminous flux, and strongly recommends that the Commission consider all light output from a directional lamp to be 'useful'. Having a fixed cone of "useful flux" across the wide range of beam angles available in the market introduces an uneven quantification of product performance, and thus an uneven application of the regulatory measure. Ignoring the light emission outside of the useful code does not represent real life usage in the home or office, where instead all forward lumens are beneficial – thus this approach represents an artificial, not realistic testing construct and rejects real life usage. Other regulatory entities around the world set requirements on directional lamps, but none use this cone of useful luminous flux. In fact, products marketed to EU and non-EU markets such as the 230V Soraa directional lamp carry two lumen output levels and two efficacies for the same lamp. Switching the definition to allow directional lamps to account for 'all forward lumens' would allow market surveillance authorities to use integrating spheres instead of goniophotometers for measuring these light sources, which would lower costs and lead to more market surveillance of the market. Some portion of the correction factor (FTM) included in Table 2 of Annex IV in the draft Energy Label Annex is applied to all directional lamps to account for the lumens not measured – why not simply measure the lumens and reduce or eliminate the correction factor? Overall, this concept of useful luminous flux is unnecessary and burdensome, adds complexity and cost, is not representative of real life, and serves no practical benefit for the European market.

ED.7) Resource Efficiency – Serviceability of Luminaires

CLASP strongly supports the Commission's proposal that luminaires be 'serviceable' to ensure that one small component failure will not result in the waste of the entire fixture. Indeed, with LED drivers and LED circuit boards / light arrays, there are many components that could fail and lead to overall catastrophic failure of the product. By having 'serviceable' luminaires, the resource efficiency objectives

can be realised, with extended product service lives by replacing parts rather than discarding entire luminaires.

CLASP encourages the Commission to consider the Zhaga Consortium system as one possible standard that can be used to develop serviceable luminaires. Zhaga establishes standards around the light source and components in an LED lighting system, and would enable end-users to benefit from upgrades in LED technology while still maintaining the design luminous flux, colour and of course the mechanical, electrical, thermal and optical consistency. Secondly, it will promote longer use of LED systems, by enabling the light modules to be replaced rather than the whole fixture. And finally, it will keep competition in the lighting market, rather than tie end-users to one manufacturer's proprietary system. Please see the Zhaga books which give specifications for many of the most common professional lighting installations: http://www.zhagastandard.org/books/overview/

ED.8) Resource Efficiency – LCA of LED Filament Lamps and LED Linear Tubes

CLASP is in discussion with partners looking at a new research project looking at the life-cycle assessment of LED filament lamps and LED linear tubes, to help improve the quantification of benefits of these technologies relative to the traditional ones being phased out. This research project will be conducted in the first quarter of 2018, in order to still be relevant to the lighting policy measure under development.

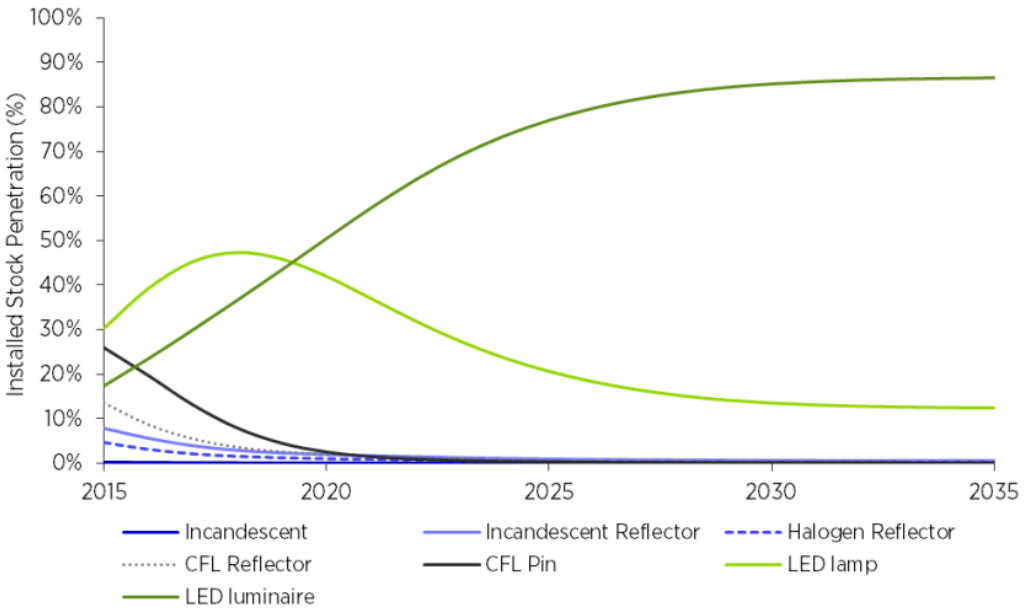
ED.9) Exemptions to Reconsider

- **Exemption 1(c)** provides exclusions for military lighting installations, including "military or civil defence establishments, equipment, ground vehicles, marine equipment or aircraft…" Several of these exemptions are redundant as they would fall under other paragraph exemptions, e.g., vehicles, aircraft, marine equipment. More importantly, however, are the fact that "military or civil defence establishments" often use fixtures that are commercially available and common to standard domestic and professional markets - thus there is no reason military-owned office buildings barracks, hangars, and other buildings should be using inefficient lighting technology. These installations are subject to safety regulations, and similarly it would seem they should be subject to energy-efficiency requirements as well. This exemption needs to be drafted in a more robust way so as only to apply to special light sources that are used for military or civil defence purposes, and not the buildings in which these institutions are based/housed.
- **Exemption 2(d)** exclusions for light sources with a beam angle of less than 10 degrees. This represents a rolling back of the requirements of EU No 1194/2012 and we do not agree with the VHK note that no LED replacements seem to be available. Furthermore, CLASP was informed by a representative of the International Association of Lighting Designers that this represented "the biggest loophole imaginable" as he envisaged exempted directional lamps manufactured with 9 degree angles that would shine into a "cheap plastic lens" that would not only be inefficient, but would redistribute the light into a wider, more useful beam angle for room illumination. For all of these reasons, CLASP strongly recommends that the Commission remove this exemption.

ED.10) Eliminating CFLni pin-based lamps

CLASP notes that in part due to the poor optical performance of CFLs in directional applications and the strength of LED, downlights were one of the first markets where LEDs made strong gains in market share. Most of the new downlight installations today are LED, contributing to a change in the installed

stock, as indicated by this graph from a US DOE study[2] of the North American market (a similar trend would be expected in Europe):



Commercial Large Directional Submarket Stock Forecast for the Current SSL Path Scenario (Source: US DOE report, 2016)

In the above graph of installed stock of lighting in the US which has no regulations on downlights, CFLni (called "CFL Pin") are shown to be virtually nil by 2021, obviating the need to keep them in the market. If an end-user were to install new CFLni fixtures in 2017, then they would be able to purchase replacement lamps in 2021 prior to the phase-out, and recover the capital investment of that fixture into 2025 (assuming 16,000 hr of life and 4,000 operating hours per year). And thirdly, manufacturers are developing direct replacement A+ LED replacement products for CFL Pin lamps, such as this LED product from Philips.[3]

[2] US DOE study: https://energy.gov/sites/prod/files/2016/10/f33/energysavingsforecast16_0.pdf

[3] Philips LED replacement for CFLni: https://www.philips.co.uk/c-p/8718696733714/led-tube Note too that in much the same way that the high volume T8s are proposed for phasing out, manufacturers have developed LED replacements for the high volume CFLni, and thus at least these may be considered to be phased out, if not all CFLni.

Our comments on the draft implementing measure for Energy Labelling:

EL.1) Support the ambition of the proposal

CLASP welcomes and endorses the Commission's proposal for the ranges of total mains efficacy (lm/W) of each of the energy-efficiency label classes. The levels presented in Table 1 of Annex IV are ambitious in January 2018, but will not seem so ambitious in September 2020. Already today, we have consumer lamps that are 115 lm/W (OSRAM Base Classic A/LED-lamp[4]) to as high as 200 lm/W (Philips Dubai Lamp[5]). The performance of these lamps will only improve in the coming 2.5 years as R&D in LED lighting technology has never been higher globally. We agree that this label should last for ten years. We also note that there may not need to a rescaling of the energy label in the future, once all light sources have exceeded 210 lm/W – for example, a 1000 lumen light source that improves from 210 lm/W to 270 lm/W would only save one additional Watt of power in use.

Table 1

Energy efficiency class	Total mains efficacy η_{TM} (*lm /W*)
A	$210 \leq \eta_{TM}$
B	$185 \leq \eta_{TM} < 210$
C	$160 \leq \eta_{TM} < 185$
D	$135 \leq \eta_{TM} < 160$
E	$110 \leq \eta_{TM} < 135$
F	$85 \leq \eta_{TM} < 110$
G	$85 \leq \eta_{TM}$

EL.2) Exemptions – avoiding loopholes

The draft regulation exempts products that are "placed on the market specifically for the mentioned operating condition or application, as evidenced at least by the technical documentation, and possibly by information on the packaging and/or in publicity." In our view, this requirement is not strong enough and leaves the exemption open to abuse by products that may be used in aviation, railway, marine or military applications but can also packaged and marketed directly to consumers as an alternative to purchasing regulated lamps. We suggest making the packaging requirement mandatory, and clarifying that 'publicity' applies to advertising and marketing materials and information about the product. The revised text therefore, might read as follows: "placed on the market specifically for one of the exempted operating conditions or applications, as evidenced by the technical documentation, information on the packaging and any advertising or marketing materials."

EL.3) QR-code linkage

CLASP notes that the QR code mark included in the proposal requires 'redirecting' (perhaps say 'directing'?) to a website optimised for mobile devices where additional information on the light source can be found. It would be stronger if the requirement were to be to a 'website for information on that specific model is provided', so that users would not be required to then look on that website for the model label QR code they just scanned. CLASP also asks whether the Commission has considered linking it back to the model as it appears in the Product Registry Database, which will be up and running for all products by the time this label takes effect in 2020. Our suggestion here is as follows: "a quick response code (QR-code) that directs users to a website that returns information on that specific model;" Additional language may be appropriate if the Commission decides to make QR-code link to the Product Registry database.

[4] https://www.amazon.co.uk/Osram-LED-Lamp-B22d-Base-Dimmable-Replacement/dp/B073QTGDP8/ref=pd_sim_201_5?_encoding=UTF8&psc=1&refRID=B4HR9Q3A4X70M3QZ0225

[5] https://www.philips.ae/c-m-li/dubai-lamp

EL.4) Product Information Requirements

CLASP welcomes the Commission's proposal for the extensive list of product information requirements in the public part of the product database. We have a few suggestions for your consideration:

- 4.1 (f) – please consider this list carefully, as you have taken the time to differentiate between T5 lamp types, but you lump all LED products into one group. Future reviews and regulation of lighting products will revolve around LED products almost exclusively, thus we would recommend you consider at least the LED categories being considered now by the international harmonised trade bodies. LightingEurope published a position paper on this in 2015[6] and the Lighting Council of Australia also recently published a paper on new categories of LED products[7]. The Commission could improve the usefulness of this category by having more than simply "LED" as a category.
- 4.1 (u) – please consider requiring both chromaticity coordinates and CIE Uniform Colour space coordinates
- 4.1 (x) and (y) – we do not understand why these requirements apply exclusively to FL and HID light sources, and there is no equivalent for the other covered and regulated light sources. It would seem to make sense that this (or similar) information would be of interest to people purchasing LED light sources. There is a requirement in section 3.1 of Annex V which calls for the "M70F50 lifetime for LED and OLED light sources" to appear on the product packaging but it is omitted from section 4.1 of Annex V. In our view, it would seem appropriate and useful if this information is also included in the public part of the product database.
- 4.1 (aa) – we do not understand the requirement that instructions be supplied on "how to switch them off or minimize their power consumption during light source testing;". On its face, this sounds like guidance for circumventing or gaming the test protocol to achieve a lower power consumption during testing. Please clarify the language in this bullet to reflect what is intended.
- 4.1 (bb) – this requirement to supply a list of compatible dimmers could become excessively burdensome on light source manufacturers who would need to constantly monitor dimmers being placed on the market and determine their compatibility. We suggest that perhaps in the review of this lighting regulation that the Commission consider identifying and establishing categories of dimmer technologies (e.g., leading-edge, trailing-edge, phase-cut, etc.) which light sources are designed to be compatible with, and that instead of an exhaustive dimmer product model list, it might instead be a list of dimmer types with which the light source is compatible.
- 4.1 (cc) – this requirement would be stronger in terms of providing useful information to consumers if it were modified to read as follows: "if it contains mercury (yes/no), and if so, instructions on how to clean up the lamp debris in case of accidental breakage;"

EL.5) Verification Tolerances for Quantities Measured (Table 4 of Annex VIII)

CLASP is aware that the Swedish Energy Agency and their in-house market surveillance laboratory are working with the Commission to revise some of the values in the tolerance allowances table in Annex VIII. CLASP is concerned that some of these values are large, such as the 20% allowance for LED lifetime.

[6] https://www.lightingeurope.org/images/publications/position-papers/LE_TF_LED_CC_088G_LE_Position_Paper_LEDs_in_HS_2022_September_2015_1.pdf

[7] http://www.lites.asia/news-and-events/news/hs-led-codes

Annex A. Calculating the Combined Annual Growth Rate (CAGR) in efficacy of LED light sources

The rate of improvement in LED technology can calculated using the combined annual growth rate (CAGR) formula applied to published trends in of LED packages (including both tested data for 2005-2015 and projections from 2016 to 2025) – resulting in a projection of 7.5% per annum between 2005 and 2025 – see graph below from the 2016 US DOE SSL R&D Plan[8]:

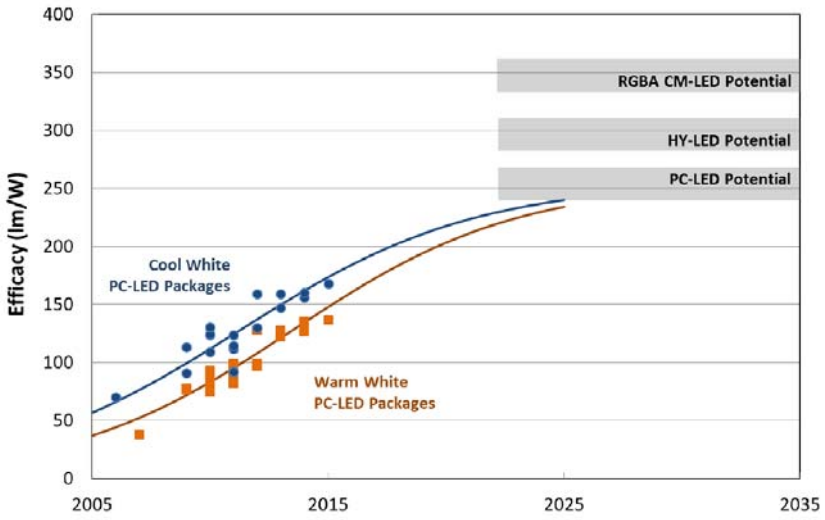


Figure A1. US DOE trend and projection of packaged LED white light sources for General Illumination

If we take that US DOE curve and apply the combined annual growth rate formula:

$$CAGR = \left(\frac{\text{Ending Value}}{\text{Beginning Value}}\right)^{\left(\frac{1}{\#\text{ of years}}\right)} - 1$$

We calculate the following for cool-white PC LED packages (note: efficacy given by US DOE based on real data from 2005 to 2015 and projections from 2016 to 2025):

2005	55 lm/W	
2025	235 lm/W	
# of years	20 years	**CAGR = 7.5%**

Commercially available LED lamps and luminaire in 2017 come in efficacies ranging from 60 to 120 lm/W (and higher) – but taking the midpoint of 90 lm/W in, doing nothing but allowing LEDs to improve performance at the natural rate forecast by US DOE, the LED lamp or luminaire would be would be 104 lm/W in 2019 and 120 lm/W in 2021 and 139 lm/W in 2023. It would be important to take this trend into account when developing future Ecodesign and Energy Labelling requirements. Note too that the DOE projection does not take into account advances in drivers, optics or other areas.

[8] US DOE report: https://energy.gov/eere/ssl/downloads/solid-state-lighting-2016-rd-plan