

ANNEX 3

Working document on possible Ecodesign requirements for Public Street Lighting

This working document builds on the Preparatory study for Ecodesign Requirements of Public Street Lighting¹ and has the purpose to consult stakeholders on the policy options envisaged for a possible implementing measure.

Form of the implementing measure

The intention is to give to the implementing measure the form of a directly applicable decision or regulation. For the purpose of this working document, the term "implementing measure", abbreviated as "IM" will be used.

Voluntary agreements

No voluntary agreement has been put forward by industry, and considering the structure of the street lighting product market a voluntary agreement is unlikely.

Interaction of the requirements

In the numbering of requirements in the table below, specific ecodesign requirements will be indicated with S, generic ecodesign requirements on environmental aspects with Ga, and generic ecodesign requirements on the supply of information with Gi.

Under the Ecodesign Directive, it is impossible to impose requirements on how the products are installed and maintained after the manufacturer has placed them on the market. However, it is possible to require the manufacturer to indicate clearly the suitability of the product for street lighting and to provide all the necessary information for proper installation. Also, once they are marked as such, in some cases more ambitious energy efficiency requirements can be set on products intended for street lighting than on other similar products. It is then up to the street lighting purchasers (installers, owners) to buy only products marked as suitable for street lighting by the manufacturer and to install them properly following the product information provided. Member State or regional/local legislation could in the future introduce installation obligations on street lighting purchasers, based on indication in the product documentation.

Therefore, in applying this IM, the first step for manufacturers is to identify whether their products (lamps, ballasts, luminaires) are intended for potential use in public street lighting or not, regardless of their technology.

a.) If they are, they should be indicated as such in the product documentation (see Gi-1 in the table below) and conform to the corresponding requirements (see requirements marked with * in the table).

b.) If the products are not intended for street lighting, but are high-intensity discharge (HID) lamps or ballasts or luminaires for HID lamps, the requirements **not** marked with a star still apply to them. So these requirements apply to **all** HID products, and include the obligation to mark the product as not suitable for street lighting (see Gi-1) and to conform with the corresponding specific requirements of this IM (not marked with a star).

¹ By VITO, January 2007, available on www.eup4light.net

This organisation serves a triple objective:

1. All lamps used in public street lighting should conform to a basic energy efficiency requirement (should be better than current-day high pressure mercury vapour lamps).
2. Because they are technology specific, the requirements set on all HID lamps and ballasts and luminaires for HID lamps will be more ambitious.
3. For HID lamps and luminaires for HID lamps used in public street lighting, even more customized requirements will be set.

The following table summarizes the principles described above, while indicating where the requirement listed further on belong.

| | All street lighting lamps (not only HID) | All HID lamps, ballasts and luminaires (not only street lighting) | HID lamps, ballasts and luminaires for street lighting |
|--|--|---|--|
| Indication of suitability (or not) for street lighting | Gi-1 | Gi-1 | Gi-1 |
| Product Information for street lighting installation | Gi-2* | - | Gi-2* |
| Common energy efficiency requirement | S1 | S1 | S1 |
| Technology specific requirements | - | S2, S3, S5, S6, Ga-3, Ga-4 | S2, S3, S5, S6 |
| Street lighting specific requirements | - | - | S4*, S7*, S8*, Ga-1*, Ga-2* |

* requirement applicable only to products indicated as suitable for public street lighting.

Without installation requirements, it is also difficult to influence the rate of replacement of inefficient street lighting already in place. The lifetime of a luminaire can be as long as 30 years or more, and the rate of replacement is rather low (3% / year). However, since the lamps used in them need to be changed about every 3 years, by phasing out the spare lamps that fit into the inefficient luminaires, it is possible to force an early replacement of these luminaires. Some of the measures below serve this purpose.

List of elements covered in this working document

- Recitals
- Scope: typology of EuPs included and excluded
- Definitions used in the IM
- Specific ecodesign requirements (marked with S)
- Generic ecodesign requirements (marked with Ga and Gi)
 - on environmental aspects
 - on the supply of information
- Information requirements for components and sub-assemblies
- Conformity assessment procedure

List of elements to be added in the IM

- Recitals
- Applicable measurement standards or measurement methods to be applied
- Formal clauses of the IM (entry into force etc.)

Further explanations are provided where appropriate for each element in the right column of the table below.

| Elements for Eco-design IM | Notes |
|---|---|
| Title | |
| Ecodesign requirements on lamps intended for use in public street lighting, on high-intensity discharge lamps and on ballasts and luminaires used with high-intensity discharge lamps | |
| Recitals | |
| <p>Identification of significant environmental aspects</p> <p>The following environmental aspects are identified as significant:</p> <p>(a) Energy in the use phase (b) Mercury content of lamps (c) Waste</p> | <p>The preparatory study showed that the dominance of energy in the use phase over all the other 15 examined environmental impact categories is overwhelming.</p> <p>Though the environmental impact of waste was not quantified as significant in the preparatory study, it is considered to be helpful to introduce a provision in the IM (Ga-4) to facilitate the implementation of the WEEE Directive.</p> <p>The significance of light pollution could not be properly assessed, because internationally agreed scientific methods for measuring its environmental impact are in an early stage of development. Therefore, light pollution is considered as potentially significant in this IM, as its significance could not be quantified.</p> |
| Definition of the class(es) of EuP(s) covered | |
| <p>This IM shall apply to</p> <ul style="list-style-type: none"> - lamps intended for use in public street lighting - all high-intensity discharge lamps - all ballasts and luminaires used with high-intensity discharge lamps. <p>"high-intensity discharge lamps" (HID) shall include</p> <ul style="list-style-type: none"> - high pressure mercury lamps (HPM) - high pressure sodium lamps (HPS) - "metal halide" lamps (MH) | <p>This IM has both technology and application based scope. This is meant to ensure that:</p> <ul style="list-style-type: none"> - all HID lamps and corresponding ballasts and luminaires are covered - no other lamp technology can be used as a backdoor way to sell public street lighting that is less efficient than the technology going with HID lamps |
| Definition of the class(es) of EuP(s) excluded | |
| <p>This IM shall not apply to</p> <ul style="list-style-type: none"> - lamps (other than HID lamps) not intended for use in public street lighting - ballasts and luminaires designed to operate only with non-HID lamps | |
| Definitions of expressions used in the IM | |
| <p>For the purposes of this IM,</p> <p>"public street lighting" shall mean a fixed lighting installation intended to provide good visibility to users of outdoor public traffic areas during the hours of darkness to support traffic safety, traffic flow and public security.</p> <p>"lamp efficacy" shall mean the quotient of the luminous flux emitted by the lamp divided by the power consumed.</p> <p>"lamp lumen maintenance factor" (LLMF) shall mean the ratio of the luminous flux emitted by the lamp at a given time in its life to the initial luminous flux.</p> <p>"lamp survival factor" (LSF) shall mean the fraction of the total number of lamps which continue to operate at a given time under defined conditions and switching frequency.</p> <p>"colour rendering index" (CRI) shall mean a measure of the ability of a light source to reproduce the colors of various objects being lit by the source.</p> | |

"light output ratio" (LOR), "upward light output ratio" (ULOR) and "downward light output ratio" (DLOR) shall mean the ratio of respectively the total, upward and downward flux of the luminaire, measured with its own lamps and equipment, to the sum of the individual luminous fluxes of the same lamps when operated outside the luminaire with the same equipment.

"luminaire maintenance factor" (LMF) shall mean the ratio of the light output ratio of a luminaire at a given time to the initial light output ratio.

"utilization factor" (UF) of an installation shall mean the ratio of the luminous flux received by the reference surface to the sum of the total fluxes of the lamps of the installation

"light pollution" shall mean the sum of all adverse effects of artificial light in as much as they have an impact on the environment, including the direct impact of outdoor lighting and the brightening of the night sky that results from the reflection of radiation (sky glow).

In this IM, except where otherwise defined, other expressions used shall have the same meaning as in Directive 2005/32/EC.

Specific Ecodesign requirements

Requirements applicable only to products marked as suitable for use in public street lighting according to Article Gi-1 are marked with a *.

S1 (partly *) – HID Lamps and lamps for street lighting

All lamps marked as suitable for use in public street lighting according to Article Gi-1 and all HID lamps shall have a minimum efficacy (lm/W) indicated in the following table:

| Lamp wattage [W] | Minimal Lamp Efficacy [lm/W] |
|----------------------|------------------------------|
| $W \leq 50$ | 55 |
| $50 < W \leq 70$ | 65 |
| $70 < W \leq 125$ | 70 |
| $125 < W \leq 400$ | 75 |
| $400 < W \leq 1000$ | 80 |
| $1000 < W \leq 2000$ | 85 |
| 2000 and higher | 90 |

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

This article shall not apply to the following HID lamps if not marked as suitable for use in public street lighting:

- coloured MH lamps with a CIE 1931 chromaticity coordinate of $y < 0.26$ or $y > 0.36$
- MH lamps with a colour temperature • 6000 K
- HPS lamps with colour rendering index • 80

Phasing out high-pressure mercury vapour lamps (HPM).
 Imposing the same requirement on all lamps marked as suitable for use in public street lighting will ensure that no other lamp technology can be used as a backdoor way to sell public street lighting that is less efficient than HIDs.

The exclusions are necessary for allowing to use those lamps in other fields of application where no alternative is currently available on the market.

S2 – Luminaires

The luminaires used with HID lamps shall only accommodate tubular-clear lamps.

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

S3 – HPS lamps

Elliptical frosted and tubular clear (TC) HPS lamps shall have a minimum lamp efficacy (lm/W), a lamp lumen maintenance factor and a lamp survival factor indicated in the following table:

| Lamp type | NaHP-TC | NaHP-BF |
|--------------------|----------------------------|----------------------------|
| Lamp Wattage W | Minimal Lamp Efficacy Lm/W | Minimal Lamp Efficacy Lm/W |
| $W \leq 50$ | ≥ 80 | ≥ 70 |
| $50 < W \leq 70$ | ≥ 90 | ≥ 80 |
| $70 < W \leq 100$ | ≥ 100 | ≥ 95 |
| $100 < W \leq 150$ | ≥ 110 | ≥ 105 |
| $150 < W \leq 250$ | ≥ 125 | ≥ 120 |
| $250 < W \leq 400$ | ≥ 135 | ≥ 130 |

| Burning hours | LLMF |
|---------------|---------|
| 16000h | >0.90 |

| Burning hours | LSF |
|---------------|---------|
| 16000h | >0.90 |

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

5 years (indicative, to be determined during impact assessment) after the entry into force of the IM, all HPS lamps will have minimum efficacy values equal to the TC values in the table.

This article shall not apply to HPS lamps with a colour rendering index \bullet 80.

Sets a minimum efficacy and quality level for both tubular clear (TC) and elliptical HPS lamps, and ensures that at term the elliptical lamps are either improved to be equal to TCs (unlikely) or phased out. This will also accelerate the replacement of old elliptical luminaires, as spare lamps for those luminaires will disappear from the market.

The exclusion is necessary for allowing to use those lamps in other fields of application where no alternative is currently available on the market

S4* – MH lamps for public street lighting

Elliptical frosted and tubular clear MH lamps marked as suitable for use in public street lighting according to Article Gi-1 shall have a minimum lamp efficacy (lm/W), a lamp lumen maintenance factor and a lamp survival factor indicated in the following table:

| Lamp type | For road category F+M | For road category S | |
|--------------------|------------------------------|------------------------------|------------------------------|
| | MHHP-TC | MHHP-TC | MHHP-BF |
| Lamp Wattage [W] | Minimal lamp efficacy [Lm/W] | Minimal lamp efficacy [Lm/W] | Minimal lamp efficacy [Lm/W] |
| $W \leq 50$ | ≥ 80 | ≥ 80 | ≥ 70 |
| $50 < W \leq 70$ | ≥ 90 | ≥ 85 | ≥ 80 |
| $70 < W \leq 100$ | ≥ 100 | ≥ 90 | ≥ 85 |
| $100 < W \leq 150$ | ≥ 110 | ≥ 95 | ≥ 90 |
| $150 < W \leq 250$ | ≥ 120 | ≥ 100 | ≥ 95 |
| $250 < W \leq 400$ | ≥ 130 | ≥ 105 | ≥ 100 |

| Burning hours | LLMF |
|---------------|---------|
| 12000h | >0.80 |

| Burning hours | LSF |
|---------------|---------|
| 12000h | >0.90 |

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

5 years (indicative, to be determined during impact assessment) after the entry into force of the IM, all MH lamps marked as suitable for use in public street lighting according to Article Gi-1 will have minimum efficacy values equal to the road category F+M values in the table.

Sets a minimum efficacy and quality level for tubular clear (TC) MH lamps used in fast and slow traffic roads and elliptical MH lamps intended for use in public street lighting, and ensures that at term all lamps are either improved to be equal to the more efficient TCs used in fast traffic roads (unlikely) or phased out. This will also accelerate the replacement of old luminaires.

S5 – Ballasts

The ballasts used with HID lamps shall have a minimum energy efficiency indicated in the following table:

| Lamp power W | Maximum ballast losses W |
|-----------------|-----------------------------|
| 50 | 10 |
| 70 | 11 |
| 100 | 14 |
| 150 | 19 |
| 250 | 26 |
| 400 | 35 |

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

Sets minimum ballast efficiency values for all HID ballasts.

Note: the measurement method for HID ballasts needs to be defined.

S6 – Ballasts for lamps P > 100 W

Ballasts for HID lamps with a power rating of more than 100 W shall be dimmable in at least 5 steps and to at least 50% of the maximum output.

Timing: 5 years after the entry into force of the IM (indicative, to be determined during impact assessment).

The potential to dim the lamp for the circumstances brings energy efficiency improvements, and prolongs lamp life. However, dimming is not useful for low light output (hence low-wattage) lamps. Also, dimmable ballasts are currently not marketed in sufficient number, hence the delay in introducing the requirement.

S7 * - Luminaires for public street lighting

Luminaires marked as suitable for use in public street lighting according to Article Gi-1 shall have an optical system that is at least hermetic against dirt and protected from pressure water jets.

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

According to EN 13201, public street lighting installations with luminaires getting dirty quickly will have to over-dimension lamp power. So cleaner luminaires bring energy efficiency.

S8 * - Luminaires for public street lighting

Luminaires marked as suitable for use in public street lighting according to Article Gi-1 shall have maximum upward and minimum downward light output ratios indicated in the following table:

| | ULOR max | DLOR min |
|--|----------|----------|
| luminaires cat F+M all lamp wattages | 3% | 75% |
| luminaires cat S | | |
| 150W ≤ lamp | 5% | 75% |
| 100W ≤ lamp < 150W | 10% | 75% |
| 50W ≤ lamp < 100W | 15% | 70% |
| lamp < 50W | 20% | 65% |

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

Limiting the light going to the sky from the luminaire and ensuring a proper ratio of useful light going to the road contribute in most cases both to improving energy efficiency and to reducing light pollution. Taken to the extreme, however, it can sometimes be detrimental to energy efficiency.

Generic ecodesign requirements

Requirements on environmental aspects (Ga)

Requirements applicable only to products marked as suitable for use in public street lighting according to Article Gi-1 are marked with a *.

Ga-1* - Luminaires for public street lighting

Luminaires marked as suitable for use in public street lighting according to Article Gi-1 must be designed and constructed in such a way that their luminaire maintenance factor is increased to the highest level, taking account of technical progress and the availability of means of increasing the luminaire maintenance factor.

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

There is potential in improving the LMF of luminaires for public street lighting beyond protecting them from ingress. Technologies such as self-cleaning glass already exist, but only a couple of manufacturers have them, it would be disproportionate to impose it as a minimum requirement.

| | |
|---|---|
| <p>Ga-2 * - Luminaires for public street lighting</p> <p>Luminaires marked as suitable for use in public street lighting according to Article Gi-1 must be designed and constructed in such a way that their light pollution is decreased to the lowest level, taking account of technical progress and the availability of means of decreasing light pollution.</p> <p>Any improvements aiming to reduce light pollution must not have a negative effect on the energy efficiency of the luminaires.</p> <p>Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)</p> | <p>As the significance of the environmental impact of light pollution could not be assessed (see above), it would be inappropriate to impose minimum requirements.</p> |
| <p>Ga-3 – HID lamps</p> <p>All HID lamps must be designed and constructed in such a way that their mercury content is decreased to the lowest level, taking account of technical progress and the availability of means of decreasing mercury content.</p> <p>Any improvements aiming to reduce mercury content must not have a negative effect on the energy efficiency of the lamp.</p> <p>Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)</p> | |
| <p>Ga-4 – All HID</p> <p>All HID lamps, and ballasts and luminaires for HID lamps shall be designed and constructed in such a way that the impact of their waste on the environment (in terms of points (j), (l), (m) in Annex I Part 1.3 of the Ecodesign Directive 2005/32/EC) is minimised, taking account of technical progress and the specific legislation on waste such as 2002/96/EC.</p> <p>Any improvements aiming to reduce the impact of their waste must not have a negative effect on their energy efficiency.</p> <p>Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)</p> | |
| <p>Generic ecodesign requirements Supply of information on/with the product (Gi) Requirements applicable only to products marked as suitable for use in public street lighting according to Article Gi-1 are marked with a *.</p> | |
| <p>Gi-1 – All HID</p> <p>Lamps, and ballasts and luminaires for HID lamps intended for use in (among others) public street lighting shall be marked as “Suitable for public street lighting (fixed lighting installations intended to provide good visibility to users of outdoor public traffic areas during the hours of darkness to support traffic safety, traffic flow and public security).”</p> <p>In addition, luminaires intended for use in (among others) public street lighting shall be marked as either “F+M category road lighting” or “S category road lighting” depending on whether they are intended for fast+mixed traffic roads or slow traffic roads.</p> <p>Other HID lamps and ballasts and luminaires for HID lamps shall be marked as “Not suitable for public street lighting (fixed lighting installations intended to provide good visibility to users of outdoor public traffic areas during the hours of darkness to support traffic safety, traffic flow and public security).”</p> <p>Location of marking: documentation accompanying the product</p> | <p>Any lamp intended for public street lighting shall be indicated as suitable for public street lighting. Same for HID ballasts and luminaires.</p> <p>On the other hand, only HID lamps, ballasts and luminaires will be required to indicate if they are NOT suitable for public street lighting. Other lamp types not intended for public street lighting will not have any obligation under this IM.</p> <p>This will ensure that products not designed for public street lighting will not get installed in public street lighting, if the instructions are followed.</p> |

when placed on the market by the manufacturer.

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

Gi-2 * - All for public street lighting

The following data and instructions shall be included in the documentation accompanying the product when placed on the market by the manufacturer:

1. For luminaires marked as suitable for use in public street lighting according to Article Gi-1:
 - a) Photometric data (complete all 10° & CENF =1.0 * CEN file format).
 - b) Luminaire Maintenance Factor value up to 4 years according to the following table:

| LMF | Exposure time in years | | | | | | |
|--------|------------------------|-----|-----|-----|-----|-----|-----|
| | 1,0 | 1,5 | 2,0 | 2,5 | 3,0 | 3,5 | 4,0 |
| High | | | | | | | |
| Medium | | | | | | | |
| Low | | | | | | | |
 - c) Realistic maintenance instructions to ensure that the luminaire maintains, as nearly as possible, its original quality throughout its lifetime.
 - d) Lamp and ballast replacement instructions to keep maintenance costs low.
 - e) Utilization Factor values for standard road conditions in tabular form for the defined road class, and for an asphalt road surface type R3008 with $q_0=0,08$. The table shall contain the most energy efficient UF values for different road widths, different pole heights, maximum pole distances, luminaire overhang and inclination.
 - f) Installation instructions for optimizing the Utilization Factor.
 - g) Additional installation recommendations to minimize light pollution (if not conflicting with UF optimization and safety).
2. For lamps marked as suitable for use in public street lighting according to Article Gi-1:
 - a) Lamp efficacy at 100 h, and Lamp Lumen Maintenance Factor (LLMF) at 4000 h, 8000 h, 12000 h and 16000h.
 - b) Lamp Survival Factor (LSF) data at 4000 h, 8000 h, 12000 h and 16000 h.
 - c) For lamps with Colour Rendering Index < 80, power balance information: efficiency in visible radiant power (P_{vis}/P_{lamp} (%)) or the lamp efficacy in scotopic lumens.
3. For ballasts marked as suitable for use in public street lighting according to Article Gi-1, the ballast efficiency.

Timing: 1 year after the entry into force of the IM (indicative, to be determined during impact assessment)

This will ensure that the product information is available for optimal street lighting project design, installation and maintenance of the products.

The disassembly instructions required by Article 11 of the WEEE Directive (2002/96/EC) apply to lighting equipment (see Annex IA and IB), so no provision is included under this IM.

1.b Because the standard EN 13201 uses 'maintained' values of luminance or illuminance, the luminaire maintenance factor at typical cleaning interval periods are needed for this calculation. Cleaning of the luminaire is currently done at lamp replacement and as high pressure sodium lamps have a lifetime of 16000h, therefore specifying LMF at 4 years is necessary.

1.e Utilization Factor values can give a first indication of the suitability of the luminaire for a certain application and the possibility to compare (roughly) luminaires under the same circumstances. Of course, after a first selection, this should be completed by a detailed photometric calculation done by the designer of the street lighting system.

2.a These data are essential to determine the maintained lighting levels according to standard EN 13201.

2.a-b Combination of LSF, LLMF and luminaire maintenance factor data are necessary to optimize the maintenance period in order to achieve the minimum operating costs.

2.c These values are needed because actual lamp efficacy information is according to photopic lumens, whereas photopic vision is often not a representative value for street lighting.

3. A new measurement method is needed to measure HID ballast efficiency.

Ecodesign parameters referred to in Annex I, Part 1 of Directive 2005/32/EC which are not considered as significant

| | |
|---|--|
| All ecodesign parameters referred to in Annex I, Part 1 not addressed by the requirements above. | |
| Info requirements for components and sub-assemblies | |
| No information requirements on manufacturers of components and sub-assemblies of lamps, ballasts and luminaires are envisaged, as the need for this was not demonstrated by the preparatory study, neither mentioned by the stakeholders. | |
| Requirements on conformity assessment (e.g. on technical documentation, choice of modules etc.) | |
| Self-assessment (module A) | |