EU GPP Criteria for Indoor Lighting

Green Public Procurement (GPP) is a voluntary instrument. This document provides the EU GPP criteria developed for the Indoor Lighting product group. The accompanying Technical Background Report provides full details on the reasons for selecting these criteria and references for further information.

For each product / service group two sets of criteria are presented:

- The core criteria are those suitable for use by any contracting authority across the Member States and address the key environmental impacts. They are designed to be used with minimum additional verification effort or cost increases.
- The comprehensive criteria are for those who wish to purchase the best products available on the market. These may require additional verification effort or a slight increase in cost compared to other products with the same functionality.

1. Definition and Scope

This document covers procurement actions for indoor lighting. For the purposes of these criteria, indoor lighting is defined as covering lamps, luminaires (light fittings) and lighting controls installed inside buildings. The criteria do not cover the following specialist types of lighting:

- Coloured lighting
- Display lighting for museums and art galleries
- Emergency escape lighting
- External lighting of any type
- Illuminated signs
- Lighting fixed to machinery or equipment
- Lighting for plant growth
- Lighting for televised sport
- Lighting for visually impaired persons with special lighting needs
- Lighting of monuments or historic buildings that have not been converted for commercial use
- Specialist medical lighting to carry out examination or surgery, for example in hospitals, medical centres, or doctors' and dentists' surgeries
- Stage lighting in theatres and TV studios

Lighting of these specialist types should not be included in the lighting power density calculations in lighting design criteria 2 and 3.

Replacement lamps form the majority of regular procurement, and criteria have been proposed for energy efficiency, lamp lifetime, mercury content of fluorescent lamps, hazardous chemical content, and packaging. Different criteria are given for replacement lamps and lamps in new installations, in order to

minimise the need to replace fittings. However in some exceptional circumstances, changes in light fitting may be required when replacement lamps are not available for the existing fittings. This is typically the case of incandescent fittings where compact fluorescent lamps with integrated control gear might be longer than the incandescent lamps which they are meant to replace and not fit in the existing luminaire.

The purchase of new lighting, either in a whole building or a particular space, has a big influence on building energy consumption. A new lighting installation should remain in place until its replacement with a more efficient solution is economically and environmentally viable, and during this time it will consume energy. For new installations, a systems approach has been adopted, based on installed power density. Two different sets of criteria are given:

1. Where there is new lighting in a whole building, the criterion is for the installed lighting power (including lamps and ballasts and control gear) divided by the total floor area, in W/m^2.
2. Where there is new lighting in a particular space in a building, the criterion is for the normalised power density in W/m^2/100 lux. This is the total power consumed by the lighting, including lamps, ballasts and control gear, divided by the total floor area of the space, and by one hundredth of the illuminance in the space. Thus if the illuminance were 500 lux, the lighting power would be divided by the floor area and by 5.

For comprehensive criteria, tougher power density limits are proposed. For both core and comprehensive criteria, further reductions in power density are the subject of award criteria. The Technical/Background Report gives more information about the power density criteria and how they were derived.

Lighting controls criteria are intended to cover the most obvious areas in which energy can be wasted by lighting being left on unnecessarily. In addition the comprehensive criteria include a requirement for lighting some types of space to be dimmable. Dimming can save energy and also meet occupant needs by allowing them to vary their working environment. An award criterion for the proportion of dimmable lighting has also been included.

It is important that lighting controls are commissioned so that they work properly, that building occupants know how to use them and maintenance staff can adjust them, for example if room layouts change. Consequently a contract performance clause on lighting commissioning is proposed. Another contract performance clause covers information provision, so that occupants know how to control their lighting, and maintenance staff can make adjustments if necessary.

Waste is generated when replacing a lighting installation with a new one. A contract performance clause requires installers to reuse or recover waste materials as appropriate.

In addition to the criteria listed in Section 3, the contracting authority may optionally wish to carry out a life cycle cost assessment, or to require the contractor to carry out such an assessment (see Section “Cost Considerations” below) using available methodologies for the calculation of life cycle costs.

Because of the rapid development of indoor lighting, especially in the use of LEDs, it is envisaged that these GPP criteria will be reviewed in 2013.

2. Key environmental impacts

The key environmental impact from indoor lighting is energy consumption in the use phase and associated greenhouse gas emissions. Other environmental impacts can result from the use of certain substances in lamps e.g. mercury. Setting energy efficiency requirements for lighting will tend to lead to a reduction in their overall mercury content, because less lighting will have to be installed.

Key Environmental Impacts	GPP Approach
• Energy consumption, in all phases, but especially the use phase of indoor lighting • Potential pollution of air, land and water during the production phase • Use of materials and hazardous materials • Generation of waste (hazardous and non-hazardous)	• At design stage, ensure new lighting installations have low power density meeting visual task requirements • Purchase replacement lamps with high lamp efficacy • Use lighting controls to further reduce energy consumption • Encourage the use of dimmable ballasts where circumstances allow • At installation stage, ensure system works as intended, in an energy efficient way • Promote lamps with a lower mercury content • Reuse or recover installation waste

Please note that the order of impacts does not necessarily translate to the order of their importance.

Detailed information about the indoor lighting product group, including the information about related legislation and other sources can be found in the Technical Background Report.

3. EU GPP Criteria for Indoor Lighting

Based on data and information in the Technical Background Report three sets of EU GPP criteria are proposed:

a) for purchasing of resource and energy efficient lamps
b) design of a new lighting system or renovation of the existing lighting system
c) installation work

<table>
<tr><th>Core criteria</th><th>Comprehensive criteria</th></tr>
<tr><td colspan="2">3.1 EU GPP criteria for lamps</td></tr>
<tr><td>SUBJECT MATTER</td><td>SUBJECT MATTER</td></tr>
<tr><td>Purchasing of resource and energy efficient lamps</td><td>Purchasing of resource and energy efficient lamps</td></tr>
<tr><td>TECHNICAL SPECIFICATIONS</td><td>TECHNICAL SPECIFICATIONS</td></tr>
<tr><td>1. Replacement lamps for existing installations shall have a lamp luminous efficacy equal to or greater than the minimum efficacy of the relevant energy class given in the table below.

<table>
<tr><th>Type of lamp</th><th>Relevant energy class</th></tr>
<tr><td>Tungsten halogen lamps</td><td>C</td></tr>
<tr><td>Compact fluorescent lamps without integral ballast</td><td>B</td></tr>
<tr><td>Globe shaped, pear shaped, reflector type or chandelier type compact fluorescent lamps with integral ballast</td><td>B</td></tr>
<tr><td>All lamps other than halogen lamps with colour rendering index Ra>=90</td><td>B</td></tr>
<tr><td>All other compact fluorescent lamps with integral ballast</td><td>A</td></tr>
<tr><td>15W T8 tubular fluorescent lamps, and miniature tubular fluorescent lamps</td><td>B</td></tr>
<tr><td>Circular lamps</td><td>B</td></tr>
<tr><td>Other tubular fluorescent lamps</td><td>A</td></tr>
<tr><td>All other lamps including LEDs and discharge lamps</td><td>A</td></tr>
</table></td><td>1. Replacement lamps for existing installations shall have a lamp luminous efficacy equal to or greater than the minimum efficacy of the relevant energy class given in the table below.

<table>
<tr><th>Type of lamp</th><th>Relevant energy class</th></tr>
<tr><td>Tungsten halogen lamps</td><td>C</td></tr>
<tr><td>Compact fluorescent lamps without integral ballast</td><td>B</td></tr>
<tr><td>Globe shaped, pear shaped, reflector type or chandelier type compact fluorescent lamps with integral ballast</td><td>B</td></tr>
<tr><td>All lamps other than halogen lamps with colour rendering index Ra>=90</td><td>B</td></tr>
<tr><td>All other compact fluorescent lamps with integral ballast</td><td>A</td></tr>
<tr><td>15W T8 tubular fluorescent lamps, and miniature tubular fluorescent lamps</td><td>B</td></tr>
<tr><td>Circular lamps</td><td>B</td></tr>
<tr><td>Other tubular fluorescent lamps</td><td>A</td></tr>
<tr><td>All other lamps including LEDs and discharge lamps</td><td>A</td></tr>
</table></td></tr>
</table>

[1] OJ L 71, 10.3.1998, p. 1

<table>
<tr>
<td>Note: The latest definition of energy efficiency class should be used. Energy efficiency is currently defined in Annex IV to Commission Directive 98/11/EC[1].

Verification: Lamp label of the specified energy class or better. Products holding a Type I ecolabel shall be deemed to comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be accepted such as manufacturer's lamp efficacy statement (lumens per Watt) and a calculation showing that it equals or exceeds the minimum value for the stated energy class.</td>
<td>Note: The latest definition of energy efficiency class should be used. Energy efficiency is currently defined in Annex IV to Commission Directive 98/11/EC[2].

Verification: Lamp label of the specified energy class or better. Products holding a Type I ecolabel shall be deemed to comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be accepted such as manufacturer's lamp efficacy statement (lumens per Watt) and a calculation showing that it equals or exceeds the minimum value for the stated energy class.</td>
</tr>
<tr>
<td>2. Lamps for new and renovated installations shall have a lamp luminous efficacy equal to or greater than the minimum efficacy of the relevant energy class given in the table below.

<table>
<tr><th>Type of lamp</th><th>Relevant energy class</th></tr>
<tr><td>All lamps with colour rendering index Ra>=90 (where this is required for the activities being carried out in the building)</td><td>B</td></tr>
<tr><td>All other lamps</td><td>A</td></tr>
</table>

Note: The latest definition of energy efficiency class should be used. Energy efficiency is currently defined in Annex IV to Commission Directive 98/11/EC[3].

Verification: Lamp label of the specified energy class or better. Products holding a Type I ecolabel shall be deemed to comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be accepted such as manufacturer's lamp efficacy statement</td>
<td>2. Lamps for new and renovated installations shall have a lamp luminous efficacy equal to or greater than the minimum efficacy of the relevant energy class given in the table below.

<table>
<tr><th>Type of lamp</th><th>Relevant energy class</th></tr>
<tr><td>All lamps with colour rendering index Ra>=90 (where this is required for the activities being carried out in the building)</td><td>B</td></tr>
<tr><td>Compact fluorescent lamps and LED lamps with a maximum dimension less than 300mm</td><td>A</td></tr>
<tr><td>All other lamps</td><td>A +10%</td></tr>
</table>

Note: The latest definition of energy efficiency class should be used. Energy efficiency is currently defined in Annex IV to Commission Directive 98/11/EC[4].

For some specialist applications, lamps with efficacies of Class A +10% may not be available, and the contracting authority may specify Class A</td>
</tr>
</table>

2 OJ L 71, 10.3.1998, p. 1
3 OJ L 71, 10.3.1998, p. 1
4 OJ L 71, 10.3.1998, p. 1

<table>
<tr>
<td>(lumens per Watt) and a calculation showing that it equals or exceeds the minimum value for the stated energy class.</td>
<td>lamps instead.

Verification: Products holding a Type I ecolabel shall be deemed to comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be accepted such as manufacturer's lamp efficacy statement (lumens per Watt) and a calculation showing that it equals or exceeds the minimum value from the table.</td>
</tr>
<tr>
<td>3. Lamps for new and renovated installations, and replacement lamps in existing installations, shall have a lifetime not less than that given in the table below.

<table>
<tr><th>Type of lamp</th><th>Lamp life (hours)</th></tr>
<tr><td>Tungsten halogen lamps</td><td>2000</td></tr>
<tr><td>Globe shaped, pear shaped, reflector type or chandelier type compact fluorescent lamps</td><td>6000</td></tr>
<tr><td>All other compact fluorescent lamps</td><td>10000</td></tr>
<tr><td>Circular lamps</td><td>7500</td></tr>
<tr><td>T8 tubular fluorescent lamps with electromagnetic ballasts (existing installations only)</td><td>15000</td></tr>
<tr><td>Other tubular fluorescent lamps</td><td>20000</td></tr>
<tr><td>HID non-directional lamps (primary burning position)</td><td>12000</td></tr>
<tr><td>HID directional lamps (primary burning position)</td><td>9000</td></tr>
<tr><td>Retrofit LEDs with integrated control gear</td><td>15000</td></tr>
<tr><td>Other LEDs</td><td>20000</td></tr>
</table>

Verification: Products holding a Type I ecolabel shall be deemed to comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be accepted such as the result of lamp life testing according to the test procedure in EN 50285 (except for HID</td>
<td>3. Lamps for new and renovated installations, and replacement lamps in existing installations, shall have a lifetime not less than that given in the table below.

<table>
<tr><th>Type of lamp</th><th>Lamp life (hours)</th></tr>
<tr><td>Tungsten halogen lamps</td><td>2500</td></tr>
<tr><td>Globe shaped, pear shaped, reflector type or chandelier type compact fluorescent lamps</td><td>8000</td></tr>
<tr><td>Other compact fluorescent lamps with separate ballast</td><td>10000</td></tr>
<tr><td>Other compact fluorescent lamps with integral ballast</td><td>12000</td></tr>
<tr><td>Circular lamps</td><td>8000</td></tr>
<tr><td>T8 tubular fluorescent lamps with electromagnetic ballasts (existing installations only)</td><td>15000</td></tr>
<tr><td>Other tubular fluorescent lamps</td><td>25000</td></tr>
<tr><td>HID non-directional lamps (primary burning position)</td><td>12000</td></tr>
<tr><td>HID directional lamps (primary burning position)</td><td>9000</td></tr>
<tr><td>Retrofit LEDs with integrated control gear</td><td>20000</td></tr>
<tr><td>Other LEDs</td><td>25000</td></tr>
</table>

Verification: Products holding a Type I ecolabel shall be deemed to</td>
</tr>
</table>

<table>
<tr>
<td>lamps and LEDs) or equivalent.</td>
<td>comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be accepted such as the result of lamp life testing according to the test procedure in EN 50285 (except for HID lamps and LEDs) or equivalent.</td>
</tr>
<tr>
<td>4. Fluorescent lamps for new and renovated installations, and replacement lamps in existing installations, shall have a mercury content not greater than that given in the table below.

<table>
<tr><th>Type of lamp</th><th>Mercury content (mg/lamp)</th></tr>
<tr><td>Compact fluorescent lamps, wattage less than 30W</td><td>2.5</td></tr>
<tr><td>Compact fluorescent lamps, wattage 30W or over</td><td>3</td></tr>
<tr><td>T5 tubular fluorescent lamps, lifetime less than 25000 hours</td><td>2.5</td></tr>
<tr><td>T5 lamps, lifetime 25000 hours or more</td><td>4</td></tr>
<tr><td>T8 tubular fluorescent lamps, wattages less than 70W, lifetime less than 25000 hours</td><td>3.5</td></tr>
<tr><td>T8 tubular fluorescent lamps, wattage 70W or over</td><td>5</td></tr>
<tr><td>T8 lamps, lifetime 25000 hours or more</td><td>5</td></tr>
</table>
Note: Circular lamps are not covered by this criterion.

Verification: According to the Ecodesign Directive (2009/125/EC) and Commission Regulation (EC) 245/2009, Annex III, mercury content is to be specified in product information on freely accessible websites and in other forms that are deemed appropriate. A copy of the layout of the packaging and a link to the manufacturer's website where the mercury content is specified can be requested as verification.</td>
<td>4. Fluorescent lamps for new and renovated installations, and replacement lamps in existing installations, shall have a mercury content not greater than that given in the table below.

<table>
<tr><th>Type of lamp</th><th>Mercury content (mg/lamp)</th></tr>
<tr><td>Compact fluorescent lamps</td><td>1.5</td></tr>
<tr><td>T5 tubular fluorescent lamps, lifetime less than 25000 hours</td><td>2</td></tr>
<tr><td>T5 lamps, lifetime 25000 hours or more</td><td>3</td></tr>
<tr><td>T8 tubular fluorescent lamps, wattages less than 70W, lifetime less than 25000 hours</td><td>2.5</td></tr>
<tr><td>T8 tubular fluorescent lamps, wattage 70W or over, lifetime less than 25000 hours</td><td>4.5</td></tr>
<tr><td>T8 lamps, lifetime 25000 hours or more</td><td>5</td></tr>
</table>
Note: Circular lamps are not covered by this criterion.

Verification: According to the Ecodesign Directive (2009/125/EC) and Commission Regulation (EC) 245/2009, Annex III, mercury content is to be specified in product information on freely accessible websites and in other forms that are deemed appropriate. A copy of the layout of the packaging and a link to the manufacturer's website where the mercury content is specified can be requested as verification.</td>
</tr>
</table>

5. Requirements concerning lamps for new and renovated installations, and replacement lamps in existing installations: packaging. Laminates and composite plastics shall not be used. Where cardboard and corrugated paper boxes are used, they shall be made of at least 50% post-consumer recycled material. Where plastic materials are used they shall be made of at least 50% post-consumer recycled material. **Verification:** Products holding a Type I ecolabel shall be deemed to comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be also accepted such as written evidence from the tenderer that the above clause is met.	**5.** Requirements concerning lamps for new and renovated installations, and replacement lamps in existing installations: packaging. Laminates and composite plastics shall not be used. Where cardboard and corrugated paper boxes are used, they shall be made of at least 80% post-consumer recycled material. Where plastic materials are used they shall be made of at least 50% post-consumer recycled material. **Verification:** Products holding a Type I ecolabel shall be deemed to comply, provided that this ecolabel fulfils the requirements listed above. Other appropriate means of proof will be also accepted such as written evidence from the tenderer that the above clause is met.
AWARD CRITERIA	**AWARD CRITERIA**
1. Credit will be awarded if lamp luminous efficacies are at least 110% of the minima given in the relevant table for criteria 1A or 1B above. **Verification:** Manufacturer's lamp efficacy statement (lumens per Watt) and a calculation showing that it is at least 110% of the minimum value for the stated energy class.	**1.** Credit will be awarded if lamp luminous efficacies are at least 110% of the minima given in the relevant table for comprehensive criteria 1A or 1B above. **Verification:** Manufacturer's lamp efficacy statement (lumens per Watt) and a calculation showing that it is at least 110% of the minimum value for the stated energy class.
2. Credit will be awarded if lamp lifetime is at least **120%** of the minimum given in the table for criterion 2 above. **Verification:** Result of lamp life testing according to the procedure in EN 50285 or equivalent, together with a calculation showing that the lamp life is at least 120% of the specified minimum value for that lamp type.	**2.** Credit will be awarded if lamp lifetime is at least **120%** of the minimum given in the table for comprehensive criterion 2 above. **Verification:** Result of lamp life testing according to the procedure in EN 50285 or equivalent, together with a calculation showing that the lamp life is at least 120% of the specified minimum value for that lamp type.
3. Credit will be awarded if lamp mercury content is at most 80% of the maximum given in the table for criterion 3 above.	**3.** Credit will be awarded if lamp mercury content is at most 80% of the maximum given in the table for comprehensive criterion 3 above.

Verification: Manufacturer's statement of lamp mercury content and a calculation showing that it is at most 80% of the specified maximum value for that lamp type.	**Verification:** Manufacturer's statement of lamp mercury content and a calculation showing that it is at most 80% of the specified maximum value for that lamp type.

Core criteria	Comprehensive criteria
3.2 EU GPP criteria for design of indoor lighting	
SUBJECT MATTER	**SUBJECT MATTER**
Resource and energy efficient design of new lighting systems or renovation of the existing lighting system	Resource and energy efficient design of new lighting systems or renovation of the existing lighting system
SELECTION CRITERION	**SELECTION CRITERION**
1. Where a new lighting system is being designed, the tenderer shall demonstrate that the design will be undertaken by personnel with at least three years experience in lighting design and/or having a suitable professional qualification in lighting engineering or membership of a professional body in the field of lighting design. **Verification:** The tenderer shall supply a list of the persons responsible for the project, including managerial staff, indicating educational and professional qualifications and relevant experience. This should include persons employed by subcontractors where the work is to be sub-contracted. The contractor shall also supply a list of lighting schemes the tenderer has designed over the last three years.	**1.** Where a new lighting system is being designed, the tenderer shall demonstrate that the design will be undertaken by personnel with at least three years experience in lighting design and/or having a suitable professional qualification in lighting engineering or membership of a professional body in the field of lighting design. **Verification:** The tenderer shall supply a list of the persons responsible for the project, including managerial staff, indicating educational and professional qualifications and relevant experience. This should include persons employed by subcontractors where the work is to be sub-contracted. The contractor shall also supply a list of lighting schemes the tenderer has designed over the last three years.
TECHNICAL SPECIFICATIONS	**TECHNICAL SPECIFICATIONS**
1. Where lighting is to be installed throughout a building, the maximum lighting power consumed in the whole building, divided by its total floor area, must not exceed the following values:	**1.** Where lighting is to be installed throughout a building, the maximum lighting power consumed in the whole building, divided by its total floor area, must not exceed the following values:

Type of building	Lighting power density W/m^2
Car park	2.5

Type of building	Lighting power density W/m^2
Car park	2.2

Court	14
Exhibition space, museum	9
Fire station	12
Further education	13
Hospital	12
Library	12
Office (mainly cellular)	13
Office (mainly open plan)	11
Police station	14
Post office	14
Prison	9
Public hall	9
Residential	11
Residential (communal spaces only)	6
School	8
Sports centre	9
Town hall	13

Verification: A calculation provided by the lighting designer showing the total power consumed by the lighting, including lamps, ballasts, sensors and controls, divided by the total floor area of all the indoor spaces in the building. The lighting designer should also show that the lighting meets the relevant performance standards in EN 12464-1, equivalent national standards or best practice guides, or those set by the public authority. Depending on the type of space and its requirements, these may include illuminance, uniformity, control of glare, colour rendering and colour appearance.

Court	13
Exhibition space, museum	7.5
Fire station	11
Further education	11
Hospital	11
Library	11
Office (mainly cellular)	11
Office (mainly open plan)	10
Police station	13
Post office	13
Prison	8
Public hall	7.5
Residential	9
Residential (communal spaces only)	4.5
School	7
Sports centre	7.5
Town hall	12

Verification: A calculation provided by the lighting designer showing the total power consumed by the lighting, including lamps, ballasts, sensors and controls, divided by the total floor area of all the indoor spaces in the building. The lighting designer should also show that the lighting meets the relevant performance standards in EN 12464-1, equivalent national standards or best practice guides, or those set by the public authority. Depending on the type of space and its requirements, these may include illuminance, uniformity, control of glare, colour rendering and colour appearance.

2. Where lighting is to be installed in an individual space or part of the building, the maximum lighting power consumed in the space, divided by its total floor area and by its illuminance in units of 100 lux, must not exceed the following values:

Type of space	**Normalised lighting power density (W/m^2/100 lux)**
Bedrooms	7.5
Canteens	3.5
Car parks	2.2
Circulation inc lifts, stairs	3.2
Conference rooms	2.8
Gyms	2.8
Halls	2.8
Hospital wards and examination rooms	4
Kitchens (domestic)	5
Kitchens (restaurants)	2.8
Laboratories	2.8
Libraries	3.2
Lounges – large area	6
Lounges – small area	7.5
Offices (open plan)	2.3
Offices (cellular)	3
Plant rooms	3.2
Post rooms/ switchboards	3.2
Prison cells	4
Reception	4
Rest rooms, toilets, bathrooms	5
Retail	3.5

2. Where lighting is to be installed in an individual space or part of the building, the maximum lighting power consumed in the space, divided by its total floor area and by its illuminance in units of 100 lux, must not exceed the following values:

Type of space	**Normalised lighting power density (W/m^2/100 lux)**
Bedrooms	6
Canteens	3.2
Car parks	2
Circulation inc lifts, stairs	3
Conference rooms	2.6
Gyms	2.6
Halls	2.6
Hospital wards and examination rooms	3.5
Kitchens (domestic)	4
Kitchens (restaurants)	2.6
Laboratories	2.6
Libraries	3
Lounges – large area	4.5
Lounges – small area	6
Offices (open plan)	2
Offices (cellular)	2.8
Plant rooms	3
Post rooms/ switchboards	3
Prison cells	3.5
Reception	3.5
Rest rooms, toilets, bathrooms	4
Retail	3.2

School classrooms	2.3
Store rooms	3.2
Waiting rooms	3.2

Verification: The lighting designer shall provide a calculation showing the total power consumed by the lighting, including lamps, ballasts, sensors and controls, divided by the total floor area of the space, and by one hundredth of the illuminance in the space. Thus if the illuminance were 500 lux, the lighting power would be divided by the floor area and by 5.

The illuminance used in the calculation shall be the recommended illuminance in EN 12464-1 or equivalent national standard, or the installed maintained illuminance if it is lower. If EN 12464-1, or the equivalent national standard, does not give a recommendation for the type of space, the installed maintained illuminance shall be used.

For stairwells, the total floor area may include the area of the risers on the stairs as well as horizontal surfaces.

For unusually small spaces, the contracting authority may increase the target power densities, or compliance with the criterion need not be enforced.

3. Design and installation of lighting controls

Lighting in infrequently occupied spaces to be controlled by occupancy sensors which turn off the lighting after the space becomes unoccupied, unless this would endanger safety or security.

Lighting in spaces which are unoccupied at night or at weekends, and where the lighting could be left on by mistake, to be fitted with either time switches or occupancy sensors to switch off the lighting after the space becomes unoccupied at night or at weekends.

Lighting in spaces with side windows to be controlled in rows parallel to the

School classrooms	2
Store rooms	3
Waiting rooms	3

Verification: The lighting designer shall provide a calculation showing the total power consumed by the lighting, including lamps, ballasts, sensors, and controls, divided by the total floor area of the space, and by one hundredth of the illuminance in the space. Thus if the illuminance were 500 lux, the lighting power would be divided by the floor area and by 5.

The illuminance used in the calculation shall be the recommended illuminance in EN 12464-1 or equivalent national standard, or the installed maintained illuminance if it is lower. If EN 12464-1, or the equivalent national standard, does not give a recommendation for the type of space, the installed maintained illuminance shall be used.

For stairwells, the total floor area may include the area of the risers on the stairs as well as horizontal surfaces.

For unusually small spaces, the contracting authority may increase the target power densities, or compliance with the criterion need not be enforced.

3. Design and installation of lighting controls

Lighting in infrequently occupied spaces to be controlled by occupancy sensors which turn off the lighting after the space becomes unoccupied, unless this would endanger safety or security.

Lighting in spaces which are unoccupied at night, and where the lighting could be left on by mistake, to be fitted with either time switches or occupancy sensors to switch off the lighting after the space becomes unoccupied at night.

Lighting in spaces with side windows to be controlled in rows parallel to the

windows, so that rows nearer to the windows can be switched off separately. Lighting in offices, conference rooms, school classrooms and laboratories to be controllable by the occupants using accessible switches in convenient locations. Lighting in daylit circulation areas and reception areas to be controlled by automatic daylight linked control (either switching or dimming). **Verification:** The lighting designer shall provide a schedule showing the lighting controls to be installed in each space, with product descriptions or manufacturers' datasheets showing their operation.	windows, so that rows nearer to the windows can be switched off separately. Lighting in offices, conference rooms, classrooms and laboratories to be dimmable, and controllable by the occupants using accessible switches in convenient locations. In spaces of these types, dimmable lighting is to be controllable automatically so that early in the life of the installation, when lamps and luminaires are clean and bright, the lighting can be dimmed to provide the required maintained illuminance; and if the space is daylit, automatic daylight linked dimming is to be provided. Lighting of individual work areas in offices to be controllable separately. Lighting in daylit circulation areas and reception areas to be controlled by automatic daylight linked control (either switching or dimming). **Verification:** The lighting designer shall provide a **s**chedule showing the lighting controls to be installed in each space, with product descriptions or manufacturers' datasheets showing their operation.
AWARD CRITERIA	**AWARD CRITERIA**
1. In spaces where dimming would be beneficial, additional credits will be awarded in proportional to the overall proportion of lighting power in such spaces that is dimmable. To count as dimmable, lighting has to be controllable automatically so that early in the life of the installation, when lamps and luminaires are clean and bright, the lighting can be dimmed to provide the required maintained illuminance; and if the space is daylit, automatic daylight linked dimming is to be provided. **Verification:** The lighting designer shall provide a calculation showing the installed lighting power of the entire installation (including that consumed by lamps, ballasts, sensors and controls) when those parts of the lighting that can be dimmed are fully dimmed, divided by the installed lighting power when all lamps are at full light output.	**1.** In spaces where dimming would be beneficial (other than offices, conference rooms, classrooms and laboratories where dimming is required), additional credits will be awarded in proportional to the overall proportion of lighting power in such spaces that is dimmable. To count as dimmable, lighting has to be controllable automatically so that early in the life of the installation, when lamps and luminaires are clean and bright, the lighting can be dimmed to provide the required maintained illuminance; and if the space is daylit, automatic daylight linked dimming is to be provided. **Verification:** The lighting designer shall provide a calculation showing the installed lighting power of the entire installation (including that consumed by lamps, ballasts, sensors and controls) when those parts of the lighting that can be dimmed are fully dimmed, divided by the installed lighting power when all lamps are at full light output.

2. Credit will be awarded if power densities are less than 90% of those given in the table for criterion 2 above, or alternatively if normalised power densities are less than 90% of those given in the table for criterion 3 above. **Verification:** Calculation as specified in the relevant criterion above.	**2.** Credit will be awarded if power densities are less than 90% of those given in the table for criterion 2 above, or alternatively if normalised power densities are less than 90% of those given in the table for criterion 3 above. **Verification:** Calculation as specified in the relevant criterion above.

Core criteria	Comprehensive criteria
3.3 EU GPP criteria for installation of indoor lighting	
SUBJECT MATTER	**SUBJECT MATTER**
Resource and energy efficient installation of new lighting systems or renovation of the existing lighting system	Resource and energy efficient installation of new lighting systems or renovation of the existing lighting system
SELECTION CRITERION	**SELECTION CRITERION**
Where a new or renovated lighting system is being installed, the tenderer shall demonstrate that the installation will be undertaken by personnel with at least three years experience in installation of lighting systems and/or having a suitable professional qualification in electrical or building services engineering, or membership of a professional body in the field of lighting. **Verification:** The tenderer shall supply a list of the persons responsible for the project, including managerial staff, indicating educational and professional qualifications and relevant experience. This should include persons employed by subcontractors where the work is to be sub-contracted. The tenderer shall also supply a list of lighting schemes the contractor has installed over the last three years.	Where a new or renovated lighting system is being installed, the tenderer shall demonstrate that the installation will be undertaken by personnel with at least three years experience in installation of lighting systems and/or having a suitable professional qualification in electrical or building services engineering, or membership of a professional body in the field of lighting. **Verification:** The tenderer shall supply a list of the persons responsible for the project, including managerial staff, indicating educational and professional qualifications and relevant experience. This should include persons employed by subcontractors where the work is to be sub-contracted. The tenderer shall also supply a list of lighting schemes the contractor has installed over the last three years.
TECHNICAL SPECIFICATIONS	**TECHNICAL SPECIFICATIONS**
1. The tenderer shall provide the following for new or renovated lighting installations: • Disassembly instructions for luminaires • Instructions on how to replace lamps, and which lamps can be used in the luminaires without increasing the stated power densities	**1.** The tenderer shall provide the following for new or renovated lighting installations: • Disassembly instructions for luminaires • Instructions on how to replace lamps, and which lamps can be used in the luminaires without increasing the stated power densities

• Instructions on how to operate and maintain lighting controls • For occupancy sensors, instructions on how to adjust their sensitivity and time delay, and advice on how best to do this to meet occupant needs without excessive increase in energy consumption • For daylight linked controls, instructions on how to recalibrate and adjust them, for example to take into account changes to room layout. • For time switches, instructions on how to adjust the switch off times, and advice on how best to do this to meet occupant needs without excessive increase in energy consumption **Verification:** The tenderer is to provide written instructions to the contracting authority	• Instructions on how to operate and maintain lighting controls • For occupancy sensors, instructions on how to adjust their sensitivity and time delay, and advice on how best to do this to meet occupant needs without excessive increase in energy consumption • For daylight linked controls, instructions on how to recalibrate and adjust them, for example to take into account changes to room layout. • For time switches, instructions on how to adjust the switch off times, and advice on how best to do this to meet occupant needs without excessive increase in energy consumption **Verification:** The tenderer is to provide written instructions to the contracting authority
2. The tenderer shall implement appropriate environmental measures to reduce and recover the waste that is produced during the installation of a new or renovated lighting system. All waste lamps and luminaires and lighting controls shall be separated and sent for recovery in accordance with the WEEE directive. **Verification:** The tenderer shall provide a description setting out how the waste is to be separated, recovered or recycled.	**2.** The tenderer shall implement appropriate environmental measures to reduce and recover the waste that is produced during the installation of a new or renovated lighting system. All waste lamps and luminaires and lighting controls shall be separated and sent for recovery in accordance with the WEEE directive. Verification: The tenderer shall provide a description setting out how the waste is to be separated, recovered or recycled.
CONTRACT PERFORMANCE CLAUSES	**CONTRACT PERFORMANCE CLAUSES**
1. The contractor shall ensure that new or renovated lighting installations and controls are working properly and using no more energy than is required. • For occupancy sensors, sensitivity and time delay shall be set to appropriate levels to meet occupant needs without excessive energy consumption • Occupancy sensors shall be checked to ensure that they are working properly and are sensitive enough to detect typical occupant movements • Daylight linked controls shall be calibrated to ensure that they switch off the lighting when daylight is adequate	**1.** The contractor shall ensure that new or renovated lighting installations and controls are working properly and using no more energy than is required. • For occupancy sensors, sensitivity and time delay shall be set to appropriate levels to meet occupant needs without excessive energy consumption • Occupancy sensors shall be checked to ensure that they are working properly and are sensitive enough to detect typical occupant movements • Daylight linked controls shall be calibrated to ensure that they switch off the lighting when daylight is adequate

• Dimming controls shall be calibrated to ensure that they maintain the combined level of daylight and electric light to that required in the space • Time switches shall be set to appropriate switch off times to meet occupant needs without excessive increase in energy consumption • The wiring of occupant control switches and dimmers shall be checked to ensure that they control appropriate areas within the room If following occupation of the space, the lighting controls do not appear to meet all the above requirements, the contractor shall adjust and/or recalibrate the controls so that they do. **Verification:** Statement by the contractor that the relevant adjustments and calibrations have been carried out.	• Dimming controls shall be calibrated to ensure that they maintain the combined level of daylight and electric light to that required in the space • Time switches shall be set to appropriate switch off times to meet occupant needs without excessive increase in energy consumption • The wiring of occupant control switches and dimmers shall be checked to ensure that they control appropriate areas within the room If following occupation of the space, the lighting controls do not appear to meet all the above requirements, the contractor shall adjust and/or recalibrate the controls so that they do. **Verification:** Statement by the contractor that the relevant adjustments and calibrations have been carried out.
2. The contractor shall ensure that the lighting equipment (including lamps and luminaires and lighting controls) is installed exactly as specified in the original design. **Verification:** Schedule of installed lighting equipment with appended manufacturers' invoices or delivery notes, and confirmation that the equipment is as originally specified. **Note:** This contract performance clause is intended to eliminate the substitution of inferior lighting products at the installation stage. Where substitution is inevitable because the originally specified products are unavailable, the contractor shall provide a replacement schedule and calculation showing that the installation with the substituted products still complies with the relevant lighting design criteria in 3.2 above.	**2.** The contractor shall ensure that the lighting equipment (including lamps and luminaires and lighting controls) is installed exactly as specified in the original design. **Verification:** Schedule of installed lighting equipment with appended manufacturers' invoices or delivery notes, and confirmation that the equipment is as originally specified. **Note:** This contract performance clause is intended to eliminate the substitution of inferior lighting products at the installation stage. Where substitution is inevitable because the originally specified products are unavailable, the contractor shall provide a replacement schedule and calculation showing that the installation with the substituted products still complies with the relevant lighting design criteria in 3.2 above.

Explanatory notes

In procuring lighting systems, contracting authorities may let separate contracts (covering, for example, design, equipment supply, and installation) to different contractors. In such cases, different contractors may therefore be responsible for ensuring that different criteria are met.

Award Criteria: Contracting authorities will have to indicate in the contract notice and tender documents how many additional points will be awarded for each award criterion. Environmental award criteria should, altogether, account for at least 15% of the total points available.

Lamp efficacy criteria: The Ecodesign requirements also set standards for lamp luminous efficacy, in order for lamps to be placed on the market. These standards are set to become more demanding in April 2012. For some lamp types the Ecodesign requirements may be more stringent than the minimum efficacy of the lamp class set in lamp criteria 1a and 1b above.

Power density criteria: When new lighting is installed in the whole of a mixed use building, the contracting authority may at its discretion either require that each part of the building meets the relevant power density design criterion 2, or alternatively it may set an overall power density criterion for the whole building based on an area weighted average of the different usage types.

When new lighting is installed in the whole of a building with an unusual mix of spaces, or with spaces that require an unusually high illuminance because of visual task requirements, or a building of a type other than those listed in design criterion 2 above, the contracting authority may at its discretion either require that each space in the building meets the relevant normalised power density in design criterion 3, or alternatively it may set an overall lighting power target for the whole building by adding the power values for each space found by multiplying the normalised power density criterion in the space by its area and its illuminance divided by 100.

Lighting controls: Before lighting controls are installed, the contracting authority should inform the installer of the way the space is occupied and used, and any particular lighting control requirements including safety and security issues. Safety and security concerns should not be overstated; in spaces without obvious hazards, properly installed lighting sensors will work effectively without endangering occupants. If there are particular concerns, it may often be possible to leave a small amount of lighting on at key locations such as stairways, while switching off the bulk of the lighting.

The lighting controls criteria cover minimum provision and often it may be cost effective for contracting authorities to specify additional controls. Depending on the requirements of the space and its occupants, these could include:

- Daylight linked switching or dimming in other daylit spaces as well as reception and circulation areas
- Occupancy sensing in parts of a space, where parts of a space may be unoccupied for long periods
- Individual occupant control using switching or dimming, perhaps using flexible controls such as infra red controls
- Time switching where lighting is only needed at set times (for example in a museum or other building with fixed opening hours)
- Time delay switching where lighting is only needed for a set period of time, for example when viewing a display
- Key switching, for example in plant rooms or bedrooms, where lighting comes on only if a key card activates it

Maintenance: Lighting requires regular maintenance to ensure that the required illuminances continue to be delivered. Over time, most types of lamp decrease in their output, and then fail; luminaires and room surfaces may become soiled. Towards the end of lamp life, an installation may only be delivering 60-80% of its initial illuminance. As well as replacing failed lamps, provision should be made for luminaires and room surfaces to be cleaned regularly. Old lamps which have dimmed over time may need to be replaced before they have failed completely. Bulk replacement, where all the lamps are changed and luminaires cleaned on a scheduled programme, may be cost effective, especially in locations where spot replacement of lamps is difficult or disruptive.

To allow for the decreased light output as the system ages, lighting installations are normally oversized so that at the start of life they deliver more (often 20-25% more) than the required maintained illuminance. Dimming controls can automatically reduce the output of the lighting, so that the maintained illuminance is delivered throughout installation life. This results in energy savings, particularly at the start of installation life when lamps and luminaires are clean and bright. Savings of 10% are typical.

Cost Considerations

Lamps and luminaires

The cost of providing lighting to a building tends to be dominated by energy costs. For example a typical luminaire may cost 50-100 Euros. Over a 20 year life, operated 8 hours per day, such a luminaire would consume 400-500 Euros of electricity (assuming 10 cents/kWh). Accordingly it is usually cost effective to use a more expensive luminaire even if it is only 10-20% more efficient. Using more efficient luminaires can sometimes allow fewer luminaires to be installed, saving capital outlay.

Energy efficient lamps last longer than their tungsten and tungsten halogen counterparts, saving on maintenance costs as well as on energy consumed. Replacing a 35W tungsten halogen downlight with a high quality 11W LED equivalent may cost an additional 50-80 Euros at current prices. Over a 10 year period, used 8 hours per day, this will save around 70 Euros worth of electricity. But during the same period the LED will not have to be replaced, but the halogen lamp will need replacing 14 times. Although the lamps are cheap, the cost of staff to replace them is not.

Lighting controls

Lighting controls can be highly cost effective, with typical payback periods of 2-4 years when retrofit to an existing installation. In a new installation the cost of installing advanced lighting controls may be the same as that of a conventional manual control system. This is because there is no need to run wiring to wall mounted switches. The automatic lighting controls may save 30-40% of electricity cost with no additional capital cost.

Controls can provide energy savings even if lighting is switched off for only short periods. It is a myth that lamps consume a lot of energy when switching on; at most it is only the same amount consumed in a few seconds of normal operation. There may be a reduction in lamp life if lamps other than LEDs are switched on and off repeatedly. For fluorescent lighting, switching off the lamps for 5-10 minutes is generally cost effective (it depends on the wattage of the lamp and how it is switched).

Life cycle costing

The contracting authority may optionally wish to carry out a life cycle cost assessment, or to require the contractor to carry out such an assessment. Such an assessment should include the initial cost of the installation, its estimated lifetime, replacement costs of lamps and their estimated life, and energy cost of the lighting over its lifetime. The contracting authority will need to define its electricity price and the rate at which this increases, and its interest rate on investments. An example approach is detailed in the Swedish Environmental Management Council's Procurement Criteria for Indoor Lighting Products[5], which also has links to a calculation tool. The SMART-SPP project has also developed a tool[6].

[5] The Swedish Environmental Management Council's Procurement Criteria for Indoor Lighting Products, version 2.0, 18 January 2011. http://www.msr.se/en/green_procurement/criteria/Office/Lighting-products/

[6] SMART SPP – innovation through sustainable procurement http://www.smart-spp.eu/