

Procurement criteria for LED Street Lighting



The PremiumLight-Pro procurement criteria and requirements recommended in this document are designed to support the procurement of high quality energy efficient LED lighting systems for street lighting. The set of criteria includes the following sections:

- A** General elements and features concerning the specification of street lighting systems: Control features, metering etc.
- B** Selection criteria: Criteria specifying general requirements for the selection of the tenderer
- C** Technical criteria: Criteria concerning the quality, efficiency and safety of the lighting system, including both mandatory requirements and award criteria to be used with a scoring approach
- D** Contractual issues: Requirements concerning the installation and calibration of the system

The criteria are primarily intended for procurement experts and decision makers at federal, local and municipal levels who are in charge of commissioning new or renovated road lighting installations. Furthermore the criteria may be useful for road lighting designers and planners, contracting companies as well as energy specialists and consultants.

In addition the document contains two possible approaches for the weighting of award criteria. The preferred approach involves a total cost of ownership concept (TCO).

A General elements for technical specifications of street lighting systems

A.1	Specification of streets and paths and appropriate related technical specifications (Illuminance, uniformity, maintenance factor).	<p>The procurer shall specify the streets and paths for which the street lighting system will be designed or lighting components shall be procured. The system shall be specified based on the standard EN13201 and the related national standards. Specifications shall take into account variable situations which offer room for lighting control and dimming. Among others the procurer shall specify:</p> <ul style="list-style-type: none"> • Illuminance levels, • uniformity levels, • lighting system maintenance factors according to EN 13201 or based on specific needs. 	
A.2	Lighting control features	<p>The procurer shall specify one of the following three options:</p> <ul style="list-style-type: none"> • No lighting control features shall be considered because lighting control respectively dimming is not deemed appropriate by the procurer for the specific lighting system. • The procurer is fully aware of the lighting control/dimming options suitable for the specific lighting system and specifies detailed requirements for a lighting control system. • The procurer is not in a position to specify optimal lighting control features for the lighting system but requests the tenderer to provide an offer for a dimmable system accompanied by a transparent LCC calculation. 	Options for lighting control features shall be assessed for every project and requirements shall be specified if appropriate.
A.3	Energy consumption metering	<p>The procurer shall specify one of the following three options:</p> <ul style="list-style-type: none"> • No energy consumption metering shall be considered because metering is not deemed appropriate by the procurer for the specific lighting system. • The procurer is fully aware of the metering options suitable for the specific lighting system and specifies detailed requirements for the metering concept. • The procurer is not in a position to specify optimal metering for the system but requests the tenderer to provide an offer for a suitable metering accompanied by a transparent LCC calculation. 	Appropriateness of metering features shall be checked for every tender.

B Selection Criteria

	Criterion	Requirement	Mandatory requirement	Comments
B.1	Know-how and experience of the design team and the installation team	A minimum of 5 relevant lighting projects in the last 3 years with a project size similar to the specific tender	✓	Proof of expertise also can include previous projects in other companies
B.2	Capacity of tenderer to complete project within specified timeframe	Capacity of the tenderer must meet the specific size and timeline of the project	✓	To be specified according to the specific size and timeline of the project
B.3	Compliance with the EN standards or other important standards	Compliance with the specific standards has to be provided by the tenderer. E. g. the tender shall comply with EN 13201.	✓	Requirements also may need to include different national standards

C Technical criteria (Mandatory requirements & Award criteria)

Energy Criteria					
	Criterion	Requirement	Mandatory requirement	Award criterion	Comments
C.1	Power Density Indicator (PDI) and Annual Energy Consumption Indicator (AECI)	<p>Power Density Indicator (PDI):</p> $D_P = \frac{P}{\sum_{i=1}^n (\bar{E}_i \times A_i)}$ <p>Annual Energy Consumption Indicator (AECI):</p> $D_E = \frac{\sum_{j=1}^m (P_j \times t_j)}{A}$ <p>D_P (PDI): Power density indicator D_E (AECI): Annual Energy Consumption Indicator P: Power (W) \bar{E}_i: maintained average horizontal illuminance (lx) A: lit area (m²)</p>	(✓)	✓	<p>PDI and AECI are based on EN 13201-5:2016 and EU GPP draft for road lighting. PDI and AECI shall be used as Award Criterion to be calculated by the tenderer in a transparent way and to be verified by measurements for a specified road segment. Procurers who wish to calculate approximate reference levels that should not be underrun by tenders may use simplified formulas for reference calculation similarly as proposed by EU GPP (Draft 2017).</p> <p>$PDI < M/(\eta \times F_m \times 0.07 \times RW)$</p> <p>$AECI < M \times PDI \times F_{dim} \times E_m \times T \times 1 \text{ kW}/1000 \text{ W}$</p> <p>$F_m$: Lighting system maintenance factor RW: Road width F_{dim}: Dimming factor E_m: Illuminance T: Time (h) η: Luminaire efficacy M: Fitting factor:</p> <ul style="list-style-type: none"> • $M = 1.3$ for existing lighting systems where positions of existing light points and poles cannot be changed • $M = 1.2$ for new lighting systems
C.2	Luminaire energy efficiency	<p>Minimum efficacy (2017–2018):</p> <ul style="list-style-type: none"> • Colour temperature $\geq 4000\text{K}$: $\geq 120 \text{ lm/Watt}$ • Colour temperature $2700\text{K}–3000\text{K}$: $\geq 105 \text{ lm/Watt}$ • Colour temperature $\leq 2000\text{K}$: $\geq 80 \text{ lm/Watt}$ 	✓	✓	<p>Target values revised once per year In exceptional cases where particularly low colour temperature is required for ecological reasons, lower efficacy $>75 \text{ lm/Watt}$ is acceptable. E.g. special low temperature LEDs are currently offered around or below 2000K for application where nature preservation plays an important role.</p>
C.3	LED module energy efficiency	Minimum efficacy: 160 lm/W	✓	✓	Target values revised once per year.
C.4	Power Factor	Full load: $\cos \phi \geq 0.9$ 50% load (dimming): $\cos \phi \geq 0.8$	✓		
C.5	Lighting control features	Optional: as if specified in "Technical Specifications"		✓	Options for lighting control features shall be assessed for every project and requirements shall be specified if appropriate.
C.6	Energy consumption metering	Optional: as if specified in "Technical Specifications"		✓	Appropriateness of metering features shall be checked for every tender.

Quality and Design Criteria

	Criterion	Requirement	Mandatory requirement	Award criterion	Comments	
C.7	Colour temperature	Domestic areas and mainly pedestrian areas: ≤ 3000 K Main roads, motorways and areas with mixed traffic: ≤ 4000 K	✓		Desirable colour temperature to be specified according to road type	
C.8	Colour rendering	Roads with mixed traffic including cyclists and pedestrians: $R_a \geq 80$ Main Roads and motorways: $R_a \geq 70$	✓		Desirable colour rendering level to be specified according to road type	
C.9	Colour consistency	Colour consistency shall be within 5 MacAdams-Ellipses at the time of putting into operation	✓			
C.10	Luminance and illuminance	According to EN13201	✓		According to the requirements in the standard.	
C.11	Light distribution (uniformity of light distribution)	Road class	U _o	UI	✓	According to standard EN 13201. UI (longitudinal uniformity) is only relevant for long uninterrupted road sections.
		M1	0.4	0.7		
		M2	0.4	0.7		
		M3	0.4	0.6		
		M4	0.4	0.6		
		M5	0.35	0.4		
M6	0.35	0.4				
C.12	Light pollution	RULO respectively ULOR = 0% RULO upward light output ratio	✓		A different ULOR may be appropriate in specific cases but should be justified.	
C.13	Glare protection (disability and discomfort glare)	Disability glare: G4 or higher Discomfort glare: G6 or G5	✓		(see e.g. guidelines for road lighting in DK, Vejregler 2015)	
C.14	Ingress protection (IP rating)	Minimum requirement: IP 65 for all road types	✓		One class below may be acceptable if justified	
C.15	Impact Protection (IK rating)	Minimum requirement: IK 07 for all road types	✓		Level can be adapted is desirable for specific applications	
C.16	IEC protection	Class II	✓			
C.17	Overvoltage protection	10 kV	✓			
C.18	Mark of conformity for all components	ENEC and national regulations	✓			
C.19	Lifetime	System lifetime $L_{80}B_{10} \geq 100.000$ hrs	✓	✓		

Quality and Design Criteria

	Criterion	Requirement	Mandatory requirement	Award criterion	Comments
C.20	Warranty	The warranty and/or service agreement period shall cover a minimum of ten years	✓	✓	a) Every defect light source, control gear and/or luminaire shall be replaced without any cost. If the luminaire provides less lumen output than initially specified it shall be considered as a defect, b) Every batch of lamps or luminaires shall be completely replaced in case the number of defect units in the batch is more than 10% of the batch. Conditions not covered: c) Luminaires defective because of vandalism, accidents, lightning or storm d) Lamps and luminaires that have been working for a significant time under abnormal conditions (e.g. used with wrong line voltage) in so-far that this can be proved by the manufacturer.
C.21	Availability of spare parts	Spare parts for lighting system components shall be available for a minimum of 15 years	✓	✓	
C.22	Ease of repair and recycling	The light source (lamp or LED module) and auxiliaries of the luminaire are easily accessible, replaceable and that the replacement can be done on site (i. e. at luminaire mounting height).	✓	✓	Scoring criteria/ levels to be specified
C.23	Design	Design criteria need to be specified individually and assessed by a jury		✓	To be assessed by jury

Criteria for projects only involving component replacement

C.24	Luminaire life time	$L_{80}B_{10} \geq 100.000$ hrs	✓	✓	
C.25	LED module lifetime	$L_{80}B_{10} \geq 100.000$ hrs	✓	✓	
C.26	Driver life time/ failure rate	Failure rate 0,1 % per 1000 h	✓	✓	

Cost Criteria

	Criterion	Requirement	Mandatory requirement	Award criterion	Comments
C.27	Life Cycle Costs (TCO) (Option 1 – preferred)	Provision of life cycle cost calculation is mandatory for all projects where applicable		✓	The tenderer shall provide a transparent life cycle cost respectively total cost calculation. If offers are based on TCO calculations, award criterion "AECI" will be included in TCO assessment.
C.28	Investment costs (Option 2 – fall back)	Award criterion for projects where Life cycle costs respectively TCO cannot be assessed		✓	If offers cannot be based on TCO calculations, award criteria "AECI" and "Investment costs" will be assessed in parallel.

D Contractual issues (installation, putting into service)

D.1	Correct installation	<p>The contractor shall ensure:</p> <ol style="list-style-type: none"> 1 The lighting system is installed exactly as required/specified, 2 Deliver a schedule of installed lighting equipment with appended manufacturers' invoices or delivery notes, and 3 Confirmation of the equipment is installed as originally specified. <p>For a road segment randomly selected by the procurer, the contractor shall select two poles for which a measurement certificate shall be supplied that certify that the lighting system for this road segment is in accordance with the requirements specified in EN 13201-2.</p> <p>For this road segment also the peak power [W] and energy consumption [kWh] shall be measured and/or calculated over a period of one week. Based on this data and the previous EN 13201-2 measurements of illuminance the PDI and AECI shall be calculated and verified with the design (+/- 10% tolerance max.).</p> <p>In order to limit light pollution the boom angle of a set of luminaires in the selected road segment shall be measured and compared to the design specifications (+/- 2° tolerance max.).</p>	Adapted according to GPP
D.2	Putting into service of lighting systems and controls	<p>The contractor shall ensure:</p> <ul style="list-style-type: none"> • That the new or renovated lighting systems and controls are working properly and using no more energy than required/specified. • Daylight linked controls shall be calibrated to ensure that they switch off the lighting when daylight is adequate. • Traffic sensors shall be verified to detect vehicles, bicycles and pedestrians depending on the application. • Time switches or control scenes in software shall be set to appropriate switch off times to meet visual needs without excessive increase in energy consumption. <p>If after the commissioning, parts of the lighting system do not appear to meet all the above requirements and specifications, the contractor shall adjust and/or recalibrate the systems.</p>	Adapted according to GPP
D.3	Reduction and recovery of waste		The tenderer shall implement appropriate measures to reduce and recover the waste that is produced during the installation of the new lighting system or lighting system refurbishment. All replaced lamps, luminaires and electronic parts shall be separated and recovered in line with the WEEE directive.

Weighting of Award Criteria

For the assessment of the award criteria a weighting approach is required. The following section provides two options for a possible weighting concept, one of them involving a TCO approach.

For projects where a robust TCO approach can be applied, main aspects including operation and maintenance are already covered and only few additional parameters like quality, design, warranty and end of life aspects are to be added (first table).

So for example energy consumption and maintenance aspects are already covered in the electricity and maintenance costs and double counting has to be avoided. Consequently TCO has a large part of the total weight.

The weighting of criteria typically has to be adapted to local needs and requirements. Thus the approach recommended here is just one possible option.

Weighting of Award criteria For Projects Including TCO information

Award criterion		Weighting [%]
Cost criteria based on total cost of ownership (TCO)		50
TCO	Investment costs	15
	Electricity costs	20
	Maintenance costs	15
Quality and design criteria		30
Lighting Quality		20
Design		10
Warranty, Design for Recycling		20
Warranty		10
Availability of spare parts, Design for Recycling		10
Total		100

Weighting of Award criteria For Projects Excluding TCO information

Award criterion		Weighting [%]
Cost criteria		25
Investment costs		25
Quality and design criteria		35
Lighting Quality		25
Design		10
Energy criteria		20
AECI or PDI or component efficiency (depending on the type of project the most appropriate indicator shall be used; some types of projects only allow to use PDI or component efficiency)		20
Operation-, Maintenance-, End of life- criteria		20
Ease of maintenance, repair		10
Warranty, availability of spare parts		10
Total		100

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