

Green Public Procurement Technical Guidelines and Specifications for Energy Efficient Lighting

30th November 2021

Bruno LAFITTE & Soledad GARCIA, United for Efficiency



Supporting Countries to Save 20% of their Electricity

By accelerating the Global Transition to [much more energy efficient lighting and appliance technologies](#) by strengthening country capacities around the world, as well as ensuring environmentally sound management practices. Building synergies among stakeholders, sharing knowledge and information, helping create strategic policy and regulatory frameworks, and addressing technical and quality issues.



Electric
Motors



Light
Bulbs



Residential Refrigerators



Room Air
Conditioners



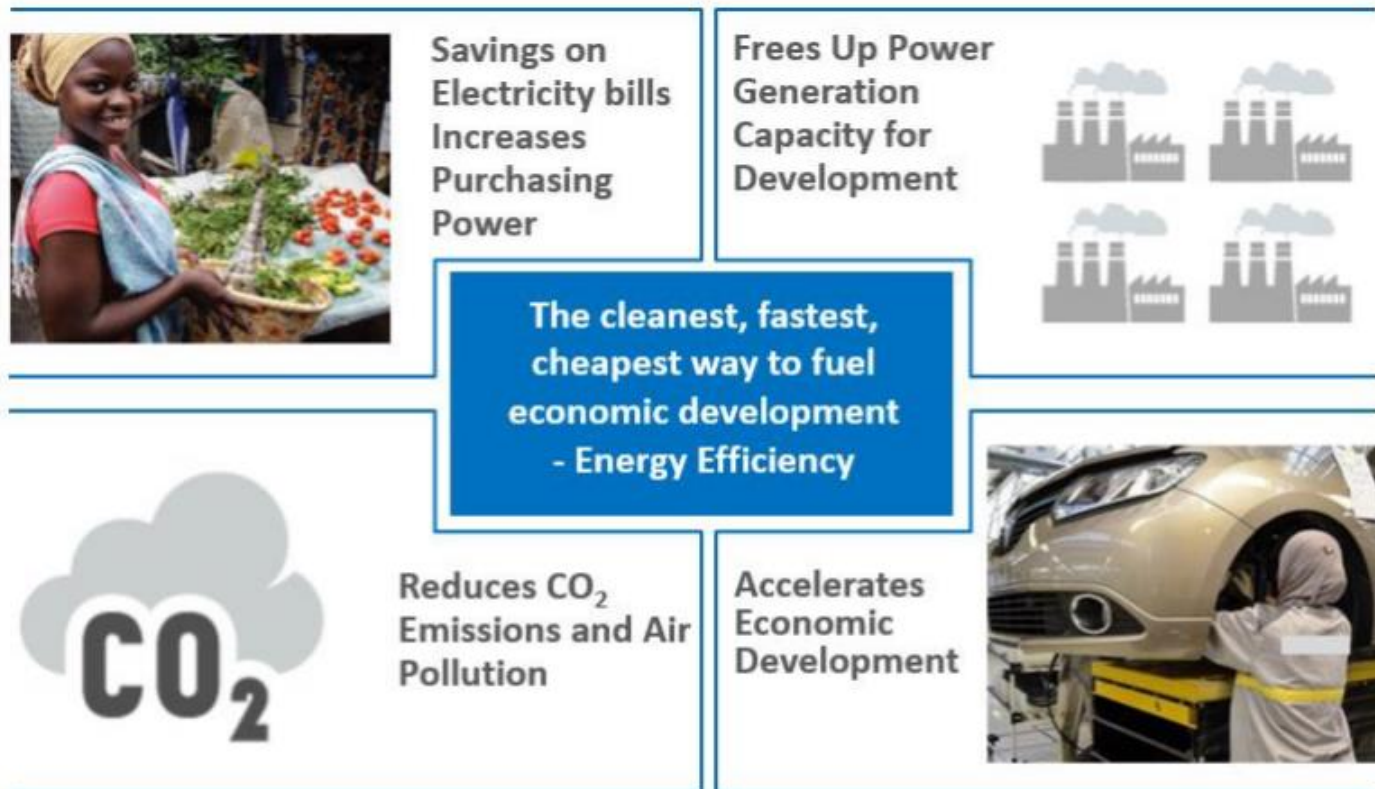
Distribution
Transformers

OUR MISSION:

Support the second goal of the UN Secretary General's SE4ALL initiative: to **double the global rate** of improvement in energy efficiency by providing assistance to developing countries and emerging economies to **move their markets to energy-efficient appliances and equipment.**



WHY ENERGY EFFICIENCY?



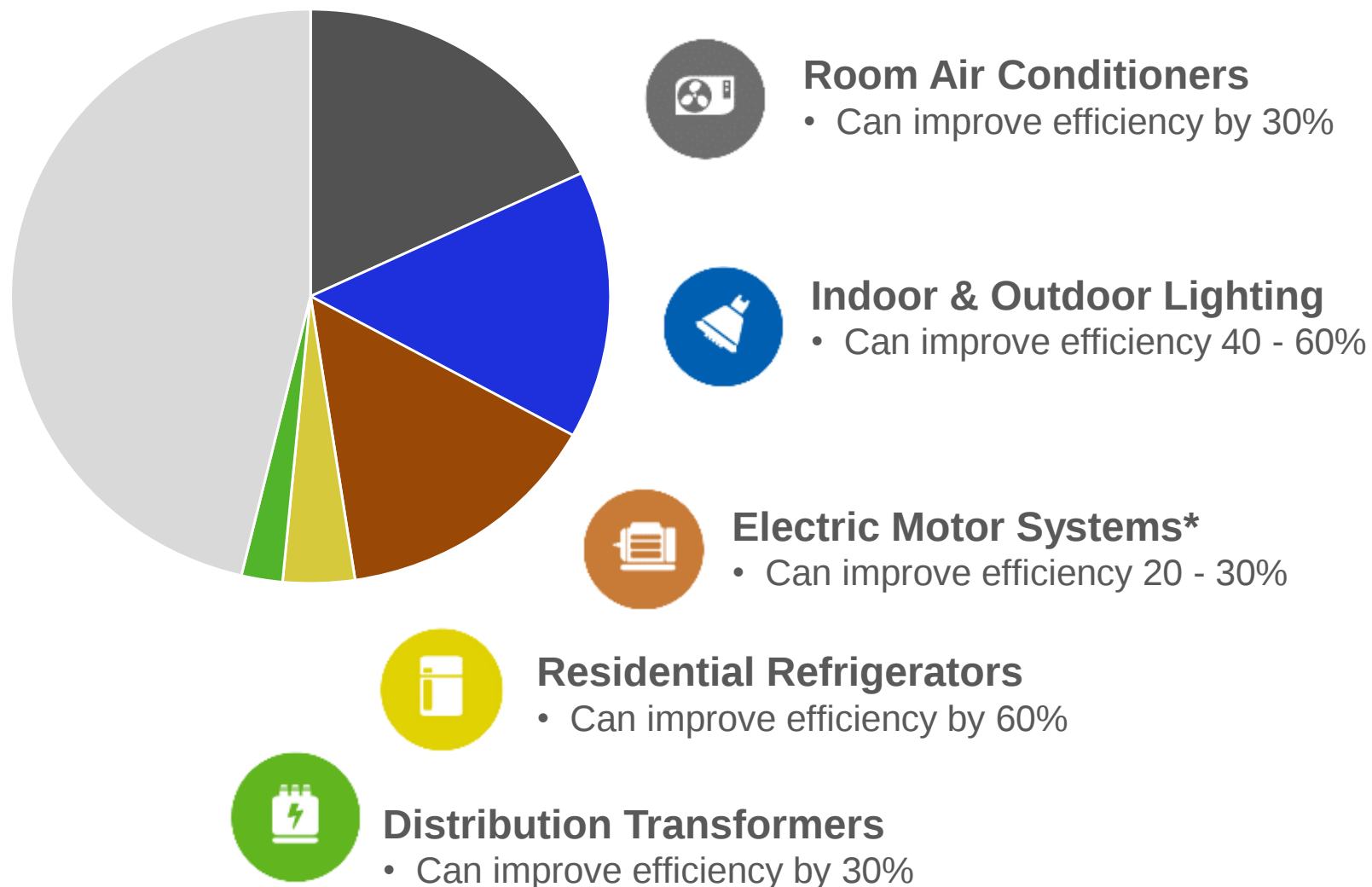
A global transition to high efficiency products will make possible:

- ✓ for people to enjoy the benefits of their increased incomes,
- ✓ for governments in reaching their economic and environmental ambitions.
- ✓ Minimize the impact on climate change and contribute towards meeting the 2°C climate target



HOW DO WE FULFILL OUR MISSION?

WE TACKLE THE 5 PRODUCTS THAT USE MORE THAN 50 % OF GLOBAL ELECTRICITY:



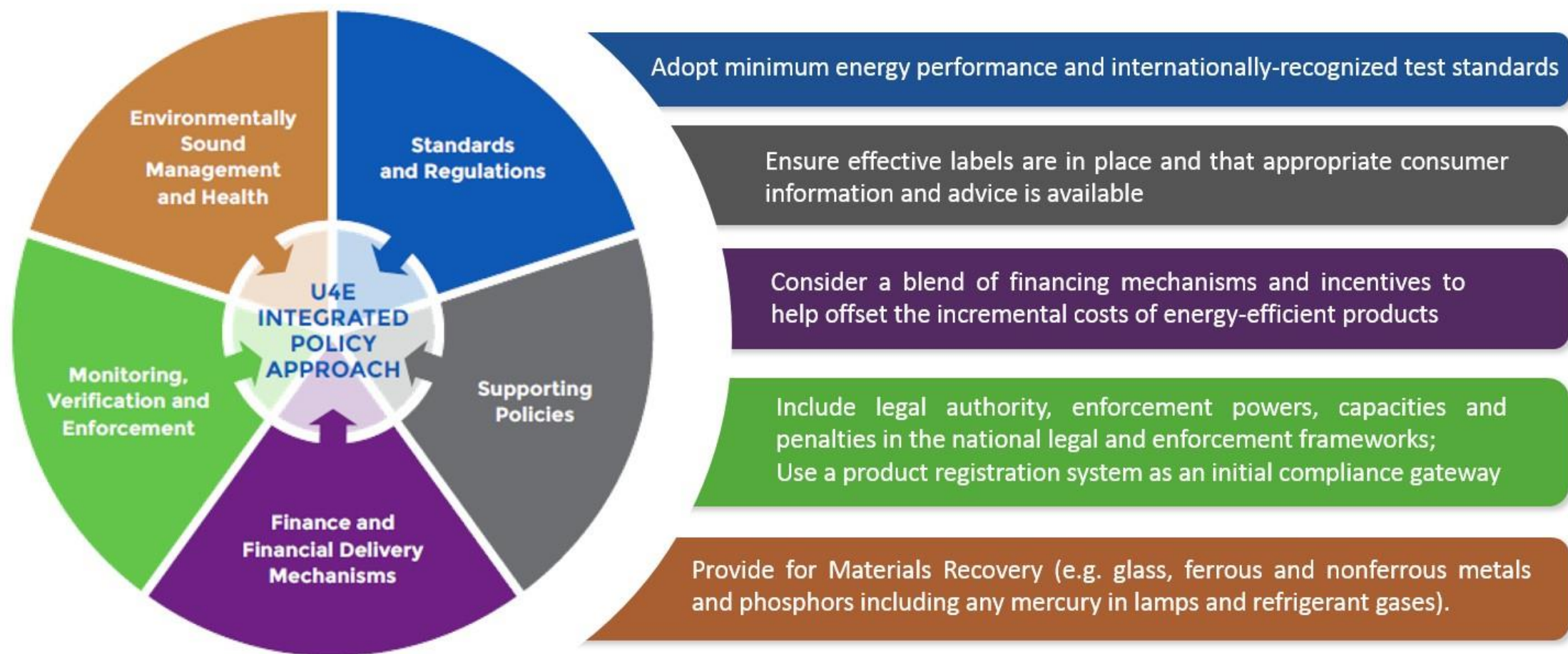
We inform policy makers of the potential environmental, financial and economic savings of a transition to high-efficiency products

We identify and promote global best practices in transforming markets

We offer tailored assistance to governments to develop and implement national and regional strategies and projects to achieve a fast and sustainable market transformation

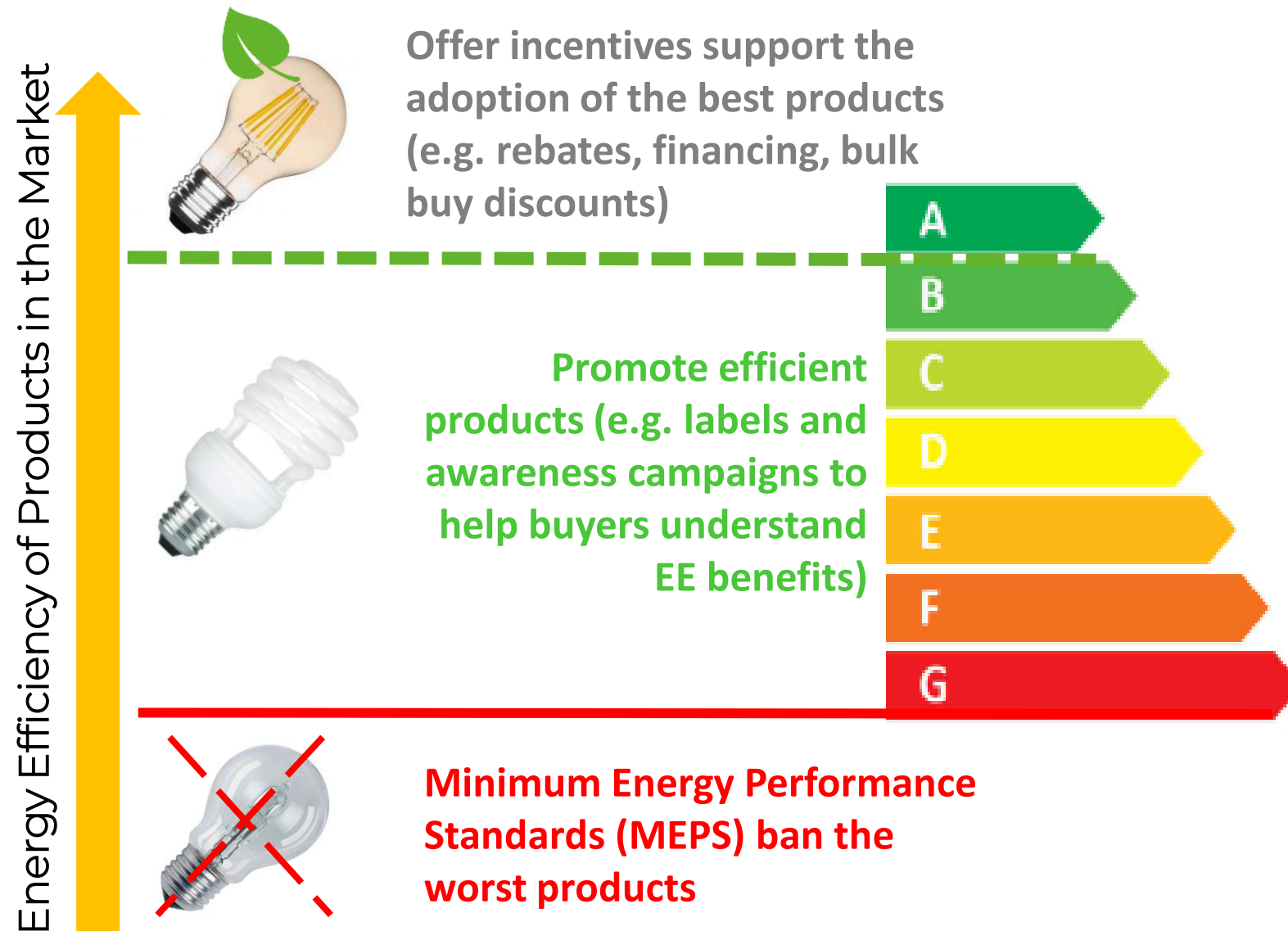
HOW DO WE FULFILL OUR MISSION?

U4E implements a proven *Integrated Policy Approach* for product market Transformation



STANDARDS, LABELLING, GREEN PUBLIC PROCUREMENT AND MARKET BASED INCENTIVES WORK

6



Monitor the market for MEPS compliance, test the products and enforce the rules

+

ESM for Recycle & dispose old products in a sustainable way



WITH WHOM WE WORK- Project Partners

MANUFACTURERS & INDUSTRY ASSOCIATIONS

OSRAM

 **SANHUA**

 International Copper
Association
Copper Alliance

 **GREE**

 **Electrolux**

mabe

B/S/H/  **arçelik**

 **Whirlpool**
CORPORATION

 **Signify**

ABB

TECHNICAL ORGANISATIONS & INITIATIVES

 **BERKELEY LAB**

 **olade**
ORGANIZACIÓN LATINOAMERICANA DE ENERGÍA
ORGANISATION LATINO-AMERICAINE D'ENERGIE

 **COPENHAGEN CENTRE
ON ENERGY EFFICIENCY**
SE4ALL EE HUB

 **SACREEE**
SADC CENTRE FOR RENEWABLE
ENERGY & ENERGY EFFICIENCY

RCREEE
Regional Center for Renewable Energy and Energy Efficiency

 **EACREEE**
Building a Sustainable Energy Future

giz

 **clasp**

 **African
Energy
Commission**

 **NRDC**

 **GELC**

 **CARBON
TRUST**

 **IIEC**
International Institute for Energy Conservation

 **BASE**

 **AMBILAMP**
PROCLAMING LA LAMP

 **ASEAN CENTRE FOR ENERGY**
ACE

 **top ten**

 **EESL**

4E

 **ONIS**

FUNDERS, FINANCIERS & IMPLEMENTING AGENCIES

 **UN
environment**
United Nations
Environment Programme

 **UN
DP**

 **gef**

KIGALI
COOLING EFFICIENCY PROGRAM

 **GREEN
CLIMATE
FUND**

 **BANQUE AFRICAINE DE DEVELOPPEMENT**
AFRICAN DEVELOPMENT BANK

 **Sida**
SWEDISH INTERNATIONAL DEVELOPMENT
COOPERATION AGENCY

 **GLOBAL CLIMATE
PARTNERSHIP FUND**
managed by responsAbility

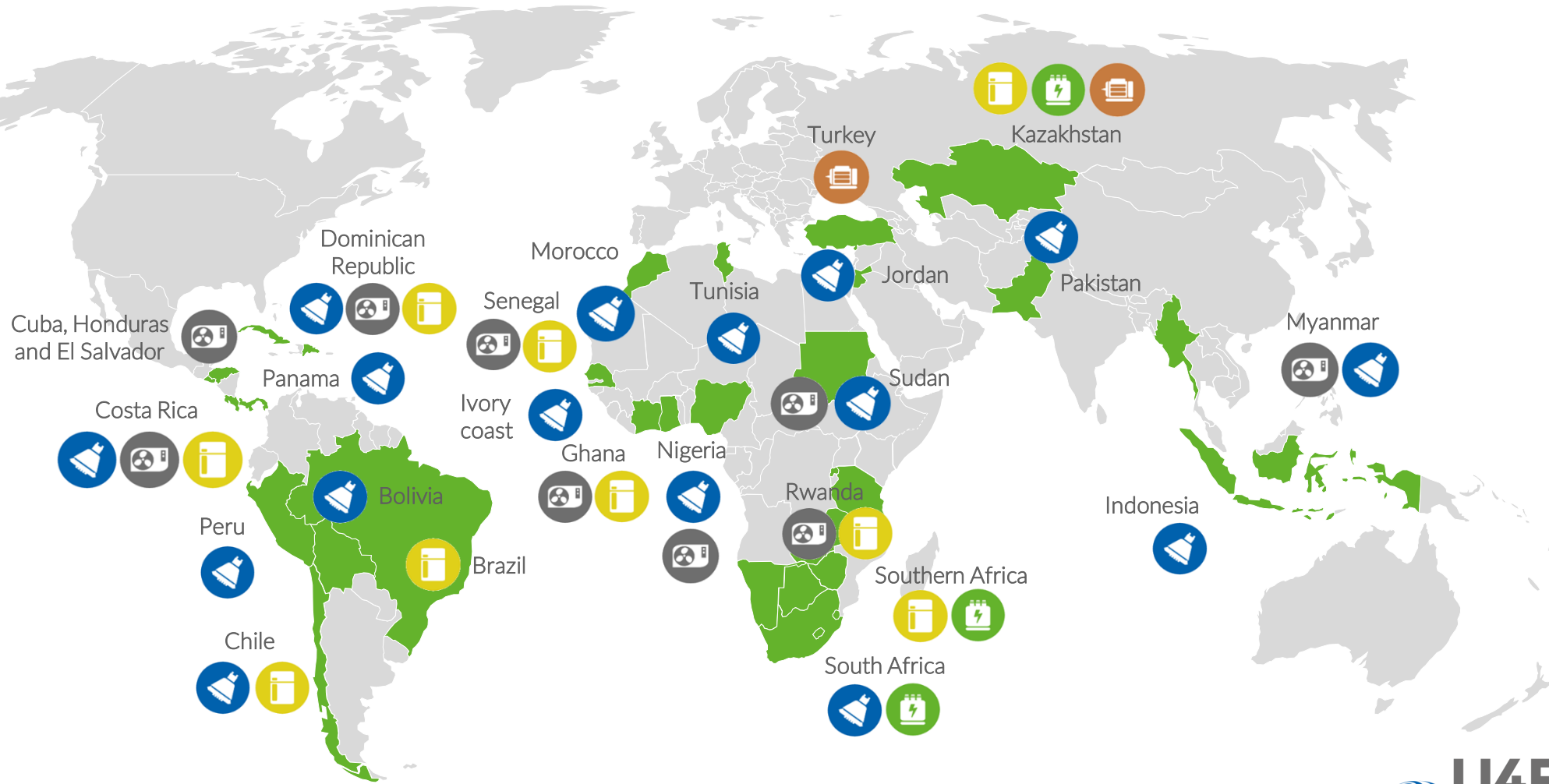
 **DEVELOPMENT
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We empower you

NATIONAL level – Where do we work?

8

U4E National Projects



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WHERE DO WE WORK – U4E Scope of Work:

9

U4E provides support at various levels



GLOBAL

- 155 Country Savings Assessments
- 6 Policy Guides
- 5 Model Regulation Guidelines
- Product Registry System
- Communications and outreach
- www.united4efficiency.org



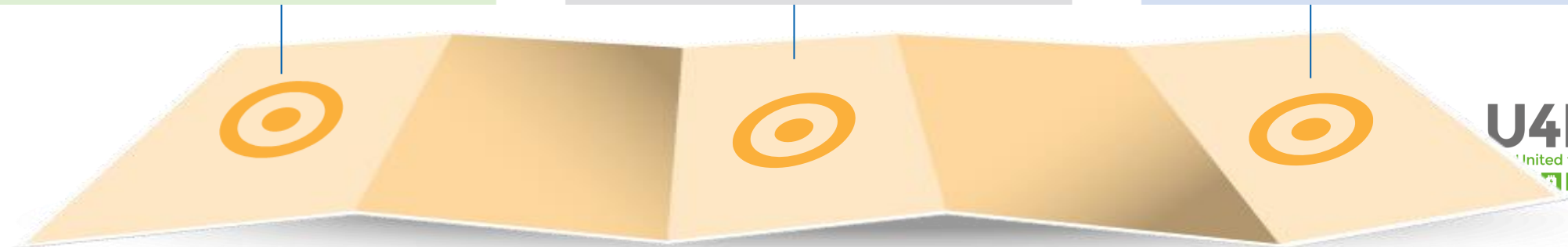
REGIONAL

- Regional Market Assessments
- Regional Capacity Building for Policy Makers
- Regional Harmonization Projects.



NATIONAL

- National Strategies
- National Training for Policy Makers and Practitioners
- Implementation Technical Assistance
- Project development and Fund raising support

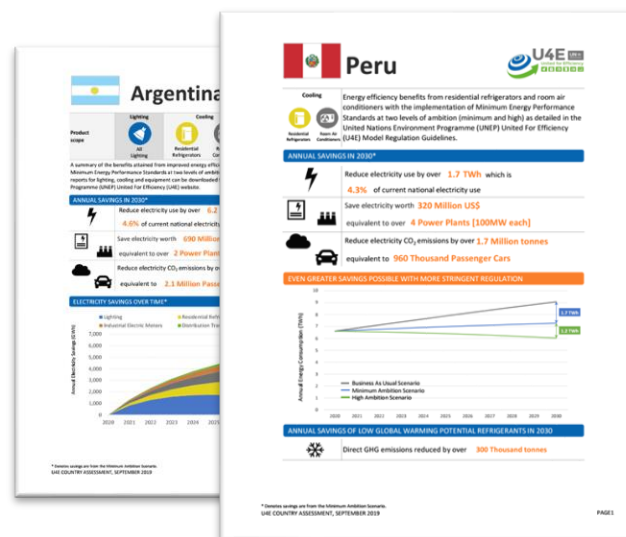


U4E Tools and Resources

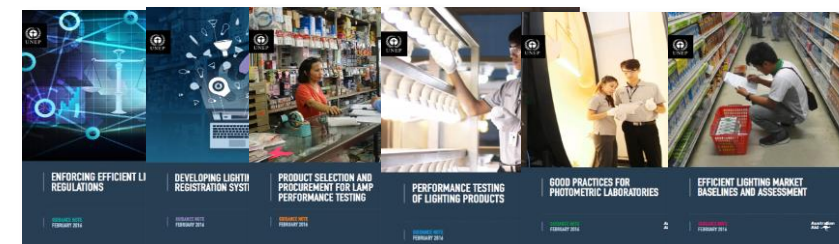
+155 Country Saving Assessment

Procurement Guidelines and Financial Mechanisms Guide

5 Policy Guides



Monitoring and Verification Guides

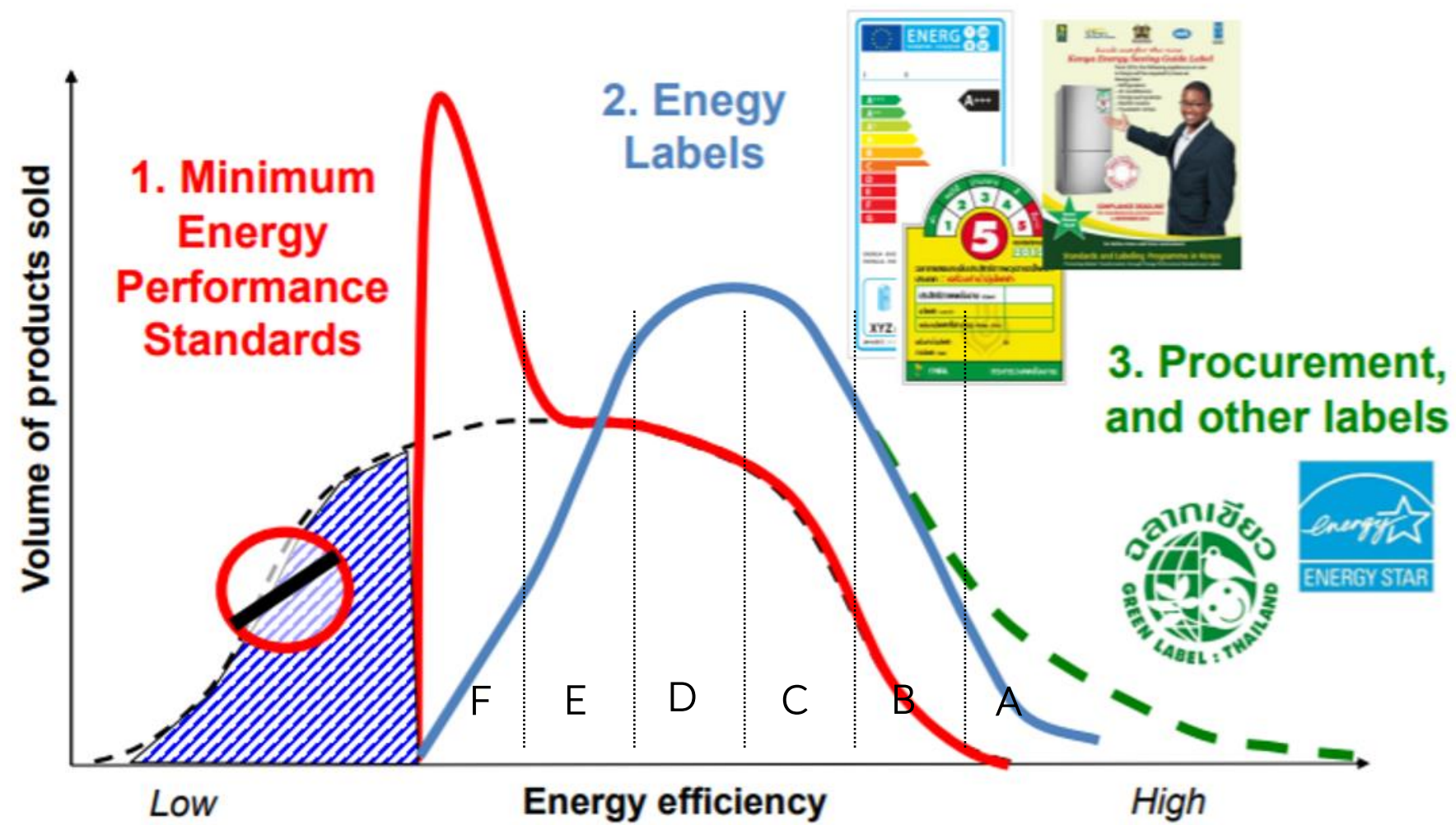


Model Regulation Guidelines

Supporting Guidelines



Role from SPP on the Market Transformation Process



Sustainable Public Procurement Guidelines

- **Intended for:** Public Procurers, Lighting and Cooling Technical Personnel, Policy Makers and related officers involved in procurement activities.

- **Scope**

Lighting



Office/large buildings lighting (LED luminaires and LED tubes) and all street/outdoor lighting luminaires.

Refrigerator appliances



Domestic refrigerators and freezers, commercial/professional refrigeration appliances, vending machines and laboratory grade refrigerators.

Room air conditioners



Portable air conditioners, split air conditioners (single and multi-split), window air conditioners and ducted air conditioners.

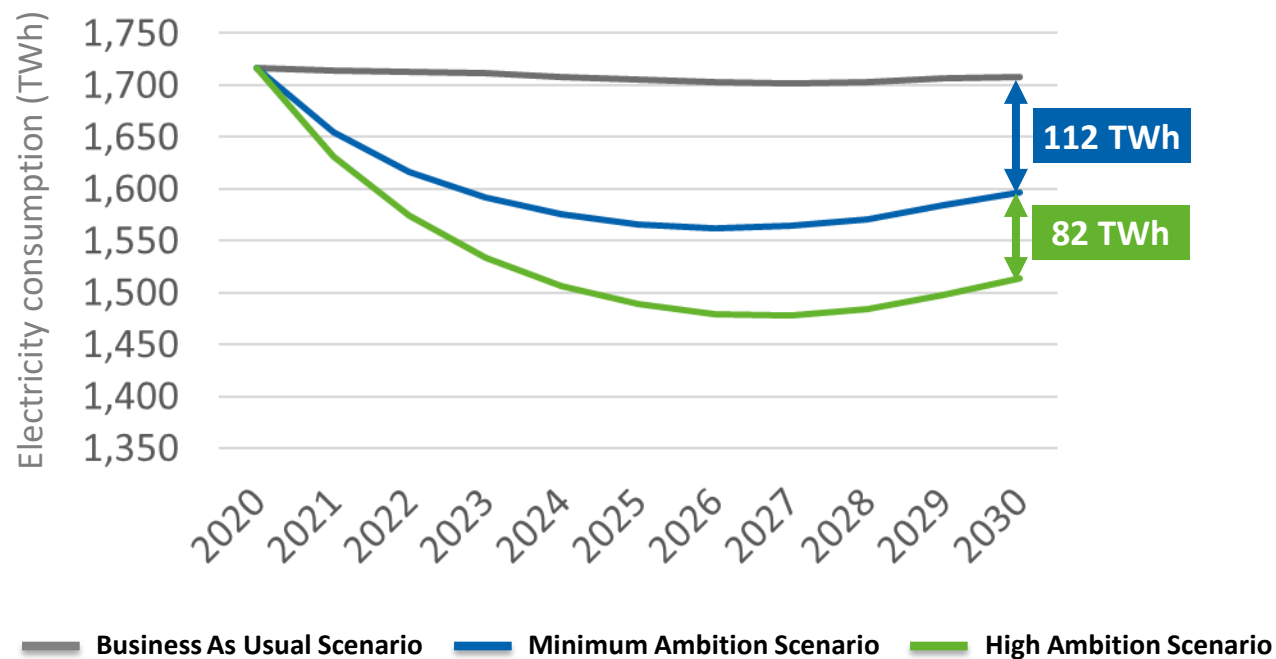
- **Additional U4E Resources for GPP:**

- ✓ **Toolkit:** Key sustainable considerations (environmental, social and economic), current barriers for its deployment (financial, awareness, capacity and regulatory), Economic analysis of delivery models and overall recommendations for the tendering process.
- ✓ **SPP Excel Spreadsheet Tool:** Compares the economic cost and environmental impact of different bids during the life span of the appliances. SPP minimum requirements on energy efficiency and refrigerant GWP can be used to easily check the compliance of each bid.



Savings Potential of Higer Efficiency Lighting

Savings Potential of Lighting by 2030*



Annual Savings in 2030**

	Electricity savings (TWh)	194
Equivalent to:		
	Power stations [500 MW]	88
	Million tonnes of CO ₂	170
	Billions of USD in electricity bills	16

* Savings refer to the 156 developing countries and emerging economies that had been assessed for the U4E Country Saving Assessments

** Energy consumption and potential energy saving across 156 nations for efficient LED lighting considering higher ambition scenarios for minimum energy performance standards (Source: U4E country assessment)

Note: The savings potential figure for lighting is shown at 2030 because of the more rapid transformation that is expected to these technologies

Content of U4E's Green Public Procurement Technical Guidelines for Energy Efficient Lighting

Green Public Procurement Guideline Content



Indoor luminaire

LED luminaire
LED tube



Outdoor luminaire

<90 Watt
≥ 90 Watt

Minimum
Efficacy

Minimum
Lifetime

Photometry

Correlated
Colour
Temperature

Colour
Rendering
Index

Flickering effect

Stroboscopic
effect

Operational
voltage range

Fundamental
Power Factor

Surge
protection

Harmonic
distorsion
limitation

Protection
against
electrical shock

Ingress
protection

Impact
resistance

Humidity and
corrosion
protection

Dimming and
occupancy
control

Performance
Criteria

Warranty and
maintenance

Environmental
Sound
Management



1. Minimum Efficacy

→ Indoor luminaires/tubes

LED tube, retrofit of fluorescent T8 tubes

Year of implementation		
2022	2024	2026
130 lm/W	150 lm/W	170 lm/W



LED luminaire

	Year of implementation		
Flux bandwidth	2022	2024	2026
$60 \text{ lm} \leq \Phi < 600 \text{ lm}$	110 lm/W	130 lm/W	150 lm/W
$600 \text{ lm} \leq \Phi < 1200 \text{ lm}$	120 lm/W	140 lm/W	160 lm/W
$1200 \text{ lm} \leq \Phi$	130 lm/W	150 lm/W	170 lm/W

1. Minimum Efficacy

→ *Outdoor luminaires/street lighting*

Park, places, urban roads, etc.

Power of the luminaire < 90 Watt

2022	2024	2026
120 lm/W	135 lm/W	150 lm/W

Roadway lighting

Power of the luminaire ≥ 90 Watt

2022	2024	2026
140 lm/W	160 lm/W	180 lm/W

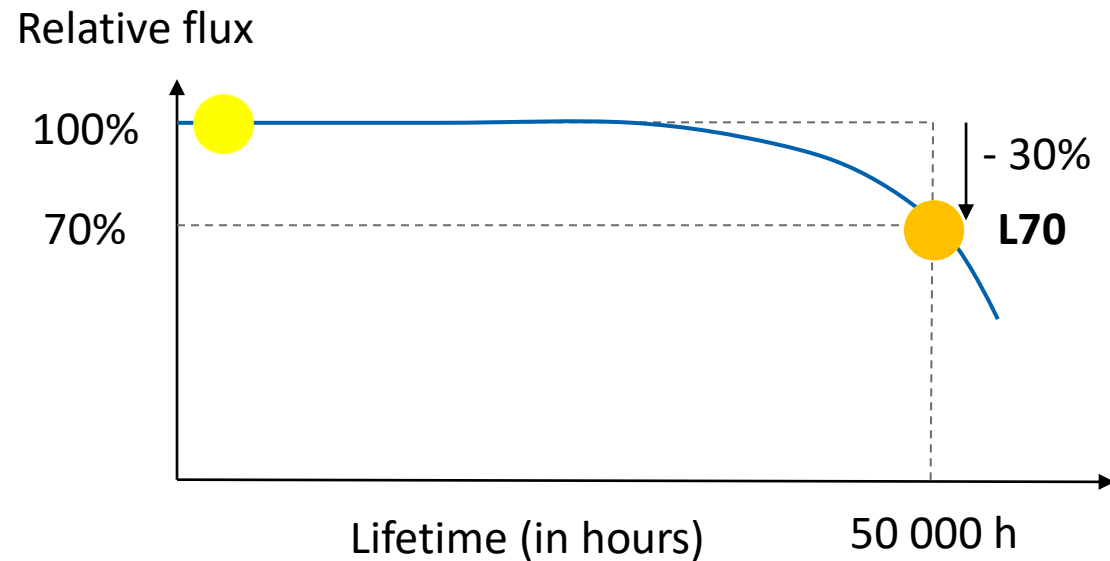


2. Lifetime

Lifetime of lamp is the total time for which a light source (i.e., lamp or integrated luminaire) has been operated before it becomes useless. Lifetime is usually expressed in hours and is a combination of the lumen maintenance factor L and the luminous flux deviation known as the B factor. Lifetime is the time at which B% of the lamps are expected to have failed or become useless in providing the intended service, having dropped to L% of its initial luminous flux. The variable used for this metric is $L_{70}B_{50}$ (time when 50% of samples have dropped to 70% luminous flux maintenance).

Indoor lighting : $\geq 20\,000$ hours

Street lighting : $\geq 50\,000$ hours

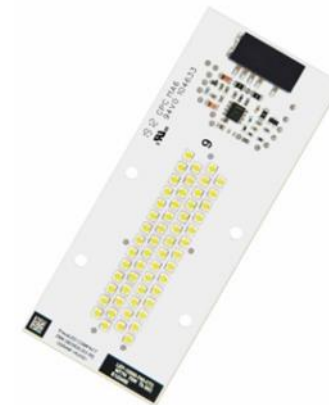


2. Lifetime

→ *End of life testing norms*

IES LM-84-14 “Measuring Luminous Flux and Colour maintenance of LED lamps, light engines, and luminaires” and **IES TM-28-14** “Projecting long term luminous flux maintenance of LED lamps and luminaires”

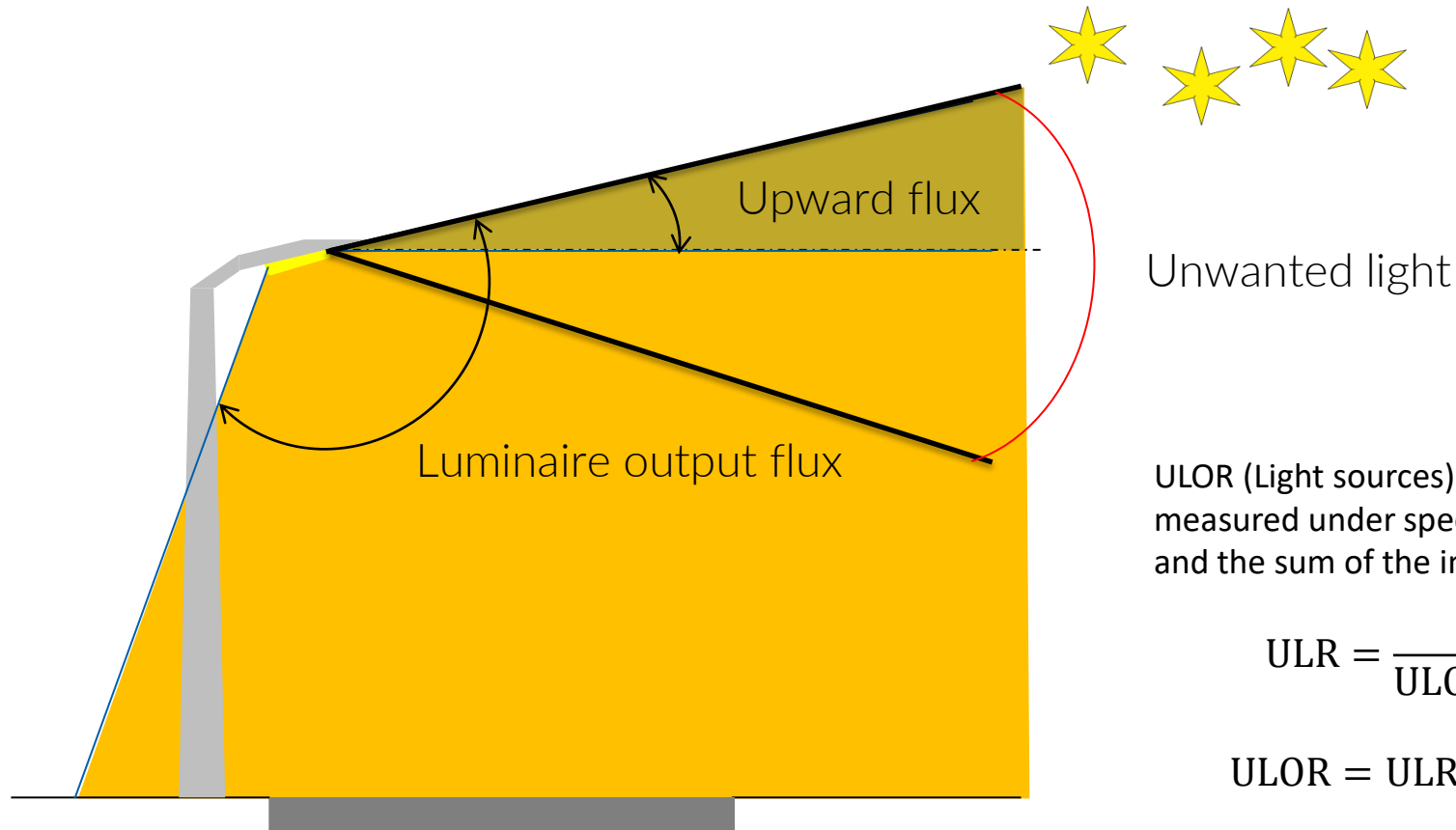
IES LM-80-20 “Measuring luminous flux and colour maintenance of LED packages, arrays and modules” and **IES TM-21-19** “Projecting long term lumen maintenance LED light sources”.



3. Photometry (outdoor lighting only)

U.L.R = Upward Lumen Ratio (for the luminaire)

proportion of the flux of a luminaire or installation that is emitted, at and above the horizontal, when the luminaire(s) is (are) mounted in its (their) installed position



$$ULR \leq 1\%$$

$$ULOR = 0\%$$

ULOR (Light sources): quotient of the upward luminous flux of a luminaire, measured under specified conditions with its own lamp(s) and equipment, and the sum of the individual luminous fluxes of the same lamp(s)

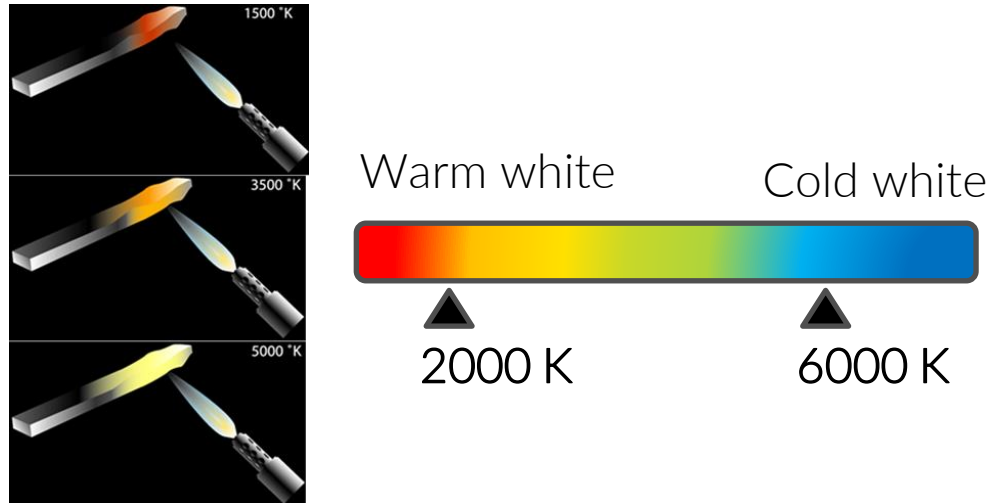
$$ULR = \frac{ULOR}{ULOR + DLOR}$$

$$ULOR = ULR \times \mu_{luminaire}$$

4. Light Quality

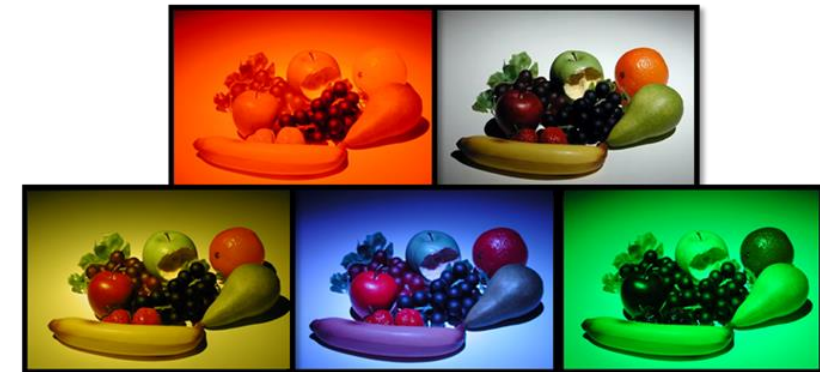
→ *Correlated Colour Temperature*

CCT of a light is the temperature of the Planckian radiator whose perceived colour most closely resembles.



→ *Colour Rendering Index*

CRI is a measure of the ability of a light source to accurately reveal the colours of various objects in comparison with an ideal or natural light source

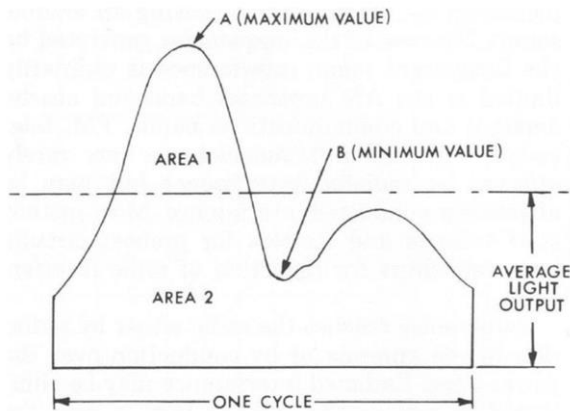


	CCT	CRI
Indoor lighting	$\leq 6,000 \text{ K}$	≥ 80
Street lighting	$\leq 5,000 \text{ K}$	≥ 70

5. Flickering

'Flicker' means the perception of visual unsteadiness induced by a static light stimulus, the luminance or spectral distribution of which fluctuates with time, for a static observer in a static environment.

Old metric (for illustration)



$$\frac{A - B}{A + B} = \text{flicker percent}$$

$$\frac{\text{Area 1}}{\text{Area 1} + \text{Area 2}} = \text{flicker index}$$

New metric adapted to LED

'Pst_{LM}' where 'st' means 'short term', or fast, and 'LM' means 'flicker meter'.

Pst_{LM} = 1 : Half of the population sees it



Indoor and outdoor lighting :

Pst LM ≤ 1.0 at full load and a sinusoidal input voltage

6. Stroboscopic effect (indoor only)

‘Stroboscopic effect’ means a change in motion perception induced by a static light stimulus, the luminance or spectral distribution of which fluctuates with time, for a static observer in a non-static environment.



The metric for the stroboscopic effect used in this Regulation is the ‘SVM’ (Stroboscopic Visibility Measure), as defined in standards

SVM = 1 represents the visibility threshold for an average observer to have a 50% probability of detecting stroboscopic effects.

$SVM \leq 0,9$ at full-load

From 1 September 2024: $SVM \leq 0.4$ at full-load

7. Operational voltage range

A luminaire is manufactured to operate within a given operational parameter range (e.g. temperature, humidity...). Concerning supply voltage range, under normal operating conditions, the supply voltage should not differ from the nominal voltage of the system by more than the specified value.

Note: The electric supply is operating at frequencies of 50 Hz or 60 Hz, depending on the country. This has no impact on the operating voltage range.

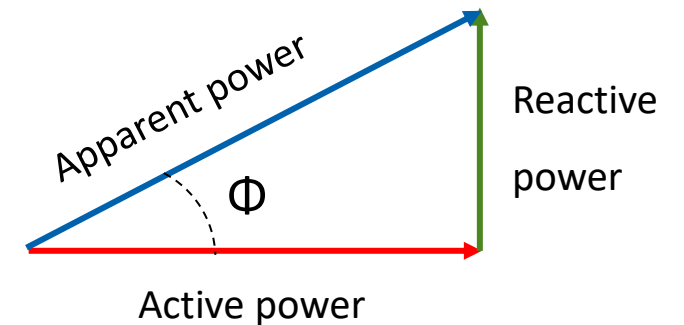
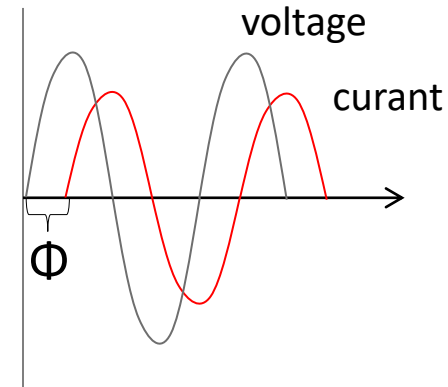
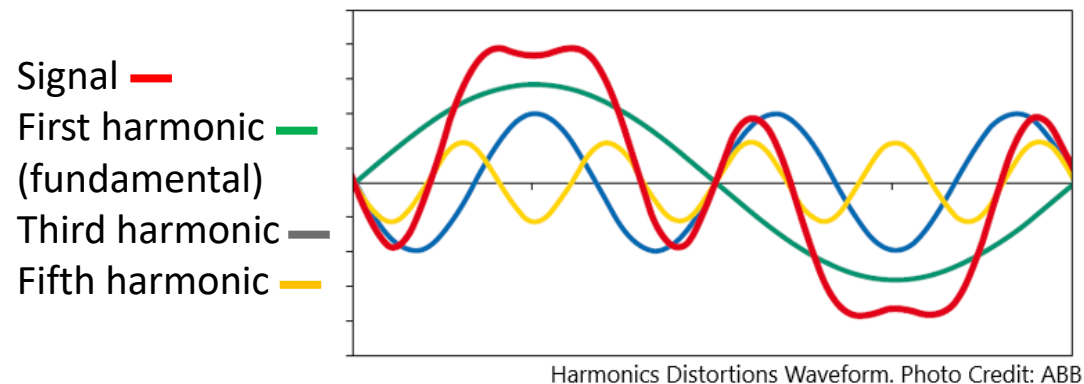
Due to voltage fluctuations on the electricity grid in developing countries and emerging economies, the operational voltage range of the luminaire should be specified as:

Indoor luminaires : 160 VAC to 250 VAC

Outdoor luminaires : 160 VAC to 250 VAC

8. (Fundamental) Power Factor

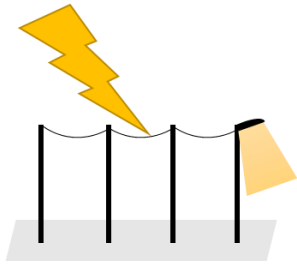
Also called the displacement power factor, it quantifies the displacement (phase-shift) between the fundamental current and voltage waveforms by calculating the cosine of the phase-shift angle. Fundamental Power Factor is a more detailed measure to quantify the displacement of the current and its effect on the power supply network.



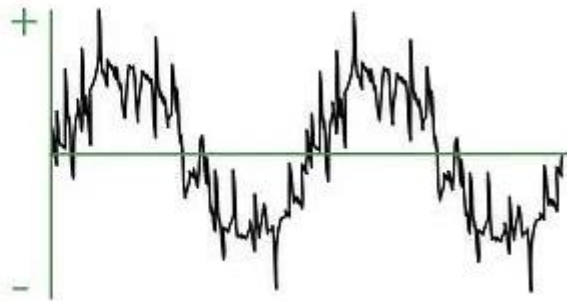
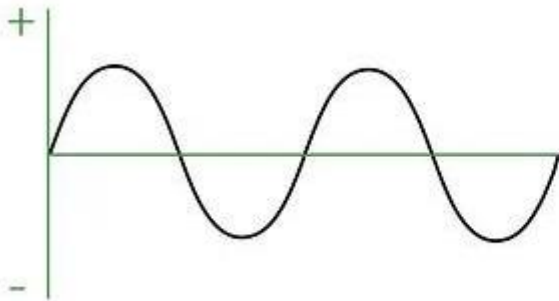
Rated Input Power P	Indoor	Outdoor lighting
$P \leq 5 \text{ W}$	No limit	≥ 0.9
$5 \text{ W} < P \leq 10 \text{ W}$	≥ 0.5	
$10 \text{ W} < P \leq 25 \text{ W}$	≥ 0.7	
$P > 25 \text{ W}$	≥ 0.9	

9. Surge protection and harmonic distortion

Follow IEC standard recommendations :



IEC 61547 “Equipment for general lighting purposes – EMC immunity requirements”

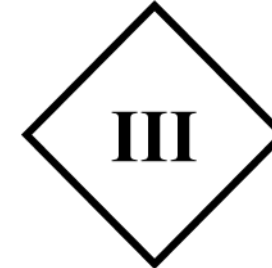
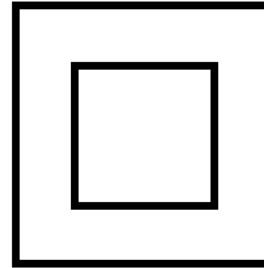
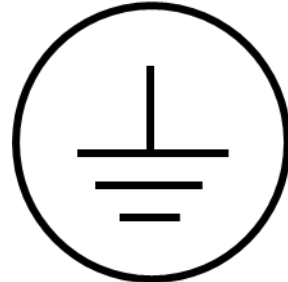


IEC 61000-3-2 “Limits for harmonic current emissions”

10. Protection against electrical shock

An electric shock is the pathophysiological effect of an electric current through the human body. Its passage affects essentially the muscular, circulatory and respiratory functions and sometimes results in serious burns. The degree of danger for the victim is a function of the magnitude of the current, the parts of the body through which the current passes, and the duration of current flow.

Luminaires shall be classified according to the type of protection against electric shock provided, as class I, class II or class III.



IEC 60598-1

Indoor luminaires : class I

Outdoor luminaires : class II

11. Ingress Protection

In some circumstance, lighting fixtures have to withstand rough conditions: such as dust and humidity, among others. Liquid or solid particles which can penetrate into the lighting equipment can be harmful to the equipment, or even the operator. Ingress protection classification is codified in international standard **IEC 60529 “Degrees of protection provided by enclosures (IP Code)”**. The designation used to indicate the degrees of protection provided consists of the characteristic letters IP followed by two numerals.

First numeral : dust, solid objects

- 0 : no protection
- 1 : hand protected
- 2 : finger protected
-
- 5 : dust proof luminaire
- 6 : dust-tight luminaires



Second numeral : moisture

- 0: No protection
- 1: Drip-proof luminaire
- 3 : Rain-proof luminaires
- 4 : Splash-proof luminaires
- 5 : Jet-proof luminaires
-
- 9 : High pressure and temperature water jet-proof

Indoor luminaires : IP20

Outdoor luminaires : IP66

12. Impact Resistance

This is an international numeric classification for the degrees of protection provided by enclosures for electrical equipment against external mechanical impacts. It provides a means of specifying the capacity of an enclosure to protect its contents from external impacts.

The relevant international standard is IEC 62262.

Indoor luminaires : Minimum IK05

IK05 is equivalent to the impact of 0.2kg dropped from a height of 350mm (equivalent to an impact of 0.7 joules), which can be sufficient in normal conditions for luminaires in office buildings. Note: for luminaires fixed on the wall, **IK08 should be required so as to provide adequate protection against impact** (tested for 5 joules).

Outdoor luminaires : Minimum IK 08

IK08 is equivalent to the impact of 1.7kg dropped from a height of 300mm (equivalent to an impact of 5 joules), which can be sufficient in normal conditions for luminaires placed at a minimum height of 6 meters. IK10 is four times more resistant.

13. Humidity and corrosion

→ *Humidity*

Humidity is directly related to performance degradation (product durability and efficiency) in many electronic devices, including LED lights, even if an LED light satisfies the IP66 grade, if it has an air vent, there is a strong possibility that condensation will occur in the lamp during a sudden change of temperature and humidity in an environment of high temperature and humidity

→ *Corrosion*

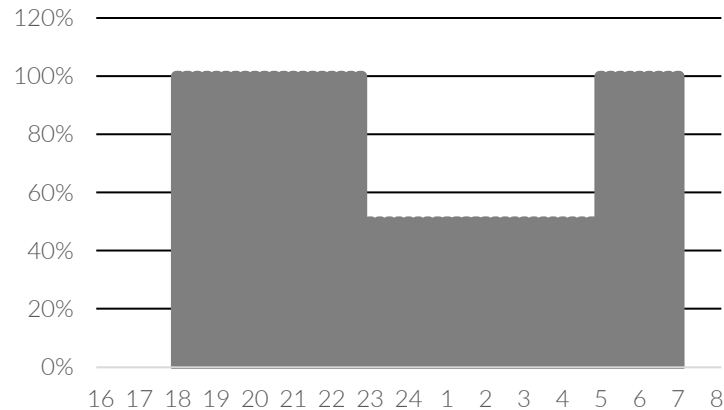
Moisture and small proportions of corrosive gases such as sulphur dioxide can cause severe corrosion over a long period of time. Luminaires which are used in atmospheres of high humidity should have adequate resistance to corrosion. An adequate level of corrosion resistance is provided by some metals or combinations of metals.

All luminaires shall be humidity-proof where humid conditions may occur in normal use following the IEC 60598-1 humidity test. (“Luminaires – Part 1: General requirements and tests”)

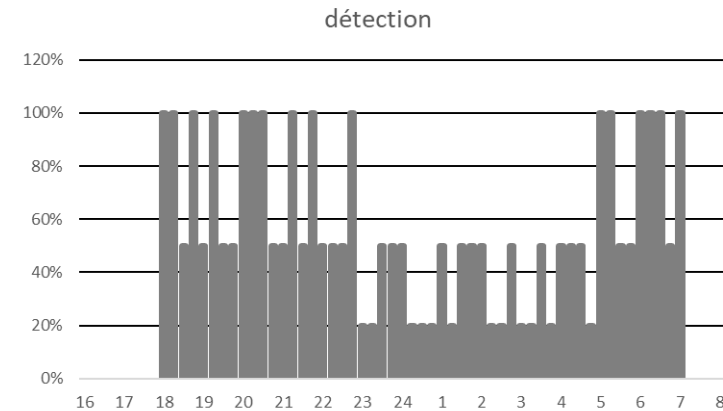
14. Dimming and occupancy control

Dimming is the ability to control the level of brightness by controlling the voltage or current available to it.

Dimming 23% energy saving



Occupancy control 42% energy savings



Office / Large Buildings

LED lighting should be dimmed when daylight is sufficient.

LED luminaires should incorporate the possibility of automatic on/standby occupancy control/presence detection with an embedded sensor or with an external detector.

Street / Outdoor Lighting

LED lighting should be dimmed by 30% of its nominal flux for at least 4 hours per night. Not applicable if the nominal illuminance level is below 1 lux.

15. Performance Criteria

It is important to have efficient luminaires, but it is also important to have an overall efficient lighting installation.

If too many luminaires are installed, unnecessary levels of light are produced with the corresponding unnecessary expenditure on energy.

This can be limited in order to promote an efficient total number of luminaires by restraining the maximum power installed by the floor area (square metres, m²) of the room.

Office / Large Buildings

< 6 Watt/m² of floor area for each place

Street / Outdoor Lighting

Power installed should not be more than
3 Watt per linear meter per road lane

16. Warranty and maintenance

The warranty should cover all the components of the luminaire, including the control gear and the light source.

→ *Indoor luminaire:*

A warranty period of 4 years could be reasonably required. The abrupt failure at the warranty lifetime (4 years or 10 000 hours) should not exceed 3%. The parameter is then C_3 at 10 000 hours.

If available on the market, products with a replaceable module should be preferred along with a guarantee to have spare parts (at least the module, control gears and relevant connectors) **available for 10 years.**

→ *Outdoor luminaire:*

A warranty period of 5 years could be reasonably required. The abrupt failure at the warranty lifetime (5 years or 22 000 hours) should not exceed 3%. The parameter is then C_3 at 22 000 hours.

If available on the market, products with a replaceable module should be preferred along with a guarantee to have spare parts (at least the module, control gears and relevant connectors) **available for 15 years.**

17. Environmental Sound Management

The generation of waste that originates when purchasing new lighting units to replace old ones must be taken into account during any procurement process. This includes:



- the old luminaires that are replaced;
- the new luminaires, which will become a waste at the end of their useful life;
- the shipment containers and packaging in which the new luminaires are sent;
- other accessory products that are part of the luminaires (e.g., lamps).

→ ESM Considerations to take into account:

1. The entity that acquires the luminaires must know, before calling the tender, if the relevant waste management legislation incorporates **an Extended Producer Responsibility (EPR) scheme** for the type of waste generated.
2. If the Extended Producer Responsibility scheme has **not been locally implemented**, the responsibility for the collection and recycling / management **lies with the buyer of the new luminaire**, as the final holder of the waste.
3. However, the buyer can request **appropriate agreement(s) with the manufacturer/seller/supplier** for the management of the waste. (agreement conditions included in the bidding rules).
4. The environmentally appropriate treatment of used luminaires **can be expensive**, and shall be take this into account when **considering their disposal cost in the offers**.
5. Separate the different lighting technologies (incandescent lamps, LEDs and discharge lamps) **at source**. If not possible, **all lamps must be treated as if they were discharge lamps**.
6. During the tendering process include certificates on: **EPR scheme** membership and **destination of the mercury** for correct disposal.

BONUS - Other recommendations featured in the Toolkit Guideline

→ Award criteria:

Weightings and parameters for lighting shall be adjusted depending on the product and the local regulations. Below an example.

Award Criteria for Street lighting and Indoor lighting	
Proposed point-based system, maximum 100 points	
Parameter	Criteria
Life cycle cost	<i>40 per cent weight</i> Points = 40 x (lowest life cycle cost of all proposals/life cycle cost of proposal) The life cycle cost calculations shall follow a standardised method, for example, as provided in the sample calculation spreadsheet provided as part of this Toolkit The respondents to the tender may only need to provide basic input data as part of their proposal: total cost of installation, maintenance intervals, lifetime of luminaires, etc.
Purchase cost	<i>20 per cent weight</i> Points = 20 x (lowest purchase cost of all proposals/purchase cost of proposal)
Extended warranty	<i>20 per cent weight</i> • Minimum + 1 year: 4 points • Minimum + 2 years: 8 points • Minimum + 3 years: 12 points • Minimum + 4 years: 16 points • Minimum + 5 years or more: 20 points
Luminous efficacy	<i>10 per cent weight</i> Points = 10 x (luminous efficacy proposal/maximum luminous efficacy all proposals)
Local content (if permissible by regulations)	<i>10 per cent weight</i> LC = local content cost of proposal (materials & labour)/total purchase cost Points = 10 x LC proposal / highest LC of all proposals

→ SPP Policy and Action Plan:

The development of an SPP policy and action plan is a key part of implementing SPP, as it provides a clear direction and a mandate for implementation.

1. Assessment of the *Cost-Benefit* of developing standardized procurement criteria/policy.
2. In the case that a standardized procurement criteria is deemed not suitable, a *project-by project approach* may be taken. When funds are not available, government officials shall *identify the barriers blocking funding* and *develop alternative delivery models* (Split CAPEX-OPEX, grants/loans, ESCO's, etc). These require a thorough assessment of existing procurement regulations, public, finance management limitations, accounting regulations, as well as the presence of vendors in the market that can offer these models.

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Check our websites

Find out tools, policy guides and policy briefs, webinars, model regulations, country assessments and news releases on our official website.

<http://united4efficiency.org/>

U4E introduction video

Need a quick introduction to our project? Our three minute general video is at:

[EN http://united4efficiency.org/accelerating-the-transition-to-high-efficiency-products/](http://united4efficiency.org/accelerating-the-transition-to-high-efficiency-products/)

GPP Technical Guidelines and Specifications

Check U4E's GPP Technical Guidelines at:

<https://united4efficiency.org/resources/publications/>



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Contact

TRANSFORMING MARKETS TO ENERGY-EFFICIENT PRODUCTS

Thank you



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