buy smart
Green Procurement for Smart Purchasing

BUY SMART

Green Procurement for Smart Purchasing

Procurement and Climate Protection

Guideline for procurement of efficient lighting

Supported by

INTELLIGENT ENERGY EUROPE

www.buy-smart.info

buy smart
Green Procurement
for Smart Purchasing

This guideline is provided within the framework of the European Union project “Buy smart – Green procurement for Smart Purchasing” funded by the program “Intelligent Energy – Europe”.

Publisher:

O.Ö. Energiesparverband
Landstraße 45
4020 Linz, Austria
T: +43-732-7720-14380
office@esv.or.at, www.esv.or.at

Content development:

Berliner Energieagentur GmbH, Germany
ENEA, Italy
Energiekontor, Sweden
Ekodoma, Latvia
O.Ö. Energiesparverband, Upper Austria
SEVEn, Czech Republic
ZRMK, Slovenia

Arrangement and text processing:

O.Ö. Energiesparverband, Upper Austria

Date:

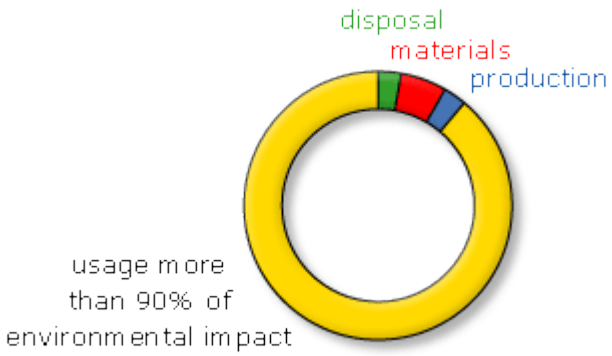
October 2009

Content

1. Introduction

Lighting has a substantial impact on the environment, accounting for up to 40 % of electricity used in non-residential buildings. Major energy savings can be achieved. Examples from the field have shown that between 30 % and 50 % of electricity used for lighting could be saved investing in energy-efficient lighting systems. While the environmental impact of most products occurs during resource use, production, transport and disposal phase, lamps have the highest environmental impact during their use phase - this can reach up to 90 % depending on the lamp type [European Lamp Companies Federation].

Environmental impact throughout a lamps life



Source: European Lamp Companies Federation: www.elcfed.org

Thus, it is worthwhile to consider energy-efficient lamp types for replacement or new installations. With the procurement of lamps an ergonomic, environmentally sound and economical lighting of the working place should be assured. A new lamp can be considered eco-efficient if it achieves the same performance with a lower energy consumption. Besides the initial costs, the energy consumption as well as the life time is considered in the economic evaluation.

In this guideline module fluorescent lamps, compact fluorescent lamps (energy saving lamps), halogen lamps, sodium lamps, metal-halide lamps and electronic ballasts are examined. In the following section the energy and environmental labels, which are relevant for the purchase of lamps, are introduced briefly. Then the possibilities for considering labels in call for tenders are examined.

Tips for energy savings by purchasing efficient lamps are also specified. In addition some references are given, how the power consumption in the office everyday life can be decreased by implementing efficient lighting solutions.

1.1 Products and Energy Consumption

1.1.1 Considered product groups

The following lighting technologies are reviewed in this guideline:

- **Linear fluorescent lamp:** A type of electric discharge source in which light is produced predominantly by the fluorescence of phosphors activated by ultraviolet energy from a mercury arc. It consists of a tubular bulb having an electrode (cathode) sealed into each end and containing mercury vapour at low pressure with a small amount of inert gas for starting. The inner walls of the bulb are coated with fluorescent powders. When the proper voltage is applied radiation, chiefly in the ultraviolet (UV) region is generated. The fluorescent coating transforms the UV into visible light. Modern fluorescent lamps (T5, three-band) have a significant better energy efficiency than older models. Fluorescent lamps differ in colour rendering and light colour. A lighting ballast is necessary to operate discharge light, for efficiency reasons, only electronic ballasts should be used. [John L. Fetters, The Handbook of Lighting Surveys & Audits]

- **Compact Fluorescent Lamp (CFL):** The generic name for a family of single- ended fluorescent lamps of folded or bridged tube design with high colour rendering and long life. CFL can be used for many purposes in private homes and businesses. A multitude of different designs and qualities are offered. [John L. Fetters, The Handbook of Lighting Surveys & Audits]

- **Halogen lamp:** Halogen lamps function after the principle of normal incandescent lamps but with higher efficiency. For low voltage halogen lamps part of the cost savings for power may be compensated by the additional power consumption of the current transformer. Normal low voltage halogen lamps can be replaced by more efficient halogen lamps (IRC infrared coating – resp. ES Energy Saving). They consume about 30 % less energy because part of the infrared radiation is reflected and given back to the filament. Inefficient supply voltage halogen lamps with a screw socket can normally be replaced by CFLs.

- **Sodium bulb:** High-pressure sodium lamp is a high-intensity discharge (HID) lamp in which light is produced by radiation from sodium vapour operating at a partial pressure of about 13.300 Pa. This category includes clear and diffuse-coated lamps. Low-pressure sodium lamp is a discharge lamp in which light is produced by radiation from sodium vapour operating at a partial pressure of 0.1 to 1.5 Pa. Standard high pressure sodium lamps will be phased out under the EC Regulation 245/2009.

- **Metal-halide lamps:** Metal-halide lamps are a member of the high-intensity discharge (HID) family of lamps, produce high light output for their size, making them a compact, powerful, and efficient light source. Originally created in the late 1960s for industrial use, metal halide lamps are now available in numerous sizes and configurations for commercial and residential applications. Like most HID lamps, metal halide lamps operate under high pressure and temperature, and require special fixtures to operate safely. Metal halide lamps are frequently used for general indoor lighting and industrial purposes, for street lighting and sport installations.

- **Ballast:** A current-limiting electrical device used with electric discharge lamps (fluorescent, mercury vapour, metal-halide, high- pressure sodium) to provide the electrical circuit conditions necessary to start and operate the lamp. A more modern type of lighting ballast is electronic instead of electromagnetic. An electronic lighting ballast uses solid state circuitry to transform voltage, but unlike electromagnetic ballasts, can also alter the frequency of power. This means that an electronic lighting ballast can greatly reduce or eliminate any flicker in the lamps. Because it uses solid-state circuitry instead of magnetic coils, it is also more efficient and therefore runs cooler. Because of their greater efficiency and ability to reduce flicker, it is recommended to exchange electromagnetic ballasts wherever possible. A few applications, however, require an electromagnetic lighting ballast, such as ballasts that must preheat or ballasts for extremely high output lamps.

- **LEDs:** LEDs (Light-Emitting-Diodes) are based on the semiconductor diode. LEDs present many advantages over traditional light sources including lower energy consumption, longer lifetime, improved robustness, smaller size and faster switching. LEDs are a fast emerging technology and their efficiency is on par with that of CFLs, however they do not contain mercury and live even longer.

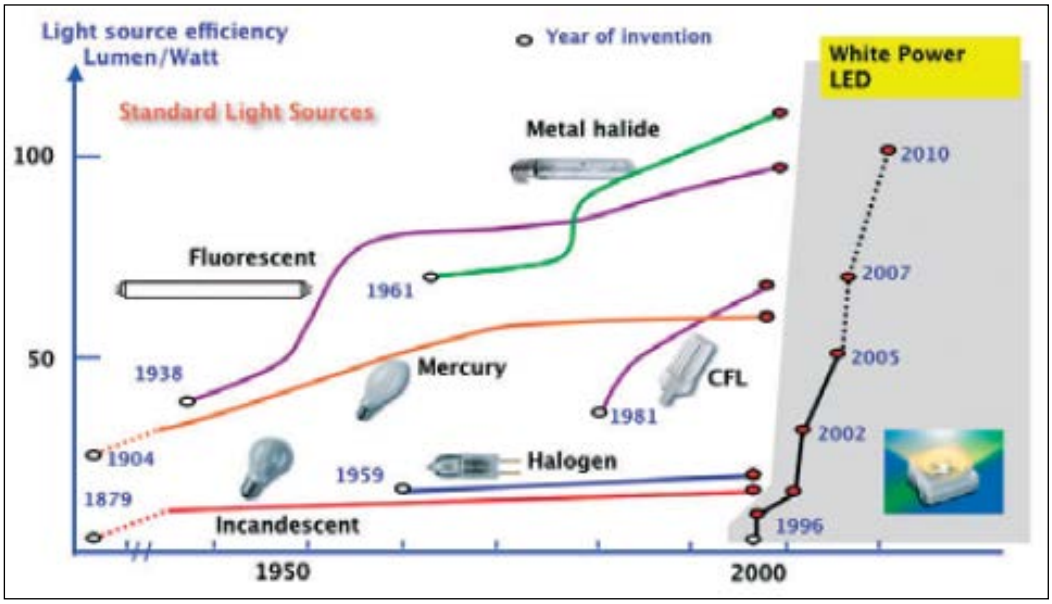
LEDs for room illumination are today only in the first phases of commercialisation, but already now they provide replacements for both clear and non-clear light bulbs. They are likely to become alternatives to the full range of lamps in the near future.

- **LED for street lighting & traffic light:** LED are a very interesting option for traffic light because they:

  - achieve up to 90% energy saving compared to conventional light bulbs
  - have longer life and extreme reliability results in reduced maintenance and lower running costs!
  - conventional lamp failure may result in a non-functioning traffic light:
    use multiple LED solutions secure continuous function at all times, increasing traffic safety
  - the LED requires no reflector as with conventional lamps, thus there are no problems with sunlight reflections in the traffic light (known as the phantom effect)
  - the LED requires low voltage supply, which results in safer installations

For street lighting first pilot projects exist and rapid development is expected within the near future.

Light source efficiency roadmap



Source: European Lamp Companies Federation: www.elcfed.org

The following products will not be considered in this guideline:

- Incandescent lamps, because they will be gradually phased out due to the provision of Commission Regulation N° 244/2009 on the ecodesign requirements for non-directional household lamps;
- Luminaries are not covered in this guideline. When procuring lamps, care should be taken to choose a high light output ratio. A high efficiency factor signifies that the light of the lamp is directed to where it is needed. Light directing elements like reflectors, louvers, or prisms enhance the light output ratio. Consequently, less lamps and power is needed to achieve the required luminance. If possible, the complete lighting installations should be looked at, not only single components. The interaction of the components determines the efficiency and acceptance of the lighting system.

1.1.2 Definitions

The following terms and designations are used in this guideline module:

- **Ballast Factor (BL) or Ballast Lumen factor (BLF):** The ratio of the lumen output of fluorescent lamp(s) operated on commercial ballast to the lumen output obtained when operated on the standard (reference) ballast specified for rating lamp lumens. [John L. Fetters, The Handbook of Lighting Surveys & Audits]
- **Colour Rendering Index (CRI)** is defined in terms of a comparison of the spectral tri-stimulus values of the objects under test illumination and standard illumination according to the recommendations of CIE Publication No.13.3-1995.
- **Colour Temperature:** The actual colour of the lamp is defined in terms of the spectral tri-stimulus values (colour coordinates) according to the recommendations of IESNA LM-16. For colour coordinates near the Black Body loci, the correlated colour temperature, measured in Kelvin (K), is used.
- **Efficacy:** Ratio of measured lamp lumens divided by measured input power. Unit: lm/W [EN 12665 Lighting applications - Basic Terms and Criteria for Specifying Lighting Requirements]

- **Electric Consumption Rate for Ballast Itself** refers to the amount of electric consumption of ballast itself as a light is turned on, and it is calculated by the following equation.

$$Electric\,consumption\,rate\ for\,ballast\,itself\ [\%] = \frac{input\ power - output\ power}{input\ power} \times 100$$

- **Illuminance (at a point of a surface):** Quotient of the luminous flux incident on an element of the surface containing the point, by the area of that element. Unit: lx=lm/m2. [EN 12665 Lighting applications - Basic Terms and Criteria for Specifying Lighting Requirements]
- **Initial Efficacy:** The efficacy of the lamp at converting electrical energy into light after 100 hours of use, measured in lumens per watt (lighting output divided by its power consumption).
- **Lamp and Luminaire:** Lamp: source made in order to produce an optical radiation, usually visible. A luminaire: apparatus with distributes, filters or transforms the light transmitted from one or more lamps and which includes, except the lamps them-selves, all the parts necessary for fixing and protecting the lamps and, where necessary, circuit auxiliaries together with the means for connecting them to the electricity supply. [EN 12665 Lighting applications - Basic Terms and Criteria for Specifying Lighting Requirements]
- **Lamp Compatibility** is the information about the lamp coexistence with existing controls (for example information about incompatibility with photo controls, dimmers), with existing fixtures, etc.
- **Lamp Current Crest Factor (CCF):** A measure of the shape of the lamp current, defined as the peak current divided by the root-mean-square (rms) current. The CCF is the ratio of the peak current to the effective average (rms) current. CCF is determined by the ballast on which a lamp operates. If the CCF is too high, then lamp life will be shortened and fluorescent tube ends will darken. [John L. Fetters, The Handbook of Lighting Surveys & Audits]
- **LED:** Light-Emitting-Diode
- **Luminous Flux:** Luminous flux, which is generated by a lamp, in lumen (lm).
- **Lumen Maintenance:** Minimum requirement for lumen output after a predefined lifetime in relation to the nominal lumen output. A high lumen output at the end of the nominal lifetime in relation to the nominal lumen output is a sign of quality.
- **Power Factor (PF):** The ratio of active power, in watts, to the apparent power, in rms volt-amperes. It is a measure of the efficiency with which an AC electrical de-vice converts input current and voltage into useful electrical power. [John L. Fetters, The Handbook of Lighting Surveys & Audits]

- **Power Input:** The actual total power used by all lamp(s) and ballast(s) of the light fixture during operation, as measured in watts (W).
- **Stabilised light output after switch on:** the time needed after switching on for the lamp to start fully and remain lighted.

1.2 Excursus: Advantages of Compact Fluorescent Lamps

An energy saving lamp offers important advantages compared to the conventional lamp.

- **Power Input:** The power input of an energy saving lamp is up to 80 % lower than an incandescent bulb while having the same performance. From this a quadruple larger luminous efficacy results and thus a larger saving potential.

CFL versus incandescent bulb [IEE]

Incandescent Bulb	Compact Flourescent Lamp
15 Watt	3 – 5 Watt
40 Watt	7 – 9 Watt
60 Watt	11 – 16 Watt
100 Watt	20 – 23 Watt

- **Durability:** The incandescent lamp is more favourable in the purchase than an energy saving lamp. The economic advantage of an energy saving lamp unfolds only over a certain period of time (see example calculation table 2).

The positive arguments mentioned here face a higher purchasing price, which has to be balanced by savings of the energy saving lamp. Than the energy saving lamp is the better ecologically and economically alternative compared to incandescent bulbs. Therefore incandescent bulbs should be replaced with more economical energy savings lamps, if a replacing is possible.
Not only technical innovations, but also the advancement of aesthetic components provides a further spreading of the energy savings lamps.

- **Lamp Design:** Today's energy savings lamps are available in different forms and sizes, so that nearly every lamp can be replaced.
- **Light Colour:** Energy savings lamps offer different light colours by different compositions of the phosphor in the illuminants of the lamp. The assortment reaches from extra warm white, which corresponds to the colour of an incandescent lamp, and daylight white for office lighting.
- **Colour Rendering:** High Quality CFL have a good colour rendering.

The following table shows, which energy savings are possible by replacing an incandescent bulb with an energy saving lamp. As period under review eight years were taken.

Saving potential of a CFL compared to an incandescent bulb [EA NRW]

	Incandescent Bulb	Compact Fluorescent Lamp
Power input	100 W	20 W
Average durability	1,000 h	10,000 h
Luminous flux	1,200 lm	1,200 lm
Relation heat to light	95 % to 5 %	75 % to 25 %
Necessary lamps in 8 years (3 h/day*365 days = 1,095 h/year)	8	1
Energy consumption in 8 years with a burning time of 3h/day	876 kWh	175.2 kWh
Energy Costs (0.14 EUR/kWh)	122.64 EUR	24.53 EUR
Costs per Lamp	0,50 EUR	10.00 EUR
Total costs in 8 years	126.64 EUR	34.53 EUR
Savings	--	**92.11 EUR**

1.3 Excursus: Phasing out of incandescent light bulbs:

The EU has set new energy efficiency requirements that lamps produced for the EU market need to fulfill as from 1 September 2009. Traditional incandescent and less efficient halogen bulbs will be gradually phased out from the market by the end of 2012.

Lamps that cannot meet the minimum energy efficiency and performance requirements (e.g. durability) will be phased out from the EU market beginning in September 2009 and ending in 2012. Further measures are planned for reflector lamps such as spotlights.

The measure distinguishes between lamps that are "clear" (transparent) and non-clear. Non-clear lamps will need to reach the A-class according to the EU's lamp energy label, which means energy savings of 75 % or more as compared to traditional incandescent bulbs. Only compact fluorescent lamps and LED lamps can achieve such high efficiency. Consumers who want other lamp technologies due to factors such as aesthetics and size may purchase clear lamps.

Meanwhile, inefficient clear lamps will also be phased out gradually. From September 2009, equivalents of clear incandescent bulbs of 100W or more must be made with more efficient technology (e.g. efficient halogens). This limit will be moved down to lower wattages gradually until 2012 (75W in 2010, 60W in 2011, 40W and below in 2012).

New requirements on the functionalities of lamps (starting times, lifetime etc.) are also introduced so that only quality lamps will be allowed on the market that will meet the users' expectations. Additional product information will also be required on the packaging to help consumers to make the right choice for the intended purpose.

The measure applies to lamps manufactured and sold by the manufacturer or the importer as from 1st September 2009. Wholesalers and retailers will be able to continue selling existing stocks even after that date. This means that the lamps that are banned will only gradually disappear from the shop shelves.

Detailed phase-out plan

	Non-clear lamps				**Clear lamps**							
Date	**Requirement**	Incandescent	All Halogen	CFL / LED	**Requirement**	Incandescent / Conventional halogen				Halogen C	Halogen B	LED [1]
						≥ 100 W	≥ 75 W	≥ 60 W	60 W >			
Today	None				None							
September 2009 [1]	A[2]				C for ≥ 100W [3]		≥ E[3]	≥ E[3]	≥ E[3]			
September 2010	A[2]				C for ≥ 75W [3]			≥ E[3]	≥ E[3]			
September 2011	A[2]				C for ≥ 60W [3]				≥ E[3]			
September 2012	A[2]				C for all							
September 2013	Second level of functionality requirements [1]											
Review 2014	Review											
September 2016	A[2]				B / C [4]					[4]		

1 First level of functionality requirements introduced in first stage. LEDs are exempted from all functionality require ments.
2 Refers to lamp energy label class. Correction factors apply to certain lamps, allowing them to be B-class.
3 Minimum requirement for all lamps: E class. F and G lamps phased out.
4 Only special cap halogen lamps are allowed to be class C.

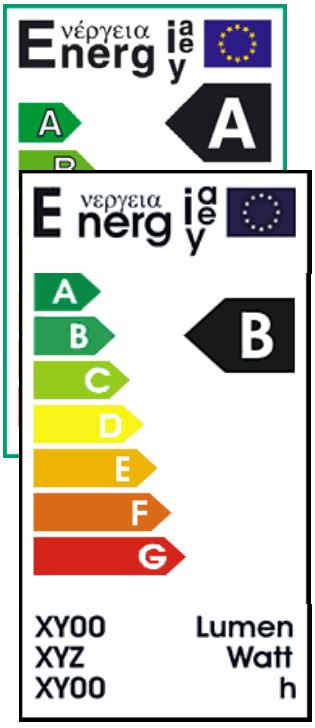
Legislation

- Directive 2005/32/EC of 6 July 2005 establishing a framework for the setting of ecodesign requirements for energy-using products and amending Council Directive 92/42/EEC and Directives 96/57/EC and 2000/55/EC of the European Parliament and of the Council.
- Commission Regulation (EC) No 244/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for non-directional household lamps.
- Commission Regulation (EC) No 245/2009 of 18 March 2009 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements for fluorescent lamps without integrated ballasts, for high intensity discharge lamps and for ballasts and luminaires able to operate such lamps, and repealing Directive 2000/55/EC of the European Parliament and the Council.

2. Labels for Energy and Environment

2.1 Relevant European Labels

2.1.1 EU-Label



According to a European Union Directive electric household lamps supplied directly from the mains have to be labelled with an energy consumption label. Excepted from this directive are reflector lamps and lamps with a luminous flux of more than 6,500 lumens or an input power of less than 4 Watts. The energy label indicates the energy efficiency class on a scale of A (more efficient) to G (less efficient).

The following parameters have to be declared on the energy label (see figure beside): the luminous flux in lumens, the power input in Watt und the average rated life in hours.
Compact fluorescent lamps are usually classified in energy efficiency class A or B, whereas an incandescent bulb only fulfils the criteria for E to G.

Internet: www.energy.eu/focus/energy-label.php
http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:31998L0011:EN:HTML

2.1.2 EU Eco-label (Eco flower)

Since 1992 the "Flower" has become a European-wide symbol for products, providing simple and accurate guidance to consumers. All products bearing the "Flower" have been checked by independent bodies for complying with strict ecological and performance criteria. The EU Eco-label is administered by the European Eco-labelling Board (EUEB) and receives the support of the European Commission, all Member States of the European Union and the European Economic Area (EEA). The Eco-labelling Board includes representatives of industry, environment protection groups and consumer organisations.

The Eco Flower is assigned for compact fluorescent lamps meeting amongst others the following criteria:

- durability of at least 10,000 hours
- electricity consumption is reduced by a factor of five compared to an incandescent light bulb
- very low mercury content
- at least 65% recycled packaging

Internet: http://www.eco-label.com

2.1.3 *Energy Star*

The EU ENERGY STAR programme follows an Agreement between the Government of the US and the European Community (EU) to co-ordinate energy labelling of office equipment. It is managed by the European Commission. US partner is the Environmental Protection Agency (EPA), that started the scheme in the US in 1992.

Computers and monitors were the first labelled products, now the label is on major appliances, office equipment, lighting, home electronics and more. In the sector of lighting e.g. compact fluorescent light bulbs, LED lightings, decorative light strings and indoor and outdoor residential light fixtures are labelled with the ENERGY STAR.

The EU ENERGY STAR programme for labelling energy efficient office equipment, a database of Energy Star qualified products is available.

Internet: www.eu-energystar.org

2.1.4 Efficient Lighting Initiative (ELI)

ELI is an international branding system for high quality energy efficient lighting products.
The original ELI programme tested the quality certification and labelling concept and focused on seven countries during the period 2000 - 2003. In 2005, the China Standard Certification Center (CSC) was commissioned by the International Finance Corporation (IFC), with funding from the Global Environment Facility (GEF), to develop and expand the ELI certification and branding system globally. The expanded ELI programme is operated by a new institute, the ELI Quality Certification Institute, which is led by CSC with assistance from a team of international experts from Asia, North America and Latin America. The ELI Quality Certification Institute is seeking strategic partnerships worldwide, and is working to establish ELI as a global service network.

Internet: www.efficientlighting.net

2.1.5 CE Marking

The CE marking is not an environment or energy label in the first place. It symbolises the conformity of a product to the Community requirements incumbent on the manufacturer of the product. It indicates that the product conforms to all the Community provisions providing for its affixing, e. g. the determination of the energy consumption.
In the end of 2002 for ballasts for fluorescent lamps a mandatory standard was set for the maximum energy consumption. According to the EuP-Directive (Energy using Products - Directive 2005/32/EC) lamps in private homes and street lighting have to achieve minimum efficiency requirements, which are a precondition for the placing of the CE marking.
Member states may not restrict the placing on the market and entry into service of products bearing the CE marking, unless there is supporting evidence of the product's non-conformity. The

marking should be affixed prior to the product being placed on the European market and entering into service. It aims to protect public interests such as the health and safety of product users.

The CE marking must be affixed by the manufacturer or his agent established within the Community. On national level random sampling is undertaken. The manufacturer bears ultimate responsibility for the conformity of the product.

Internet:
http://europa.eu/legislation_summaries/consumers/product_labelling_and_packaging/l21013_en.htm and
http://ec.europa.eu/enterprise/newapproach/legislation/guide/document/chap07.pdf

2.1.6 European Compact Fluorescent Lamps Quality Charter (CFL Quality Charter)

The European CFL Quality Charter is a voluntary set of criteria established by the European Commission in collaboration with a number of private and public organisations.

The present European Quality Charter for CFL was initially developed in 1998 on the initiative of the European Commission and Eurelectric to support the European Wide Initiative for the Promotion of Efficient Lighting in the Residential Sector. The aim is to offer a high quality standard to be used by utilities and other bodies in their promotion and procurement campaigns. The ultimate goal of the European Quality Charter for CFL is to increase consumer confidence in this environmentally friendly technology, which save money and the environment.

In 2008, a revision of the European CFL Quality Charter took place. Today the European CFL Quality Charter aims at raising consumer awareness and confidence in the CFL, by assuring that certain quality and performance levels are reached. The European CFL Quality Charter is revised regularly to keep up with technological development.

The CFL Quality Charta includes:

- self-ballasted, one and two part Compact Fluorescent Lamps (CFL's) with Edison screw or bayonet cap

The CFL Quality Charta excludes:

- CFL's with a magnetic ballast

The CFL Quality Charta Criteria (simplified description):

- Safety: Lamps must meet the safety requirements of EN 60968 (or EN 61199 and EN 60598) and comply with relevant CE Marking legislation.
- Energy efficiency: Class A of the EU energy label
- Lumen maintenance: After 2000 hours the luminous flux should be not less than 88% of the initial luminous flux (for lamps without external casing) and 83% of the initial luminous flux (for lamps with external casing)
- Stabilised light output: The time to 80% of stabilised light output after switch-on from cold at normal room temperature should be less than 60 seconds.
- Ignition requirement: The number of ignitions that the lamp can endure should not be less than the claimed lamp life in hours.
- Colour rendering: CRI > 80
- Life: Minimum life cycle should be 6,000 hr.

Internet:
http://re.jrc.ec.europa.eu/energyefficiency/CFL/pdf%20CFL%20quality%20charter/EU%20CFL%20QC%202008%20V5%20final.pdf

2.1.7 Blauer Engel (Blue Angel)

The Blue Angel is the first and oldest environment-related label in the world for products and services. It was created in 1978 in Germany. Only those products are awarded, which are clearly less harmful to the environment compared to conventional products. The Blue Angel should help to speed up the structural change of the economy towards a sustainable development. The label is assigned by the Environmental Labelling Jury. This committee decides on the assignment bases in cooperation with experts and Germany's Federal Environmental Agency. The catalogues of criteria are adjusted to the state of the art in intervals of 3 to 4 years.

In the sector of lighting only electronic ballasts for fluorescent lamps are labelled with the Blue Angel.

Internet: www.blauer-engel.de

3. Practical Instructions

The energy efficiency criteria can be integrated either into the tendering documents or into the economic efficiency calculation by stronger weighting the operating costs (e. g. in relation to the purchasing price). For the economic efficiency calculation a calculation tool is available on the "Buy Smart" website (www.buy-smart.info). A further possibility for the integration of energy and environmental criteria are the performance sheet. With the help of the performance sheets environmental aspects can be considered in a simple way. In tendering procedures two alternatives can be used:

- Alternative A: simplified procedure only considering minimum requirements, no consideration of life cycle costs, i. e. low effort, but relatively low environmental effect. For Alternative A only the respective performance sheet is used.
- Alternative B: comprehensive procedure by weighting of challenging environ-mental criteria versus life cycle costs, i. e. relatively more effort, but definite more effect. In Alternative B the procedure consists of:
  - performance sheet Alternative B with additional target-criteria compared to Alternative A (only must-criteria shall be fulfilled);
  - calculation tool for the evaluation of the life-cycle-costs;
  - evaluation tool to detect the best economical offer by combining both (included module within the calculation tool).

3.1 General Tips for Procurement of Lamps

The following advices should be considered with the procurement of new lamps. Ideally lamps, luminaires and control system are seen as an lighting system which means that all components have to go together. When purchasing new lamps this should be taken into account. However, the following criteria could be considered in any procurement case:

a. High energy efficiency class

For lamps that are labelled, it is recommended to check the energy efficiency class. Where available and depending on the application, preferably "A-class" lamps should be used.

b. Durability & maintenance costs

A high durability is not only because of environmental reasons recommended but for example also reduces costs for exchange of lamps (maintenance costs). Therefore tenders should always take into account the life time of different products. For CFLs for example a life time of at least 10,000 operation hours is recommendable.

c. Consideration of burning hours per year

With a high burning time per year, the use of energy saving lamps disburses particularly fast.

d. Fluorescent lamps

With fluorescent lamps, models with the most luminous efficiency are favourable. The greatest saving potential can be achieved when changing from T8 (26 mm diameter) to T5 lamps (16 mm diameter). However in such cases the luminaries have to be exchanged as well. Compact fluorescent lamps such as energy savings lamps represent the energy efficient alternative to incandescent bulbs and halogen lamps.

e. Halogen lamps

Normal low voltage halogen lamps can be replaced by efficient IRC halogen lamps (IRC infrared coating resp. ES Energy Saving). They consume about 30 % less energy. Supply voltage halogen lamps with a screw socket can – depending on the application - be replaced by CFLs, if the other lighting requirements are met (check compatibility with luminaires).

f. Sodium bulbs

Low/ high-pressure sodium lamps as well as metal-halide are high intensity discharge lamps (HID). The vast majority of road lighting installations are based on one of the high intensity discharge (HID) lamp systems. In comparison, the still widely used mercury vapour lamps have a low efficiency and high pressure mercury lamps will be phased out in the next years.

The efficiency of lamps varies widely, as indicated in Figure 2. From it can be seen that high-pressure sodium lamps are at higher wattages generally the most efficient of the common lamps. However, low-pressure sodium lamps have very poor colour characteristics.

Lamp efficiency:

Lamp type	Conversion efficiency [Lumen per Watt]	Life [hours]
incandescent bulb	8-10	1,000
low voltage halogen	12-25	2,500
infra-red coated halogen	25-30	5,000
Compact fluorescent lamp	38-66	6,000 – 15,000
Fluorescent lamps (T8, conventional ballast)	47-83	8,000
Fluorescent lamps (T8, three-band-lamps, electronic ballast)	up to 100	19,000
Fluorescent lamps (T5, conventional ballast)	67-104	24,000
Metal-halide lamps	70 - 90	12,000 +
High pressure Sodium lamps	90 - 150	16,000 - 25,000
Low pressure Sodium lamps	120 - 200	12,000 - 20,000

g. Ballasts

There are two main types of ballasts used in commercial applications, magnetic and electronic. Fluorescent lamps and HID-lamps should be equipped with an electronic ballast.

Advantages of electronic ballasts:

- Energy efficiency
- Multiple lamp operation, from one to four lamps
- Can replace magnetic ballasts in a retrofit
- Lamp flicker is eliminated
- Quieter than magnetic ballasts
- Non-toxic materials
- Lighter weight

HID lamps have used magnetic ballasts until recently, because they have a longer life span and are robust. New developments will also make the use of electronic ballast for HID-lamps outside possible. Moreover, ecodesign requirements will progressively phase out non efficient ballasts.

h. Further criteria

Further ecologically relevant criteria, which should be considered during the procurement of lamps, are the following:

- High luminous efficiency
- Low consumption of auxiliaries
- High durability
- Less harmful substances
- Electro-magnetic compatibility
- If necessary electromagnetic ballasts with a high switching resistance (more than 20,000 switches)
- Low idle power consumption

Furthermore, the influence of the colours of walls and floors should be taken into ac-count. Dark colours absorb more light and rooms with dark walls, floors and furniture require significantly higher light intensity.

3.2 Energy Saving Advices for the office Everyday Life

However with the purchase of energy-efficient lamps only one part of saving potentials for lighting can be opened up. The utilisation behaviour in the office everyday life and thus the employees can achieve a crucial contribution for power saving within the lighting sector. Only by their energy efficient behaviour the saving potential can be fully exploited. Thereby the following energy saving tips can be useful:

a) Absence

Switched-on light sources use unnecessary energy, if the area is left for more than 5-10 min. Of course artificial light is redundant with sufficient daylight and the use of day-light should be the first priority.

b) Halogen lamps

If low-voltage halogen lamps should be present in the office, the power consumption of the transformer can be avoided by switching off light with a switchable connexion plug board.

c) Lighting of adjoining rooms

In corridors, toilets or in kitchens the light should be turned-off when not needed. Per-haps motion detectors or time switch devices can be helpful.

d) Motion detector/ stairway automatic

In corridors or stairways with small frequentation the power consumption can be reduced by the use of movement detectors up to 50 %. The high energy savings balances fast the higher initial costs.

A further possibility for using lamps effectively offers the so called stairway automatic. After switching on the lighting the mechanism switches itself off after an adjusted time. This technology is suitable for stairways, stockrooms, garages etc.

e) Regular cleaning

Lamps and luminaries have to be cleaned on a regular basis, in order to be able to furnish their full light. This cleaning can be connected with further necessary maintenance work.

f) Replacement

Defective lamps should be replaced if possible by energy savings lamp. Depending on the situation and difficulty of replacing, it is possible to make a single or a collective exchange. The simultaneous exchange of all lamps is recommended, in order to conserve maintenance intervals.

g) Disposal

Incandescent lamps are disposed with the domestic waste. (Compact) Fluorescent lamps contain small quantities of mercury and they have to be collected separately.

The WEEE Directive 2002/96/EG – WEEE for Waste of Electrical and Electronic Equipment – took effect on February 13, 2003. The principal objective of this EU directive is to prevent electrical and electronic waste, and also the reuse, material usage and other forms of use of waste of this kind in order to reduce the amount of waste and to preserve resources, particularly by means of reusage and recycling. As of coming into effect of the respective national laws, all manufacturers and importers of electronic equipment are obliged to accept returns of their products, and to take steps regarding the handling, usage or recycling.

3.3 Performance Sheets

The integration of environmental and/or energy criteria is possible into the call for tender by must and target criteria. Both groups of criteria are used in the performance sheet for different types of lamps (see: www.buy-smart.info):

- Must criteria represent thereby the minimum requirements, which the offered product has to fulfil. The non-compliance leads to the exclusion from the call for tender.
- The observance of target criteria is evaluated with points depending upon the certain weighting of different aspects (beside the small boxes in the column „target “). The sum of the maximum scores results is 100 and means the reaching of 100% of the target criteria. Possible weightings and point distributions are already presented as example.

The design of the performance sheet including the mandatory and target criteria is only an example on how the label requirements in this guideline can be integrated into the procurement. The data and the layout can be adapted to the individual specific conditions and priorities. In addition the performance sheets are available for download on the Internet site www.buy-smart.info in word-format.

In the following the requirements under each point of the performance sheets are explained briefly and the label is named, to which the used data refer.

a. Product Details

Under this point the provider or manufacturer can give specific data of his offered product. In particular the indication of the average durability of the lamp is important for the economic comparability of the offers.

b. Energy Consumption

Here the power of the lamp has to be indicated first. Further the indication of the energy efficiency class is critical for a positive evaluation of the offer after the European Union label. Energy savings lamps achieve the classes A or B – incandescent bulbs are only in the class D to G. These elements were considered by setting the mandatory and target criteria.

c. Durability

A long durability for energy saving lamps is of an utmost importance, since the higher initial costs have to be cleared by energy costs saving and a long burning time of the lamp.

d. Environmental Impact

To this point belong the mercury content and a recyclable package. The target values are based on the conditions of the EU Eco Label. The European Union Label does not specify limit values for these data.

3.4 Proposed Procedure

3.4.1 Description how to use the performance sheets for Alternative A (simplified procedure):

- The performance sheet in Alternative A only consists of must-/minimum-criteria
- Send the performance sheet as integral component of call for tender, and indicate:
  - that the supplier is obliged to complete the performance sheet
  - that products, that do not fulfil the criteria will be excluded
- The supplier has to detail all requested information respectively to confirm the compliance with the must-criteria
- The offers, in which a single must-criteria are not full-filled, will be excluded
- If desired, life cycle costs can be calculated with the according sheet of the calculation tool.

3.4.2 Description how to use the performance sheets for Alternative B (comprehensive procedure):

- The performance sheet in Alternative B consists of must-/minimum-criteria as well as target-criteria
- Send the performance sheet as integral component of call for tender, and indicate:
  - that the supplier is obliged to complete the performance sheet entirely
  - that products, that do not fulfil the must-criteria will be excluded
- Decide on a weighting share for environmental criteria (performance sheets), other criteria and life cycle costs and state it in the call for tender:
  - We recommend a weighting share of 30 % for environmental criteria. It should not be higher than 45 %, to comply with European jurisdiction (Wienstrom Rs. C-448/01, 04.12.2003)
  - If points for other criteria are given, it should be taken care that the weighting share for the life cycle costs is over 50 % and thus remains the most important acceptance criteria

- The supplier has to detail all requested information (especially the target-criteria) and to confirm the compliance with the mandatory criteria
- The offers, in which single criteria are not full-filled will be excluded

3.4.3 Economic Efficiency Calculation (only Alternative B)

The running costs are of an utmost importance as well as the investment costs, since the initial costs for lamps are relatively small compared with household or office equipment. The operating costs are reduced with energy efficient lamps, so that expensive energy efficient and long life lamps can represent the economically most favourable alternative during a longer period.

The calculation tool can be used as support for the calculation of the economy. On the basis of the product details and the results of the calculation the offers can be com-pared and the most economical offer can be selected.

- Description how to use the calculation tool to calculate the life cycle costs:
  - Fill in of all product specific information given by the supplier in the performance sheet
  - Adapt the user specific basic conditions
  - The calculation results in the life-cycle-costs considering the most relevant parameters, if necessary add other parameters
- Description how to calculate the most economic offer considering life cycle costs and environmental performance:
  - Fill in the number of target-criteria points evaluated in the performance sheets
  - Change the weighting share for environmental criteria if it is not 30 %
  - The result is the evaluation of the best economical offer.

4. References

[DENA]	German Energy Agency: Information of energy efficiency lighting in the Household. Consumers' brochure in the frame of the Initiative EnergieEffizienz. Berlin (www.initiative-energieeffizienz.de)
[EA NRW]	Energy Agency NRW: plenty of light for little money. Wuppertal *Energieagentur NRW: Viel Licht mit wenig Geld. Wuppertal*
[ELCFED]	European Lamp Companies Federation, www.elcfed.org
[EN 12665]	Lighting applications - Basic Terms and Criteria for Specifying Lighting Requirements
[EUROPEAN COMMISSION]	Public Procurement http://ec.europa.eu/internal_market/publicprocurement Efficient Lamps: http://ec.europa.eu/energy/efficiency/ecodesign/lumen/index.htm
[GREENLIGHT]	Austrian Energy Agency: GreenLight – A European program for energy efficiency lighting. Vienna
[IEE]	German Energy Agency: Information of energy efficiency lighting in the Household. Consumers' brochure in the frame of the Initiative EnergieEffizienz. Berlin (www.initiative-energieeffizienz.de)
[ÖKOKAUF]	Ökokauf Wien: Ecological criteria for the procurement of energy saving lamps. (www.wien.gv.at)

5. List of Abbreviations

AC	Alternating Current
BLF	Ballast Lumen Factor
CE	Communauté Européenne
CCF	Current Crest Factor
CFL	Compact Flourescent Lamp
CRI	Colour Rendering Index
CSC	China Standard Certification Center
EC	European Commission
EEA	European Economic Area
e.g.	for example
EPA	Environmental Protection Agency
ELI	Efficient Lighting Initiative
etc.	et cetera
EU	European Commission
EUEB	European Eco-labelling Board
EuP	Energy-using-Products
GEF	Global Environment Facility
h	hour
HID	High-intensity discharge
i.e.	id est
IFC	International Finance Corporation
IRC	Infrared coating
K	Kelvin
kWh	Kilo Watt per hour
LED	Light-Emitting-Diodes
lm	lumen

min.	minutes
P	Power Consumption
Pa	Available external pressure
PF	Power Factor
rms	Root-mean-square
UV	ultraviolet
W	Watt
WEEE	Waste Electrical and Electronic Equipment (Directive)