

The end of the incandescent bulb - THE FUTURE for interior and exterior lighting installations

Based on Informations provided by Dipl.-Ing. Holger Kilb

Head of Product Department FG11 Lighting Components
Ivan Stamboliev

VDE representative for Bulgaria
VDE Prüf- und Zertifizierungsinstitut
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First Lamp to 1809

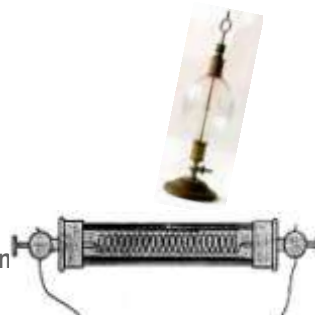
- Humphry Davy presented the first functional lamp before
- It is this lamp is a gas discharge lamp
- The lamp produced a very high proportion of light glowing through the graphite electrode



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First bulb around 1820

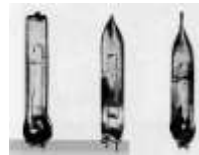
- It is a lamp with a platinum filament evacuated under a glass bell
- The lamp has been known under the name "De la Rue lamp" or "De la Rive lamp"
- The inventor is Auguste-Arthur De La Rive



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Heinrich Göbel's Incandescent bulb

- Heinrich Göbel in 1854 created the first functional incandescent lamp
- It was carbon filament lamps
- These lamps have not yet sat down, because the power supply of buildings was still far from
- The lamps were supplied from batteries
- However, he could not prove in the patent litigation and before the court that he invented the light bulb.



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Lamp by Edison

- 25 years later (1879) Thomas Alva Edison developed the light bulb
- The lamp, like the lamp of Göbel, had a filament from charred bamboo fibers.
- However, Edison was already able to use generators on dynamo principle as power supply.



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Today's normal incandescent lamp with a filament made of tungsten

- Tungsten filaments have existed for more than 100 years
- Untreated tungsten is very brittle and fragile. In this form it can not bend or pull.
- The thread is tungsten powders with a binder material. This paste is then injected to threads
- These threads are then sintered and annealed until the binder is removed and one made of pure tungsten filaments containing



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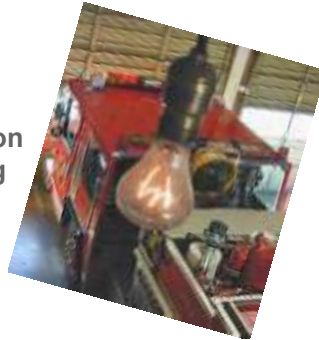
General advantages of using incandescent bulb

- Immediate full brightness
- Dimmable
- Easy handling (no additional equipment required) Mit dem, dem Sonnenlicht ähnlichsten Farbspektrum
- No Toxins (gas, materials)
- Low cost

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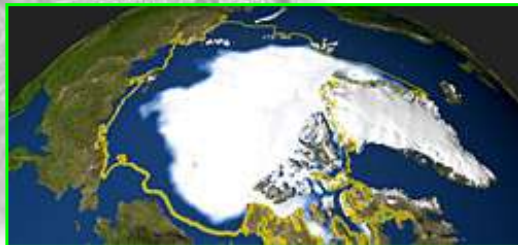
Disadvantages of using incandescent bulb

- Low light output in relation to the recorded energy spent
- Low lifetime of typically 1000 h (exception is the Centennial Light with an operating period of 108 years)
- For such light output very high energy consumption and therefore high CO₂ emissions



Global Warming

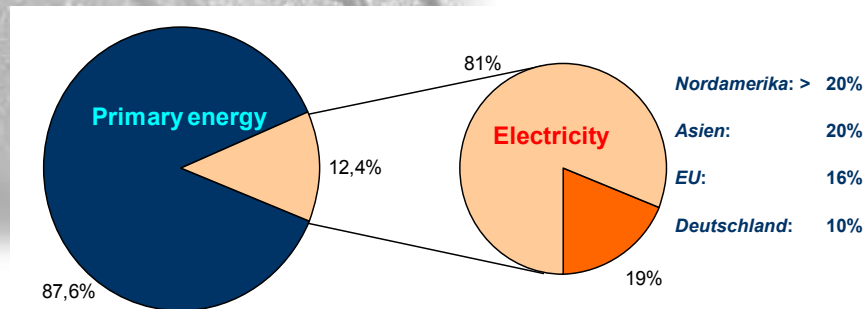
- IPCC Climate Report: 1.4 to 5.6 degrees warming in this century



- Commitment of the EU - CO₂ emissions reduction by 20% until 2020 (compared to 1990) (Kyoto Protocol of 2005)

The Importance of Lighting

Lighting = **19% of global electricity consumption**



⇒ For lighting are used ca. 2.53% of the primary energy.

⇒ This is equivalent to 2700 TWh / a.

Global electricity consumption for lighting

- Approx. **40%** of this electricity is consumed by incandescent lamps
- These produce only **9%** of the electric light



Directive 2006/32/EC about energy efficiency and energy services

- Increasing energy efficiency and energy services in the EU member states
- Market penetration of energy efficient products.

Objectives:

- Reducing energy consumption and restructuring of the energy 'market'
- Energy efficiency targets for member states r: +1% increase p.a. over 9 years
- Member States must draw up National Action Plans and review them at every 3 years.

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2005/32/EG The Eco Design Directive establishing a framework for setting Eco-design of Energy-using Products

Core requirement:

- Development of environmentally friendly products (product design)
- Restriction of selling non-environmentally friendly products

Targets:

- Regulation of product design
- Saving of energy and other resources during manufacture, use and disposal of affected products
- Carrying "bad" light bulbs out of the market, Up-sell for efficient light bulbs

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What reduction in CO2 emissions are expected by the guidelines?

- Electric Propulsion Systems 39 Mio t CO₂
- Office equipment, private and tertiary 34 Mio t CO₂
- **Lighting, private and tertiary** **24 Mio t CO₂**
15% of the value of 2000
- Consumer Electronics 14 Mio t CO₂
- Heating 12 Mio t CO₂
- Household Appliances 12 Mio t CO₂
- Commercial HVAC 8 Mio t CO₂



Ban incandescent light bulbs? by the EU

- The concept of banning incandescent light bulbs is not correct
- It is correct:

the gradual prohibition of non-efficient lightning bulbs (EU Comitee decision 2009-12-08)



Steps of banning the incandescent lamps

1. Stage September 2009:

Sales ban

- all halogen and incandescent lamps >80 W,
worse than the energy efficiency class C
- all halogen and inc. bulbs between 7 W und 500 W,
worse than the energy efficiency class E
- matted halogen and inc. light bulbs,
worse than the energy efficiency class A
- all energy saving lamps,
worse than the energy efficiency class A

Steps of banning the incandescent lamps

- 2. Stage September 2010: Sales ban on all halogen and inc. lamps > 65W, which are worse than energy efficiency class C.
- 3. Stage September 2011: Sales ban on all halogen and inc. lamps > 45W, which are worse than energy efficiency class C.
- 4. Stufe September 2012: Sales ban on all halogen and inc. lamps > 7W, which are worse than energy efficiency class C.
- 5. Stufe September 2016: Sales ban on all halogen and inc. lamps, which are worse than energy efficiency class C.

Exceptions to the incandescent bulbs

- Incandescent bulbs < 7 W
- Special lamps with identification for special applications and not suitable for ambient lighting (eg, oven lamps, UV lamps)
- Halogen lamps with R7s or G9 Base may continue to have energy efficiency class C
- By 2013, there are exceptions for example, Lamps with base S14 (line lamps)

S15 und S19 (Soffittenlampen).



Alternatives to the incandescent lamp

Incandescent lamp
old, inefficient technology



- low light yield 10 - 13 lm/W
- lifetime 1.000 h
- very good lightening color (100)
- Energy efficiency class E - G

HV halogen lamps
new, energy-efficient technology



- high light yield 12 - 15 lm/W
- lifetime 2.000 h
- very good lightening color 100
- Energy efficiency class C (D)

Alternatives to the incandescent lamp

Incandescent lamp
old, inefficient technology



- low light yield 10 - 13 lm/W
- lifetime 1.000 h
- very good lightening color (100)
- Energy efficiency class E - G

Energy saving lamps
new, energy-efficient technology



- very high light yield > 50 lm/W
- lifetime > 6.000 h
- very good lightening color >80
- Energy efficiency class A (B)

Alternatives to the incandescent lamp

Incandescent lamp
old, inefficient technology



- low light yield 10 - 13 lm/W
- lifetime 1.000 h
- very good lightening color (100)
- Energy efficiency class E - G

LED-Lamp

new, energy efficient technology



- very high light yield > 40 lm/W
- lifetime > 15.000 h
- good lightening color >80
- Energy efficiency class A

annual number of light bulbs sold in Europe: 2,1 Mrd.

possible CO₂-savings: 23 Mton / a



Requirements for „Tertiary-Sector“

(Street lighting ; Office lighting)

■ **Directive 2005/32/EG**

Regard to the setting of ecodesign requirements

- to fluorescent lamps without integral ballast ,
- High intensity discharge lamps and ballast devices, and lamps

Council Directive **2000/55/EG** of the European Parliament and Council to their operation and repealing.



What comes with 1 Level (2010) ?

Lamps	Ballasts	Luminaires
Ban of L-T8 lamps in Halophospat execution	For all L-Lamps, in accordance with table, minimum energy-efficiency index "EEI"	Luminaires with > 2000 total lamp lumen, websites and information in appropriate technical information documents (after 18 months)
Ban on all L-Lamps T8 and T5 with color Index Ra <80	For L-Lamps, not incl. In the table, min. Energie-efficiency-Index „EEI“	
For L-lamps and bulbs ,high pressure' - information in suitable sites and technical information documents	Identification of the energy-efficiency index "EEI" or the efficiency of the blast ("řballast") on the devices	
	L-lamps allowable standby power <1 W (no light bulbs)	Lamps standby power is not greater than any ballast with <1W (no light bulbs)





What comes with the 2nd Level (2012) ?

Lamps	Ballasts	Luminaires
Ban of L-T10 and T12 lamps in Halophospat-Execution	Minimum values for energy efficiency of high-intensity discharge lamps "ηballast",	Luminaires in protection <IP4X also available with and for ballasts with efficiency after 3rd Stage.
Prohibition of less efficient high pressure sodium lamps	In high pressure lamps indication "ηballast" on the ballast itself	
Prohibition of less efficient metal halide lamps (E27, E40 and PGZ12)		Information in suitable sites and technical information documents now for all lights
After (2015) ban on high-pressure mercury vapor lamps. Ban on sodium vapor lamps (retrofit lamps)	L-lamps allowable standby power <0,5 W (no light bulbs)	Lamps standby power is not greater than any ballast with <0,5 W (no light bulbs)

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What comes with 3th Level (2017) ?

Lamps	Ballasts	Luminaires
Prohibition of large number of metal halide lamps (E27, E40 and PGZ12)	For L-lamps - prohibition of devices with „EEI“ von B1, B2, A3	Now all the lights with ballasts, which the 3rd Step
Ban of L-lamps, that can only be operated with conventional ballasts, for example L compact lamps with 2 - pin socket	For high-pressure lamps have higher "ηballast"	

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Street lighting

- **1. Phase 2010:**
Prohibition of mercury vapor lamps with prescribed minimum efficiencies *for all lamps (in the meantime changed to 2015)*
- **2. Phase 2012:**
Ban less efficient high pressure sodium vapor lamps and metal halide lamps
by defining minimum performance requirements (except for retrofit as mercury vapor lamps)
- **3. Phase 2014:**
Ban less efficient high pressure sodium vapor lamps without exception

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Office and industrial lighting

- **2010:** Inefficient T8 fluorescent lamps are replaced by efficient technologies
- **2012:** T10 / T12 fluorescent lamps and lamps with conventional ballast – end of use.
- **2017:** Lamps, that can only be operated with conventional ballast (eg, compact lamps with 2 pins) – end of use.

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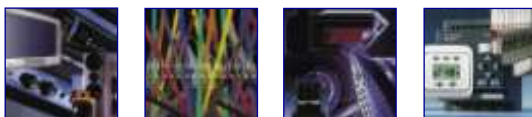
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VDE – Your Partner for Safety and Quality

- Non-profit activities and independence
 - intensive cooperation with market surveillance authorities
- Cooperation with ministries and authorities
 - Chair of the sector committee 'Low Voltage Directive' EK 1 of the Central Authority of the Federal States for Safety (ZLS)
- Active participation within the standardization committees of the electro technology
 - High competence concerning laws, directives and standards



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VDE – Outline of our services

<ul style="list-style-type: none"> ■ Safety and EMC 	<ul style="list-style-type: none"> • Testing and certification of standard conformity • Standards consulting • Conformity tests during the development phase
<ul style="list-style-type: none"> ■ Chemical product analysis 	<ul style="list-style-type: none"> • Testing for hazardous materials (PAH) • Confirming RoHS conformity • Assessing the compliance with the WEEE guideline
<ul style="list-style-type: none"> ■ Usability testing 	<ul style="list-style-type: none"> • Evaluation of the handling, ergonomics and operational function • Energy efficiency & noise emission measurement; product ecology • Reliability test; hygiene and sensorial tests
<ul style="list-style-type: none"> ■ User manuals 	<ul style="list-style-type: none"> • Creation of an ergonomic design • Risk analysis • Consumer tests
<ul style="list-style-type: none"> ■ Supporting the purchasing process 	<ul style="list-style-type: none"> • Information concerning legal product requirements • Construction design evaluation and product assessment • Supplier qualification
<ul style="list-style-type: none"> ■ Inspections and assessments 	<ul style="list-style-type: none"> • Monitoring of production sites worldwide • Certification of management systems • Special inspections (e.g. pre-shipment inspection)
<ul style="list-style-type: none"> ■ International certification 	<ul style="list-style-type: none"> • Obtaining product admissions, globally • Issuing of CB certificates and CCA notifications



Product range



- Consumer electronics
- IT and multimedia
- Electrical household appliances
- Wellness and fitness appliances
- Electrical tools
- Garden equipment
- Luminaires
- Photovoltaics
- Industrial technology
- Medical technology
- Cables and cords
- Electrical and electronic components
- Installation technology

... and much more





Testing of lamps and lamp-holding device by the VDE Institute

- Examination of the safety and operation of energy saving lamps and control gear
- Testing the energy efficiency of lamps and ballasts
- Flux measurements in the Ulbricht sphere
- Testing of LED modules and LED lamps with integrated ballast
- Measurement of light color



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Overview of the VDE marks (selection)

Safety and EMC



Usability / Quality label



Chemical product assessment



- VDE RoHS compliant
- VDE toxicity tested
- VDE hygiene tested
-

Certification of management systems



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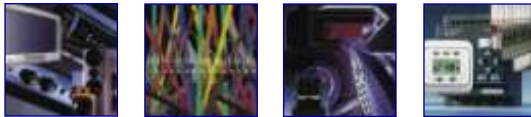


Our Marks for Safety

The ENEC-Mark of the VDE



Safety mark for electrical products according to harmonized certification procedures; at present luminaries, luminary components, energy saving lamps, information technology appliances, transformers, switches for appliances, electrical control systems, terminals, appliance couplers, different kinds of capacitors and noise suppression components.



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The international orientation of the VDE



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VDE International Certification Services

Concrete VDE offerings

- Administrative processing for approvals in all countries within the framework of international certification procedures
- Use of a framework of bilateral co-operations with the most important certification bodies
- Issuance of CB and CCA certificates for applications of national approvals in other countries
- Generally transformation into foreign approvals without re-testing
- Factory surveillance on behalf of the foreign body is mostly conducted by VDE inspectors within VDE routine inspections



WARNING!

- On the market at the moment are some 'little questionable' exchange lamps that do not meet the standards.
- The certification may be an appropriate risk assessment of the manufacturer.

Examples of non-standard lamps

- Energy saving lamp with base G9
- The allowable weight of 12 g will be greatly exceeded
- This allows it to fall out of the lampholder



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Examples of non-standard lamps

- Energy saving lamps with base R7s
- By the great weight outside of the axle creates a very large torque, which can lead to the protection against the version erupts



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Examples of non-standard lamps

- LED Lamp with base G13
- To exchange for fluorescent lamps T8
- Problem: The operating devices are to be removed from the lamp and the LED-lamp must be supplied with 230 V
- Not an easy replacement of the lamp. Luminaire must be changed.
- Loss of warranty and the approval of the lamp
- Big trouble for redemption against possible conventional lamps .



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Thank you for your attention!

Иван Хр. Стамболиев

VDE Институт за изпитване и сертификации/
VDE Pruef- und Zertifizierungsinstitut

Представител за Р България

ул. Ивац 12 9009 Варна

Tel.: int. +359(52)981802

Fax: -int. +359(52)981802

Mobile: +359(889)228224

e-mail: ivan.stamboliev@vde.com

<http://www.vde.com>

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