Presentation on

Worldwide Light sources and Fluorescent light market

Presented by:
M. M. Ahtashom

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Introduction

A typical "light source" emits electromagnetic radiation in the visible spectrum. The list is oriented towards visible light: nearly everything emits photons through blackbody radiation.

Classification of Light sources

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    - 2.2 Terrestrial
3. Direct Chemical
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1. Combustion

- Fire

2. Natural

2.1 Celestial and atmospheric light

- Astronomical objects
  - Sun (Sunlight (solar radiation))
  - Starlight (Stars forming groups such as Star clusters and galaxies and indirectly lighting nebulae)

- Lightning (Plasma)
  - Sprite (lightning)
  - Ball lightning
  - Upper-atmospheric lightning
  - Dry lightning
- Aurorae
- Cherenkov radiation (from cosmic rays hitting atmosphere)

- **2.2 Terrestrial**
- Bioluminescence
  - Luciferase - found in glowworms, fireflies, and certain bacteria
  - Aequorea victoria (a type of jellyfish)
  - Antarctic krill
  - Parchment worm (Chaetopterus), which exhibits blue bioluminescence despite having no light sensitivity
  - Cavitation bubbles
  - The common piddock (*Pholas dactylus*)

- A volcano
- Incandescence
  - Volcanic
  - Volcanic eruption (lightning, heated material)
  - Lava
  - Lava flow
  - Lava lake
- Radioluminescence (man-made)
- Triboluminescence (also man-made)
- Earthquake light

3. Direct chemical

- Chemoluminescence (Lightsticks)
- Fluorescence
- Phosphorescence

4. Electric powered

4.1 Electron stimulated

- Cathodoluminescence
- Electron stimulated luminescence (ESL light bulbs)
- Cathode ray tube (CRT monitor)
- Ne discharge tube

4.2 Incandescent lamps

- Carbon button lamp
- Conventional incandescent light bulbs
  - Flashlight
- Halogen lamps
- Globar
- Nernst lamp

4.3 Electroluminescent (EL) lamps

- Light-emitting diodes
  - Organic light-emitting diodes
  - Polymer light-emitting diodes
  - Solid-state lighting
  - LED lamp
- Light-emitting electrochemical cells (LECs)
- Electroluminescent sheets
- Electroluminescent wires
- Field-induced polymer electroluminescent (FIPEL)

4.4 Gas discharge lamps

- Fluorescent lamps
  - Compact fluorescent lamps
  - Black light
- Induction lighting
- Hollow cathode lamp
- Neon and argon lamps
- Plasma lamps
- Xenon flash lamps

4.4.1. High-intensity discharge lamps

- Carbon arc lamps
- Ceramic discharge metal halide lamps
- Hydrargyrum medium-arc iodide lamps
- Mercury-vapor lamps
- Metal halide lamps
- Sodium vapor lamps
- Sulfur lamp
- Xenon arc lamps

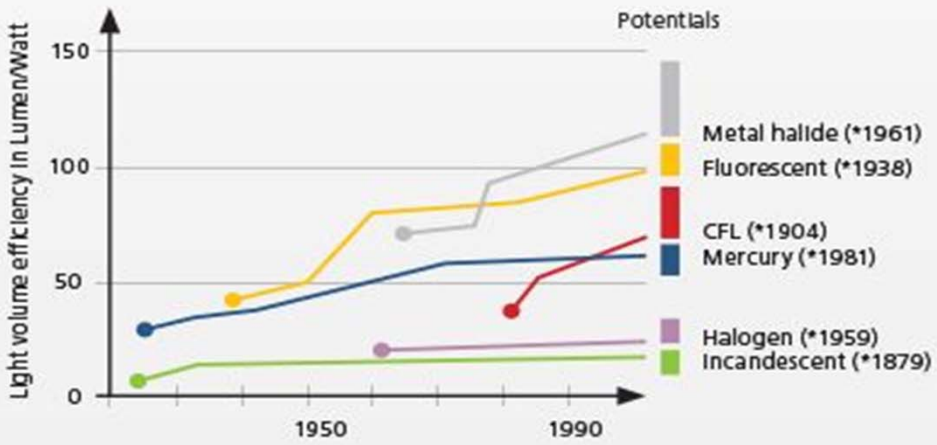
Other

- Annihilation
- Nepal tube lights
- Blackbody radiation
- Bremsstrahlung
- Cherenkov radiation
- Cyclotron radiation
- Diffuse sky radiation
- Electrodeless lamp
- Explosion

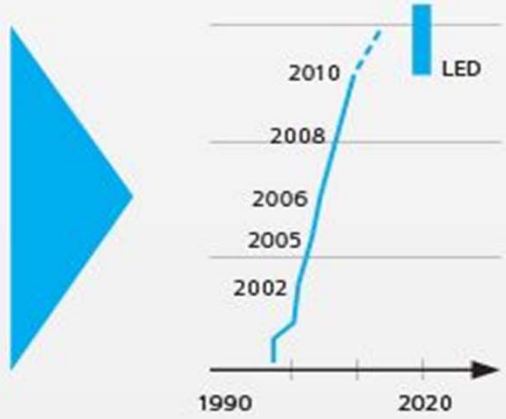
Lighting Efficiency Comparison

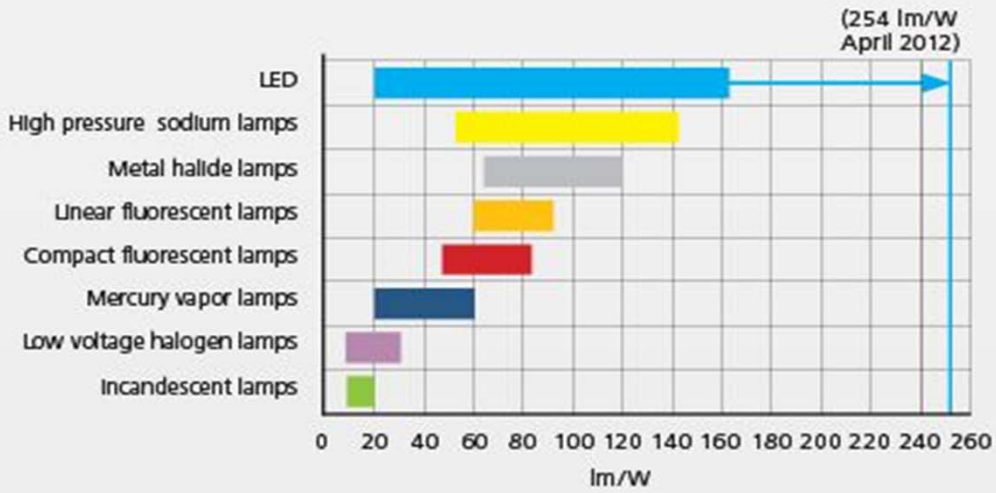
If we compare efficacy of the light sources over the time (Figure 7.2.1), we can confirm that LED technology is the fastest growing technology in lighting.

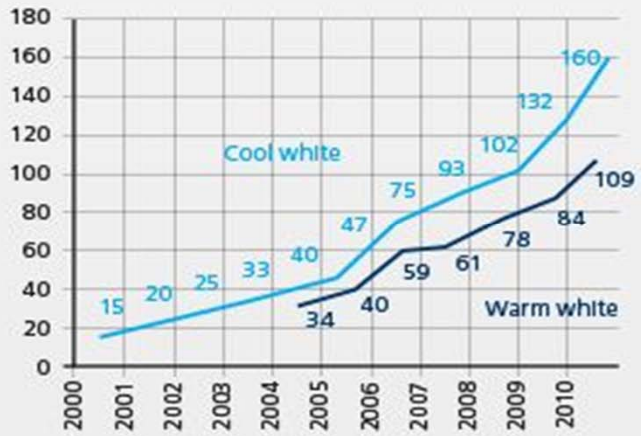
CONVENTIONAL TECHNOLOGIES



SOLID STATE LIGHTING



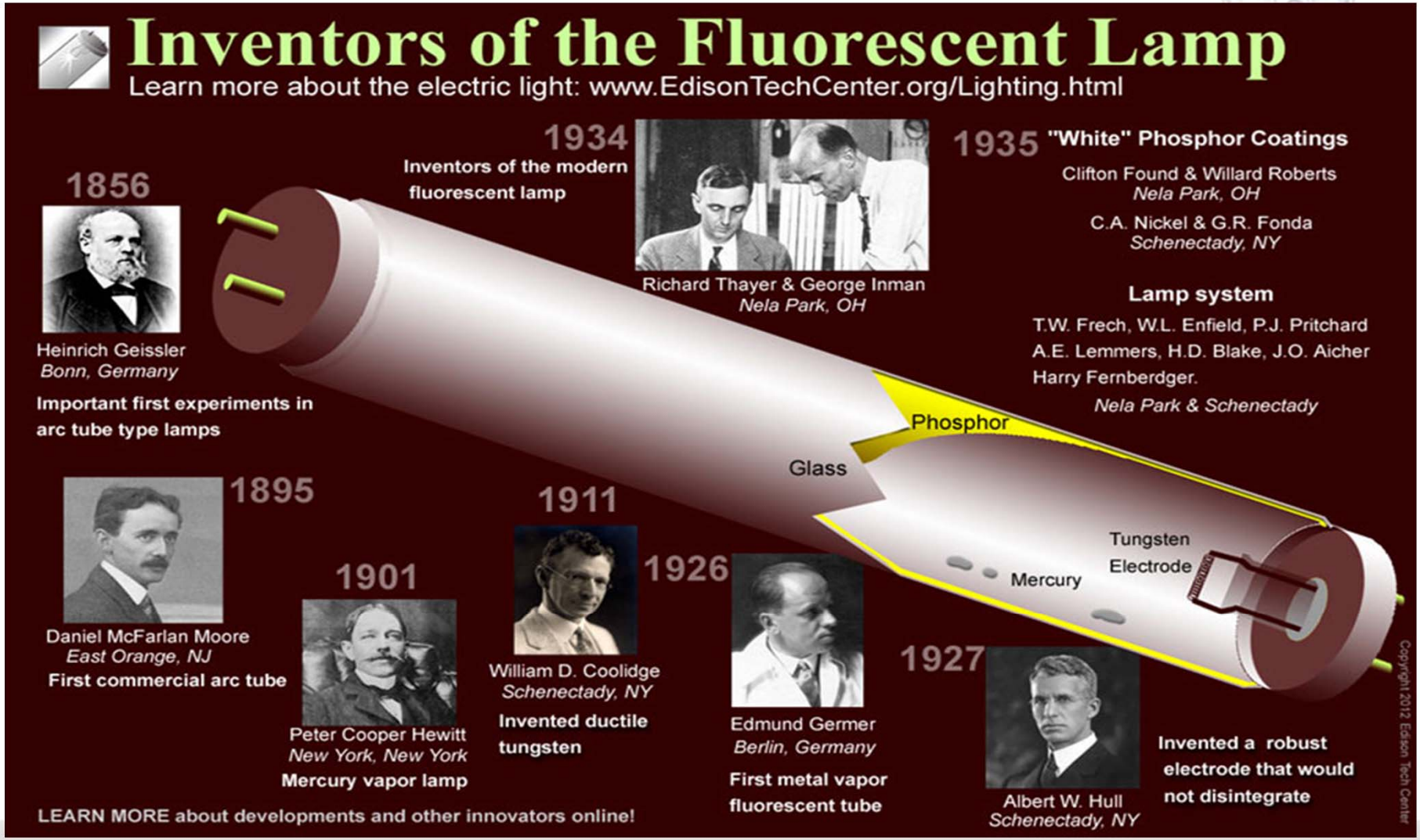




Fluorescent lamp

- There are a wide variety of non-incandescent visible light sources that are employed for indoor and outdoor lighting, in addition to having important applications in optical microscopy. Most of these light sources are based on electric discharge through a gas such as mercury, or the Noble gases neon, argon, and xenon.

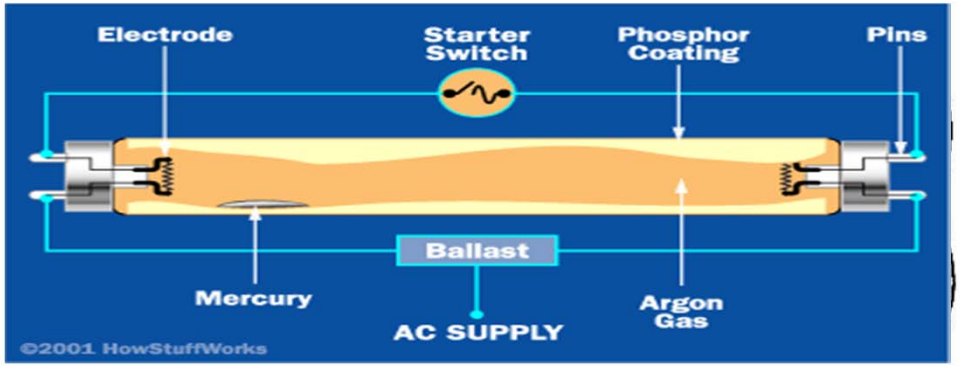
History Background



SLI LIGHTING

HOW IS LIGHT PRODUCED

The fluorescent lamp produces light by the passage of an electric current flowing through a vapor of mercury.



1.Electron emitted from electrode collides with mercury atom.

2.Impact produces ultraviolet rays

3.Phosphor converts ultraviolet to visible light.

This process is known as “fluorescence,” hence the name fluorescent lamp.

Types of Fluorescent lamps

- **Linear fluorescent lamps (LFLs)**
- **Compact fluorescent lamps (CFLs)**

Linear fluorescent lamps (LFLs)

-- are gas-discharge lamps that use electricity to excite mercury vapor.

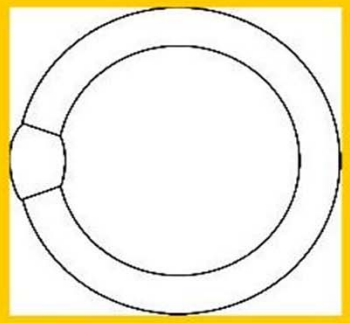
-- LFL has a relatively high luminous efficacy (~ 35 - 87 lumen per watt)

-- lifetime of 7,500 - 20,000 hours with T8 as an example.

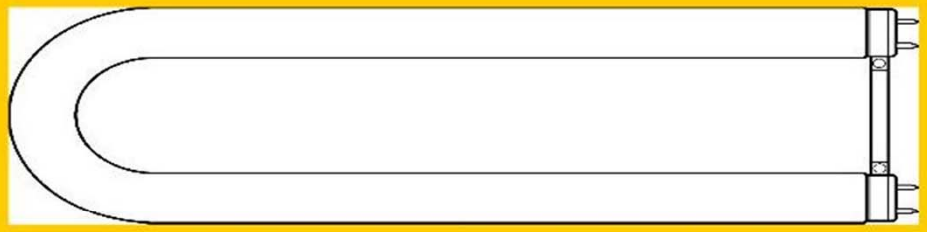
-- The luminous efficacy of LFLs is high, but the color quality is low (~ 52 - 90 CRI), and the color tends to be cold.

Fluorescent Lamp Types (Linear)

- T12 HO: 800 mA, high output lamp
- T12 WM: 34W lamp, norm in most fixtures still using lamp
- T8 32W: new industry norm for troffers
- T5 and T5HO: great for indirect



- Circline: Table lamps and some surface fixtures



- T12 and T8 U-Tube, good for 2'x2' applications

Compact fluorescent lamps (CFLs)

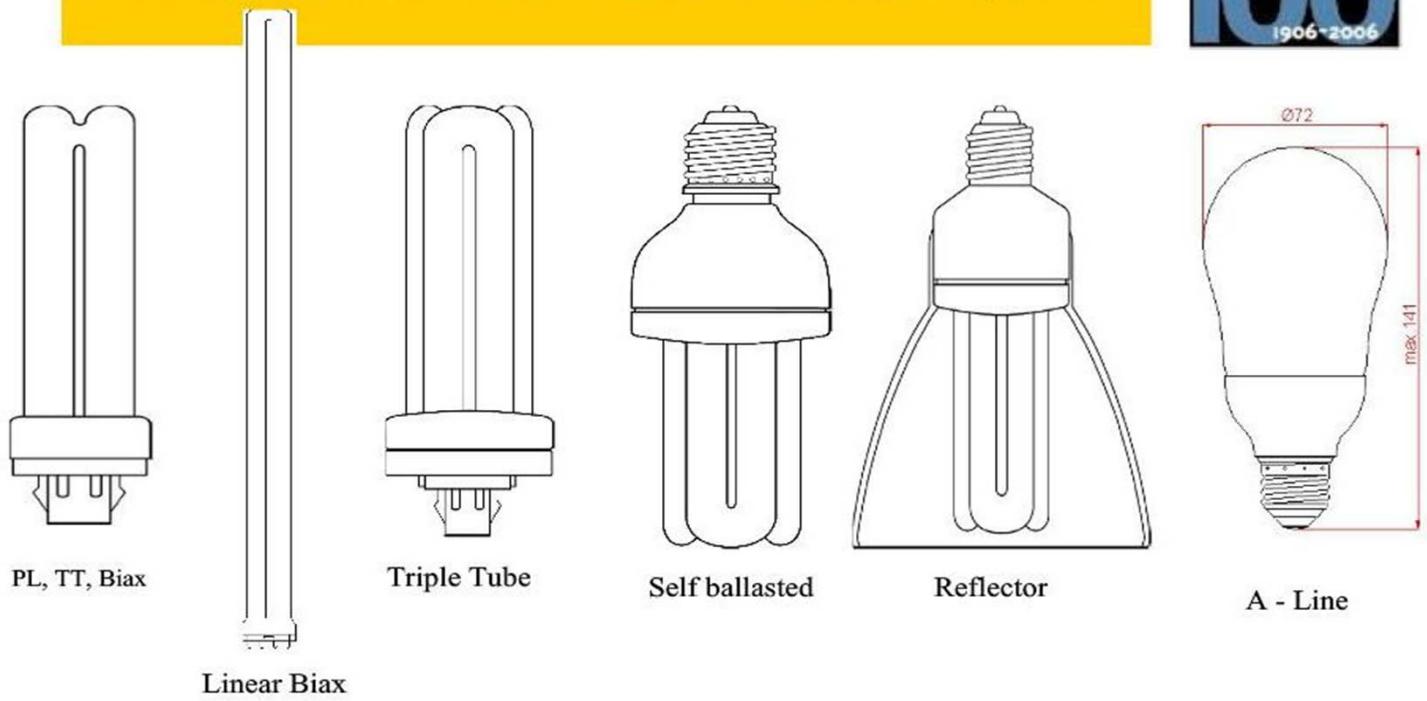
-- contain a gas that produces invisible ultraviolet light (UV) when the gas is excited by electricity. The UV light hits the white fluorescent coating material inside the bulb and the coating changes it into visible light.

-- CFLs have a luminous efficacy of 40 - 70 lumen per watt

-- lifetime of ~ 10,000 hours.

-- The color quality has traditionally not been as good as incandescent even though it is improving,

Compact Fluorescent Lamp Types:



Popularity of Compact fluorescent lamp (CFL)

→Less Mercury.

OPERATING CHARACTERISTICS

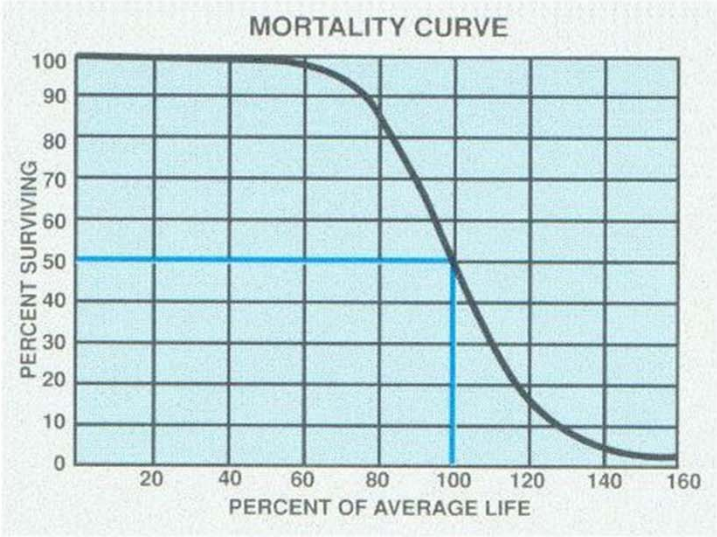
SLI LIGHTING

RATED LIFE AND MORTALITY

As with incandescent lamps, rated hours life refers to the average life of a large group of lamps operated under specified conditions.

Some lamps will fail before their rated life, others will still be burning beyond their rated life.

In general, 50% of a large group of lamps will fail by the time rated life is reached.



Applications

- in kitchens, basements, or garages, schools and businesses.

- stage lighting for film and video production.

Things to note with Fluorescent Lamps

- Dimming requires a special more expensive ballast
- Frequent switching reduces lamp life
- Temperature sensitivity
- Compact fluorescent + occupancy sensor can be slower warm up time

Advantages

- Fluorescent lamps convert more of the input power to visible light than incandescent lamps.

- The efficacy of fluorescent tubes are much higher than a modern electronic ballast.

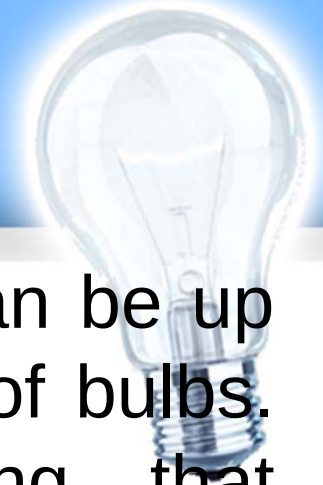
- Typically a fluorescent lamp will last between 10 to 20 times as long as an equivalent incandescent lamp

- Compared with an incandescent lamp, a fluorescent tube is a more diffuse and physically larger light source.

- About two-thirds to three-quarters less heat is given off by fluorescent lamps compared to an equivalent installation of incandescent lamps.

- This greatly reduces the size, cost, and energy consumption.

Disadvantages



- The initial cost of fluorescent lighting can be up to three times higher than other types of bulbs. Many people see this as meaning that fluorescent lights are more expensive, but the truth is quite the opposite, since they last longer and save money in the long run.

- Some lighting may require professional installation the first time around, as the electrical connections are more complex.

- Some fluorescent bulbs can flicker noticeably and produce an uneven light that may bother some users. Once the flicking becomes obvious to the eye, there is no choice but to replace the lamp.

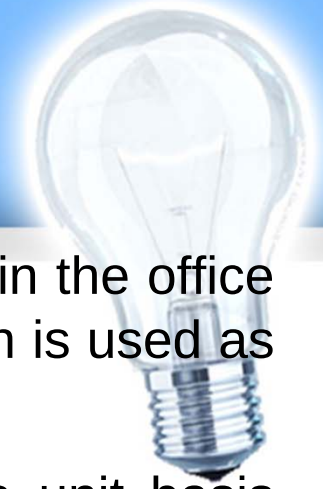
- Fluorescent lighting is often less attractive. Unless you invest in special decorative ways to hide the lamps, they are often visible and can take a lot from the visual aspect of the room. Traditionally, fluorescent bulbs only came in bright white, although a wider range of tones is now available.

Commercial Prospect

- Though LED applications are expected to see fast growth but in Office and industrial applications of LED light will be slower movers due to the current high penetration of cost-competitive linear fluorescent lamps.

- European consumers tend to prefer warm colored light, which favors the halogen market, while those in Asian markets have strong preference for warm-colored light, high energy efficiency, and long lifetime, giving the fluorescent lamp an advantage.

- The second largest light source on a unit basis is the fluorescent lamp, which is already the largest based on value, with a share of over 50 percent.



- The linear fluorescent lamp (LFL), which is mainly used in the office segment, and the compact fluorescent lamp (CFL), which is used as a replacement light source for incandescent bulbs.
- LFL's current market share is around 16 percent on a unit basis (19 percent based on value), while CFL's is 17 percent (31 percent by value). CFL's growth has been significant over the past few years as many governments have been supporting CFL to restrict incandescent usage.
- Application at shop--LED is already better than LFL and CFL where many light quality features are concerned, but its current challenge versus these fluorescent lamps is cost.
- Major light sources in the outdoor -- LFL for narrow-area lighting.
- The current very high fluorescent market share – even in residential segments – will be a barrier to expansion of the total LED general lighting market.

Compact Fluorescent Lamp (CFL) Recycling Project

The expected benefits of this project include:

- Convenient recycling method for household CFLs
- Increased economic activity from the promotion and recycling of energy efficient products
- A replicable model for other states or regions to use when implementing CFL recycling
- The reduction of one of the sources of mercury to landfills
- Improvement in the environment for human health and ecosystem protection

Reference

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