

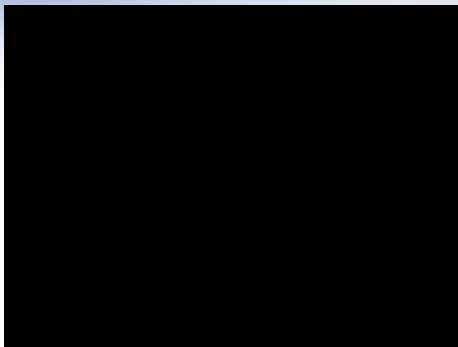
Lighting Systems



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Luminous Flux (lm)



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Luminous Efficacy (lm/W)



Lamps	Life (hrs)	Efficacy (lm/W)
GLS	1000	14-16
CFL	6000-8000	60-65
FTL	12000- 18000	70-104
Metal Halide	10,000-12,000	65 to 90
HPSV	15,000-20,000	90-140
LED	50000	90-100
Induction	80000	60-80

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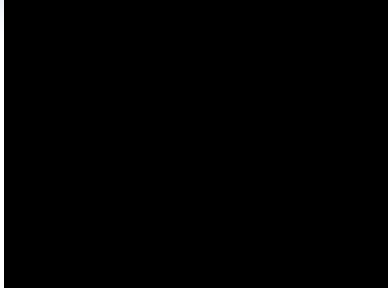
Color Rendering Index (CRI)



Source	CRI
Incandescent	100
FTL	60-95
Mercury Vapor	70
Compact Fluorescent	65-85
Metal Halide	65-90
LPSV/HPSV	0/22

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Illuminance (lux)



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GLS v/s CFL

Comparison					Cost	Life
GLS	Watts	100	60	40	Rs.10/-	1000hrs
	Lumen Output	1380	720	425		
CFL	Watts	20	15	9	Rs.120/-	10000hrs
	Lumen Output	1300	900	400		

$\frac{80W \times 10hrs/day \times 365 days \times Rs\ 4/kWhr}{1000} = Rs\ 1168/-$ per year Savings for One Lamp

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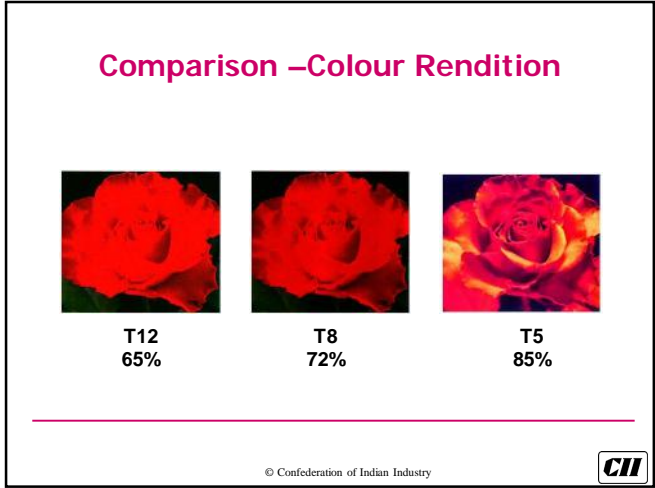
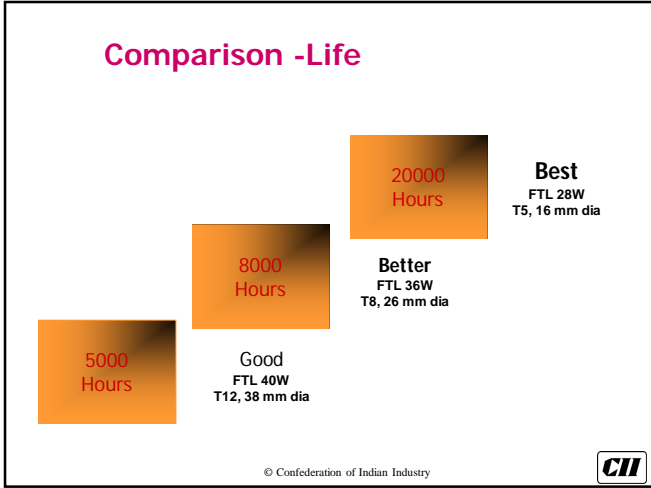
Fluorescent Lamps



T5: .625 in, 104lm/W
 T8: 1.00 in, 68lm/W
 T12: 1.50 in, 60lm/W



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High Intensity Discharge Lamps

- Mercury Vapour Lamps
- Sodium Vapour Lamps
- Metal Halide Lamps

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Comparison Of Various Lamps

Type	Watt	Lumens	Efficacy
HPMV	250	13500	54
HPSV	250	27000	108
Metal halide	250	20000	80

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Comparison of HPMV & HPSV

HPMV	Watts	80	125	250	400
	Lumens	3500	6250	13500	23000
HPSV	Watts	70	150	250	400
	Lumens	5800	13500	27000	47500

- High efficacy for HPSV - 108 Lumens / Watt
- Colour rendering – poor (<40)
- Godowns, Storage yards, ware House, Highways, Flood lighting and Street Lighting

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Case Study - Replace HPMV Lamps With HPSV Lamps

❖ Street lighting, Yard lighting and some plant area

➤ 120 Nos. 250 Watts HPMV

❖ Replaced by 120 Nos. 150 Watts HPSV

➤ Power Savings : 12 kW

Annual Savings : Rs.1.60 lakhs

Investment : Rs.2.00 lakhs

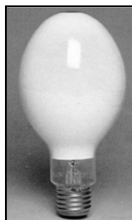
Payback : 15 Months

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Metal Halide Lamps

- ❖ Gas discharge lamps
- ❖ Excellent colour rendering
- ❖ High light output
- ❖ Suitable for colour critical areas



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Replacing MV Lamps with Metal Halide Lamps

❖ 250 W MV lamps were in use – 55 Nos

➤ Shop floor area

➤ HPSV not suitable due to poor colour

❖ Replaced with 150 W metal halide lamps

Annual Saving - Rs 0.84 Lakhs

Investment - Rs 1.5 Lakhs

Payback period - 22 Months

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Voltage & Power of Lamp



- ❖ 3 Phase voltage supplied at 415V
 - ❑ Equivalent Phase voltage
 - 240V
- ❖ Optimum voltage required for discharge lamps is 210-220V
 - ❑ 10% reduction in voltage results in 10% reduction in power consumption
 - ❑ Reduction in lux level is minimal and can be identified only with digital lux meters

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Lighting Transformer



Output Voltage
Maintained at 415V 3 ϕ



Output Voltage
Maintained at 190-240V 1 ϕ
Lighting Load
supplied at 240V 1 ϕ

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Case Study- Automobile Industry



- ❖ Distribution voltage of plant maintained at 420V
 - ❑ Lighting load supplied from the same transformer
 - 243V 1 ϕ supply
 - Total lighting load – 180kW (night time)
- ❖ Installed a separate lighting transformer
 - ❑ 210kVA Capacity
 - ❑ Maintained supply voltage at 220V
 - 9% reduction in supply voltage
 - Equivalent to 9% reduction in power consumption
 - Savings- 16kW

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Other Opportunities in Lighting Energy Conservation



- ❖ Maximum utilisation of natural light
- ❖ Combination of Day light & Artificial light lamps
- ❖ Natural Light Controlled by Motorised Blinds
- ❖ Sensors to detect natural lighting & switch-on artificial light
- ❖ Providing limit switches in MCC rooms

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Other Opportunities in Lighting Energy Conservation



- ❖ Use movement sensor and dimmer control system, wherever required
- ❖ Proper grouping of lights and proper control system
- ❖ Timer based on/off system or lux level control for street lighting

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Other Opportunities in Lighting Energy Conservation



Cost Effective Option:

**Employing proper maintenance
& cleaning programmes**



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LED Lamps



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What is LED ?



❖ LED

- ❑ A P-N junction diode that emits light when current passes through it
- ❑ Can be produced in various colours
 - Depends on semi-conducting material
 - Depends on impurities added
- ❑ Only based on solid state lighting
 - No glass or fragile material used

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Advantages of LED



- ❖ Longer life : 100,000 burning hours
- ❖ Can withstand
 - ❑ Vibrations
 - ❑ Heat & cold climate
- ❖ Lower power consumption
 - ❑ 1 Watt/LED

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Advantages of LED



- ❖ Low light loss in other directions
 - ❑ More focussed light with special fixtures & optics
- ❖ Eco friendly
 - ❑ Contains no pollutants like mercury
- ❖ Reduced glare
 - ❑ Increased road safety



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Light Emitting Plasma (LEP)



- ❖ Emits light from a small area, in a forward direction into a lambertian pattern
- ❖ LEP
 - ❑ Electrode-less quartz lamp encased by a ceramic resonator



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Light Emitting Plasma (LEP)



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Light Emitting Plasma (LEP)



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Light Emitting Plasma (LEP)



❖ LEP's plasma 'arc' directly emits a full-spectrum white light without the need for a secondary phosphor conversion like in LED or Induction sources



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Light Emitting Plasma (LEP)



❖ Eliminates

- ❑ Energy wasted as heat in the electrodes
- ❑ Glass-to-metal seals which are typically the weakest link of an HID lamp
- ❑ Quartz wall darkening, a source of lumen depreciation and failure, as electrode material evaporates and deposits on the transparent surface of lamp.
- ❑ Molybdenum foils allowing faster warm-up and restrike times

❖ Dimmable – 20%

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LEP- A Case Study @ITC



Innovative Project – 4 (Energy Cell) Energy Efficient Lighting System

Past Scenario :

We have fifty two Hibay lamps in Finishing House area. Hibay was powered with 400W Metal halide lamps. Metal halide is energy inefficient in current scenario. So alternate energy efficient lamps like LED, Induction & LEP were studied.

Present Scenario :

We installed 27 Nos of 270W LEP (Light Emitting Plasma lamps) in place of 68 Nos Metal halide lamps. Plasma lamps are energy efficient and coverage factor is very high. Also S/P ratio of plasma lamp is higher (>2), which shows that objects will be much more sharper in plasma lamps at lower energy.




Project Summary:

Energy Savings	690	Units/Day
Investment	27.8	Lakhs
Payback	38	Months


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Graphene



Strong
Graphene is 200 times stronger than steel.

Thin
The thinnest material on earth - 1 million times thinner than a human hair.




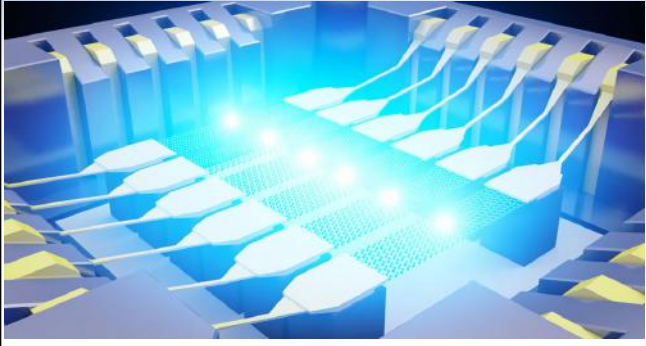
Two-dimensional
The world's first 2D material, opening the doors to new, experimental fields.

Conductive
The world's most conductive material.

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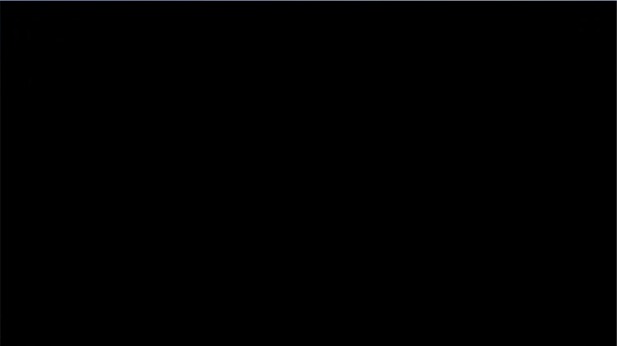
Stretchable
As well as transparent, flexible and impermeable.

Thinnest Light Bulb


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Thinnest Light Bulb

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Light Pipes








Roof
Light Collector
Mirror Finished Light pipe
Light Diffuser
Daylight coming in



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Light Pipes



Diameter of lightpipe	Light pipe length recommended	Approx. area that can litup
250 mm	6 m	150-175 sft
400 mm	9 m	300-350 sft
530 mm	15 m	500-600 sft
750 mm	24 m	900-1000 sft


Day Light Harvesting








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Day Light Harvesting



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Day Light Harvesting






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Latest Technologies – Light Pipe



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Latest Technologies – Light Pipe



Electrical lighting	LightPipe™
	

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Latest Technologies – Light Pipe



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Latest Technologies – Light Pipe



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Hybrid Energy Solution

- ❖ Harvest two or more different energy sources and convert to a single form of energy
 - ❑ Offsets seasonality
 - ❑ Consistent energy generation
- ❖ Hybrid Solar and Wind energy system
 - ❑ Solar Mill



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Hybrid Energy Solution




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Few Installations

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Lighting Control

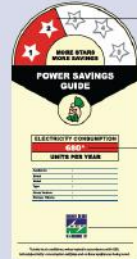
- ❖ Occupancy Sensors



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Equipment Energy Savings






Count the stars with in the colored strip. More Stars, More Savings

Know the number of electricity units consumed in one year

See the BEE logo for authenticity of the Label



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BEE Star Labeling






BEE STAR LABEL
is now
MANDATORY!

- for Frost Free Refrigerators, Room ACs, Tubular Fluorescent Lamps and Distribution Transformers

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BEE Star Labeling



❖ 250lt frost free refrigerator

Star Rating	Energy Consumption Per Year (Approx.)	Per Unit Charge (Approx.)	Electricity Cost/year	Total Savings (w.r.t No Star Every Year)	Refrigerator Cost (Approx)	Cost Difference	Pay Back Period
	Units (kWh)	Rs.	Rs.	Rs.	Rs.	Rs.	Years
No Star	1100	2.50	2750	0	14000	0	0
1	977	2.50	2443	308	15000	1000	3.25
2	782	2.50	1955	795	15500	1500	1.89
3	626	2.50	1565	1185	16500	2500	2.11
4	501	2.50	1253	1498	17500	3500	2.34
5	400	2.50	1000	1750	18500	4500	2.57

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If He Can, Why Can't WE



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Let's Not Go Back To This Stage



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