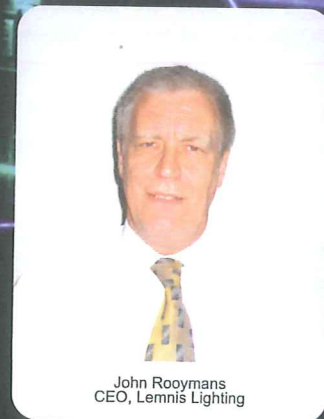


ARE LED LIGHTS READY FOR HOME LIGHTING?

An important value to look out for when buying LED drivers is how much lumen per watt [lm/W] the lamp provides.



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CEO, Lemnis Lighting

LED lights are lately more and more in the picture. The first remark people always make when they see LED lamps is that they are expensive. When compared with an incandescent bulb that might seem true but when taking the energy use in consideration it's not true.



vantage of CFL's is that the lumen out put drops during the average lifetime of 6000 hours up to 50%. Therefore one could say that CFL's give over their lifetime is 37,5 to 49 lm/W.

Energy savings

A realistic savings comparison between the different lamps should be based on the real light one gets for the money. Therefore the real lumen in the table are based on the fact that the average light over the lifetime for CFL is only 75% and for Led lamps 85%.

After that the compared real lumen are made equal to each other

typical type	Watt	Lumen	Lm/W	avrg real	avrg lifetime	avrg real lm	equalized	avrg e cost 10 year
Incandescent	40-60	400-710	10 - 12	11	1000	550	0,95	4,921
Halogen	35-50	320-400	9	9	1500	382	0,66	5,473
CFL	9-18	500-1200	50 - 65	43	6.000	580	1,00	1,147
Good LED	3 - 8	200 - 600	66 - 75	60	35.000	330	0,57	820

so that each lamp is compared at the same amount of light. The energy cost in Rs. over a period of 10 year is given in the last column based on a constant Rs. 5 per kWh at 17.000 hours. The cost of new lamps that are to be bought over that 10 year is not considered in this table.

Light comfort

LED lamps are bright enough for general purpose lighting. The amount of light of a LED house light is meeting the level of the low power incandescent and CFL lamps. The world wide trend in the past decades in lighting is more light points in the house.

This is more comfortable than using one very bright lamp in a room. With one lamp there will be spooky shades on the walls and objects will be lighted from one side. More lamps of reduced power produce much more uniform light which will light objects from all sides and avoid shadows.

The brightness of lamps should never be too high. Small light sources or uncovered lamps can be very bright. This will reduce the pupil size. A lamp with a large milky bulb is more comfortable to the eye. Standing lamps are used with a cap. This is especially done to reduce the intensity of the glowing wire in the bulb and enlarge the lighting surface.

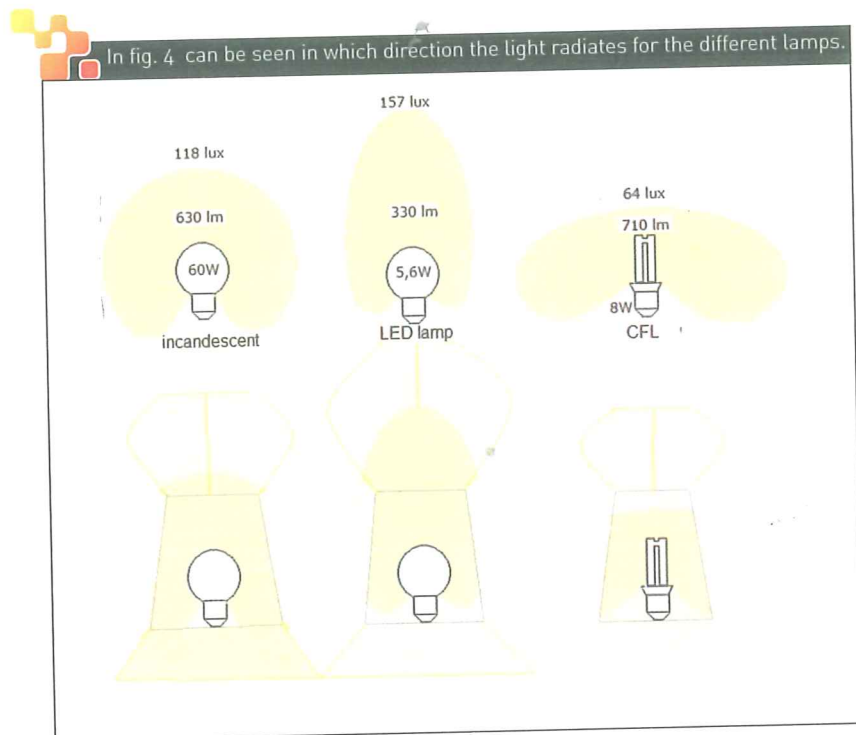
Many users apply dimmers to increase comfort and to make it cozy. With multiple light points in the room this is very effective for the comfort. From energy point of view its very inefficient for all conventional lamps except for LED lamps. At full power the spiral in the lamp is white hot and gives its maximum light

(1,5%). When dimming the spiral goes from yellow-orange to orange-red and at 50% of the energy there is only one fifth of the light left. This means that the lamp produces than only 0,3% of light and 99,7% of heat!

LED lights become more efficient when dimmed. At 50% of the energy consumption is the light output more than 50%! With respect to the color

Replacement options

Most LED lights nowadays are retrofit lamps with a B22 or Edison 27, E14 fitting. This means that the 'old' lamp can be screwed out and the new lamp is placed back. This was also possible with CFL's. One thing should be realized, each type of lamp from incandescent, CFL to LED have a different radiation pattern.



temperature and spectral distribution LED lights are better than the CFL's. There is choice from a wide range of LED lamps from flame to warm white and cold white with Color Rendering of up to 90.

In the bottom row of the pictures a cap is placed over the lamp. The brightness impression is totally different when looking towards the lamp or judging the light output with our back turned to the lamp. The cap on the CFL

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will be the brightest when looking towards it and the one with the Led lamp is darkest. However when we turn our back to the lamp and judge the light in the room it will be lightest in the room with the LED lamp on.

When the LED chips of the lamp are visible and can be seen directly, than the lamp should be used for indirect lighting only. This means one should not be able to look into the bright light

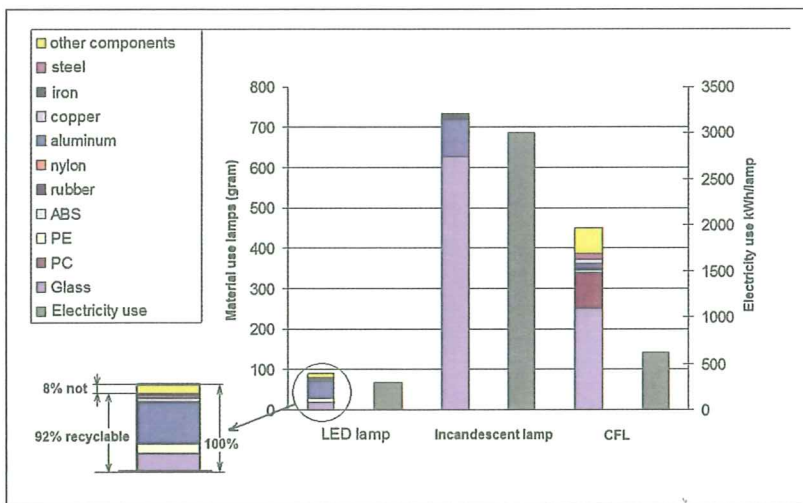
which will use 3 to 5 Watt only. A small solar panel and 12V battery will be able to lit the house for many hours with these type of lamps. Can be helpful in situations of frequent power down.

For house lights the LED lights can bring color in the interior. There are hundreds of different colors possible in the mix of Red Green and Blue. With halogen type lamps one can paint particular walls with another color or automatic changing colors.

Nowadays there are also LED strips available. These strips are not really bright enough for indoor illumination but can be used for decorative or indirect accent lighting.

A limited lifetime should be considered for such strips as explained in the introduction.

From the comparison with conventional lighting solutions and the given specifications we can conclude that LED house lights are ready to go. An additional benefit to use LED lighting is that they contain no mercury which is after lifetime of the lamp a risk to environment and health. Independent research on the environmental and sustainability aspects show that the choice for LED house lights is the best choice you can make for the future of our planet.



points. The intensity may harm the human eye. Such lamps can be used to light out walls or paintings.

Other directional lights like halogen replacements can be used in kitchen ceilings or under kitchen cabinets. One usually tends not to look up into the lamps. An interesting phenomena of the low voltage halogen lamp like the MR16 type like in fig. 5 is that they work on 12V only. This enables an alternative light source in the house