



# THE ENCIPHER 2007

# White Light Emitting Diodes (WLEDs) and Solid State Lighting

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**W**hite LEDs (WLEDs) made from the combination of blue LED and phosphor introduced by Nichia in 1996 enabled LEDs to be developed as the highest efficacy light source. Prof. Shuji Nakamura of Japan invented the key component, that is the high brightness blue LED, and received the Millennium Technology Prize for his invention in 2006, worth of one million euro, which is in fact the largest technology award.

Recent developments in ultra-high-brightness LEDs have opened the door for the technology to invade territory traditionally dominated by the light bulb and opened up the doors for Solid State Lighting for general illumination. Solid state lighting (SSL) refers to a type of lighting that utilizes Light-Emitting diodes (LEDs), Organic Light-Emitting Diodes (OLED), or Polymer Light-Emitting Diodes (PLED) as sources of illumination rather than electrical filaments or gas. Solid state lighting has the advantage of high luminous efficacy (more amount of light per watt of energy use), very long life, robustness, and flexibility in design of fixtures. The most important of them is high energy-efficiency or luminous efficacy. The following table shows how commercially available LEDs compare to other light sources.

Light Source	Typical Luminous Efficacy Range in lm/W (varies depending on voltage and lamp type)
Incandescent	10-18
Halogen Incandescent	15-20
Compact Fluorescent (CFL)	35-60
Linear Fluorescent	90-100
Metal Halide	50-90
Cool white LED 5000K	45-99*
Warm white LED 5000K	22-37*

\*Current as of October 2006.

Source: Energy Efficiency of White LEDs, US Department of Energy

Moreover, LED performance is continuously improving. In Nichia Corporation of Japan, by the Lamp type LED, (Ex.: NSPWR70), the efficacy was achieved at 150 lm/W (luminous flux: 9.4 lm) by the color temperature; 4,600K at the If=20mA driving condition in the laboratory. The luminous efficiency of this white LED corresponds to 1.7 times of three wavelength fluorescent lamps (90 lm/W), 11.5 times of an incandescent lamp (131 m/W) and even better than high pressure sodium lamp (132 lm/W), regarded as the best possible efficacy light source in the conventional market. This 150 lm/W product release is however not scheduled yet.

Even though it has not been so long since LEDs were introduced for the alternative light source, by using LED technologies enable to largely reduce consumption of

electricity and maintenance cost. Although, still the cost of good quality high brightness LEDs are high, WLEDs have been in good consideration for general lighting, traffic lighting, rural lighting, emergency lighting, torches, flash lamps, back-lighting of LCD panels etc.

In Nepal, WLED is greatly considered for rural lighting (as Tukimara), small solar module powered lights for rural lighting (solar-tuki), emergency lights, cluster-type solar or pico hydro powered village lighting, lighting from improved water-mills, lighting with small wind-power, etc. Cheap, relatively inferior, but most of the times adequate for the purpose considering affordability WLEDs are also available in the market. One can quickly build WLED based lamp driven by batteries with terminal volts 3.6 V (3 x 1.2 AAA Ni-Cd or Ni-MH type) and 4.5 V general primary battery (3 x 1.5V) at will with various configurations. Other batteries also can be readily used with very simple design.



Application of WLEDs for general lighting seems to be more applicable to developing countries with poor infrastructure like Nepal that for developed countries, as we have less and we want to make use of it most. It is thus necessary that technologists keep on looking at the

opportunities offered by the solid state lighting technologies. Information on products, application notes, design ideas, and application ideas may be obtained by using internet (searching and surfing) and we can design, implement, and disseminate what for lighting is most appropriate for our capacity and purpose. The information on the following web-sites may be useful: <http://www.led-professional.com/>, <http://www.cree.com/>, <http://www.osram.com/>, <http://www.lumileds.com/>, <http://www.nichia.com/>, <http://www.ledsmagazine.com/>, [http://en.wikipedia.org/wiki/Light-emitting\\_diode](http://en.wikipedia.org/wiki/Light-emitting_diode), <http://www.netl.doe.gov/ssl/>, <http://www.superbrightleds.com/>, <http://www.sslighting.net/>, and [http://en.wikipedia.org/wiki/Solid-state\\_lighting](http://en.wikipedia.org/wiki/Solid-state_lighting).

This study is supported by European Commission Asia-Link Project ENLIGHTEN, a cooperation project between Kathmandu University, Helsinki University of Technology, and Vilnius University.

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