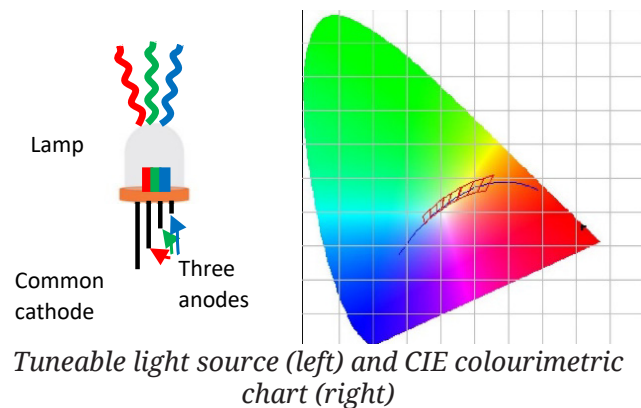


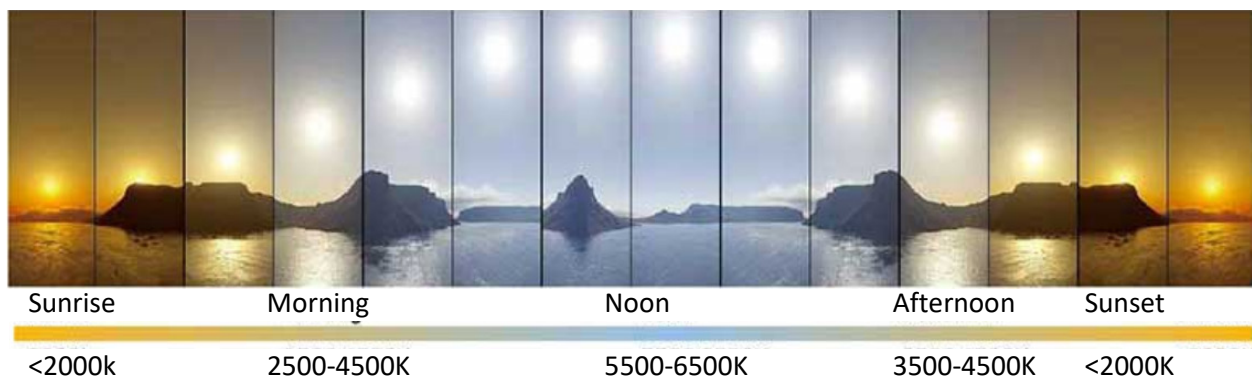
# Colour-Tuneable Light Sources: A Demand of Modern Society

With the invention of efficient blue light-emitting diodes by Shuji Nakamura, a bright energy-saving white light source has become the base for a widely used artificial light source. Just in a decade, the LED market has grown from just a monochrome light source to colour tuneable light source. A tuneable light source is a technology in which the user has the ability to control a light source's colour and intensity. Mixing and producing a wide variety of spectrum with RGB LEDs are called colour-tuneable lighting. Tuneable lighting can also be referred to as custom lighting where the lights can be made to adjust according to the environment or the user preferences. Moreover, colour-tuneable light affords the ability to attune lighting to individual preferences or specific application needs.



issue of human psychological perception about natural light. Tuneable light source has changed the way human perceive artificial light source that no other light sources had shown since the first incandescent light bulbs appeared on the market in the 19th century.

With the invention of artificial lights, the



*Figure 2: Colour temperature variation of natural light during a typical day*

In the case of white tuneable LEDs, the colour of white is quantified by referring to its colour temperature. Tuneable lights are becoming the first choice of users (homeowners and commercial building owners) due to their unblemished behaviour.

Tuneable light source combines multiple light sources, which controls the multiple light sources individually to shift or tune the required colour. This has led to a marvel of both engineering and addressing the

working hours of humans have extended drastically and are now spending more time indoors. Although the working hours have been extended, our bodies' response to the natural lighting cycle remains the same (Circadian Rhythm). Tuneable light source can also be tuned to match the environment of the time of the day according to the natural lighting. This type of tuning of the light course can be represented as human-centric lighting (HCL). HCL refers to lighting technology people can manipulate to mimic natural

lighting and its cycles throughout the day. Along with HCL, tuneable light sources have other benefits like:

**Providing apparent sensation:**

Lights create psychological effects like a warm light lit in a room make its occupant feel warmer on a chilling winter night, or reverse.

**Simulating a light setting:**

Simulate daylight or candlelight to set a mood, or match gallery lighting to the works of art on display.

**Assist with behaviour control:**

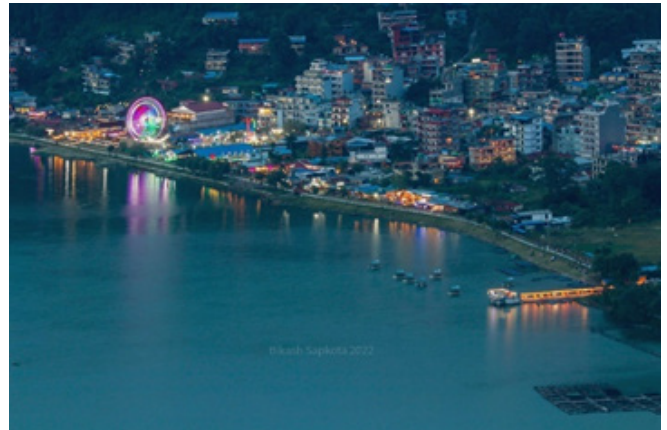
Researches done in classroom studies suggest that the colour and intensity of light can be modified to calm or invigorate students, or to focus their attention.

**Support the human circadian system:**

Light play a crucial role in setting the biological body's clock. Both the intensity and the spectral content of light can be used to stimulate or suppress the secretion of melatonin and other hormones that in turn affect our mood, alertness, and health.

With the control system of light being more user-friendly and easier to use, the demand for tuneable light products is increasing rapidly. A study done by Allied Market Research showed that the global human-centric lighting market size is expected to reach \$14.95billion by 2030 from \$0.91 billion in 2020, growing at a CAGR of 33.50% from 2021 to 2030.

Needless to say, the global rise in the usage of tuneable lighting products will also eventually lead to the usage of tuneable lighting products in Nepal. Usage and demand of light sources of different colours are seen to increase in the Nepalese market too. The Nepalese market is currently dependent to use a monochrome light source of various colours to aesthetically represent urban



*Figure 3: Artificial lighting in Lakeside, Pokhara*  
tourist destinations. An intervention of coloured LED light sources is seen in a lot of destinations in major cities like Kathmandu, Pokhara, and Chitwan. The introduction of colour-tuneable light sources can benefit the industry with energy-efficient and aesthetically pleasing light sources. Figure 3 shows the lighting at the lakeside of Pokhara which indicates the trend of use of coloured lights and lighting vividness. [pic credit: Bikash Sapkota, 2022]

With this need and demand for colour-tuneable light sources, demand for research in this sector is also equally necessary to correctly maintain the intervention of light sources. The lighting laboratory at the Department of Electrical and Electronics Engineering, Kathmandu University is performing various research in the field of lighting. Along with the research, other services like test facilities for different light sources are also available at the laboratory. The laboratory is well equipped with the latest test instruments for testing the luminaires and light sources and is also capable of production of different tuneable light sources (prototype). Also, user preference studies for various light sources can also be performed in the laboratory.

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