

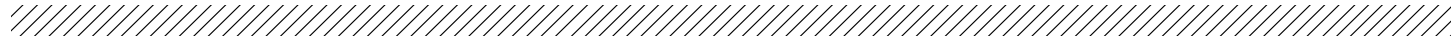


# LED Fundamentals for Interior Designers

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**AUGUST 18, 2020 4:30 – 5:30pm**





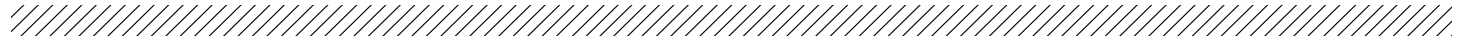
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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



## Learning Objectives

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At the end of this course, participants will be able to:

- 1. Have an understanding of Basic LED technology, relevant terminology, terms and principles**
- 2. Have a discussion of the pros and cons of LED's**
- 3. Have an understanding of the forms of LED Products and their applications**
- 4. Have an understanding of how LEDs can be controlled**

# LED

## Light-Emitting-Diode

*The Light of Today*



# LEDs

## PROs

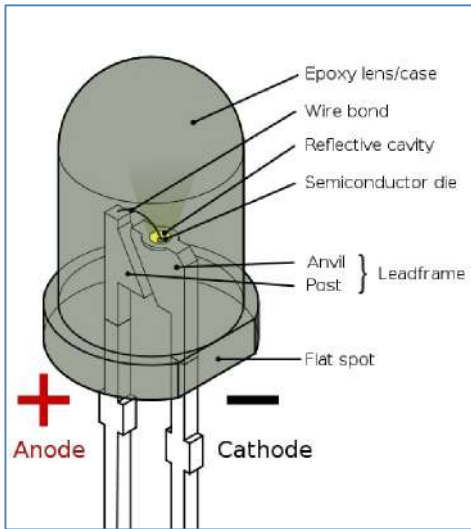
- Controllability Can be dimmed
- Saves on energy consumption
- Longevity: long service-life
- Color adjustment
- Small size for design capabilities
- Cooler in temp: expands possibilities for design
- Solid State: no mechanical parts (no filaments or glass so not fragile)

## CONs

- Less options for legacy fixtures
- Initial cost
- Lack of standardization (bulbs from different manufacturers are not consistent)
- CRI and Color Temp can vary
- Requires drivers which need to be incorporated into the design
- Knowledge gap between manufacturers and the design community

# What is an LED?

*LED is an acronym for  
Light Emitting Diode*



**Single LED**



*A group of LEDs  
is called an  
Array of LEDs*

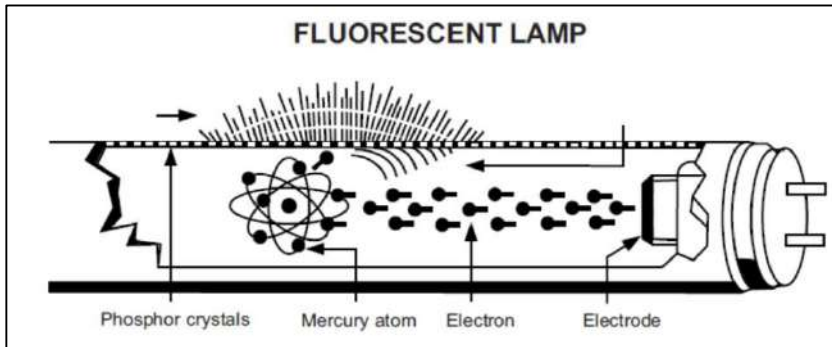


**LED LIGHT  
ENGINE**



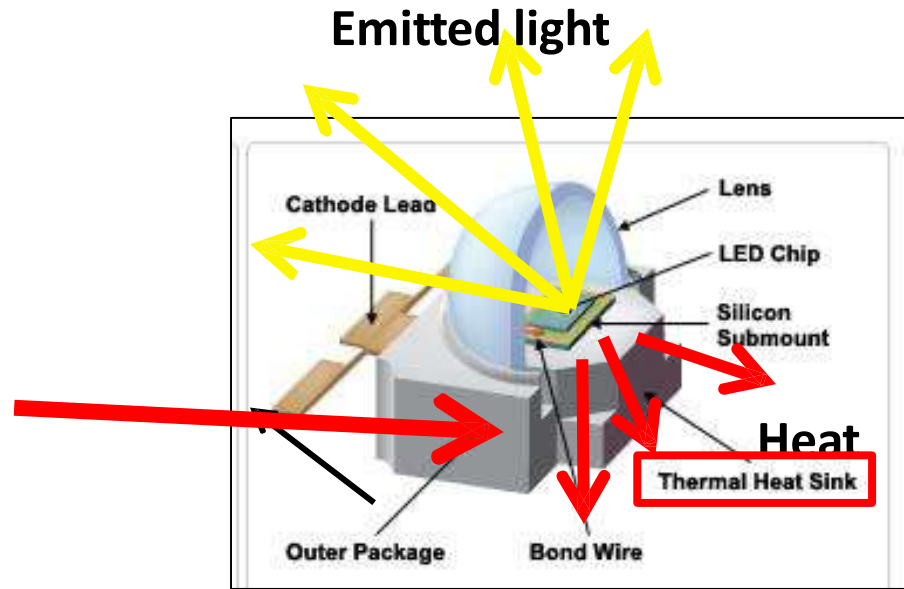
How do LEDs differ from other types of light sources?

***LEDs have no Mercury Content.***  
***LEDs contain no lead***  
***LEDs are recyclable***



***Fluorescent and HID lamps  
contain a minimal amount of  
mercury***

- *LEDs emit heat mostly in the form of conduction.*
- *To dissipate this heat, LEDs are mounted on heat-conducting material called a heat sink.*

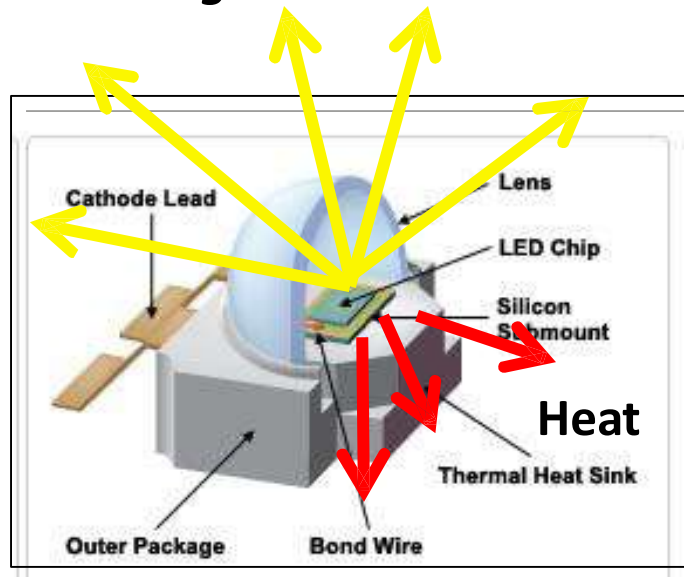




## How do LEDs differ from other types of light sources?

***No IR or UV emissions -  
LEDs intended for lighting do not emit IR or UV radiation.***

***Emitted Light: No IR or UV emissions***



# HEAT SINKS

Heat sinks are an important part of LED lighting because they provide the path for heat to travel from the LED light source to outside elements. Heat sinks are able to dissipate power in three ways: conduction (heat transfer from a solid to a solid), convection (heat transfer from a solid to a moving fluid, air in most cases), or radiation (heat transfer from two bodies at different temperatures through thermal radiation).

# HEAT SINKS

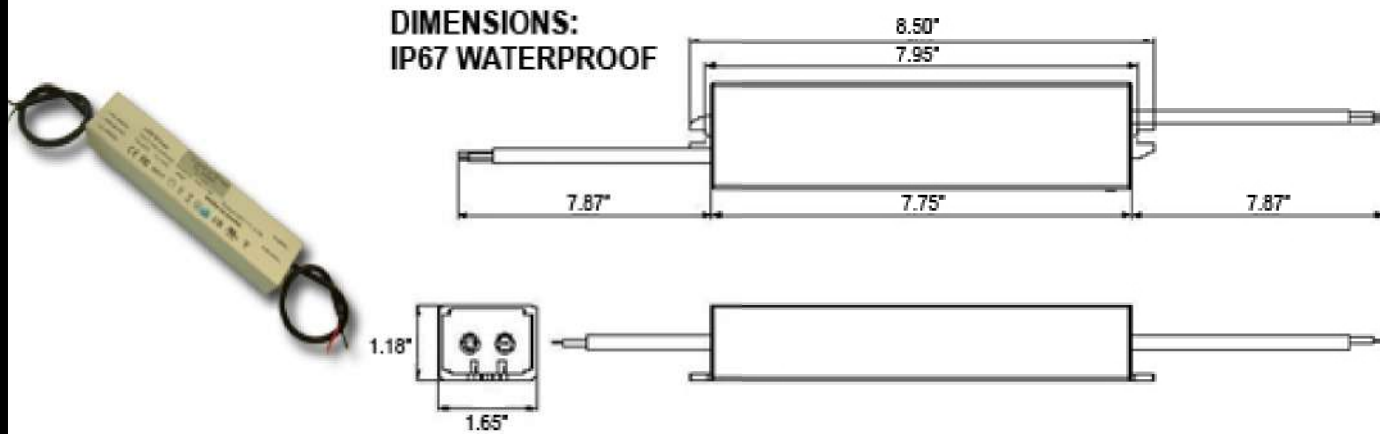
LEDs don't emit heat out of the front of the fixture or a lamp. They emit heat from the back. Heat sinks absorb the excessive or unwanted heat.



# DRIVERS/POWER SUPPLIES



An **LED driver** is an electrical device that regulates power to an **LED** or a string of **LEDs**. Like transformers, they step-down voltage but also allow for control of the **LED's** color and output.



**Drivers** are not limited by the number of **LED** lights they power. They are restricted by the total wattage of the **LED** lights they power



## What is an Integrated LED fixture?

**Integrated LEDs are all-in-one fittings that contain both a light source and an external fixture. They typically connect directly to mainline voltage without needing any other components or accessories**



## INTEGRATED LED FIXTURES

**Unlike traditional light sources that can easily be detached from their fixtures, integrated LED's are built into multiple electrical circuit boards. This means that if they fail, they cannot easily be replaced, especially not by the average person. Instead, the whole integrated fixture must be replaced.**

# Integrated LED

lights have the LEDs actually built into the fixture itself. Whether on a panel, strip or disc, the diodes are installed into the fixture, so you won't find a standard socket for a bulb.





# Integrated LED FIXTURE





## AFTER-MARKET LAMPS



# LED Lamps



A19 GU24



A19 LED Filament



A19 LED Filament All Glass Body Zig Zag



A19 LED Filament Amber All Glass Body

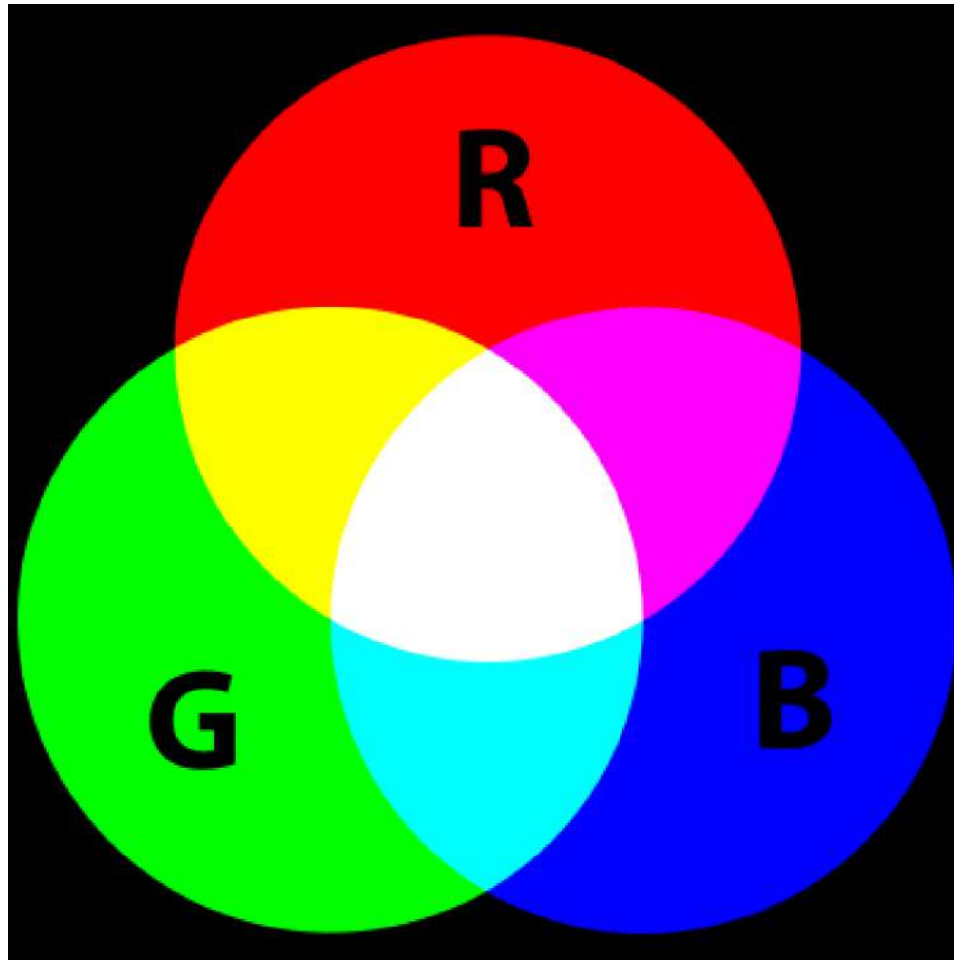


A19 LED Multi-Filament All Glass Body



A19 Milky Glass

Combining **RED**, **GREEN** and **BLUE** (RGB) allows  
for millions of color possibilities  
**WHITE** is the sum of all colors



# chromotherapy

*noun*

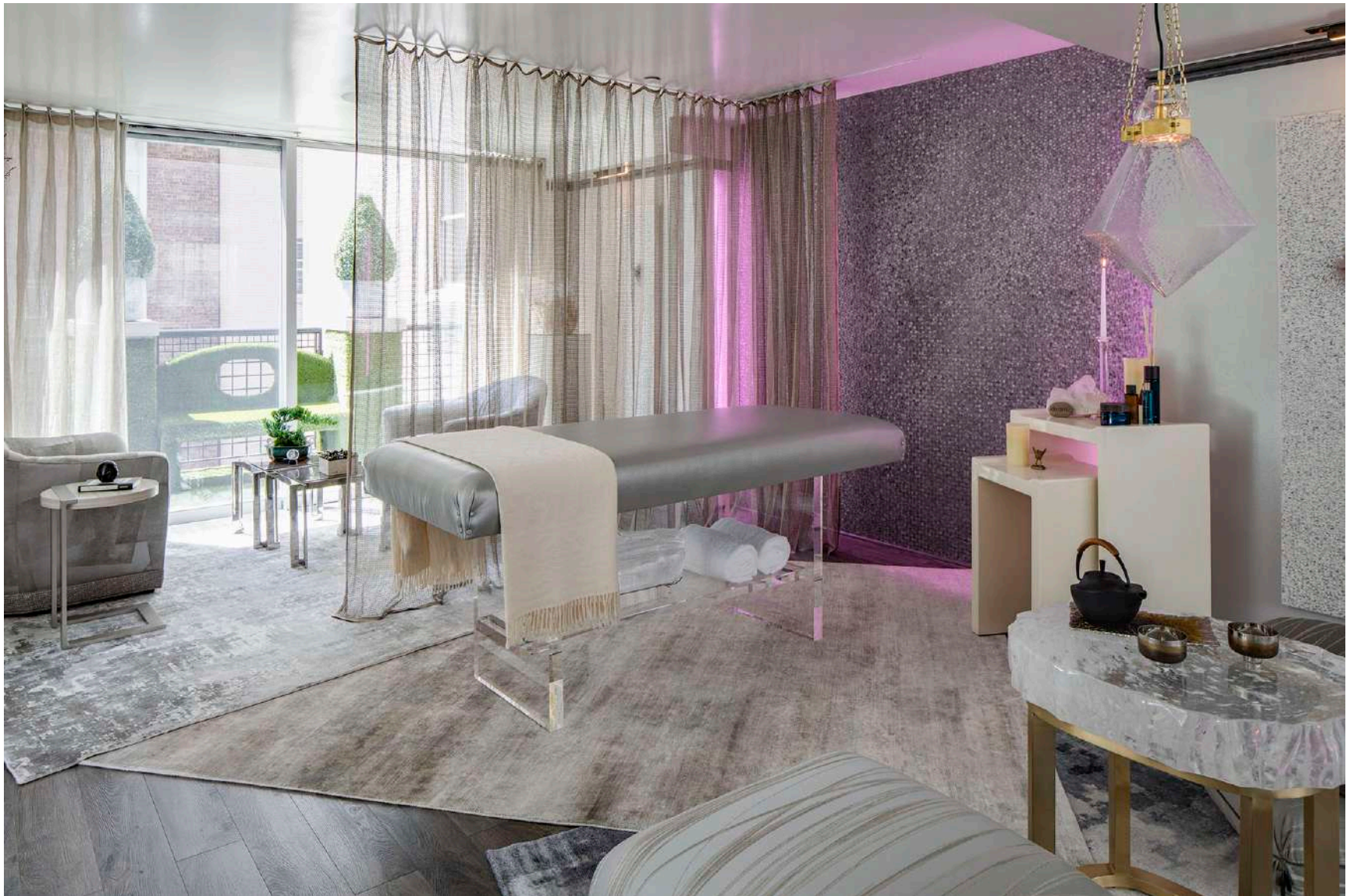
the use of color and light as a restorative therapy and to promote mental and physical well-being





CHROMOTHERAPY used in a healing environment





## *Small size - allows for Design Possibilities*

Trac 12 LED Mini-Cylinder

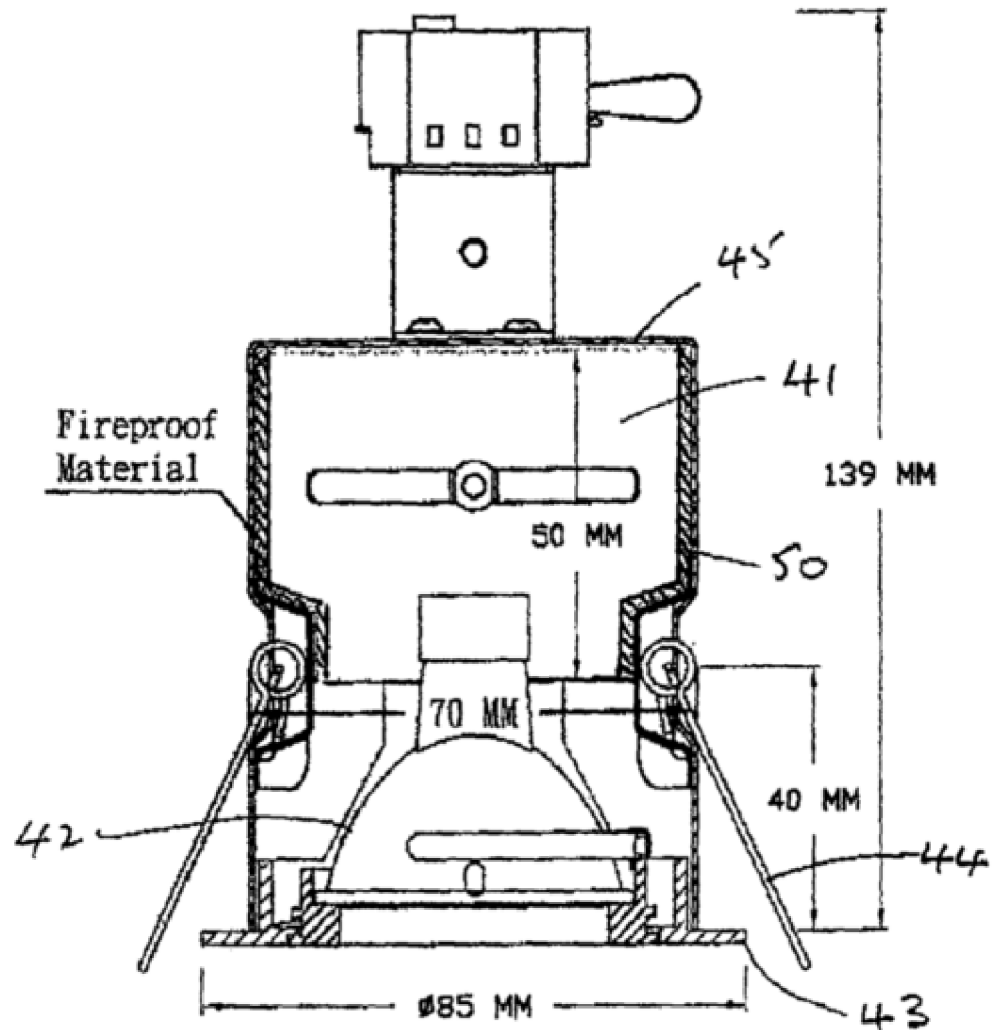


Flex 12 LED Mini-Cylinder





**LED Recess Light Housing**



**Typical Recessed Housing for Incandescent Light**



**LED fixtures can be recessed into a floor.**



**A ceiling LED recessed light**



**Spotlights are omnidirectional, with adjustable light distribution angle, dimming, and color temperature.**







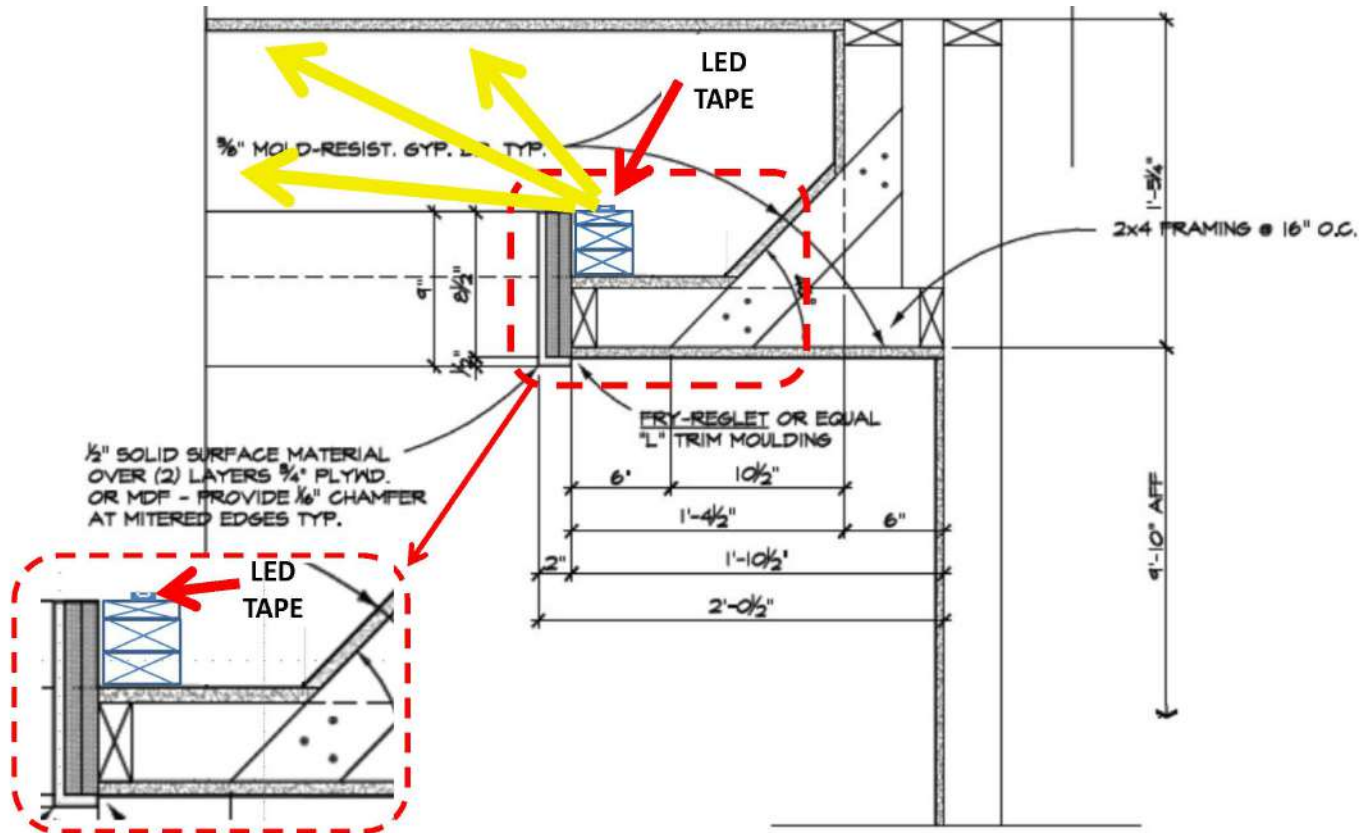




**EXTRUSIONS** allow you to conceal and diffuse LEDs so you don't see the nodes

[www.shide-led.en.alibaba.com](http://www.shide-led.en.alibaba.com)

# Proper LED installation for cove lighting



2 COVE LIGHT - TYPICAL  
SCALE: 1 1/2" = 1'-0"





## Strip Lights



# FLEXIBLE LED STRIP SHEETS





You cannot begin a conversation on  
**SUSTAINABILITY** or **GREEN DESIGN**  
without **LEDs** entering the discussion.



**LED Picture Lights can be hard-wired or battery operated. They are now dimmable.**




**What you need to know to  
specify LEDs for your  
RESIDENTIAL Projects and the  
Fundamentals you need to know  
to achieve the lighting you desire**

- **LUMENS**
- **KELVIN**
- **CRI**
- **TUNABLE WHITE**
- **WARM DIM**


# LUMENS:

a measure of the total quantity of visible light emitted by a source per unit of time

**Lumens = Brightness**



LUMENS	INCANDESCENT	LED
2600 lm	150 W	25-28 W
1600 lm	100 W	16-20 W
1100 lm	75 W	9-13 W
800 lm	60 W	8-12 W
450 lm	40 W	6-9 W





## LED Lumens required per foot for special tasks using LED strip lights.

Example Application	Lumen required / foot of LED strip
<u>Accent Lighting</u> and <u>Mood Lighting</u>	~ 100 – 350 Lumens
<u>Under cabinet Lighting</u>	~ 175 - 525
<u>Task Lighting with low distance from light source</u>	~ 280 - 437
<u>Task Lighting with higher distance from light source</u>	~ 344 - 687
Indirect lighting in a <u>bedroom</u> / hotel / <u>vehicle</u> / lobby	~ 375 - 562
<u>Industrial lighting</u> / <u>signage</u> / tube replacements	~ 500 - 950

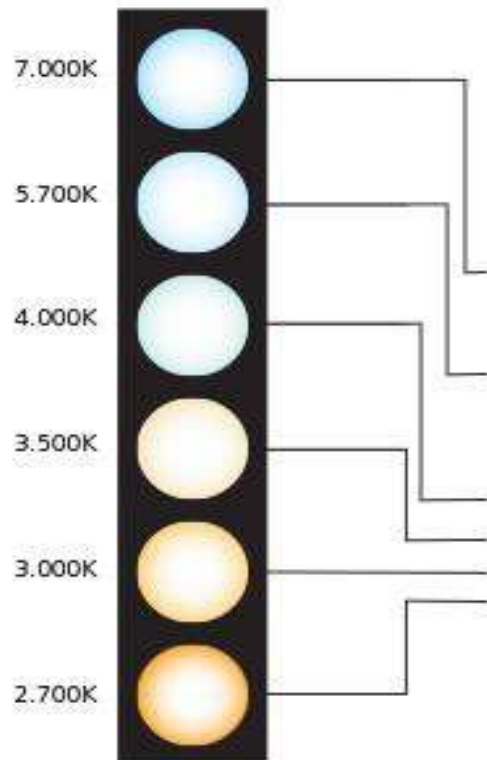
# COLOR TEMPERATURE + DEGREES KELVIN:

**Color temperature** is a way to describe the light appearance provided by a light bulb. It is measured in degrees of **Kelvin** (K) on a scale from 1,000 to 10,000. Typically, **Kelvin temperatures** for commercial and residential lighting applications fall somewhere on a scale from 2000K to 6500K.

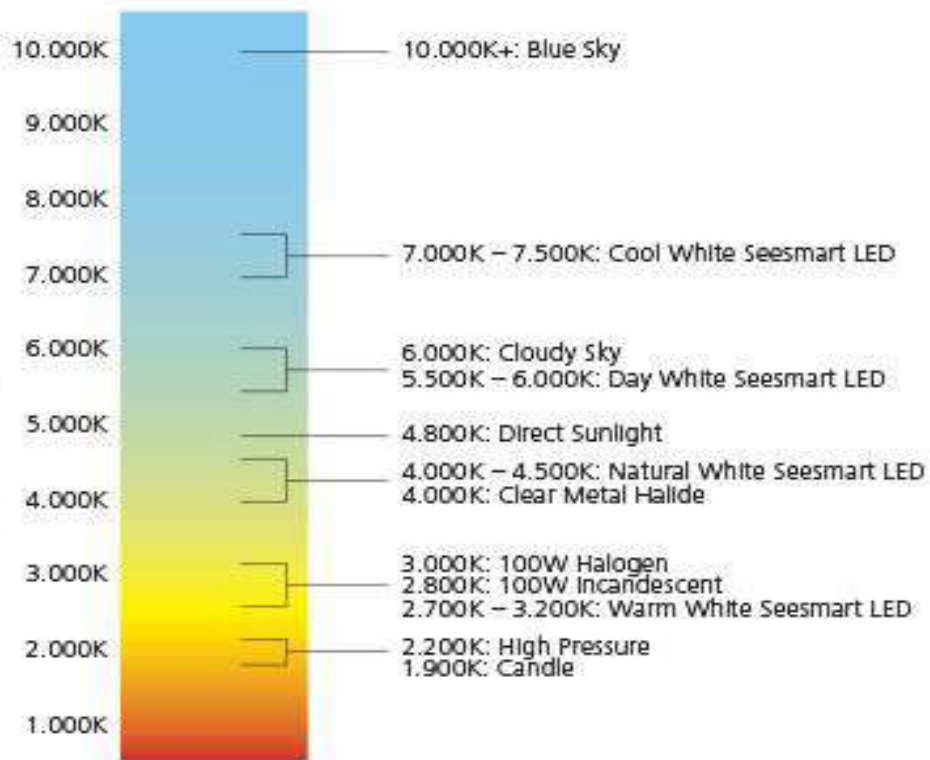


# Color Temperature is measured in degrees KELVIN (K)

Basic LED Reference Example



Kelvin Color Temperature Scale Chart



## ***Color Rendering Index (CRI)***

*The color rendering index (CRI) scale is used to compare the effect of a light source on the color appearance of its surroundings.*

*A scale of 0 to 100 defines the CRI.*

*A higher CRI means better color rendering, or less color shift.*



- 97 Lumens per Watt
- **CRI 90+**
- 2700K, 3000K, 3500K, 4000K

### CRI 100

All colors clearly separatable

EXCELLENT CRI



### CRI 80

Some colors looks like same

GOOD CRI



### CRI 70

Can't distinguish most colors

POOR CRI



## COLOR RENDERING INDEX

# CRI

AFFECTS YOUR PERCEPTION OF COLOR



CRI = 51

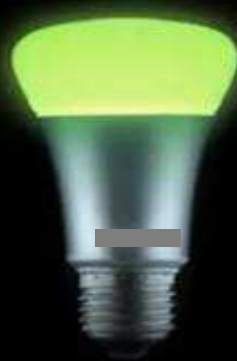


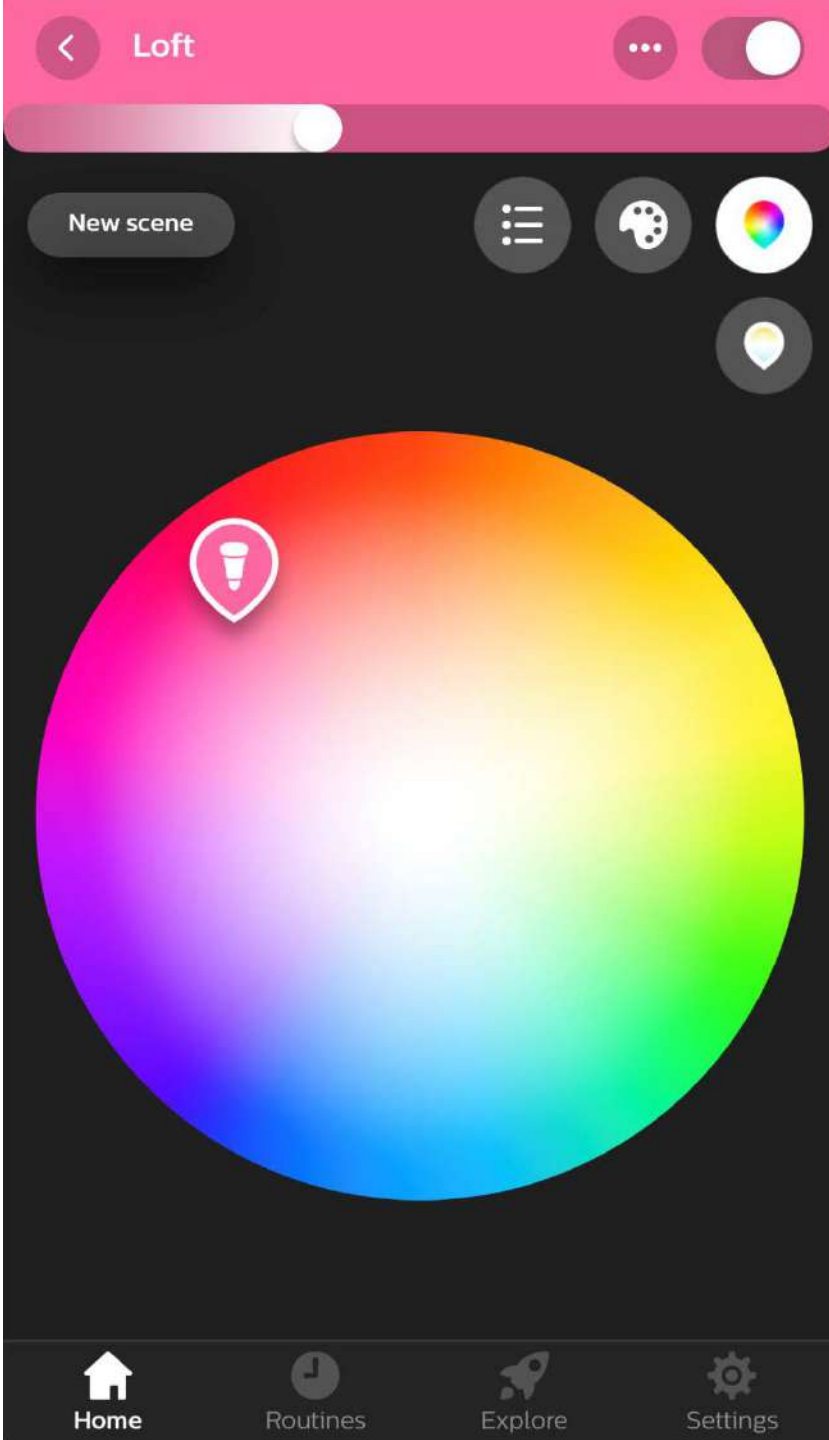
CRI = 80



CRI = 90

*Tunable  
lighting*



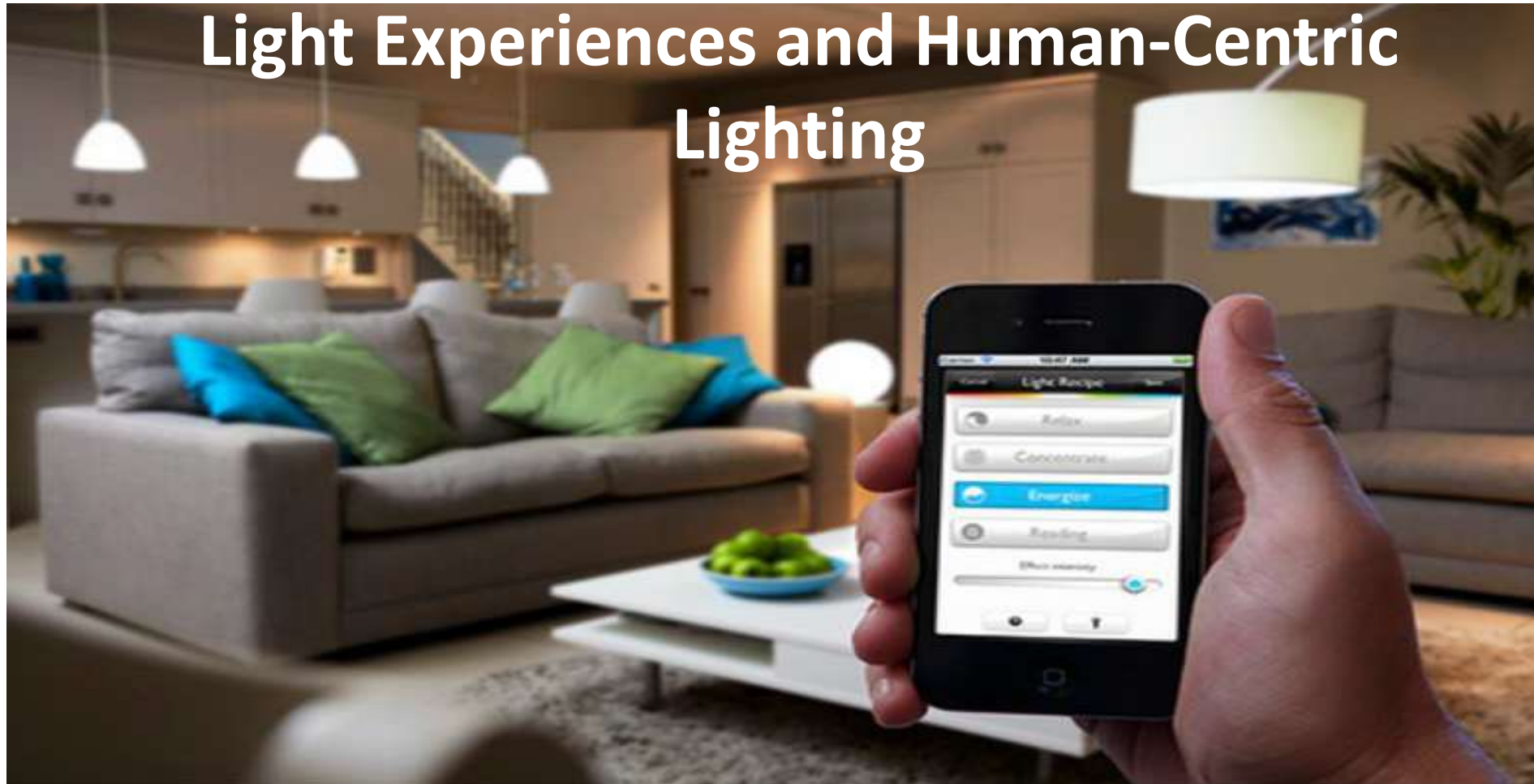






LED Outdoor lighting brings possibilities and ambience to places you were not able to before. There are flexible outdoor LED tapes with diffusers for creating outdoor lighting effects

# Light Experiences and Human-Centric Lighting

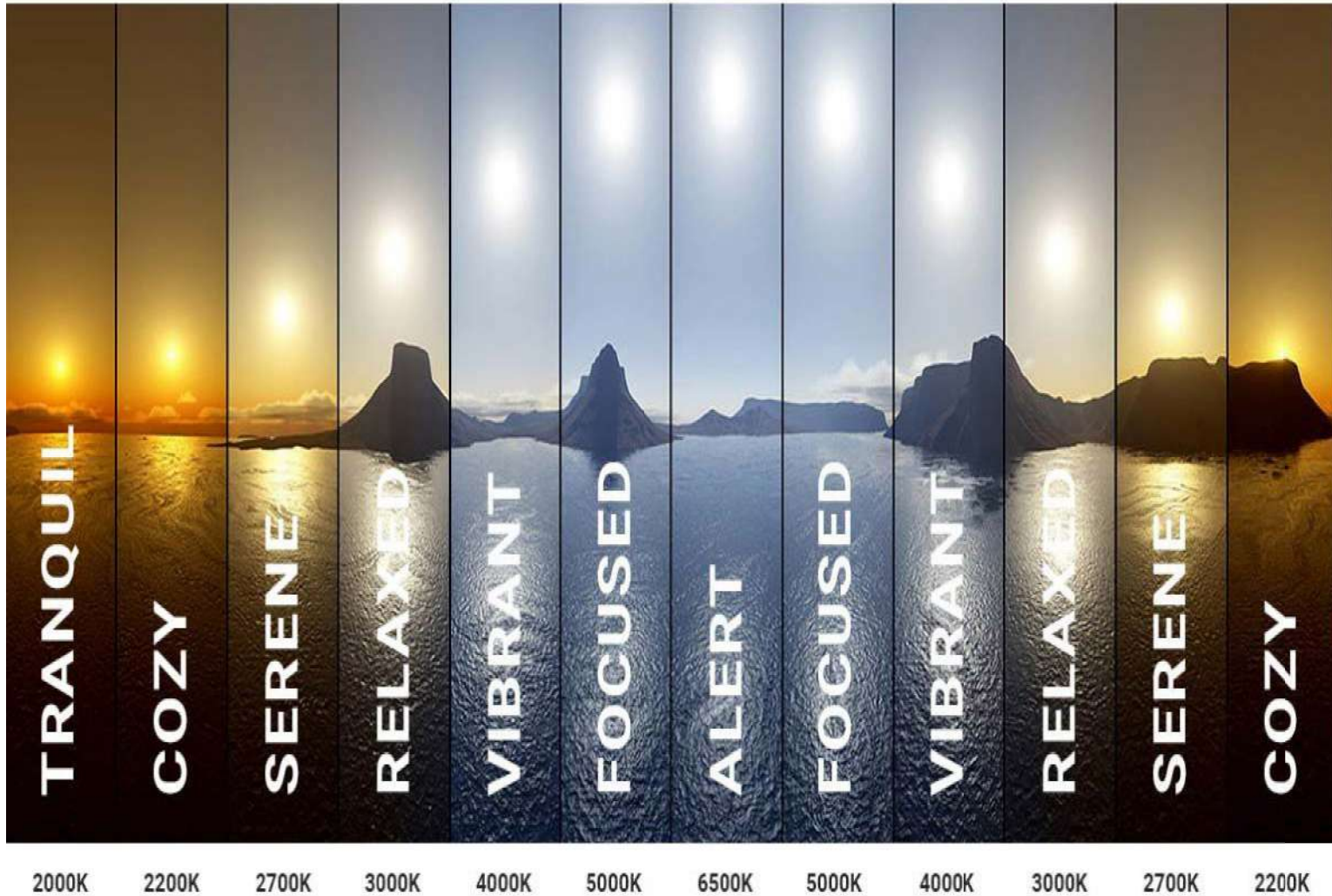


**HUMAN CENTRIC LIGHTING** is a type of lighting that can benefit the biological, emotional, health, or well being of people. This is achieved by dimming the smart light source (LED) to mimic the levels of sunlight throughout the day.



# Light Experiences and Human-Centric Lighting





# TUNABLE WHITE



Control your color temperature, while maintaining brightness

Adjust from 4000K to 2000K

Ideal for new construction:  
4 wires with 2 dimmers

Indoor or Outdoor







Notice the changes Tunable White lighting makes in this interior. The same light sources produce 3 very different feelings in this room.



## What is Warm Dim?

- Dims like an incandescent, from cool to warm
- Color temperature becomes warmer as you dim, from 3000K or 2700K to 1800K
- Perfect for retrofit or remodel; no rewiring
- Mimics incandescent and candlelight
- Great for full home, outdoor, retail and commercial spaces

## Warm Dim

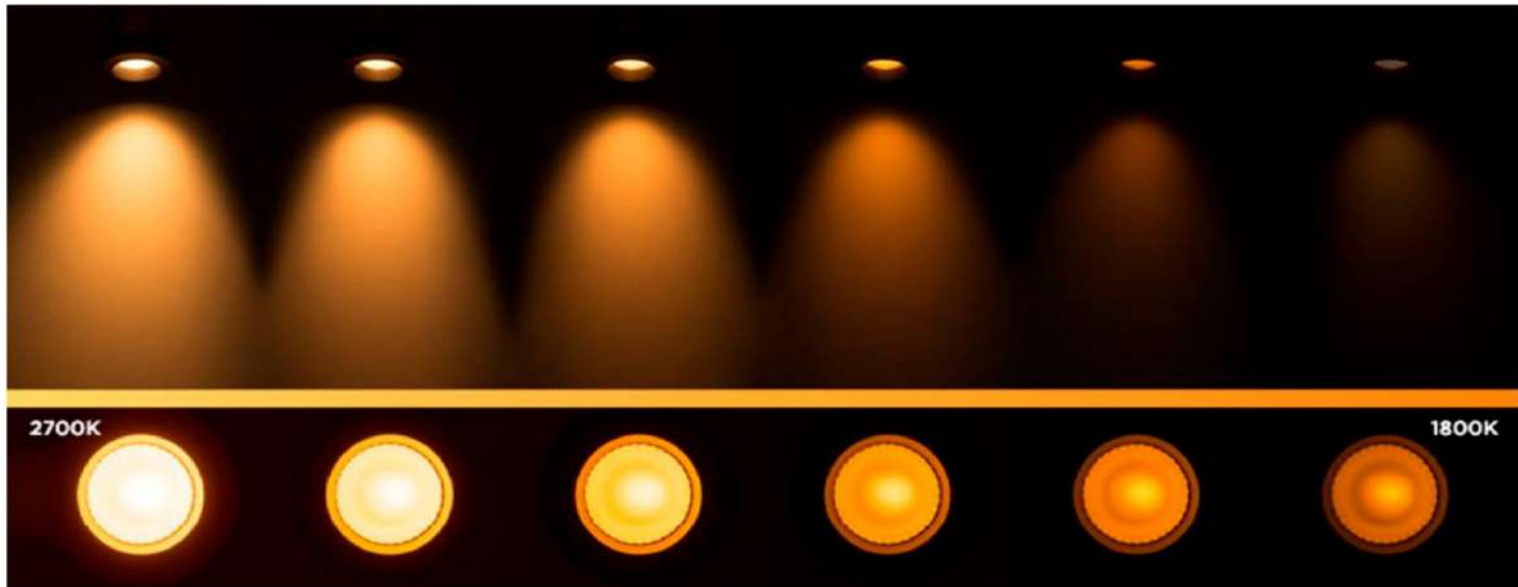
Dims like and incandescent, from cool to warm

Color Temperature becomes warmer as you dim, from 3000K to 1800K

Ideal for retro fits or remodels: no rewiring

Create the feeling of incandescent and candlelight

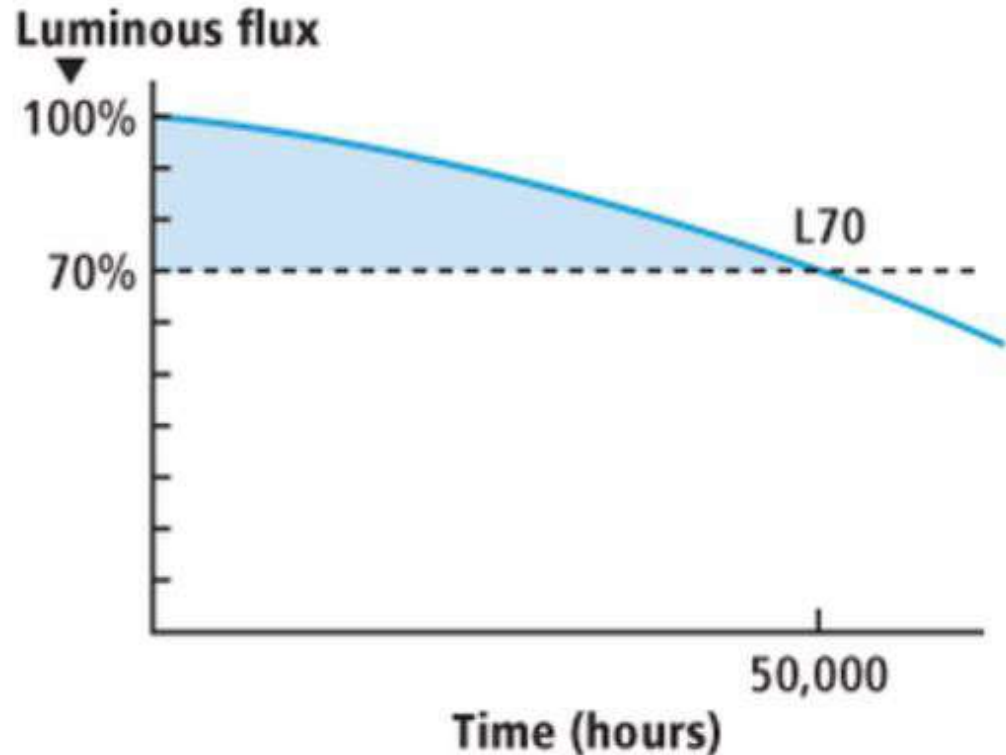
Indoor Outdoor



**As our understanding of color temperature and its impact on our actions, moods, and performance expands, lighting will become**

**personalized**

## Lamp Lumen Depreciation and Lumen Maintenance



### Lamp Specification:

9.5 System Watts; 7 **LED** Watts, 12VAC **LED**, 2858K, 85 CRI, 322 total lumens, 46 lumens per watt; 70% lumen maintenance based on 50,000 hours of operation.



**The most significant difference in**

**LED technology**

**vs.**

**other lighting technologies:**

**LEDs will create Fundamental differences  
in how we will design our interiors.**

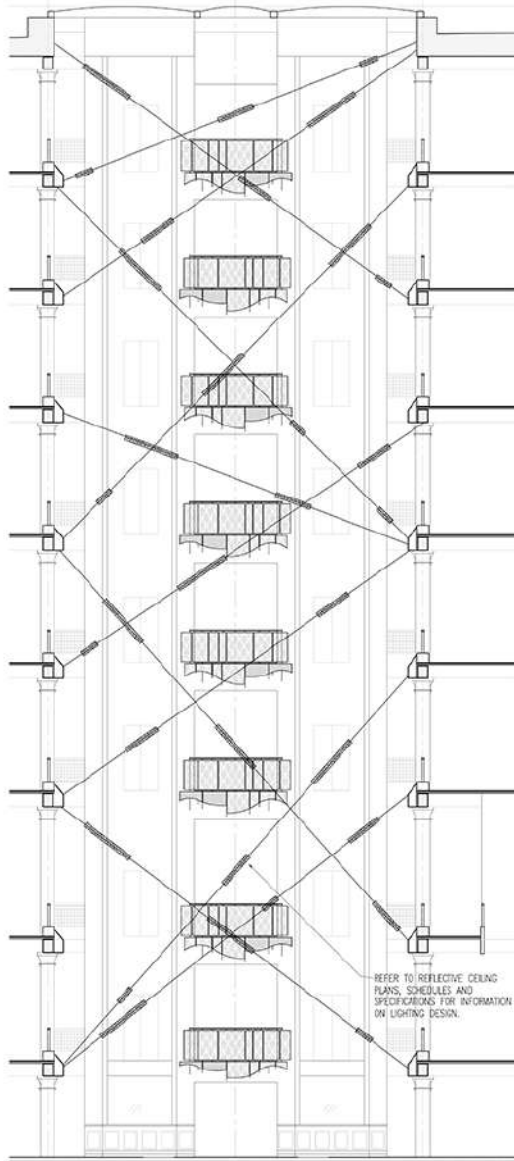




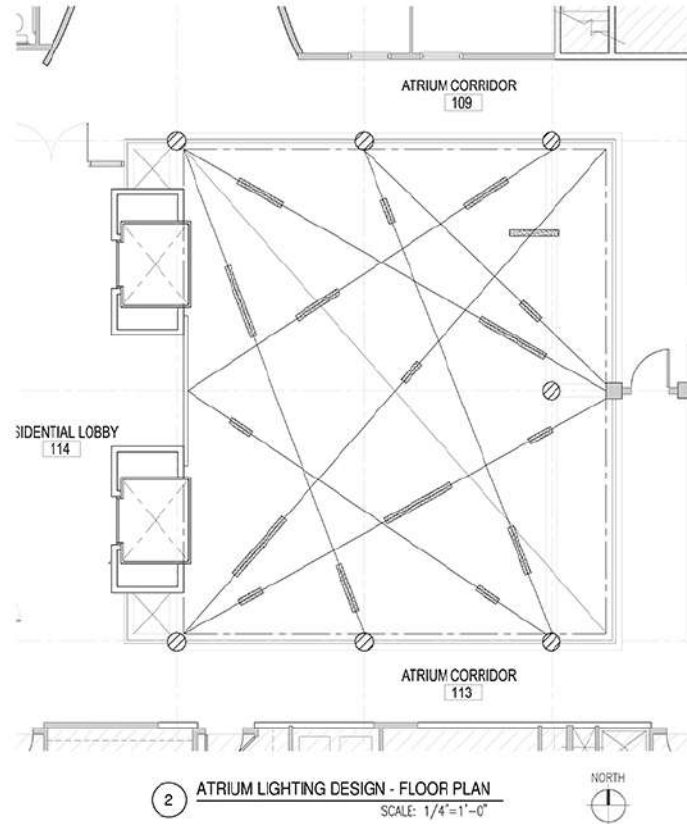








1 ATRIUM LIGHTING DESIGN - WEST ELEVATION  
SCALE: 3/16"=1'-0"







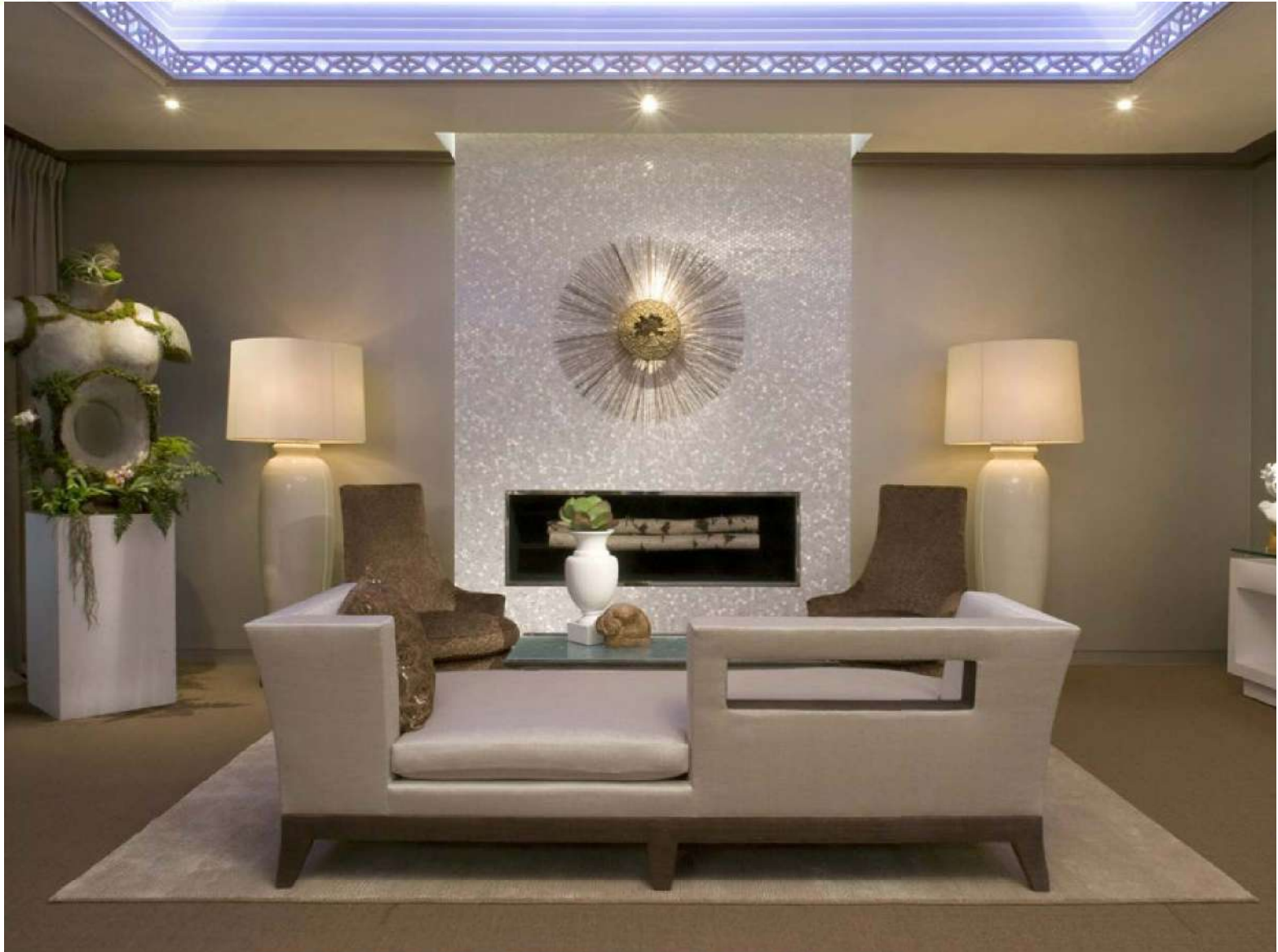




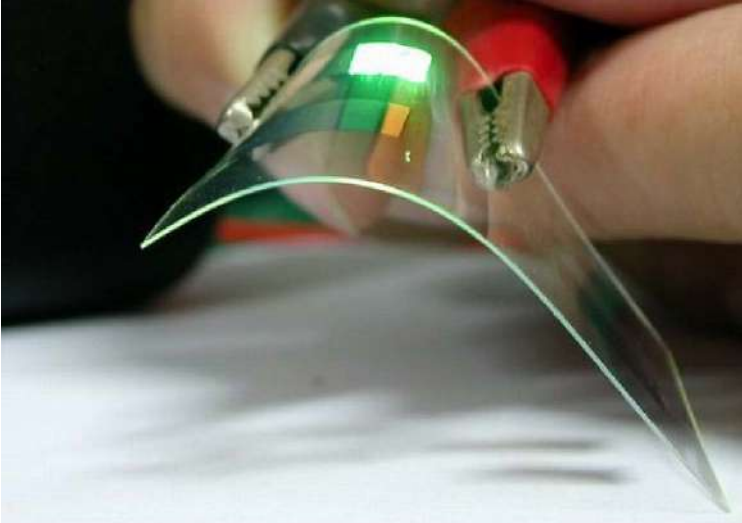










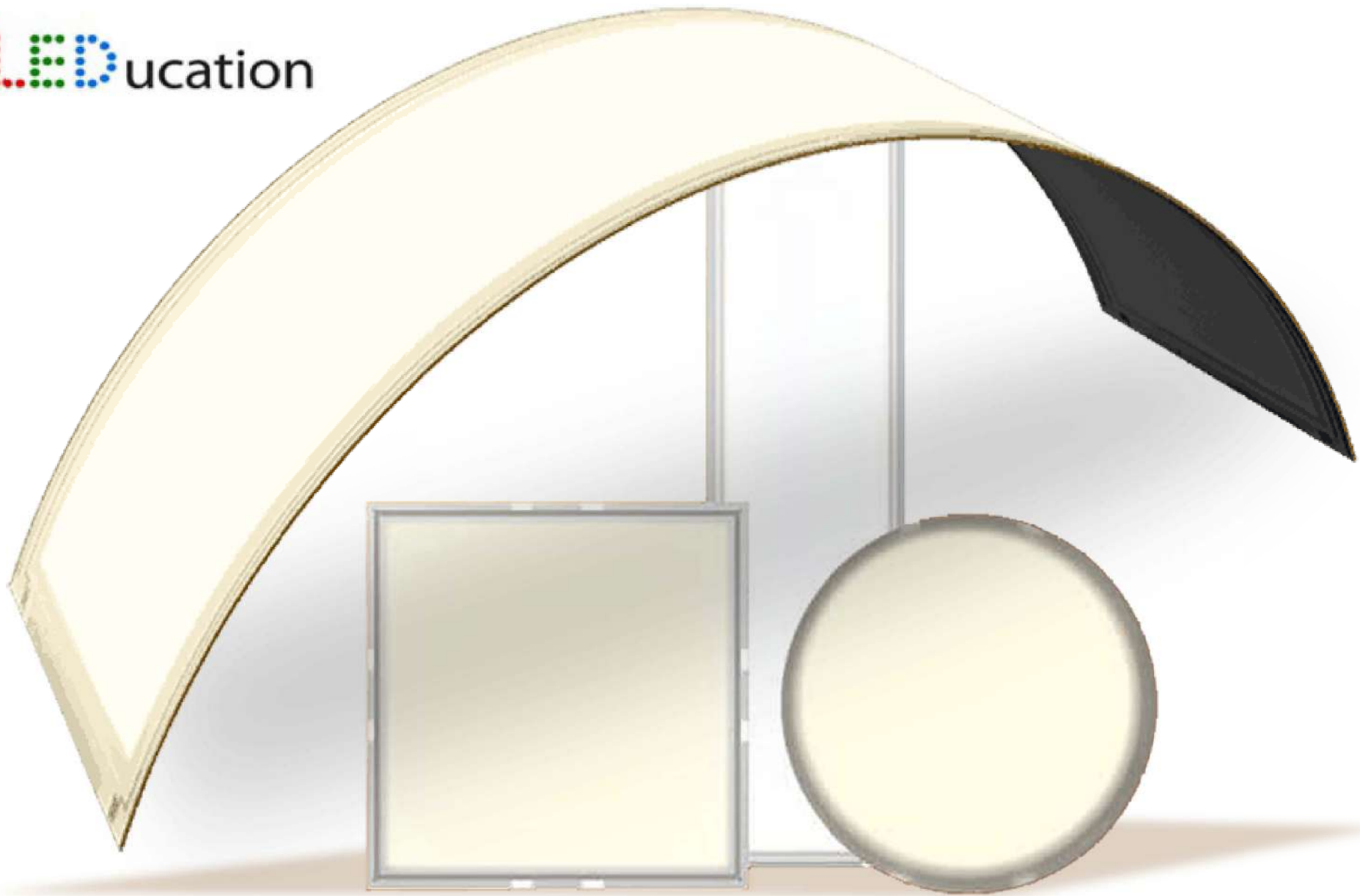


## OLED TECHNOLOGY:

light-emitting diode containing thin flexible sheets of an organic electroluminescent material, used for visual displays.















This concludes The American Institute  
of Architects Continuing Education  
Systems Course

