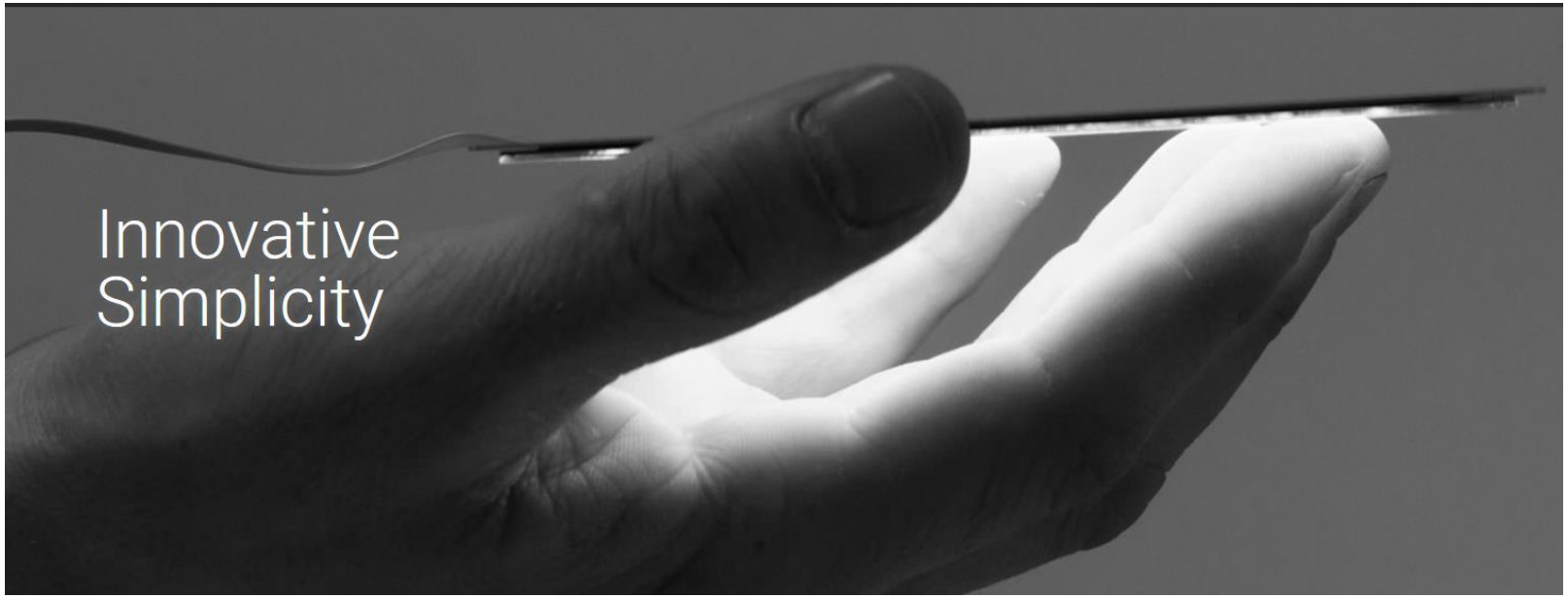
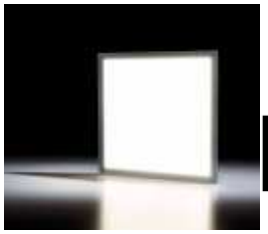
OLED Lighting

Giana Phelan, OLEDWorks LLC



“There is something about that light.”

Global View: OLED light engines



	OLEDWiorks	Osram	Kaneka	Konica Minolta	LG
Efficiency lm/W	60	40 (70)	50	45	60 (80)
L70 Khrs	10 @ 9000nits	10 @ 2000nits (20@3000nits)	30 @ 3000nits	8 @ 1000nits	40 @ 3000nits
CRI	>90	>75	>80	>75	>90
	High brightness	Transportation	Architectural	Flexible	Broad Portfolio

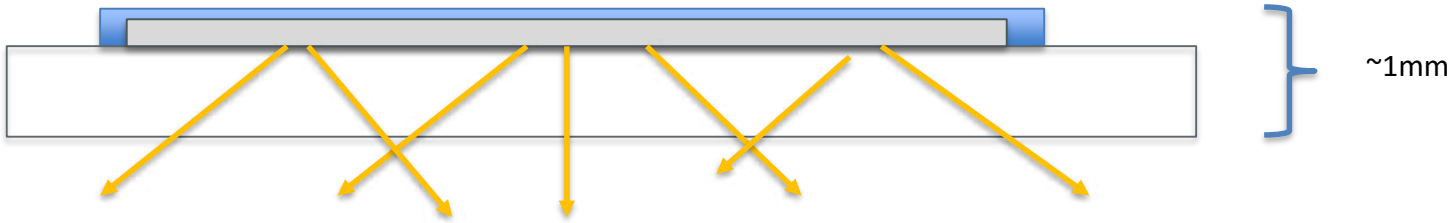
- Are OLED lighting panels positioned for market adoption?

✓ Yes, surpass threshold for many applications

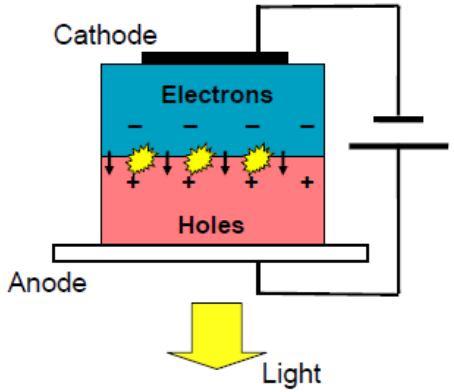
OLEDWorks Naturally Illuminating

OLED: Naturally diffuse area light

- OLED is Organic Light Emitting Diode, a solid-state lighting technology
  - Easily dimmable and compatible with LED control systems
- OLED is made of very thin carbon based layers that create a naturally diffuse, broad spectrum, area light source.
- Designers are encouraged to break the paradigm of traditional lighting
  - Shades, diffusers, reflectors are not needed
  - OLED lighting can be a direct view experience

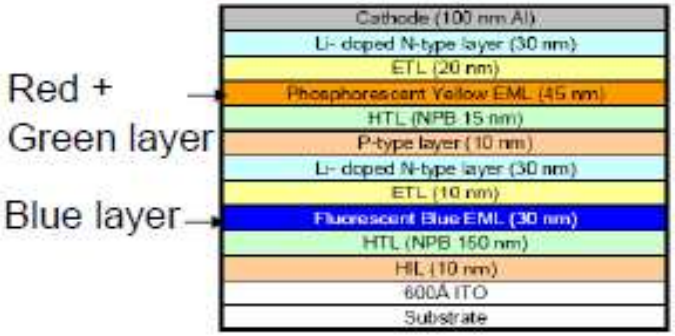


Challenges: Technical

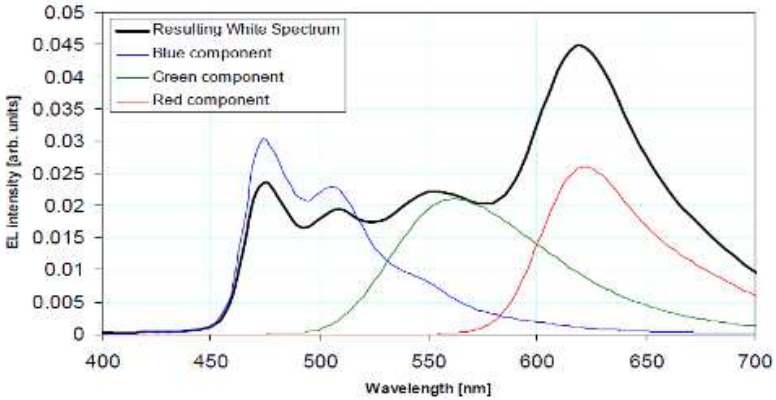


Source: Kodak, 2009

- OLED is inherently a planar device
- Current driven, light is emitted when holes and electrons combine
- Composed of carbon based (organic) molecules
- Active layers less than 1 micron thick
- Total device thickness ~2mm
- Light gets trapped!!
- Extensible to large format and flexible substrate



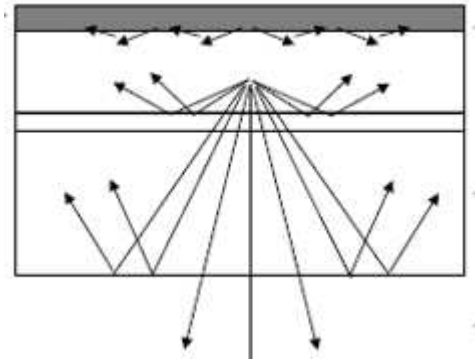
Source: UDC



OLEDWorks
Naturally Illuminating

Challenges: Technical

- Larger scale efficient OLEDs at low cost
  - Efficiency: Getting the light out
  - Scale: Uniformity
  - Cost: Yield



- Drivers
  - Very low current requirements pose efficiency challenges
- Integration: Finishing & Handling
  - Into fixtures and into buildings
    - Controls, series/parallel, integration architectures
  - Light elements as building tiles

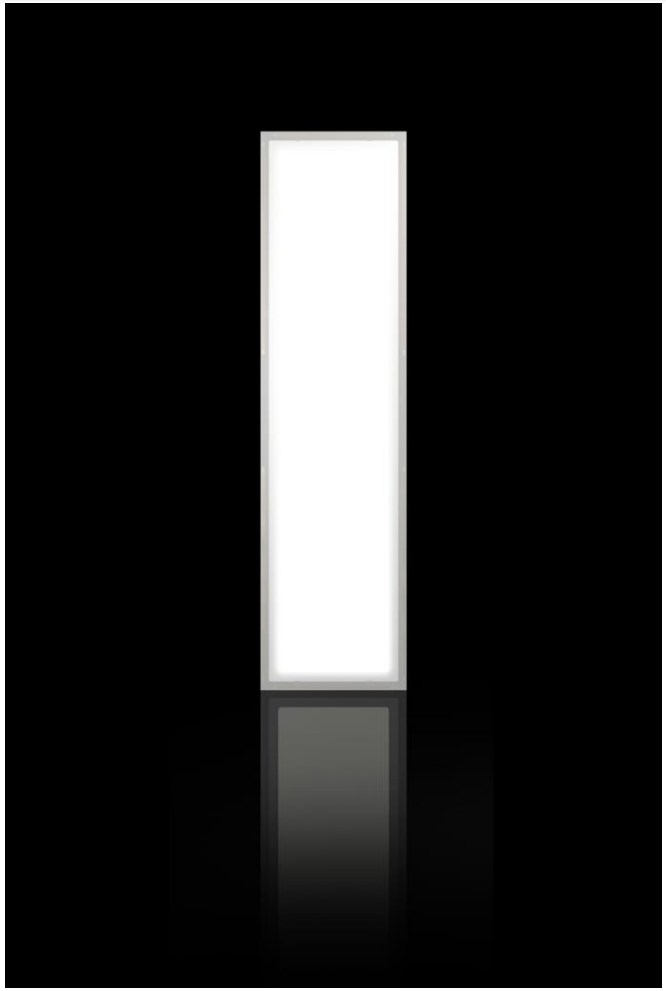
What do people love about OLED lighting?

What do people love about OLED lighting?

Thin Planar Light Source

Naturally diffuse

Excellent Color rendering



Low Glare

Cool to the Touch

Solid-State Efficient and Controllable

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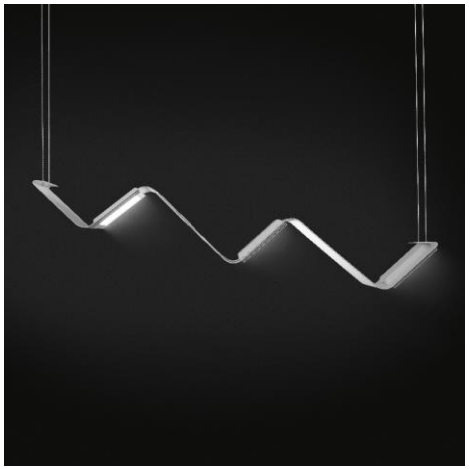
Challenges: Design

Aerelight.com



Visalighting.com

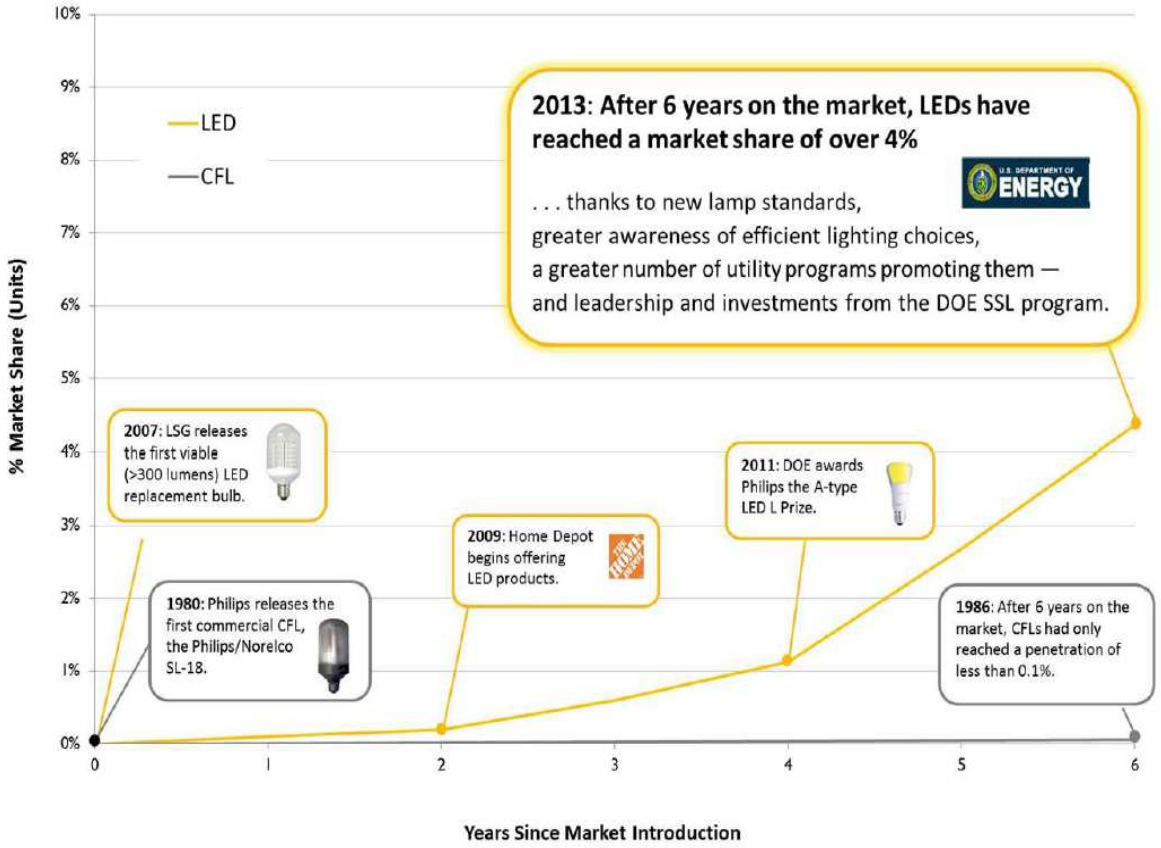
Omled.com

New Design Perspective, New Applications

- Bring light closer to the user and where light is needed
- Direct mounting on surfaces – akin to a building material
- Diffuse lighting for machine vision
- A better light experience:
  - General lighting: commercial and residential
  - Hospitality and retail
  - Museums
- A healthier light experience:
  - Wellness – seniors, patient rooms, recovery, etc
- A “lighter” light experience
  - Transportation
  - Furniture
- Flexible

Challenges: Design

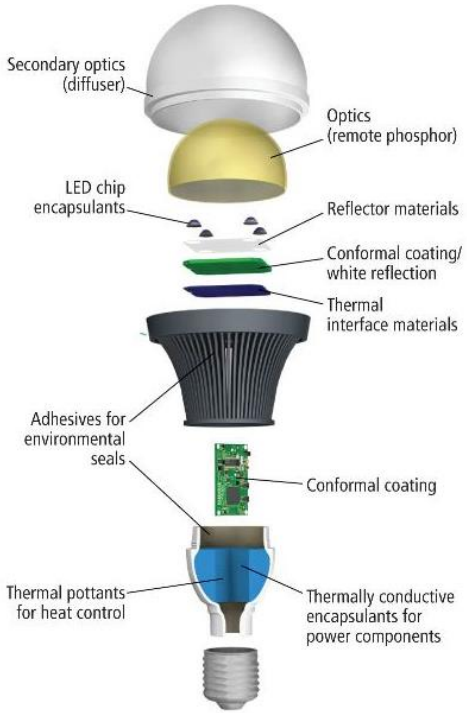
Learning from CFL



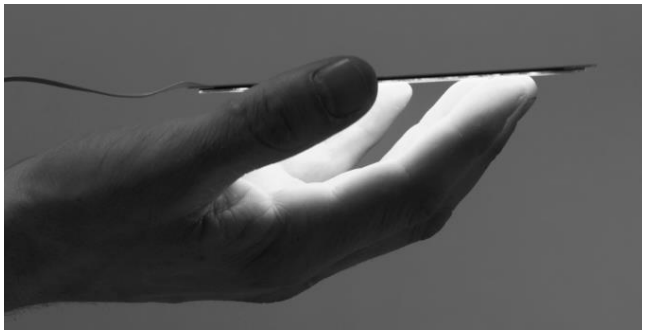
More efficient and lower cost not enough for market adoption if lighting is a bad experience

Source: James Brodrick, Dept of Energy, SSL Workshop Portland Oregon Nov 13 2013.

Challenges: Design



LED: Point source



OLED: Area source

Challenges: Design

- OLED can build on LED, solid-state lighting, expertise including drivers and controls
  - But far simpler assembly
- *Blurs the line between light engine and fixture*

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The OLED Way

Fixture Design

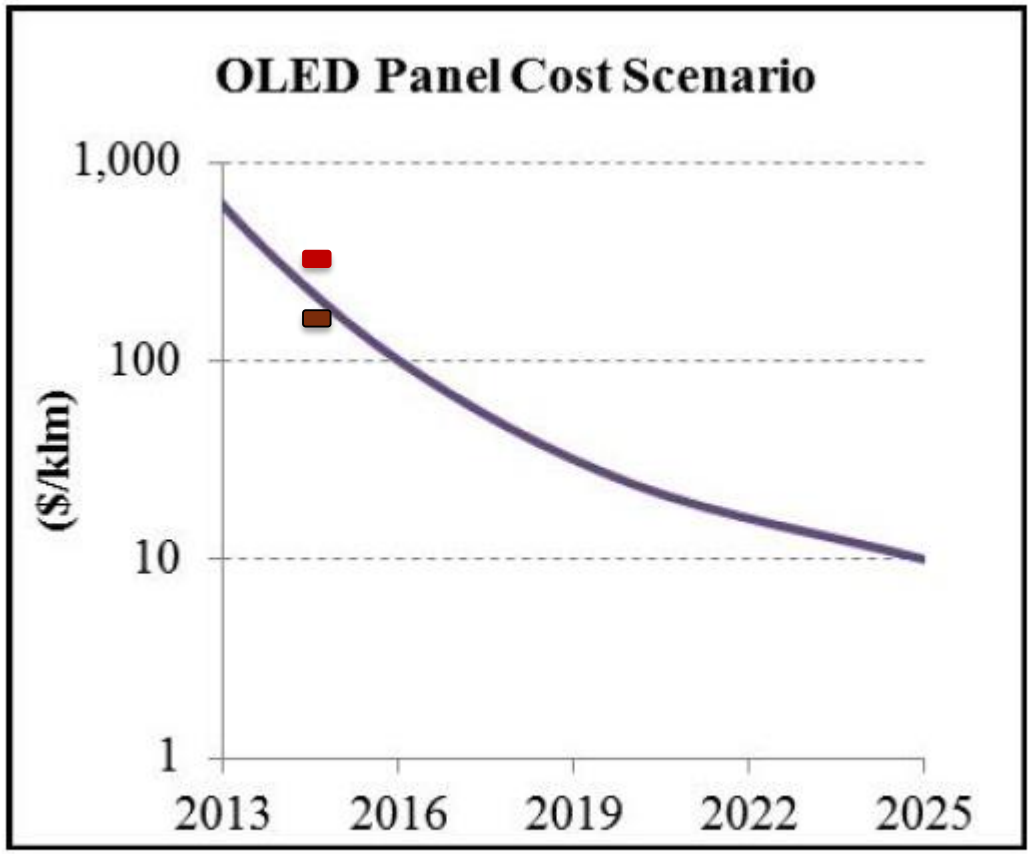
Channel

=

OLEDWorks Naturally Illuminating

Challenges: Cost

OLED Cost Reduction



Executive Summary, 2014 SSL R&D Manufacturing Roadmap: www.ssl.energy.gov/techroadmaps.html

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Affordability

- Consider total cost
  - No need for heat sinks, optics, etc.
  - Can bring light closer to user, efficient use of light in many applications
  - Many applications don't need very high lumen output with focused beams
    - ✓ *It is not all about $/klm*
  - Faster product development cycle
- Many fixtures now very cost competitive

New Design Perspective, New applications

Get ready for a superb lighting experience.