

Where Do OLEDs Fit In?

DOE SSL Workshop

Portland, OR

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OLEDWorks.com

Where do OLEDs fit in?

- A solid-state lighting solution that complements LED
- With the SSL advantages you've come to expect:
 - control, efficiency, environmental
- And evolutionary performance trajectory that mirrors LED
 - Efficacy, lifetime, CRI, cost

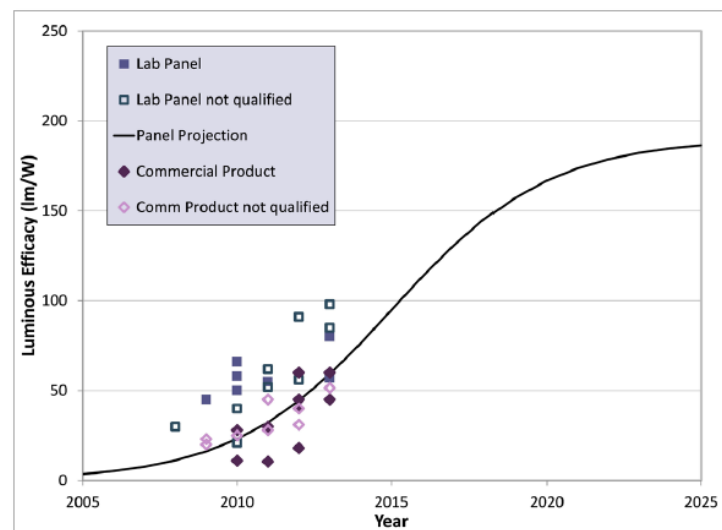


Fig. 4.2, 2014 SSL Multi-Year Program Plan: www.ssl.energy.gov/techroadmaps.html

Where do OLEDs fit in?

- OLED is a different experience
 - Light quality
 - Thinness (<1mm)
 - “something about the light”
 - Cool to the touch
 - Direct view
- Enable new designs

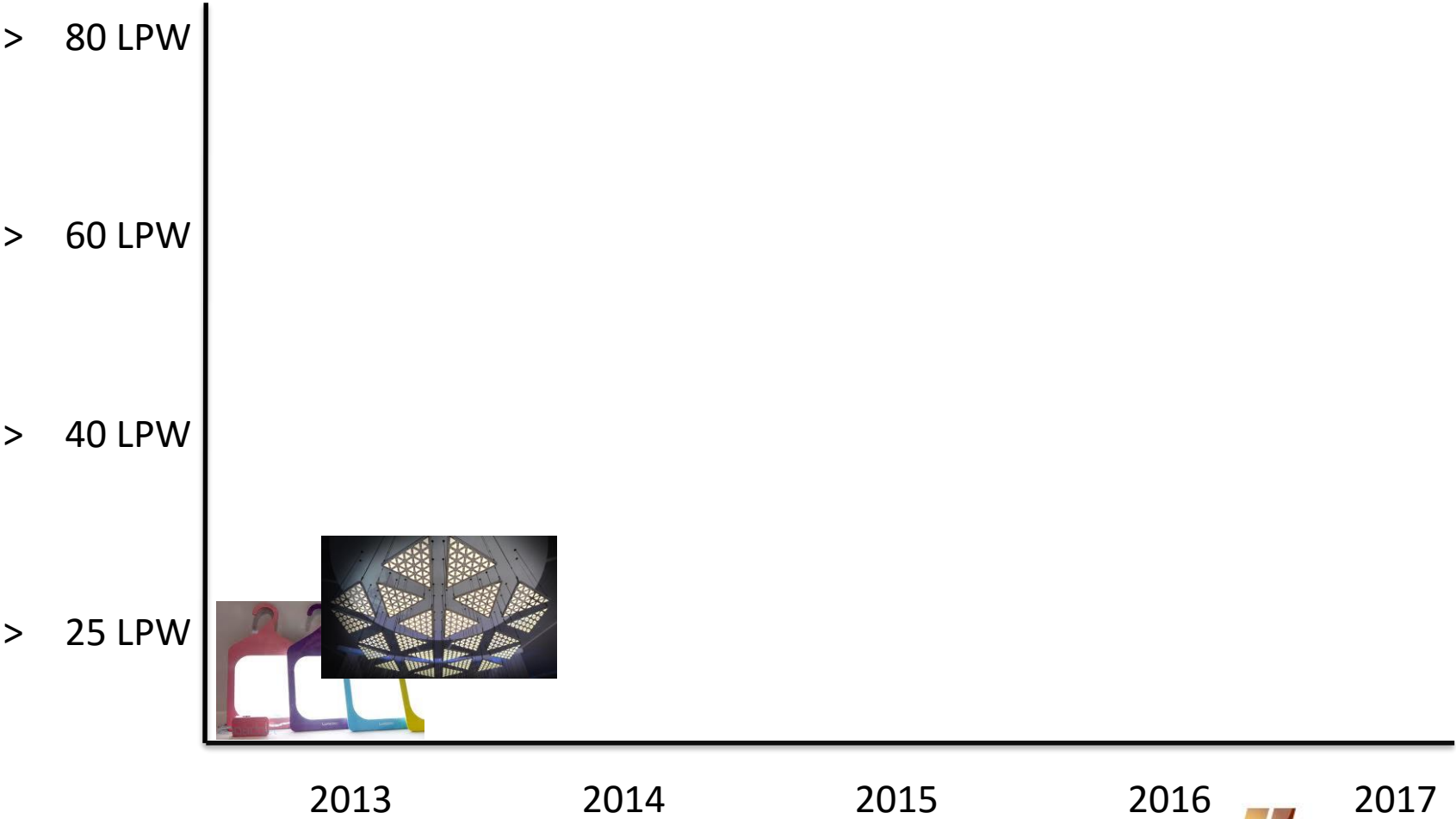
Global View: OLED light engines



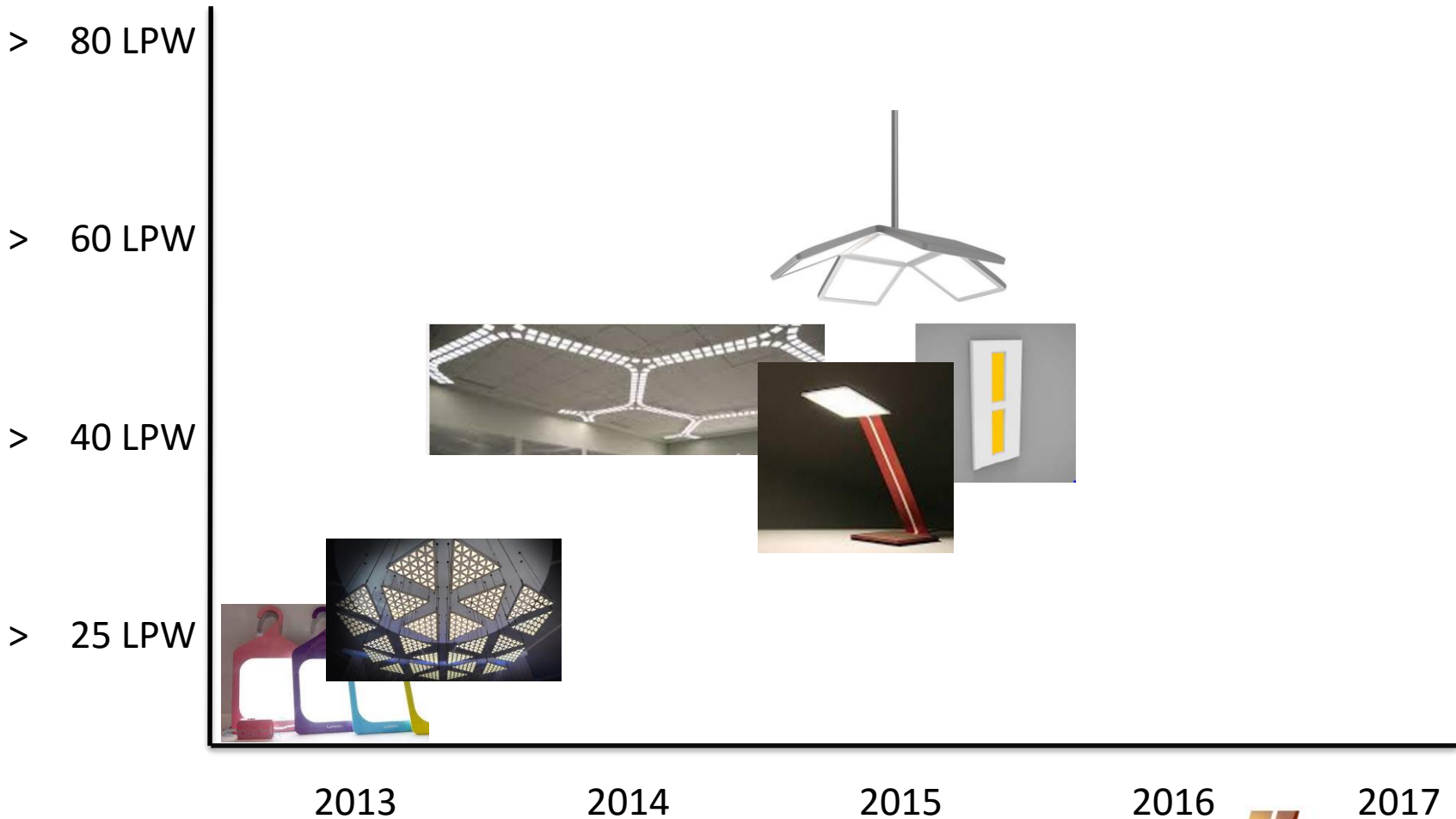
	Philips	Osram	Kaneka	Konica Minolta	LG	OW
Efficiency lm/W	45	40	40	45	60 (80)	50 (80)
L70 Khrs	10 @ 9000nits 50 @ 4000nits	20@3000nits	50 @ 3000nits	8 @ 1000nits	40 @ 3000nits	30 @ 3000nits
CRI	>80	>80	>80	>75	>90	>84
Notable	High brightness	Transportation	Architectural	Flexible	Broad Portfolio	Versatile Mfg

- Are OLED lighting panels positioned for market adoption?
- ✓ Yes, surpass threshold for many applications

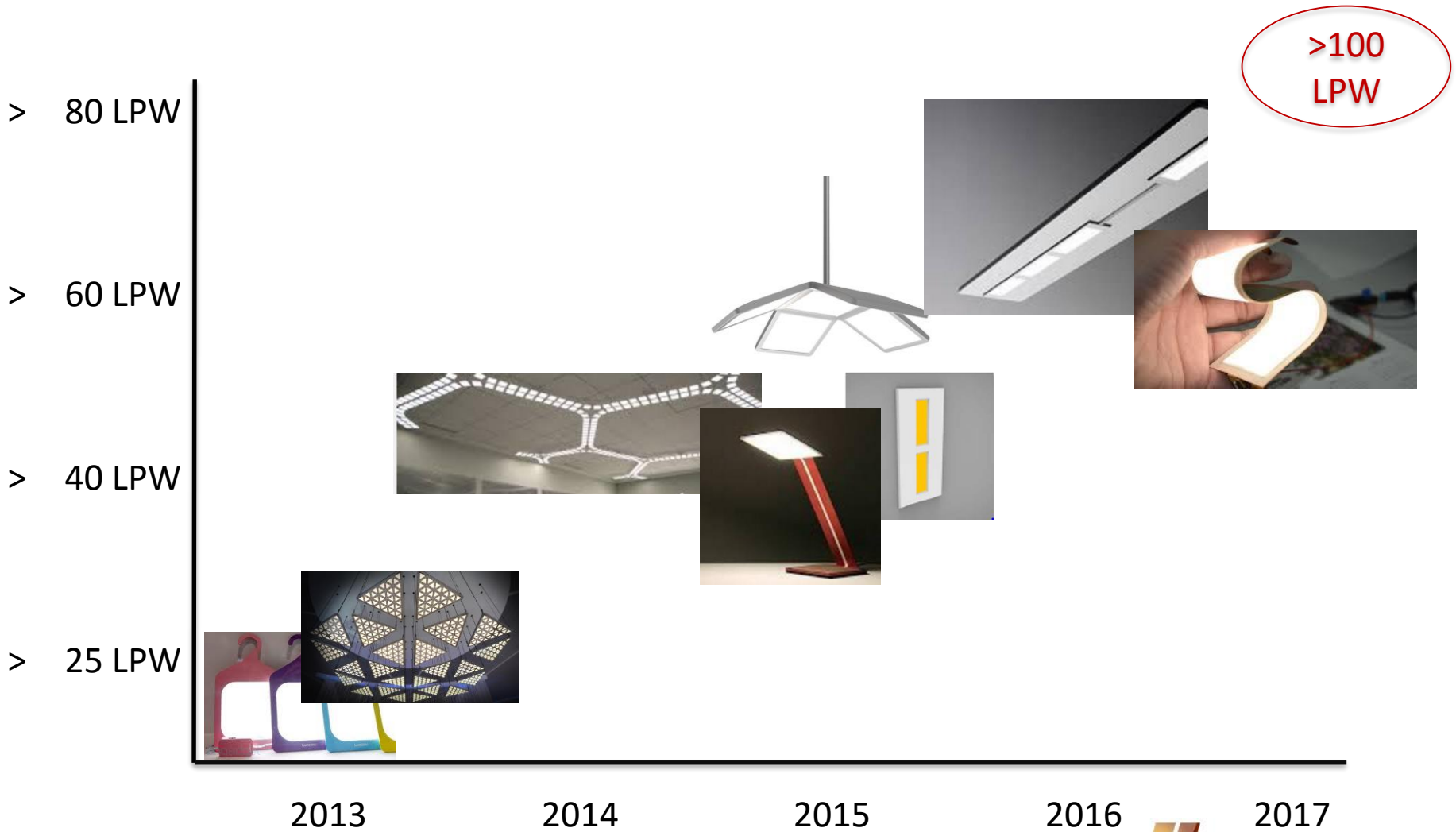
OLED Application Evolution



OLED Application Evolution



OLED Application Evolution



Efficiency Forecast – Is it real?

- Higher performance materials including blue phosphorescent emitters being developed
- Harnessing all the trapped light – new substrates and extraction techniques
- Big improvements in drivers

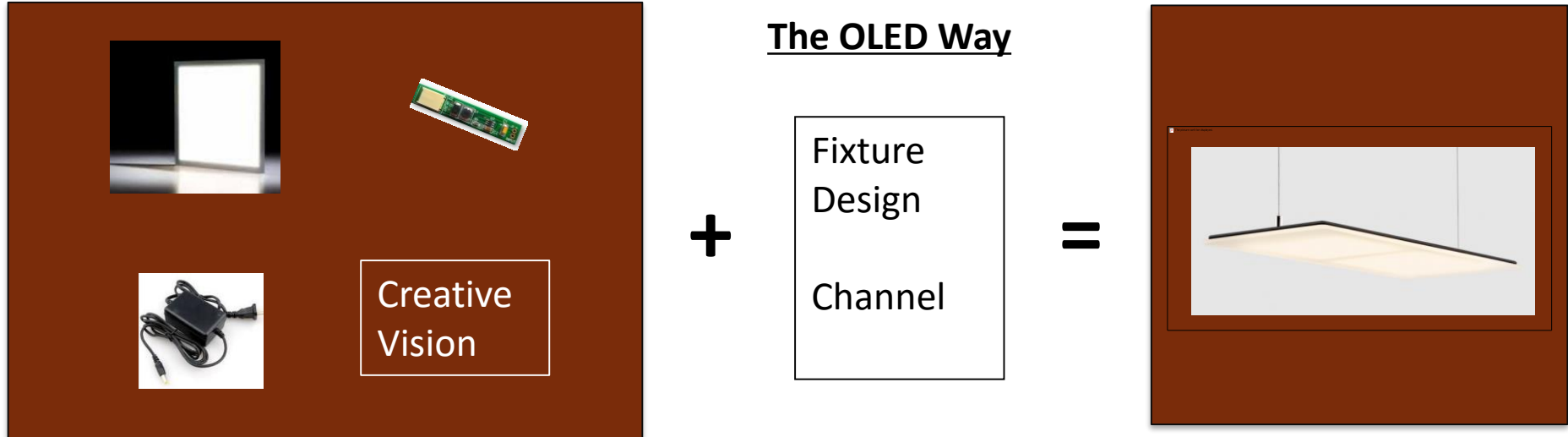
- Yes: OLEDs offer an efficient lighting solution for current and future applications

OLED Designs – An opportunity and a challenge

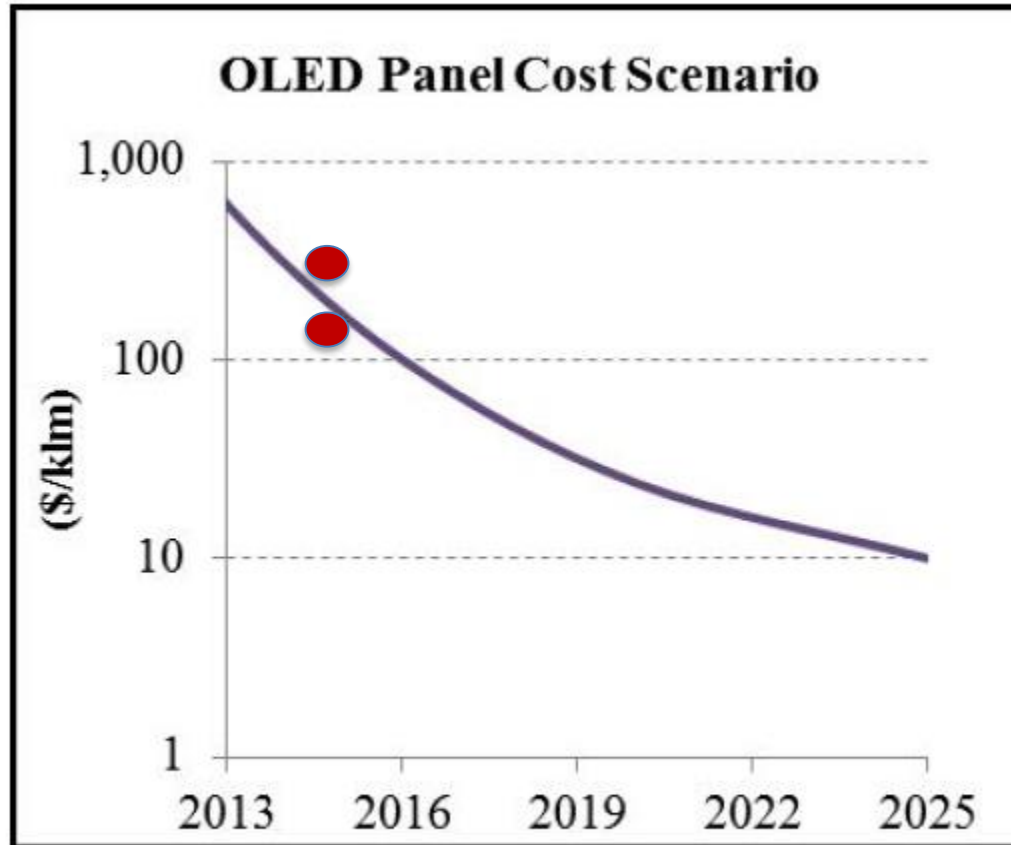
- OLED lighting industry infrastructure
 - Drivers – more challenging as panels get more efficient
 - Cost effective supply
 - Standards
- Design paradigm
 - The very attributes that enable new designs also challenge existing paradigms – no shades, reflectors, etc.
 - Showcase thinness
 - Connectivity – needs to be easy
 - Area source – not competing for the Edison socket
- The 80/20 rule

OLED Designs – An opportunity and a challenge

- OLED can build on LED, solid-state lighting, expertise including drivers and controls
 - Simpler assembly
 - Fast development time, low development cost
- *Blurs the line between light engine and fixture*



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

Cost Forecast – Is it real?



- Cost decrease with volume increase – efficiency in production
 - OLED as lamp, building material, electronic component...
- Higher yields
- Material costs – display and lighting demand drives efficiency in supply
- Device and finishing engineering improvements

- Yes: OLEDs offer an affordable lighting solution for current and future applications

Real World Application: OLED World Summit 2014 Panel Discussion; Road to Commercialization

OLED LUMINAIRE LAYOUT COMPARISONS ("STANDARD" VS. "APPLICATION EFFICIENT" LAYOUTS)

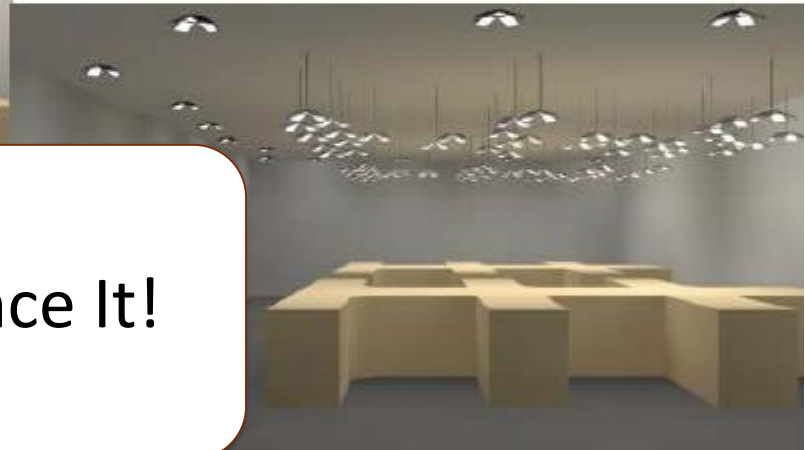
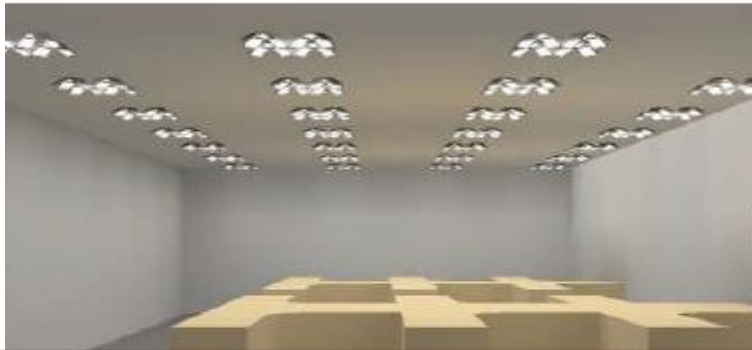
9' CEILING HEIGHT; 80-50-20 REFLECTANCE

 	3500K OLED LUMINAIRE ("STANDARD" LAYOUT)	3500K OLED LUMINAIRE ("APPLICATION EFFICIENT") LAYOUT
Luminaire Quantity / Mounting Height	112 (Surface-Mounted)	88 (15 Surface; 73 Pendant)
Total System Watts	849 W	685 W
Luminaire Spacing	6' x 6' o.c.	VARIES
Average Initial Work Zone Illuminance at 30' AFF (FC)	34 FC	35 FC
Average Initial Circulation Area Illuminance at 30' AFF (FC)	22 FC	16 FC
Avg. Horizontal Uniformity (Max/Min; Avg/Min) – Work Zone	1.5 (Max/Min); 1.3 (Avg/Min)	2 (Max/Min); 1.6 (Avg/Min)
Avg. Horizontal Uniformity (Max/Min; Avg/Min) – Circulation	2.5 (Max/Min); 1.7 (Avg/Min)	2.7 (Max/Min); 1.7 (Avg/Min)
Average Initial Wall Illuminance (FC)	16 FC	11 FC
Lighting Power Density (W/sq.ft)	0.8 W/sq.ft	0.65 W/sq.ft

P. Ngai, Acuity Brand Lighting

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OLED LUMINAIRE LAYOUT COMPARISONS ("STANDARD" VS. "APPLICATION EFFICIENT" LAYOUTS)



But you have to Experience It!

P. Ngai, Acuity Brand Lighting

"APPLICATION EFFICIENT" LAYOUT – VARYING LOCATIONS & HEIGHTS

Where do OLEDs fit in?

- Expanding design space while embracing the SSL imperatives of efficient, affordable, high light quality lighting solutions.

A superb lighting experience.