OLEDs als Lichtquelle: Status Quo und Zukunft

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OLEDWorks
Naturally Illuminating

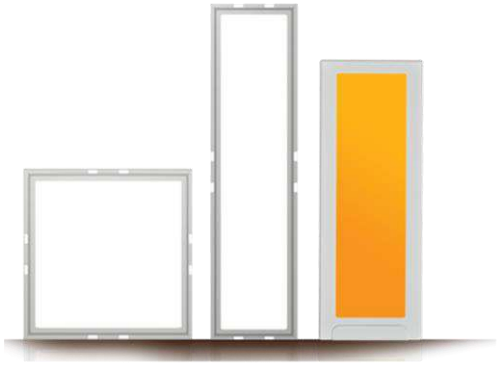
OLEDWorks.com

OLEDWorks

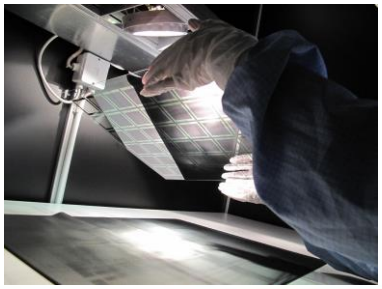
- 2010: OLEDWorks LLC founded in Rochester, NY, by Kodak OLED pioneers
- 2011-2014: Class A equity raise and build-up of production facility
- 2015: Acquired key assets of Philips OLED lighting business, including Lumiblade product line, manufacturing facility, patents and talent
- 2016: Announcement of Lumiblade Brite2 and Keuka module at L+B

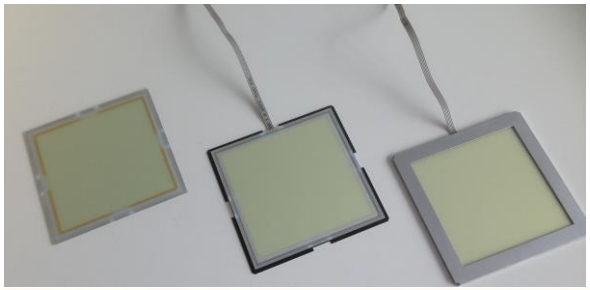
Over 400 years of OLED expertise supporting your OLED experience

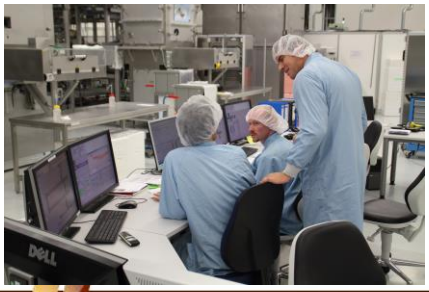
OLEDWorks capabilities



- Commercial products
  - ✓ High brightness white – square and rectangular
  - ✓ Amber
  - ✓ Modules with integrated driver
- Manufacturing in Aachen with worldwide biggest installed capacity for OLED Lighting
  - Incl. thin film encapsulation technology
- Significant R&D capabilities
- Joint Development
  - ✓ Corning – Willow® Glass for application in bendable OLEDs







OLEDWorks Naturally Illuminating

What do people love about OLED lighting?

Thin planar light source, rigid & flexible

Naturally diffuse

Excelle color rendering

Low glare

Cool to the Touch

Solid-State efficient and controllable

It is the experience. The light quality is beautiful.

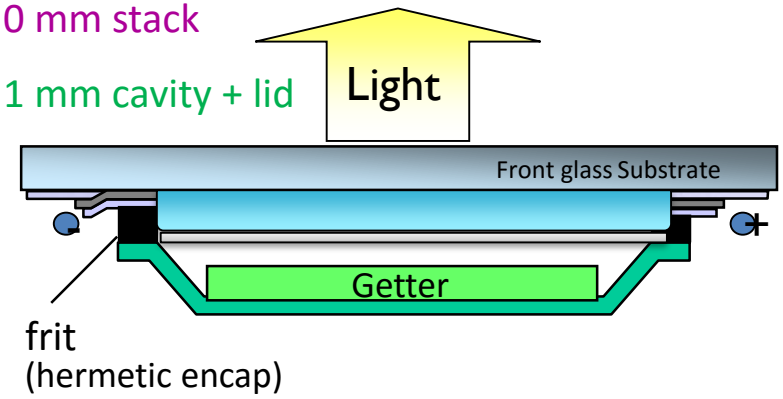
Robust Products

Frit sealing

0.7 mm glass

~ 0 mm stack

~ 1 mm cavity + lid



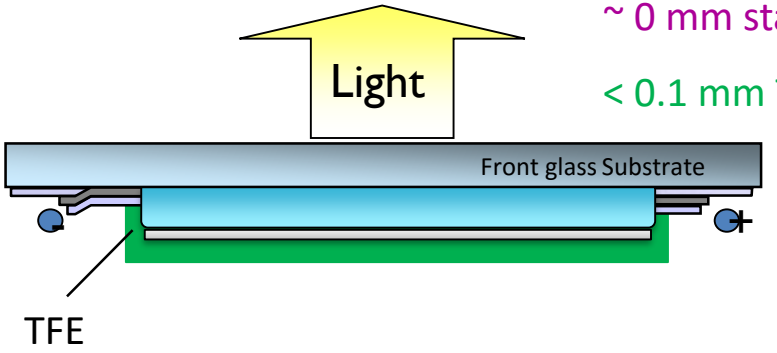
thin film encapsulation*

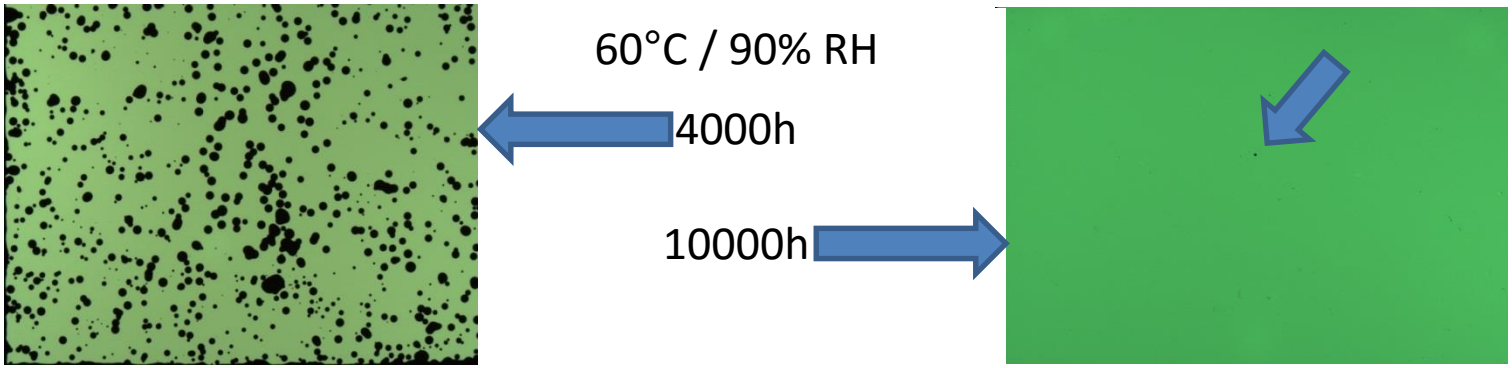
*depending on concept

0.7 mm glass

~ 0 mm stack

< 0.1 mm TFE





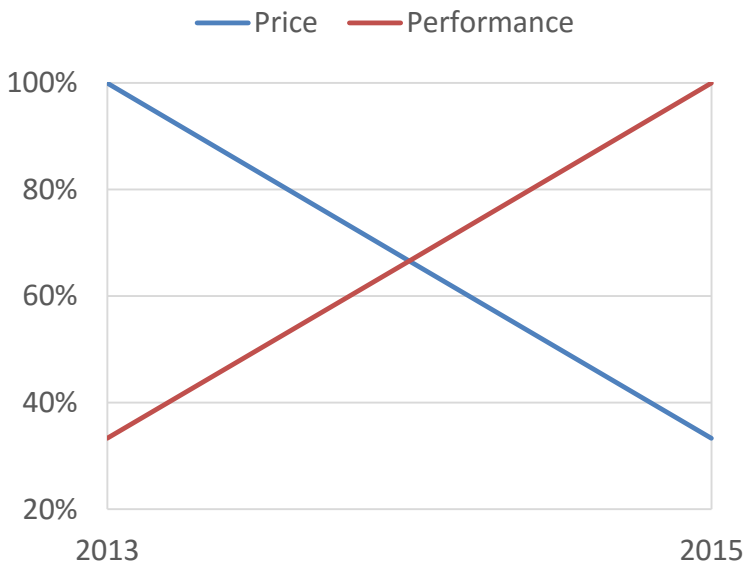
OLEDWorks Naturally Illuminating

Fast Technology / Product Development

Commercialized products
in the last 3 years Lumiblade…

…tripled the efficacy
…tripled the luminance
…tripled the lifetime

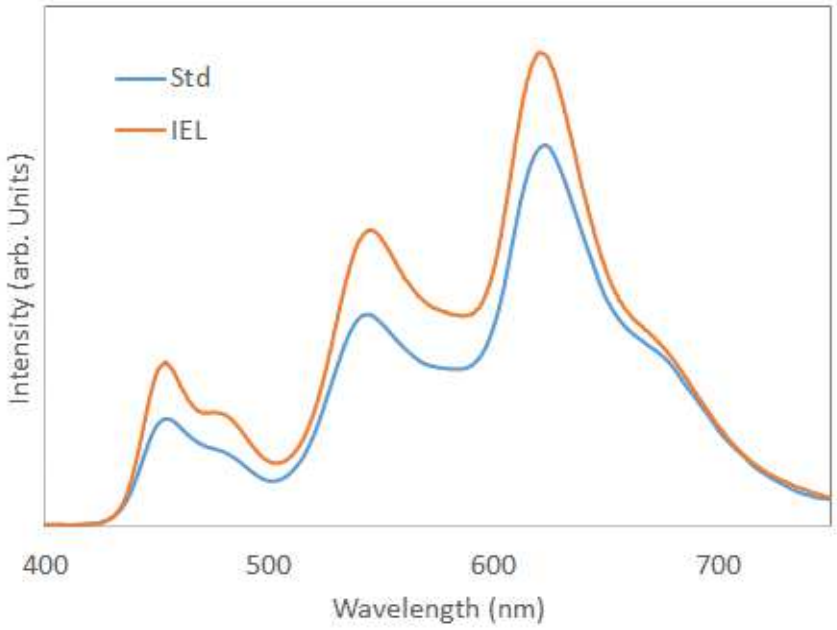
By dividing the price by three!!!



2013: GL350 1st Gen
→ *16lm/W, 120lm max, 15khrs, 150-180€*

2015: FL300
→ *47lm/W, 300lm max, 45khrs (@120lm), 50-60€*

Boost performance

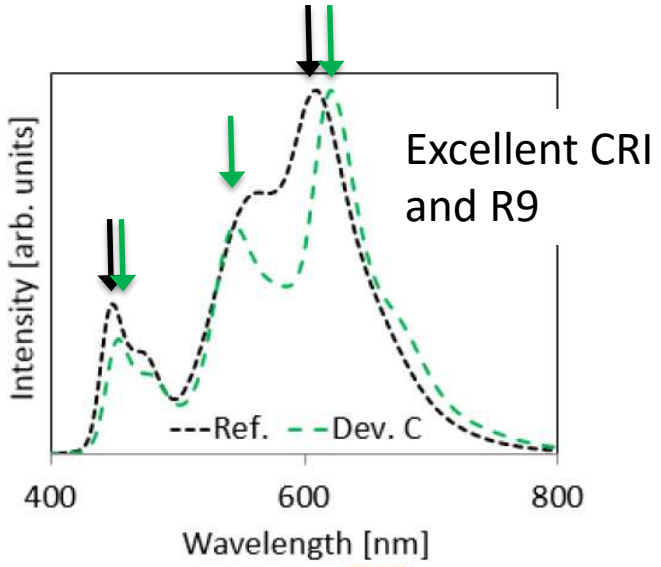


- ≈1.3x efficiency gain → efficacy, lifetime, junction temperature
- Spectral dependence of enhancement factor

3,000 cd/m^2

Device	cathode	CRI	CCT	lm/W
Std	Al	>90	~3000	46
IEL	Al	>90	~3000	63

- Further gains in efficacy (>100 lm/W)
- Extension of lifetime (>50,000 hr at high brightness)

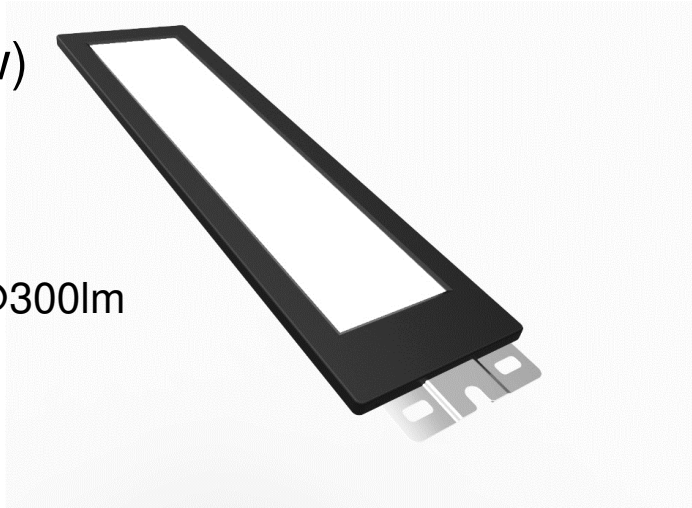


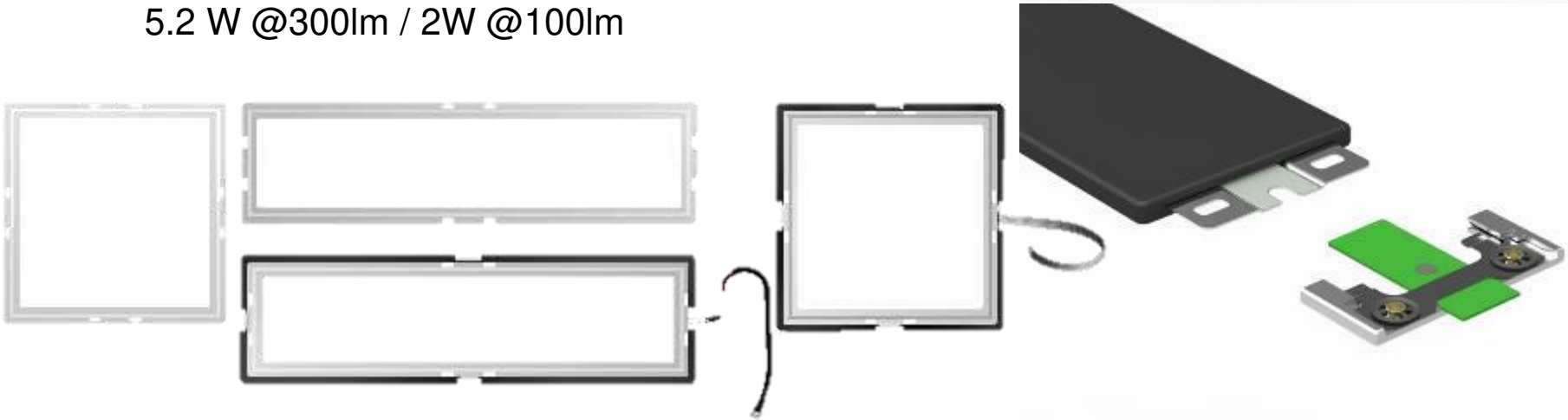
Technical performance today

New product range 2016 (Brite 2 FL300 ww)

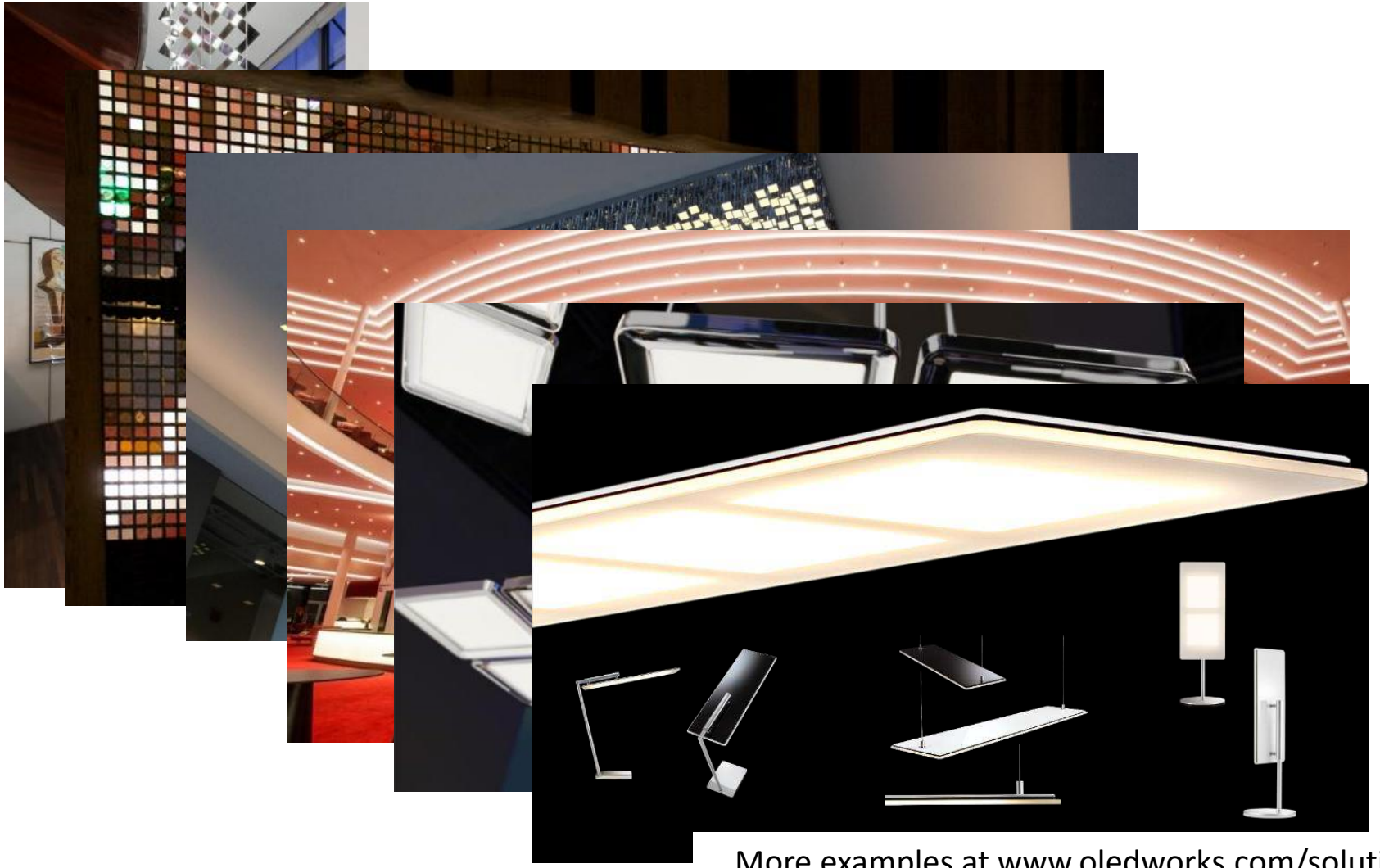
up to 62 lm/W
up to 300lm / 8,300 cd/m² brightness
up to 50,000 hours lifetime @100lm / 10,000 hours @300lm
CRI > 90
CCT 3000K and 4000K

5.2 W @300lm / 2W @100lm



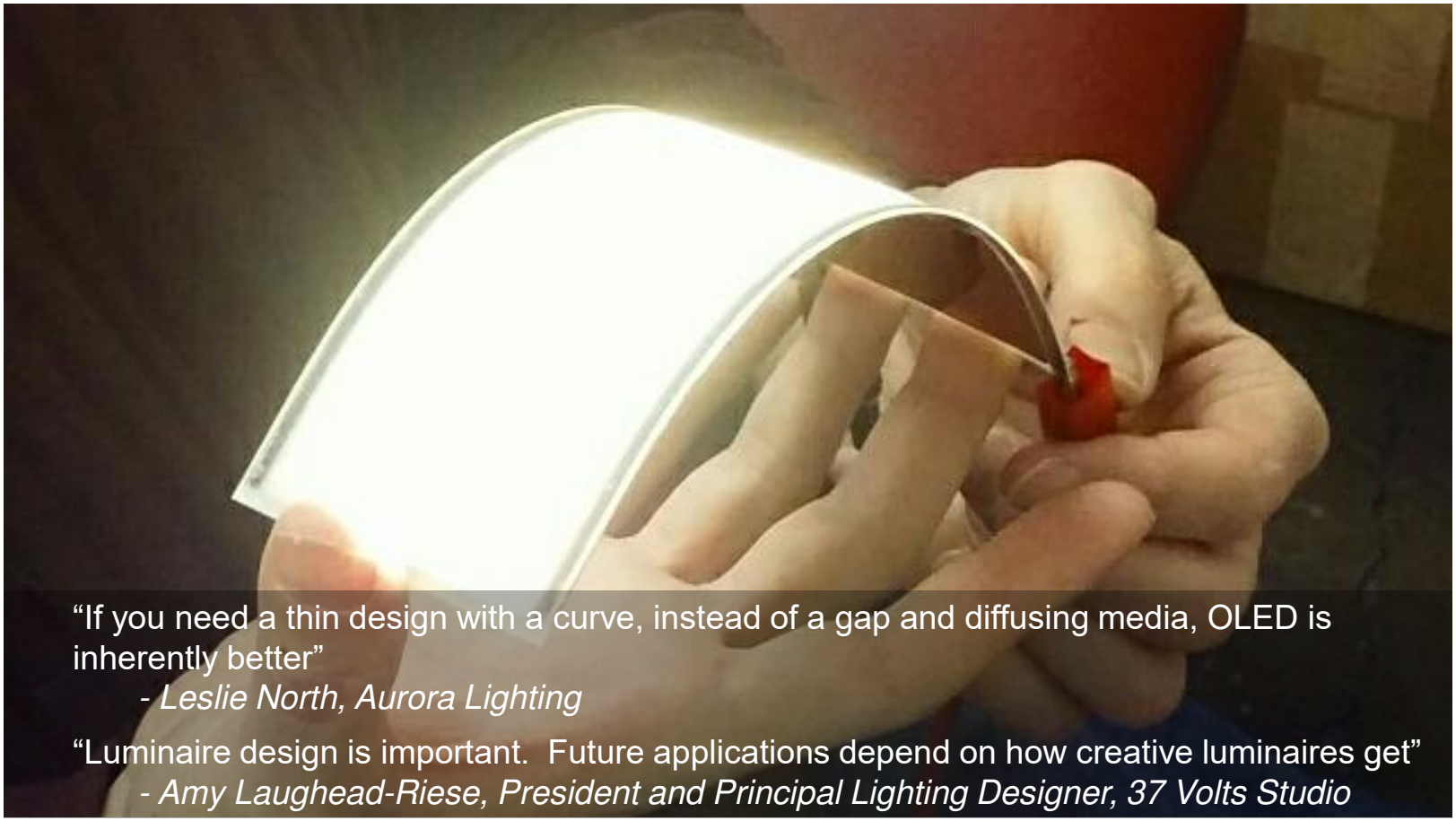


Applications



More examples at www.oledworks.com/solutions/

Flexibility unlocks additional value



"If you need a thin design with a curve, instead of a gap and diffusing media, OLED is inherently better"

- Leslie North, Aurora Lighting

"Luminaire design is important. Future applications depend on how creative luminaires get"

- Amy Laughead-Riese, President and Principal Lighting Designer, 37 Volts Studio

Summary

- **OLEDs left R&D stage to become readily available commercial products for functional lighting**

- Continued improvements in light quality and efficacy enable ever more applications for rigid panels
- Flexibility unlocks additional value for OLED lighting
- Cost-down remains a key topic

With thanks to all colleagues at OLEDWorks and Corning who contributed to the results shown here

THANK YOU

OLEDWorks LLC

Design Freely

Organic Light Emitting Diodes