ECOMAL®
Electronic Components and Logistics

LG Display OLED Light

OLED Lighting ready for the mass market.

LG Display

Agenda

- 1) Introduction
- 2) Gen 5 Production
- 3) Product overview
- 4) Efficiency roadmap
- 5) Light quality
- 6) OLED lighting reference projects

1) Introduction

LG OLED so far

- Widest panel range (size and shape)
- 1st OLED player to commercialize flexible panels for mass market
- 1st OLED player to bring efficacy up to 90lm/W
- Panel life time up to 40K h at 3000cd/m^2

BUT
→ Pricing too high for many applications

Still interested in using OLEDs? → We‘ve got news for you!

2) New OLED production

OLED lighting business moved from LG Chem to LG Display.

→ $120M investment in new Gen 5 production line for OLED lighting
→ Total LG investment into OLED technology $1.5B

→ Complete overhaul of existing OLED lighting product range to:
- → Standardize panel sizes
- → Increase efficacy
- → Implement new technologies for further efficacy improvements
- → Reduce panel prices to make them ready for wide market

→ Launch planned for Q2 2017

ECOMAL®
Electronic Components and Logistics

Gen. 2 Vs Gen. 5

	Gen. 2	Gen. 5
Substrate Size (mm)	370x470	1,100x1,250
Production Capa. (# of substrate)	6,000/month	15,000/month
Production Capa. (Area)	1,000㎡/month	20,000㎡/month
Availability	2011~	2017.08~

Benefits

What does increase in substrate size mean?
Gen 2: 12 panels (10x10cm) per substrate
Gen 5: 110 panels (10x10cm) per substrate

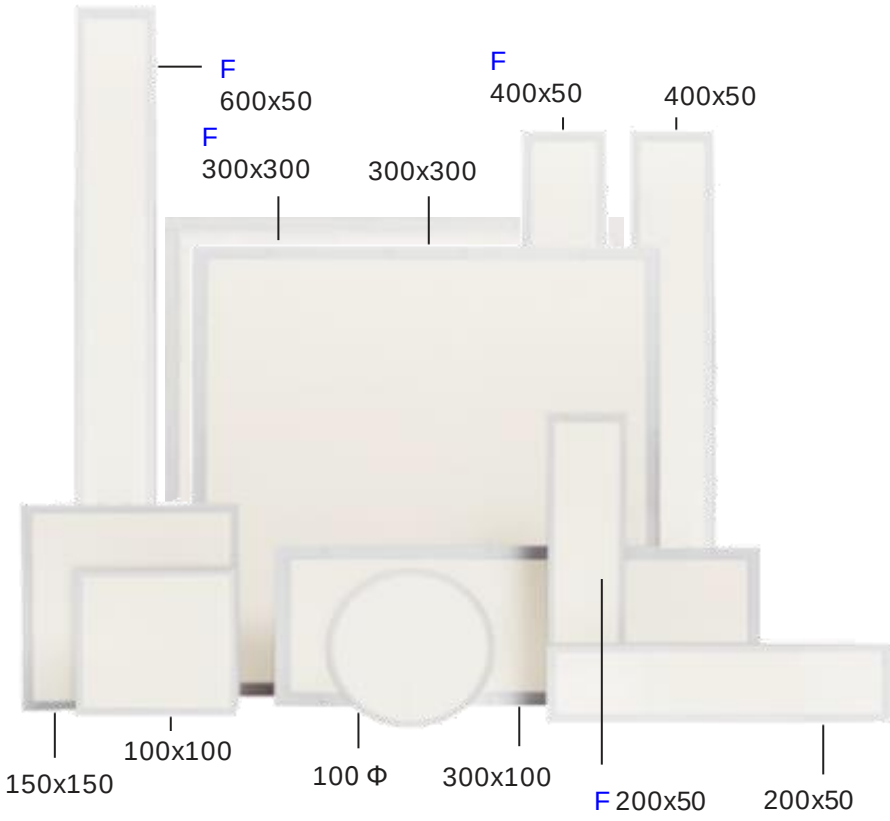
What does new production capacity mean?
Gen 2: 72K panels/month (10x10cm)
Gen 5: 1.65KK panels/month (10x10cm)
→ Scalable up to 90K substrates/month or 9.9KK panels/month (10x10cm) depending on demand

What does that mean for the panel price?
- Gen 5 pricing appr. 30-50% lower than Gen 2
- Higher price reduction for larger panel area
- Further reduction potential with production ramp up beyond 15K substrates/month

3) New OLED panel range

Type	Size		Color
Rigid	Square	100x100	3000K
		150x150	
		300x300	
	Rectangular	300x100	4000K
	Stripe	200x50	
		400x50	
	Circular	100 Φ	
Flexible	Stripe	200x50	3000K
		400x50	
	Square	300x300	4000K

Models



All sizes in mm.

3) New OLED panel range

Standardization of panel sizes according to display standards.

- old: 320x320mm
- New: 300x300mm

Focus on increasing variety on flexible panels.

ECOMAL®
Electronic Components and Logistics

4) OLED technology roadmap

	~'16	~'17	~'18	~'19
Rigid		May CCT: @3000K Efficacy : 70 lm/w Lifetime : 40K, @3000nit CRI : Ra 93, R9 70 CCT: @4000K Efficacy : 60 lm/w Lifetime : 40K, @3000nit CRI: Ra 93, R9 50 Dec CCT: @3000K Efficacy : 90 lm/w Lifetime : 40K, @3000nit CRI : Ra 93, R9 70 CCT: @4000K Efficacy : 75 lm/w Lifetime : 40K, @3000nit CRI: Ra 93, R9 50	2Q CCT: @3000K Efficacy : 120lm/w Lifetime : 40K, @5000nit CRI : Ra 93, R 9 70 CCT: @4000K Efficacy : 90lm/w Lifetime : 40K, @5000nit CRI: Ra 93, R9 50
Flexible		Oct CCT: @3000K Efficacy : 55 m/w Lifetime : 30K @3000nit CRI : Ra 93, R_9 70 Bending : 20R CCT: @4000K Efficacy : 50 lm/w Lifetime : 40K @3000nit CRI: Ra 93, R_9 50 Bending : 20R	4Q CCT: @3000K Efficacy : 110lm/w Lifetime : 40K, @5000nit CRI : Ra 93, R9 70 Bending : 5R CCT: @4000K Efficacy : 110lm/w Lifetime : 40K, @5000nit CRI: Ra 93, R9 50 Bending : 5R	

4) OLED technology roadmap

Samples rigid panels available now, flexible Q1 2017.
Launch mass production: rigid Q2 2017, flexible Q4 2017

Range:
3000K – 3 layer structure at 40K h
4000K – 2 layer structure at 30K h
Preliminary data sheets available Q1 2017

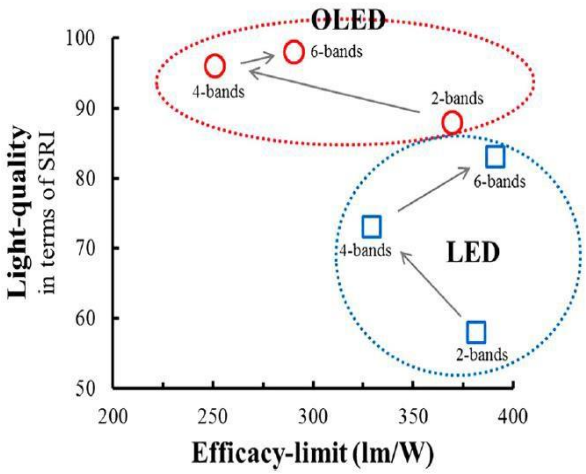
Efficacy
- Slight improvements over previous range for products launched in 2017

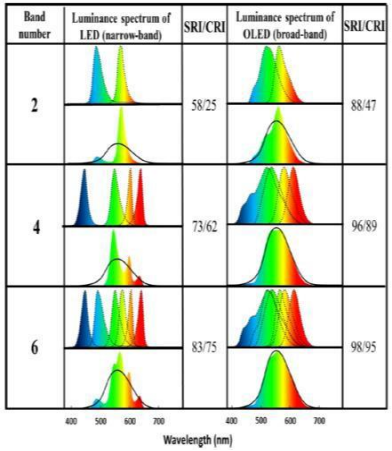
→ old: 60/55lm/W, new: 70/60lm/W

- Next step planned for 2019: 120lm/W at 40K h and 5000cd/m^2

5) OLED lighting – new tests

OLED Provides higher SRI* which represent higher light quality





" Recently, the demand for healthy lighting is increasing as traditional electronic light can cause the damage the person in physically and psychologically"

"By using OLED technology, daylight-style emission with a 96% natural light resemblance is obtained"

"The study show that OLED has better light quality over LED according to SRI Index"

SRI : **S**pectrum **R**esemblance **I**ndex presented the light quality over 0 to 100 scale.
Zero represents a poorest light-quality, while 100 rates for highest light-quality.

5) OLED lighting – new tests

Conventional Light: CRI 80

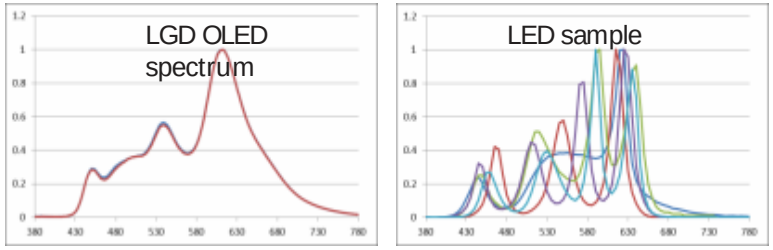
VS

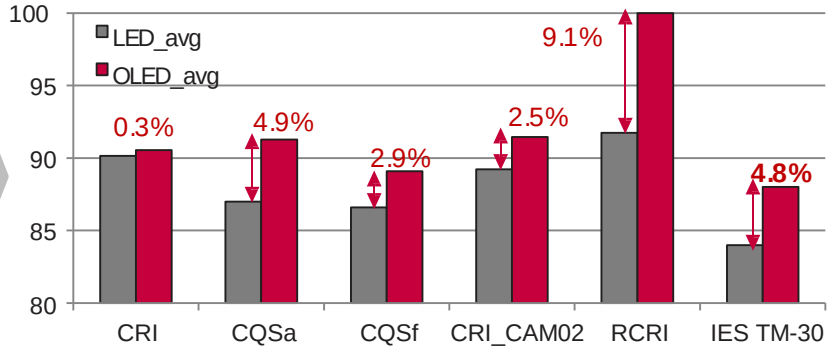
LG Display OLED Light: CRI 90

True color is a key element that influence to product presentation, moods, and buying decision.

OLED light provides a higher color fidelity level than LED lights at when using IES TM-30 metrics

OLED vs. LED Color Fidelity analysis @CRI90





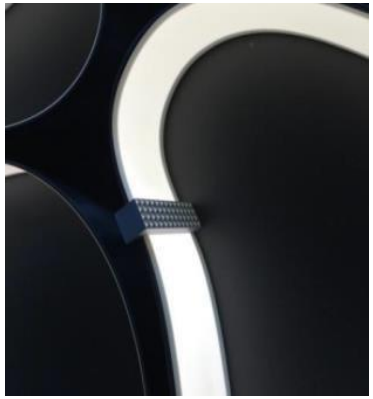
CQS=Color Quality Scale

ECOMAL®
Electronic Components and Logistics

Flexible Light

The flexibility of the light source offers ultimate design freedom for designers and architects

- Bending radius of 20mm
- Currently two types are available: 200x50mm and 400x50mm

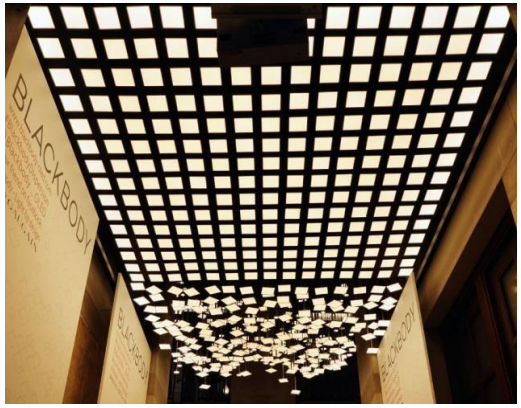


ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Hospitality (1)

OLED Decorative Installation



Description

- Designed by Blackbody OLED

In addition to its decorative features, the decorative installation has an added purpose which is to bring the occupant's attention and to interactive with the people

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Hospitality (2)

OLED Mirror Lighting

Description

- Sheraton Walker Hill Hotel, Seoul

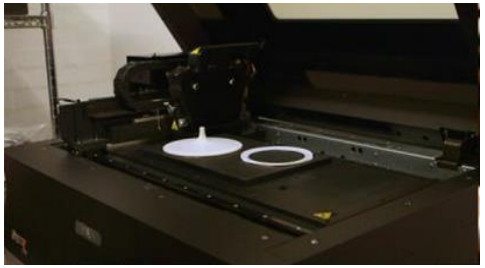
The thinness and excellent light quality of OLEDs make them perfect for mirror lighting. The mirror can be kept under 1 inch while providing a uniform and glare-free light

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Hospitality (3)

OLED Restaurant Lighting



Description

- Tincan Restaurant, Soho London
  - Designed and Manufactured by AL_A

The simplicity of OLEDs enabled Amanda Levete and her team of architects to easily design and manufacture OLED lightings for their Tincan project. The initial process was done by utilizing a 3D printer.

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Hospitality (4)

OLED Cafe Lighting

Description

- Marley Coffee Shop, Itaewon Seoul
  - Designed by MS Cho Studio

Marley Coffee Shop used OLEDs to create the ambiance that represents their philosophy of 'One Love', taken from the artist Bob Marley's song of the same name. Now, the OLED Lightings have become a part of the brand's standard design for their franchises.

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Hospitality (5)

OLED Club/ Stage Lighting




Description

- Fuse Lounge, Hanoi
  - Designed and Installed by Contrast Studio

This is an example that displays the extreme dimming and programmability function of OLEDs, without blinding the audience

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Retail (1)

OLED Shelf Lighting for Retail

Description

- Belport Cosmetics Brands Shop, Myeongdong Seoul

OLED in Retail comes with multiple benefits: A better presentation of the products with high CRI; a better presentation of the shop with its thin/slick display shelves; and better preservation of the products with low heat emission and no UV

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Retail (2)

OLED Decorative Installation for Retail

Description

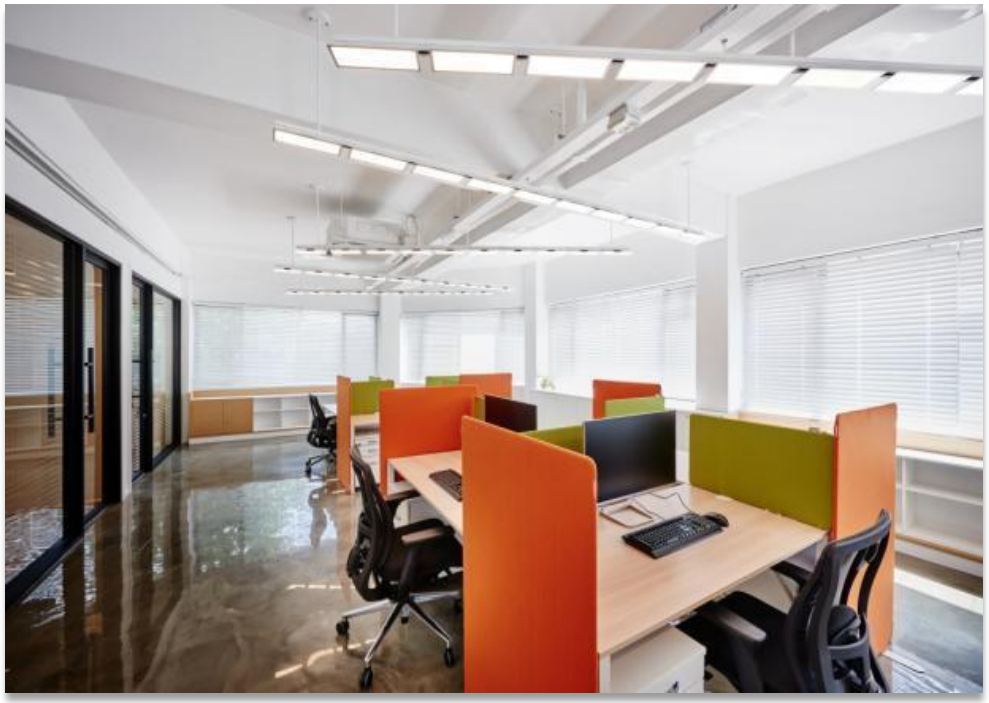
- Selfridges, Birmingham
  - Designed by Ab Rogers Design

In addition to its decorative features, this installation has an added purpose which is to bring the customers' attention to the product, brand, or 'promotion of the season' placed underneath the lighting

6. OLED Lighting Reference Projects

Office (1)

OLED Office Lighting



Description

- Open Office by LG Display

Unconventional lighting designs made possible while fulfilling office lighting requirements.
Occupants can get instill warmth within space with visual comfort

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Office (2)

OLED Meeting Room Lighting

Description

① LG Chem Meeting Room, IFC Seoul
- Trilia by Acuity Brands Lighting

② LG Hausys Meeting Room, Z:IN Square Seoul
- Custom Installation by LG Electronics

③ United States Embassy, Finland
- Trilia by Acuity Brands Lighting

Lighting requirements for meeting rooms are relatively lenient compared to office areas, thus made one of the earlier applications where OLED Lighting had been installed

ECOMAL®
Electronic Components and Logistics

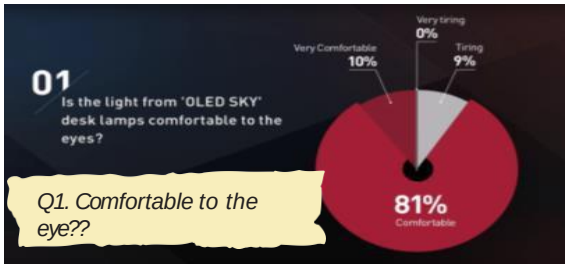
6. OLED Lighting Reference Projects

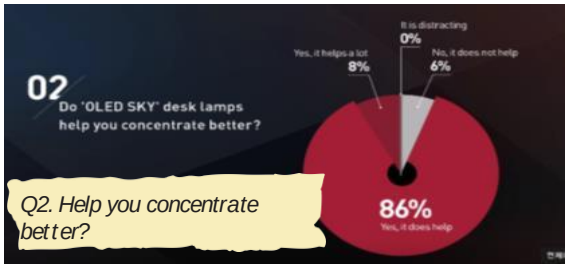
Office (3)

OLED Library Desk Lamp

Description

■ Seoul National University Library





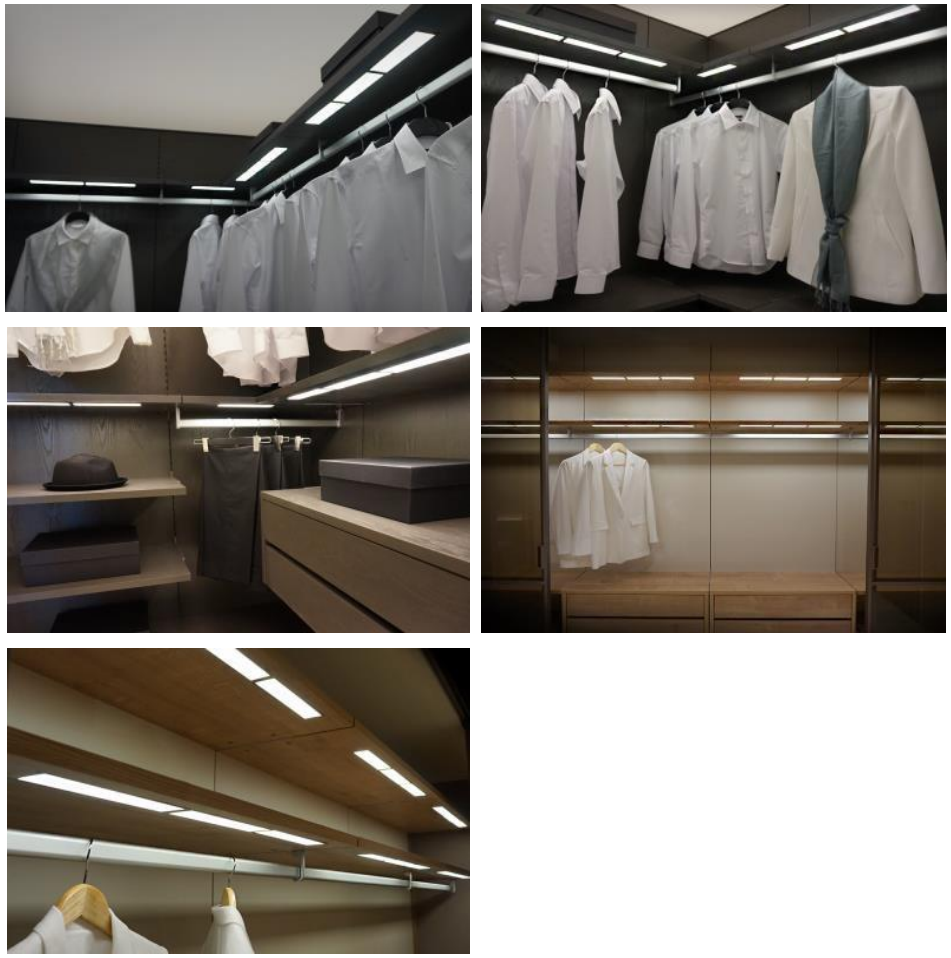
by Workrite Ergonomics

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Residential (1)

OLED Wardrobe Lighting



Description

- Model House by DAERIM Construction

DAERIM sought to utilize OLEDs in wardrobes to benefit from the high CRI and low heat factor of OLEDs, improving various comfort factors for the user

ECOMAL®
Electronic Components and Logistics

6. OLED Lighting Reference Projects

Residential (2)

OLED Heritage Lighting

Description

- Hanok (Korean Traditional Building)
  - Installed by IVVAIU Architects

Lighting installation often is a challenge for heritage buildings, especially when regulations make it difficult to nail or engrave into the structure.

In this case, OLED panels provided a simple solution as they were directly applied to the wall with double-sided tape.

https://www.youtube.com/user/LGOLEDLIGHT/videos

ECOMAL®
Electronic Components and Logistics

Thank you for your attention.

ECOMAL Europe GmbH
Dipl. Ing. (FH) Guido Schott
Technical Support Center Europe
Kerkrader Str. 10
D-35394 Gießen / Germany
Telefon: +49 (0)641 94 439 – 15
Mobil: +49 (0)162 29 55 267
technique@ecomal.com

European Headquarters
ECOMAL Europe GmbH
Wilhelm-Schauenberg-Strasse 7
79199 Kirchzarten / Germany

Phone +49 (0)7661 395-0
Fax +49(0)7661 395-35
E-Mail info@ecomal.com
www.ecomal.com

Martin Behlke
Managing Director

The major component in your success!