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The World of OLED Lighting

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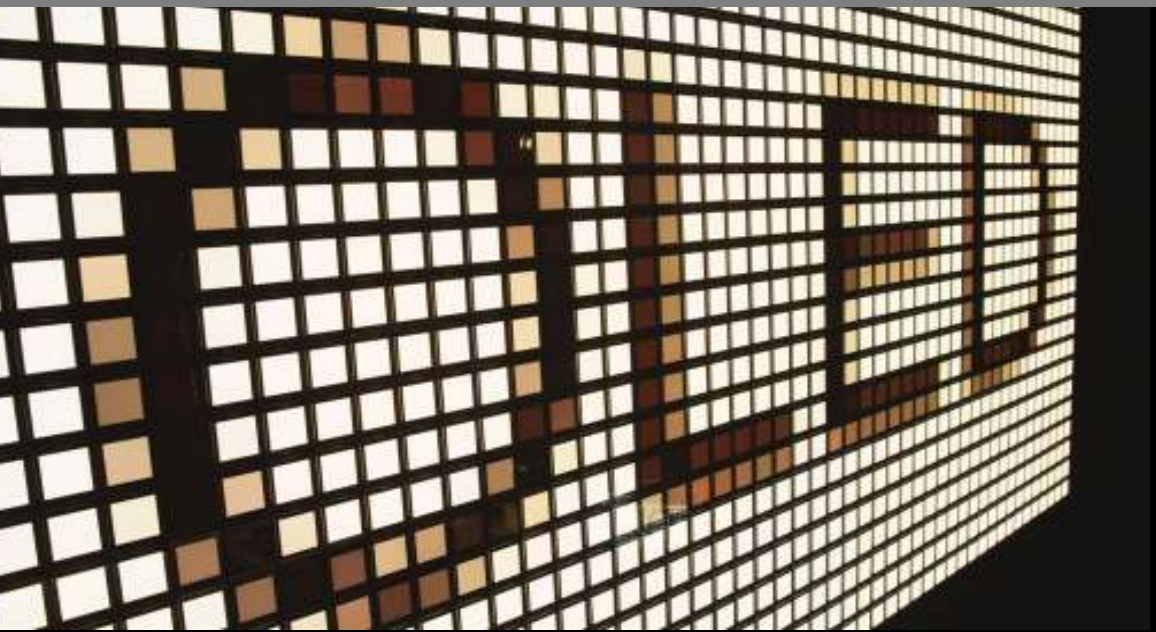
The World of OLED Lighting



Content

- What are OLEDs?
- Benefits of OLEDs
- Realised Projects
- Application Areas
- The Future

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OLEDs

What is OLED?

OLED stands for “organic light emitting diode”.

Name is misleading: has nothing to do with animals or plants.

“Organic” because materials used in the production of OLEDs come from the field of organic chemistry (carbon based compounds).

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OLEDs

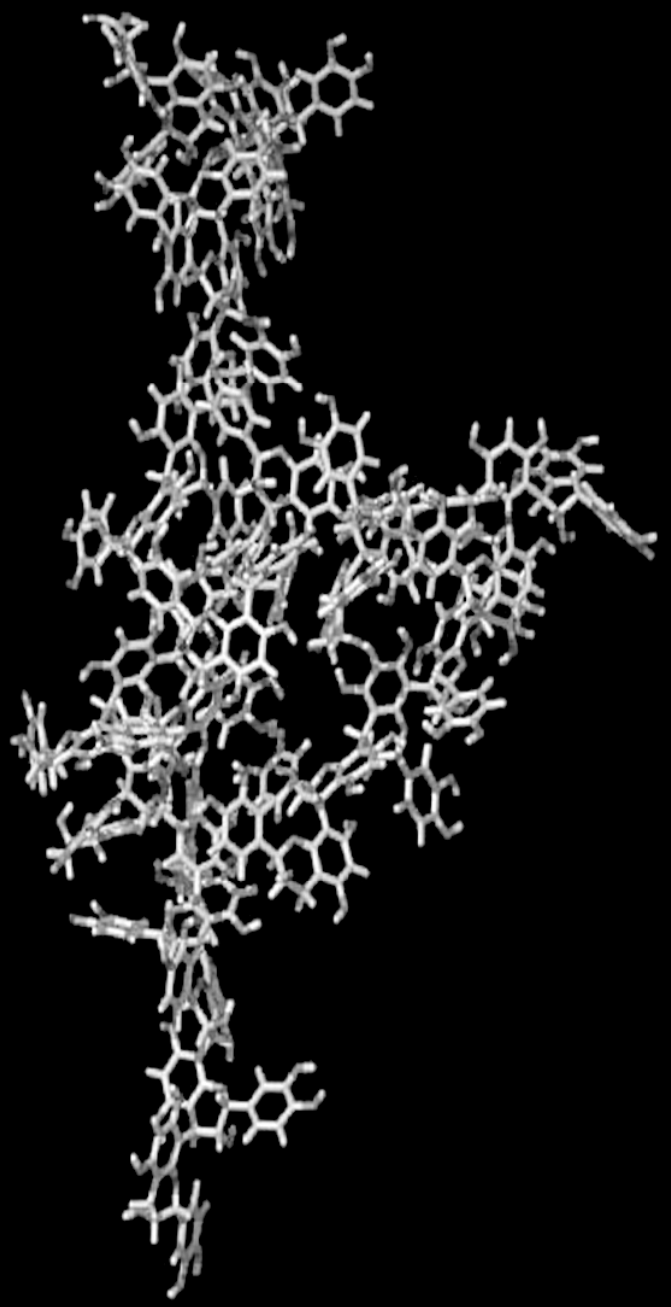
Some basics about the technology

Chemical substances in the OLED emit light when current is applied. This principle is called electroluminescence.

Not to be mistaken with phosphorescence.

Principle discovered in 1953, birth of today's OLEDs in 1975 by Ching W. Tang at Eastman Kodak.

Today, OLEDs are made with small-molecules structures. Polymers will be the future of OLEDs.



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Known for displays, new for lighting

OLEDs are used as displays in smart phones and mobile gaming devices.

First commercial available large OLED TVs announced at CES 2013 – screen size of 55”, price of £8,000.

However: First prototypes were shown already in 2004.
9 years+ to the market.

Relatively new on the market:
Lighting applications based on OLED.

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Differences between OLED displays and OLED lighting

	Passive matrix display	Active matrix display	Lighting
Substrate	Glass/ITO pixelated	LTPSilicon TFT	Glass/ITO large area
Emission	R,G,B saturated		All, especially white
Brightness (cd/m²)	400		4,400
“Pixel” size	~0,005cm x 0,01cm		> 5cm x 5cm
Defect tolerance	Up to 2 pixel		0
Value enabler	OLED/Driver IC	TFT backplane	OLED
Applications	Sub-display, MP3	Mobile phone display/TV	Any lighting
Market development	Declining	Strong growth	Embryonic
Major issue	Limited size	TFT yield/stability	Costs

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Why are OLEDs a revolution to lighting?

Point source

Linear sources

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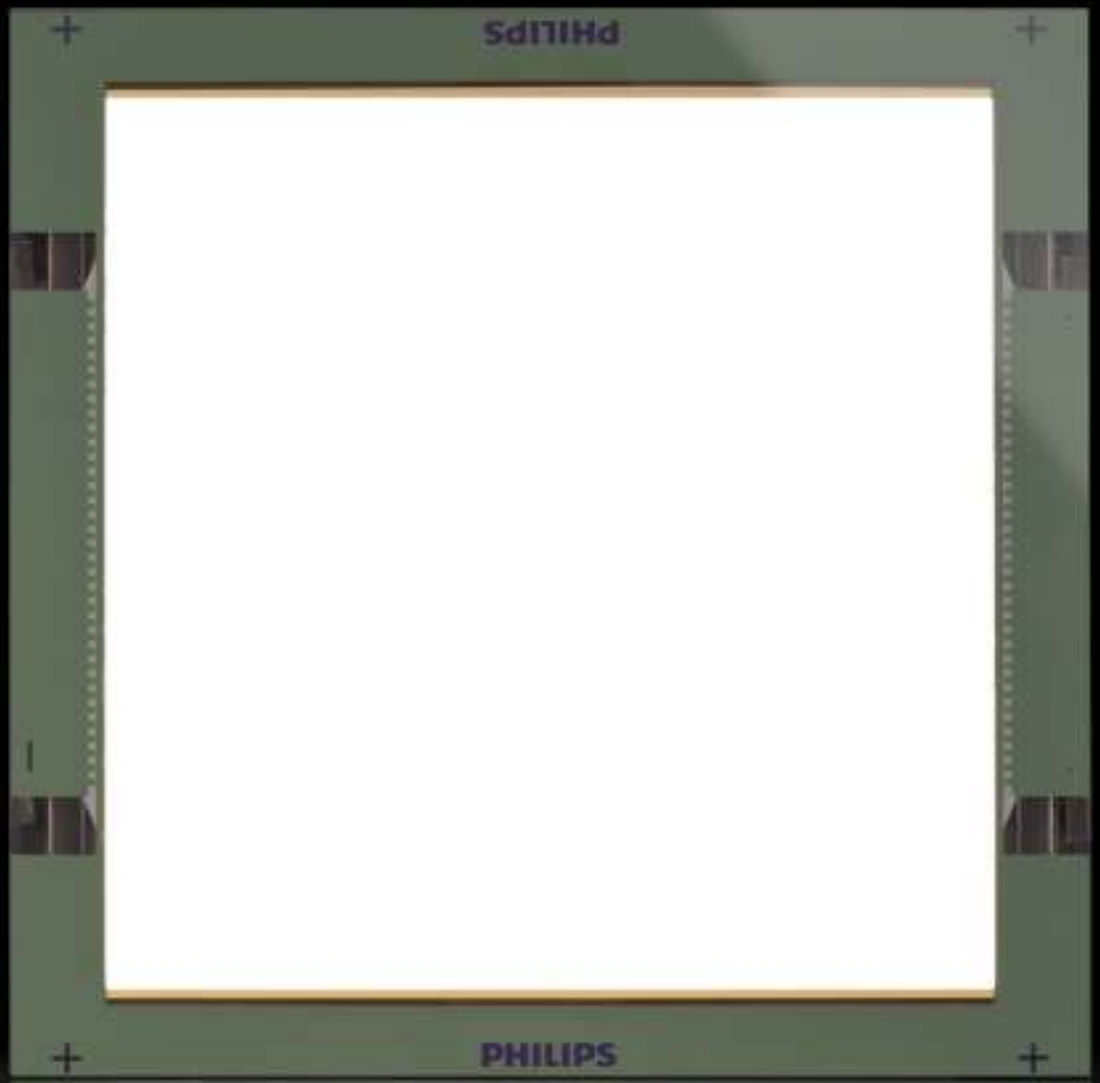
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A new perception of light

Rather than a beam emerging from a single light-emitting point, light coming from the larger surface provides pleasant, uniform illumination.

The OLED produces a soft light, casting no shadows and no glare: It is about purity and subtle beauty.

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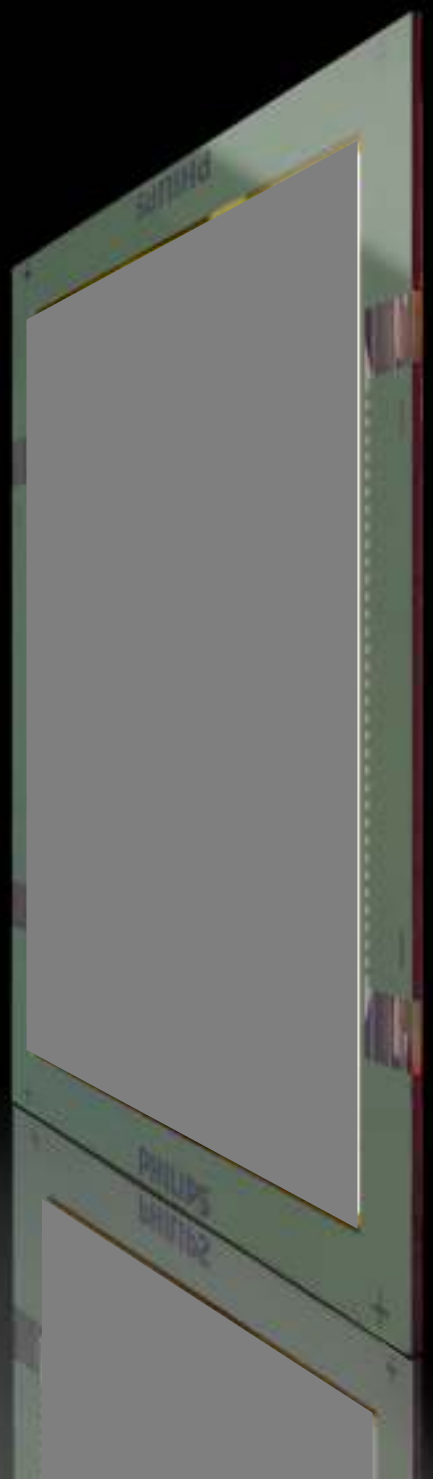
Instant on and dimmable

All actions of staging the light between instant on and smooth dimming are possible.



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Ultra-flat and ultra-light

OLEDs are only between 1.8 mm and 0.7 mm thin and a lightweight.

A high-tech light source at its best.

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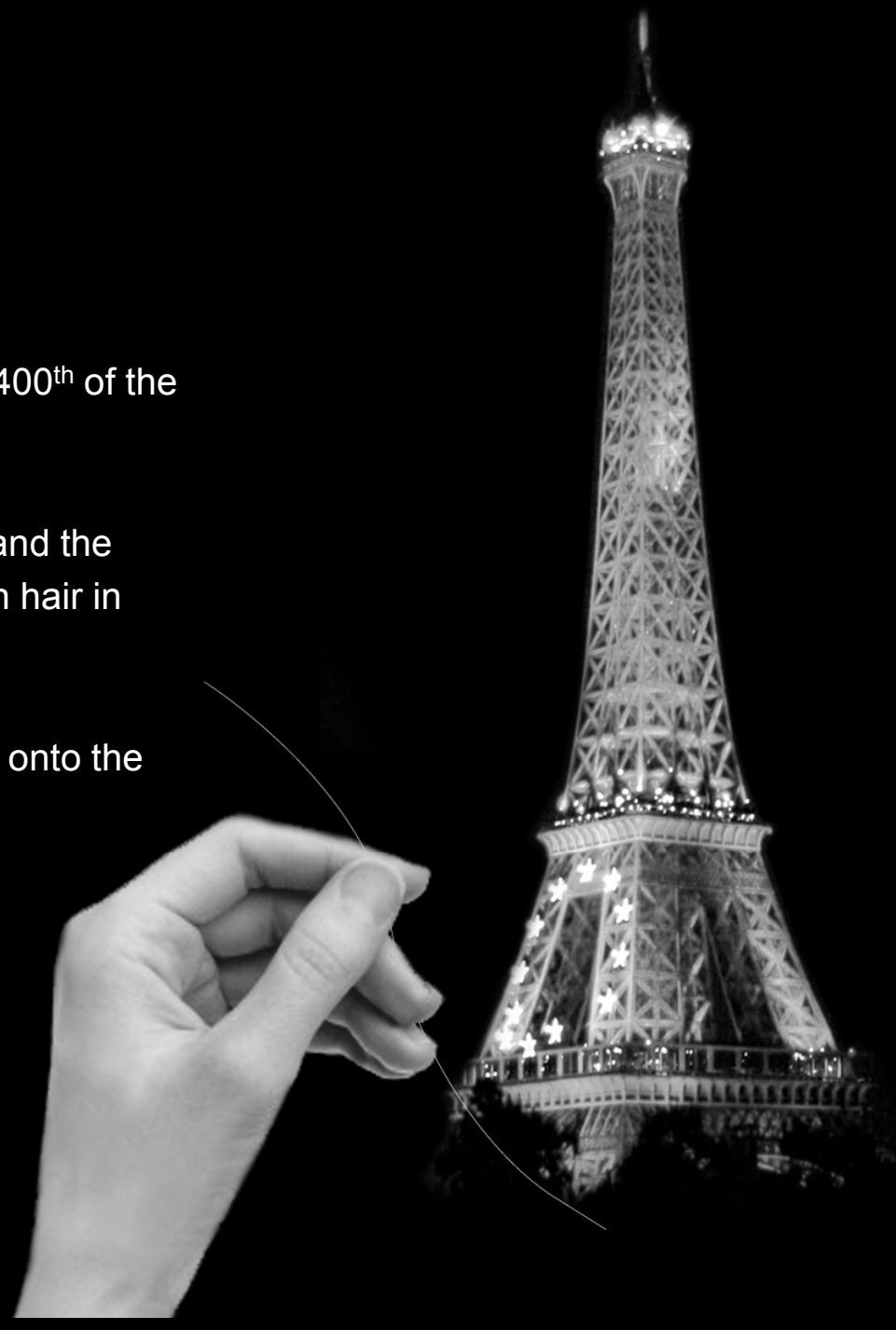
High tech at its best

Layers that emit the light are just 400 nm – that is a 400th of the thickness of human hair.

The relation between the size of the Organic layers and the thickness of the total OLED is the same like a human hair in front of the Paris' Eiffel Tower.

During production process, atom by atom is sprayed onto the glass plate.



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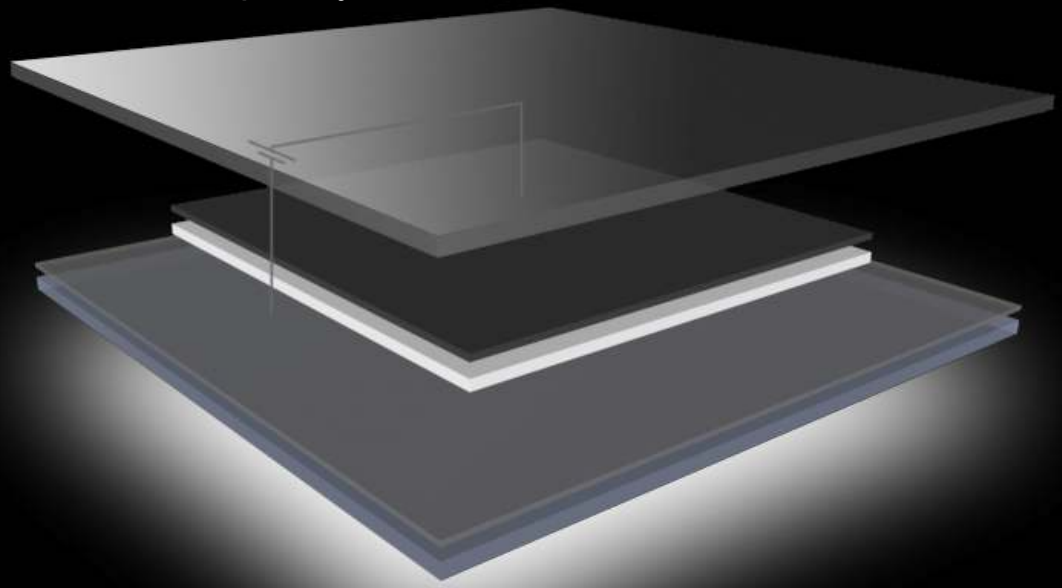
How OLEDs work

A layer of light

OLED works by passing electricity through nanometer thin layers of organic semiconductors sandwiched between two electrodes. The electric current travels from the positive to the negative electrode through the organic film, causing the film to emit light. To protect the organic layers, the OLED is completely sealed between two glass plates.

Glass cover & Getter
Metal cathode
Organic layer(s)
Transparent anode
Glass substrate
Light



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All shades of white

The OLED is able to produce the cool white emitted by an LED as well as the warm white radiated by an incandescent bulb.

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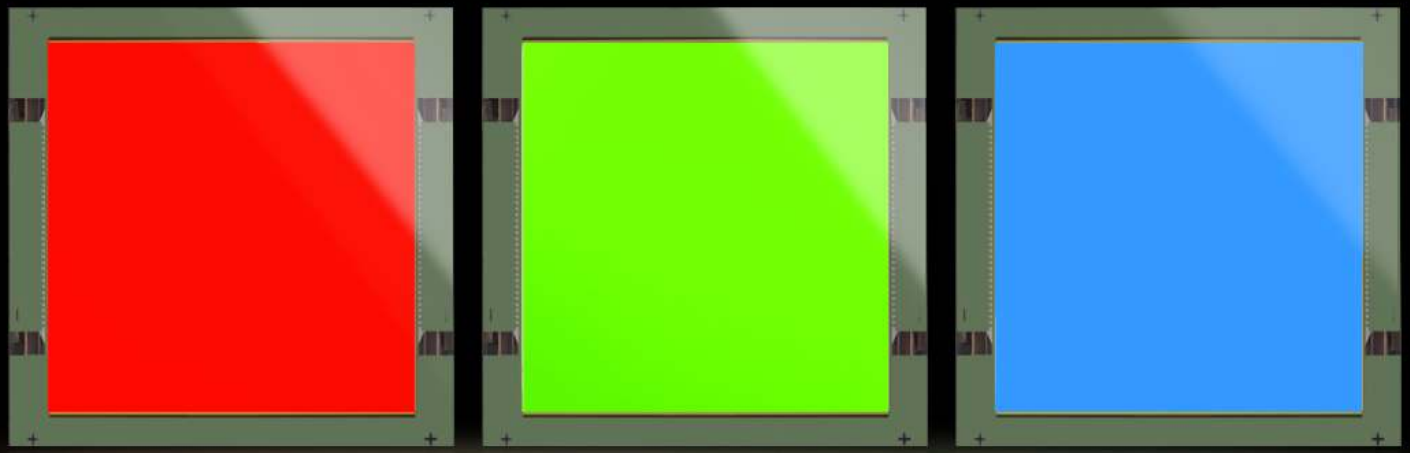
All colors

The colours emitted are produced by mixing the Red, Green and Blue OLED compounds in specific amounts and combinations, this way exact colour shades can be created.



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All shapes

As well as symmetric forms like e.g. ovals or rounds, all kinds of free shapes are possible.

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Light as a material

OLEDs opens up a whole new world of opportunities for working with light. Functional as well as decorative, and surprisingly easy to use, organic lighting represents a new raw material.

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Long-living and highly efficient

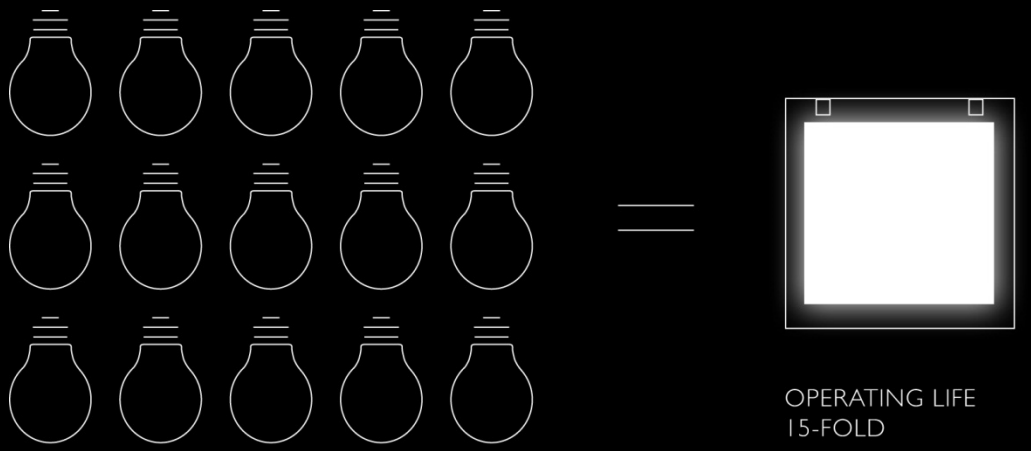
Lifetime (L70): 15.000 hours

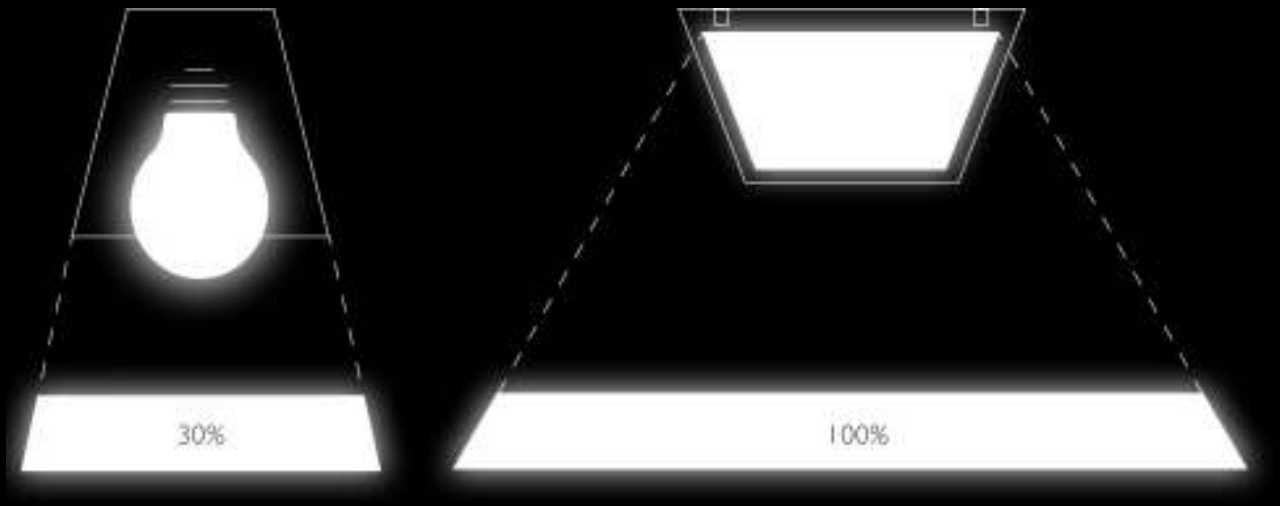
Already far more efficient than halogen, with no losses due to secondary optics.

Made from glass – easy to recycle.

Philips Lumiblade OLEDs meet European Union's RoHS and REACH directives.

No drawbacks of conventional lighting like harmful substances and heat dissipation.





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A green light source

20 percent of the worldwide energy is used for lighting.

Energy for lighting accounts for six percent
of the world's greenhouse gases
(1.9 billion tons of carbon dioxide).

By using energy-saving lighting
these figures can be reduced.
UN says even halving them.

Source: United Nations Environment Program

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Today’s performance

up to 45 lm/W in different shades of white and RGB
up to 4,400 cd/m² brightness
up to 15,000 hours lifetime (at 70% initial brightness)
between 1.8 mm and 0.7 mm thin
<120 cm² surface

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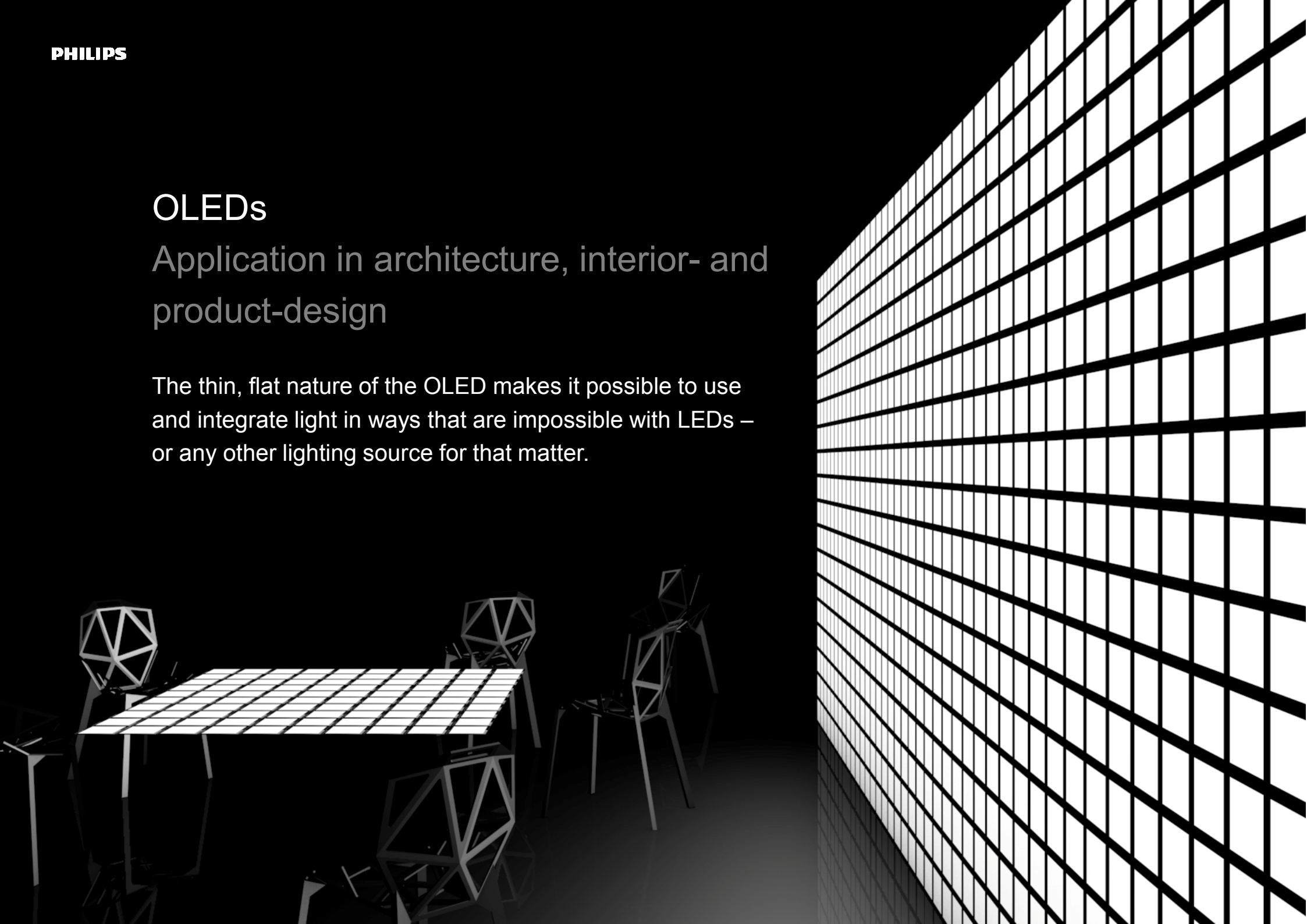
Application in architecture, interior- and product-design

The thin, flat nature of the OLED makes it possible to use and integrate light in ways that are impossible with LEDs – or any other lighting source for that matter.



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Realised projects

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Mimosa

Jason Bruges Studio

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Engulfing the Aston Martin One-77

Jason Bruges Studio

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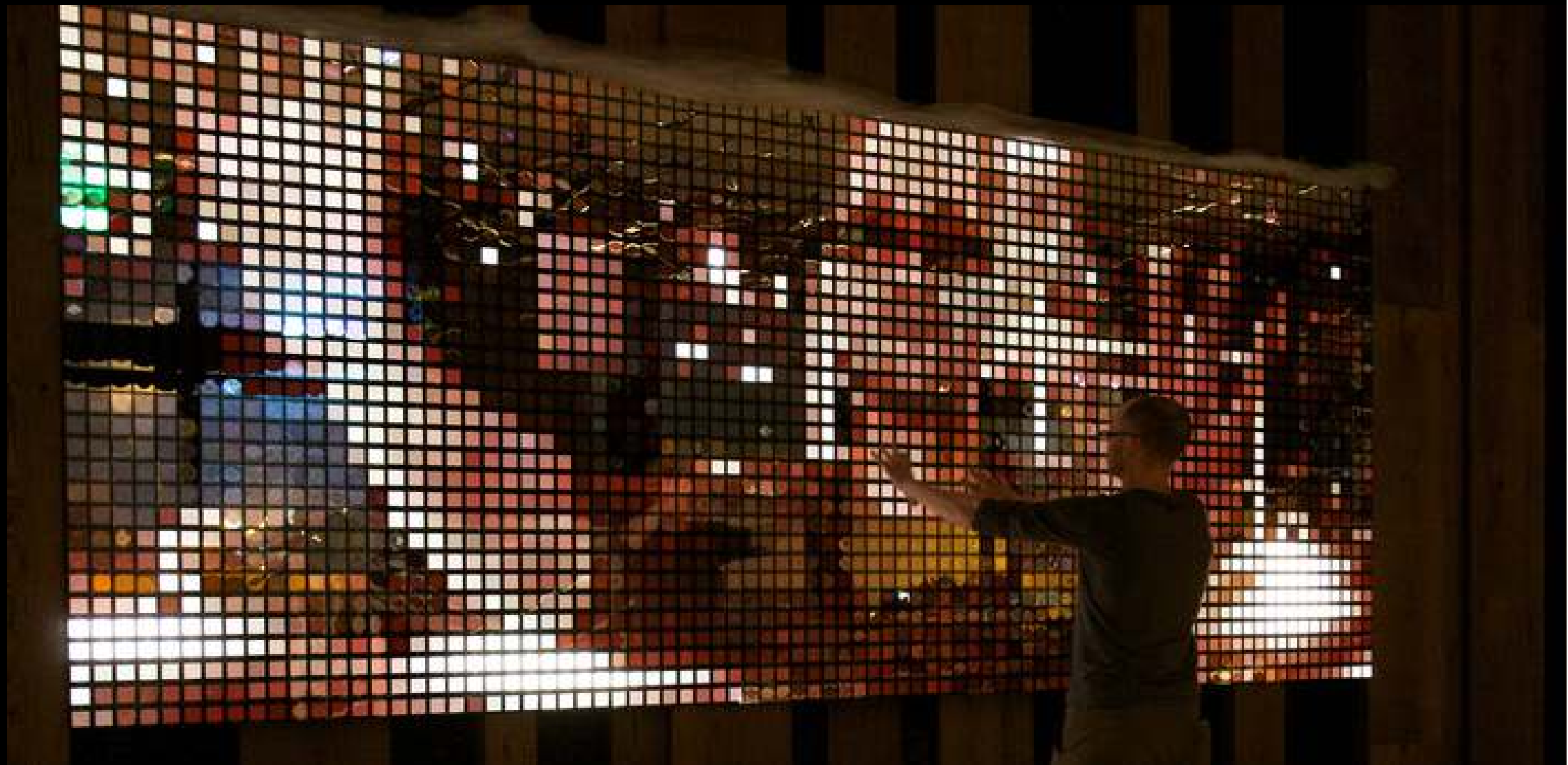
Philips LivingShapes interactive wall

Light installation the easy way



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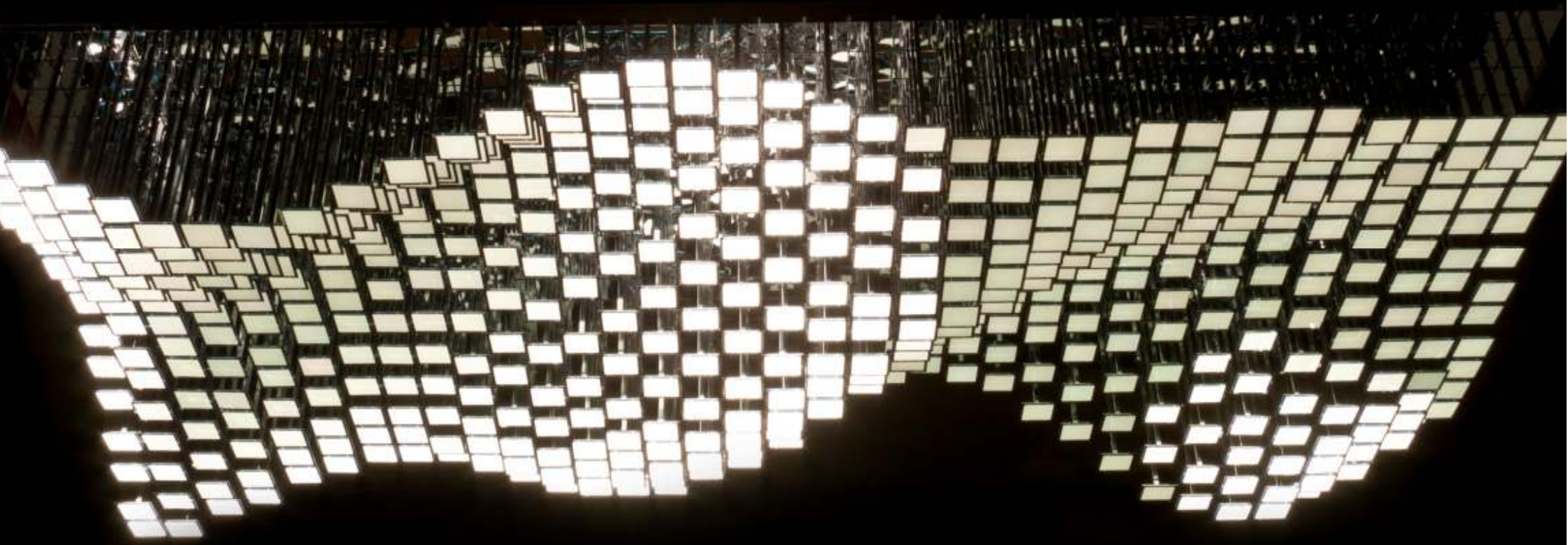
Philips LivingSculpture 3D module system

Adding the third dimension to OLED



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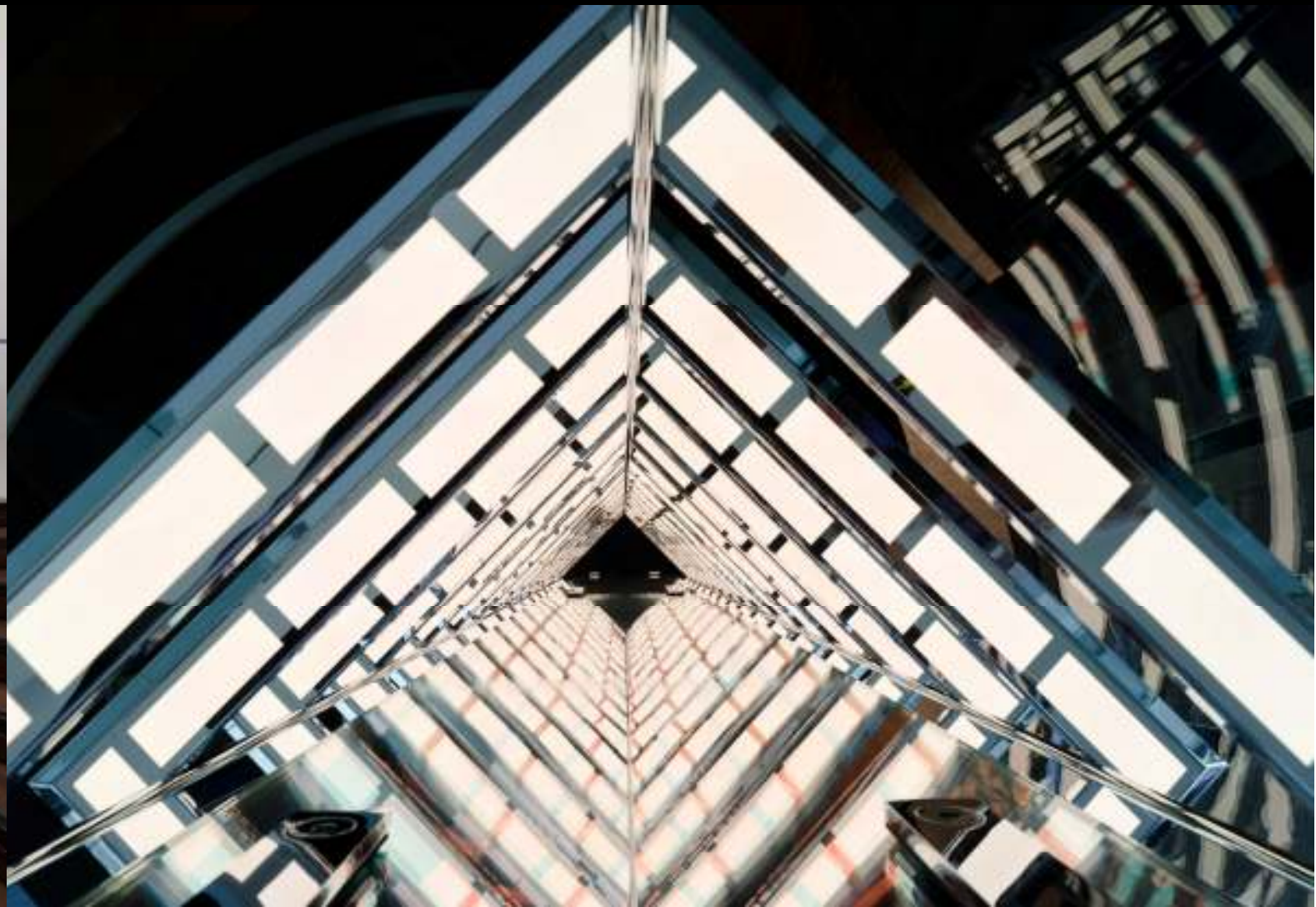
Suspended OLED luminaire

Board room in Berlin



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LivingSculpture kinetic installation

Shaping light in the air

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Moorea

Daniel Lorch Industrial Design

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Edge

Amanda Levete

Established & Sons

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O’Leaf

Modular Lighting Instruments

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Flat Lamp

Tom Dixon

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smart forvision

Letting the sun thru the roof

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Audi light concept

The backside of the near future

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Black Eyed Peas

Lighting up Fergie

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Philips LivingShapes interactive mirror

Feel the aura of OLED light

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The Lumiblade Creative Lab

Open Innovation at its best

More than just an abstract design concept, our Lumiblade Creative Lab is a real workshop in Aachen (Germany), where experts in the fields of lighting, electronics and materials are on hand to advise you how to integrate light and add a new dimension to your projects.

The Lumiblade Creative Lab team offers advice and guidance as well as practical support, helping your project to progress beyond the design stage into a prototype or even entering production as a small series.

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What happens next?

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Color tunability

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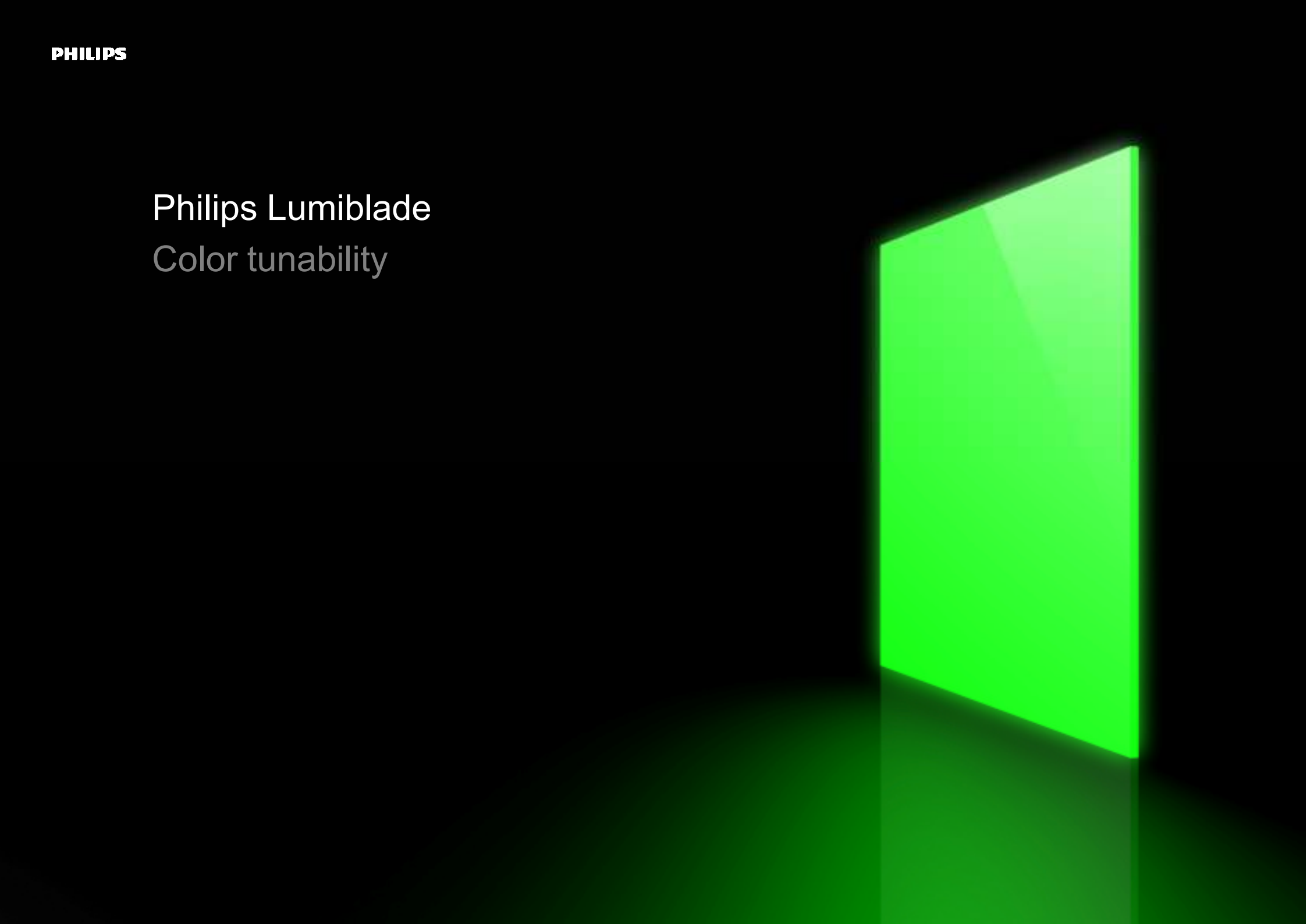
Color tunability



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Color tunability

OLEDs will be color tunable in about 5 years from now.

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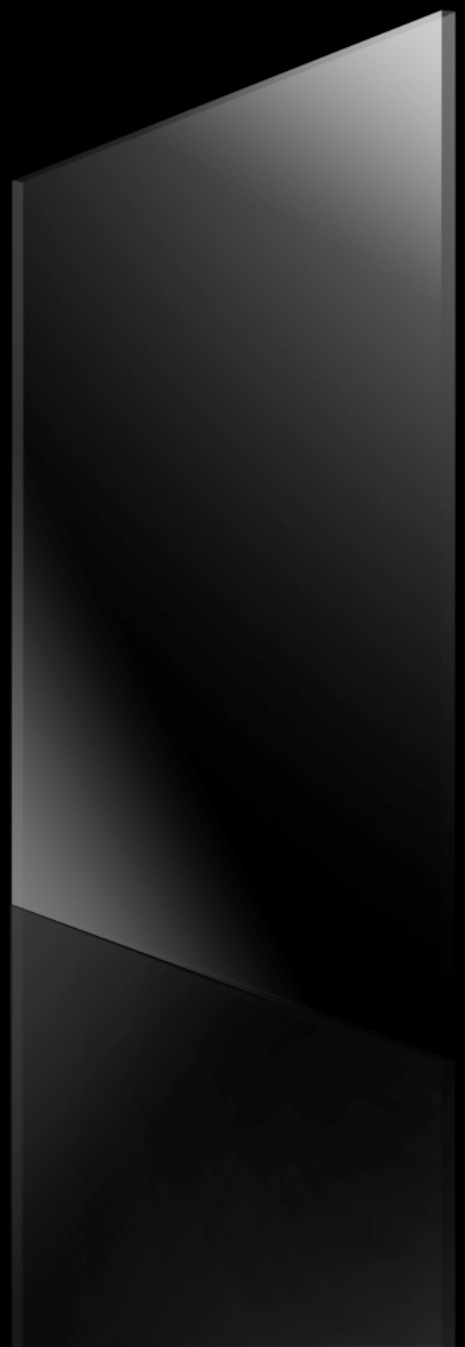
Transparency

Transparency in the off-state is perceived as a very attractive product feature, because no other material can make glass glow – without being visible in the off-state.



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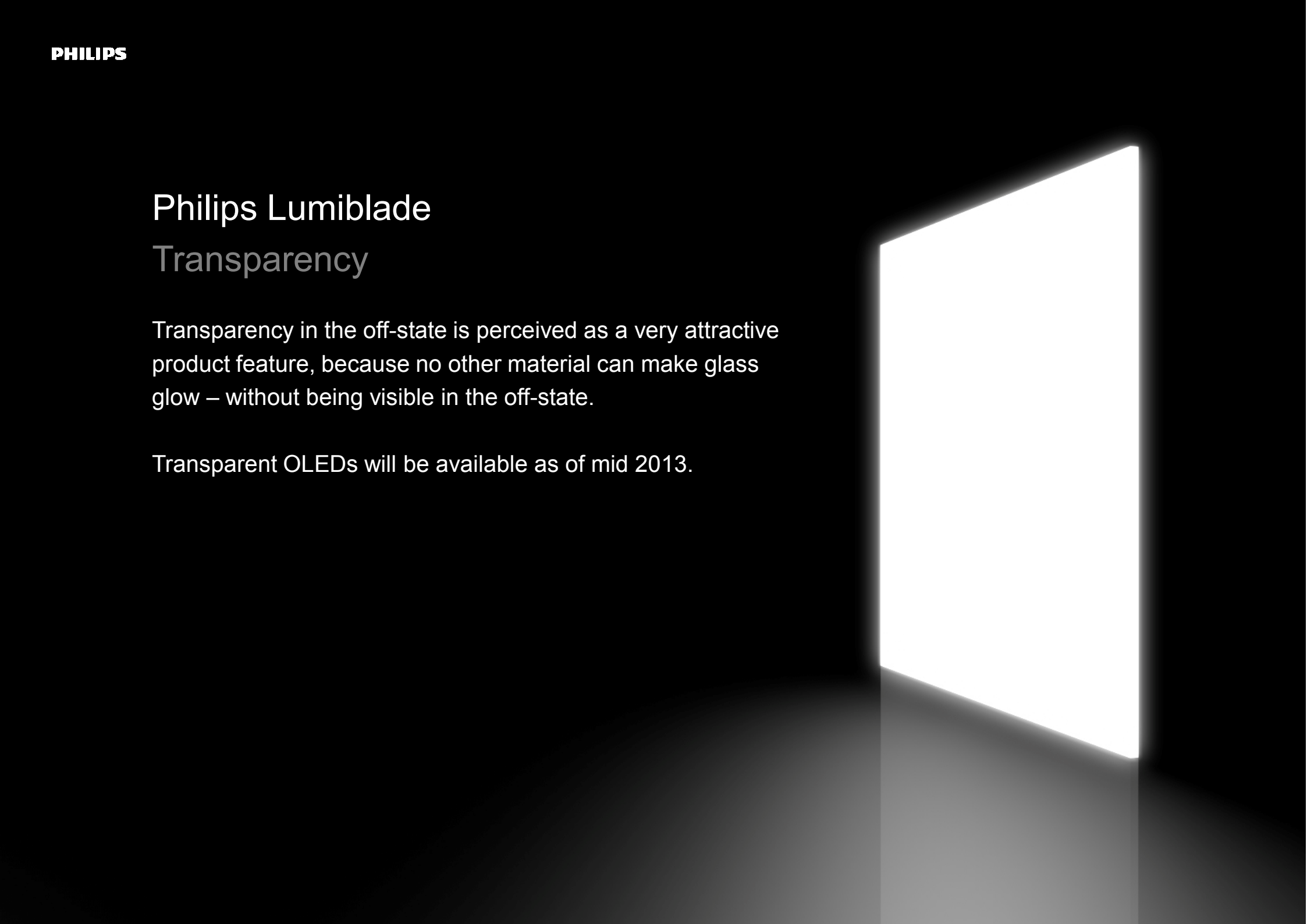
Transparent OLEDs will be available as of mid 2013.



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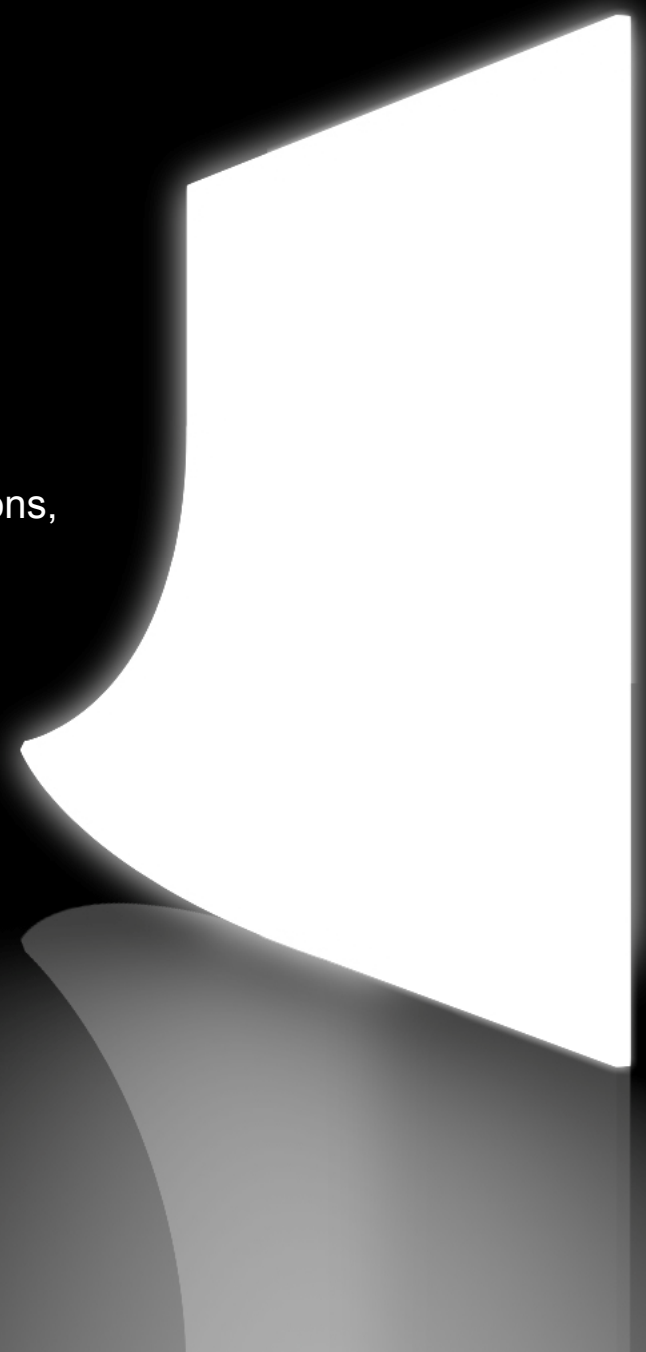
Flexibility

The next thing we are working on, are flexible OLEDs.

Flexible OLED displays are already on the market,
but if it comes to small molecule OLEDs in lighting applications,
it is still in a research phase.

OLEDs will be flexible in 5 years from now.



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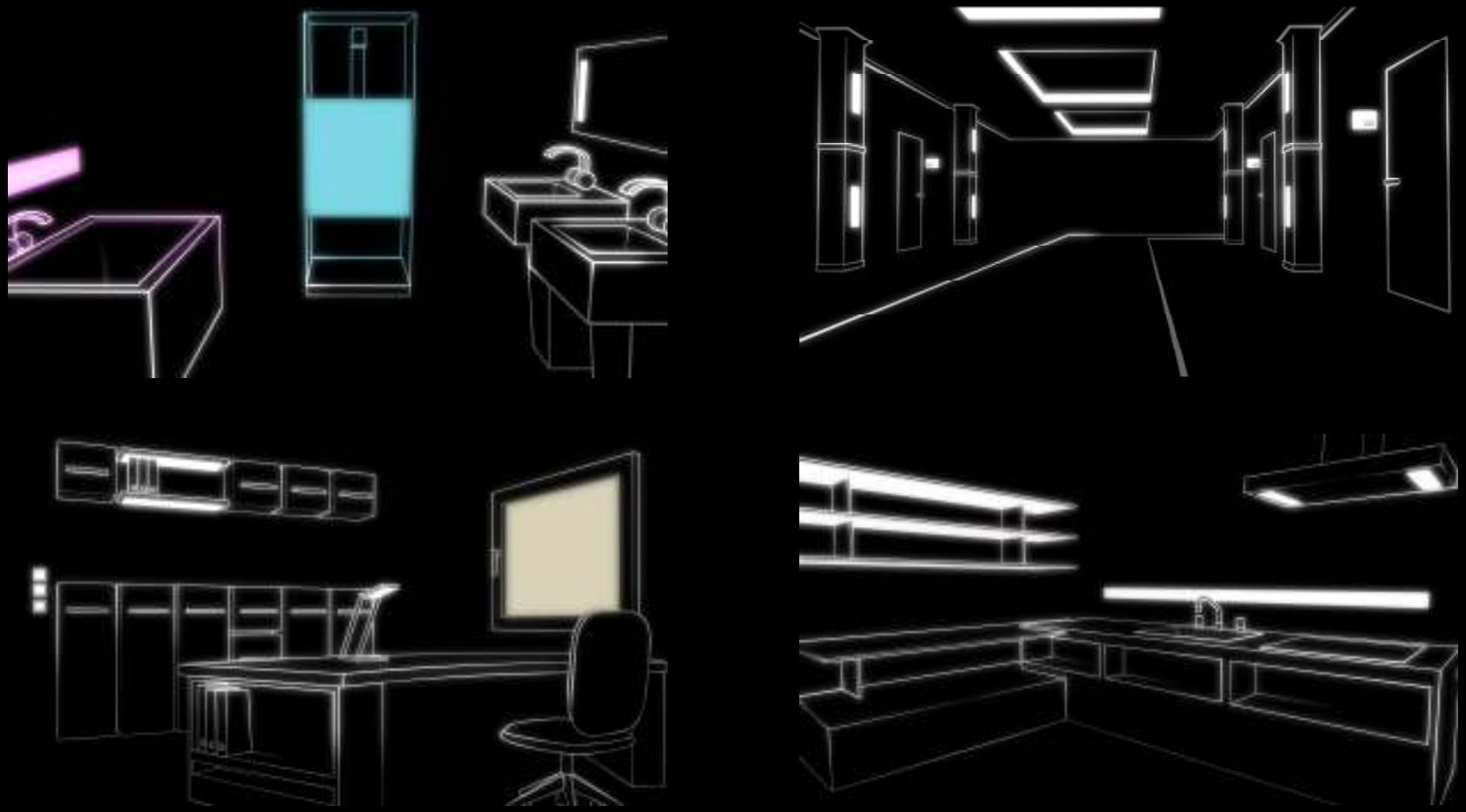
Making the impossible possible



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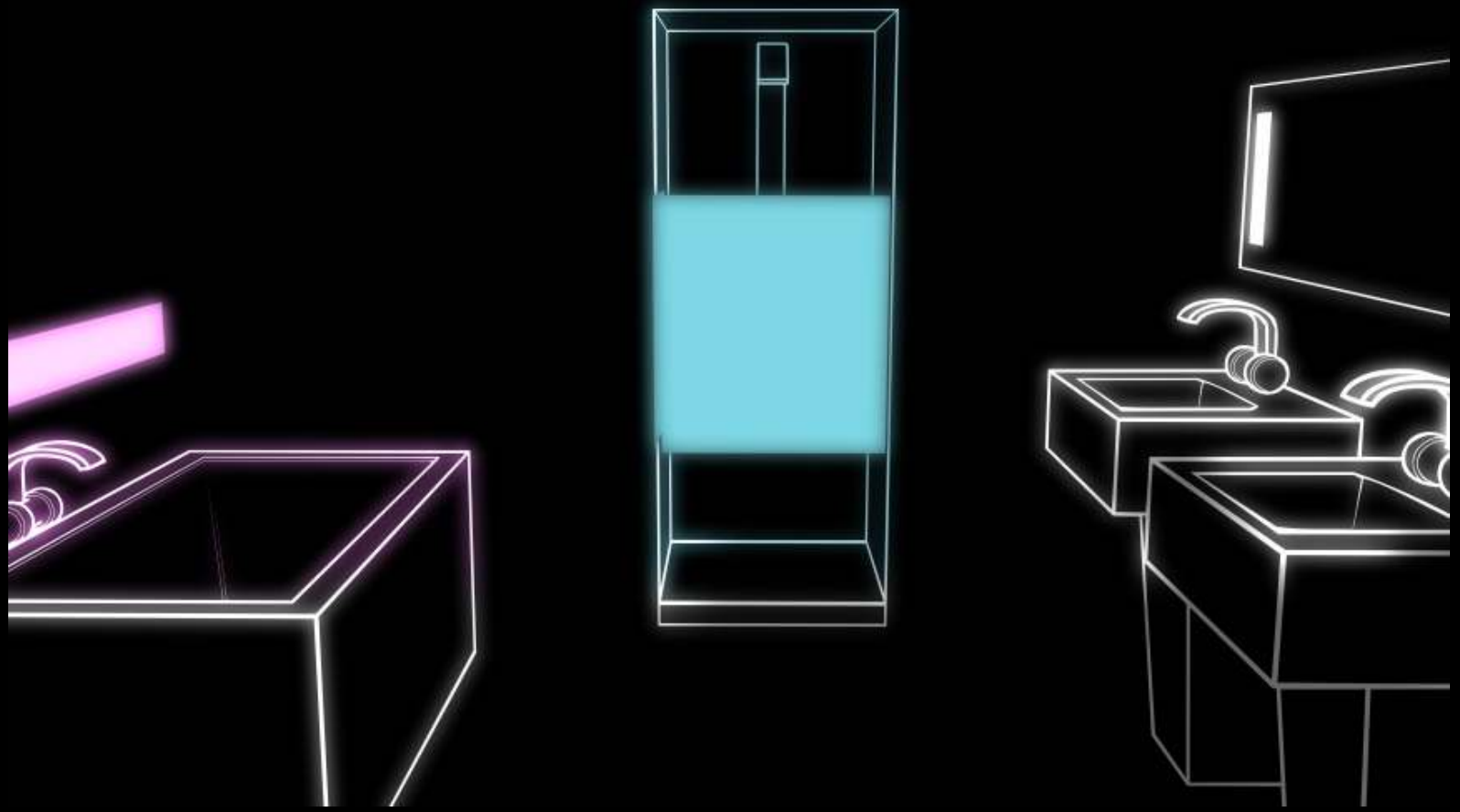

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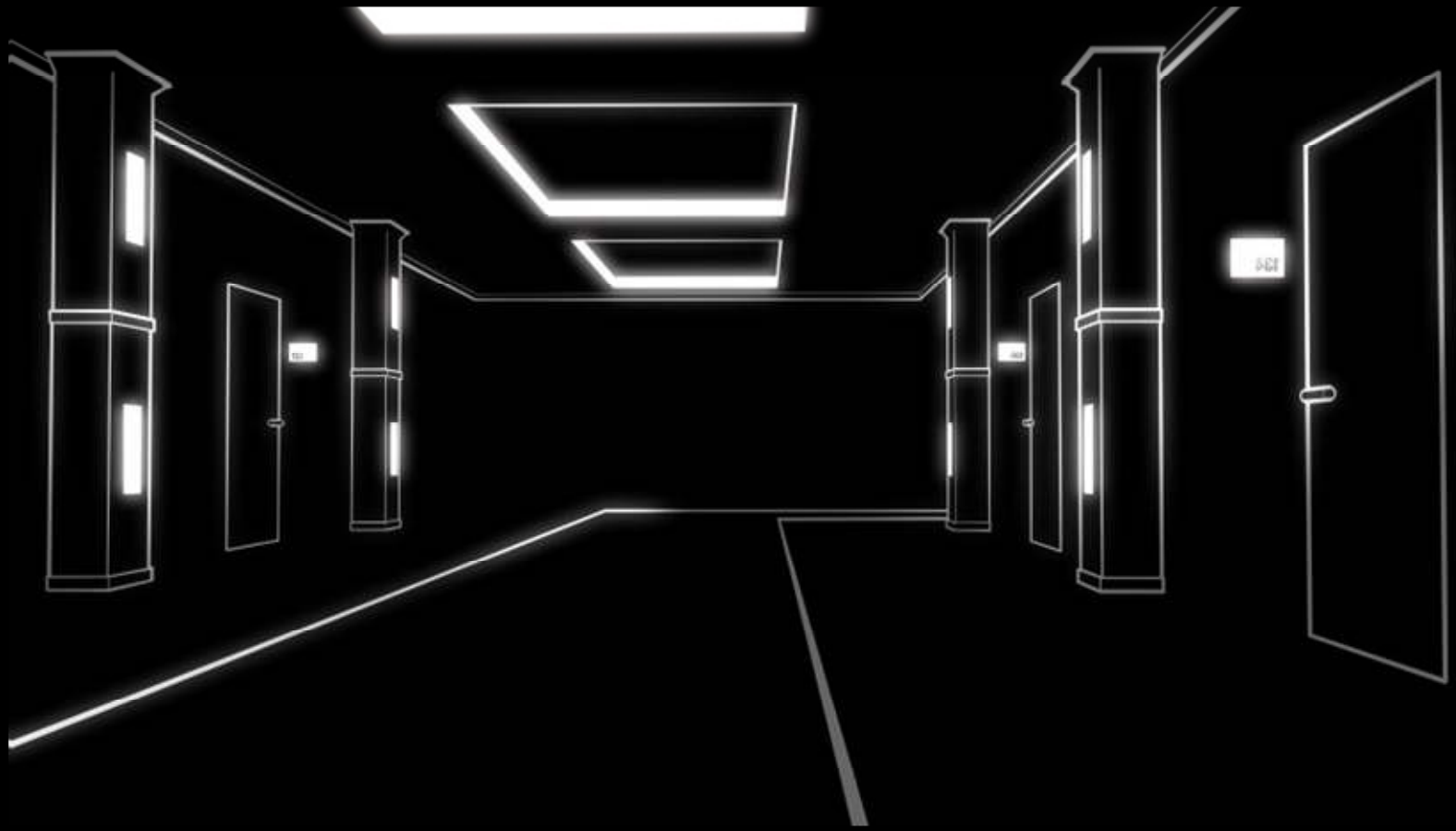

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Making the impossible possible

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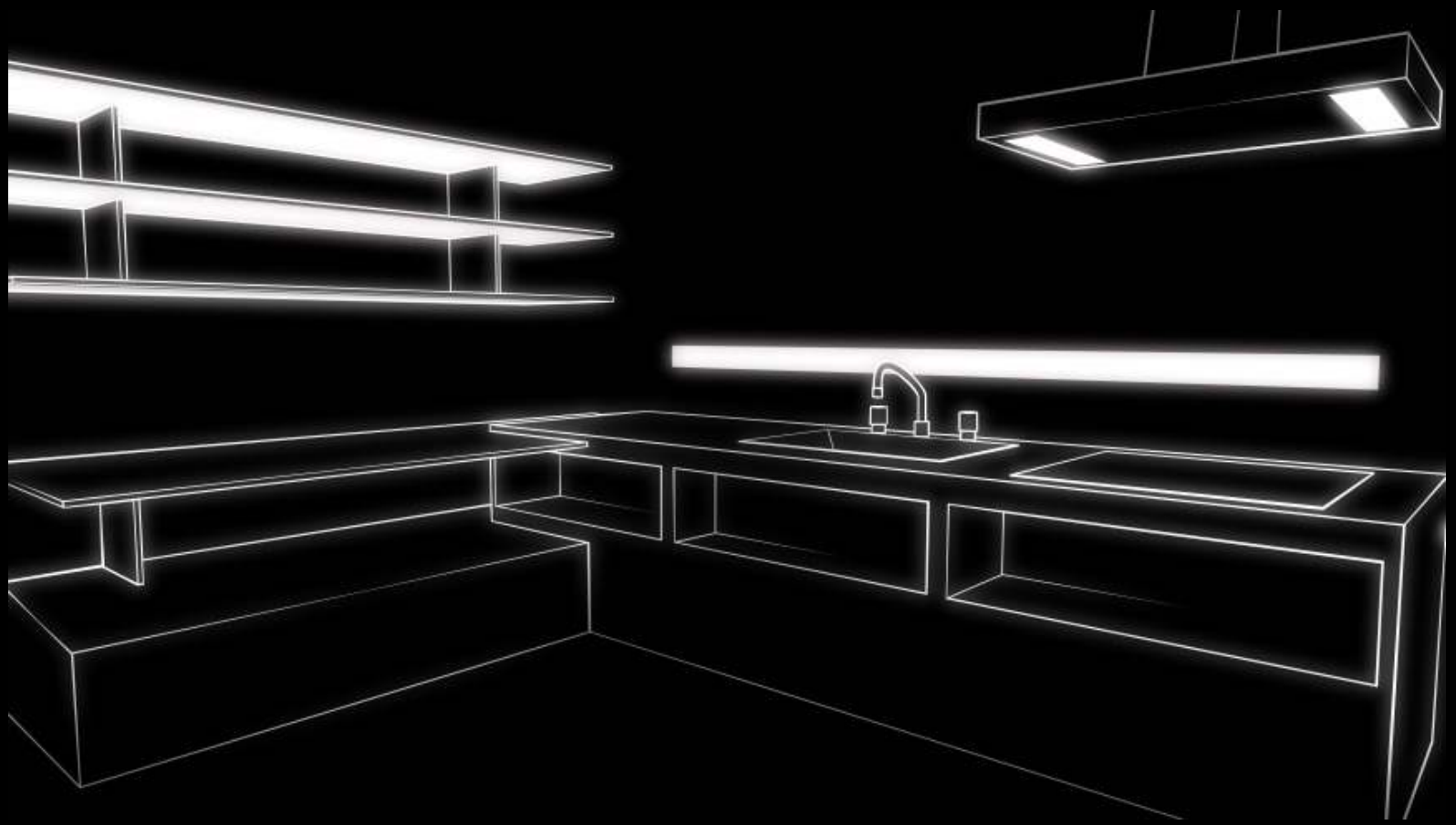

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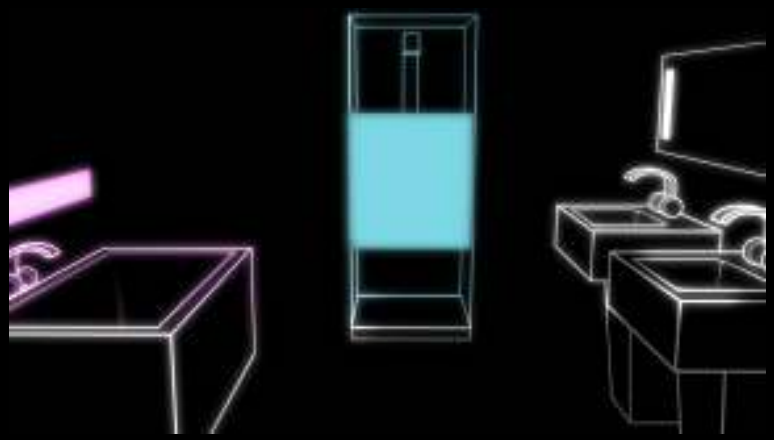

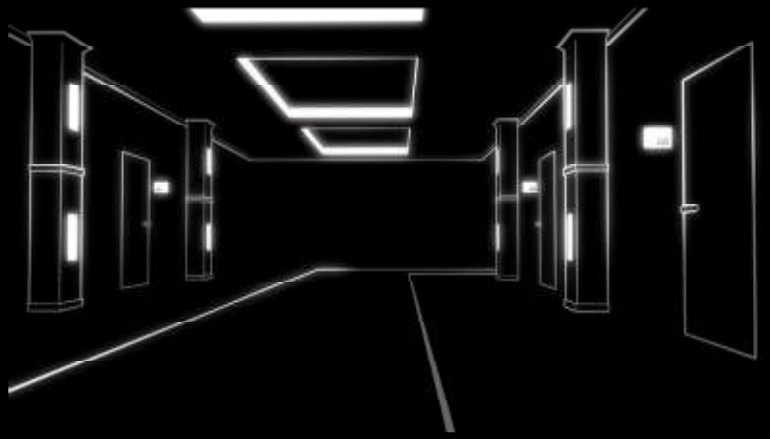

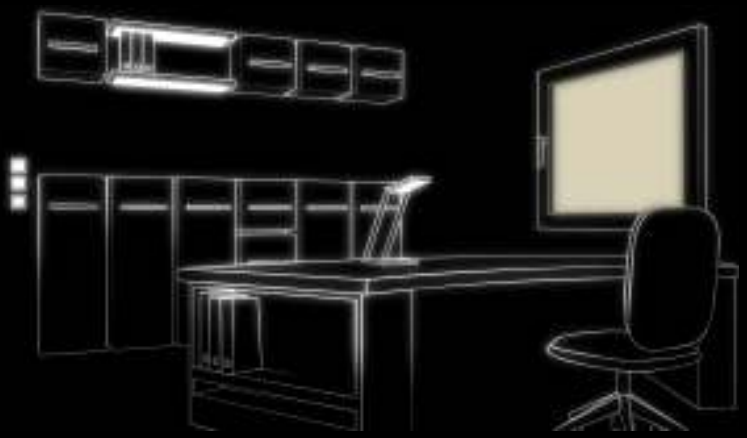

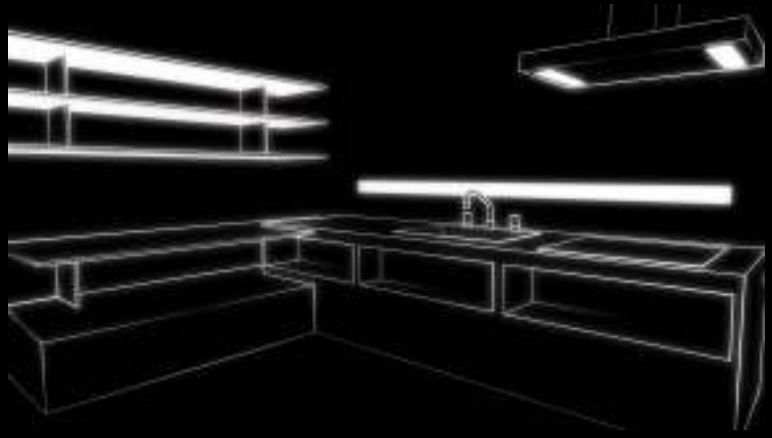

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Roadmap - Decorative Line

Year	2014	2015	2018
Efficacy	15 lm/w	15 lm/w	35 lm/w
L70	15,000 h	30,000 h	40,000 h
Intensity	2,500 cd/m^2	2,500 cd/m^2	3,000 cd/m^2
Max size	120*120 mm	150*150 mm	1.000*1.000 mm
Features	transparent, structured		color changeable/flexible

Note: OLEDs of the Lumiblade Decorative Line are normally reflecting in off-state as where otherwise indicated. Color point adjustable to customer specifications. Short realization and production cycle for new forms and shapes.

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Roadmap - Performance Line

Year	2014	2015	2018
Efficacy	60 lm/W	>90 lm/W	130 lm/W
L70	15,000 h	20,000 h	40,000 h
Intensity	4,500 cd/m^2	5,000 cd/m^2	>5,000 cd/m^2
Lumen Output	10,000 lm/m^2	15,000 lm/m^2	>15,000 lm/m^2
CRI	>90	>92	>95
Max size	150*150 mm	170*170 mm	400*400 mm

Note: OLEDs of the Lumiblade OLED Performance line are non reflective in off-state.

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The World of OLED lighting

Summary

- OLEDs are more than just another light source.
- OLEDs are the last revolution in lighting.
- OLEDs are highly adaptable material that emits beautiful light.
- OLEDs remove the boundaries of shapes and size associated with conventional lighting.
- OLEDs are extremely thin and easy to integrate.



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