

Architecture and BIPV: innovative materials enabling new design possibilities

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**FIELDS
OF
IDEAS**

GERMAN PAVILION
EXPO MILANO 2015

PARTNER
OF THE CONSORTIUM
GERMAN PAVILION



**Healthcare, Life Science &
Performance Materials**

founded in 1668

66 countries

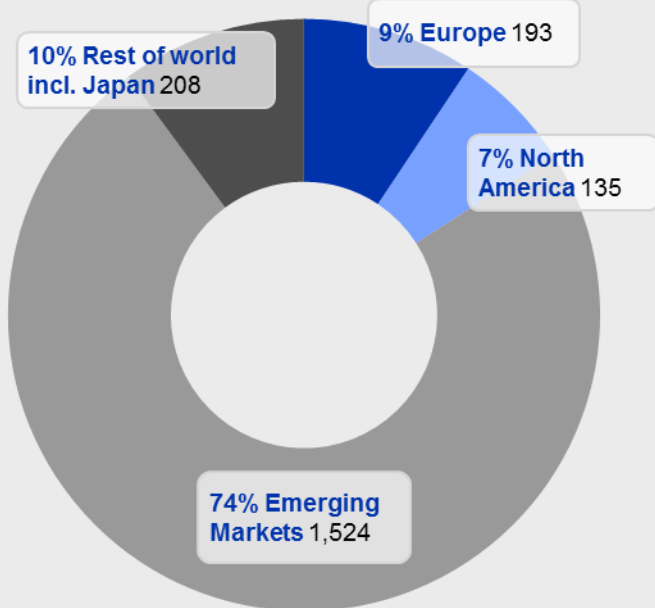
39,000 employees

€1.7 billion invested in R&D in 2014

€11.3 billion sales in 2014

Performance Materials Facts & Figures

Sales by region 2014 in € million



Highly competitive and international business

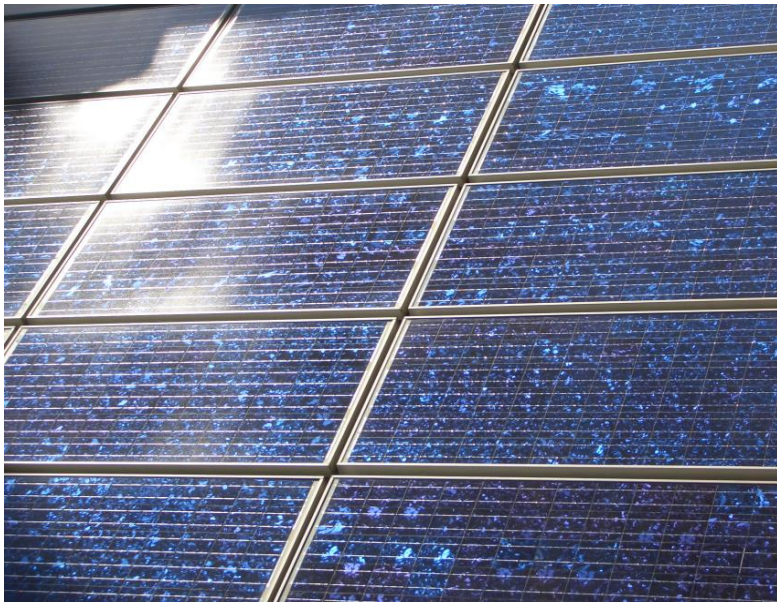
Chemical Industry	2.06 billion Euro*	5,900
Industry Sector	Total Revenues	Number of Employees
around 5,000	more than 7,200	almost 10%
Number of Customers	Number of Products	R&D Spending

* figures based on FY2014 annual results for Merck's businesses as of March 3, 2015

„Performance“ segment

=> *Solutions derived from excel sheets*

As much **energy** as possible (=> revenues)
for the **lowest investment** (=> ROI)



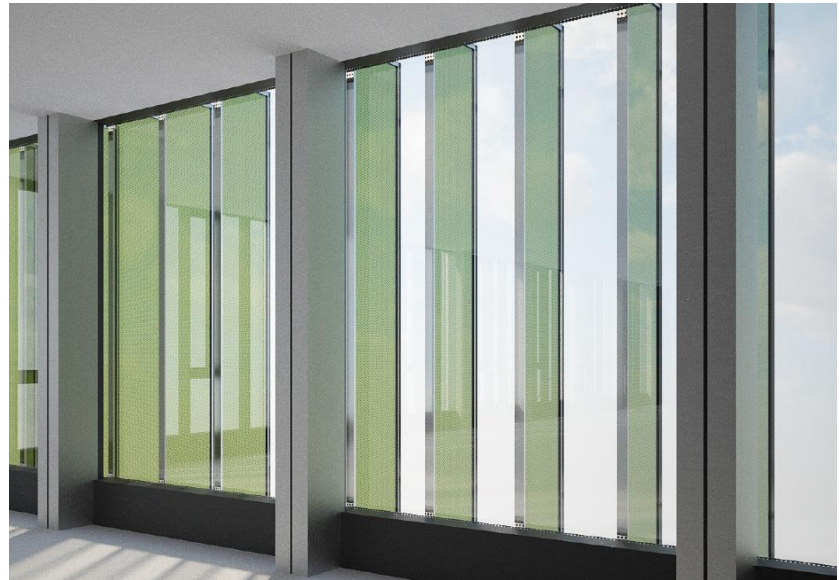
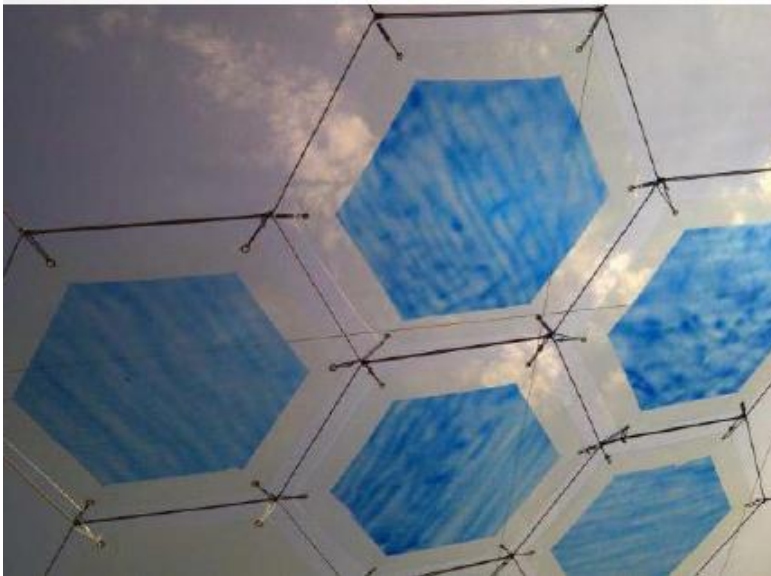
Doesn't really matter how it looks...!

„Integration“ segment

=> solutions driven by function and aesthetics

As **functional** as possible (=> integration)

for the **highest added value** (=> multiple drivers)



Aesthetics are one main driver...!

The ideal solar cell and its value drivers

No “one fits all solution” due to several trade offs

Performance

No or positive temperature dependence

High efficiency & stability

Efficiencies independent of light intensity & type

Low costs & capex light production

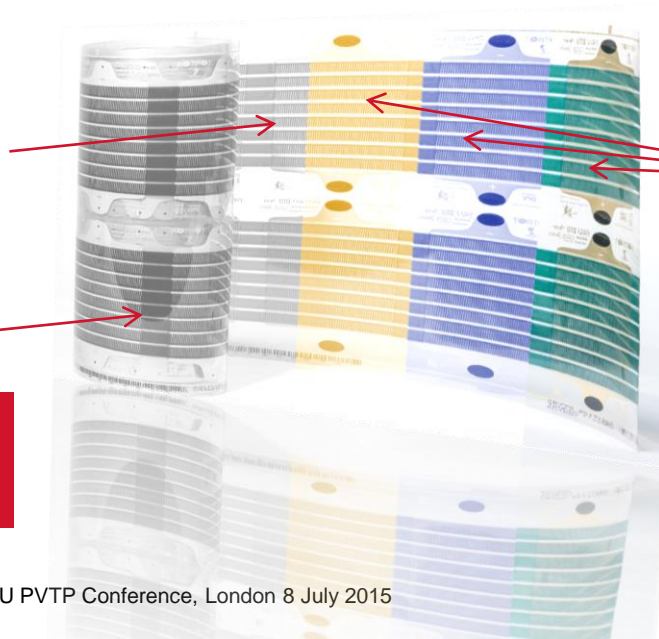
Efficient off-axis light collection

Semi-transparency and grey-scales

Ability for different colors

Flexible and light-weight

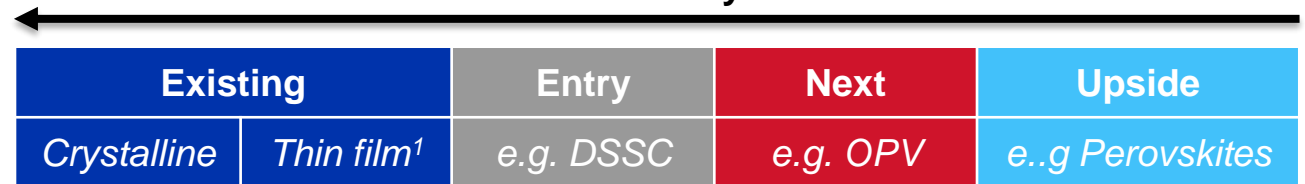
Thin - minimal material usage



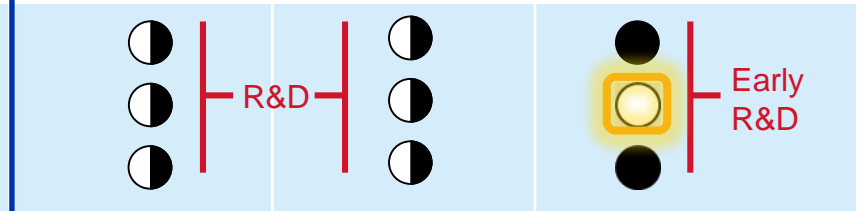
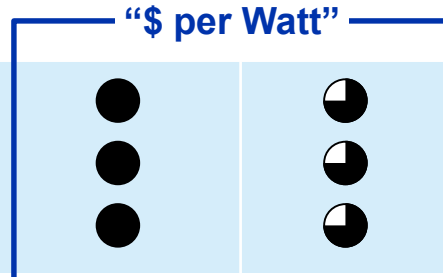
Integration

PV technologies – a status snapshot

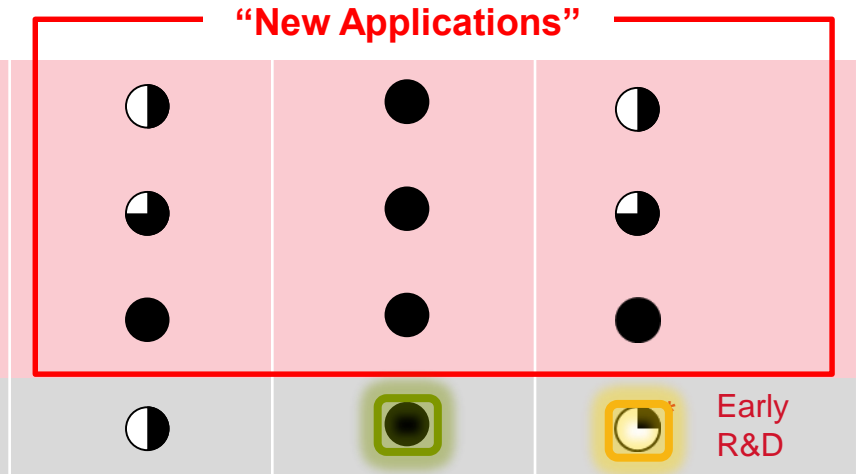
maturity



Performance



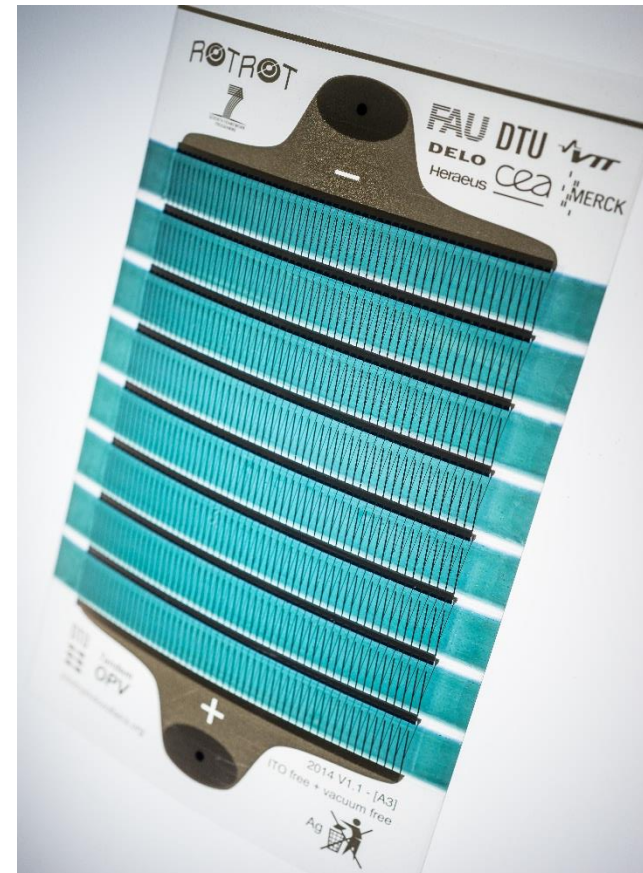
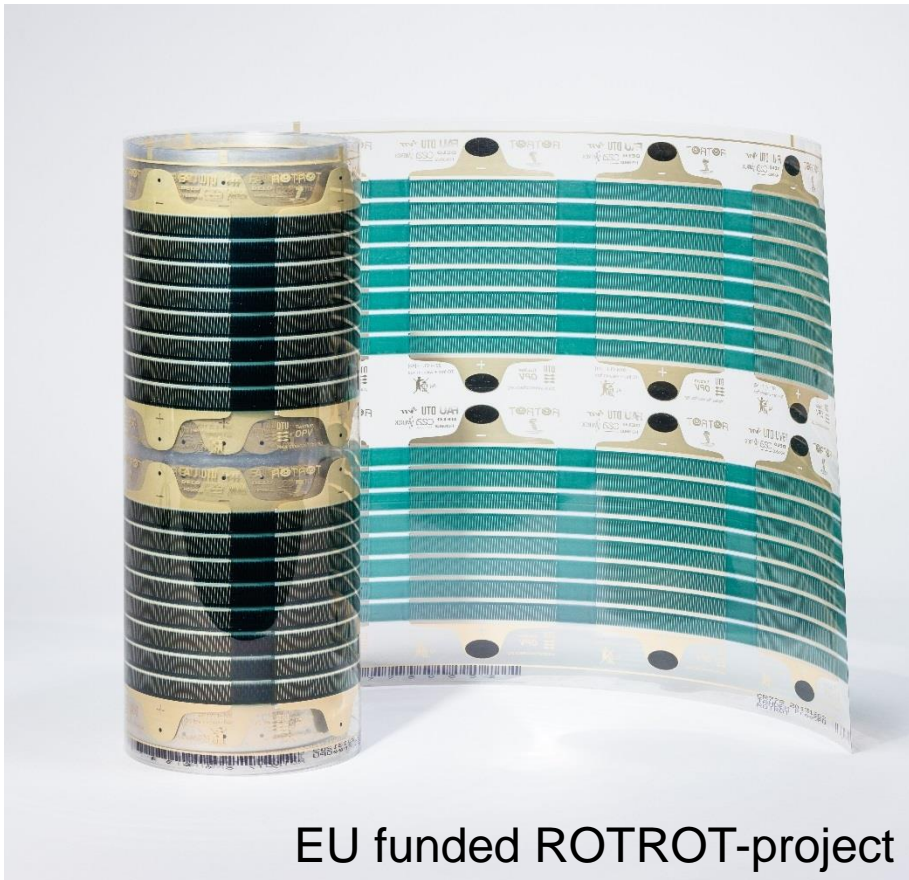
Integration



1) Depending on thin film technology (amorphous silicon, CdTe, CIGS)

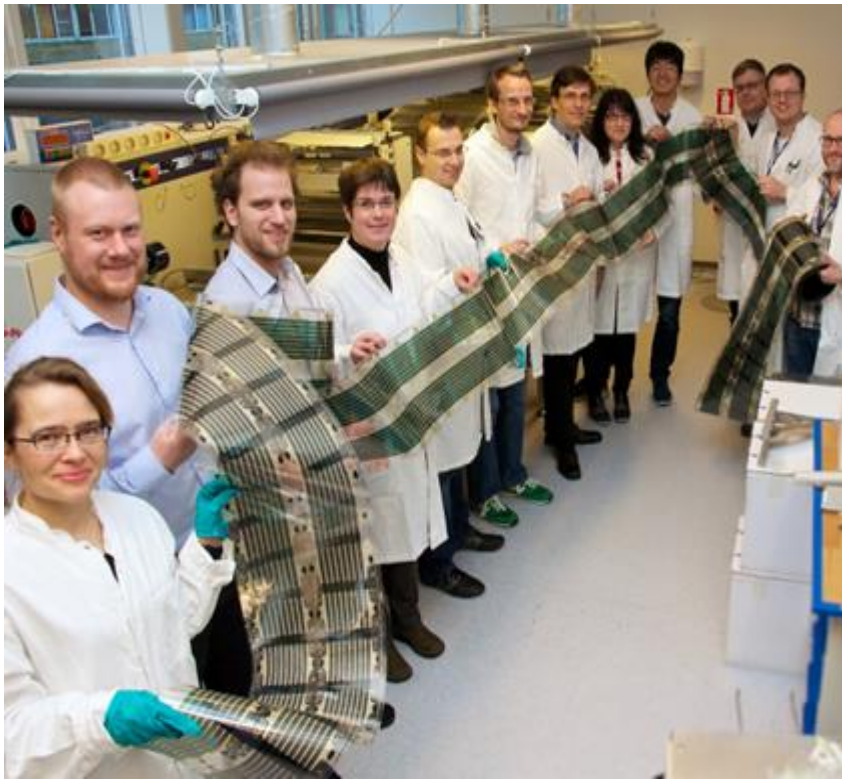
*) Lead based version

Getting ready for market – Organic Photovoltaics (OPV)

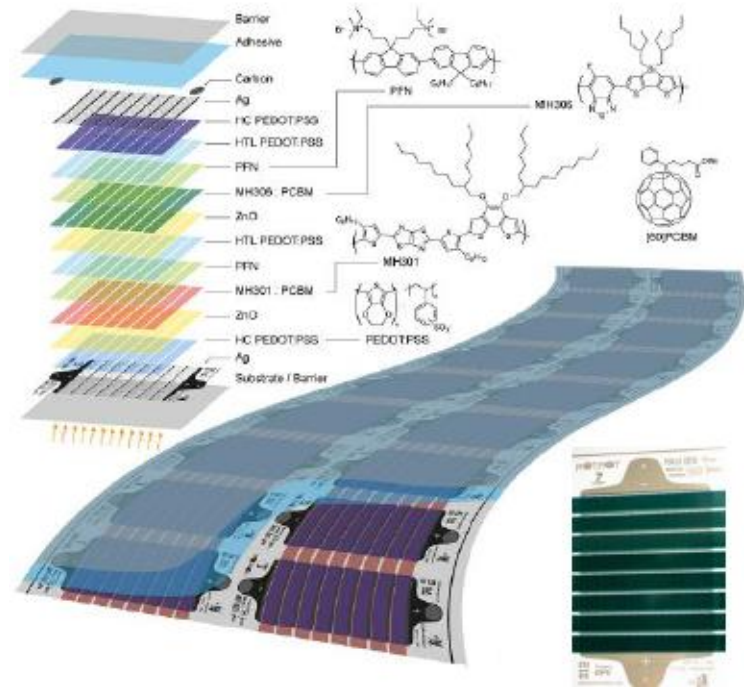


Fully printed roll-to-toll OPV tandem cell

An important milestone on the road to green mass-production



EU funded ROTROT-project

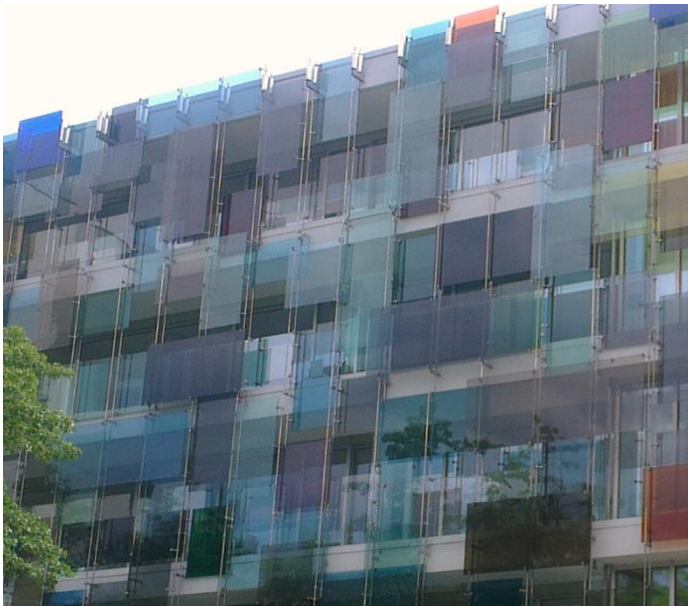


ROTROT

Roll to Roll production of Organic Tandem cells

BIPV - visualizing the importance of color

**Colored windows in architecture
(no PV function):**



Diener & Diener / Norvatis Campus / Basel, Suisse

**Merck's portfolio of darker
colors (example OPV):**

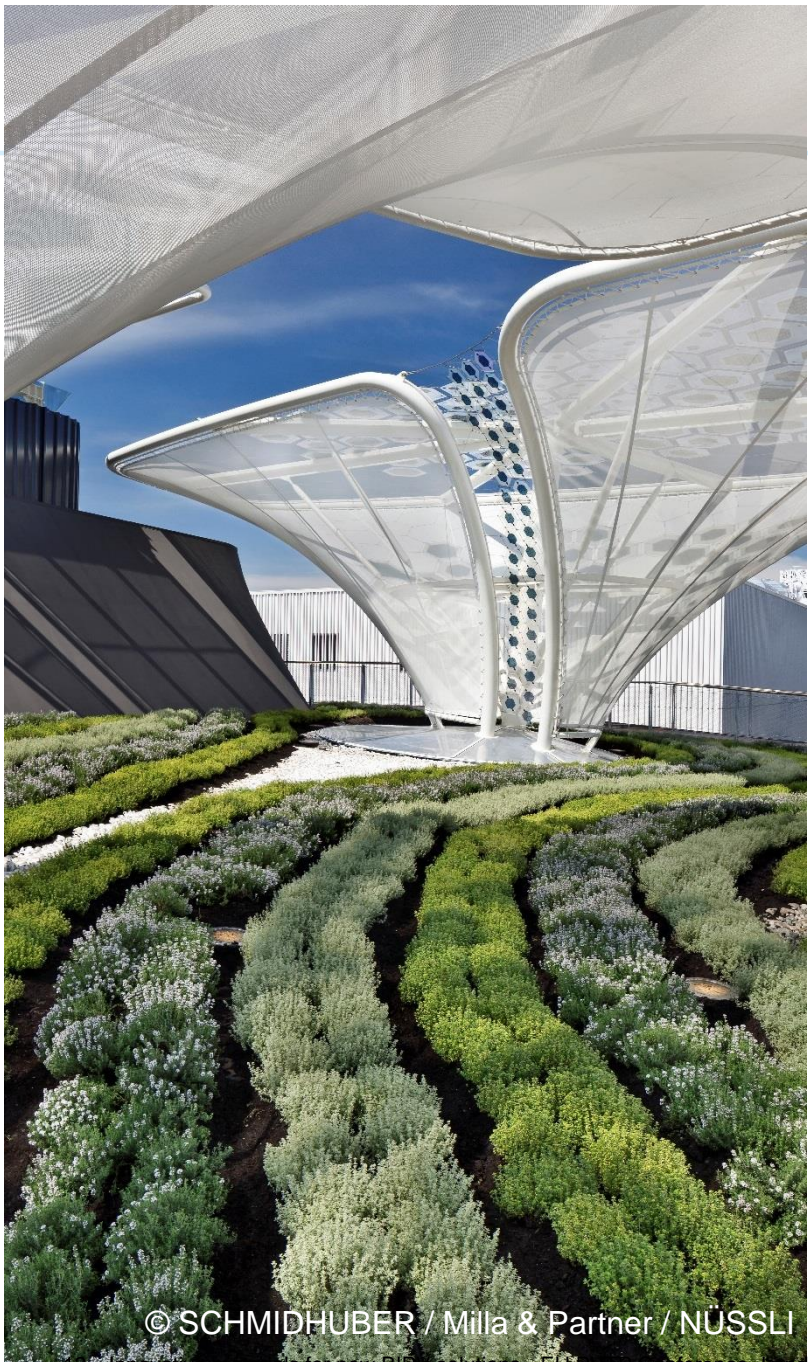


Examples of colors feasible with Merck's OPV solutions

SOLAR TREES WITH OPV TECHNOLOGY

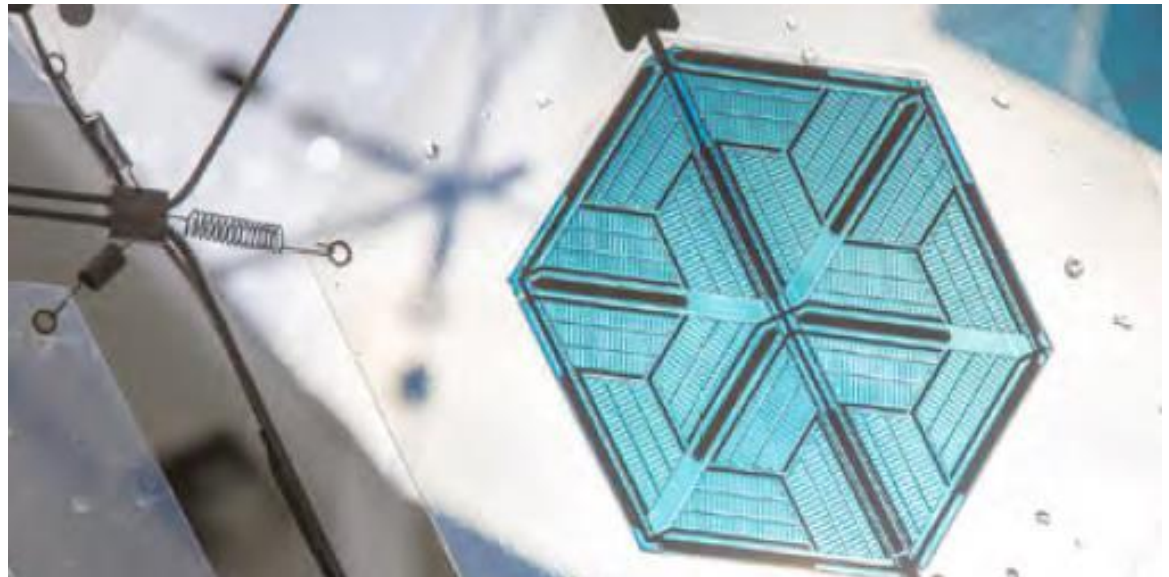
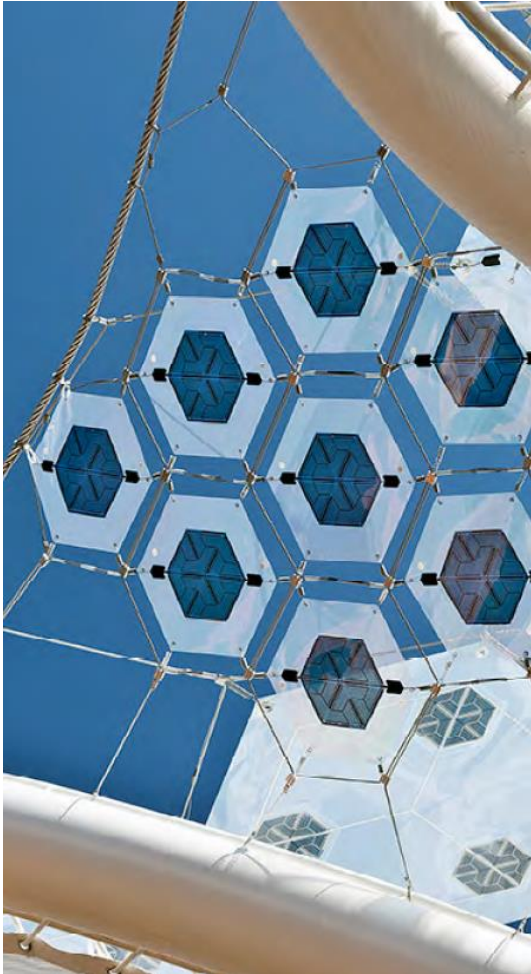


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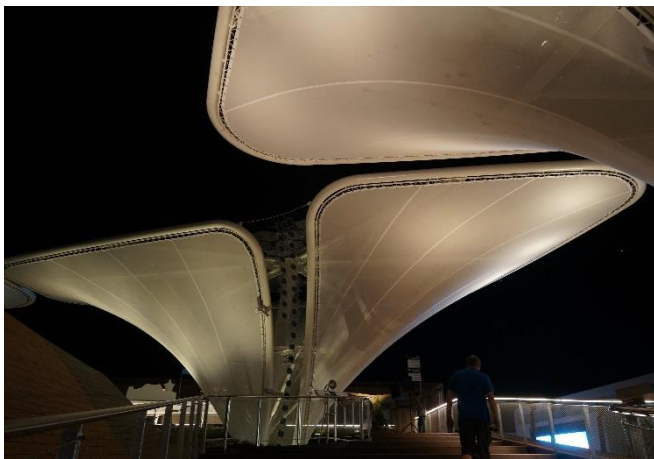
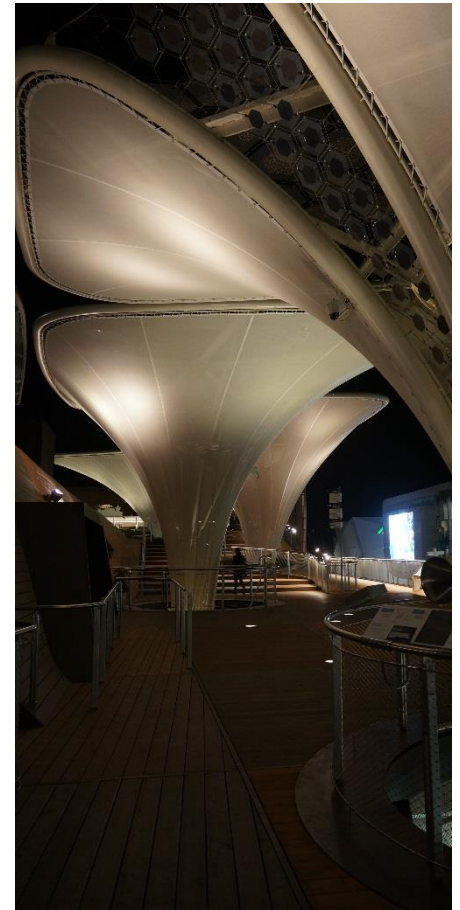


Solar Trees @ Expo Milano

OPV as design element in membrane architecture

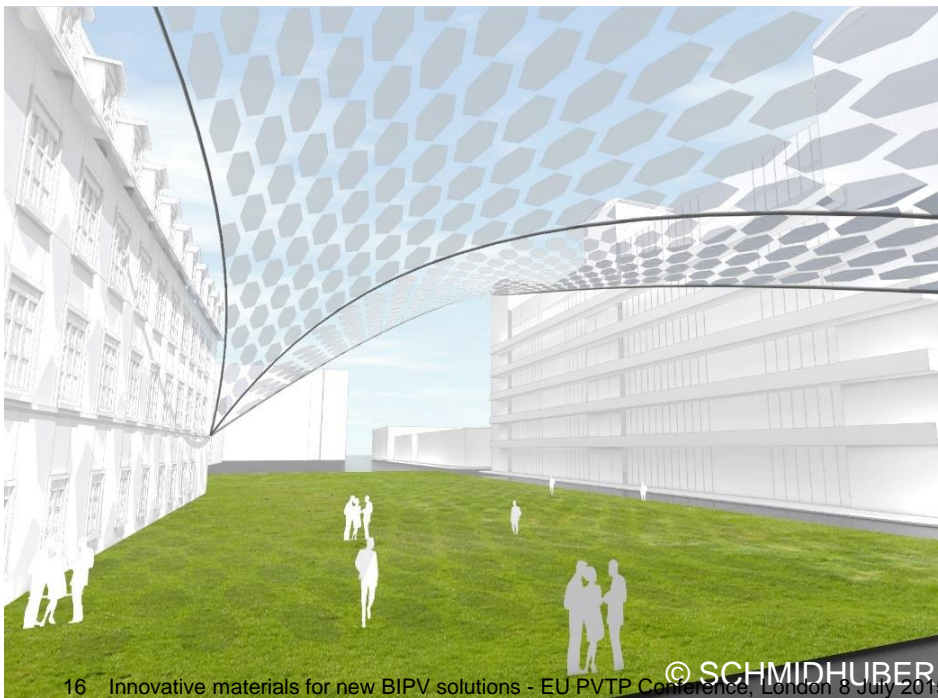


OPV trees power LED illumination at night





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OPV laminated in glass – freedom of shape & design



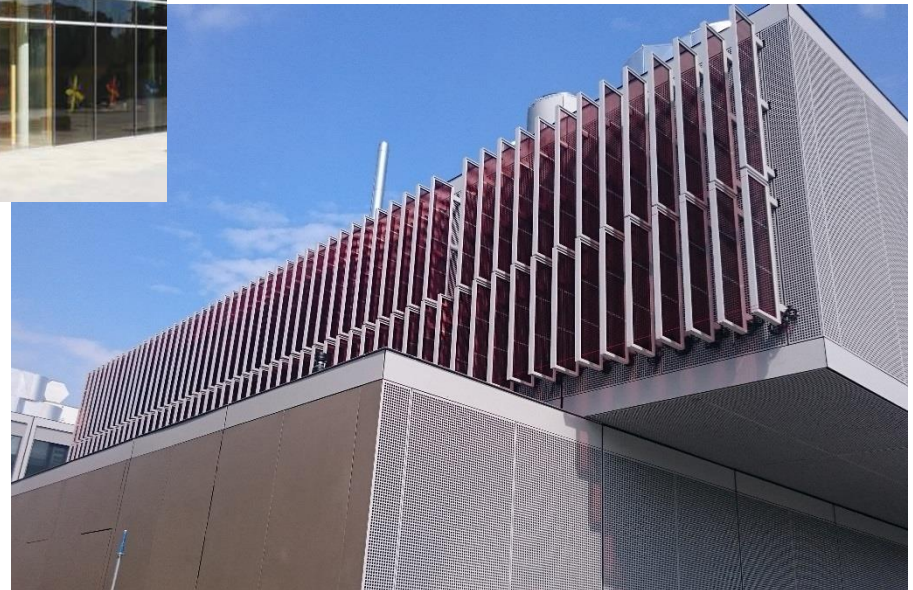
PV (DSSC) as sun shading systems



With courtesy from Colt international GmbH

Passive system

- Sun shading
- Design



Merck – modular innovation center - Darmstadt

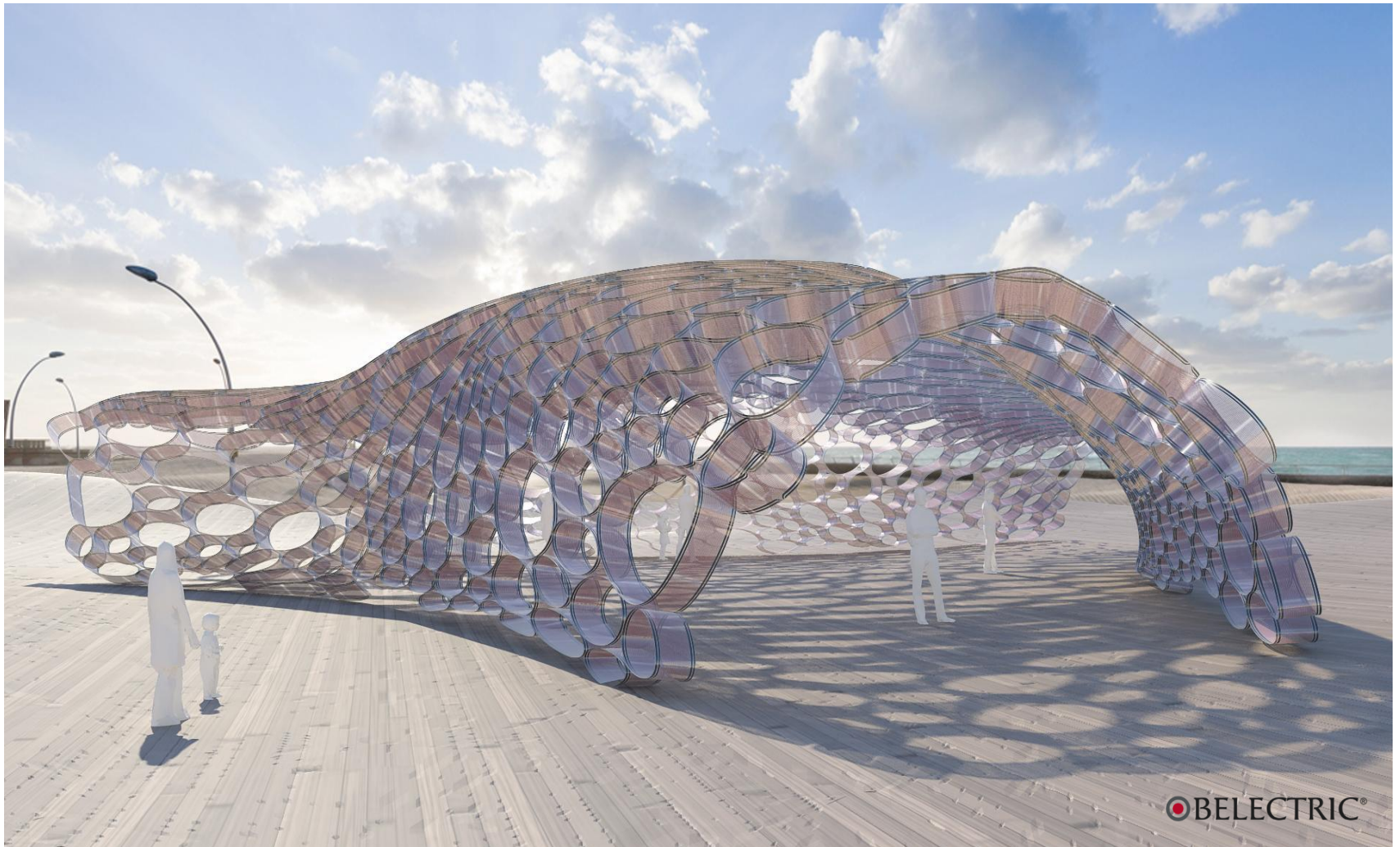
Active system

- Sun shading
- Design
- Electricity generation

From complying with traditional design rules...



...to futuristic design!





What we offer to you

Open to discuss and share your ideas and vision for the future
Capable to partner up creating synergies of our different strengths
Develop the market together and make it happen... **faster**



Thank you!