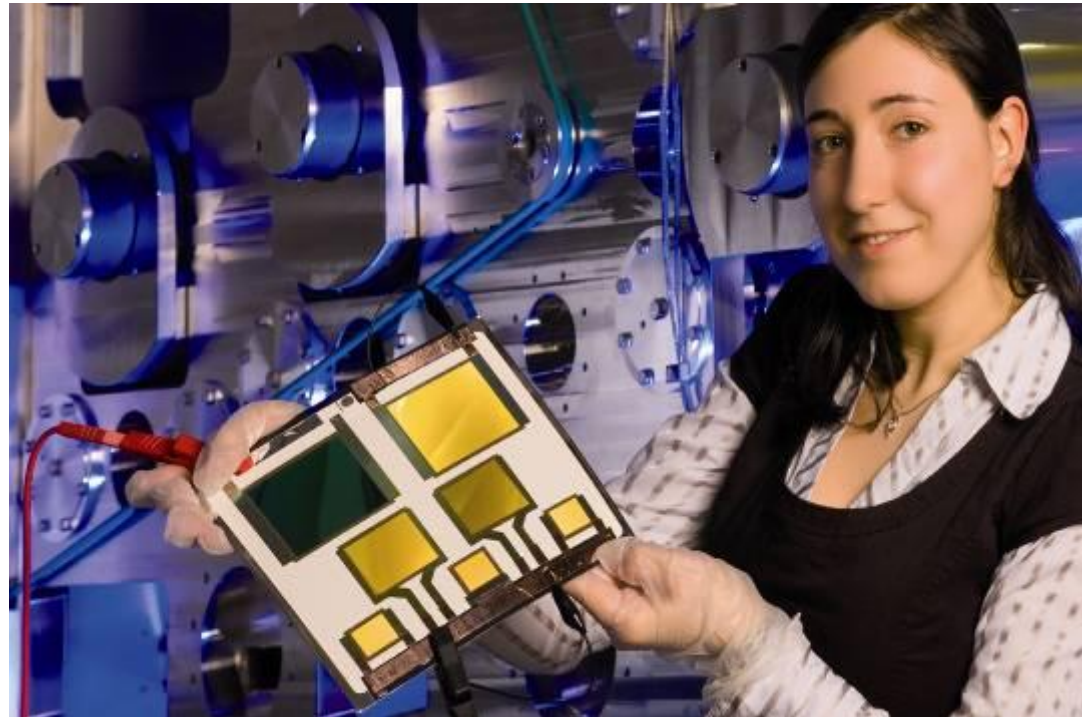

ORGANIC AND FLEXIBLE ELECTRONICS IN GERMANY – A SNAPSHOT

Dr. Christian May

Fraunhofer IPMS - Center for Organic Materials and Electronic Devices Dresden
COMEDD

National Academies
Symposium
“Flexible Electronics”
September 24, 2010
Washington DC



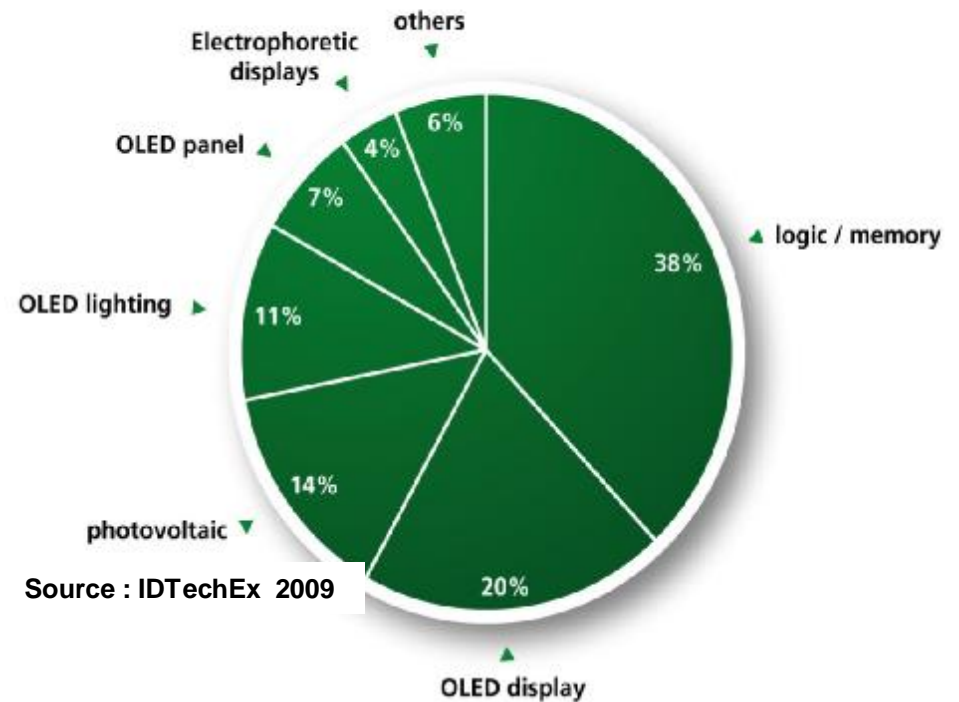
OUTLINE

- n Organic & Large Area Electronics (OLAE) in Europe
- n German funding policy in Organic Electronics
- n The German research landscape
- n The FRAUNHOFER-GESELLSCHAFT
 - n FRAUNHOFER IPMS - Institute For Photonic Microsystems
 - n COMEDD – Center for Organic Materials and Electronic Devices
Dresden
- n Organic Electronics Saxony
- n Project example R2FLEX
- n Summary

ORGANIC & LARGE AREA ELECTRONICS (OLAE)



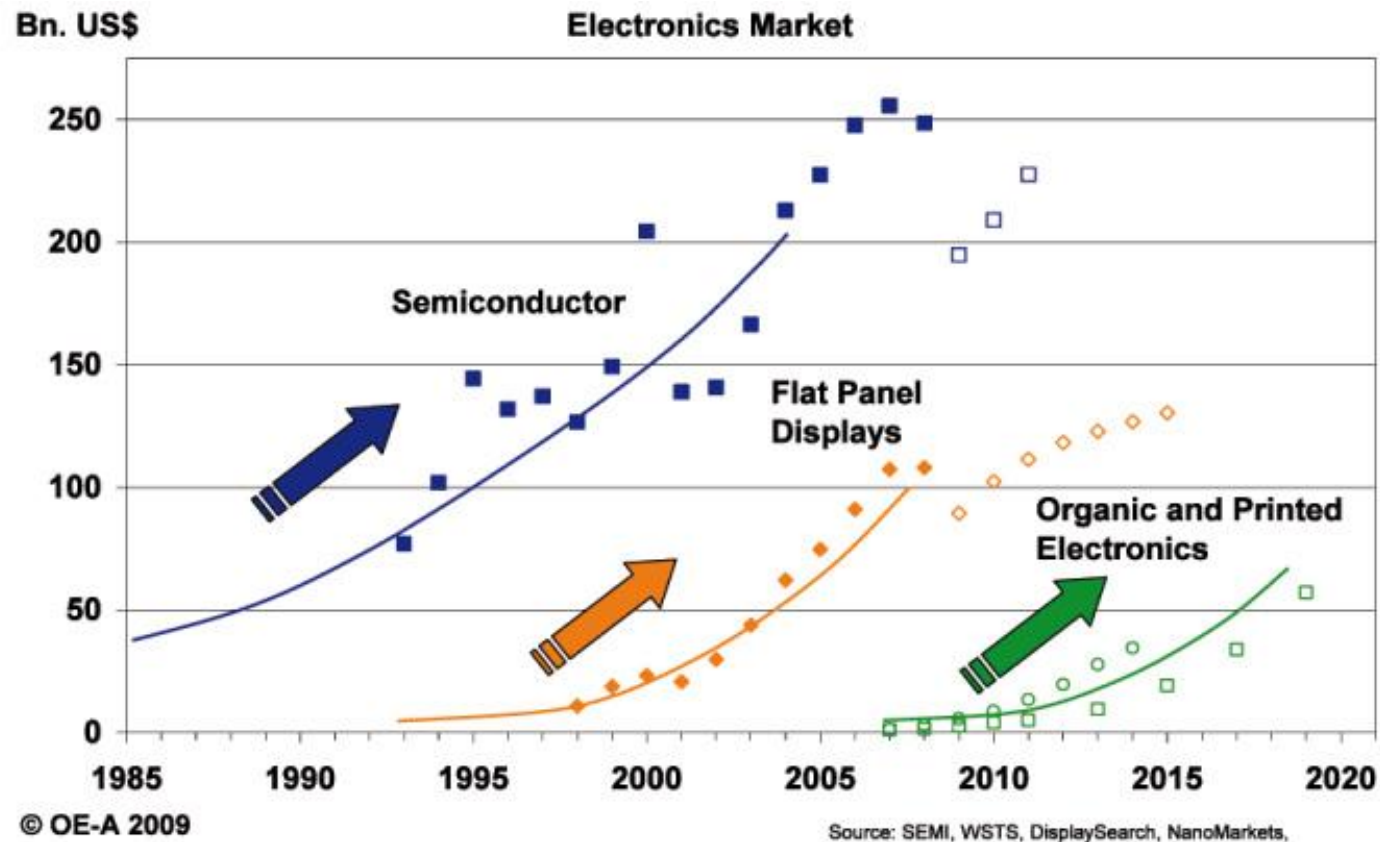
Total market 2027: 330 billion US\$



OLAE AS A GREEN TECHNOLOGY

- n OLAE is inherently green and applies to the principle of people, profit, planet.
It is :
 - n Robust
 - n Flexibility allows for ubiquitous electronics
- n Low carbon print
 - n Low material consumption, low impact manufacturing and substantial contribution to reducing energy consumption
- n Low cost manufacturing
 - n achieving cost levels to substitute CMOS technology
- n OLAE to allow further integration of IT and ET

OLAE ROADMAP



OLAE SWOT FOR EUROPE

- ▶ Already in possession of materials and production machinery
- ▶ Huge European market

- ▶ Lack of start-ups and entrepreneurs with clear view from research to manufacturing
- ▶ Committed giants are needed

- ▶ Formidable research on OLEDs, printed RFIDs and transistors.
- ▶ Field of applications steadily growing

- ▶ European market will be taken over by foreign manufacturers
- ▶ External companies will benefit from the research and investment done in Europe

Source: Strategic Research Agenda Organic & Large Area Electronics

STRATEGIC RESEARCH AGENDAS - TOGETHER IN PHOTONICS & ORGANIC ELECTRONICS

- n The new **Strategic Research Agenda of Photonics21** (European Technology Platform for photonics) and the first **Strategic Research Agenda of the Organic Large Area Electronics (OLAE)** were handed over to the European Commission during the Photonics21 Annual Meeting in Brussels, January 2010
- n SRA Photonics 21 available at :
http://www.photonics21.org/download/SRA_2010.pdf
- n SRA OEA available at :
http://www.photonics21.org/download/ola_e_sra.pdf



OLAE KEY RECOMMENDATIONS FOR SRA IMPLEMENTATION

- n Initiate clustered approach with pilot production centres to close the gap between R&D and products
- n Nurture the emergence of a European OLAE industry, for example through new approaches to create lead markets
- n Establish OLAE platform together with all stakeholders
- n Coordinate existing OLAE networks and platforms
- n Coordinate EU and national member state R&D programmes
- n Develop an approach for R&D cooperation in and beyond Europe
- n Take measures to early establish standards for new products
- n Establish new training schemes, fit to the heterogeneous OLAE field
- n Increase the EU R&D funding budget for OLAE in proportion to huge market expectations and establish new ways to access capital

GERMAN FUNDING ACTIVITIES IN ORGANIC ELECTRONICS (1/2)

- n Organic Electronics funding since 10 years by the German Federal Ministry of Education and Research, first in single projects, later in coordinated actions, like:
- n Funding topic “Polymer Electronics”: since 2001, appr. 30 Mio € funding up to now
- n Innovation Alliance OLED
 - n Funding 120 Mio €, Start Phase I: 2006, Start Phase II: 2009
 - n Innovation Alliance: Industry commits to invest a volume 5 times of the funding budget after the funding phase and successful project results
 - n Projects Phase I:
 - n OPAL
 - n R2Flex – see slides project example at the end of this talk
 - n Projects Phase II:
 - n Lili
 - n So-Light
 - n Topas

GERMAN FUNDING ACTIVITIES IN ORGANIC ELECTRONICS (2/2)

n Innovation Alliance OPV

- n Funding 60 Mio €, Starting: 2008, 2nd phase intended to start 2011

- n same conditions for Innovation Alliance OLED, here 240 Mio € + 60 Mio € during project phase

- n several projects

n “Cluster of Excellence” Organic Electronics in Heidelberg

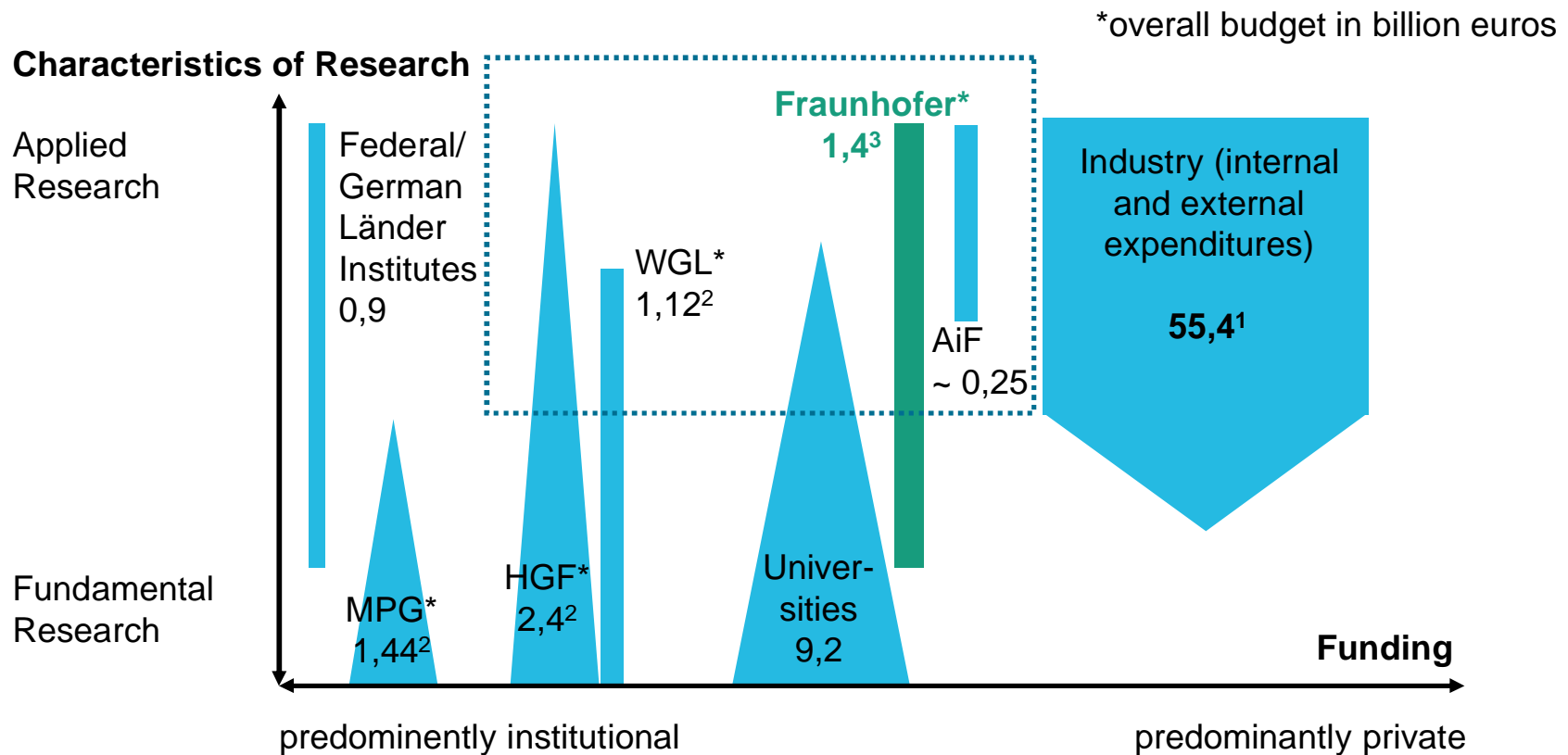
- n 40 Mio.€ funding, funding quote 50%, 2008-2013

- n several projects

n Links to project websites available at:

<http://www.optischetechnologien.de/index.php?id=584>

THE GERMAN RESEARCH LANDSCAPE



HGF Hermann von Helmholtz-Gemeinschaft
WGL Wissenschaftsgemeinschaft Gottfried Wilhelm Leibniz
AiF Arbeitsgemeinschaft industrieller Forschungsvereinigungen
MPG Max-Planck-Gesellschaft

¹ estimation Wissenschaftsstatistik 2008, Stifterverband

² 2007

³ 2008

Source: Stifterverband für die Deutsche Wissenschaft, Destatis

FRAUNHOFER-GESELLSCHAFT



- n Undertakes applied research of direct utility to private and public enterprise and of wide benefit to society
- n Our Customers:
 - n Industry
 - n Service sector
 - n Public administration
- n 59 Institutes, 17 000 employees
- n Non-profit organisation
 - n $\approx 33\%$ basic funding by government
 - n $\approx 33\%$ public funded projects
 - n $\approx 33\%$ direct contracts by industry
- n 7 Groups:
 - n Information and Communication Technology
 - n Life Sciences
 - n Microelectronics
 - n Light & Surfaces
 - n Production
 - n Materials and Components - MATERIALS
 - n Defense and Security

FRAUNHOFER INSTITUTE FOR PHOTONIC MICROSYSTEMS - IPMS



n Directors:

Prof. Dr. Hubert Lakner

Prof. Dr. Karl Leo

n Figures 2009:

- n Permanent staff: 207
- n Scientific assistants: 26
- n Operating budget: 23,3 Mio €
- n Industrial commissions: 26 %
- n Project revenues: 62 %
- n Basic funding: 38 %

n Business Units:

- n Micro Scanner Devices
- n Spatial Light Modulators
- n Sensor and Actuator Systems
- n Lifetronics
- n Lighting and Photovoltaics
- n OLED Microdisplays and Sensorics

CENTER FOR ORGANIC MATERIALS AND ELECTRONIC DEVICES DRESDEN

COMEDD as trademark of Fraunhofer IPMS

- n Opened in 2008
investments of about 30 M€ (EU, Saxony, FhG)



Mission

- n Customer and Application Specific Research, Development and Pilot fabrication on novel device concepts and manufacturing methods in the field of organic electronics (small molecule)

Infrastructure

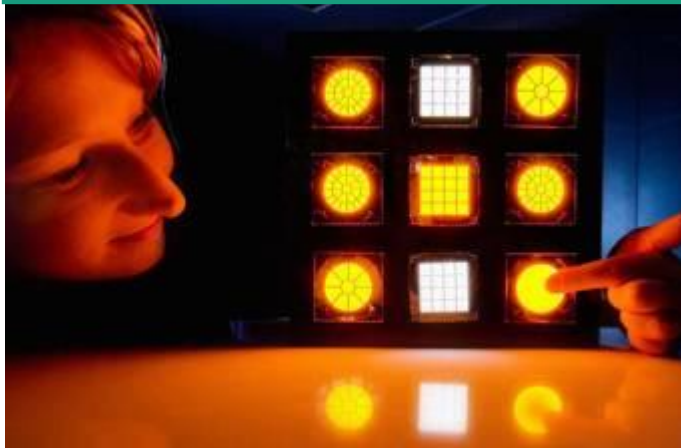
- n Clean room 900 m², Labs 100 m²

Fabrication lines

- n Pilot line Gen2 (370 x 470 mm²)
- n Pilot line OLED-on-CMOS (200x200 mm²)
- n Roll-to-Roll line (300 mm foils)

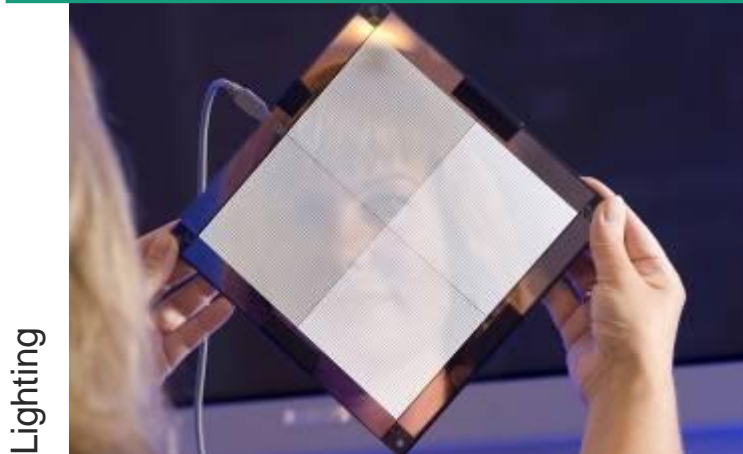


COMEDD APPLICATIONS



Signage

OLED on CMOS



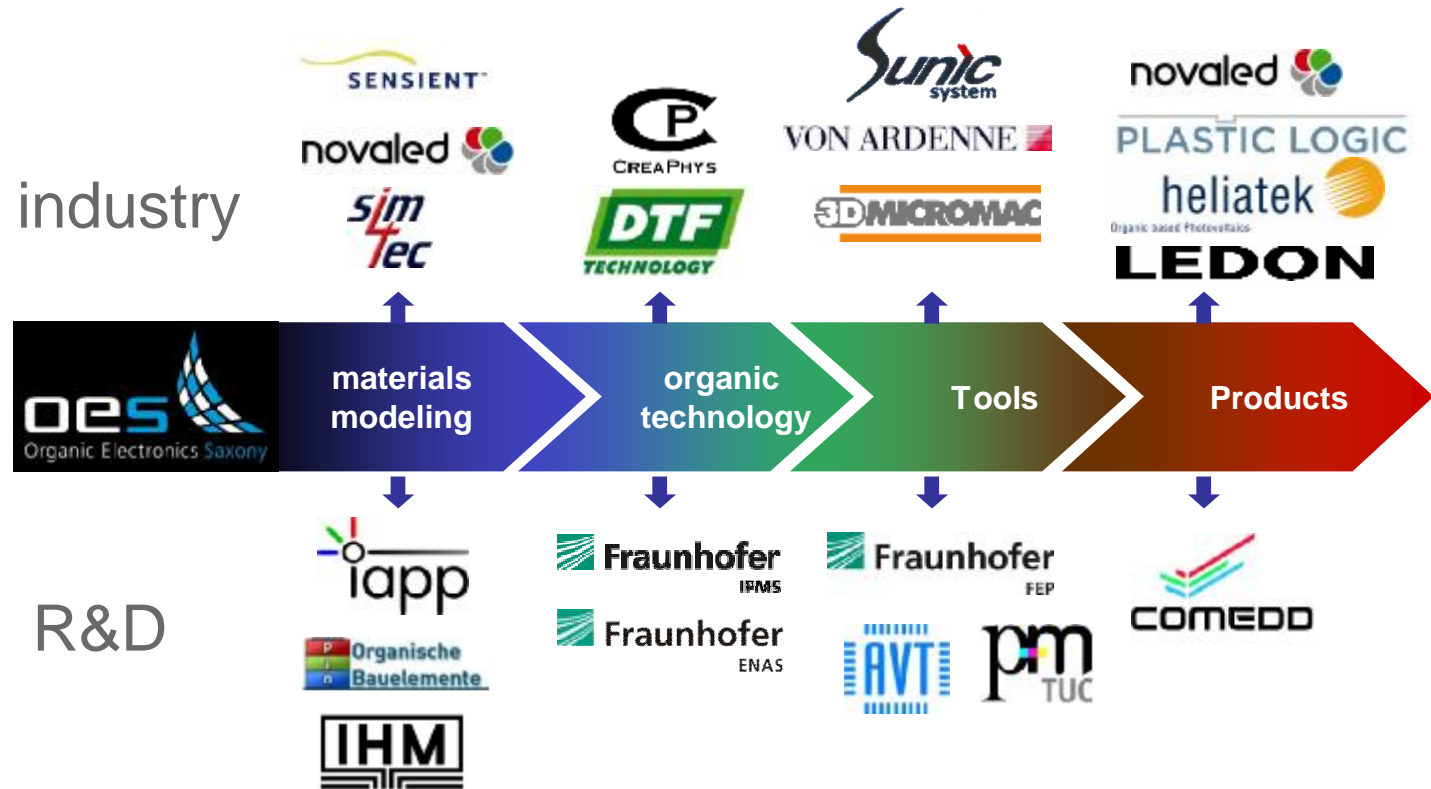
Lighting



Organic Photovoltaics

OES Value Chain

Organic Electronics
OLED displays
OLED lighting
Photovoltaics
Electronics: RFID
display-backplanes
Electronics
everywhere
Value chain
Members



job market: already > 800 coworkers in Saxony!

PROJECT EXAMPLE R2FLEX SETUP

- n R2flex = Roll-to-roll fabrication of small molecule OLEDs for lighting applications and organic solar cells on flexible substrates
- n 11 partners from industry and research
- n Project volume: 10.7 Mio. € in total (58% funding by BMBF)
- n Development Targets
 - n Technology for flexible OLED and OSC
 - n Development and installation of Roll-To-Roll Pilot Coater
 - n Transfer of technologies from sheet-to sheet- to R2R pilot processing
 - n monochrome OLEDs (signage)
 - n white OLEDs (lighting)
 - n organic solar cells
 - n encapsulation
- n www.r2flex.de



VON ARDENNE

novalad

iapp

LAYTEC
optical sensors

3DMICROMAC

alanod

Fraunhofer
IPMS

Fraunhofer
FEP

CP
CREAPHYS

LEDON

heliatek



Organic based Photovoltaics



PROJECT EXAMPLE R2FLEX RESULTS

- n Roll-to-Roll line for small molecule OLED for lighting application under installation at COMEDD
- n Batch type R&D vacuum coater for metal strips and polymer webs up to 300 mm with up to 14 linear organic evaporators
- n First OLED processed in this R2R coater shown!
- n Substrate patterning and coating by wet processes
- n Lamination under inert atmosphere
- n Inert transfer between the systems possible



SUMMARY

- n Organic & Large Area Electronics (OLAE) in Europe
 - n Clustered approach with pilot production centres to close the gap between R&D and products
 - n Coordinate existing OLAE networks and platforms, EU and national member state R&D programmes
- n Well focused German funding policy in Organic Electronics
- n COMEDD – Center for Organic Materials and Electronic Devices Dresden
- n Organic Electronics Saxony as one of the major clusters in Europe
- n Project R2FLEX – First SM-OLED by R2R processing shown

- n Visit Plastic Electronics Conference & Exhibition 2010 October 19-21, 2010, Dresden, Germany
<http://www.plastic-electronics2010.com/>



Thank you for your attention!

COMEDD
We shape the light.