Huntsman

CSEM; Basel
3rd Gen Photovoltaics- Clean tech day

Dr. B. Sailer; August 19th, 2009

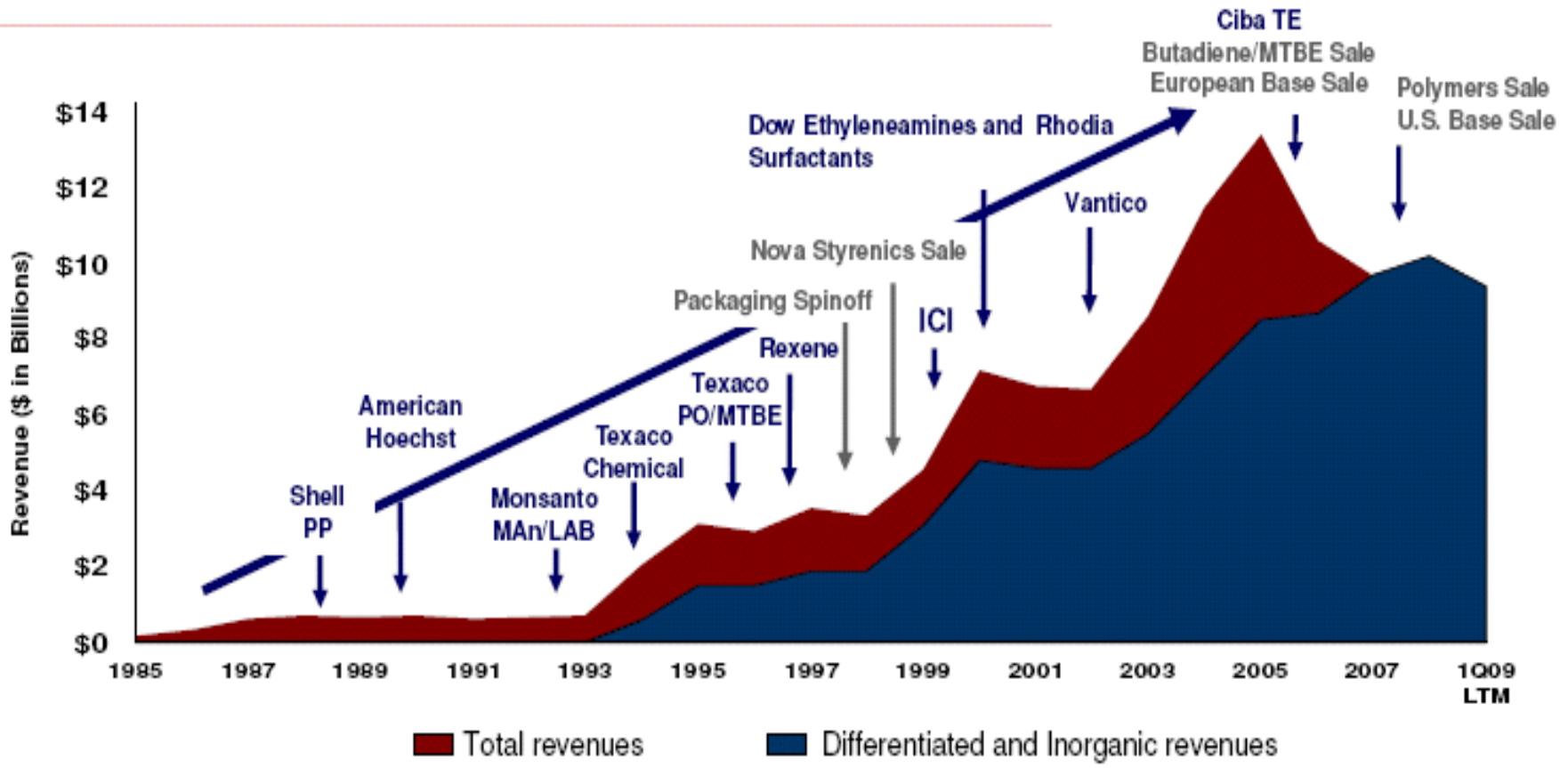
Overview

- Huntsman introduction
- Our history in electronics and energy
- Our way to Organic electronics
- Current activities in organic electronics
- Future oportunities

3rd Gen Photovoltaics: Clean Tech Day

Huntsman Growth

Enriching lives through innovation



Huntsman Corporate: 10 B US$ turonover in 2008

Differentiated				Inorganic
Polyurethanes	Advanced Materials	Textile Effects	Performance Products	Pigments
MDI Polyols PO/MTBE TPU Systems	Base Resins Formulated Systems Specialty Components	Apparel & Home Textiles Specialty Textiles	Performance Specialties Performance Intermediates Maleic Anhydride & Licensing	Titanium Dioxide




3rd Gen Photovoltaics: Clean Tech Day

Advanced Materials

Markets include:

- Adhesives
- Aerospace
- Automotive
- Coatings
- Construction
- Electronics
- Marine
- Power
- Sports and Leisure
- Wind Energy

- 1.6B US$ revenue in 2008
- 2400 employees, 13 production facilities
- Leading global manufacturer of advanced epoxy, acrylic and polyurethane-based products
- ARALDITE® brand

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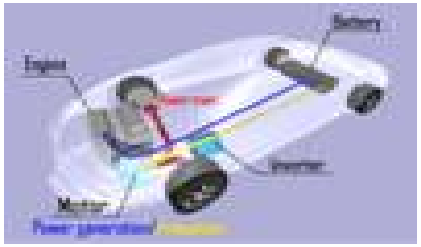
Our history in electronics, energy and light (snapshots)

- **Electronics:**
  - Huntsman is global leading supplies in encapsulation and issolation materials for heavy electronics (>20 KV application)
  - Huntsman is among leading suppliers for automotive electronics
  - Huntsman is #3 suppliers for PCB (printed circuit board)

    (Huntsman created Curtain coating application for PCB industriy in early 80's)

- **Energy:**
  - Huntsman was among first companies to develop resins systems for wind-mill applications
  - We are active in supplying organic materials to a fuel cells manufacturer
  - We are long time supplier for adhesives for silicon cutting (PV-wafers)
  - We are currently developing adhesives for PV module assembly

- **Lighting:**
  - We are toll manufacturer for OSRAM for LED encapsulants since mid 90's
  - We supply white solder mask for LED electronics



Our way into organic electronics

- **In late 2005, we started to look for next generation of electronic applications**
- **Organic electronic was at it's hype, mainstream was RFID and OLED's**
- **Based on our expertise, skills and history we decided to scan two area's:**
  - Protection (barrier layers)
  - RFID: dielectrics
- **By mid 2006, we decided to go in barrier technologies and joined Holst Center,TNO, Eindhoven by early 2007 in TP2 programm**

TP2 programm at TNO/ Holst center Eindhoven

TP2: main objectives of this program are two-fold:

- Developing a transparent barrier on foil and encapsulation stack that prevents the growth of black spots during accelarated lifetime tests for 504 h at 60 °C and 90% humidity (60/90). (expected lifetime 10 years under 20/50 expected)
- Developing a roll-to-roll process for depositing both the electrodes and the barrier/encapsulation layer

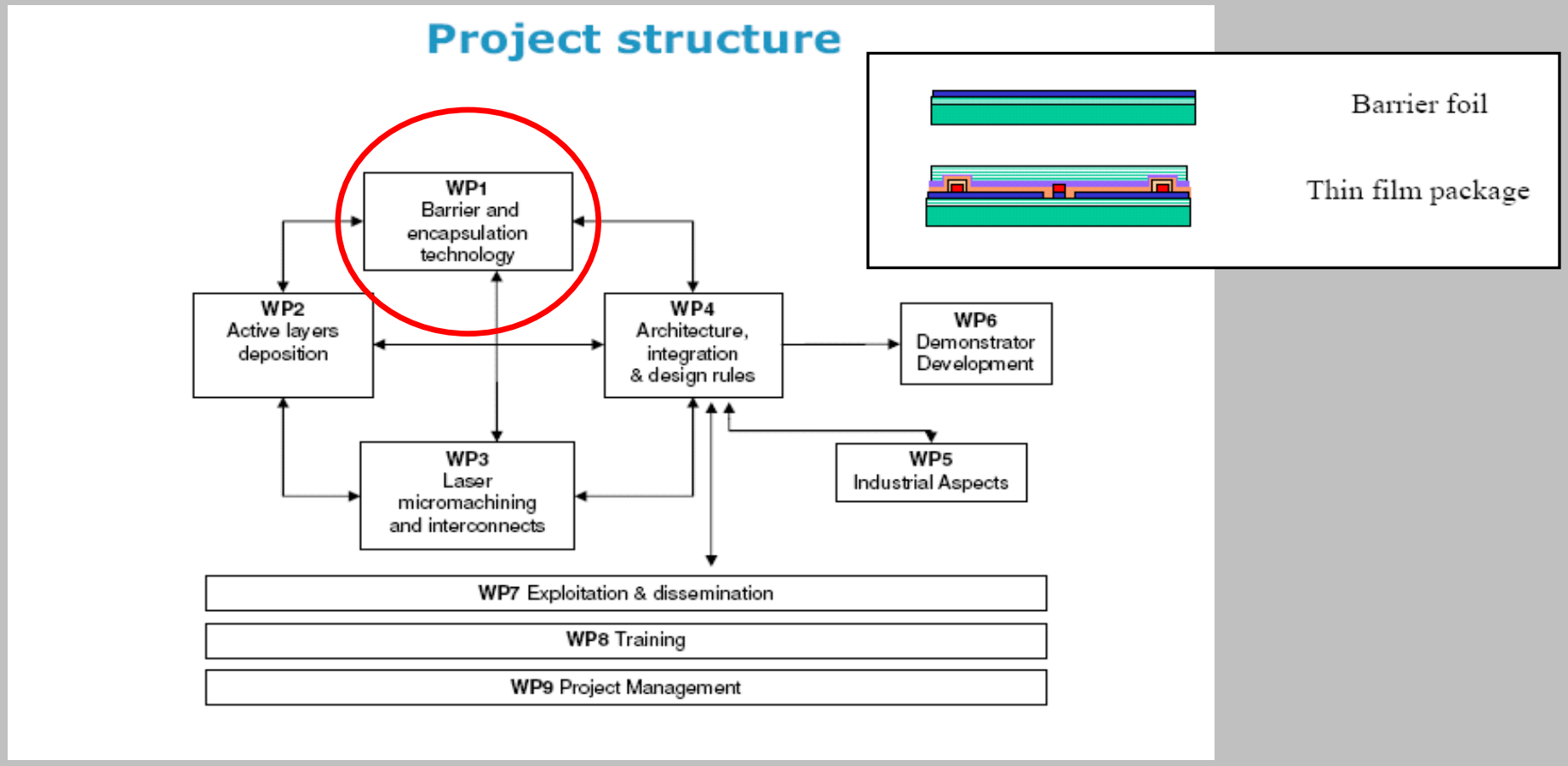
- In Q1 2007, TP2 became:

F2L overall goal:

General objective

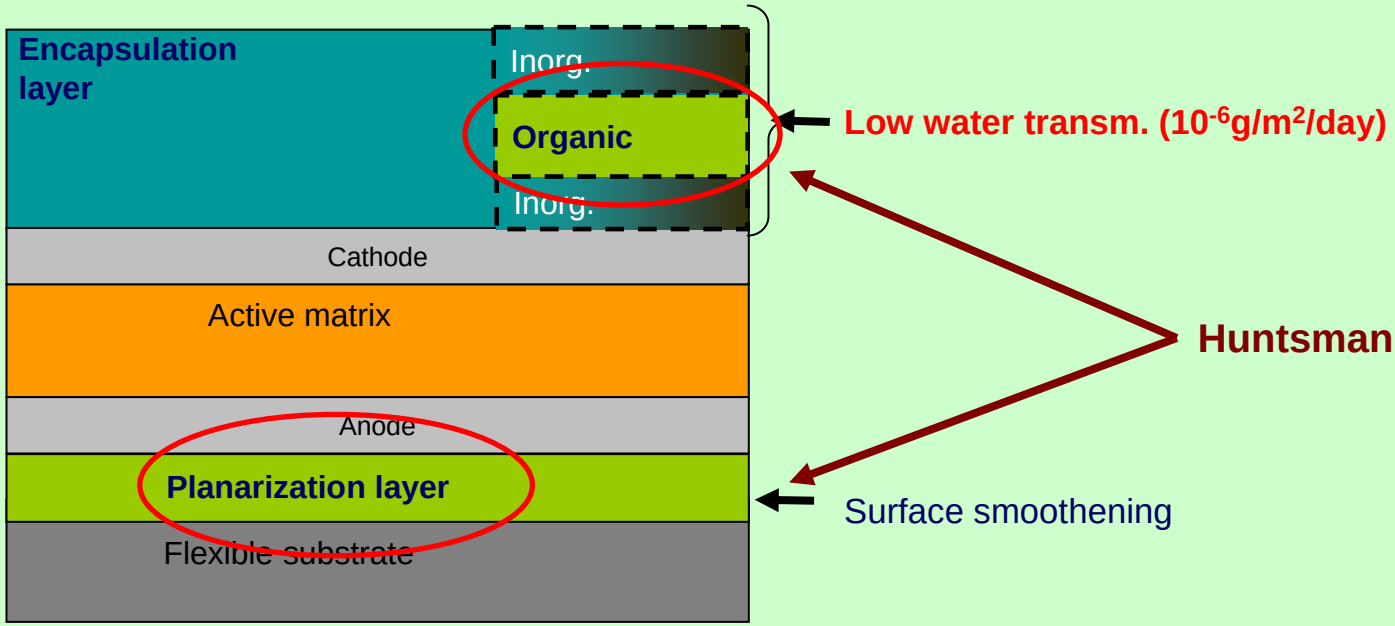
Develop novel, cost-effective, high throughput, roll-to-roll, large area deposition processes for fabricating light-emitting polymer-OLED foils for lighting applications.

F2L- project structure



F2L programm at TNO/ Holst center Eindhoven

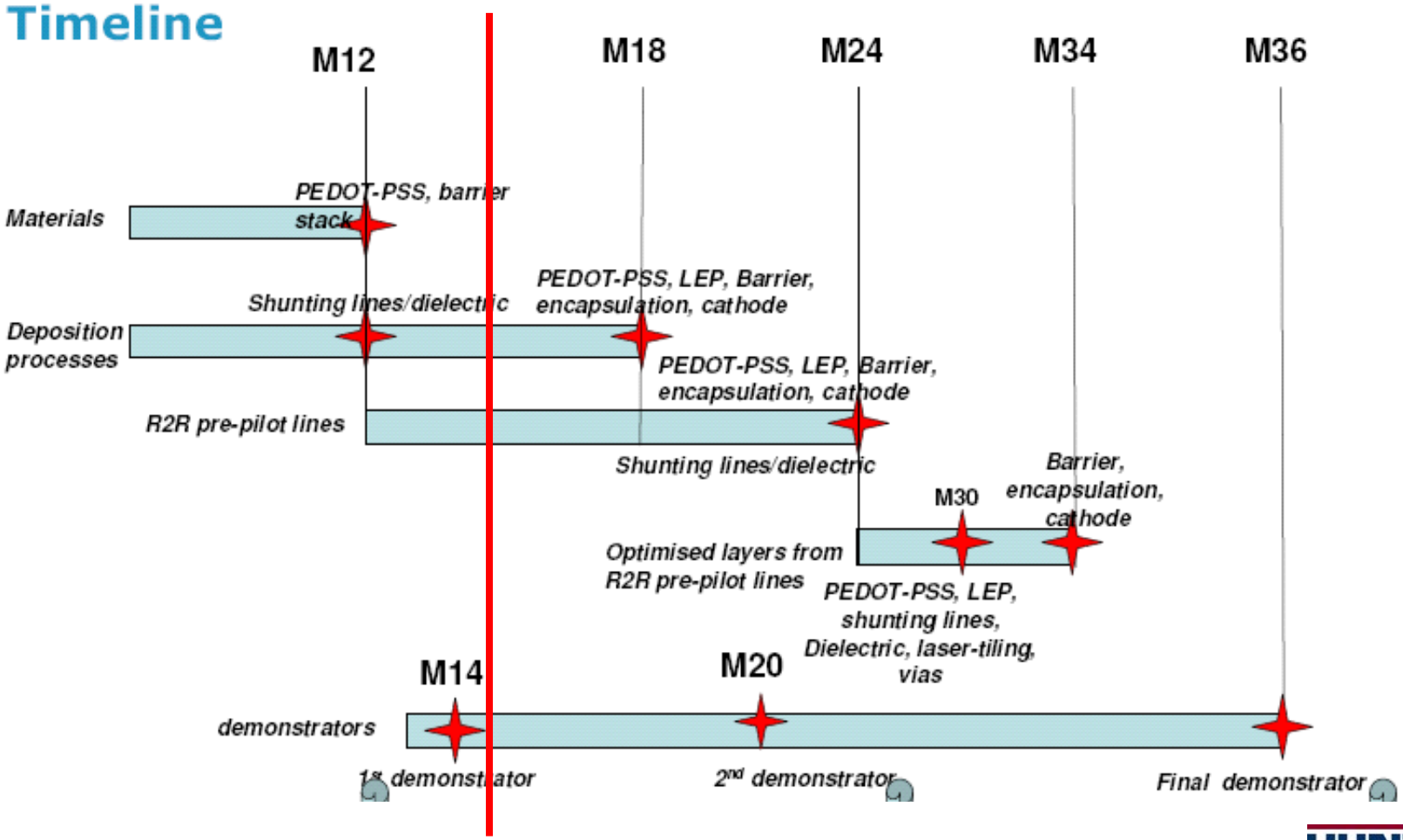
- **What is Hunstman developing:**



Schematic representation of an OLED device

F2L- a EU project within FP7 program

http://www.fast2light.org/



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Partners in F2L

Participant number	Participant organization name	Participant short name	Country
1 (coordinator)	TNO Science and Industry	TNO	NL
2	Philips Research Eindhoven	PRL-E	NL
3	Philips Technologie GmbH	Philips	DE
4	NV Bekaert SA	BEK	BE
5	Agfa Materials	Agfa	BE
6	OTB Display	OTB	NL
7	University of Wales Swansea	UWS	UK
8	Hanita Coatings RCA Ltd.	Hanita	IL
9	Interuniversity Microelectronics Centre	IMEC	BE
10	Oxford Lasers Ltd.	Oxford Lasers	UK
11	Fundación Gaiker	Gaiker	ES
12	Huntsman Advanced Materials GmbH	HadMat	CH
13	Budapest University of Technology & Economics	BME	HU
14	Orbotech Ltd.	Orbotech	IL

Merck Chemicals is supplying state-of-the-art polymers

8 countries, 4 hgher education/institutes, 4 SME's, 5 large enterprises

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Barrier layer technology - chemistry - results

Fast2Light current barrier stack achieves the specified WVTR of 10^{-6} g/day.m^2 (Presentation ISFOE conference Athens, June 2009)

- details cannot be communicated due to ongoing IP filings and confidentialy contracts
- a 4 pages publication submitted to cintelliq in 2008 “thin film encapsulation of OLED’s” is available, see technical details in paper, Sin- POL-Sin structure,
- Next target: WVTR 10^{-6}g/m^2/day, cost efficient R2R process
- Project is moving forward team is confident to meet F2L targets

Other projects on OE

- **we will focus on exploitation of barrier layer technology in organic electronics applications**
  - Light , display, signage
  - OPV
- **additionally we are open to discuss projects in the area of:**
  - assembly chemicals (adhesives, coatings, …)
  - Case by case analysis
- **Contacts:**
  - Marketing: Dr. B.Sailer
  - R&D: (Core research) Dr. M.Elwell; Dr. Z.Cherkaoui