

THORN



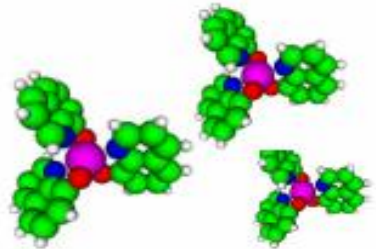
Polymer Organic LED Lighting, the opportunities

Deposition methodology

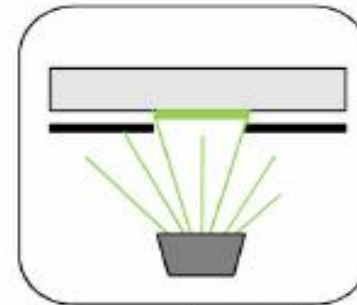
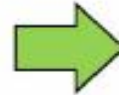
The difference between material classes: Polymers and small molecules

Small Molecule OLEDs (SM-OLEDs)

Invented 1985 by Tang, van Slyke (Kodak)



Emissive materials are small molecules

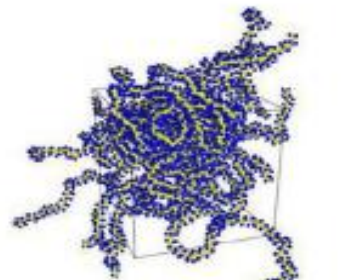


Vacuum deposition

IP now owned by LG
10% -15% material utilisation

Polymer OLEDs (P-OLEDs)

Invented 1989 by Burroughes, Friend, and Bradley (Cambridge)



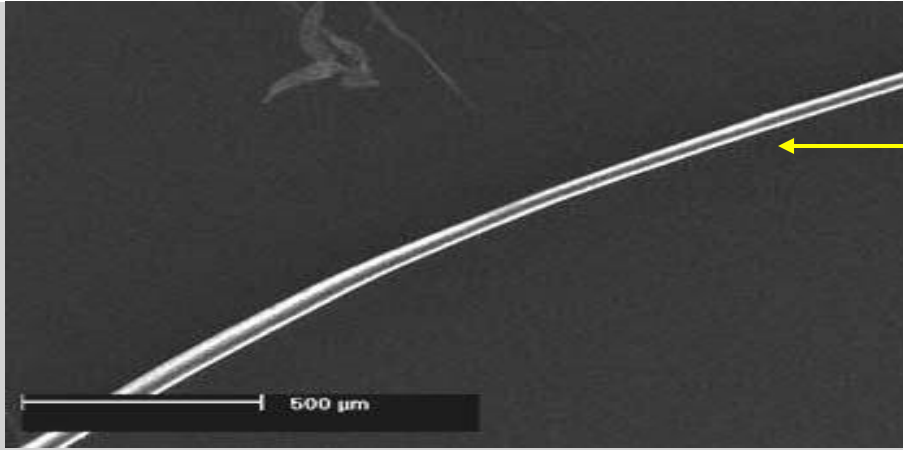
Emissive materials are long chain molecules



Solution processing

90% + material utilisation when printed, not spin coated

Solution processing: three organic layers, thickness ~ 100nm



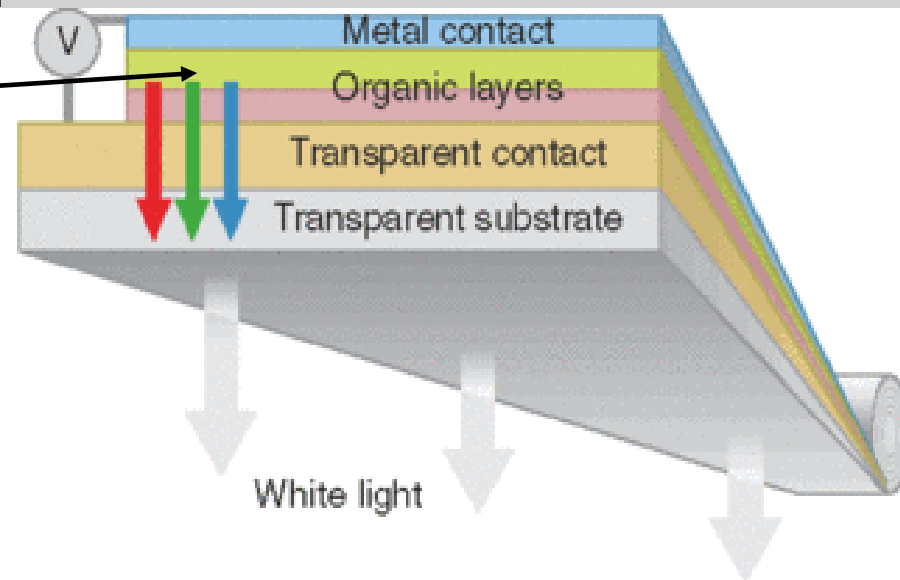
Human hair 0.1mm thick

3.5V – 5V dc

Organic layer thickness
1/2000 a human hair!!

0.00005mm (50nm)

Controlled layer thickness to
10% (5nm)



- **Project TOPLESS**
- **March 2007 to February 2010**
- **Thorn Lighting**
- **Cambridge Display Technology**
- **University of Durham**
 - **Physics and Chemistry Departments**

The TOPLESS Lamp



Topless Lamp

- **White light 5V DC 0.68 Amps 1200cdm-2 CIE (0.364, 0.394)**
- **$\sim 18 \text{ LmW}^{-1}$ with external outcoupling**
- **60Lm delivery ($\sim 1/10$ of a 60W incandescent!)**

Green issues in lighting:

EU directives – Energy used for electric lighting

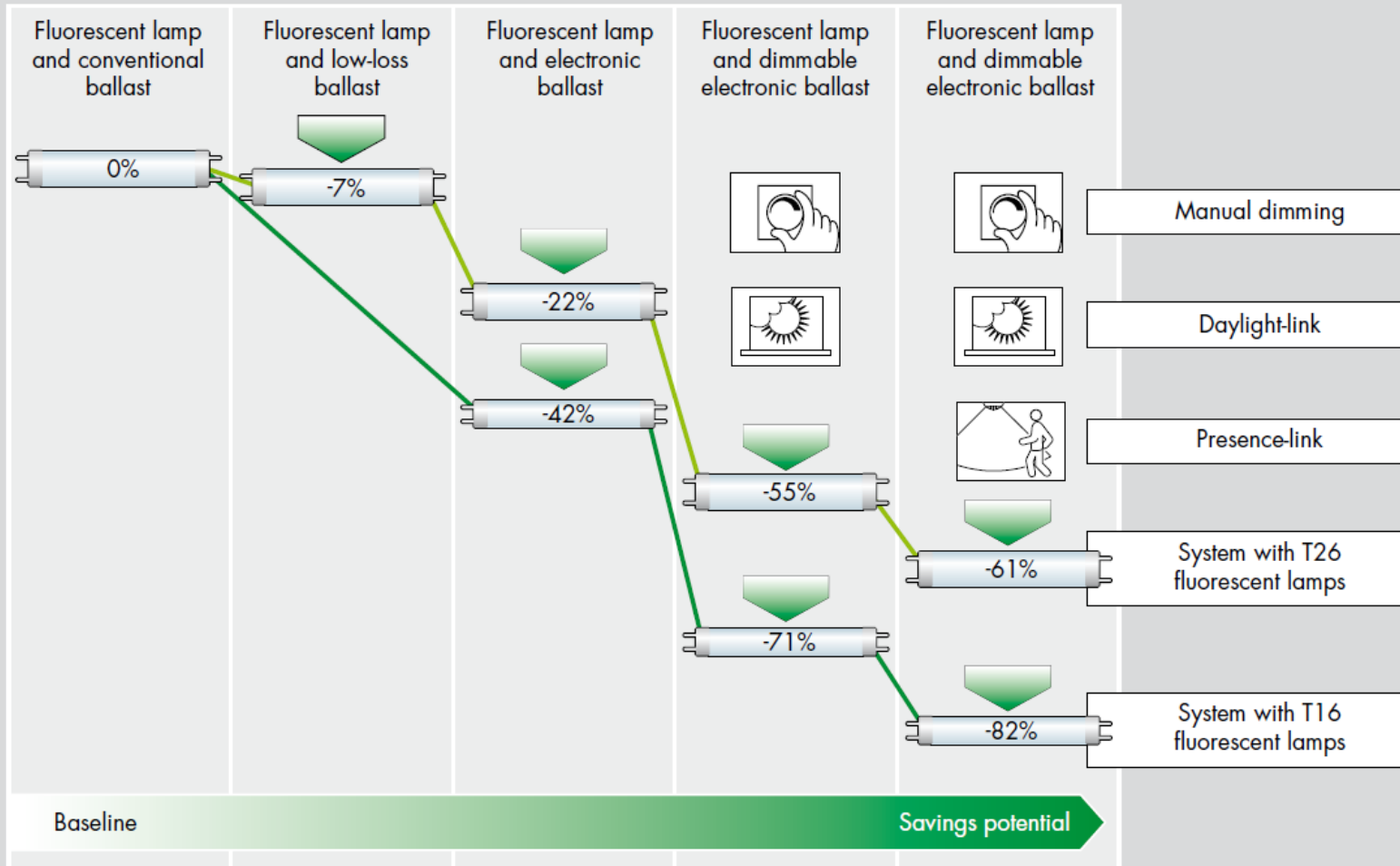
- 14% of electricity in the EU is used for lighting (19% globally, ~1900Mt CO₂/year from 1265 power stations)
- Europe accounts for ~ 40% of global lighting consumption
- commercial lighting, in Europe, accounts for 70% of all electrical power consumed by lighting....equating to ~ 3,000,000,000,000 m² of lighting producing ~ 600 million Tonnes of CO₂ (almost the same as the global contribution from petrol/diesel vehicles!!)
- 65% of European lights installed are inefficient
- EuP directive aims to improve efficiency of products
- EPB directive aims to improve efficiency of buildings
- EC GreenLight programme is a voluntary scheme and is a register of organisations of lighting users who promise and do improve the efficiency of their present electric lighting
- Intelligent Energy is a European programme to promote new technologies, intelligent habits, energy efficiency in buildings and industry and more new or renewable energy sources

Green issues in lighting:

- we can reduce this consumption today by up to 80% with excellent lighting/building design, better use of existing electronic control systems (hands free lighting control).
- **Solid State Lighting (in-organic and organic) is the new kid on the block and Europe can be the leading global community to offer comprehensive efficient lighting solutions, but by:**
 - a. coupling directly to renewable power sources....solar, wind, tidal**
 - b. coupled with sophisticated re-chargeable battery technology**
 - c. new and efficient DC drive electronics.**
 - d. lighting powered via novel DC building infrastructures**
- **lighting efficiency can be realised by technology (as above) and through strong European directives and legislation (political will). Lighting is far dirtier than petrol vehicles but just not as sexy!**

Green issues in lighting: Lighting Controls

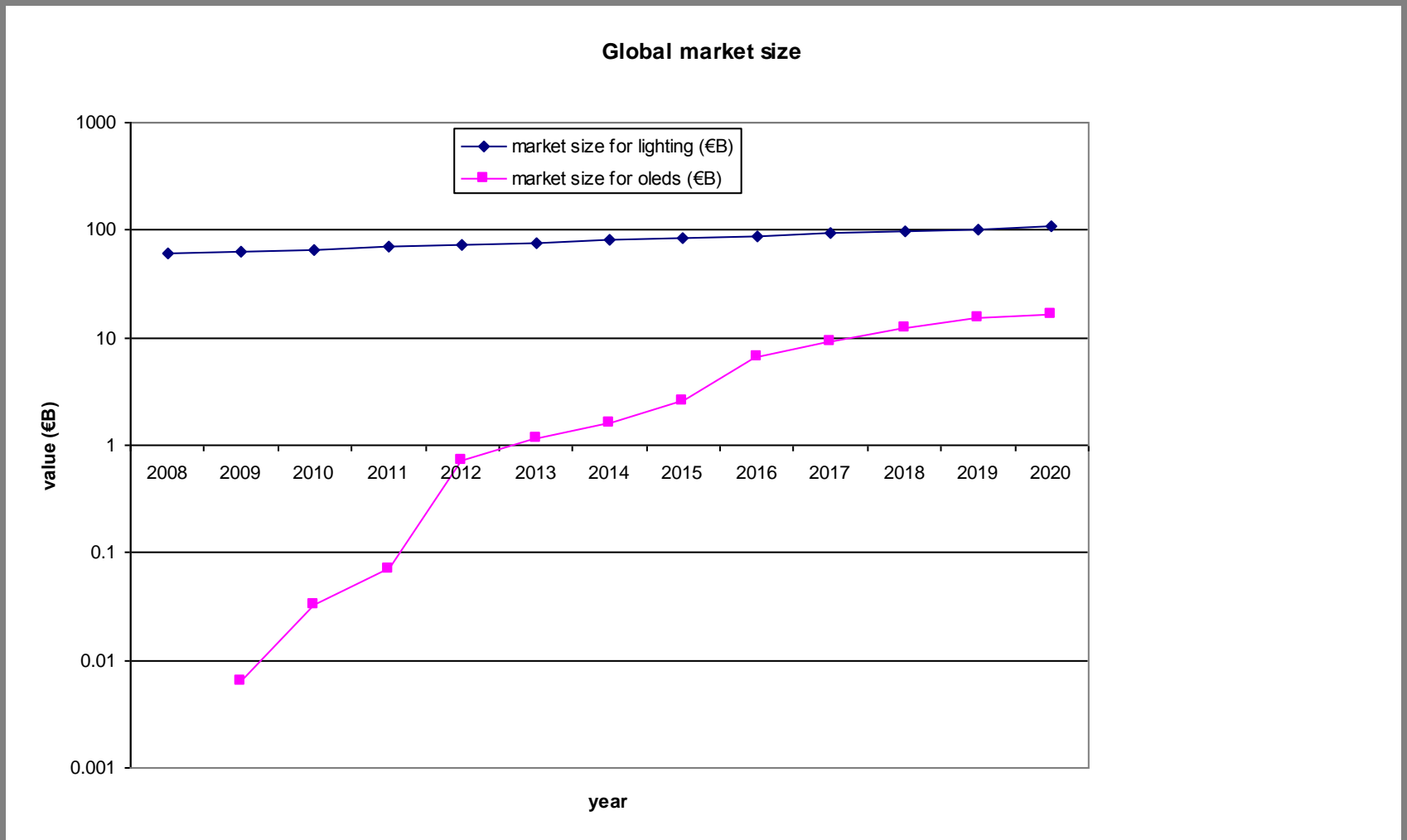
Milestones to energy conservation with modern lighting



Green issues in lighting: for Stephen Hughes and Connie Hedegaard

- Ultra-efficient lighting costs money, but the return on investment is short, and in general single figure months!!
 - But the impact on the environment is far greater
- Organic solid state lighting offers further benefits
 - Zero mercury,
 - No land fills
 - Vastly reduce transportation cost
 - Huge reduction in packaging
 - Complete supply chain in Europe....
 - Job and wealth creation coupled with environmental, societal and political benefits

The market opportunities



■ Thank You!

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