



Status and Perspectives of Thin Film Solar Cell Production

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Renewable Energies**



Disclaimer

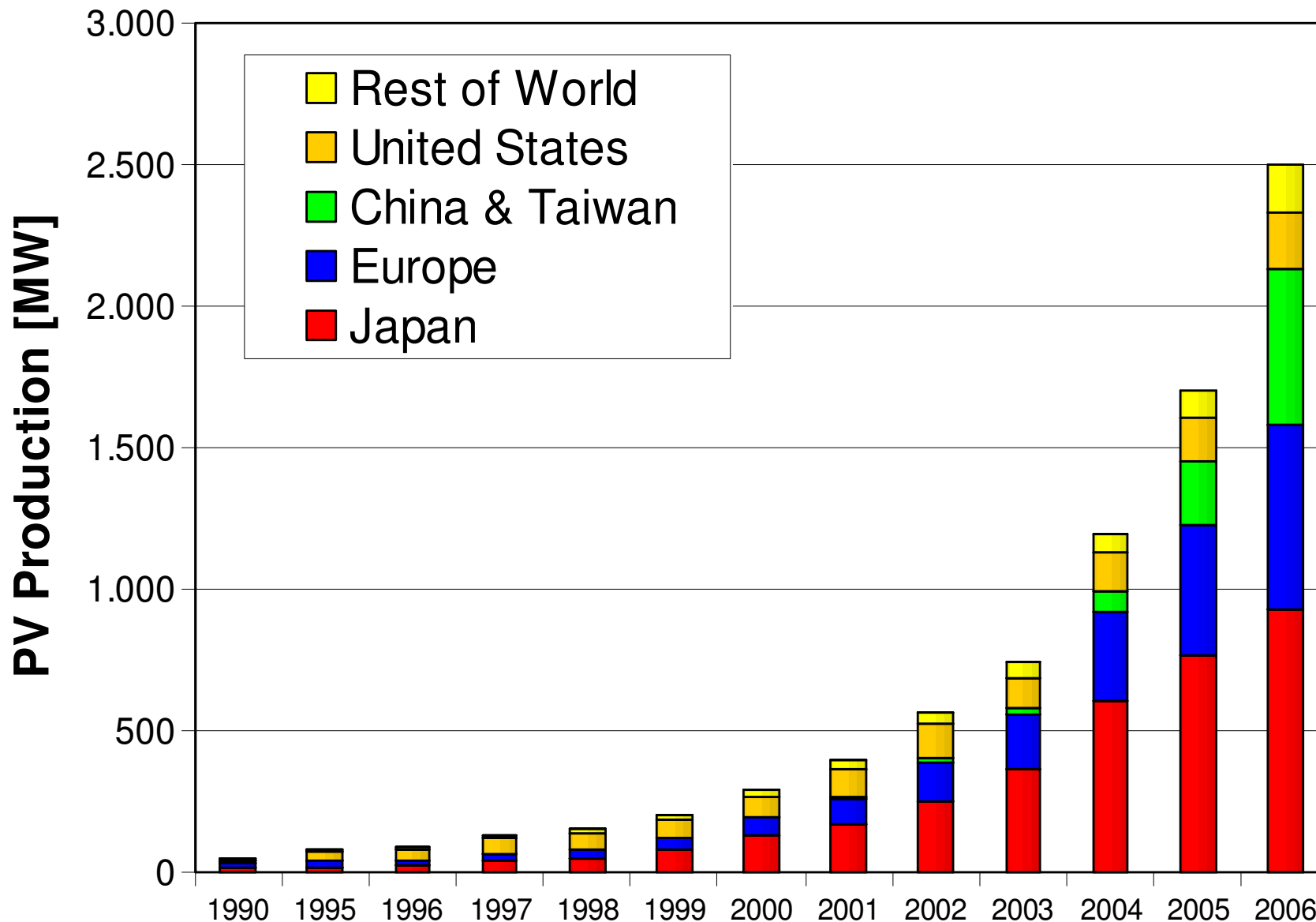
- The capacity numbers were collected from Press Announcements of the different companies with a cut-off date End of August 2007.
- There is a sometimes quite high uncertainty in the overall figure as well as the time lines. As I pointed out in the presentation I consider 50% to be realistic in the given time frame.
- On slide 10 and 11 the 4.5 and 2€/Wp are possible system prices for the customer. The figures for the modules represent the selling price of the module
- The use of the material is permitted as long as the sources are acknowledged.
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- **Photovoltaics Overview**
- **Industry**
- **Cost Reduction and Learning Curves**
- **Markets**
- **Conclusions**



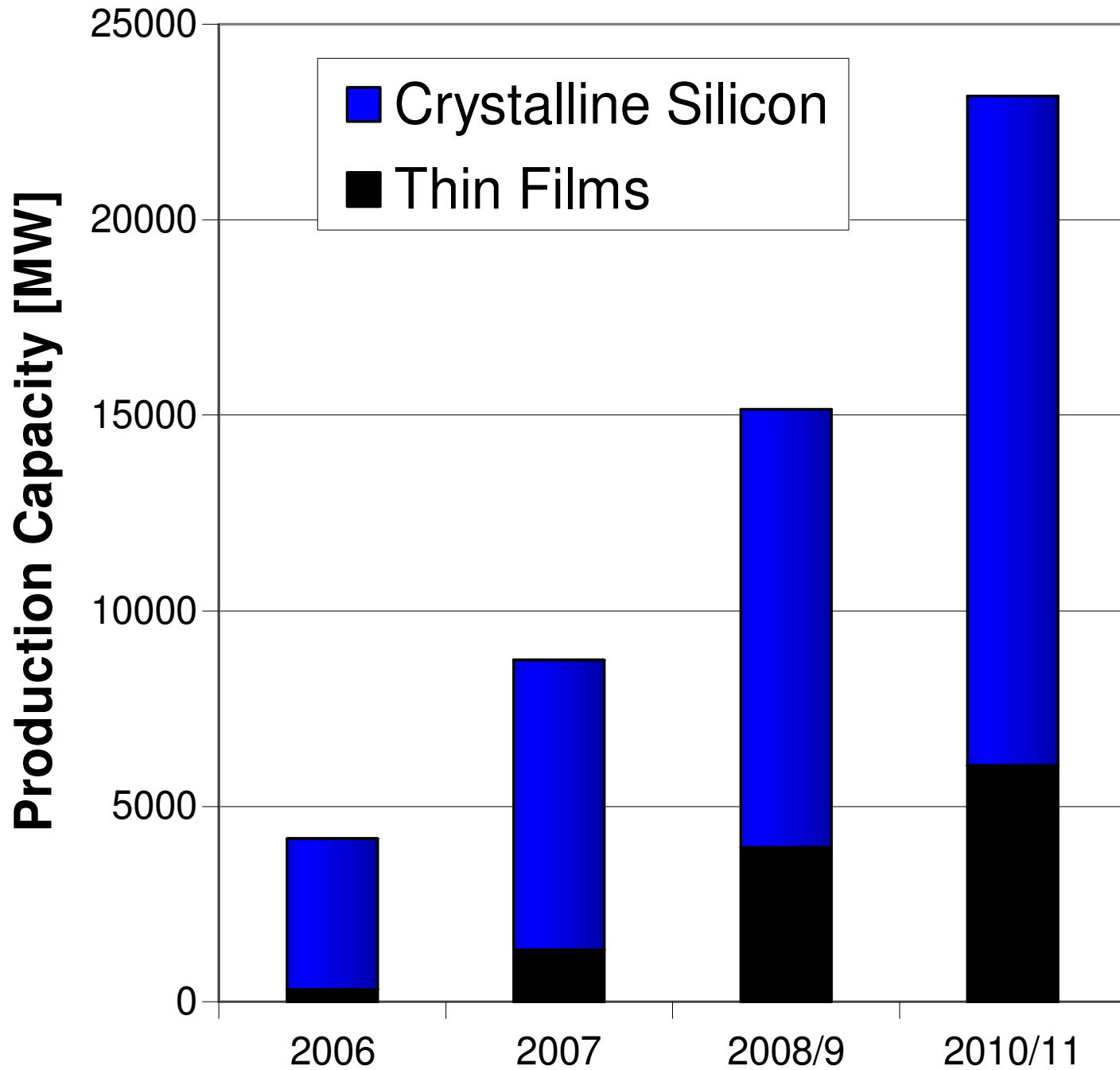
World-wide PV Cell/Module Production



Data source: PV News

Renewable Energies



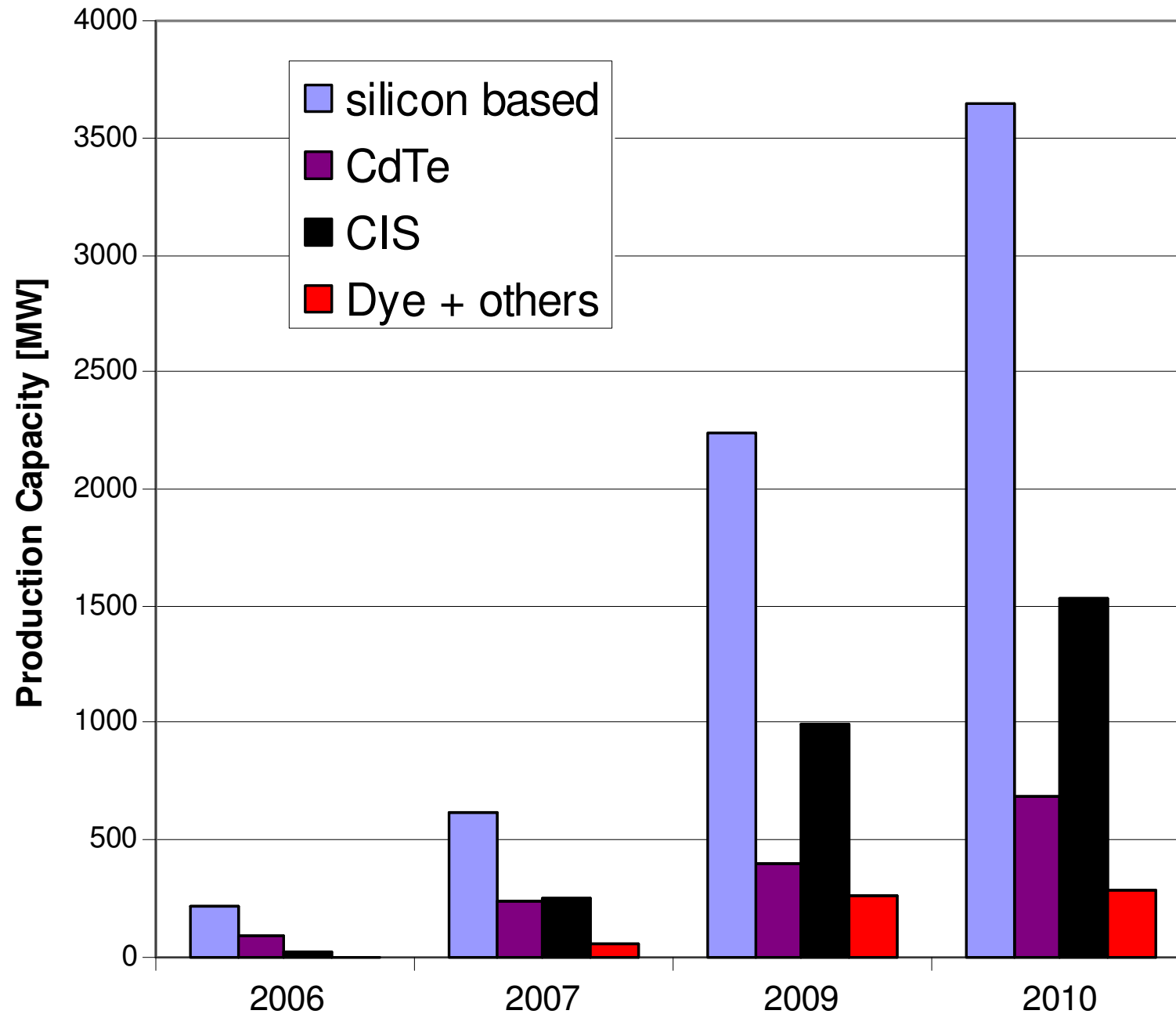


**Announced
Capacity
Increases**



Thin Film Industry

- more than 130 companies world wide (range : research to production)
- 21 companies have produced thin film PV in 2006
- 82 companies have announced plans to increase their production capacities
- 32 in Europe, 14 China, 19 USA, 9 Japan, 8 ROW
- 50 silicon based
- 19 $\text{Cu(In,Ga)}_2(\text{Se,S})_2$
- 8 CdTe
- 5 Dye & others

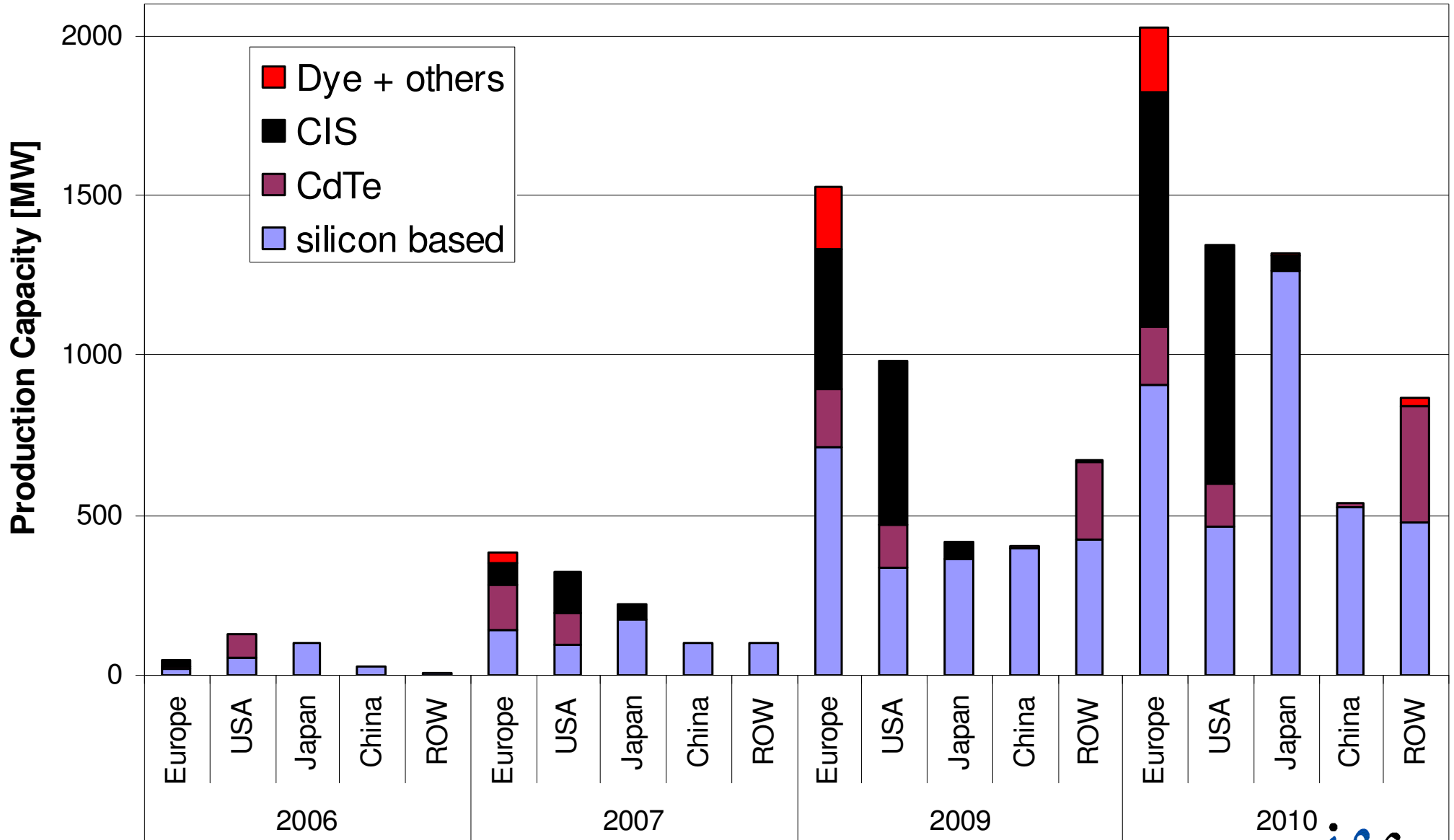


Announced Production Capacities by Technology



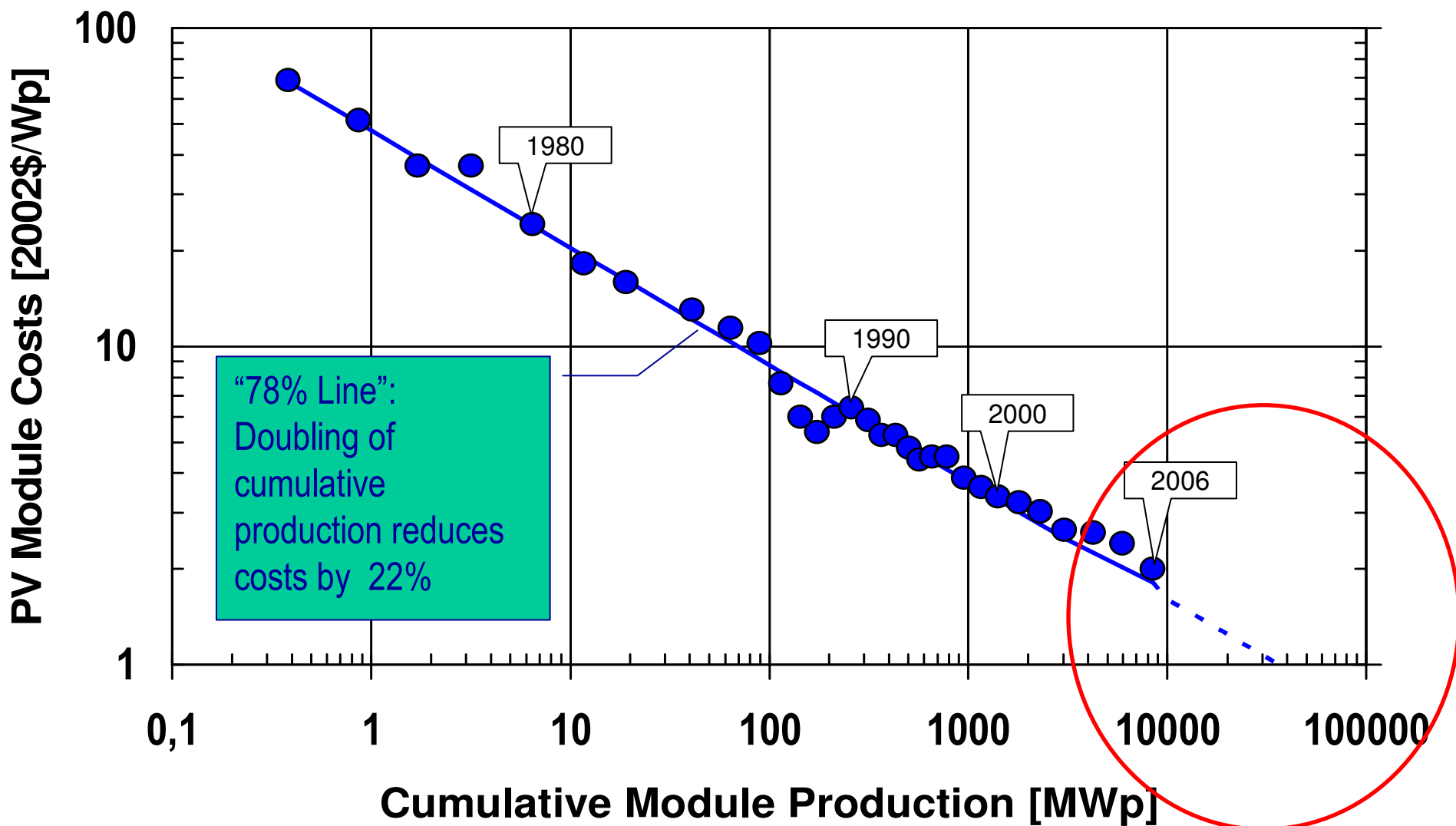
Announced Capacity Increases: Regional Differentiation by Technologies

Joint Research Centre



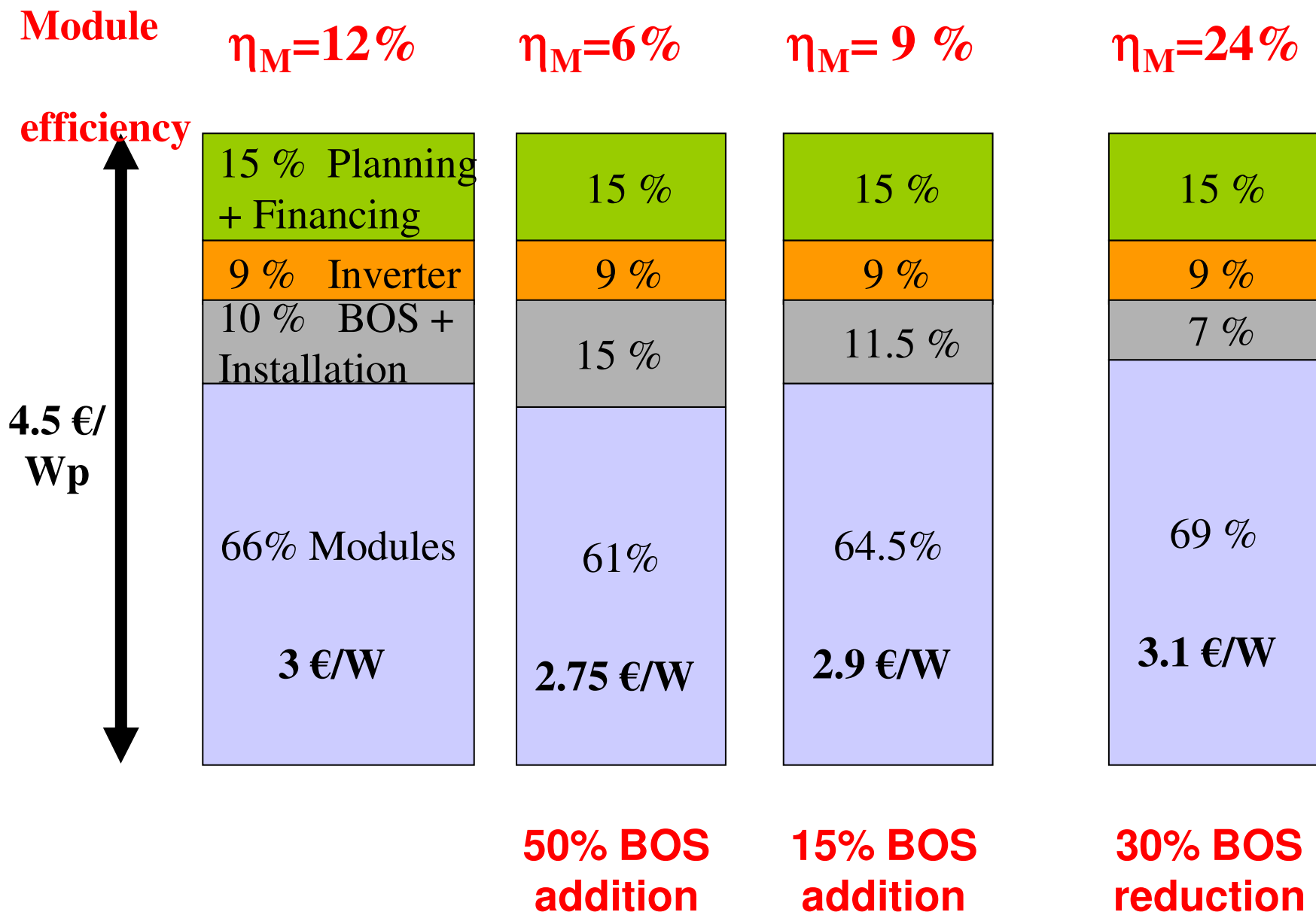


PV Technology Learning Curve since '76



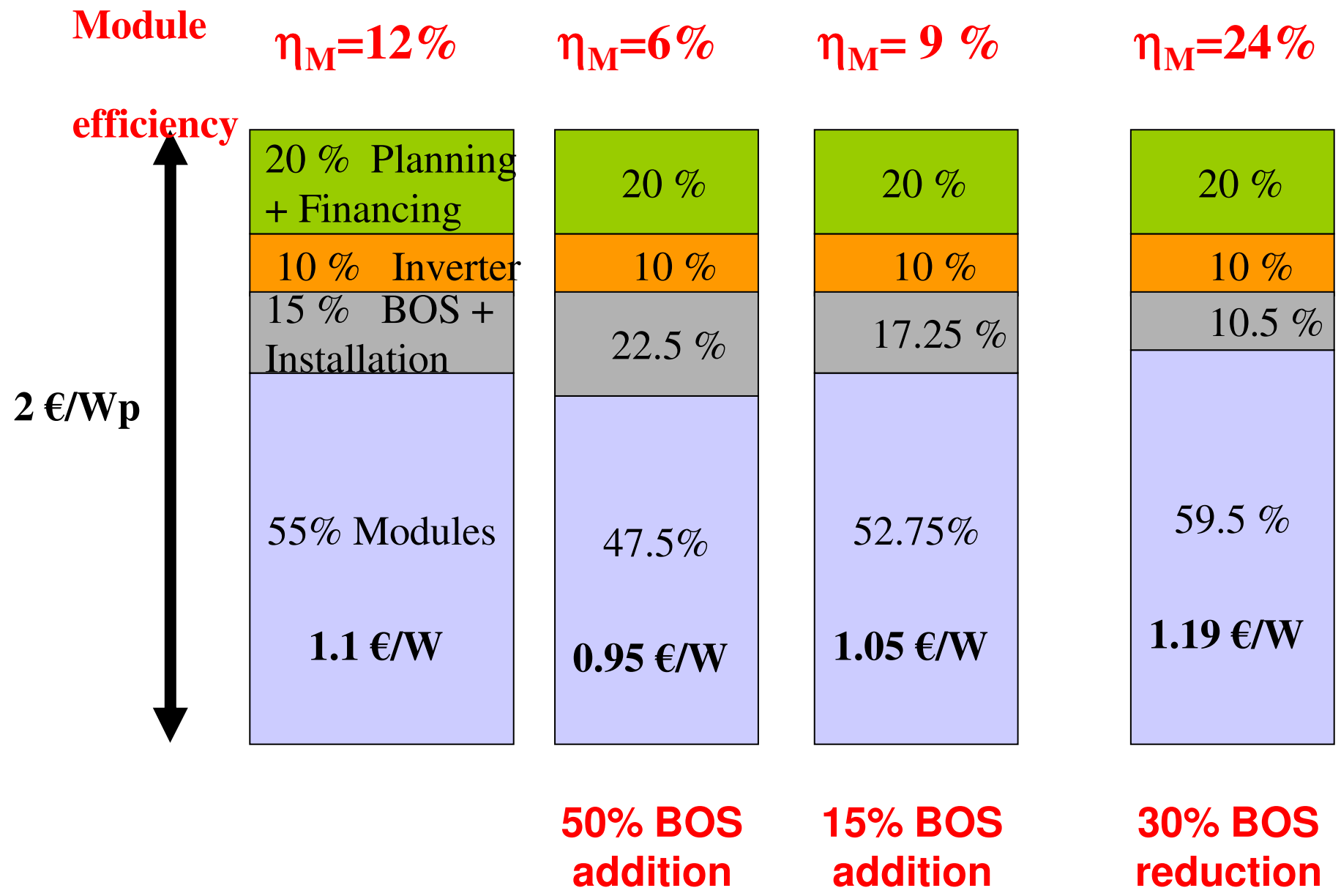
Cost Relevance of Module Efficiency

Joint Research Centre



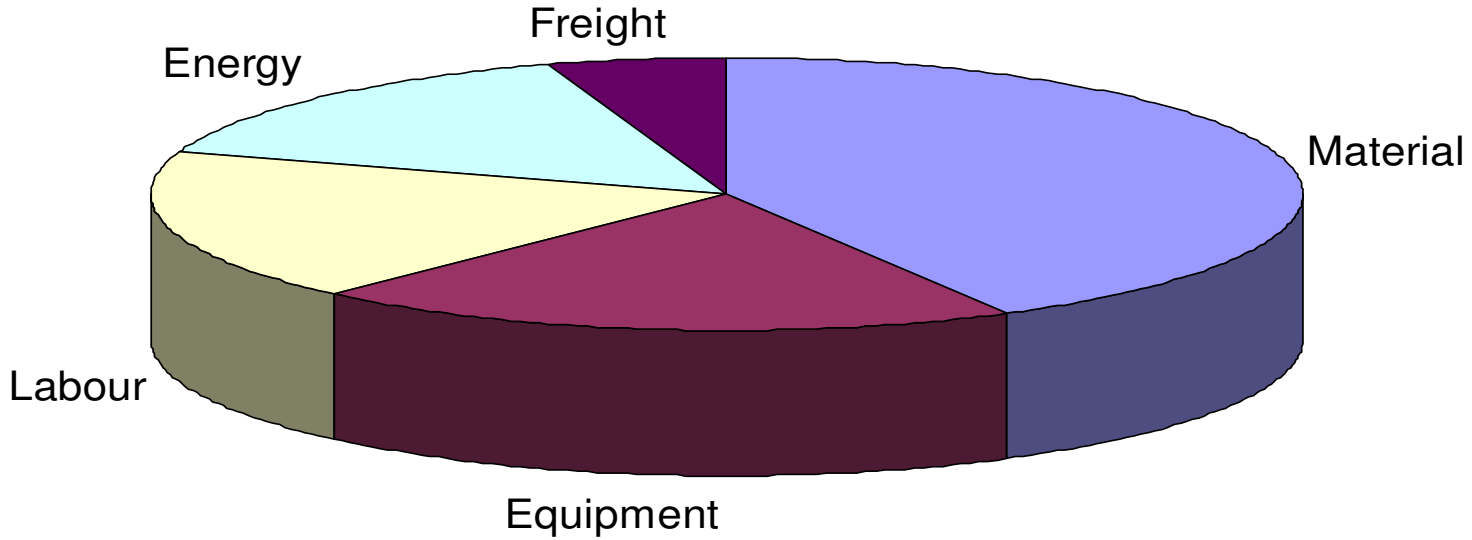
Cost Relevance of Module Efficiency

Joint Research Centre



Average Thin Film Cost Structure

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Technology dependent Drivers

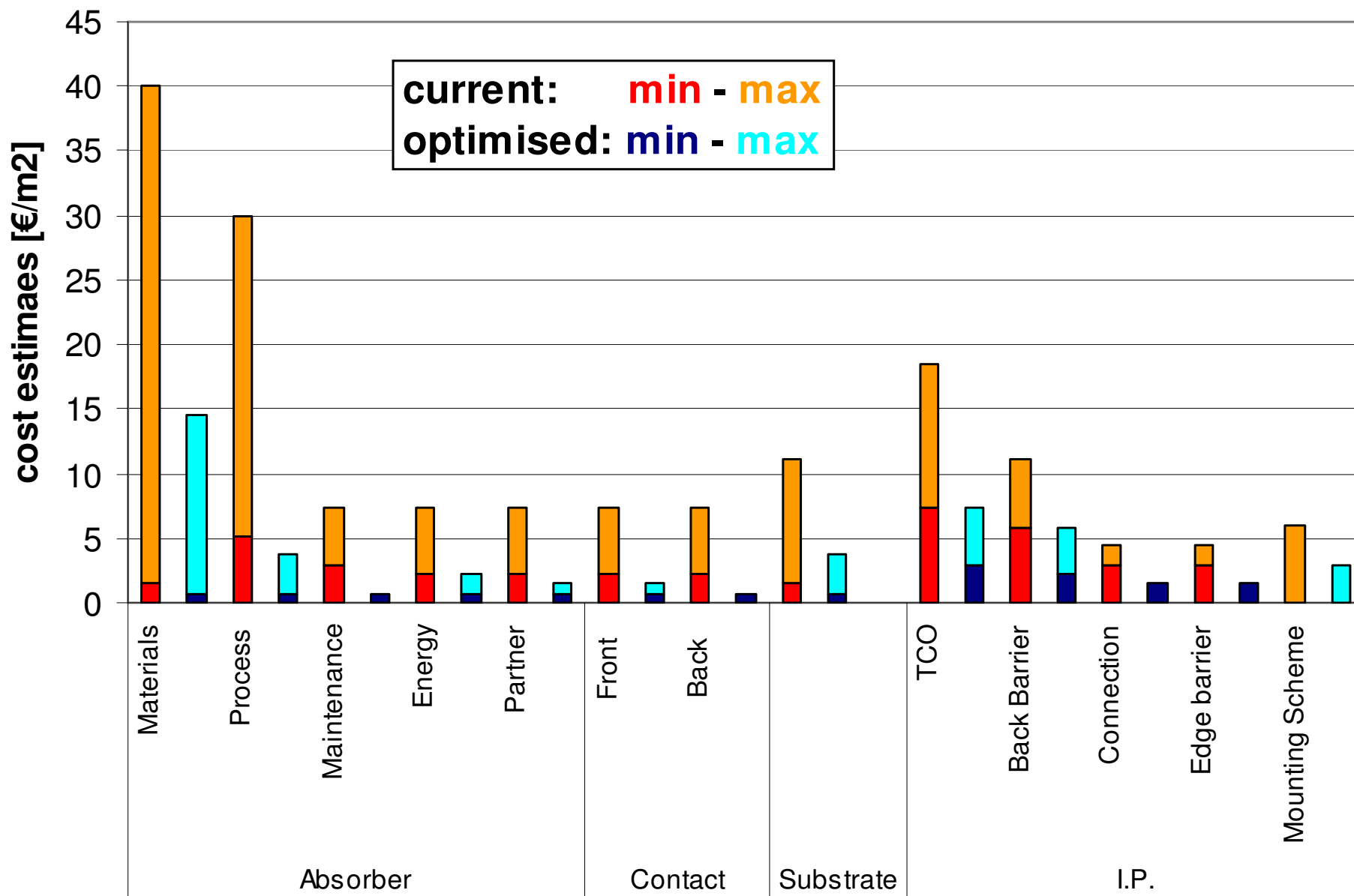
- Deposition Process: Dominates Energy
- Deposition Materials: Dominates Depreciation
- Package/Assembly: Dominates Materials

Common Drivers

- Material Cost: Volume, Efficiency
- Depreciation: Throughput, Efficiency
- Labour: Throughput, Automation, Efficiency
- Energy: Throughput, Efficiency



Thin Film Cost Reduction Potentials





Thin Film Cost Reduction Potentials

Current:

Active Layers: 20 – 98 €/m²

Inactive Parts: 19 – 26 €/m²

Total: 39 – 124 €/m²

Optimised:

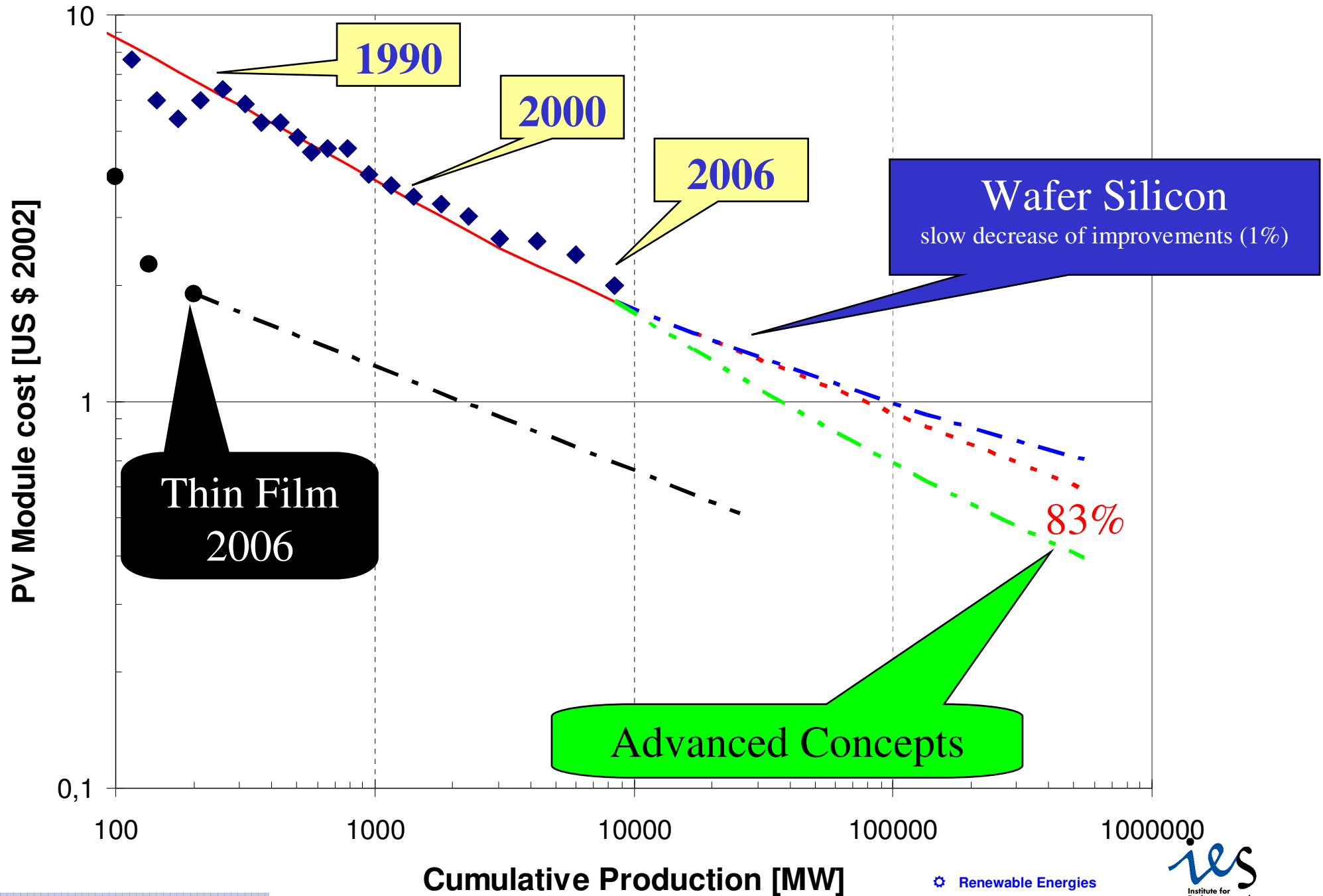
Active Layers: 5.5 – 23 €/m²

Inactive Parts: 8 – 11 €/m²

Total: 13.5 – 34 €/m²



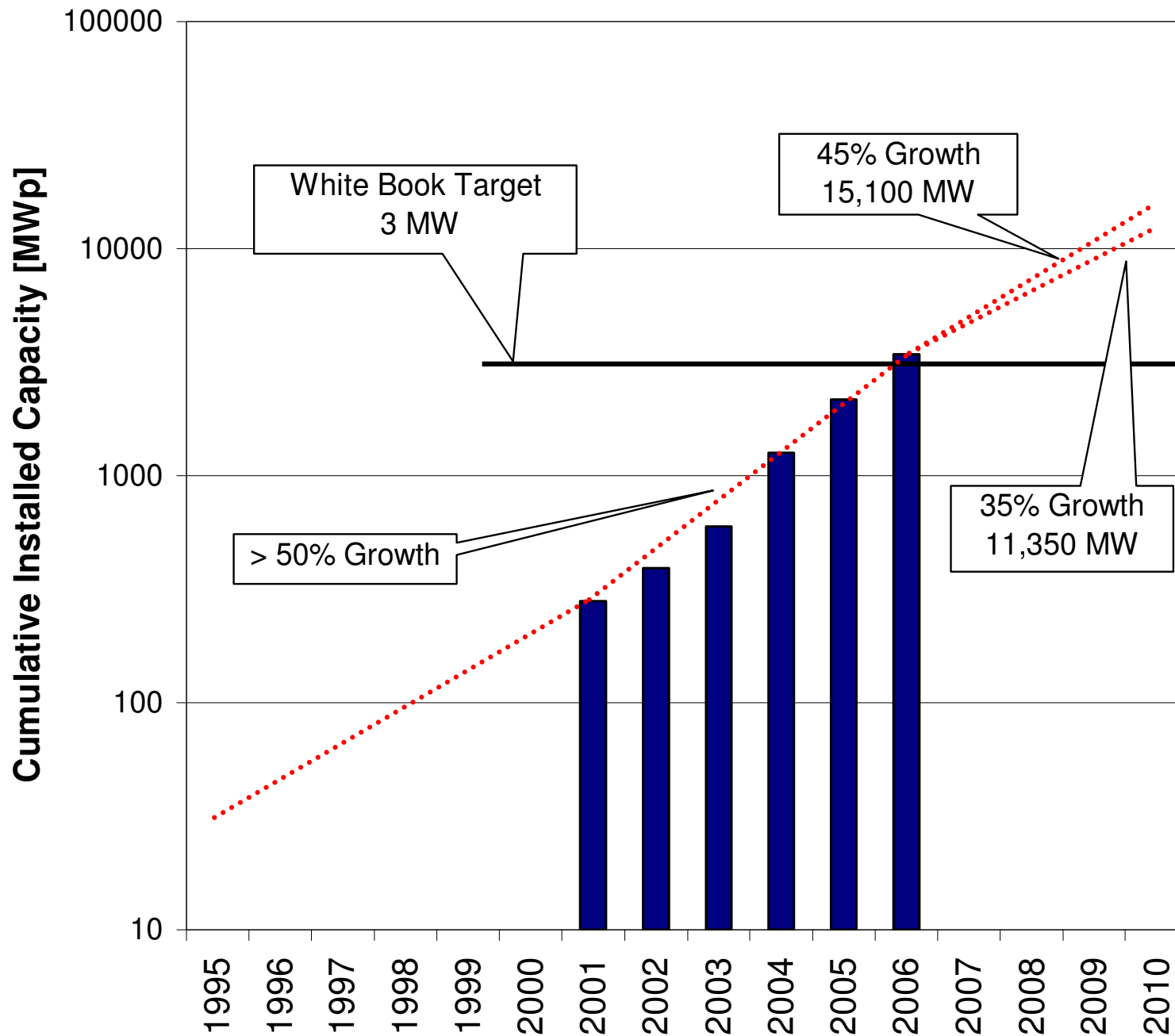
Learning Curve Scenarios



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European Installations





Market Estimates

PV News

Europe + Japan + USA

35% Growth

45% Growth

2006: 2,500 MW

1,680 MW

1,680 MW

2010: 7,140 MW

5,200 MW

7,700 MW

2011: 9,300 MW

7,000 MW

11,165 MW



Conclusions

- 😊 **Thin Film PV Production Capacities grow faster than the already high PV growth rates**
- 😞 **High uncertainty about time schedule of about 50% of the announced capacity increases**
- 😊 **If production volume is ramped up according to plans, Thin Film PV has the potential to reach the 1 €/Wp cost target at the end of this decade**
- 😐 **Markets for the next decade will still depend on public support**

Thank you for your attention!



Photo by Steve Locke