

Technology policy for low-C technologies

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Karsten Neuhoff

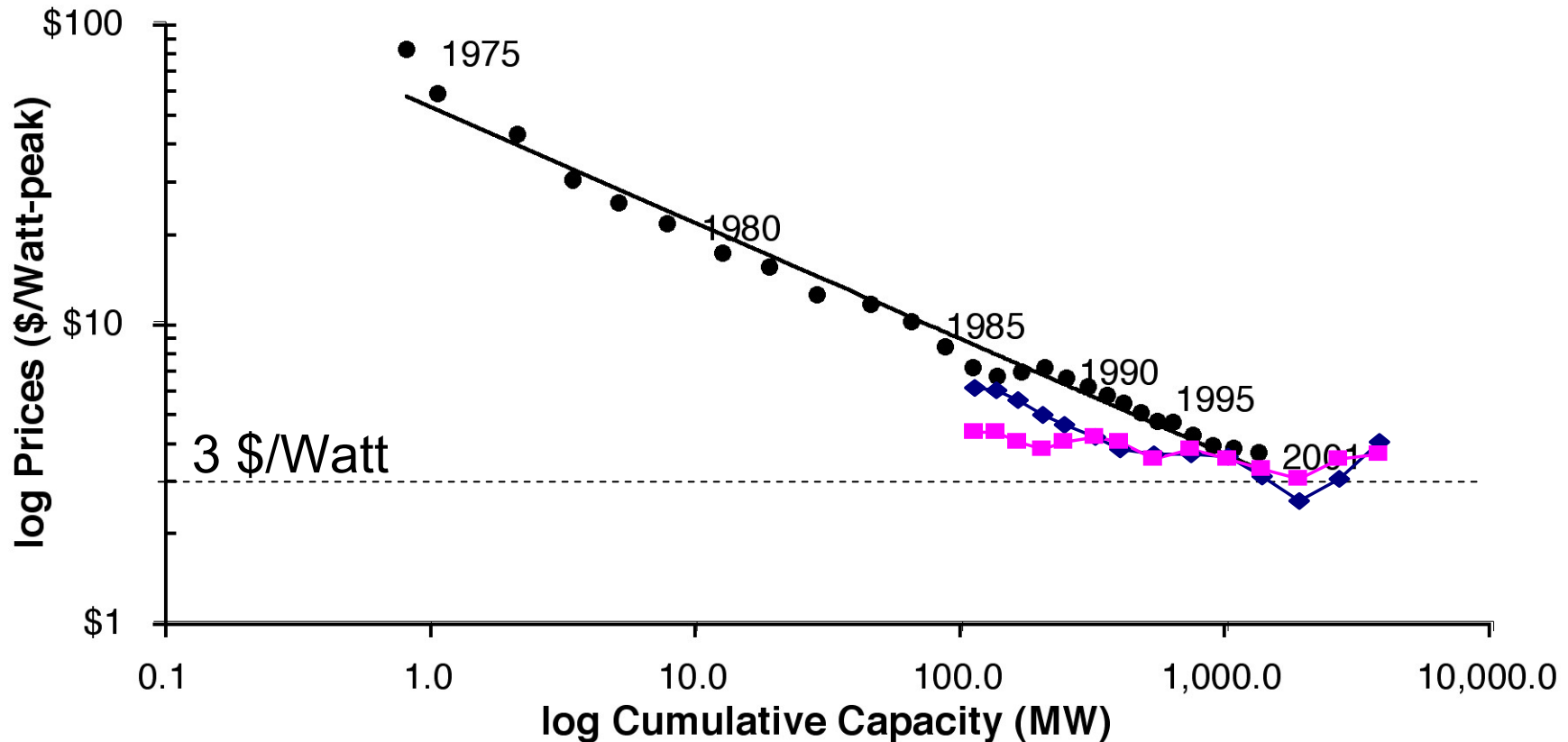
www.electricitypolicy.org.uk/tsec/2

Outline

- The challenge for low Carbon - cost and market size
- Incentives for innovation from strategic deployment
- How strategic deployment could address market needs
 - of project developers
 - of PV producers and equipment suppliers
- Conclusion

The Challenge of lower Carbon technologies – cost and market size

Price evolution for PV modules



Recent profit margins (based on solarworld annual reports)

Euro/W	wafer	cell	module	Total
2005	0.286	0.079	0.063	0.427
2006	0.308	0.162	0.059	0.529

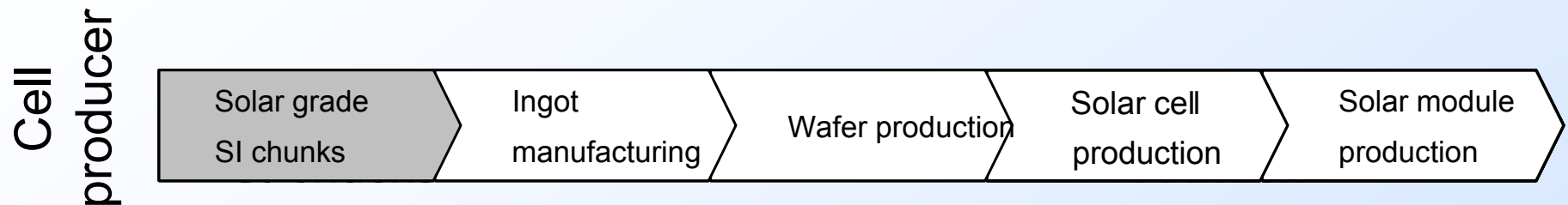
The Challenge of lower Carbon technologies – cost and market size

Where do we need to go ?

- Cost of PV electricity (2007)
 - Module, cost/price 2200-3500 Euro/KWatt
 - Average output 900 h/a
 - Interest + depreciation = 10%
 - Levelised cost **240-390 Euro/MWh**
- Fossil fuel
 - Levelised cost **40 Euro/MWh**
 - Increase with 25 Euro/t CO₂ **12-20 Euro/MWh**
- Can we reduce PV costs by factor 4?
- How long will it take?
 - Learning rate 0.8 -> 1/4 cost -> 2⁶ capacity
 - Growth rate 30% -> double in 2.5a -> 15 years

Incentives for innovation from strategic deployment?

The production line of PV cells



Work with:

Katja Schumacher
DIW
Berlin

Gregory Nemet
University of
Berkeley

Misato Sato
University of
Cambridge

Jan Lossen
Ersol

Incentives for innovation from strategic deployment?

The modelling framework – what fraction of line to improve?

Period 1

Period 2

Cell Producer innovates on
 $0 < \alpha < 1$ of new line

Production loss $(1 - \beta\alpha^2)$

Innovation cost αC_d

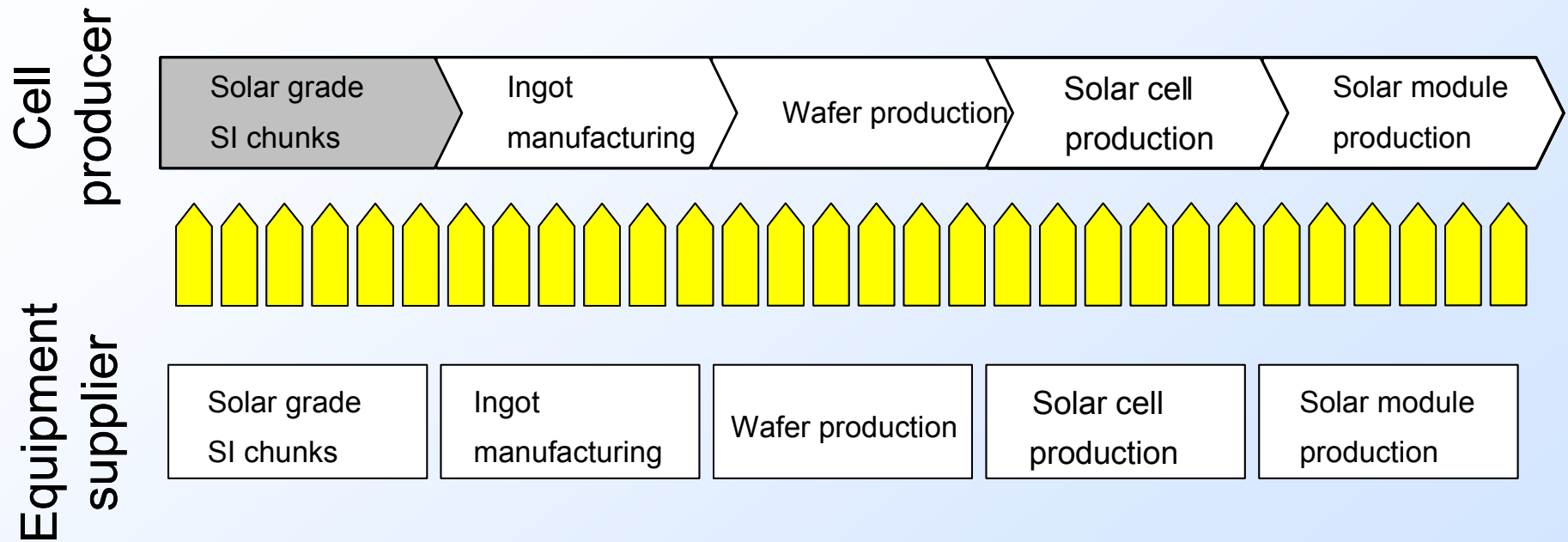
Capacity expansion I_1

Cost reduction $\gamma\alpha$

Capacity expansion I_2

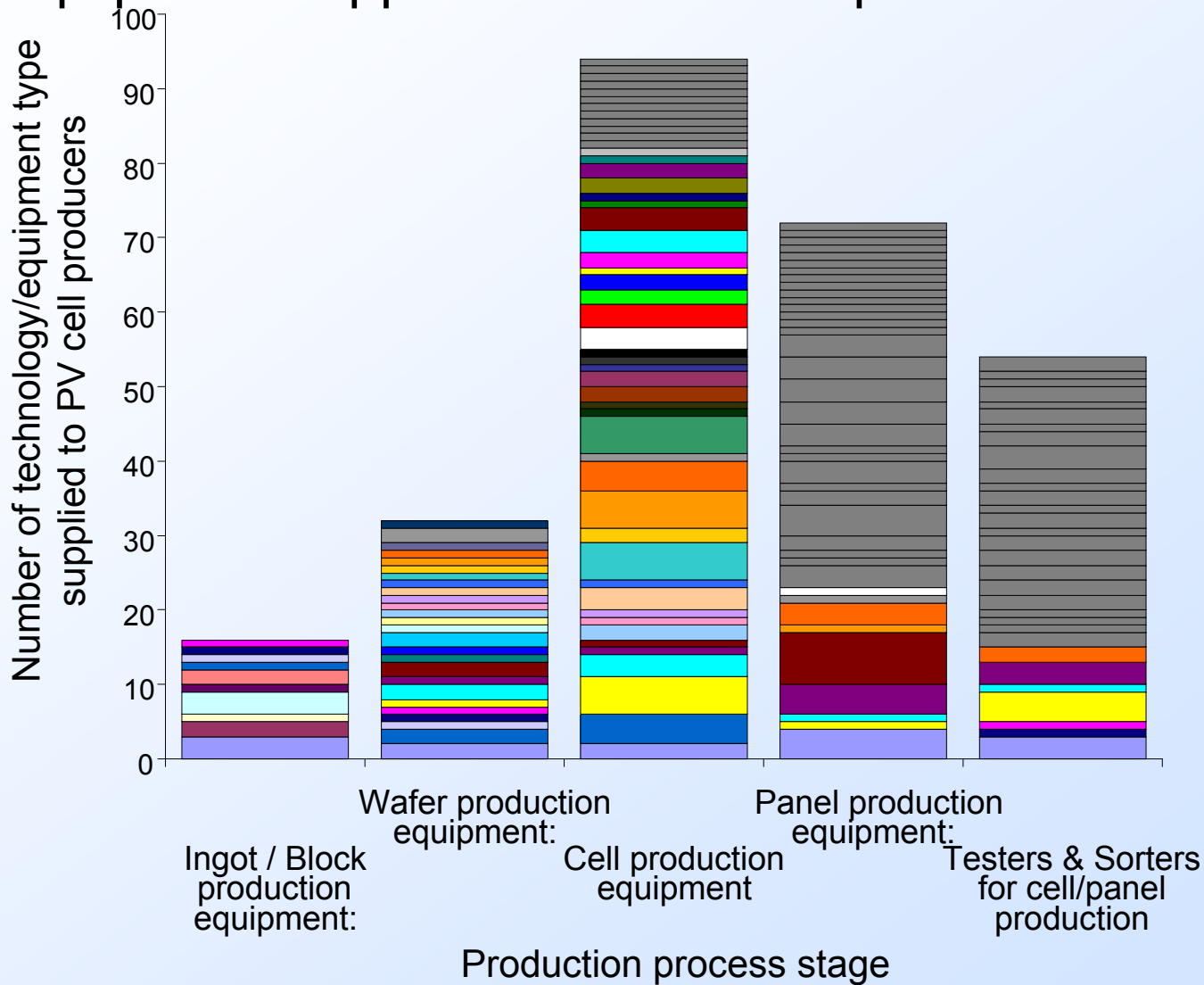
Incentives for innovation from strategic deployment?

The role of the supply chain



Incentives for innovation from strategic deployment?

Most equipment supplied for individual production steps



Incentives for innovation from strategic deployment?

Survey – Who initiated improvements?

		Equipment supplier	Cell producer	Industry network	University/ Research Institute
Equipment supplier	0.50	0.13	0.00	0.19	
Cell producer	0.16	0.76	0.04	0.28	

Survey:

$n_{\text{equip}}=10$

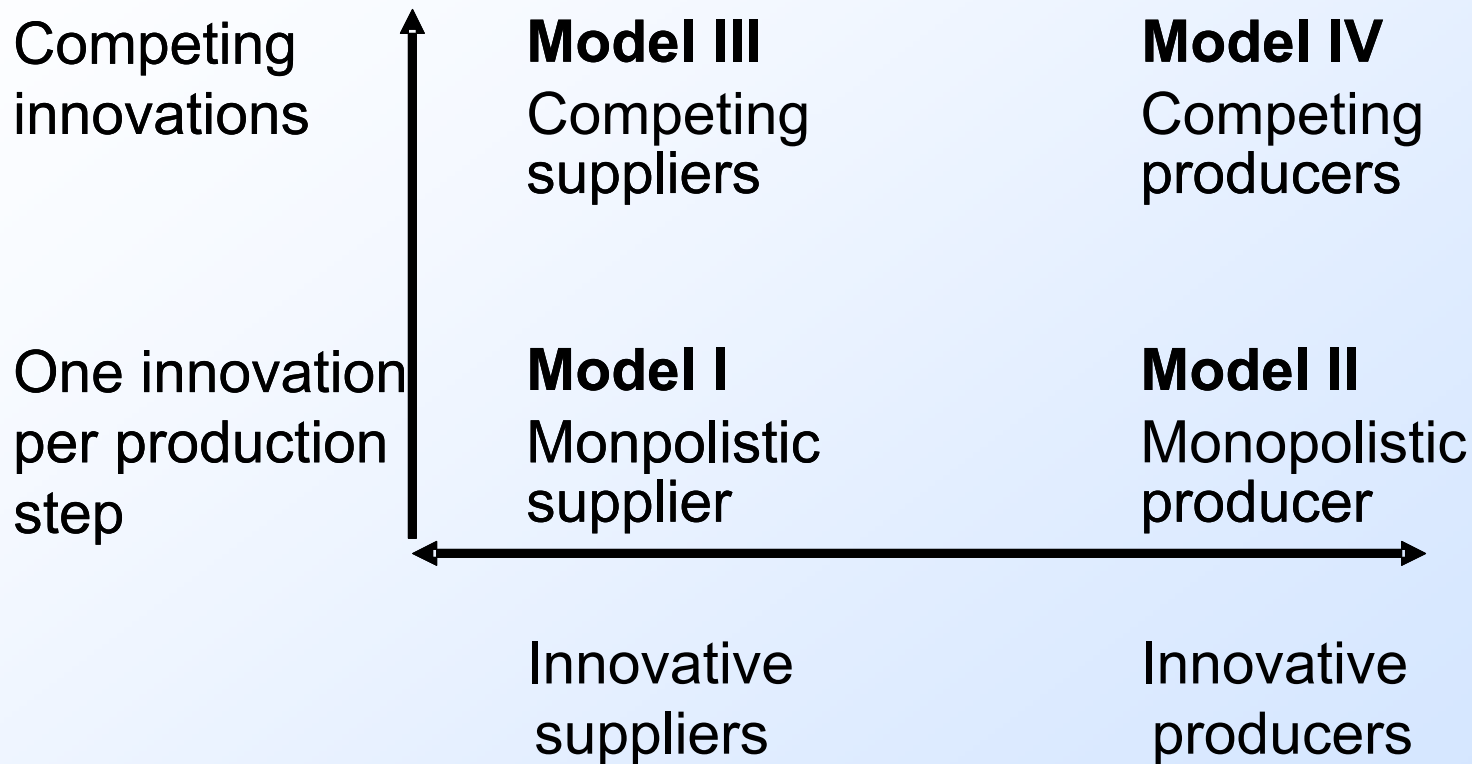
$n_{\text{cell}}=17$

Survey - How did the idea come about?

		Research project	Suggested by equipment supplier	Problem identified in production process	Opportunity identified in production program	Transfer of idea from other industry sector
Equipment supplier	0.82	0.16	0.55	0.09	0.00	
Cell producer	0.84	0.32	0.20	0.04		

Incentives for innovation from strategic deployment?

The four models that we will look at



Incentives for innovation from strategic deployment?

Model results

Competing innovations

One innovation per production step

Model III
Competing suppliers

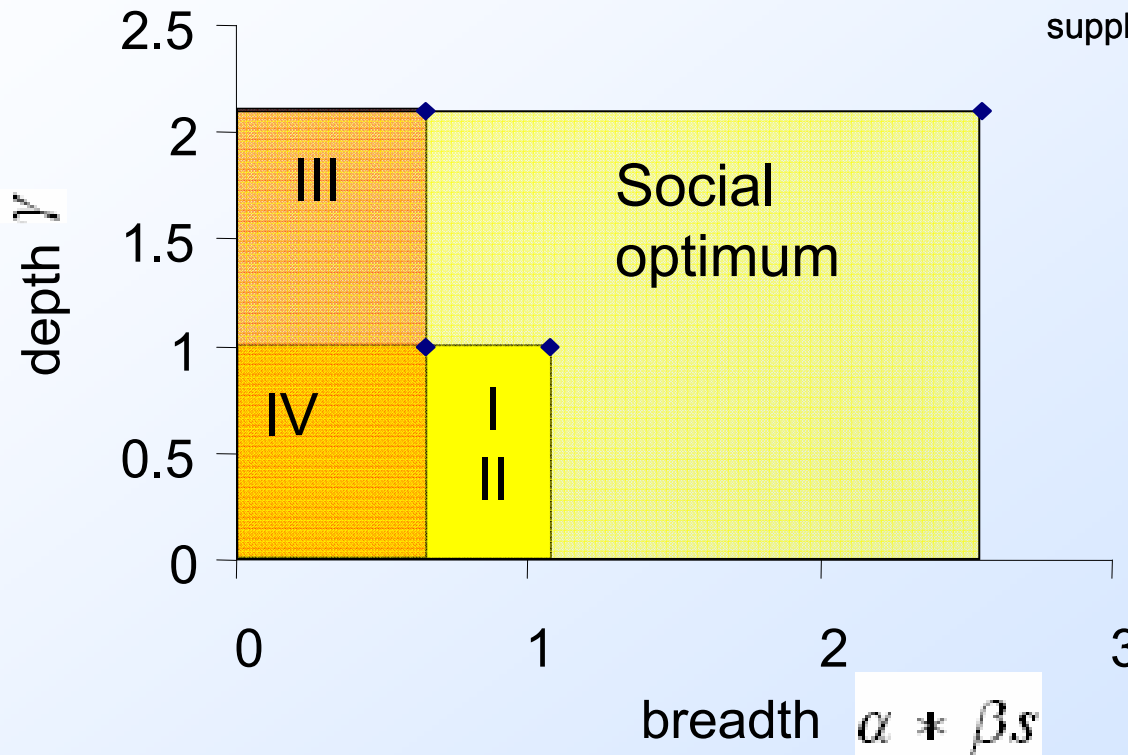
Model IV
Competing producers

Model I
Monopolistic supplier

Model II
Monopolistic producer

Innovative suppliers

Innovative producers



Incentives for innovation from strategic deployment?

Results from PV model (Preferred market structure?)

(1) Trade-off: Breadth versus Depth of innovation

- Depth high if many equipment suppliers innovate for one segment of production line
- Breadth high with monopoly suppliers

(2) Where equipment suppliers own innovation, successful innovation spreads faster

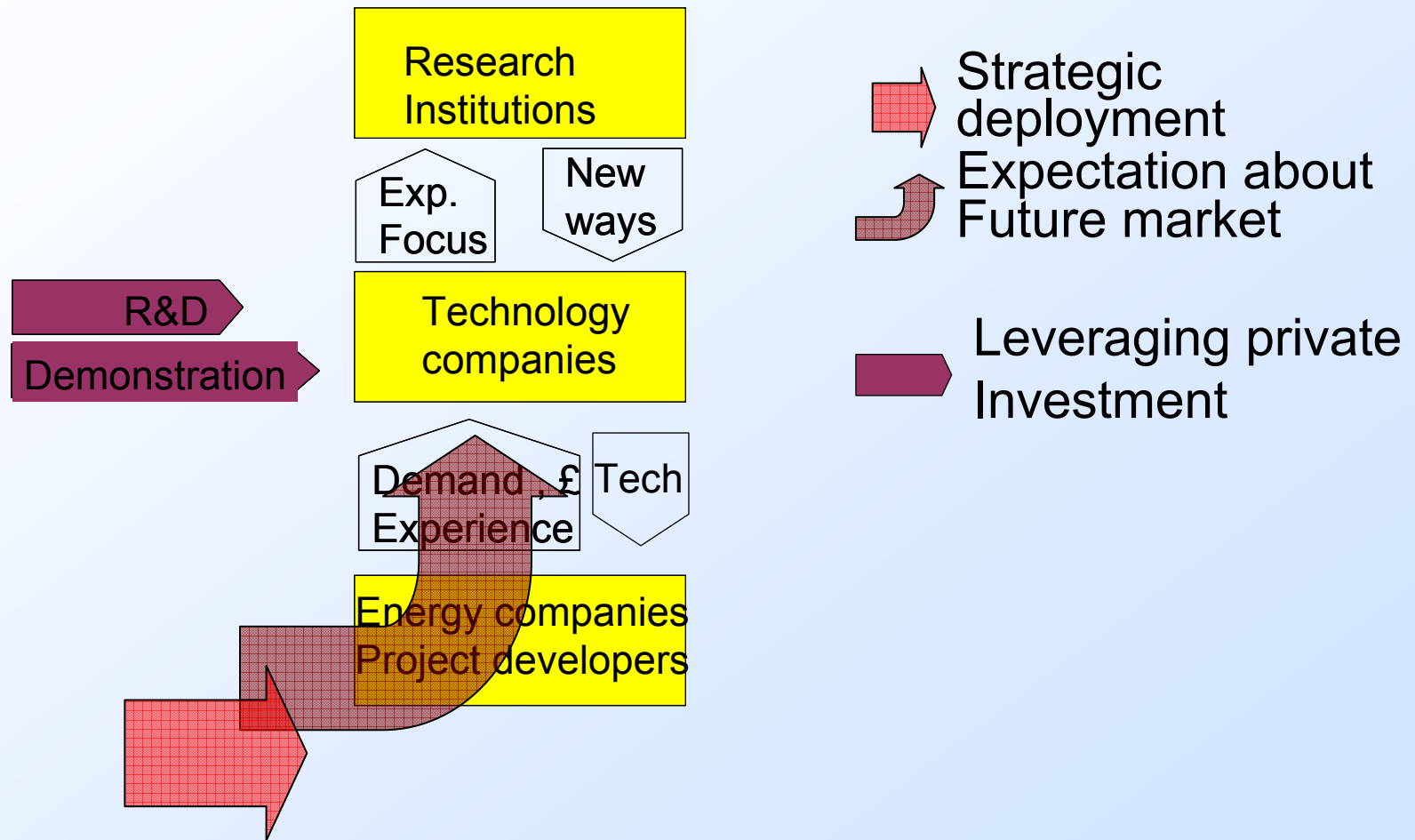
- Also incentive for entry from other industry sectors
- But challenge to coordinate along production line

Results PV model (Insights for support policy)

- (3) Breadth of innovation always below social optimum
 - Provide subsidy for production innovation (Japan)
- (4) Bigger future market increases today's innovation
- (5) Rapid (unexpected) current market growth
 - Creates profits for investment/innovation
 - High current margins are disincentive for experimenting (delays/downtimes)

How strategic deployment could address market needs?

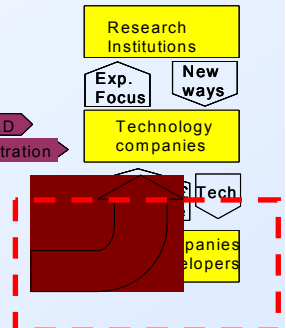
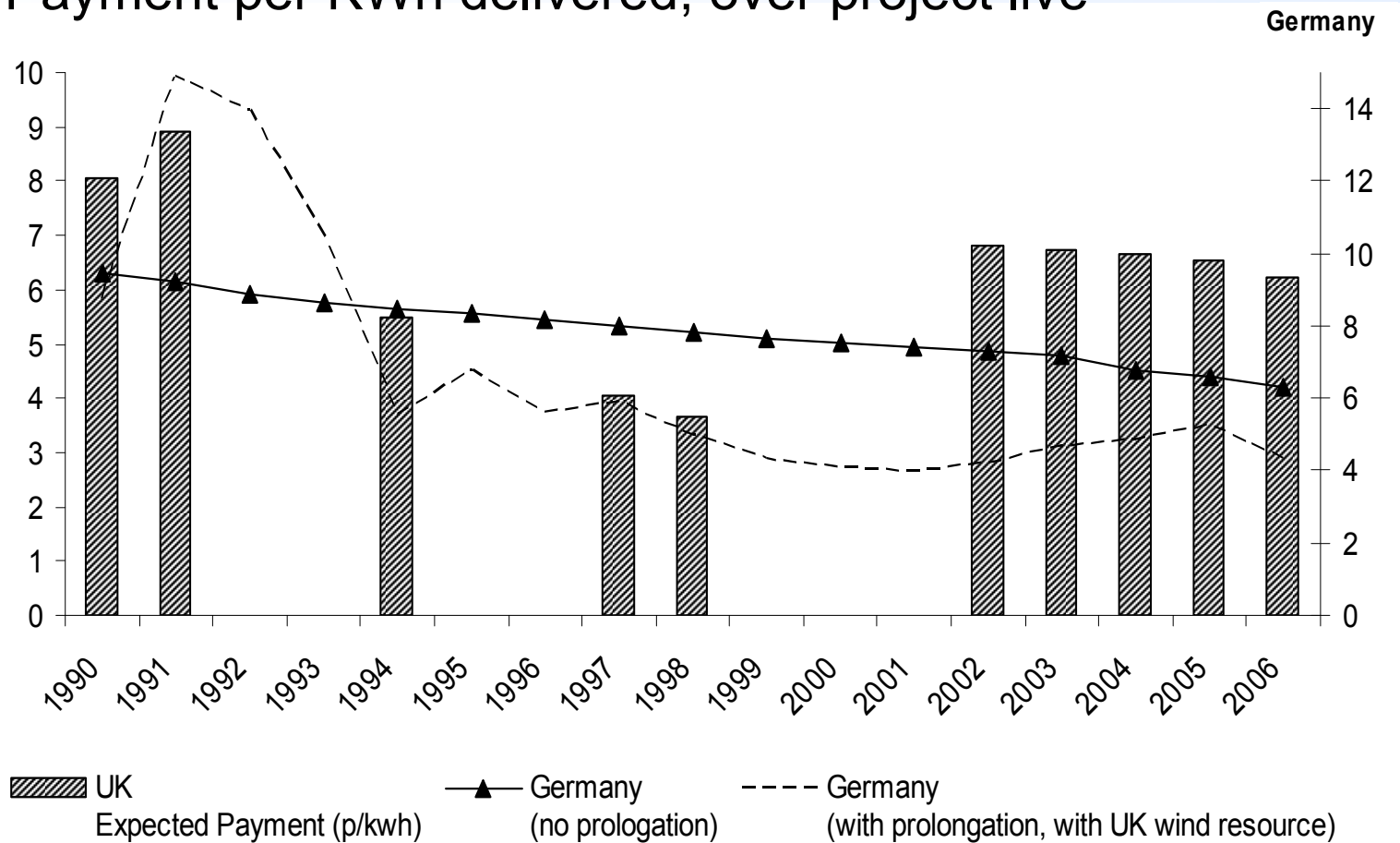
Strategic deployment works via project developers



How to address needs of project developers?

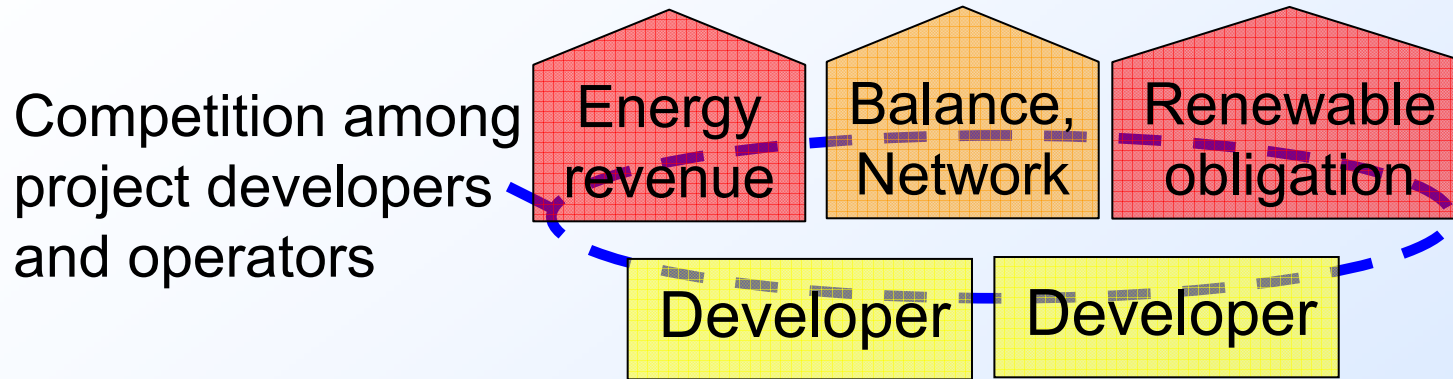
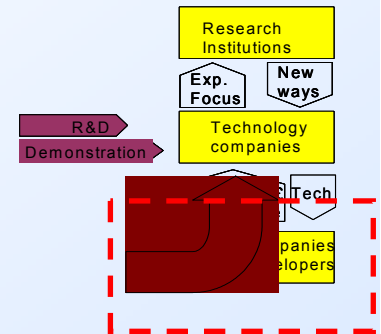
Cost effectiveness of deployment instruments differs

Payment per KWh delivered, over project live



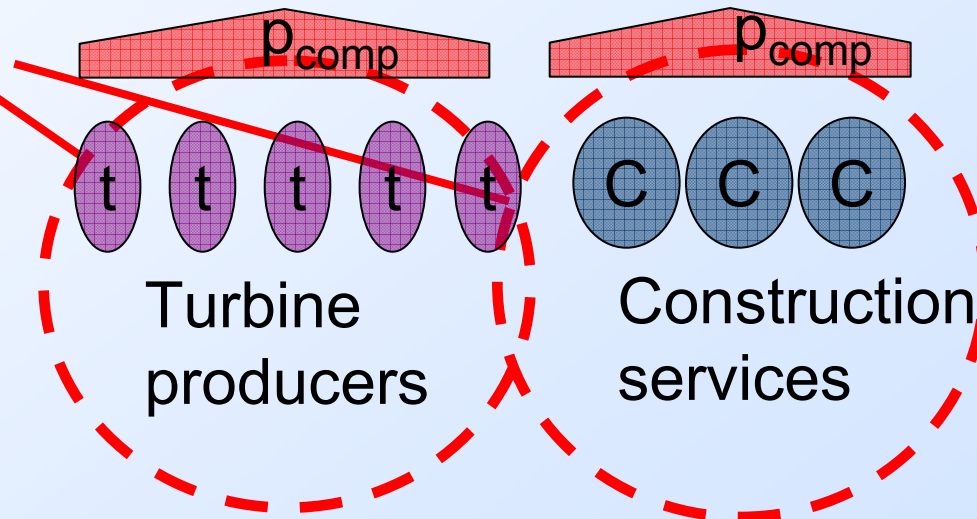
How to address needs of project developers?

ROC proponents might focus on wrong market



20% VA

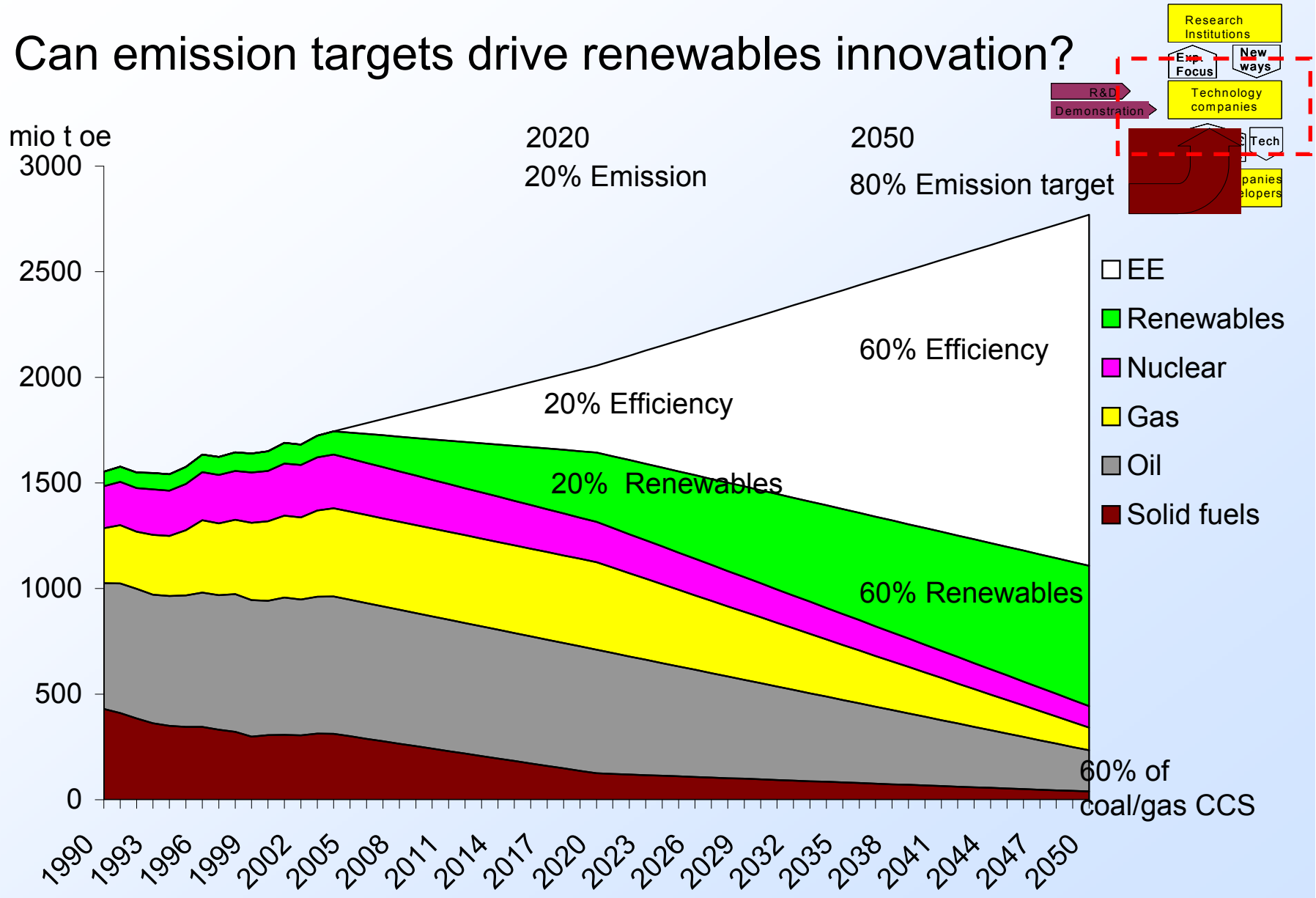
Competition in Markets for input factors



80% Value added (VA)

How to address needs of PV producers and equipment suppliers?

Can emission targets drive renewables innovation?

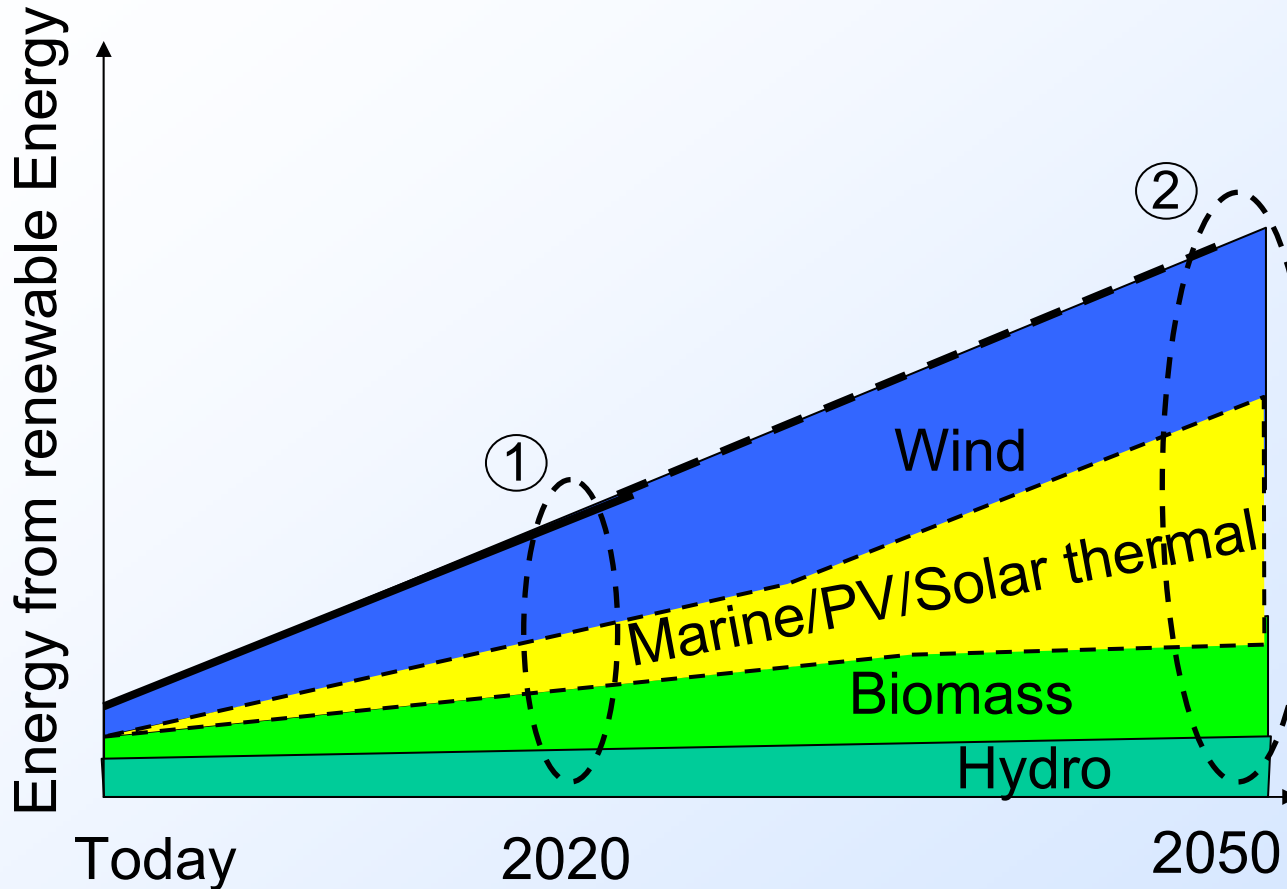


Historic data – Energy and Transport in Figures, 2006, EU Commission, DG energy and transport, CCS fraction 2% in 2020, efficiency 85% in 2020 and 80% in 2050, all emission reduction domestically

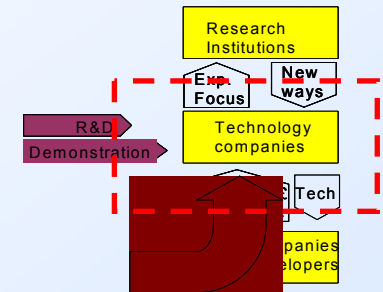
How to address needs of PV producers and equipment suppliers?

Renewable targets more tangible
for banks and technology companies

Illustrative

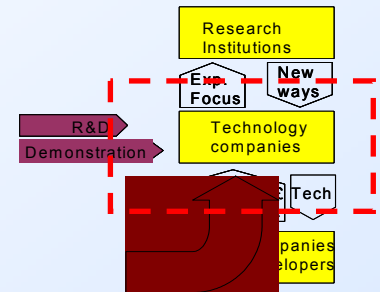


1. 'Early' role for renewables
2. Long-term position of technologies conditional on their performance

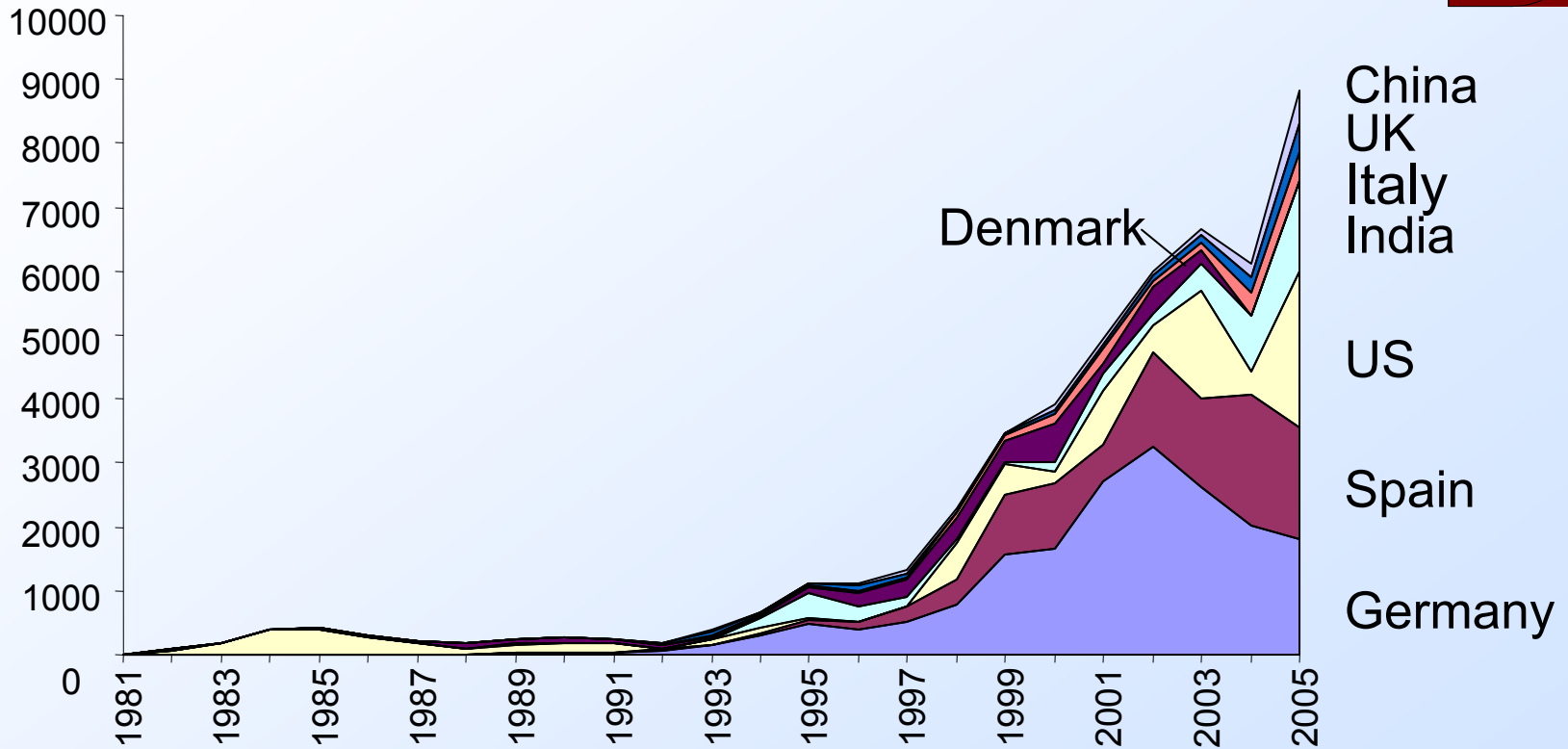


How to address needs of PV producers and equipment suppliers?

International markets make demand more predictable



Installed wind power per year (MW)



Source BTM consult, GWEC

Conclusion

- The challenge for low Carbon - cost and market size
 - Learning by doing & R&D to get costs down
 - Scale up producers capabilities
- Incentives for innovation from strategic deployment?
 - 5 year expectations drive innovation
 - Unexpected demand surge might hamper innovation
 - Key role of manufacturing equipment suppliers
- How strategic deployment could address market needs
 - Facilitate financing for projects (feed in)
 - Allows focus on planning and implementation
 - Basis for large scale participation/policy success
 - Create growth perspective for technology developers
 - Renewables targets
 - International technology markets