Improving the efficiency of research & development in energy research policy by making use of innovation science insights

IEA-Workshop
"Using long term scenarios for R&D priority setting"

Paris

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Overview

1. Challenges & opportunities in energy-related research and technology markets
2. Objectives: develop a method for more efficiency of energy R&D funding
3. Methodological procedure of the EduaR&D project
4. Identify the stage of the energy technology within the technology cycle
5. Describe the major players of the innovation system of the technology
6. Lessons learned and Conclusions

Platzhalter für Dateinamen

Folie 2

Challenges & opportunities in energy-related research and technology development

Major challenges:

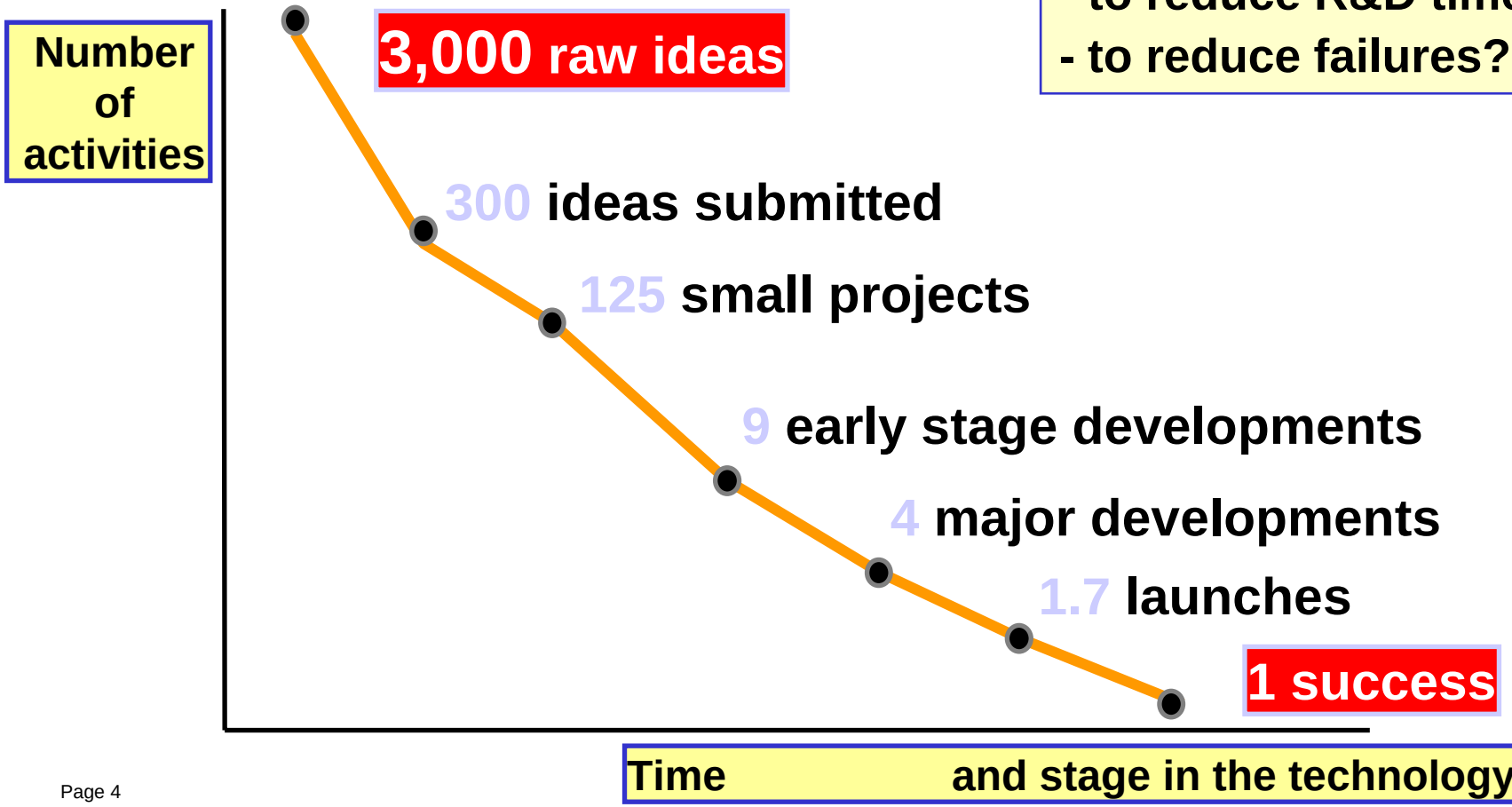
- Climate change
- Depletion mid-point of oil in 10 to 25 years?
  Severe energy price increases? Pressure on natural gas?
- Doubling primary energy demand by 2040?

Future energy systems need more efficiency, more flexibility, faster technical progress

However: Public funds are already constrained, private R&D funds are equally limited.

The Challenge of Energy R&D Policy:

Is it feasible
- to reduce R&D time ?
- to reduce failures?



Source: Stevens and Burley, *Plotting the rocket of radical innovation*, 2003

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Objectives of the EduaR&D project

What **methods** are available to *achieve a **more efficient and effective use of public funds*** for research and innovation?

Is it possible to develop such?

Or is allocation of research funds a process of chaos due to complexity?

- Reduce recognisable risks, increase chances of success,
- Expose lobby groups to a broader discussion based on more information,
- Evaluate R&D topics not only from energy-economic and energy-technology perspectives, but also in their innovation and market diffusion context
- Work in the framework of technical competition, exports of manufacturing industries, division of labour of EU and national research, public/industrial

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Methodological procedure of the EduaR&D project

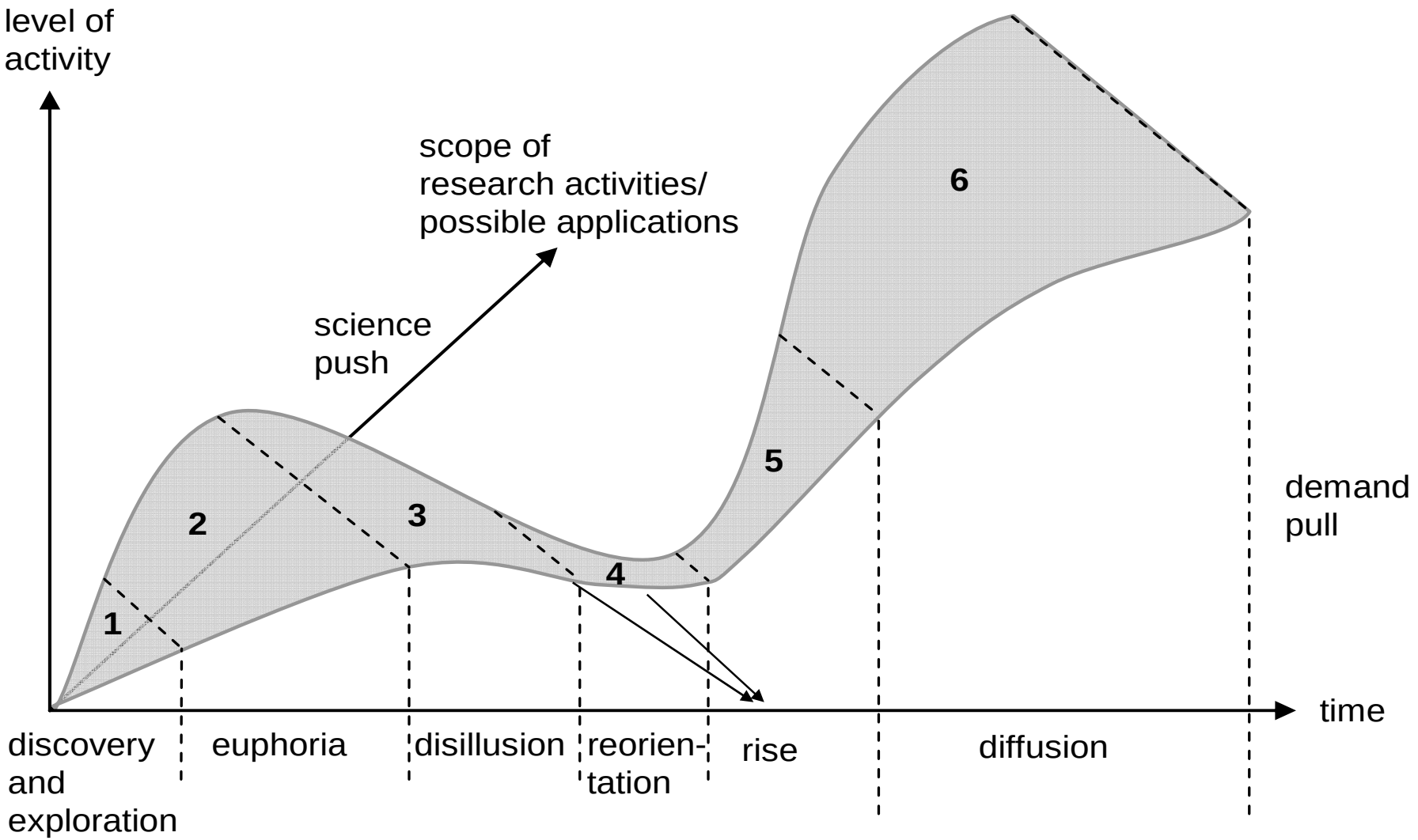
Traditional procedure:

- mainly from an energy-economic viewpoint (often supply-oriented)
- technology-oriented, R&D hardly seen as part of an innovation process
- open R&D programme, assessment of submitted applications based on scientific and project management criteria

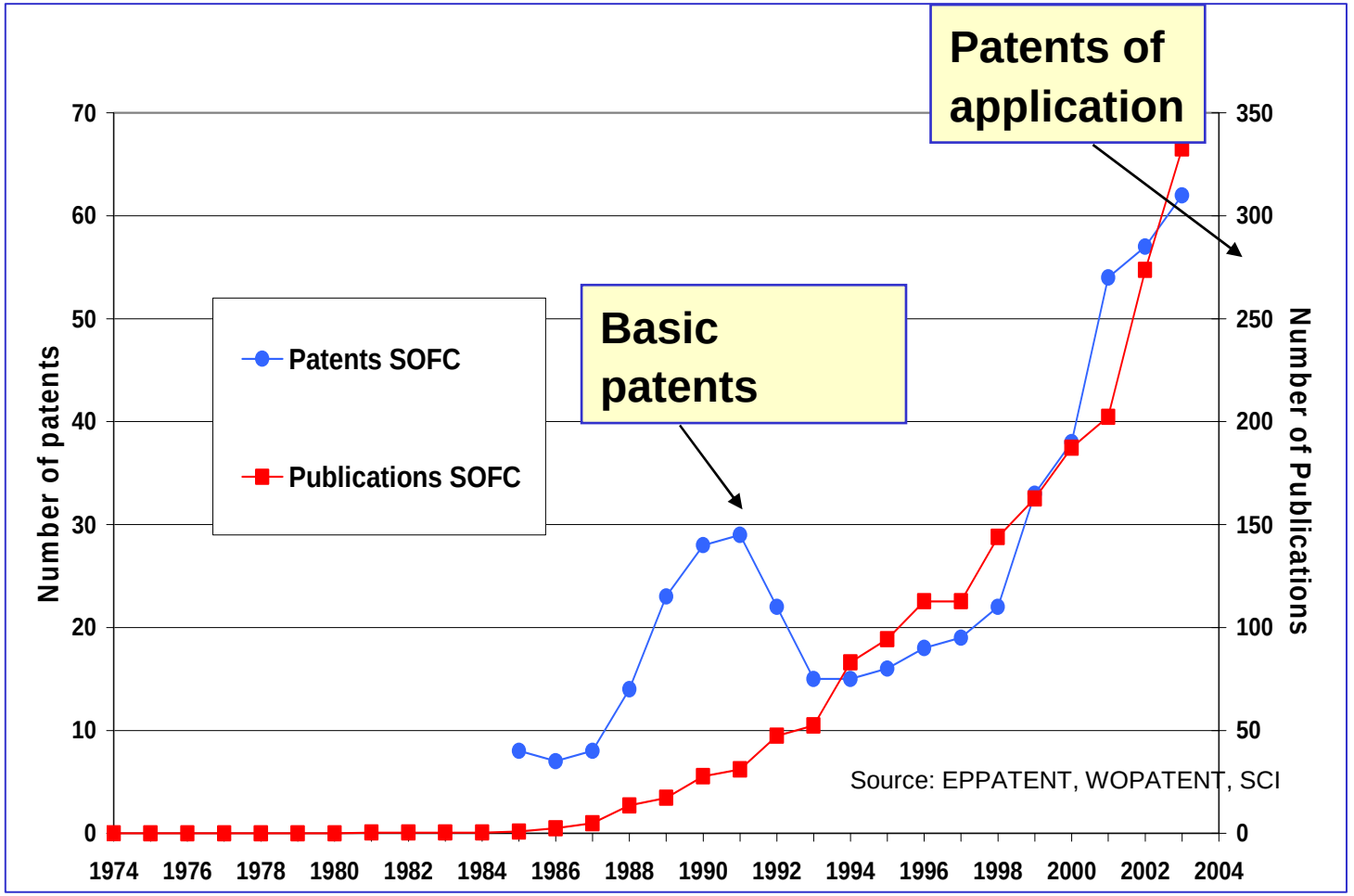
This EduarR&D project: procedure for four selected technology areas

- Future energy-economic significance of the technologies (2020 – 2030)
- Analysis of position in technology cycle (for individual technology elements)
- Analysis of the technology-specific innovation system (for individual elements)
- Get advice and tacit knowledge from experts by interviews
- International workshop to discuss methodology and results in February 2006

Basic Technology Cycle for macro-innovations



Example: Fuel Cells
SOFC patents at the European Pat. Office and publications of SCI



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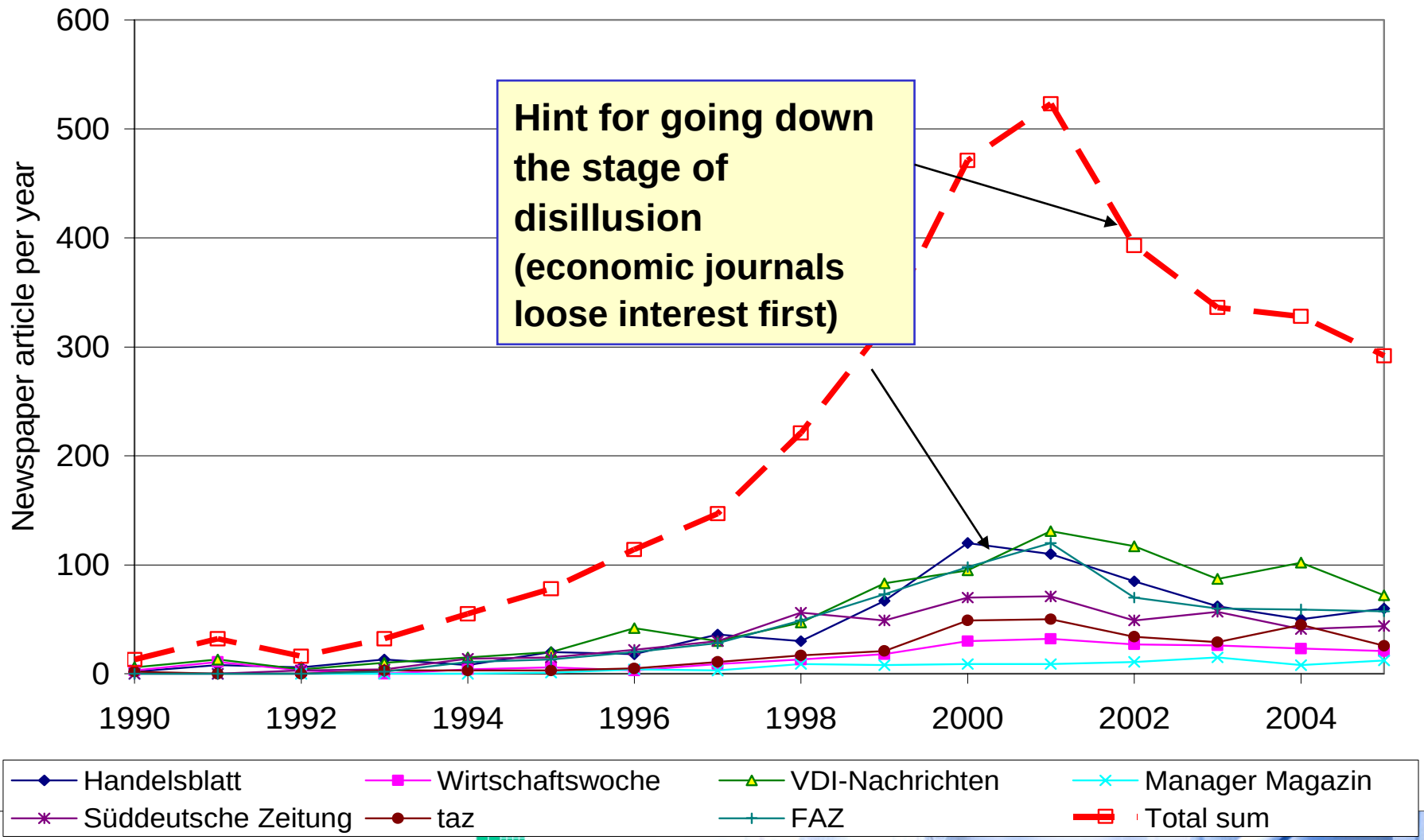
Fuel cell citations in German popular literature



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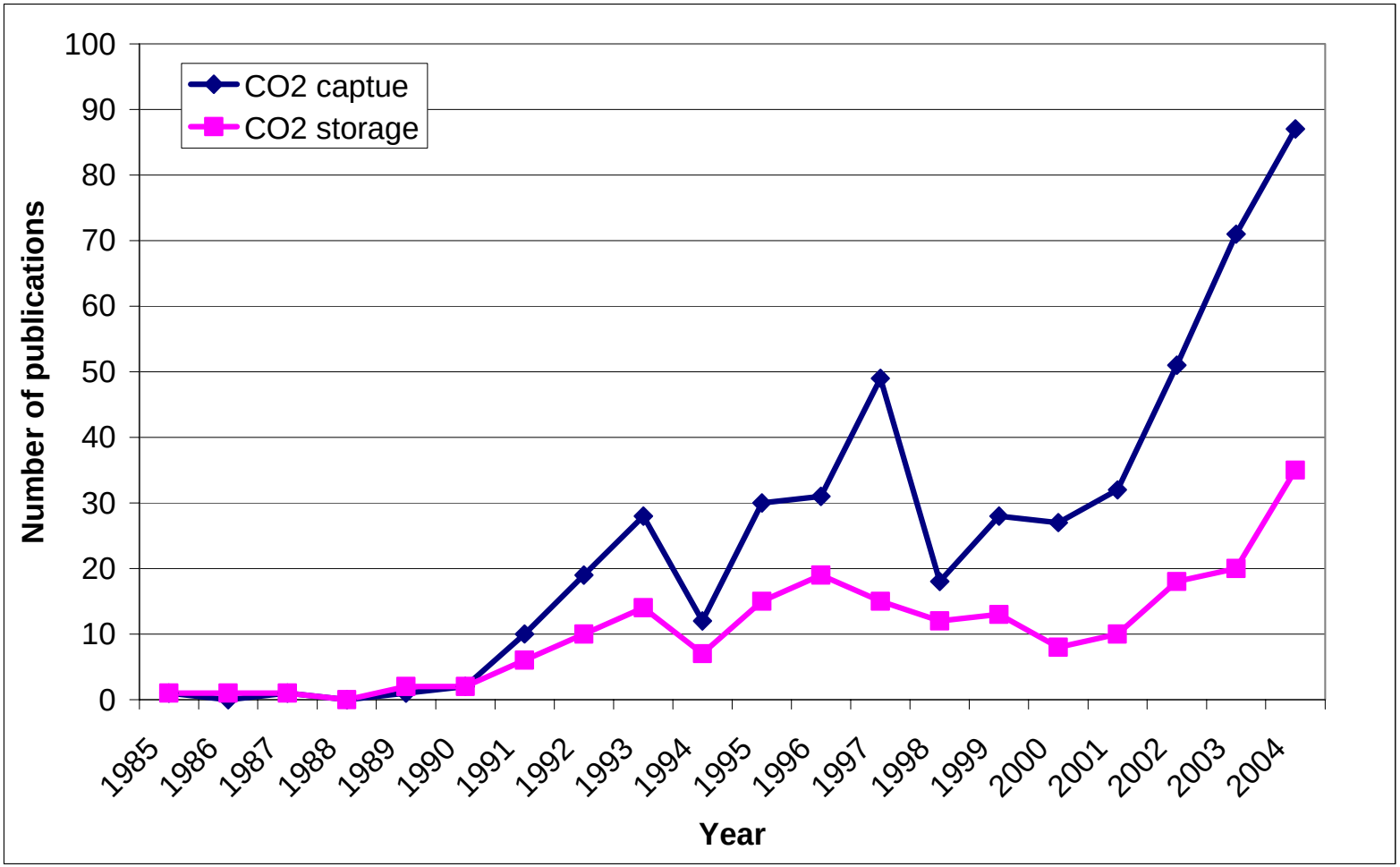
Example CO_2 Capture and Storage
Trends in scientific journals for CO_2 capture and CO_2 storage



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The German Innovation System for CCS-Technologies

Oil & Gas Companies

Framework Conditions

Emissions Tradel

Acceptance Storage

Utilities: Demand for Power Plants

RWE | E.ON | Vatten-fall | EnBW | Municipal utilities

Industry

Siemens

Alstom

Component Producer (Babcock-Hitachi, Lurgi, Uhde, Linde, BASF, …)

COORETEC

Research Results

Research System

TUs

DLR

FhG ISI

BGR, GFZ

Policy System

BMWi, BMBF (BMU)

EU (DG TREN, …)

NGOs (Greenpeace, …)

Infrastructure

Standards and Norms | Laws | Finance System

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The CCS Innovation System in Germany (I)

- **Industry: technology producers**
  - World market for power generation technologies
  - Two large suppliers in Germany with domestic R&D and production:
  - To date: still co-operation for the development of CCS technologies as mainly fundamental problems are tackled
  - Openness/Uncertainty: technology producers tend to follow all technological routes
- **Industry: utilities**
  - Very low number of "customers" for CCS technologies
  - Utilities used to be a long time very reluctant towards CCS
  - Now: Pilot plant is built and demo plants are in planning phase

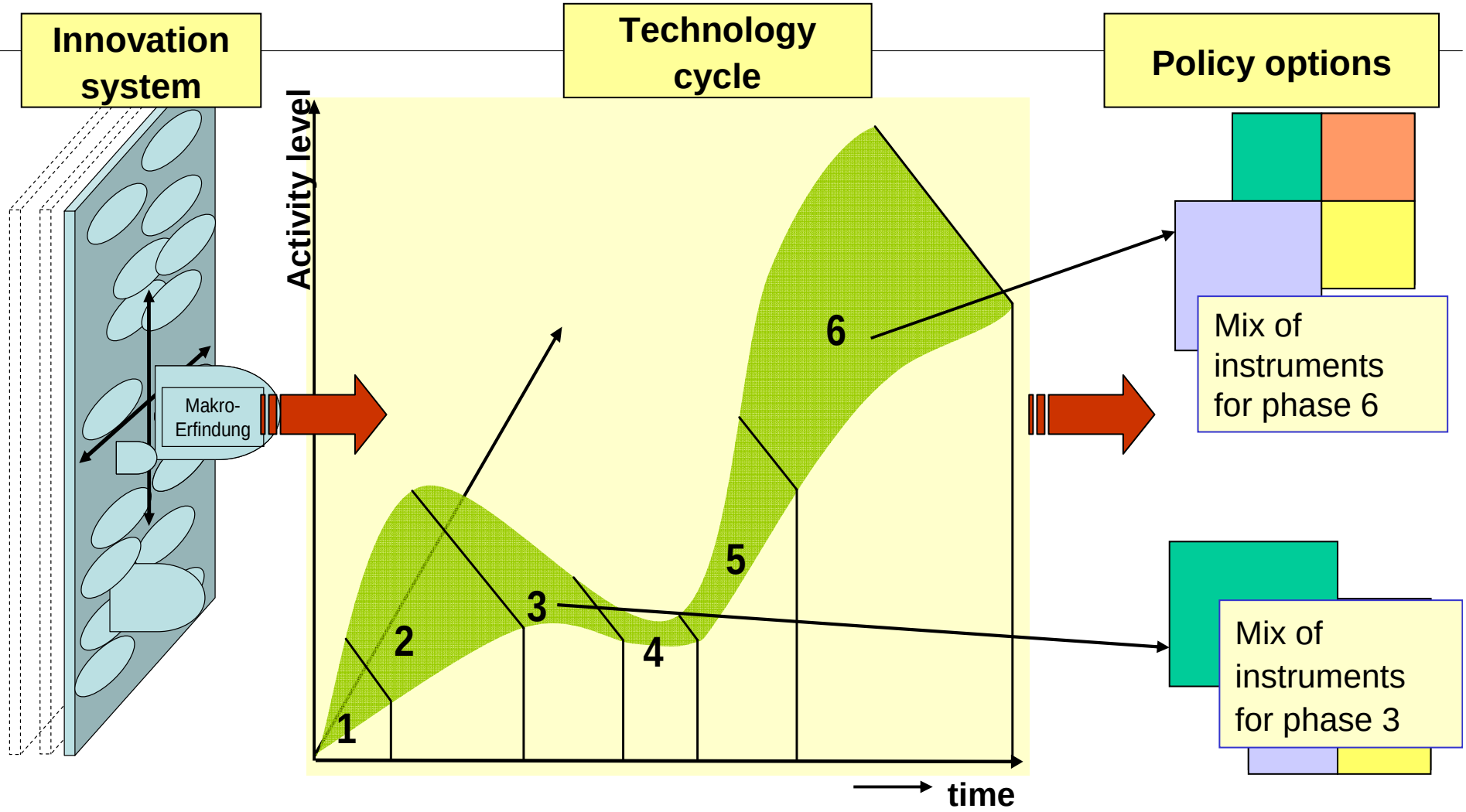
The CCS Innovation System in Germany (II)

- **Public Research**
  - High share of public funding and dependency thereon
  - Low level of international co-operation and low interest to seek higher degree of international co-operation
  - Institutes started to work on CCS with a delay compared to other industrialised countries
- **Intermediaries, financial, educational institutions**
  - Need for intermediaries low: large players
  - Institutional adaptations started to train engineers

Lessons learned and conclusions

- Most of the new technologies emerging from R&D do have their traditional technological competitors – often no clear analysis of the competing technology
- New technologies often more costly than their traditional competitors due to almost individual manufacturing (lack of mass production, lacking learning effects). Cost reduction potential often not analysed (or too late)

- The analysis of the technology cycle identifies technical bottlenecks and avoids policy action not suited for the stage of the technology cycle
- The innovation system analysis identifies most knowledgeable players of the various components of the new energy technology and upcoming bottlenecks of the market diffusion phase



Innovation system, technology cycle, and policy options

Conclusions

- Analysis goes beyond the technological bottlenecks;
  it identifies cost and systemic bottlenecks (looking ahead to diffusion)
  - Opens floor for a wider set of technology options (including technical competitors)
  - Focuses R&D funds and policy measures to the relevant bottlenecks
- Structuring the discourse of all stakeholders involved by referring to the stage in the technology cycle
- Approach seems to be flexible enough to match the requirements of almost any new energy-related technology
- Approach demands a major analytical and interdisciplinary effort
- Approach has good chances to improve efficiency of energy-related R&D

Thank you for listening!

**The report on this project will be published as a book,
tell me if you want to be informed when it is printed**

Thanks again - also on behalf of Eberhard Jochem.

Developing an assessment framework to improve the efficiency of R&D and the market diffusion of energy technologies – EduaR&D

**Report on a research project to the
Ministry of Economics and Technology
Berlin**

(To be published by

Springer this year)