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# ***Science for Sustainability - Experiences***

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# Megatrends require sustainability research + innovations

- Environmental problems are increasingly global challenges
  - Effect is global
  - Driving forces are becoming increasingly global
- In addition to traditional environmental technologies, systems innovations are necessary
- Sustainability technologies are fast growing market, system innovations offer economic opportunity
  
- **Research has to provide information on**
  - causes, effects, and drivers of problems
  - New technological, organizational and institutional solutions
  - Socioeconomic embedding of solutions, functioning of innovation systems of sustainability technologies
  - Impact assessment for sustainability strategies and technologies
  - State of knowledge and innovation dynamics**=> experiences with research policy**

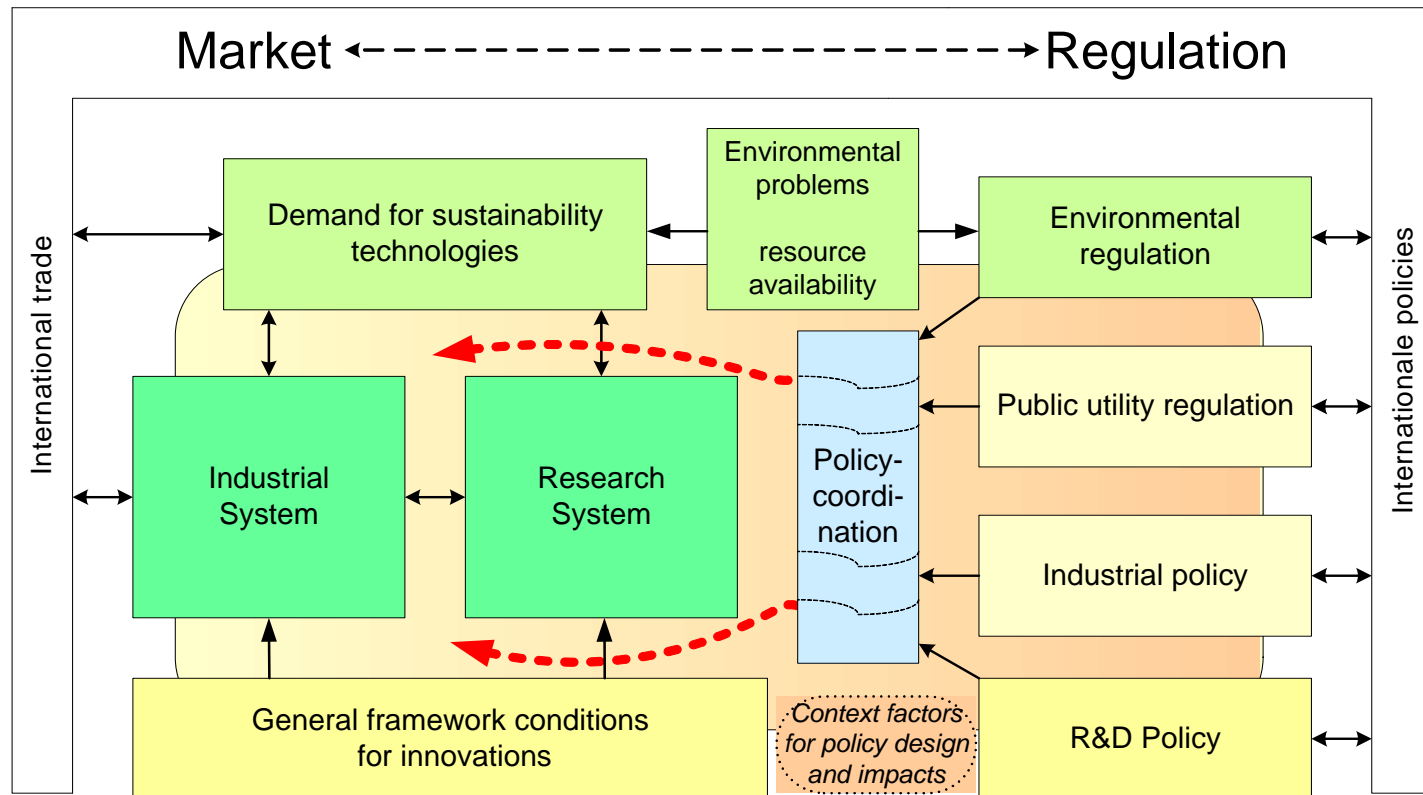
Page 2



# Characteristics of successful sustainability research policy

- Reflect the systemic nature of sustainability innovations
- Numerous feedbacks
- Importance of government regulation
- Program design to enhance communication between different actors
- Policy coordination
- Account for global nature of problem

## System of sustainability innovation (SSI)



# Measurement of experience with innovations indicators

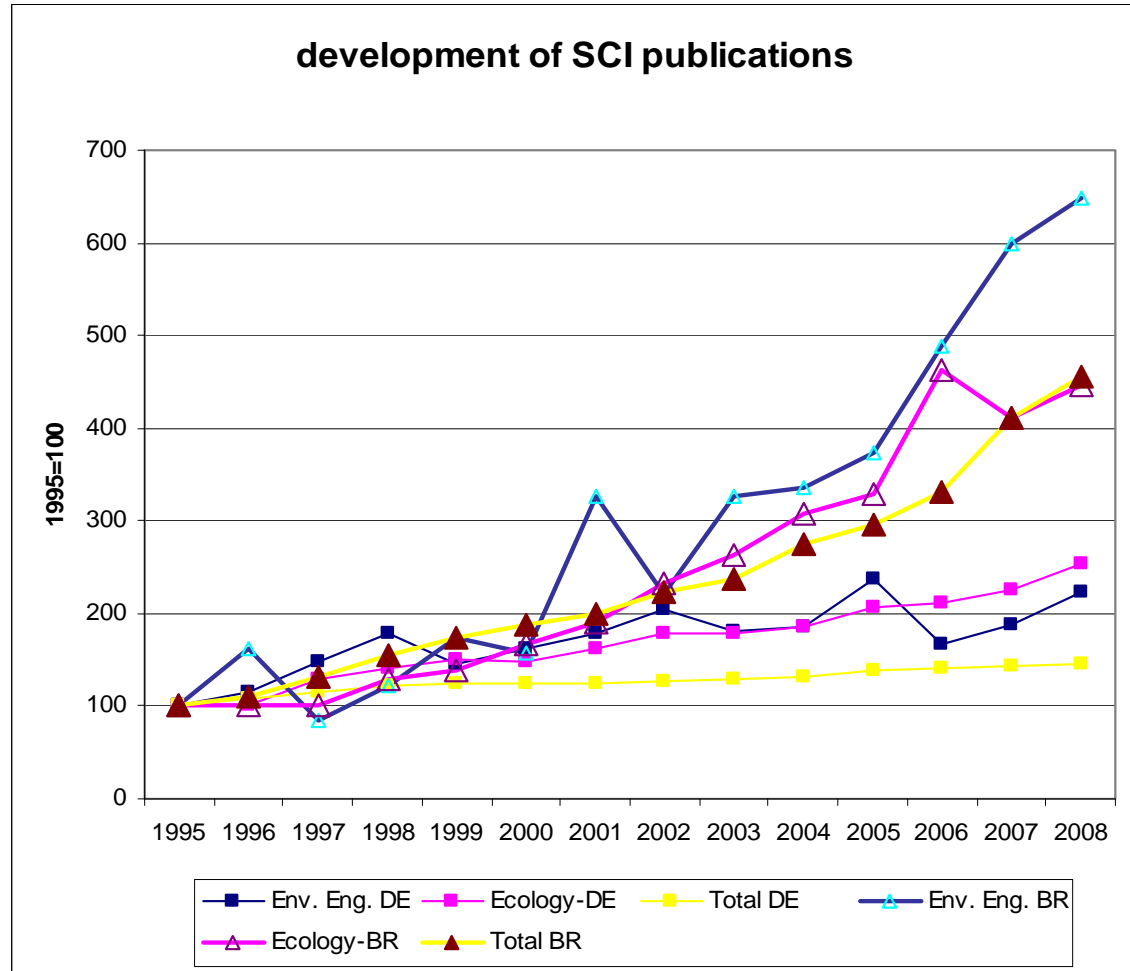
Feedback loops between different phases of innovation process lead to different **innovation indicators**:

- Input indicators, e.g. R&D budgets, **programs**
- Intermediate indicators, e.g. **publications**
- **Patents**
- Output indicators, e.g. production, **exports**



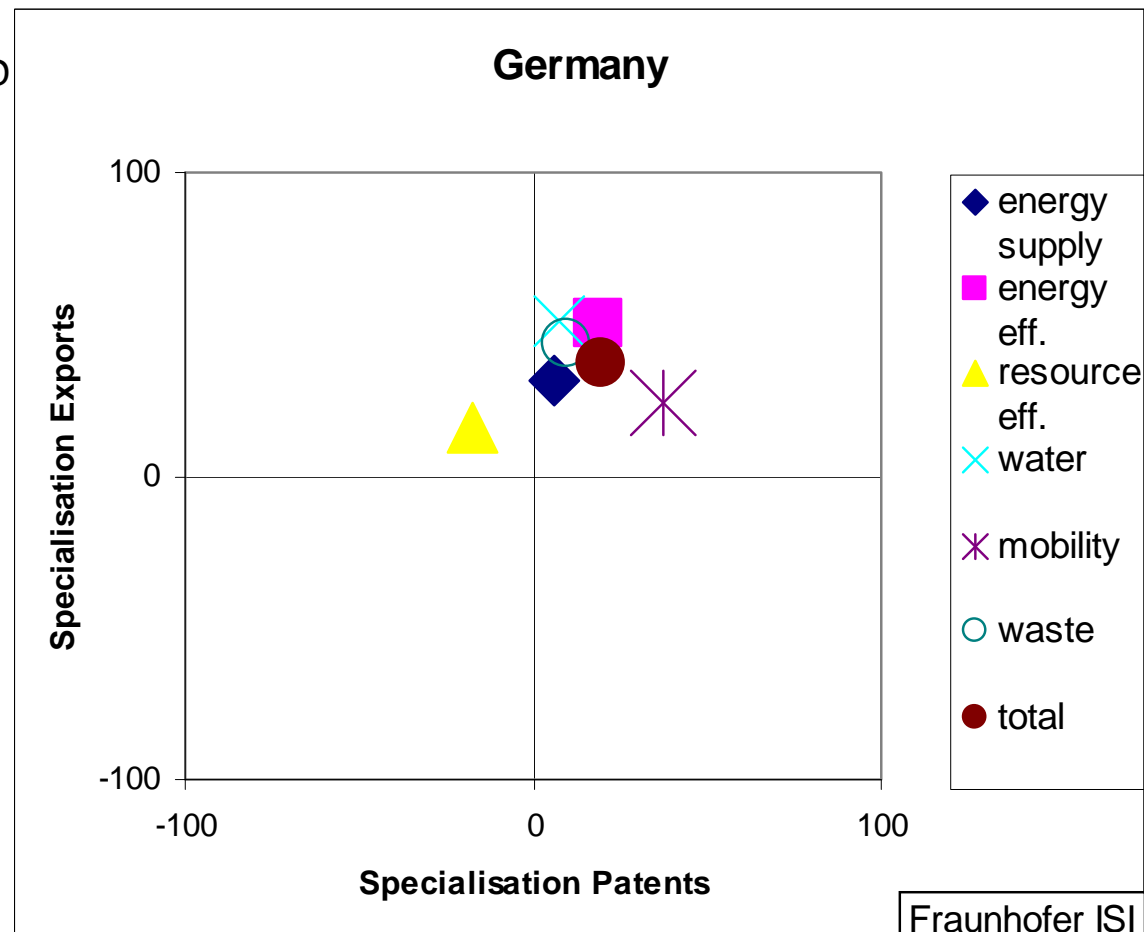
# Experience with sustainability research: Publication analysis

- Analysed fields in publication analysis: Ecology, Environ. Engineering, Social Science Sustainability
- Publication indicators
  - How is the dynamic of knowledge increase in different fields => dynamics indices
  - How important are the fields within the countries => specialisation indicator
- Success: high publication dynamics in Brazil and Germany
- Challenge: Specialisation within countries below average
- ⇒ Increase international focus of natural and engin. community
- ⇒ Increase social science perspective of sustainability



# Experiences with Sustainability Technologies - Germany

- Framework conditions
  - Expenditures on R&D close to OECD average
  - Differentiated research system: universities, non-university research institutions, enterprises
- Research Programs
  - Specific research programs for sustainability
  - research programmes with links to sustainability fields
  - Participation at EU Research Programs
  - Need to integrate demand pull and supply push in research, e.g. common master plan on environmental technologies
- Output of Innovation System
  - Germany among world leaders in sustainability technologies
  - Specialisation in many fields of sustainability technologies

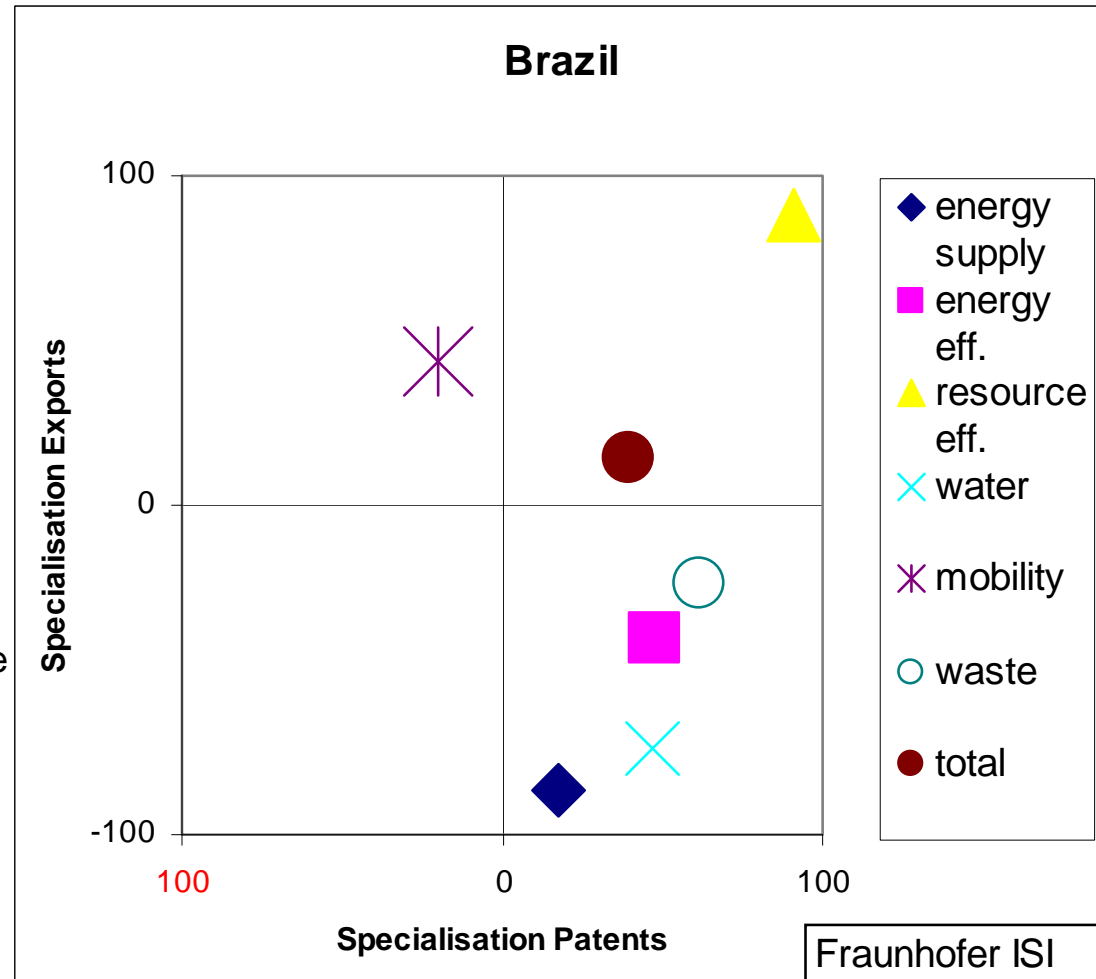


Page 6



# Experiences with Sustainability Technologies - Brazil

- Framework conditions
  - economic growth
  - FDI inflows in the past
  - Lack of engineers
  - Research priorities in agriculture, life sciences, medical/health
- Research Programs
  - research programmes with links to energy, buildings, and transport
  - Sectoral funds, e.g. for water, transport
- Specialisation profile
  - Above average build up of knowledge
  - Dependency on imported technologies in energy supply and water
  - Very strong in renewable material
  - High exports, lower knowledge base in transport



# Conclusions

- International sustainability research cornerstone of sustainability strategies
- Successful Research Policy
  - Reflects the systemic nature of sustainability innovations
  - Includes the social science side of conditions for innovation and their diffusion
  - Targets the different actors and sustainability fields
- Experiences
  - Publications: substantial increase in Brazil and Germany, but still a challenge to increase international focus
  - Brazil: specialization on some sustainability technologies, e.g. biomass related
  - Germany: Specialization in many fields of sustainability technologies
- Conclusions for cooperation
  - strategic and systemic positioning necessary
    - => look for complementarities, combine strengths
    - => priority setting must proceed on disaggregated level
  - Also provide for comparative research on the conditions and dynamics of competence building for sustainability



# The German Research System

Research system must link basic research with application

Universities

Non-University institutions  
basic and applied research

Industry

Max  
Planck

Helm-  
holtz

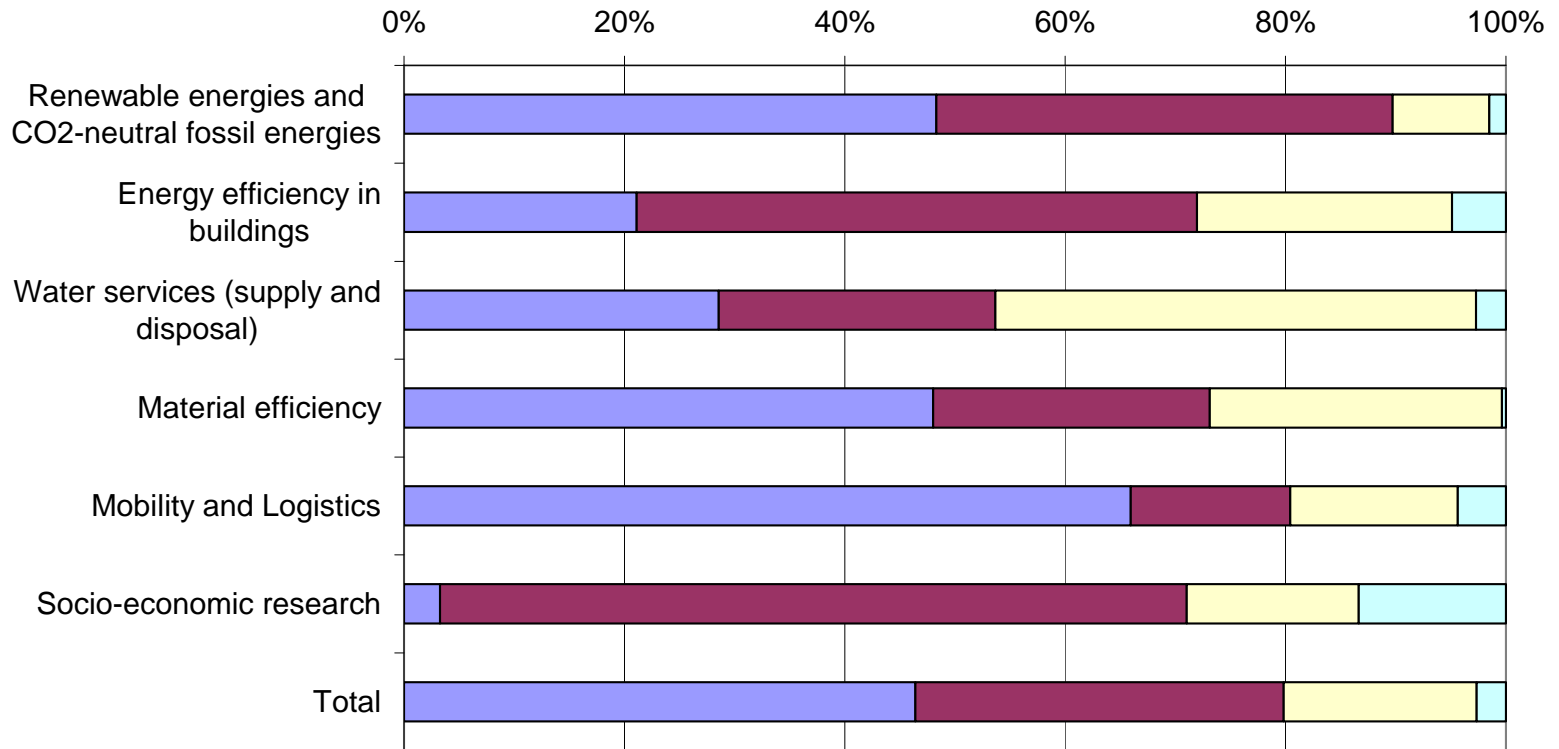
Leib-  
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# Research programs in Germany

sustainability research very diversified (also outside universities)



Source: ISI analysis of BMBF Foekat

Page 10

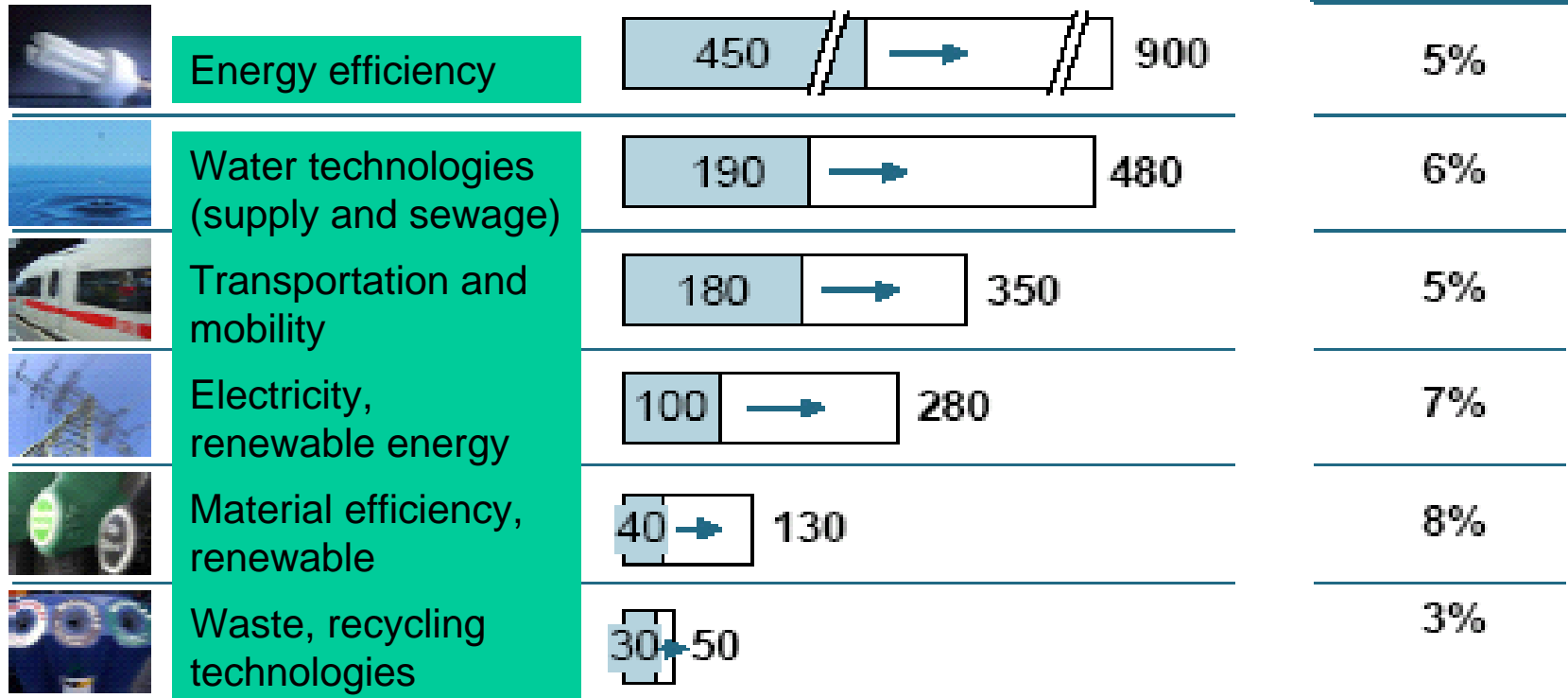
■ Industry ■ Non-university research ■ Universities ■ Others



# Sustainability technologies: fast growing technology market

Figures in billion €/a!!!

CAGR<sup>1)</sup>  
2005-2020p



1) CAGR = Cumulated average growth rate

 2005

Source: Roland Berger 2007

