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The Role of Innovation in Green Growth

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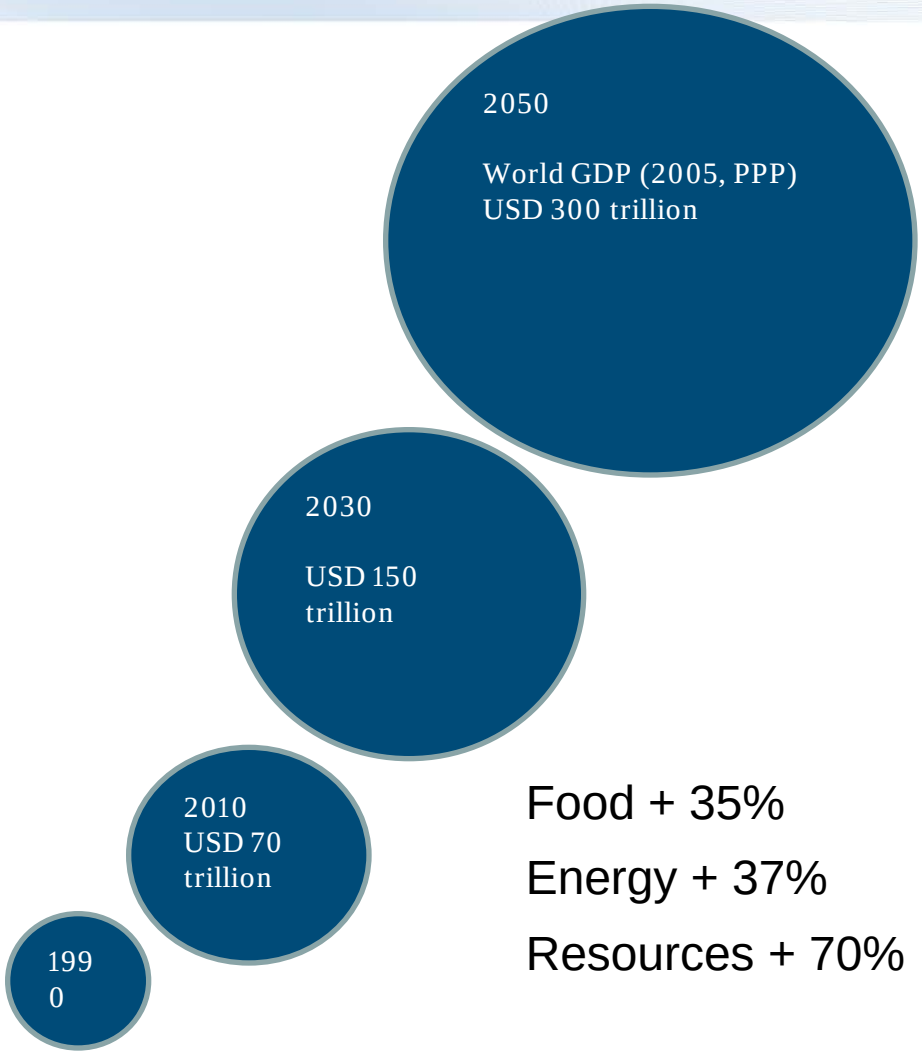
The need for green

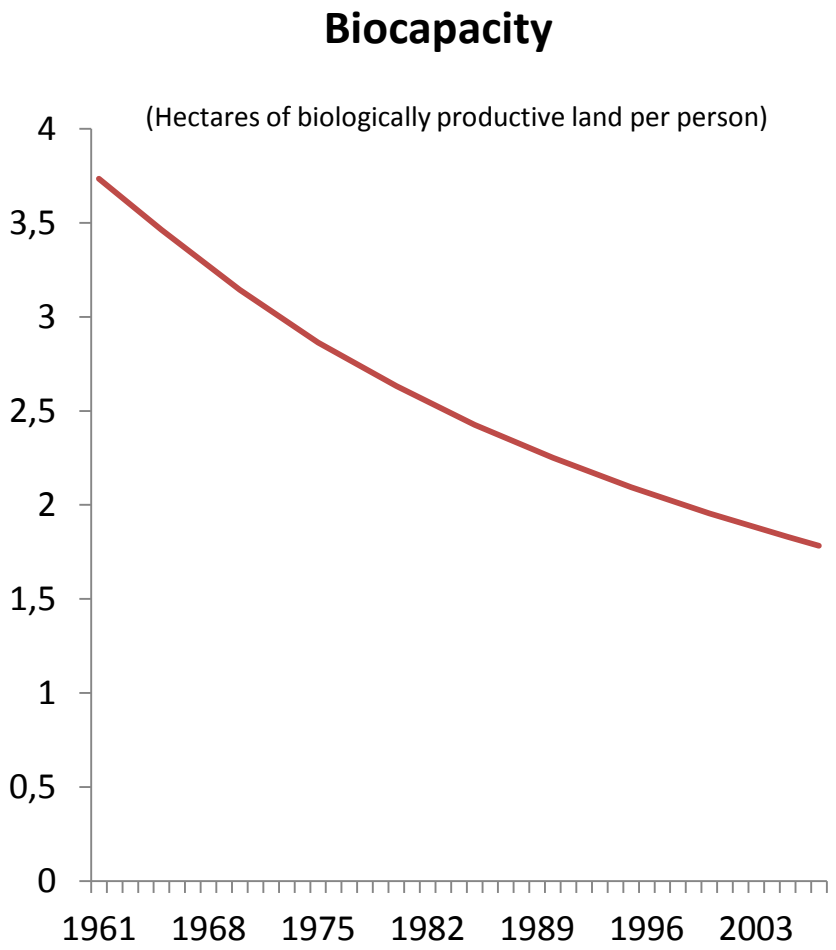


Food + 35%

Energy + 37%

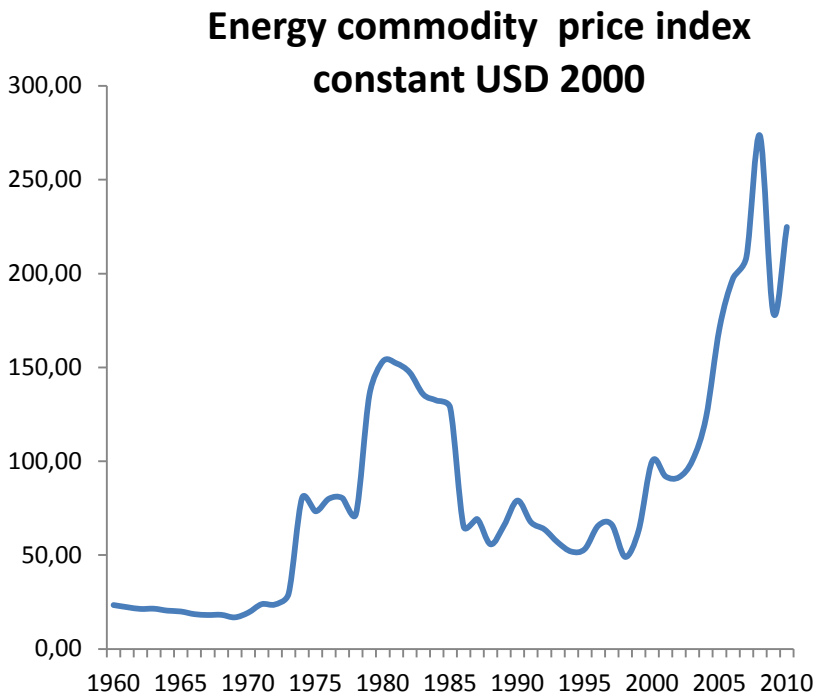
Resources + 70%

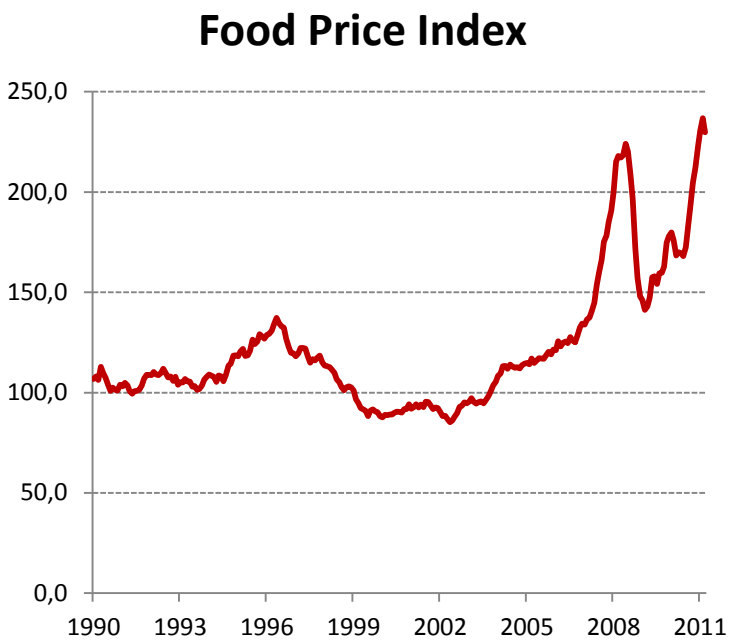
Source: OECD



Source: Global Footprint Network

Risks in not going green: bottlenecks





And also:

- Pressures on natural capital
- Biodiversity loss
- Water scarcity
- Systemic risks (e.g. climate change)
- Pollution and human health

OECD's Green Growth framework

Enabling conditions

- Balanced tax structures
- R&D and innovation policy
- Competition
- Infrastructure investment
- Openness to trade and FDI

Major environmental challenges

- Water scarcity
- Climate change
- Health impacts of pollution
- Biodiversity loss

Key policies

- Pricing of pollution and resource use
- Subsidy reform
- Regulatory and policy predictability
- Support to basic research and emerging technologies
- Governance of natural assets

Promoting the transition

- Skills and labour market adjustment
- Distributional and competitiveness concerns
- Science and technology cooperation
- Development assistance
- Management of global public goods

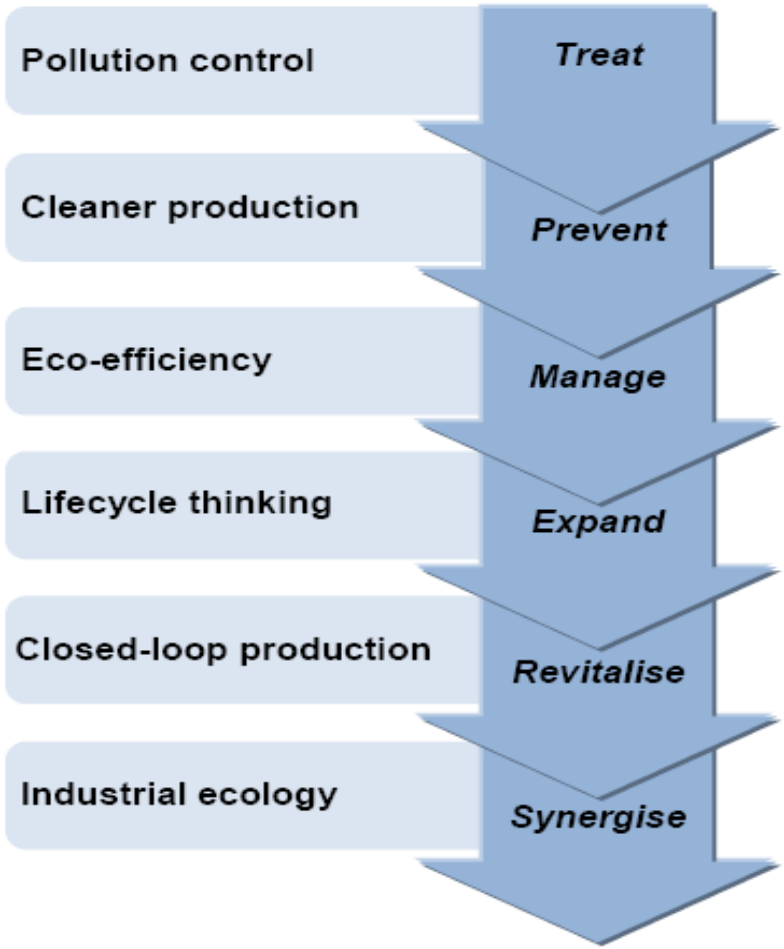
Measurement

- Productivity of resource use
- Physical evolution of the natural asset base
- Environmental quality of life
- Opportunities arising from environmental considerations
- Evolution of policy and social responses
- Promoting efforts consistent with international standards

Source: OECD, Towards Green Growth

Challenges are so big that we can't afford expensive solutions – we are up against time and inertia so need (lots of) innovation

Green innovation is much more than technological change!



Implementation of non-essential technologies
End-of-pipe solutions

Modify products and production methods
Process optimisation; Lower resource input & output
Substitution of materials: non-toxic and renewable

Systematic environmental management
Environmental strategies and monitoring
Environmental Management Systems

Extending environmental responsibility
Green supply chain management
Corporate social responsibility

Restructuring of production methods
Minimising or eliminating virgin materials

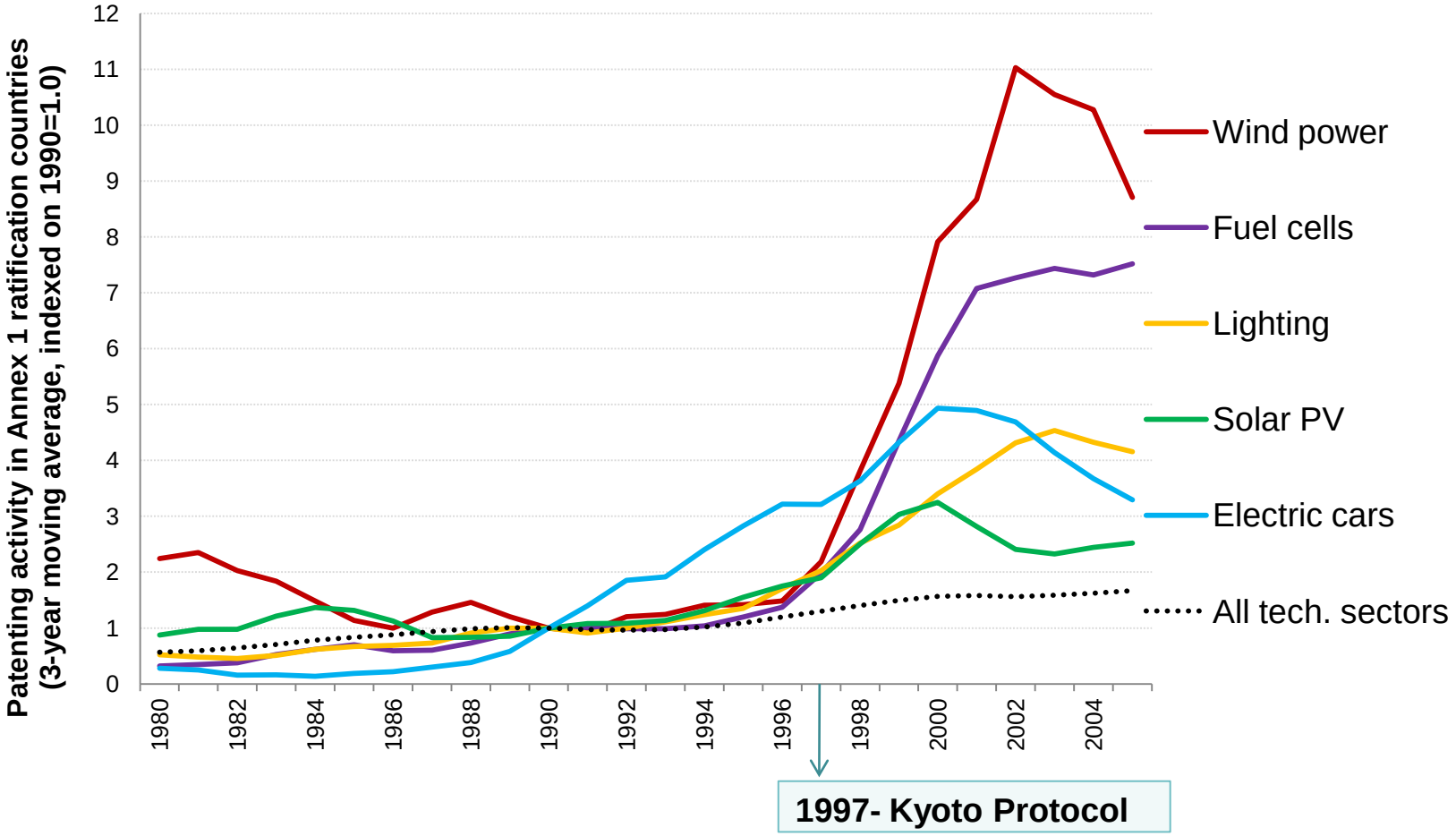
Integrate systems of production
Environmental partnerships
Eco-industrial parks

What is Driving Green Innovation?

- Detailed econometric work at OECD on: renewable energy, electric/hybrid vehicles, 'clean' coal, air and water pollution abatement
- Relative prices, policy measures (e.g. standards) and public R&D drive green innovation – but differs depending upon a number of factors (i.e. maturity of technology)
- General innovative capacity and market conditions are often the most important determinants – "**a rising tide lifts all boats**"
- While environmental policy stringency matters, **policy stability and flexibility** are also key – give investors incentives for 'search' over planning horizon

Source: www.oecd.org/ienvironment/nnovation

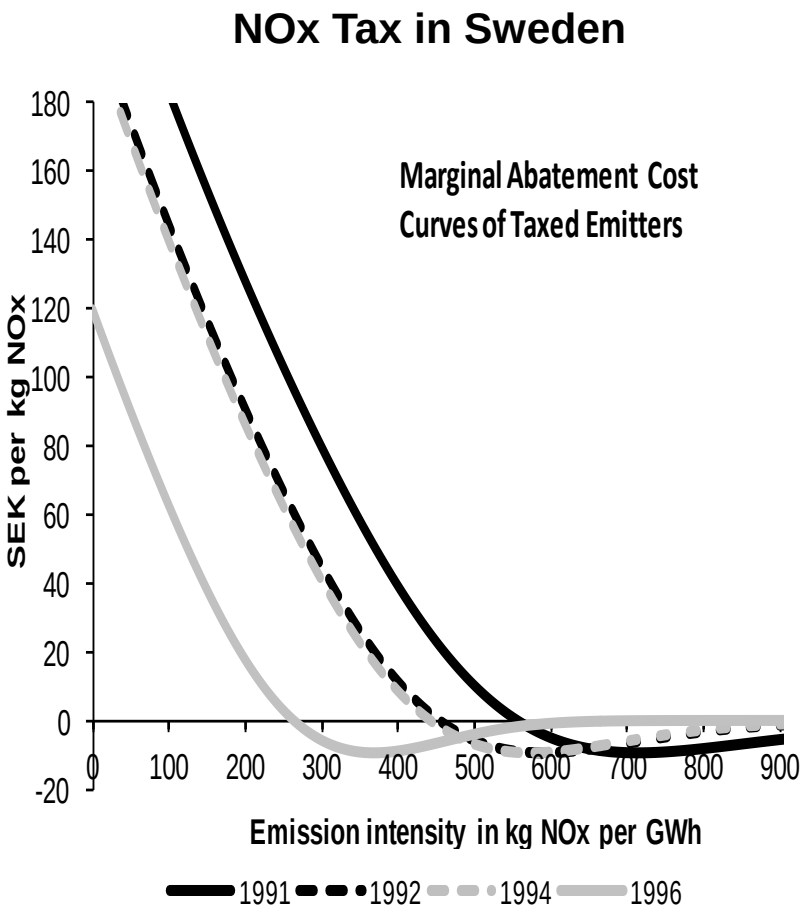
Clear policy signals help



Source: OECD (2010), *The Invention and Transfer of Environmental Technologies*

Getting prices “right” is important …

- Swedish NOx tax
  - Patents increased; emission intensities declined; Marginal Abatement Costs fell
- Swiss VOC tax
  - Firms were quite innovative and found many solutions involving changes in organisational and production practices that did not result in patenting of technologies
- UK Climate Change Levy
  - Firms that agreed to a voluntary emission-reduction agreement received a 80% reduction on carbon tax = > innovated less

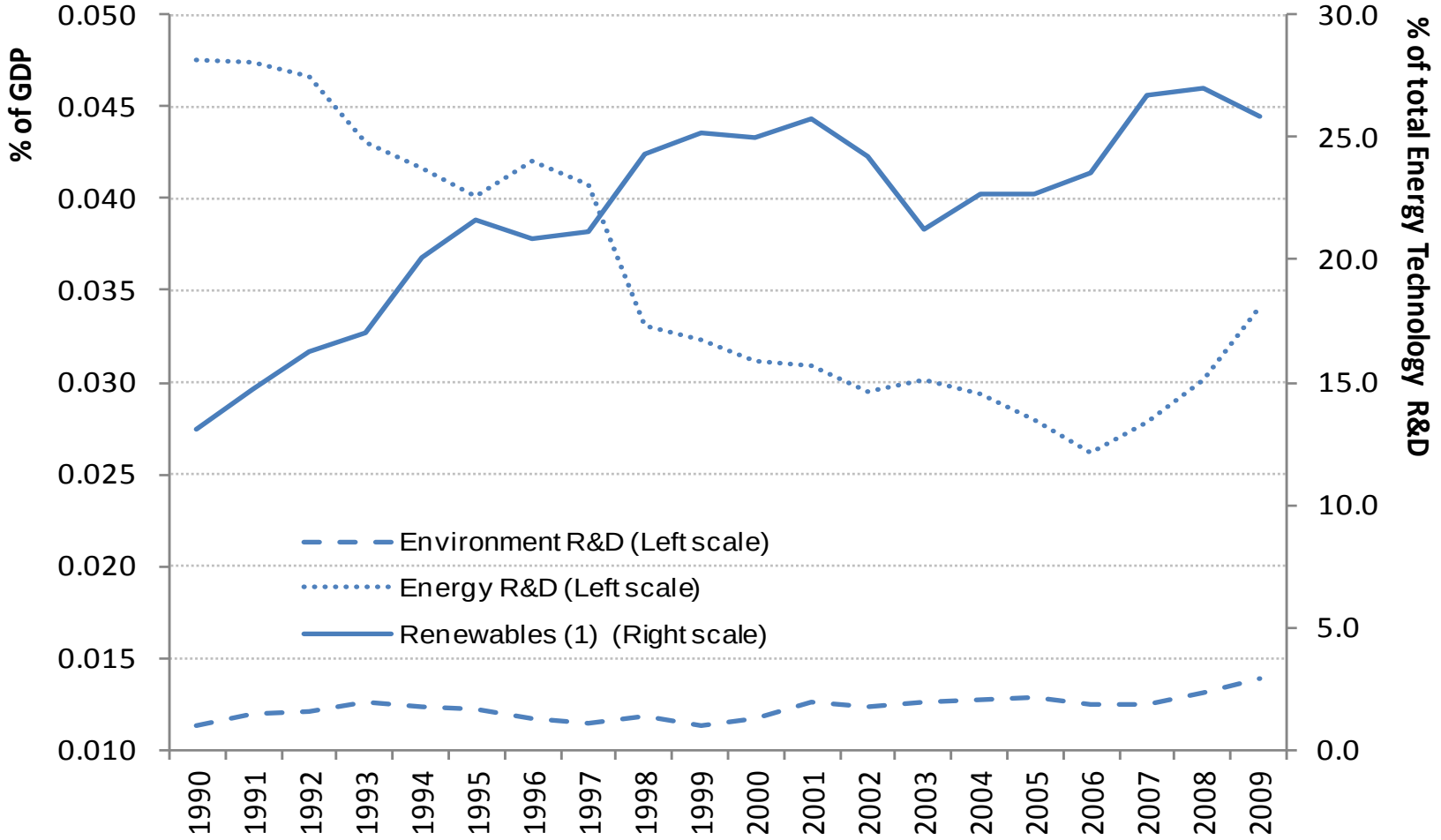


- *Graph based on:* Hoglund-Isaksson (2005) cited in OECD (2011) *Taxation, Innovation and the Environment;* based on observations from 55 plants in the energy sectors over the period 1992-1996

… but are not sufficient

- Sometimes difficult to target environmental ‘bad’ directly and excessive administrative costs
- Range of other ‘non-environmental’ market failures – e.g. knowledge externalities that limit private investment in innovation, but also information failures, split incentives, network externalities
- ‘Credibility’ of policy-induced price signals over the longer term may not be sufficient for risky investments: scaling up can be highly capital intensive and risky
- Inertia in the market can favour incumbent firms, technologies and systems
- Evidence thus far suggests that better pricing mainly induces incremental innovation.

Public spending on energy and environmental R&D has not kept pace …

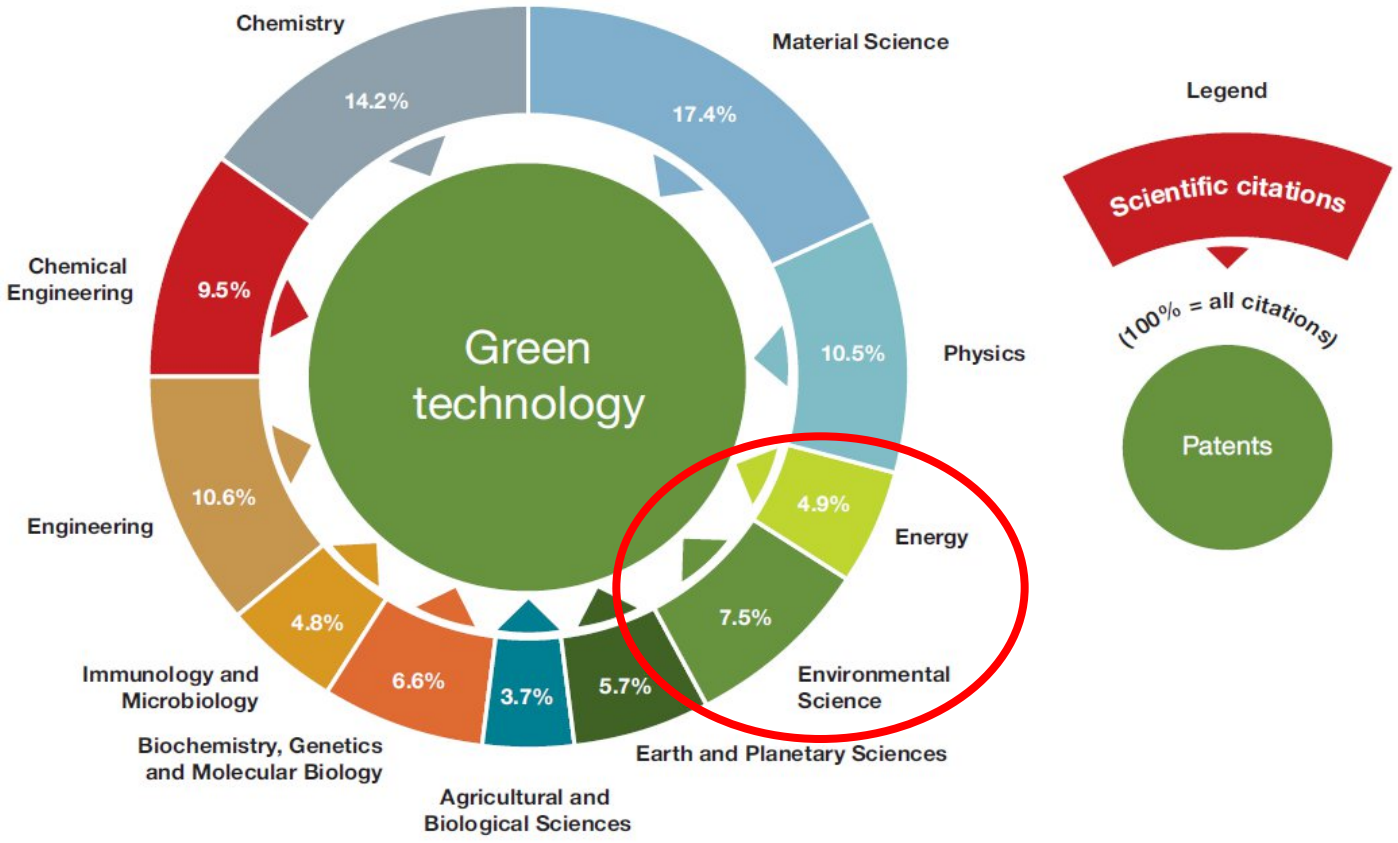


Source: OECD, R&D statistics and IEA database.

… but green innovation draws on a broad range of research

The innovation-science link in selected green technologies

Patent-science link via citations, 2000-07

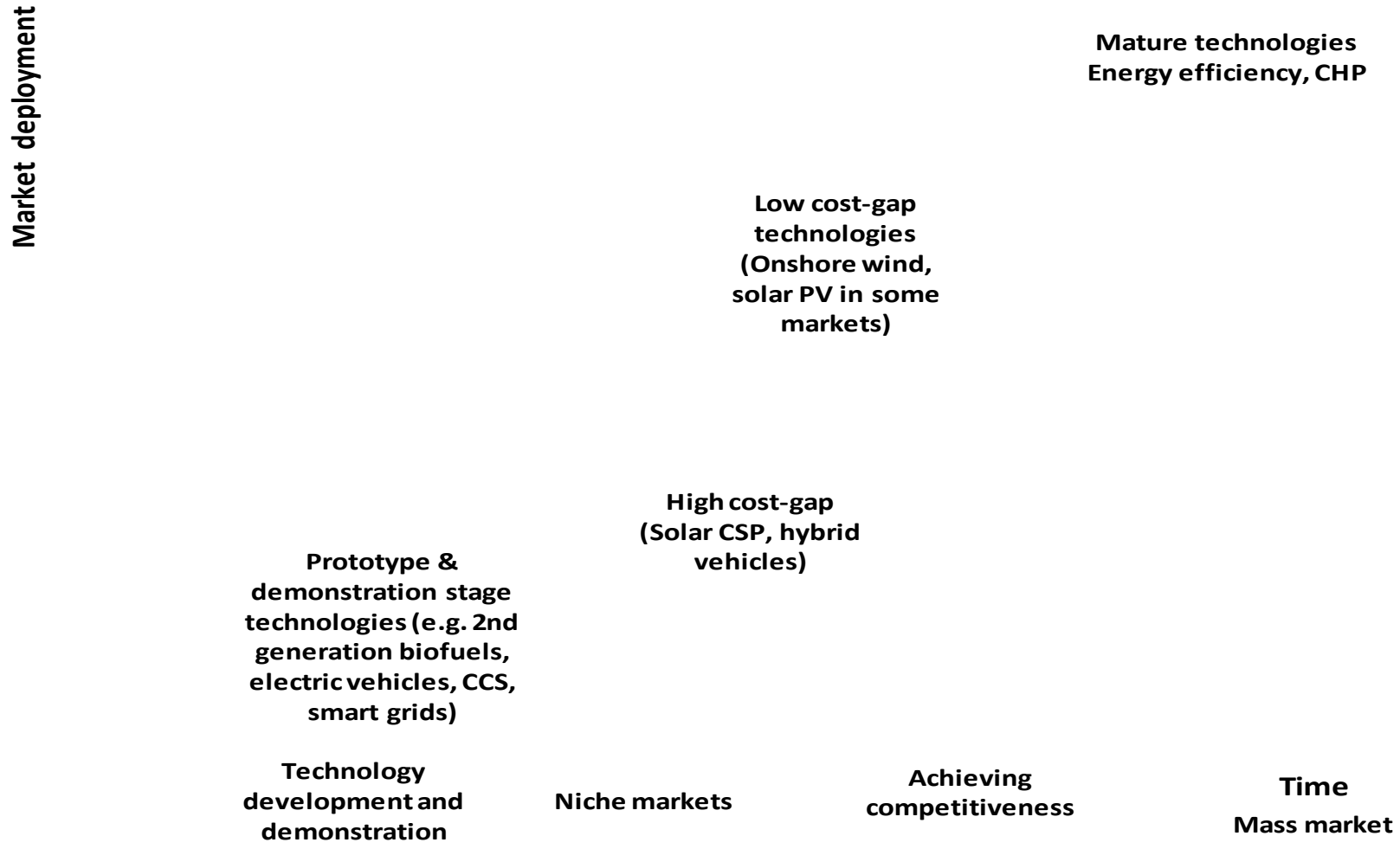


Source: OECD (2010), *Measuring Innovation – A New Perspective*, based on Scopus Custom Data, Elsevier, July 2009; OECD, Patent Database, January 2010; and EPO, Worldwide Patent Statistical Database, September 2009.

Implications for research policy

- Need greater investment in relevant research, which can involve reorienting R&D spending
- Mission-oriented research (e.g. Apollo project) probably less important – commercial application is key.
- Focus on both short-term (commercial applications) and long-term challenges.
- Research should increasingly be multi- and interdisciplinary – breakthroughs emerge from competition & cooperation.
- The effectiveness of funding depends on strong and effective interactions between science and industry

Support for innovation and deployment



Source: IEA (2010)

Implications for support policies

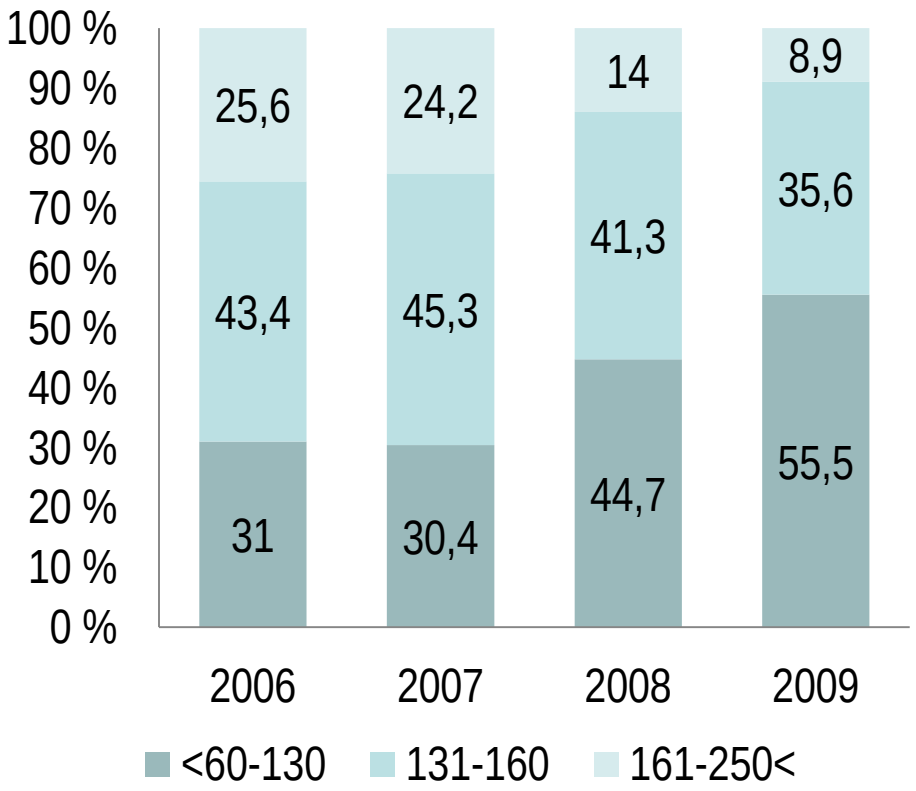
- Since technology-neutral pricing of externality is not ‘sufficient’ = > necessity to be ‘prescriptive’ (at least to some extent) => main challenge for policy makers
- Some general principles:
  - Support a ‘portfolio’ of technologies to diversify risk of getting it “wrong”
  - Benefits of chosen portfolio should be robust with respect to information uncertainty (i.e. consider ancillary benefits)
  - Identify “local general purpose technologies’ which complement a variety of emission-reducing strategies, e.g. battery technologies, instead of very specific applications

Demand-side policies play a role …

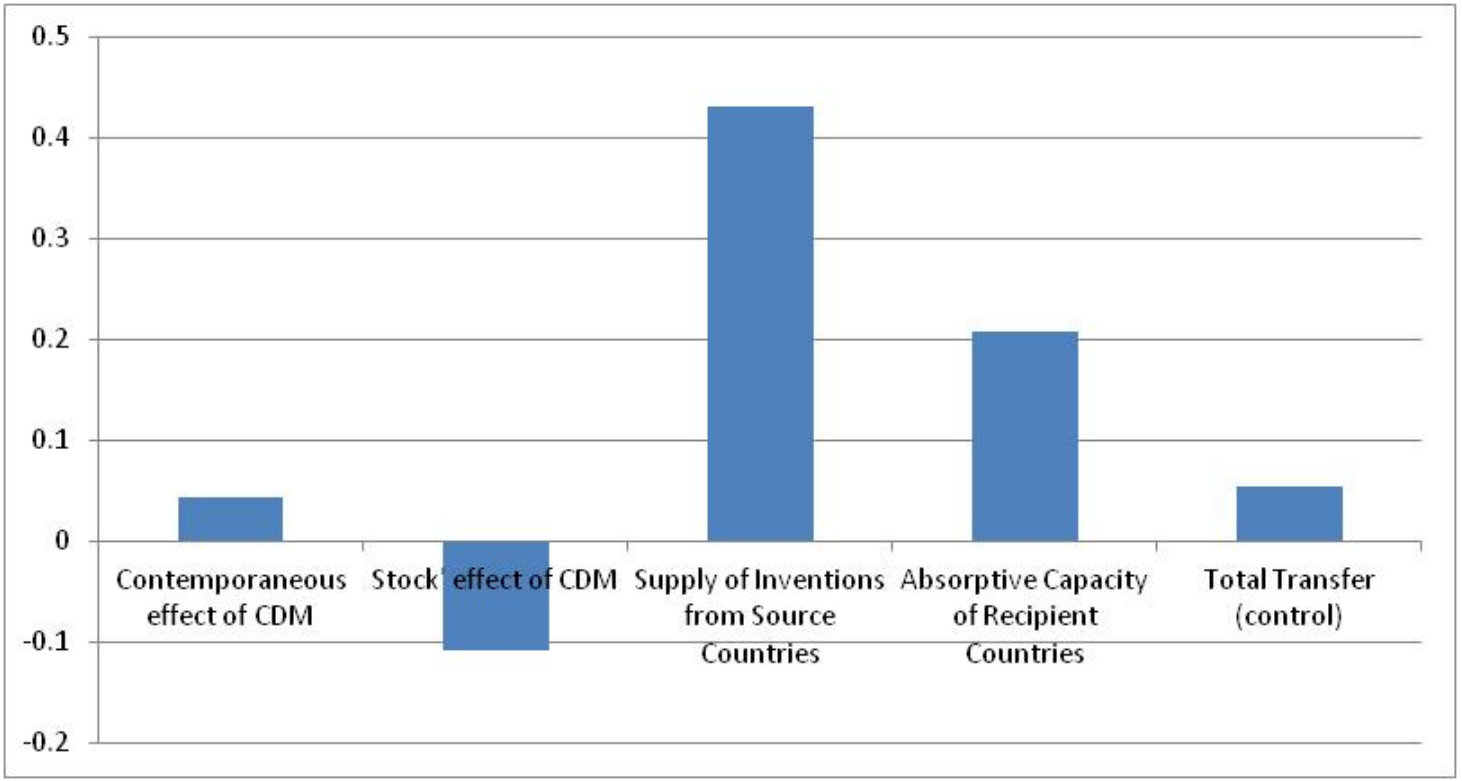
- In fostering markets, in particular in areas where price measures (e.g. carbon taxes) are ineffective or insufficient.
- Involves:
  - Regulation and performance standards
  - Technology standards
  - Public procurement
  - Specific pricing measures, e.g. French bonus-malus scheme
- These policies should also emphasize performance and competition, rather than supporting specific technologies.

… e.g. the French bonus-malus scheme

- "Carrot and stick" approach applied for personal vehicles according to CO2 emissions
- Possibility to make fiscally neutral
- Clear shifts in purchasing behaviour

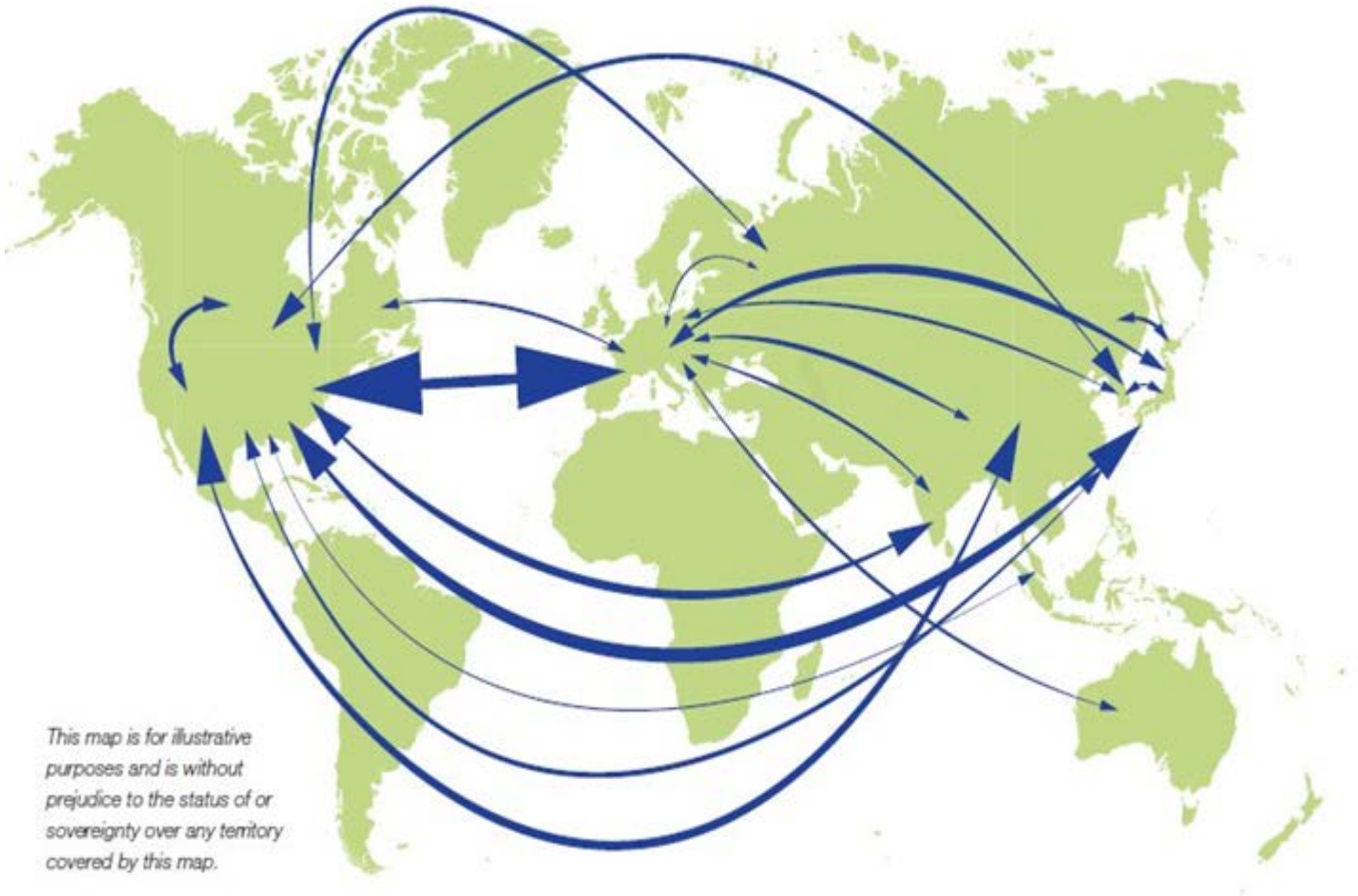


What Is Driving Transfer and Spillovers? CDM and the Case of Wind Power



Note: The histogram shows the relative importance of different determinants of transfer of wind power technologies, from Annex I to non-Annex I countries.
Source: Haščič, Ivan and Nick Johnstone (2011) *"The Clean Development Mechanism and International Technology Transfer: Empirical Evidence on Wind Power"* in *Climate Policy* 11(6)

Cooperation in CC Mitigation Technologies
(Co-invention of Solar Photovoltaic Technologies)



Source: OECD (2012) *Energy and Climate Change Policy and Innovation* (forthcoming).

Technology transfer and diffusion within and across countries

- Openness to trade, FDI and people is important
- Good IPR protection supports technology transfer
- Transfer depends on absorptive capacity – innovators more likely to benefit from others' innovations
- New approaches and models for technology diffusion are needed and need to be scaled up, especially for the least developed countries, e.g.
  - ✓ Collaborative mechanisms, e.g. the CDM
  - ✓ Voluntary approaches (e.g. patent pools)
  - ✓ Building up capacity for innovation and entrepreneurship in developing countries

The policy mix for green innovation

- No silver bullet, range of policies needed
- Stable long-term policy signals, better pricing.
- Supply and demand: Strengthening incentives and markets, and development of new alternatives
- Competition between technologies is key; and,
- Guard against lock-in – support broad range of options, including general-purpose technologies such as ICT.

For more details: OECD (2011), OECD Green Growth Studies – Fostering Innovation for Green Growth.

Policy Challenges

- Providing policy predictability in conditions of imperfect and changing information
- Providing a mix of incentives that induce solutions from ‘close-to-market’ up to ‘breakthrough’
- Directing technological change onto a green trajectory without being “unduly” prescriptive
- Building international cooperative solutions for environmental problems which stretch widely across space and time

Thank you

For further information:

www.oecd.org/greengrowth

or

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