Martin Jänicke
(Environmental Policy Research Center,
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Structure and Dynamics of the „Eco Industry“ in Germany

Lecture at the FU Berlin
30th Sept. 2008

Main Points

1. Booming eco-innovations
2. Actual and structural long-term (“structural“) drivers.
3. Smart technology forcing
4. Forcing diffusion: creating domestic/lead markets
5. Caveats

Eco-industry in the EU 25: Turnover 1999-2004

(Source: Ernst & Young 2006)

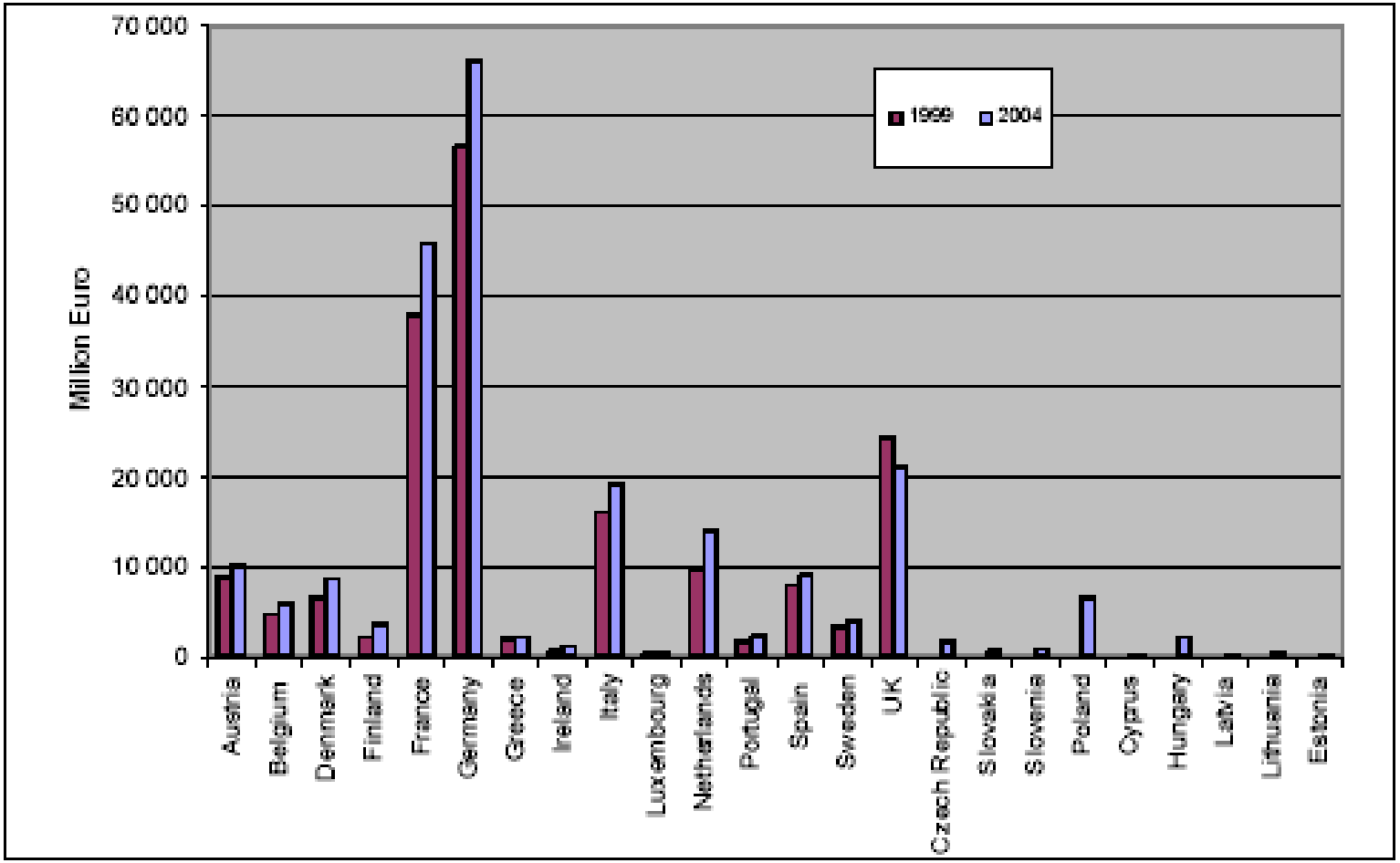
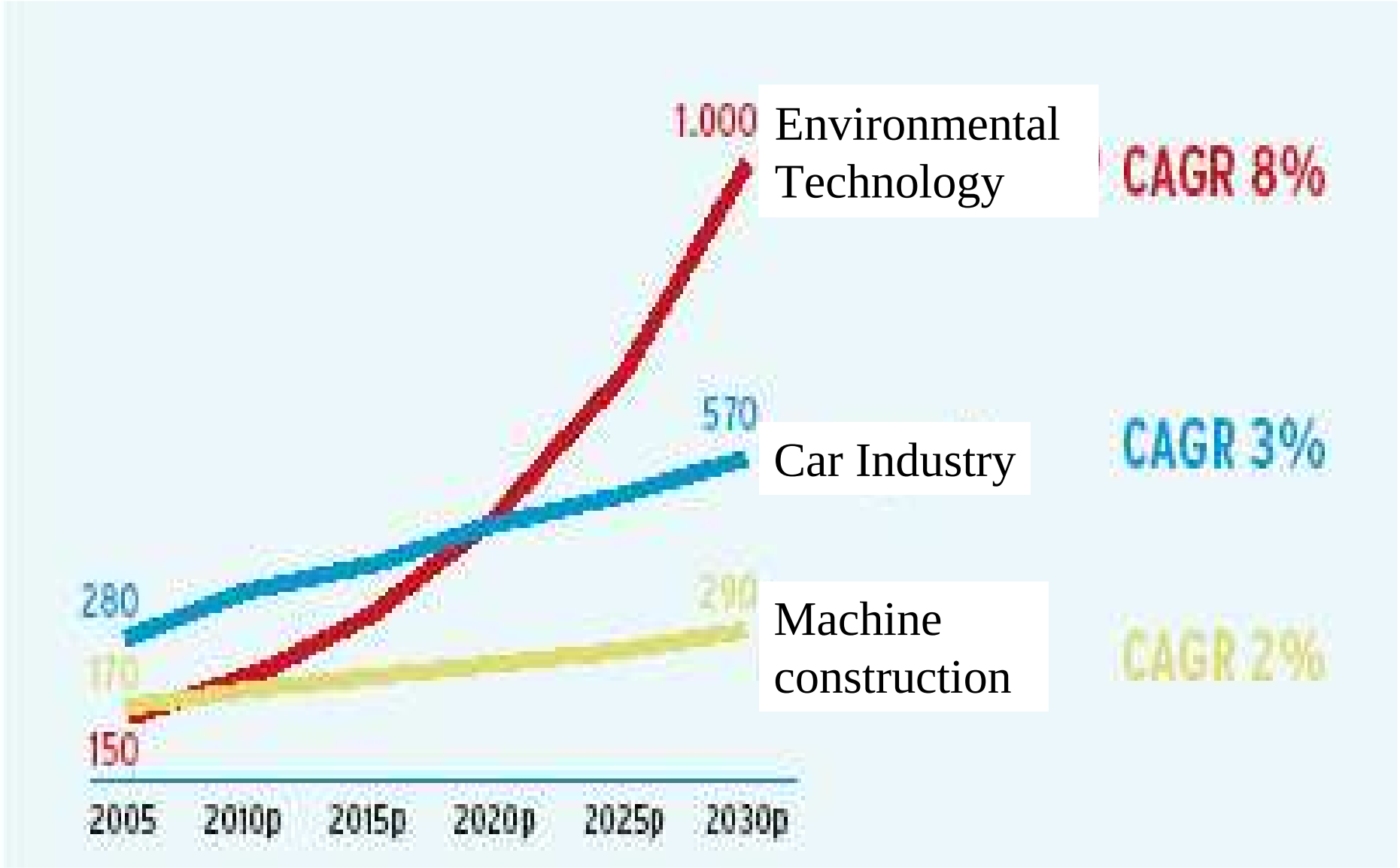


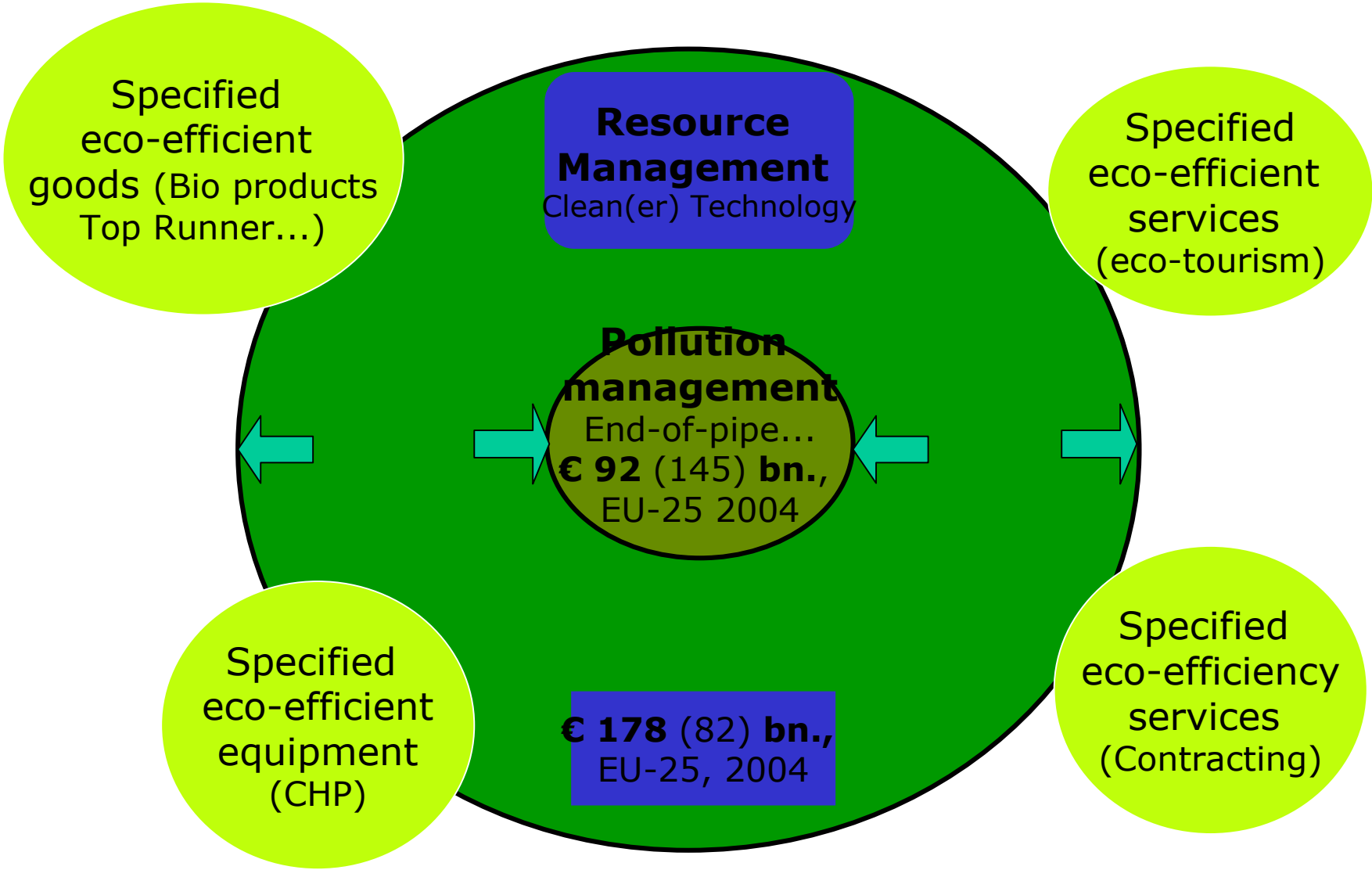
Figure 13: Comparison between updated 2004 expenditure data and 1999 expenditure data

N.B.: Data available for the 10 NMS from the previous Analysis of the size and employment of the eco-industries of the candidate countries report are not used because here because they are incomplete or not directly comparable (differences in sources, perimeter, extrapolation method)

The German „Environmental Industry“: A Prognosis (Source: Roland Berger 2006 (x), BMU 2006)



Eco-Industry EU-25 2004



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revised data Ernst & Young 2006

The Eco Industry: the Under-estimated „Invisible“ Sector

- Due to unclear definition and lack of data the Eco Industry is by far under-estimated.
- The official figures for Germany:
  - 4 % GDP (2005), forecast: 16% (2030)
  - 4,5% of the employment = 1,8 million (2006)
- However: Investment for climate protection in Germany already amounts to
  - 5% GDP (2005) and
  - 6,5% if the new climate programme is taken into account.

Two Parts of the Environmental Industry

- Part I: Pollution Management: „...sectors that manage material streams from processes (the techno-sphere) to nature... typically using ‚end of pipe' technology".

  Growth in advanced OECD countries: Stagnation
  Contribution to productivity: rather negative.

- Part II: Resource Management: „sectors that take a more preventive approach to managing material streams from nature to techno-sphere" (Ernst & Young 2006).

  Growth in advanced OECD countries: High growth
  Contribution to productivity: positiv.

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(1) Definition: Eco-efficient Innovation and Ecological Modernisation

- Eco-efficient innovation is the creation and diffusion of novel competitive goods, processes and services designed to preserve or improve the environment with a life-cycle minimal use of natural resources (see also EuropeINNOVA/EC, 2006).
- Eco-efficient innovation is a synonym for „ecological modernisation“.
- „Environmental innovation“ is the broader term including both, eco-efficient and „end-of-pipe“ technology.

Structure and Growth of the German „GreenTech“ Industry

	German Share of GreenTech World market (%)	Annual Turnover Growth 2004-2006 (%)	Expected Annual Turnover Growth 2007-2009 (%)
Environmental friendly energy supply	**30**	**30**	**27**
Energy efficiency	**10**	**21**	**22**
Material efficiency	**5**	**11**	**17**
Recycling	**25**	**13**	**11**
Sustainable water supply	**5**	**12**	**15**
Sustainable mobility	**20**	**29**	**20**

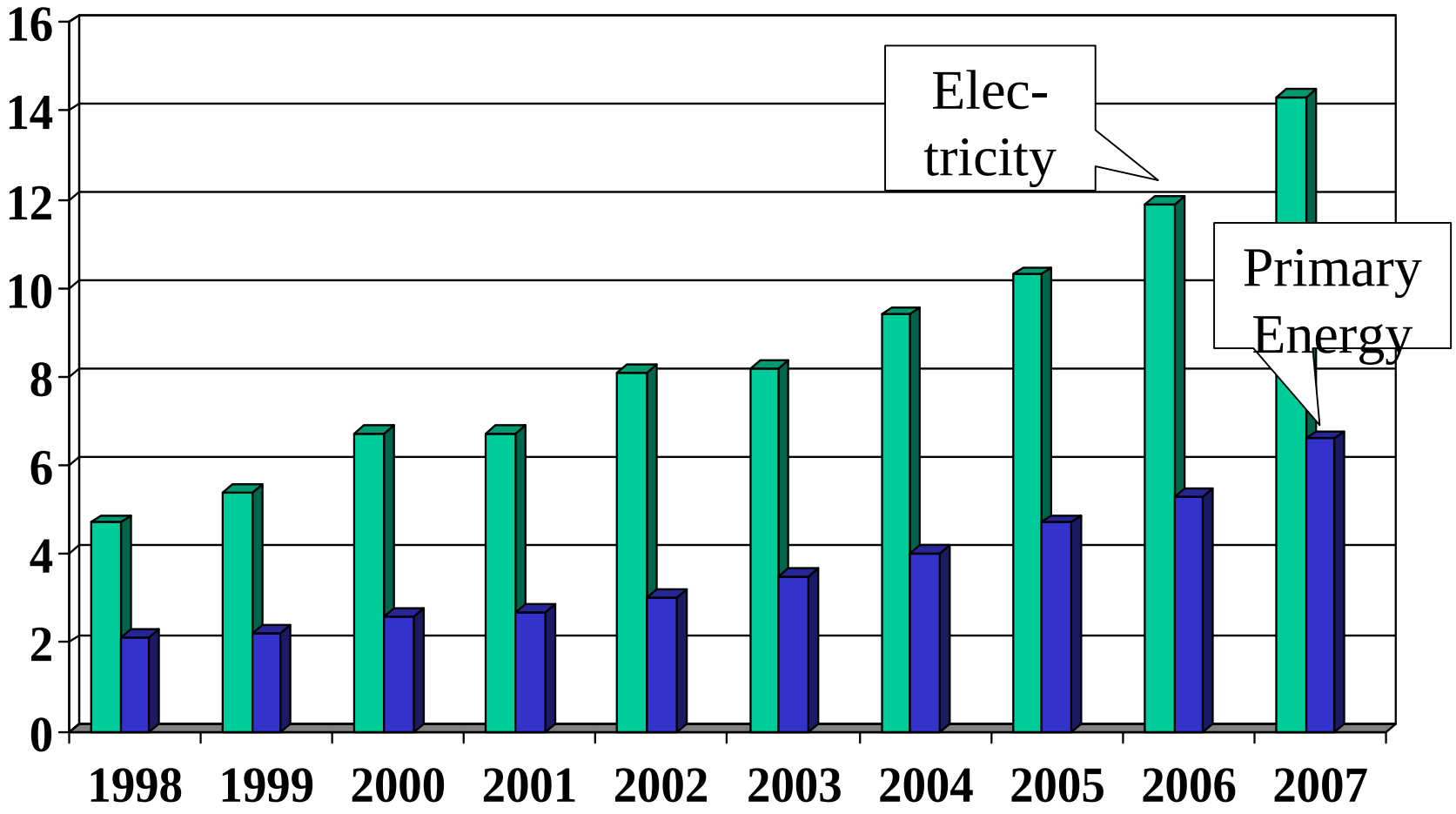
Source: BMU 2007, p. 3 and 14 (Roland Berger)

Annual Growth of Climate friendly Technologies in Germany 2005-07

- PV: 50%
- Heat pumps (2005/06): 44%
- Bio mass power: 37%
- Wind energy (2000/07): 26%
- Bio diesel (2005/06): 22%
- Passive houses: 19%
- Contracting (2005/06): ca. 15%

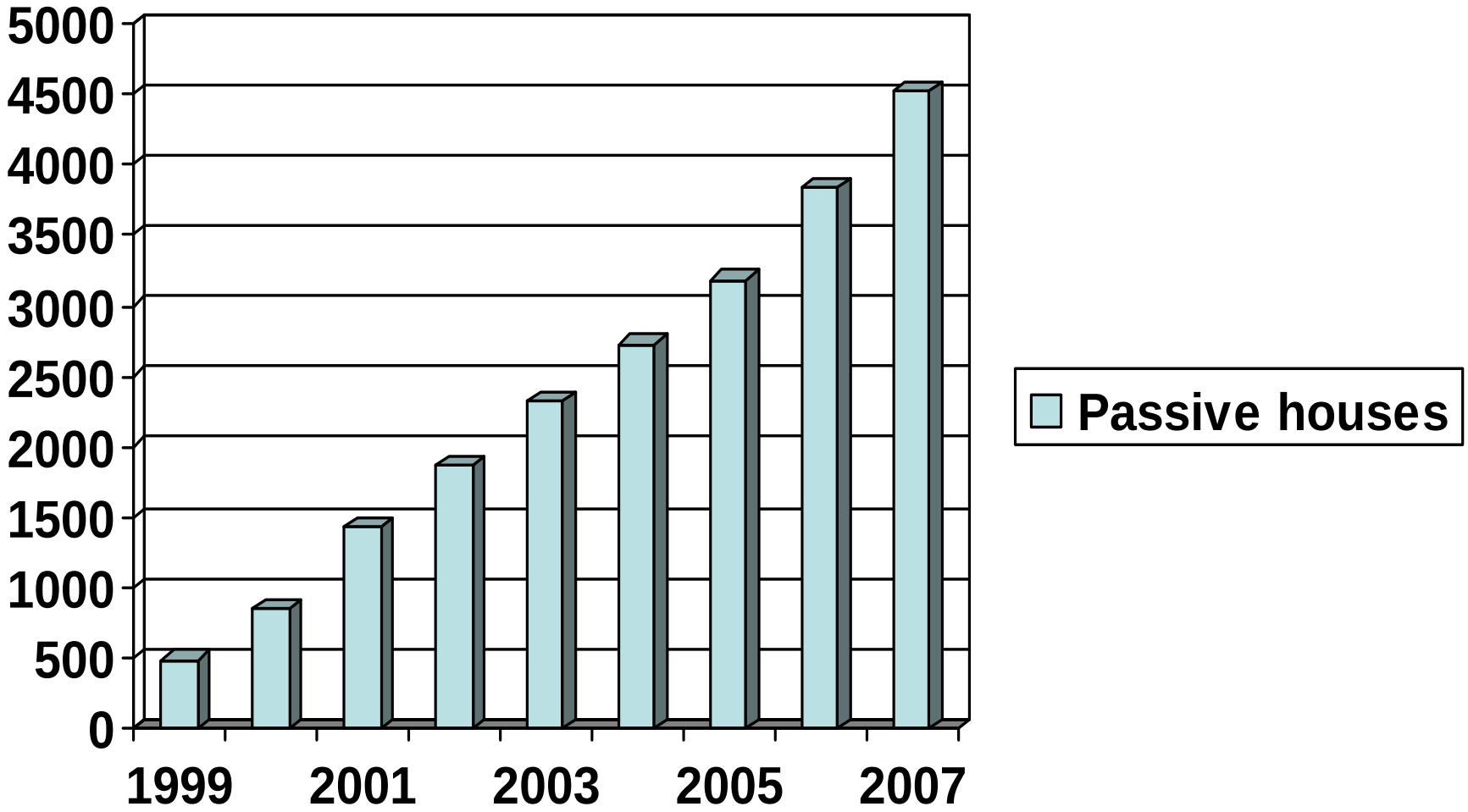
Own Compilation, Sources: BEE, KfW and others

Share of Renewable Energy in Germany 1998-2007 (BMU 2008, BEE 2008)



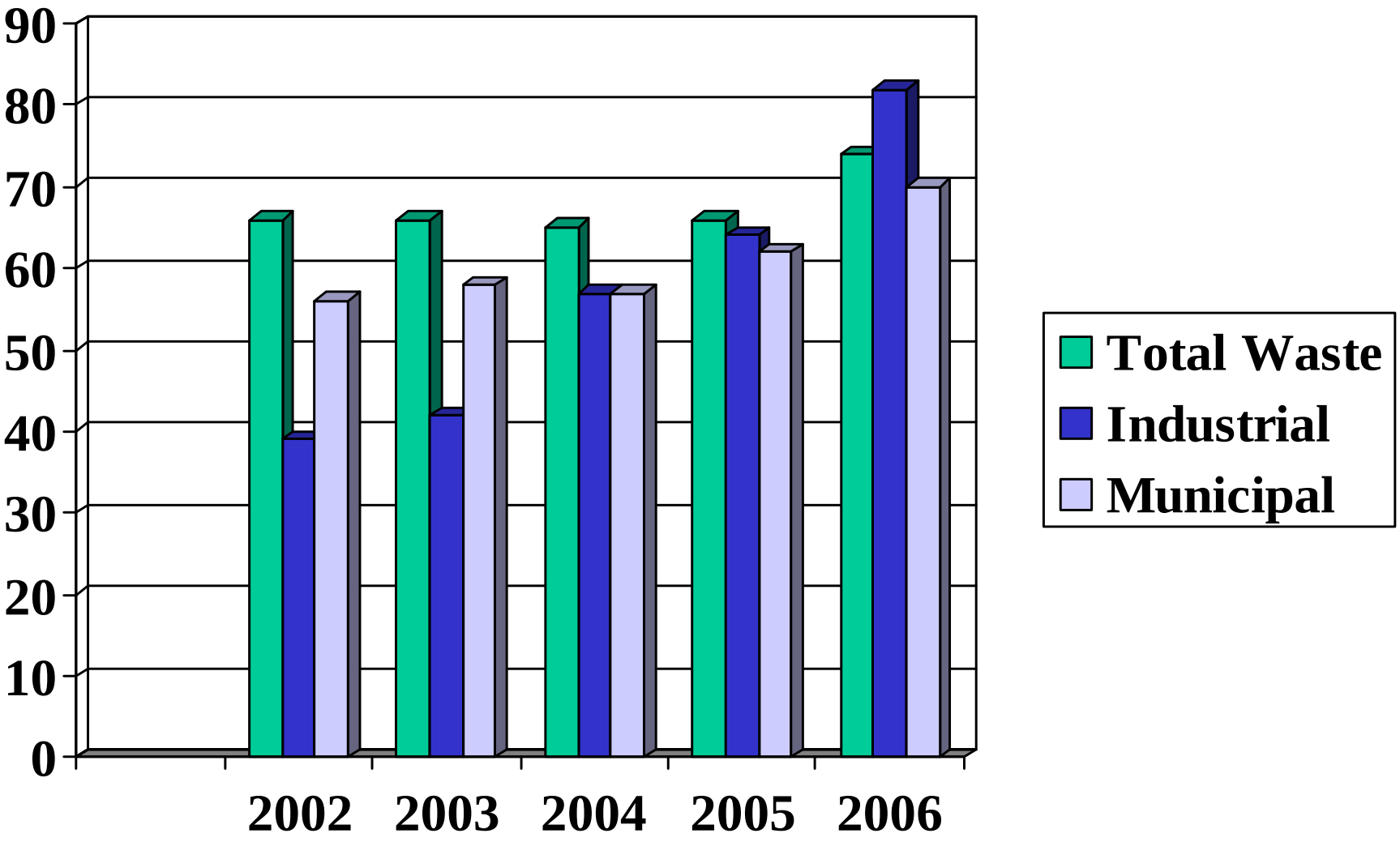
Passive Houses in Germany 1999-2007

(KfW 2007)

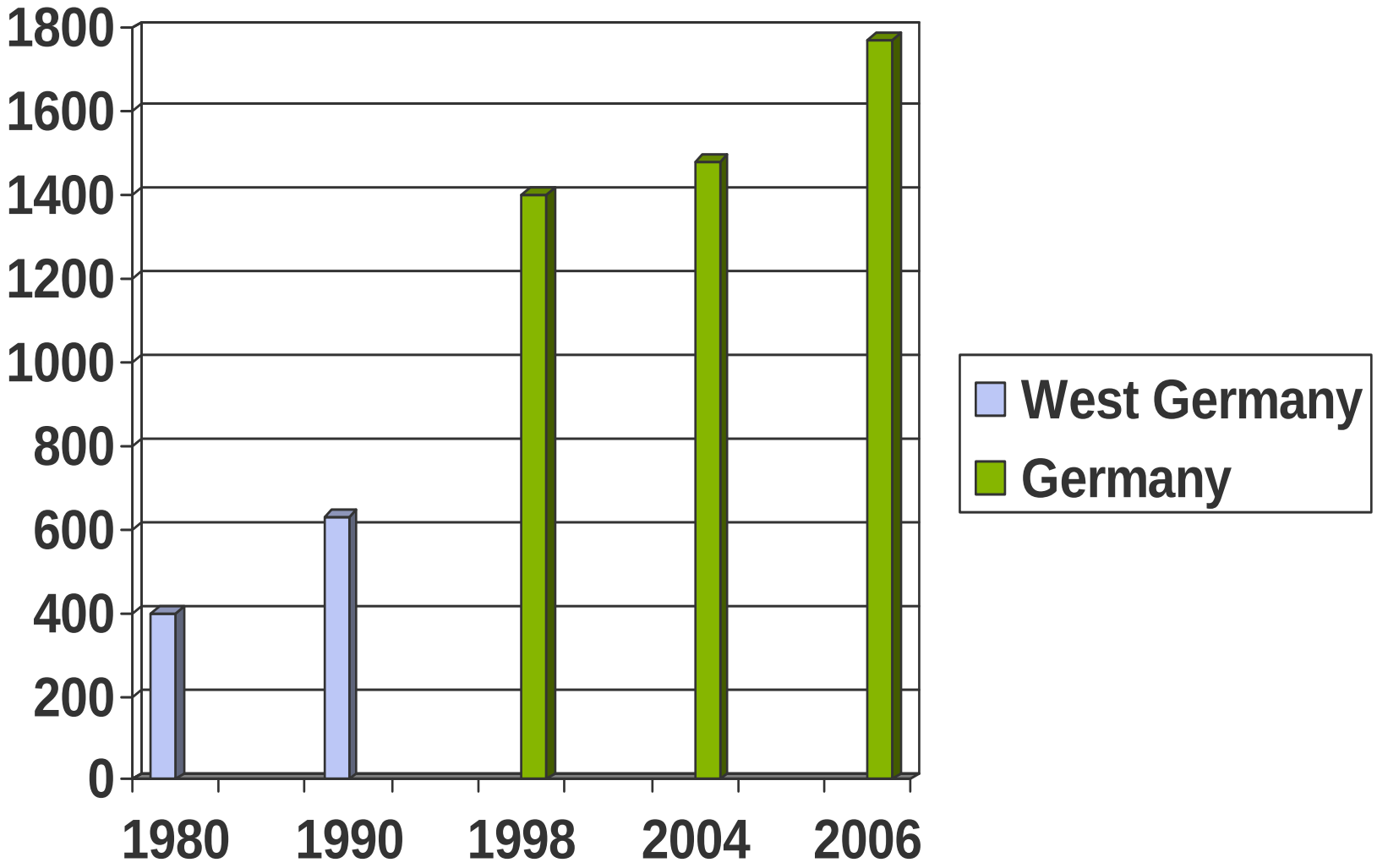


Waste Recycling Rates in Germany

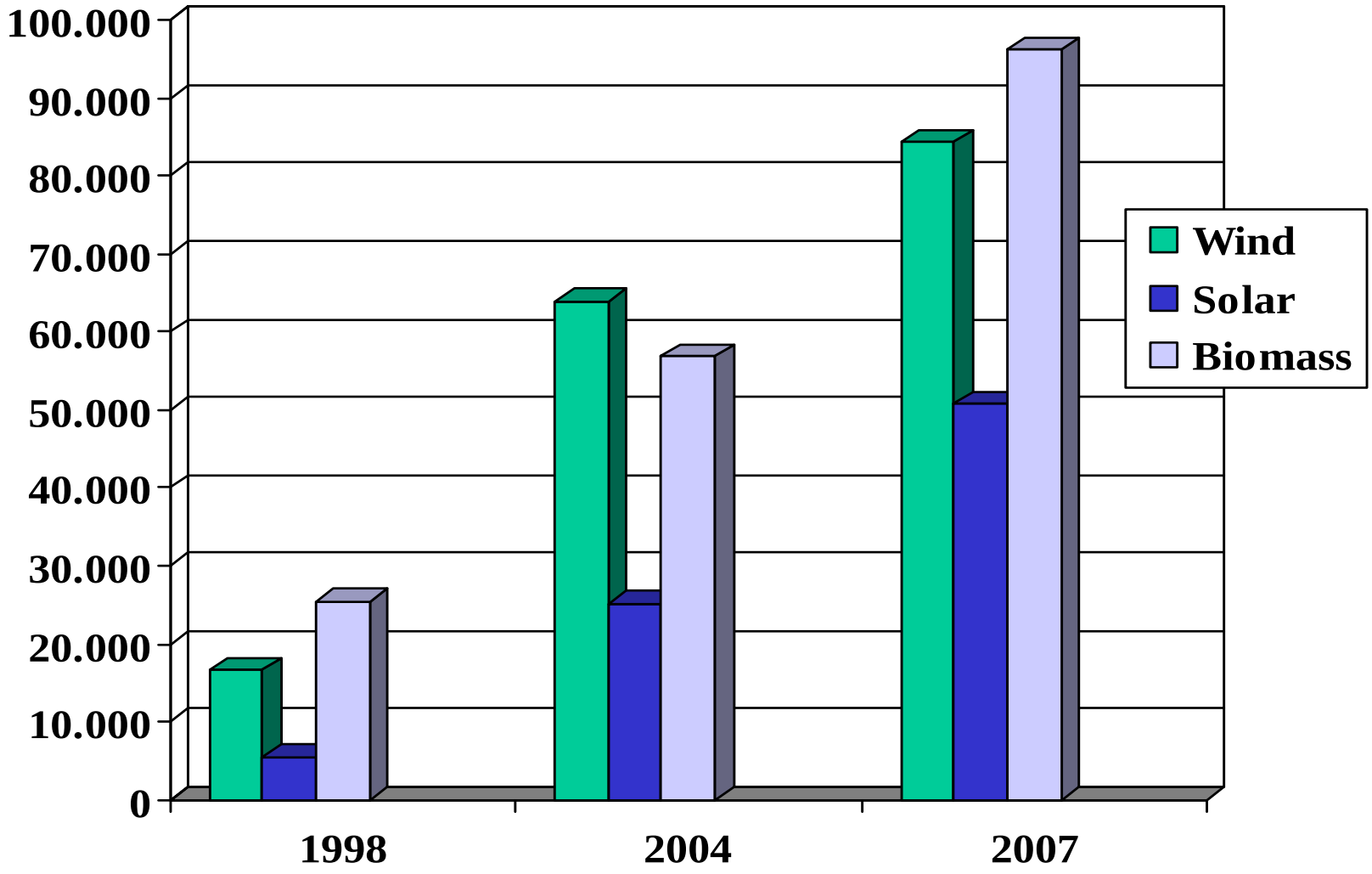
(including Incineration)(Statist. Bundesamt 2008)



Employment in the German Eco Industry (BMU, UBA 2008)



Employment in the German Renewable Energy Sector (BMU 2008)



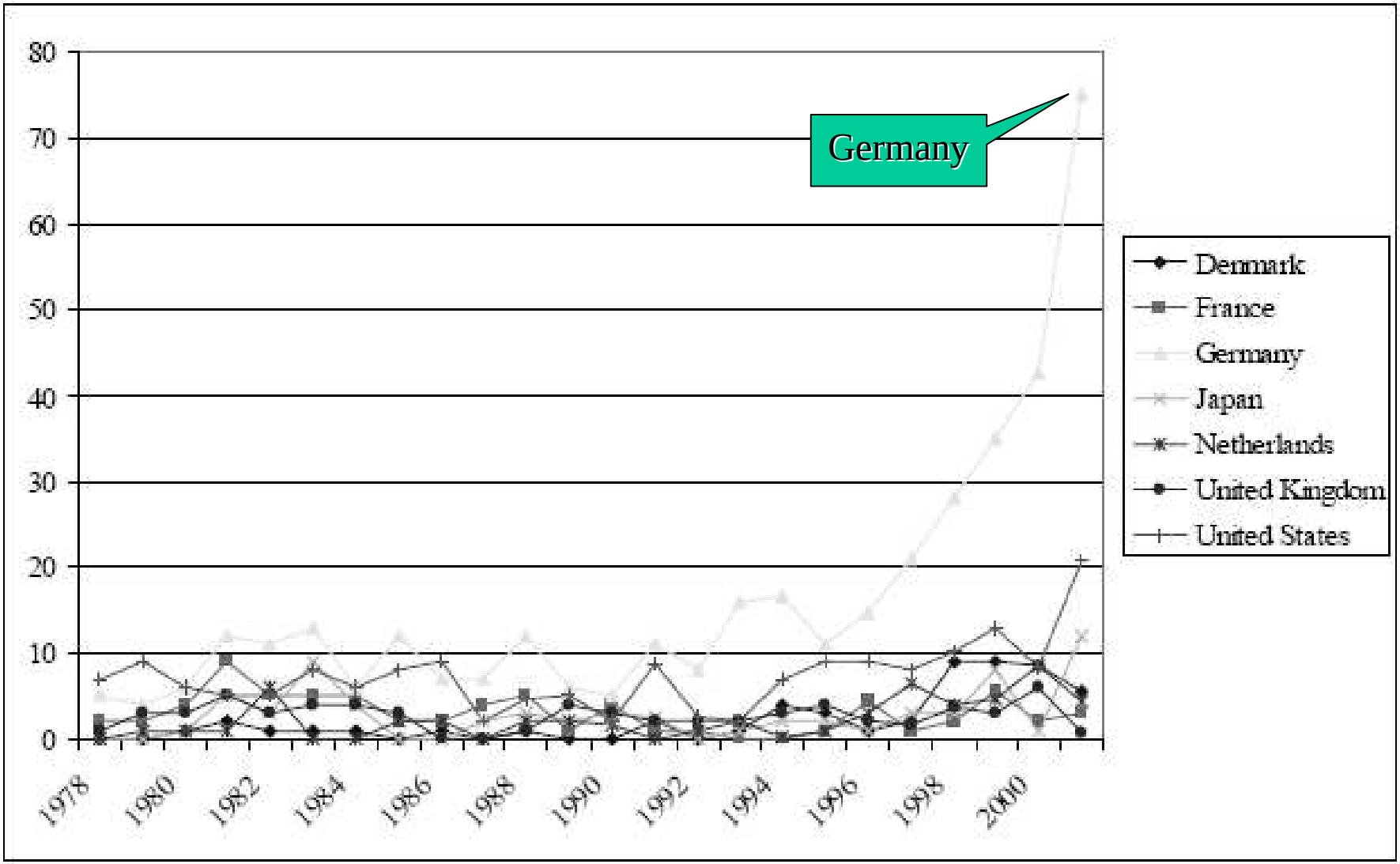
Booming Global Markets for Eco-effivient Technologies (annual growth)

- PV (grid-connected capacity)[1)]: 49% (7,8 GW)
- Investment in renewable energies[1)]: 32% (71 bn $)
- Wind energy (capacity) [1)]: 26%
- Hybrid cars [2)]: 22%
- Bioplastics [2)]: 22%
- Energy efficient technologies [3)]: 22%
- Material efficient technologies [3)]: 17%
- Automatic waste separation [2)]: 15%

1) Annual Growth 2005-07, 2) Forecast -2020. [3)] Forecast -2009

Source: Roland Berger 2007, REN21 2007.

Patents for Renewable Energy in selected OECD Countries (OECD 2005)



Energyplus Buildings in Freiburg

(„Sonnenschiff Freiburg“: Commercial Building + 58 Energyplus Houses)

Source: R. Disch 2008

Actual Drivers of the Eco-Boom

- Shocking news from the 4th. IPCC Assessment Report (2007), visible damages from climate change (New Orleans etc.)
- Exploding energy prices
- Perceived environmetal damage in high-growth countries like China
- Environment becoming a dimension of international competition
- Growing vulnerability and insecurity „dirty“ producers („regulatory risk“)

Special Characteristics of Environmental Innovations

1. *Environmental* innovations are a **necessary condition for long-term industrial growth**: Preventing *external environmental damage* necessitates technological improvements et ever higher level. This means permanent pressure for innovation.
2. They have high *future* as well as *global* market potentials.
3. *Eco-efficient* innovations, especially low carbon, energy and resource efficient technologies, have a high *economic win-win potential* regarding productivity and competition.
4. Eco-innovations are essentially “policy-driven”.
5. Their global expansion strongly depends on regulatory trends and trend-setters (e. g. EU and MS).

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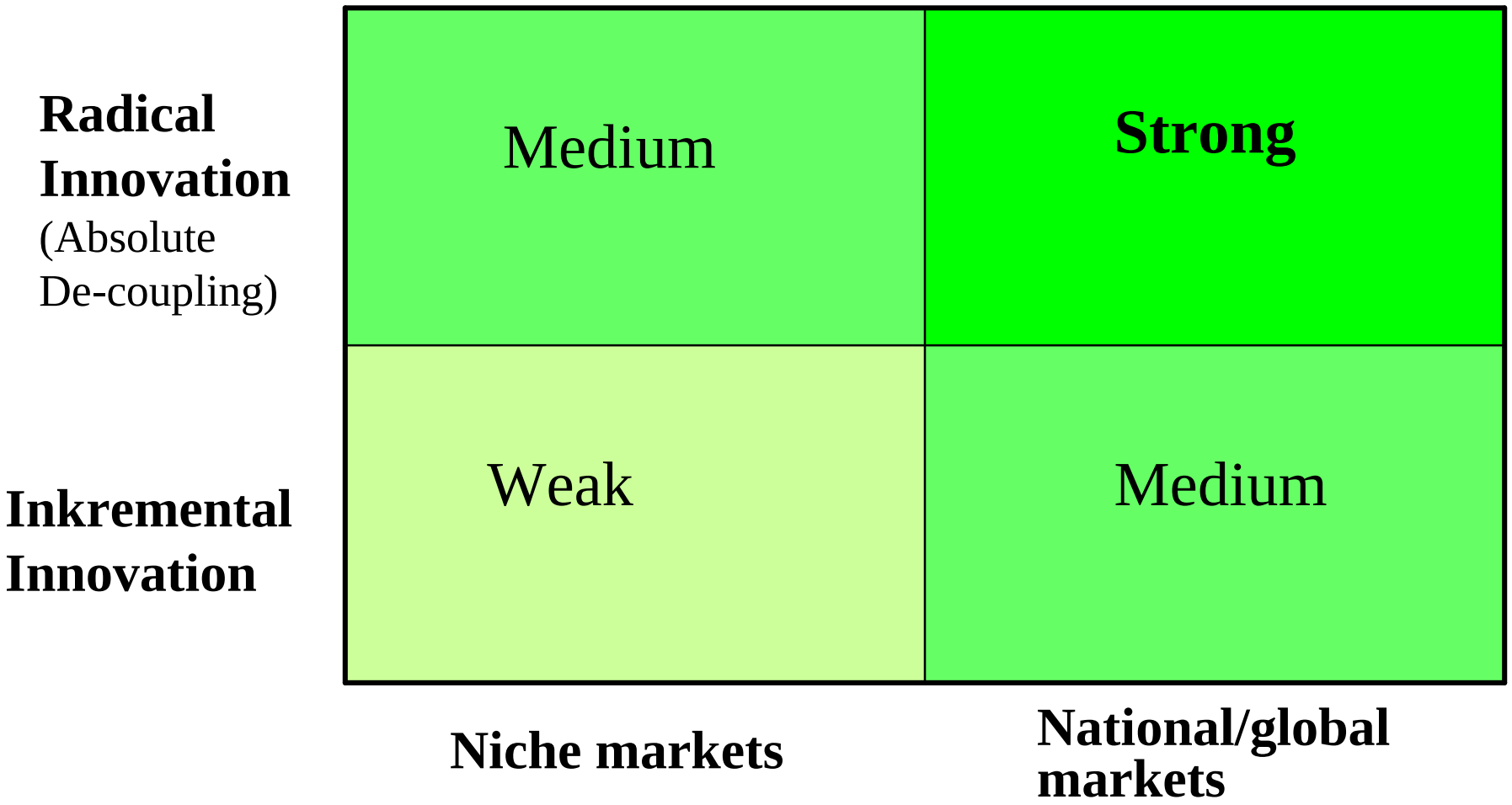
Eco-innovations are Policy-driven

- OECD (2007, 27) stresses “the dominant role” of the policy framework: “perceived policy stringency is the single most important factor driving environmental investment, technological innovation and reported performance”.
- “Compliance with policy objectives and legal requirements set by EU and national authorities will be the main drivers of eco-industry growth” (Ernst & Young 2006, 48).
- EUCETSA* (2006): “The reality is that regulation drives this industry” (* Lobby organisation for environmental technology)
- „A complex interplay has begun between regulation and competition. The regulatory drive...has forced companies to compete against each other on environmental criteria“ (McLauchlin, 2004).

Effectivity of Eco-innovations



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„Strong“ Environmental Innovations!

- There is nothing new with “Eco-efficient innovation” as such (MITI 1974); what do we mean today?
- “Weak” environmental innovations:
  - small, incidental innovations, good for green-washing but easily neutralised by growth (rebound effects)
  - innovations restricted to niche markets.
- **„Strong“** environmental innovation:
  - Greening *and* speeding up technological change
  - radical environmental improvements: absolute de-coupling from related growth processes
  - broad market penetration: lead markets, global markets
  - long-term processes and improvements comparable to the increase in labour productivity.
- „Weak“ environmental innovations can often be left to the market – Strong environmental innovations can not.

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“Smart“ Technology Forcing

„Technology forcing“ in environmental policy (narrower definition) means: setting environmental standards which cannot be achieved even by best available technology, thereby exerting pressure for technological innovation (Bryner 1995).

„Smart“ technology forcing in environmental policy could be unterstood as a more flexible and dynamic strategy to achieve ambitious long-term objectives by innovations significantly exceeding the existing state of art.

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Technology Forcing: The Top-Runner Programme

Target Year and Energy Saving (Examples)

Product:	**Target Year** (basis)**:**	**Expected Saving:**
Computers:	2005 (basis: 1997)	- 83% **(achieved 2001)**
	2007 (2001)	- 69%
Magnetic hard-disks:	2005 (1997)	- 78% **(achieved 2001**)
	2007 (2001)	- 71%
Video recorders:	2003 (1997)	- 59% (**achieved: – 74%)**
	2008 (2003)	- 22 %
Air conditioners (Heating & cooling):	2004 (1997)	- 66% (**achieved: – 68%)**
	2010 (2005)	- 22 %
Refrigerators:	2004 (1998)	- 30% (**achieved: –55%)**
	2010 (2005)	- 21%
Passenger cars (gasoline):	2010 (1995)	- 23% **(achieved 2006)**
	2015	- 29%
Diesel transporters	2005 (1995)	- 6,5% **(achieved: – 22%)**
TV sets:	2003 (1997)	-16% **(achieved: - 26)**

Source: ECCJ 2008

Policy Design for Eco-Innovations

- The **policy design** should:
  ....be based on **ambitious, and reliable targets**
- ...provide a **flexible policy mix** supporting the innovation cycle from invention to diffusion (and back to invention).
- ...focus on two core **instruments**:
  *** detailed, dynamic regulation** to exploit specific innovation potentials and to overcome specific obstacles +
  *** general price incentives** (MBI) such as taxes, targeted subsidies or ET to influence the general direction and to prevent rebound effects (x).
  * Use supporting instruments such as dynamic labelling (Top Runners!), green public procurement, EMAS etc.
- Competent pluralistic **networks**.

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(x) IEA (2007, 20): „...well-designed and well-enforced regulation..., coupled with appropiate energy-pricing policies“

Forcing Diffusion: Supporting Domestic Markets

- Dynamic Regulation (ambitious minimum performance standards)
- Market incentives
- Green procurement
- Agreements with retail traders
- Business-to-business trade (EMAS)
- Dynamic labelling (top runners)

Lead Markets for Eco-Innovations

- Forcing diffusion means supporting both, domestic and global market penetration.
- Lead markets for eco-innovations have become a strong tool for this purpose. *Lead markets are markets which adopt an innovation before it becomes adopted by most other countries* (Beise, 2001).
- Lead-market initiative of the EU focusing on four eco-innovative markets: sustainable construction; recycling; bio-based products; and renewable energies.
- Main function: The consumers of a developed country bear the costs of the development and further improvement of the eco-innovation, until it is cheap and attractive enough to be exported even to less developed countries.

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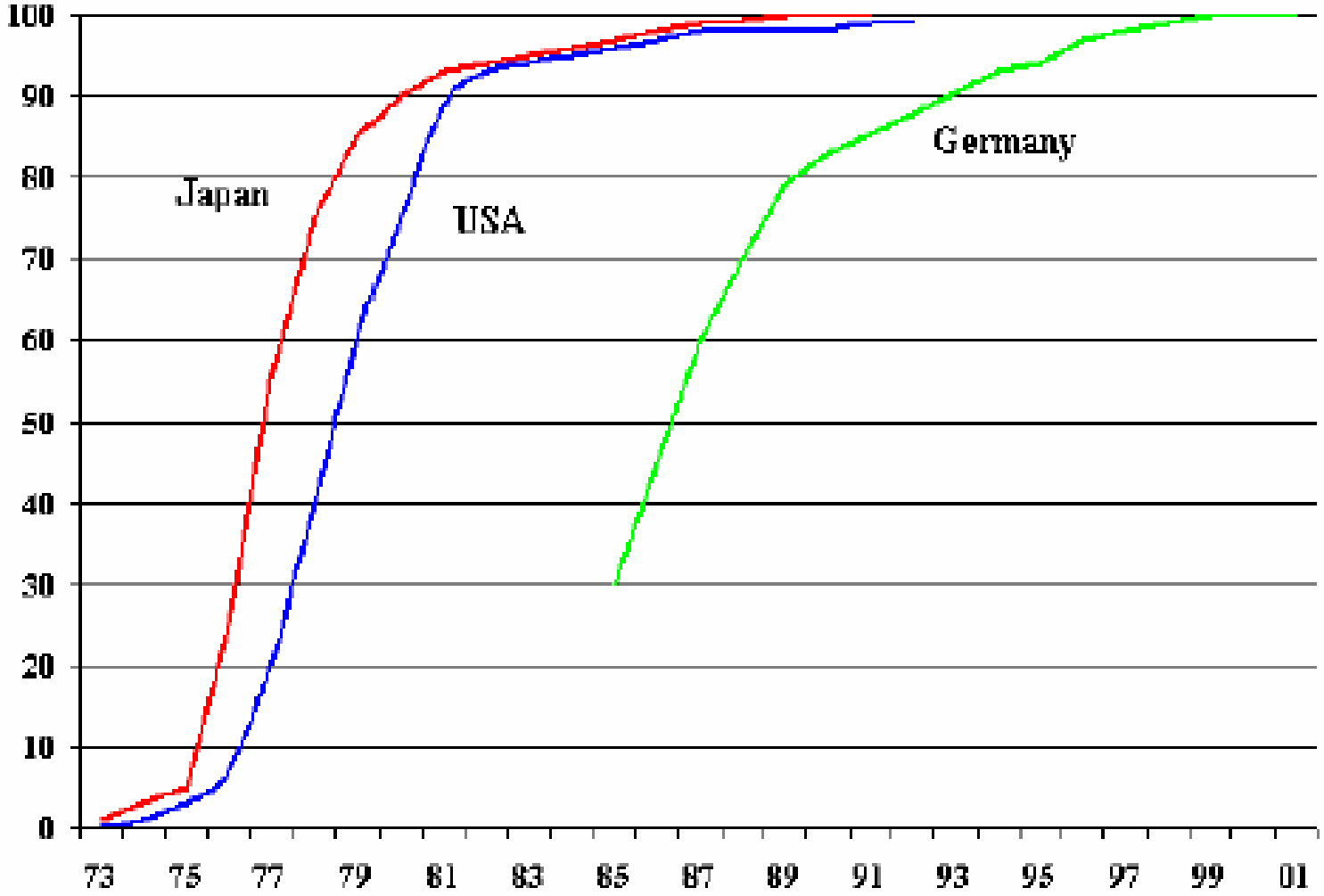
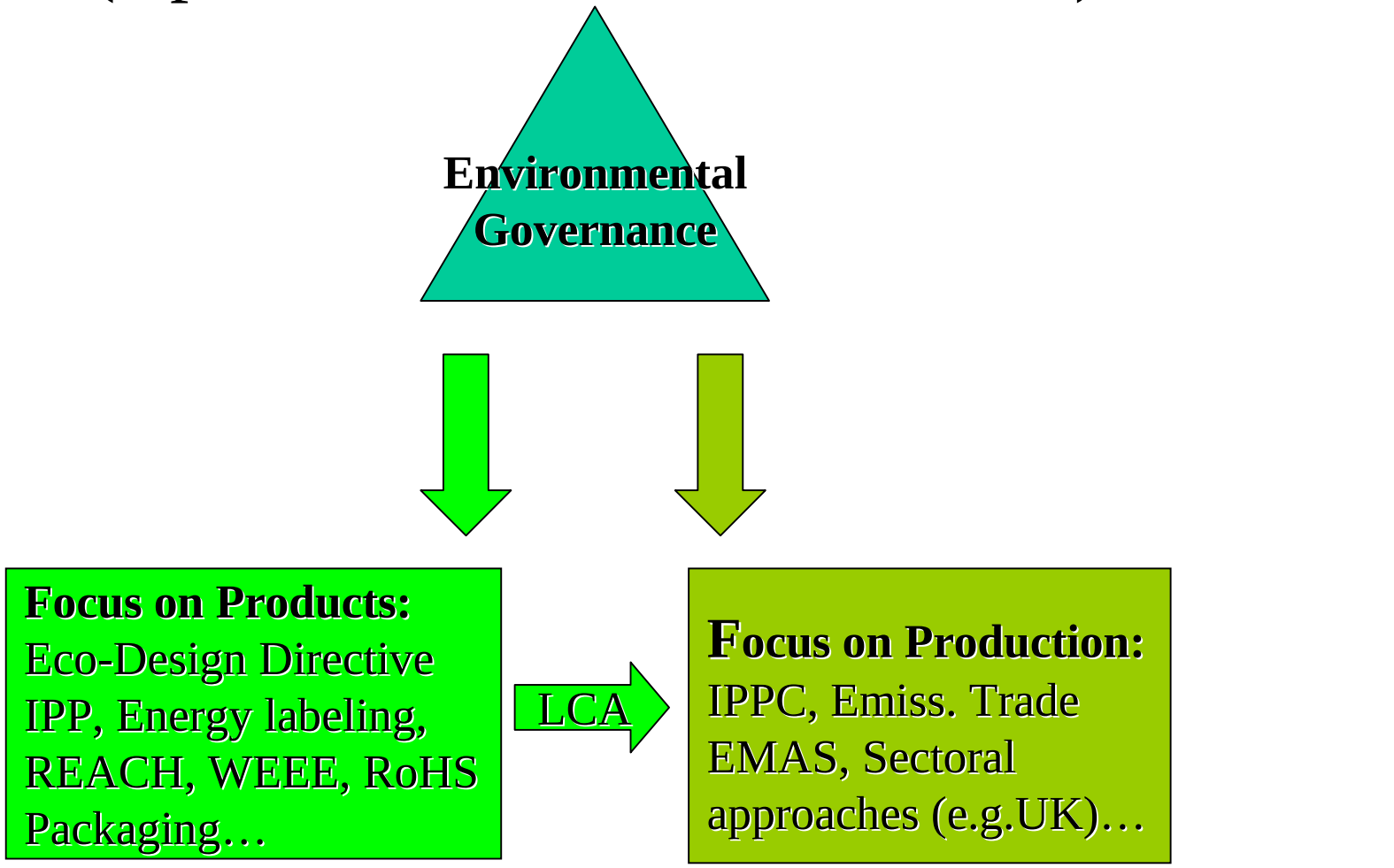
Forced Environmental Innovation: the Lead Market for Catalytic Converters

(ZEW/FFU 2005)



4. Integrated Approaches to Sustainable Production and Consumption
(Optimization of Material Flows)



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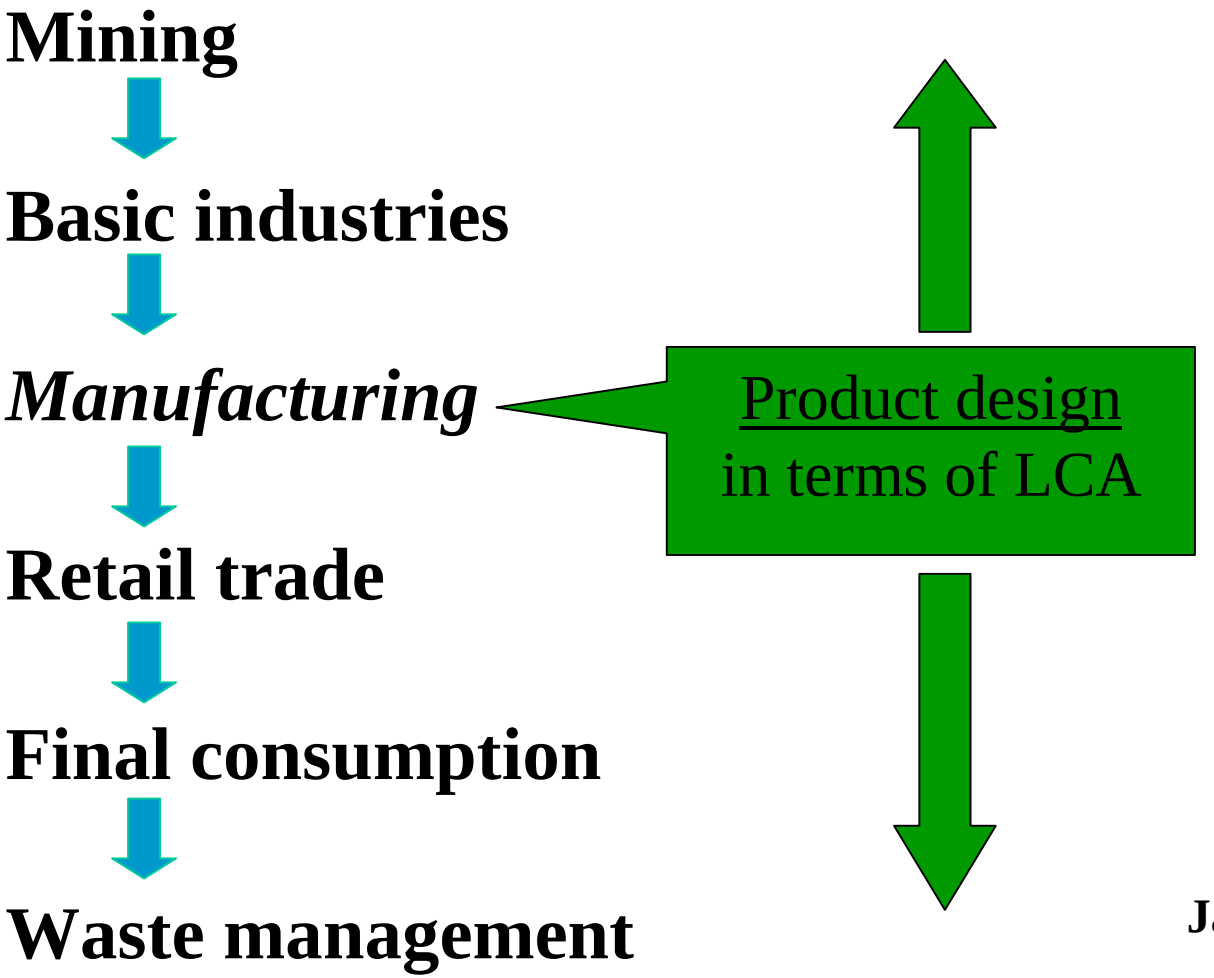
Product Design: Greening the Supply Chain

Material Flows:



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Top Runner and EuP Standard

	Top Runner St.	EuP Standard
Regulated Products	>20 (cars included)	14+6 (cars not included)
Production: Integrated approach?	**No, energy efficiency**	**Yes, IPP**
LCA, Least life cycle costs	**No**	**Yes**
Economic incentives („hybrid“ instrumentation)	Weak	Strong (ET, Eco taxes..)
Strictness	High	Still Open, critical
Effectiveness	Partly very high (> 90%)	Open
Innovation effect	Strong, technol. forcing	Open
Competitiveness	High	Open
Policy process	High speed	Slow, so far
Concerned players	Limited number	Complex configuration
Transaction costs	Medium	Probably higher
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Caveats (I)

- Limits to green innovation and ecological modernisation:
  - Problems, which cannot be solved by marketable technologies
  - Solutions which are neutralized by growth (rebound effects).
- Regulation should be „better regulation“.
- Technology forcing strategies should not lead to „overheating“ and respect investment cycles. Policy support should be limited etc.
- It is not the primary objective of environmental policy to create growth and employment.

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Caveats (II)

- Innovation processes are always ambivalent:
- They create winners but also losers threatening markets of traditional products (e. g. energy supply).
- The potential losers are often strong players in the policy arena (the „dynosaurs“).
- Power as a privilege: low pressure to learn and innovate.
- Tank syndrom vs.bycicle syndrom.
- Governments dealing with highly polluting „dynosaurs“ need constructive strategies. Creative change management instead of „creative destruction“.

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Thank you!

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(Environmental Policy Research Center, Freie Universität Berlin):

Environmental Innovation, Lead Markets and Competitiveness

7th European Forum for Science and Technology

Prague 22 May 2008 (= Portoroz)

(3) Environmental Governance and Competitiveness 2004

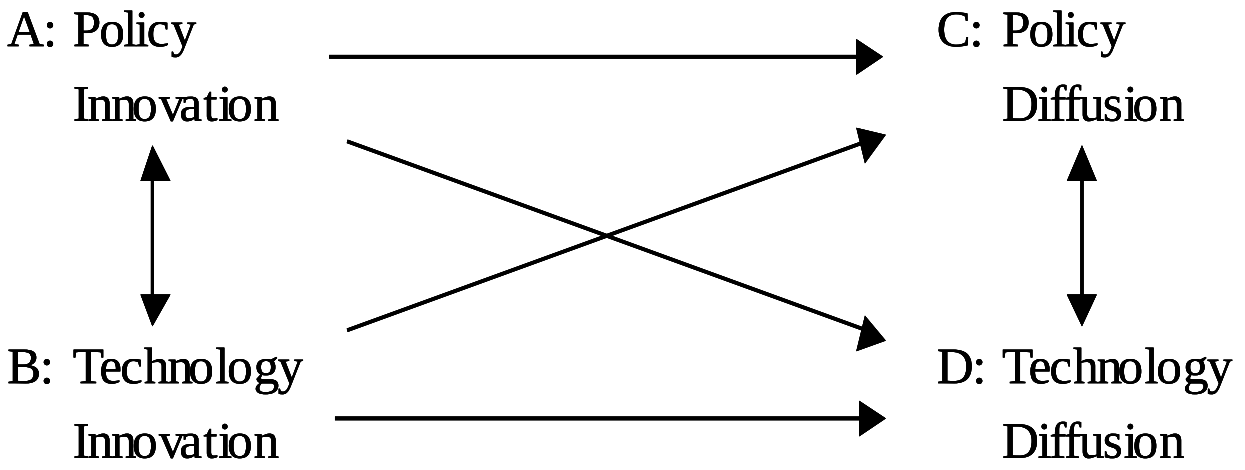
- Correlation w. Growth Competitivenes Index (+GDP/cap.) -

- Environmental Governance (x): 0.80 (0.78)
- Private sector environmental responsiveness: 0.83 (0.76)
- Participation in international environm. collaborative efforts: 0.87 (0.83)

(x) Aggregated from 12 Indicators (WEF Survey on environmental gover-nance, protected land, Local Agenda 21, environmental knowledge creat-ion, gasoline price, IUCN member org., rule of law, civil liberties etc.)

- Own compilation. Data Source: Esty et al. (2005)

Diffusion Patterns of Environmental Innovations (Jänicke / Jacob 2006)



Policy induced Diffusion

- Technology Forcing $A \Rightarrow B \Rightarrow C \Rightarrow D$
  e.g. Car Emission Standards & Technologies
- Political Initiative $A \Rightarrow B \Rightarrow D \Rightarrow C$
  e.g. Cadmium substitutes
- Political Dominance $A \Rightarrow C \Rightarrow B \Rightarrow D$
  no example yet ?

Technology induced Diffusion

- Technological Initiative $B \Rightarrow A \Rightarrow C \Rightarrow D$
  e.g. desulphurization technologies
- Technological Dominance $B \Rightarrow A \Rightarrow D \Rightarrow C$
  e.g. CHP technologies
- Autonomous Diffusion $B \Rightarrow D$
  e.g. energy efficient technologies

Eco Design and Eco-Efficient Production

- Eco design in terms of LCA provides a strong additional incentives to improve eco-efficiency of production processes.
- LCA may also highlight the fact that costs of energy and material consumption are higher than labour costs. (A tax reform increasing costs of materials and reducing labour costs should remain on the policy agenda.)
- Main environmental objectives of green design:
  * Reducing impacts of high material and energy use
  * Substitution of dangerous materials
  * Recyclability.

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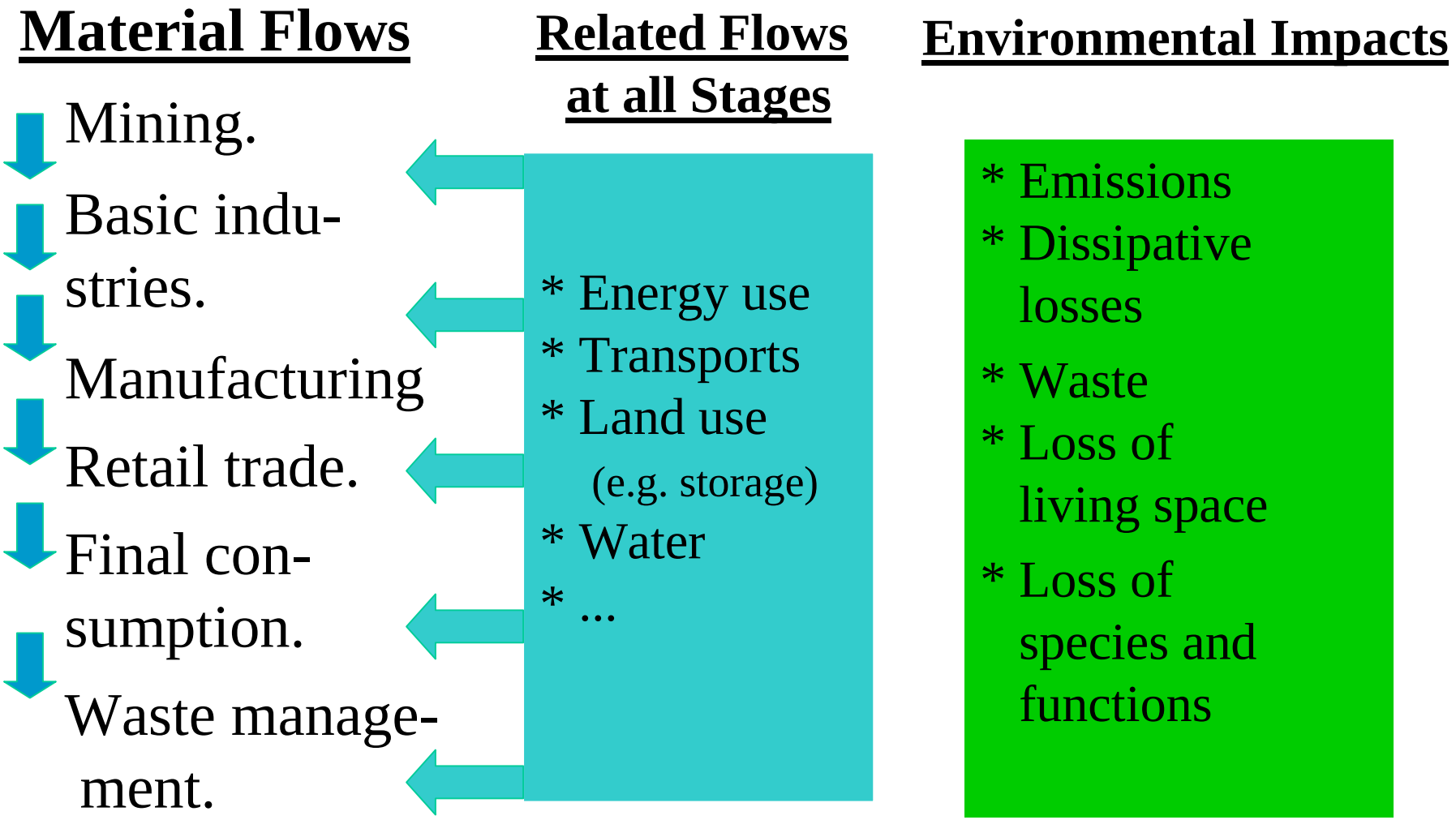
Environmental Impacts of Material Flows



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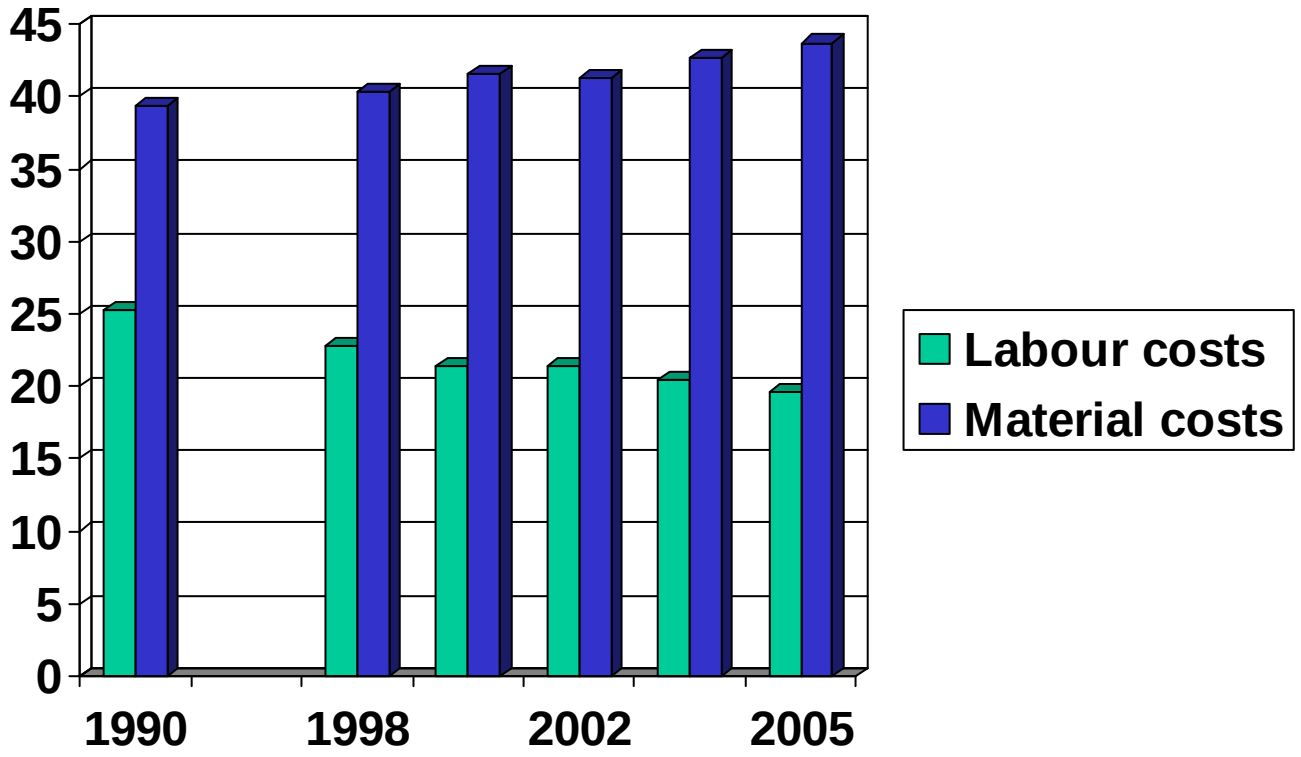
Die Entwicklung des Metallpreisindexes seit 1947

(BMU 2008: Megatrends der Nachhaltigkeit)

Labour and Material Costs of the German Industry (Statist. Jb.)



Technology Forcing (TF): Examples

- ***Definition:*** *Technology Forcing* ist im Umweltschutz die mit politischen Maßnahmen angestrebte Durchsetzung einer Technologie, die anspruchsvolle Umweltkriterien über den Stand der Technik hinaus erfüllt (BRYNER 1995, WEIDER 2007). Dabei wird davon ausgegangen, dass diese Technik ohne diese Intervention nicht entwickelt oder vermarktet werden würde.
- **US-Clean Air Act** (1970): strikte Reduktionsziele f. HC, CO, NOx

  jenseits des Standes der Technik, die allerdingas zuerst in Japan eine neue (Katalysator-)Technik erzwangen.
- Das **kalifornische Zero Emission Vehicles** (ZEV) **Programm** (1990) verpflichtete die Automobil-industrie, bis 2003 10 % ZEVs auf dem kalifornischen Markt abzusetzen. Diese Verpflichtung wurde zwar später auf Druck der Industrie aufgeweicht, hatte eine Reihe neuer Technologien zur Folge.
- Die **Euro-Normen** als antizipierbare **dynamische Standards:** eine moderate Variante des technology forcing. Der japanische **Top-Runner-**Ansatz ist die radikale Variante forcierter Technikentwicklung durch dynamische Standards.
- Auch **Zielvorgaben** können über den Stand der Technik hinaus weisen, auch Degressive Förderungen wie im EEG.
- Drängen auf Carbon Capture and Sequestration (CCS) als Quasi-Variante des TF.

- Rechtliche Möglichkeiten, den Stand der Technik zu transzendieren bestehen abgesehen vom Atomrecht ansatzweise auch Anlagenrecht (IVU-RL Art. 10), sind dort aber bisher nicht innovationspolitisch zum Tragen gekommen

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(4) Forcing Diffusion (2): Global Markets Need National Lead-Markets

- *An environmental lead market is the core of the world market where local users are early adopters of an environmental innovation on an international scale (Beise/Rennings).*
- The innovation relating to a (manifest or latent) global environmental problem, which creates a *potential* demand also in other national markets.
- As a rule environmental lead markets are created by national policy innovations (e.g. standards) which potentially diffuse into other countries.
- The diffusion of environmental policy innovations is supported both by horizontal imitation ("lesson-drawing") and by international organisations.

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Strong Role of Government

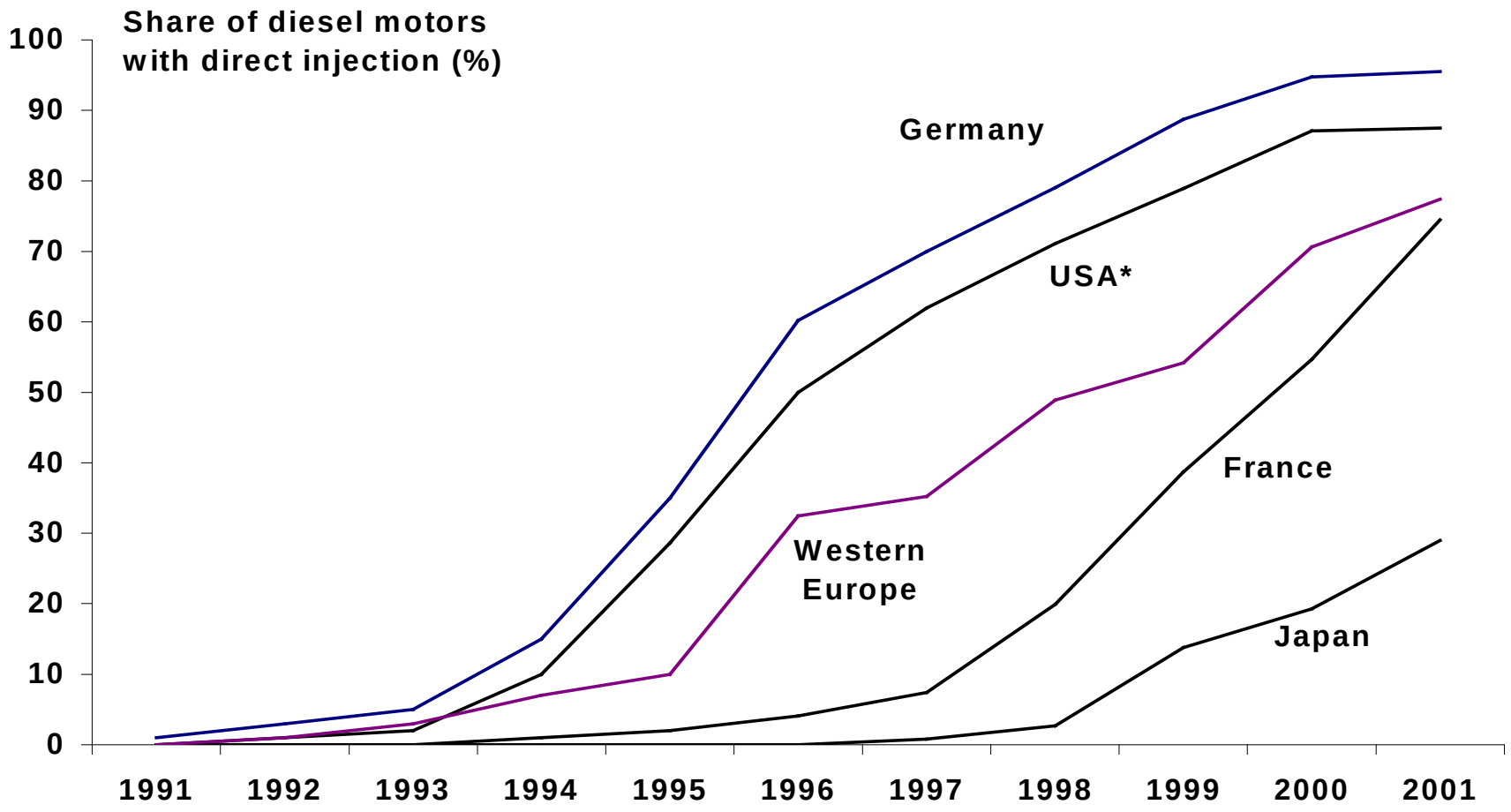
- Weak innovations may be left to the market
- Strong environmental innovations need strong government support and technology forcing:
  - national poineer policies, both domestic and in the international arena
  - greening of the innovation system
  - greening of public demand
  - market support by government regulation
  - dynamik efficiency standards and labels
  - environmental reform
  - transition management etc.

Pressure from Innovators: Regulate Me!

- **EUCETSA* (2006): "The reality is that regulation drives this industry"** (*Lobby-Organisation for environmental technology)
- **SUN MICROSYSTEMS (2006):"We want standards and market opportunities for companies that meet them".**
- **HP (2007): "We want standards to drive energy efficiency"**
- **SEEEM** (Electric motors, 2006)**: Ambitious energy standards!**
- **NOKIA (2006): "Better regulation...Provide incentives to front-runners"!**
- **EURIMA** (2006): Better insulation of houses!**
  (** European organisation for house isolation materíals)
- **PHILIPS (2005, 06): Regulation for better lighting!**

Jänicke 2007, Source: Ends Europe Daily, diff. issues

Lead Markets for fuel-efficient Diesel Cars



Source: ZEW, Bosch

* USA: predominantly light trucks

The Creation of Lead Markets

(dominant instruments)

- Desulphurization: Japan (1971, 1975: 1000 units! Standards + levy +)
- Catalytic converters for cars: Japan 1971 (standards)
- Wind energy: Denmark 1975/84, Germany 1991/99 (both: feed-in regulation; DK main exporter)
- Photovoltaic energy: Japan 1974 (Sunshine Program +), Germany 1991/99 (feed-in tariff regulation + , Japan main exporter)
- Phosphate substitutes: Germany 1975 (Detergent Act)
- CFC-free paper: Scandinavia 1991 (NGO campaign +)
- CFC-free refrigerators: Germany 1993 (NGO campaign +)
- Energy-efficient refrigerators: Denmark 1994 (policy mix)
- Fuel-eff. diesel (dir.inject.): Germany 1997/99 (taxes +).
- Energy-efficient appliances: Japan 1998 (top runner pr. +)

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Creating Lead Markets

- **<u>Specific national regulation:</u>**
  - **<u>Ambitious (dynamic) standards</u>, e. g. emission standards for cars or power stations, Top-runner programme** (Japan)**.**
    Authorisation criteria (EU: REACH, Eco-Design Directive?)
  - **<u>Feed-in tariffs</u>, e. g. the Renewable Energy Act** (Germany)
    Authorisation criteria (EU: REACH, Eco-Design Directive)**.**
  - **Labelling.**
- **<u>Supporting national regulation:</u>**
  - **Monetary instruments** (CO_2 taxes, certificates, subsidies)
  - **Green public procurement** (UK, J)**,**
  - **Green business purchases** (EMAS, ISO 14.001).
- **<u>International actions:</u> Support and use the international policy agenda** (e.g. the Renewables2004 Conference in Bonn).

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<u>Generally Policy-mix, "smart regulation", long-term targets/programmes in accordance with the international environmental policy agenda (e. g. Kyoto Protocol)!</u>

The Role of Lead Markets for Eco-efficient Technologies

Global Role:

* Providing marketable solutions for global environmental needs
* Paying R&D and learning costs until the eco-efficient technology is cheap and attractive enough to penetrate the global markets (e. g. wind energy).
* Technological signal effects: new benchmarks for the international markets
* Political demonstration effect: new models for political lesson-drawing
* Lead markets are an alternative to organised technology transfer.

Domestic Role:

* First-mover advantages
* Attractiveness of the country for eco-innovative investors
* New policy options, legitimation (role as global player)

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Eco-Innovation: German and European Perspectives

Martin Jänicke

March 25. 2008
TERI, New-Dehli

Sustainable Industrial Policy (x)

Main objectives:

- Increase of resource productivity beyond BAU
- Reduction of material/energy flows
- Substitution of material/energy flows being dangerous or leading to climate change
- „Strong“ innovation
- „Third Industrial Revolution“ (Barroso)
- „Sustainable Growth“ (Ekins et al.)
- Changing products and production processes.

(x) Synonyms: „Ecological industrial policy“ (Gabriel), „Ecological modernisation“, „Greening of industry“

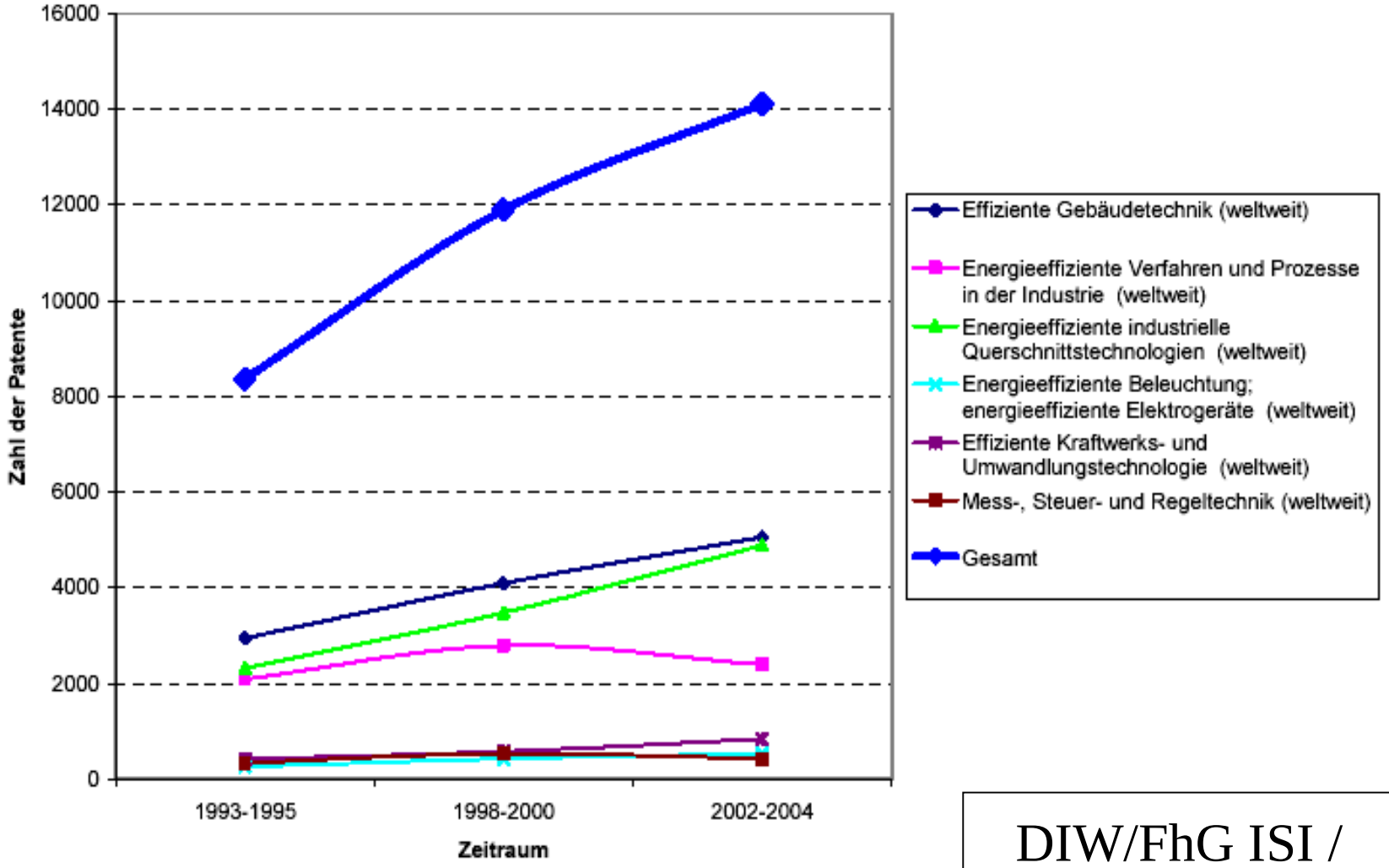
Definitions

Industrial Policy, Mid-term Review: In the **mid-term review of industrial policy**, the European Commission identifies that globalization and technological change are likely to intensify in the coming years. Furthermore industry needs to adapt to the challenges posed by climate change and to grasp the opportunities of new low- energy and resource saving processes and products. Based on the assessment of the current situation, and building on the achievements since 2005, the Commission envisages **strengthening some of the ongoing initiatives and launching some new initiatives** in response to recent challenges. The Sustainable Industrial Policy Action Plan is one of the new initiatives called for.

Sustainable Consumption and Production (SCP): Addressing social and economic development within the carrying capacity of ecosystems and decoupling economic growth from environmental degradation. In practice, SCP is about changing the ways we design, produce, distribute, use and dispose of goods and services, minimising the overall environmental impact taking a life cycle perspective.

Eco-efficiency: Joint analysis of the environmental and economic implications of a product or technology. It chooses the method for production, service, disposal or recovery that is most ecologically and economically efficient, ensuring optimum conservation of resources, minimum emissions and waste generation at a minimum cost. In short: assessing the overall environmental impact per cost. (EU-Com. 2007, Annex IV)

(2) Energy Efficiency: Global Patent Dynamics 1993-2004



DIW/FhG ISI / Roland Berger 2006

Quelle: Fraunhofer-ISI

The Neo-classical Paradigm Has Failed in Environmnental Policy

- No „Race to the bottom“ (RTB)
- No serious negative impact on competitiveness
- However: high correlation between strict environmental policy and competitiveness; „environment“ has become an issue in the competition for innovation.
- Deregulation may be sometimes necessary but has not contributed to environmental innovation as promised
- Voluntary agreements have been sometimes usefull but often they are neither effective nor efficient (OECD, ...)
- Cost-benefit analysis of policy measures - according to recent studies - tend to ignore eco-efficient innovation as potential „by- product“: The resulting overestimation of costs leads to a pessimistic view of government policy which is essentially wrong (Zeddies 2006, Oosterhuis 2006, IEA 2007). **Jänicke 2007**

(5) European EPAs on „Good Environmental Regulation“

A „modern approach to regulation can:

- **reduce costs for industry and business**
- **create markets for environmental goods and services**
- **drive innovation**
- **reduce business risk and increase the confidence of the investment markets and insurers**
- **assist competitive advantage...**
- **create and sustain jobs**
- **improve the health of the workforce and the wider public**
- **protect the natural resources on which business and we all depend“ (EEA 2005).**

Regulatory Drive for Energy Efficient Products

- **Rapid diffusion of minimum energy performance standards (MEPS) for electric appliances.** Some 51 countries already having, additional 26 developing MEPS (OECD 2006)**.**
- **Japan: Top-Runner Programme, 1999 (>20 Products)**
- **EU: Eco-Design Directive, 2005** (14 +6 products)
- **USA: Several MEPS, Energy Policy Act, 2005**
- **Obligatory fuel-efficiency standards for cars:**
  - **Japan (1999, 2006)**
  - **California: (2002, *Global Warming Bill),***
  - **China (2004)**
  - **Taiwan, Süd-Korea**
  - **EU (2008)**

(5) Theory of Regulatory Capitalism

- “The notion of regulatory capitalism…rests on a new division of labour between state and society, on the proliferation of new regulatory agencies, on new technologies and instruments of regulation, and on the legalization of human interactions. Regulatory capitalism is a technical as much as a political order”.
- „Smart regulation“: „highly sophisticated” and “knowledge-embedded instruments are one of the defining characteristics of the new order”.
- “These regulations are shaping a new global order that reflects the set of problems and solutions that were socially and politically constructed in some dominant countries” (Levi-Faur, 2005, 13, 21-22, see also Jordana / Levi-Faur, 2004).

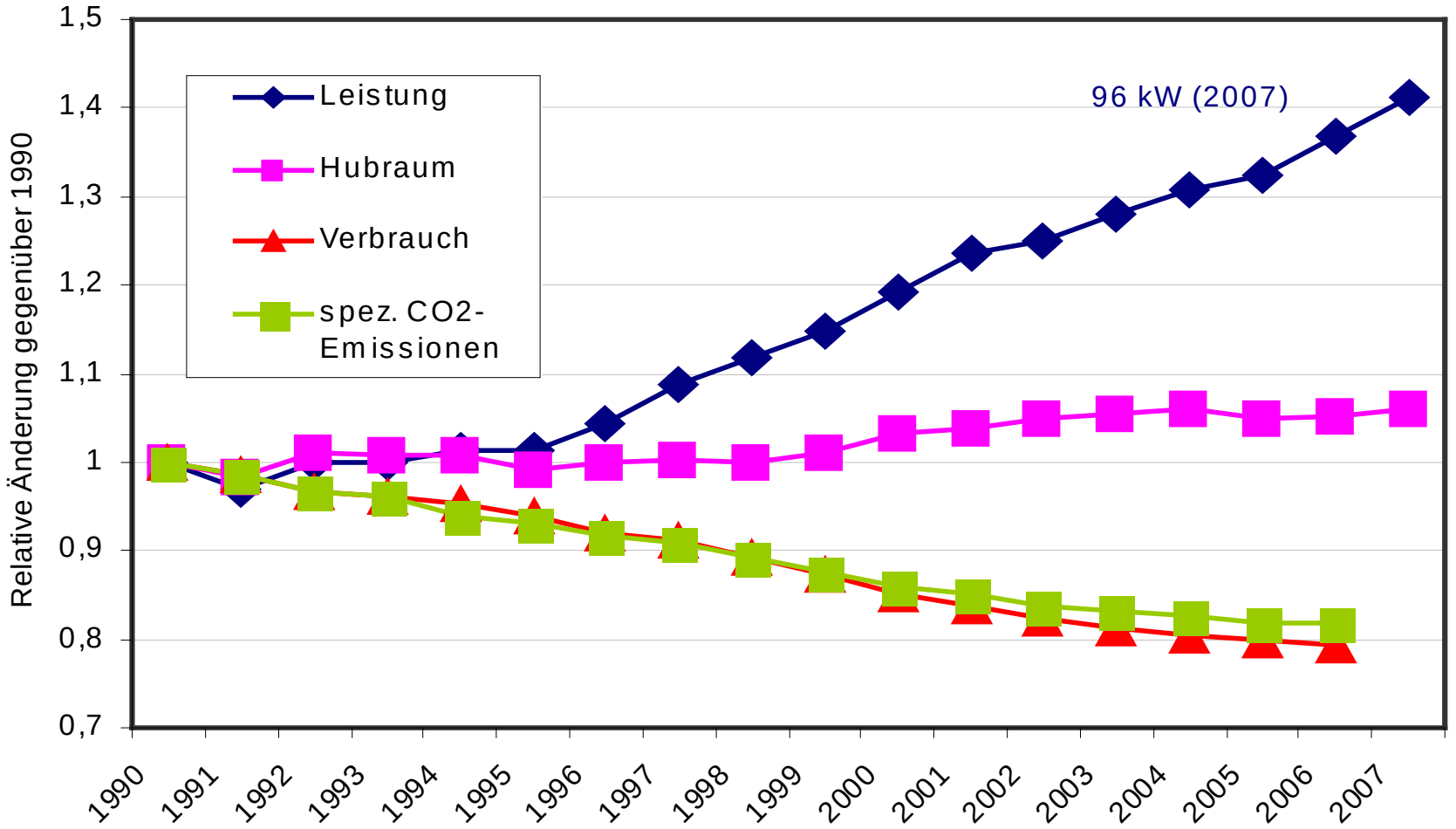
Martin Jänicke
(Freie Universität Berlin,
German Advisory Council on the Environment):

The Policy Design of Environmental Innovation and Sustainable Production

Bridging the Gap – Responding to Environmental Change – From Words to Deeds

Portoroz, Slovenia, 14-16 May 2008

Kompensation höherer Energieeffizienz durch Verbrauchststeigernde Entwicklungen im PKW-Design Deutschlands (1990-2007):



Quelle: SRU 2008 nach: EUROPÄISCHE KOMMISSION 2006f, S. 12; ACEA (EUROPEAN AUTOMOBILE MANUFACTURES' ASSOCIATION) 2008; BMU o. J.

EU-Com: Sustainable Industrial Policy

- “The Sustainable Industrial Policy (SIP) aims at fostering market penetration for products that will make a difference in terms of energy efficiency and consumption” (Annex V).
- Simulation: “making the current product policy more ambitious through SIP will have positive results on the economy”, “improving energy efficiency by 10% (EUP simulation) could induce an extra growth of GDP of 0.4%” (Annex V)
-

Definitions

Sustainable Industrial Policy: "… globalization and technological change are likely to intensify in the coming years. Furthermore industry needs to adapt to the challenges posed by climate change and to grasp the opportunities of new low- energy and resource saving processes and products" (EU-COM 2007)

"The Sustainable Industrial Policy (SIP) aims at fostering market penetration for products that will make a difference in terms of energy efficiency and consumption"(EU-COM 2007)

2008: The Sustainable Industrial Policy Action Plan.

Sustainable Consumption and Production (SCP): "Addressing…decoupling economic growth from environmental degradation…SCP is about changing the ways we design, produce, distribute, use and dispose of goods and services, minimising the overall environmental impact taking a life cycle perspective".

Table3.1.2 Comparison of Innovation Observed

Case Study	Country or Area	Policy Result in Inducing Innovation	Policy Type				Innovation Type Experienced		
			Market Based	Regulation	Voluntary	Information Based	End of Pipe	Process Integrated	Product Innovation
1	Europe	*Medium*			X				X
1	USA	*Poor*		X					X
1	Japan	*Good*	X	X		X			X
2	Europe	*Poor*			X[13]				X
2	USA	***Excellent***	X	X					X
2	Japan	***Excellent***	X	X		X			X
3	Germany	*Good*	X						X
3	Japan	***Excellent***	X	X					X
3	UK	*Poor*	X	X					X
4	Various	*Unclear*		X			X	X	
5	Sweden	*Good*		X					X
5	Denmark	*Good*	X						X
5	USA	*Good*		X				X	
5	Germany	***Excellent***		X				X[14]	

Source: Ekins /Venn (psi) 2006

The Impact and Effectiveness of Various Climate Policy Instruments (IPCC 2007, III)

Table TS.11 The impact and effectiveness of various policy instruments aimed to mitigate GHG emissions in the buildings sector

Policy instrument	Effectiveness*	Cost-effectiveness	Policy instrument	Effectiveness*	Cost-effectiveness
Appliance standards	High	High	Tax exemptions/ reductions	High	High
Building codes	High	Medium/ High	Public benefit charges	Medium/High	High
Procurement regulations	High	Medium	Capital subsidies, grants	Medium/ High	High/ Medium
Energy efficiency obligations and quotas	High	High	Mandatory labelling and certification	High	High
Demand-side management programs	High	High	Voluntary labelling and certification	Medium /High	Medium
Energy performance contracting/ ESCO support	High	Medium	Voluntary and negotiated agreements	Medium	Medium
Co-operative procurement	High	High	Public leadership programs	High	High
Energy efficiency certificate schemes	High	High	Education and information programs	Medium/High	High
Kyoto Protocol flexible mechanisms	Medium	Medium	Mandatory audit and energy management	High, but variable	Medium
Taxation (on CO_2 or fuels)	Generally low	Medium	Detailed billing and disclosure programs	Medium	Medium

EU Lead-Market Initiative

- Lead-market initiative of the EU focusing on four eco-innovative markets: sustainable construction; recycling; bio-based products; and renewable energies. These sectors are highly innovative; supported by well characterised customer needs; have a strong technological and industrial base in Europe; and depend on the creation of favourable framework conditions by public policy.

Figure 1 Model and examples of environmental policy approaches (Jänicke 1984, 1995)

Curative approaches			Preventive approaches	
	Repair: Reduction / compensation of damage	*End-of-pipe treatment*: Clean-up technology	*Ecological modernization*: Clean(er) technology / Eco-efficiency	*Structural change*: Decrease of "dirty" industries / activities
Examples	Payments for noise damage	Passive noise protection	Less noisy motors	Alternative traffic modes, less traffic
	Ex-post measures against forest damage	Desulfurization of coal power stations	More efficient power production and consumption; CHP; cleaner primary energy	Less power-intensive modes of production and consumption
	Measures against damage caused by industrial waste	Waste incineration	Recycling	Reduction of waste-intensive sectors

Greening the Economy: Forcing Eco Innovations:

Martin Jänicke

Feb. 16. 2008
Heinrich-Boell-Stiftung, Barcelona

* Governments Claiming Leadership in Energy Efficient Technology

- EU Commission: „to become world leader in renewable energy“ and „the world‘s most energy-efficient region“ (2006)
- Japan: „Developing the world‘s best energy-efficient appliances“ (Slogan of the Top Runner Programme, 2002)
- „...Norway shall be...world leading (in) environmental friendly energy“ (Minister Enoksen Nov. 2005)
- Finnish govt. commission: make the country “one of the most eco-efficient and competitive societies“ in 2025 (2005)
- Blair (2004): Britain „will take the lead“ in climate Policy, similar Germany (2005/6) and Sweden.
- Scharzenegger: California to become „world leader“ of climate policy (2006).
- PM Ahern: Make Ireland an „world leader...in the areas of renewables...and energy efficiency“ (2006).

Strong Environmental Innovation - an Ambitious Concept

Specifics:

- **Rapid diffusion** and broad penetration of national and global markets
- **Strong environmental Effects:** Absolute de-coupling
- **High resource efficiency**: towards a less ressource-intensive, highly competitive model of production and consumption.

Objectives:

- **Speeding up** technological progress („technology forcing“)
- **Greening of industry**: Changing the direction of technological progress
- Green Innovation as **long-term process** comparable the increase of lab our productivity

(5)Regulation: A*dvantages* for Enterprises:

- **Regulations provide a standardized information about problems, solutions and the probable behaviour of competitors or clients**
- **Regulation can create or support markets for domestic industries**
- **Regulation increases the calculability of markets.**
- **Regulation can make things easier for enterprises:**
  - Contrary to voluntary agreements they have security that competitors will do the same.
  - Reduction of internal problems of the company to implement technical changes.
  - The necessary changes within the value chain will be easier.

(6) „Smart“ Environmental Regulation: Examples

- The Japanese Top-Runner Programme (1999, 2002)
- The EU emission trade system
- The German obligatory feed-in tariffs
- The EU „Eco-design“ directive for energy using products
- The UK System of Climate Change Agreements

Smart Environmental Regulation: the Japanese Top-Runner-Programme 1998

- “Developing the world’s best energy-efficient appliances”
- METI regulation for more than 20 energy using products
- The “top runner” regarding energy efficiency becomes the basis of the product standard (weighted average)
- Efficiency standard mandatory for producers and importers in the target year
- Name and shame as a intermediate instrument
- Combined regulations (Green Procurement Law, 2001, annual awards for energy efficient products).
- The fulfilment of the standards “very positive” (SEPA): several products achieve the standard before the target year (air conditioners, cars, computers, videotape recorders).
- Producers confirming increased competitiveness.
- Strong motor for technological innovation and diffusion.

Governance for Environmental Innovations

Case Study	Country or Area	Policy Result in Inducing Innovation	Policy Type				Innovation Type Experienced		
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5	Germany	***Excellent***		X				X[14]	

Source: Ekins /Venn (psi) 2006

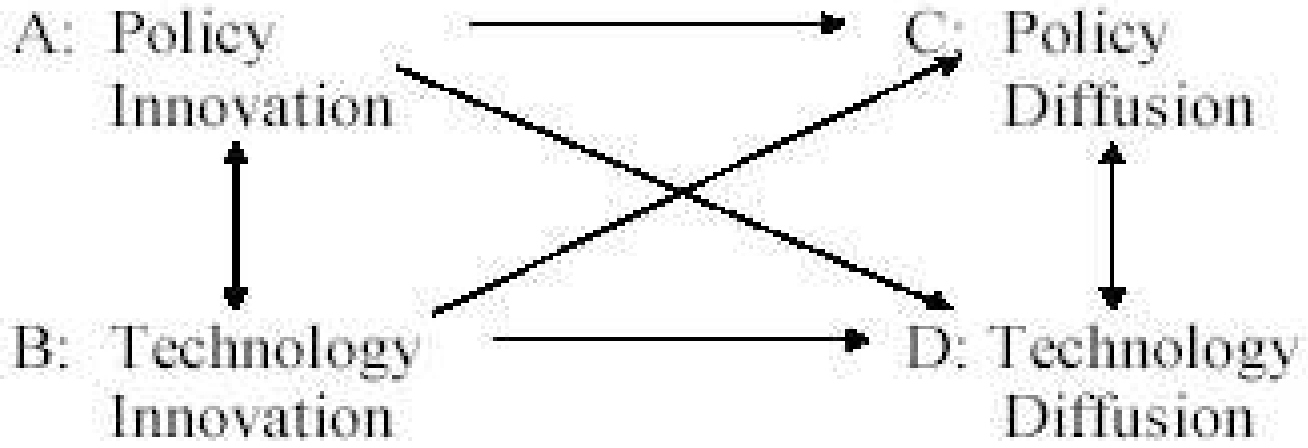
(8) Do We Need Environmental Regulation?

- **IEA** on energy efficiency regulations:

  „It is apparent that industry is increasingly willing...However governments need to take a lead in developing policies“ (IEA 2007, 13).

- „Government support […] is important for effective technology development, innovation and deployment. […] Governments have a crucial supportive role in providing […] institutional, policy, legal and regulatory frameworks […] without which it may be difficult to achieve emission reductions at a significant scale“ (IPCC 2007, III, p 31)

(4) The Interrelation between Policy and Technology Innovation



Policy induced Diffusion

Technology Forcing (A⇒B⇒C⇒D): e.g. US-Car Emission Standards (1970)

Political Initiative (A⇒B⇒D⇒C): e.g. Cadmium substitutes

Political Dominance (A⇒C⇒B⇒D): no example yet?

Technology induced Diffusion

Technological Initiative (B⇒A⇒C⇒D): e.g. wind energy

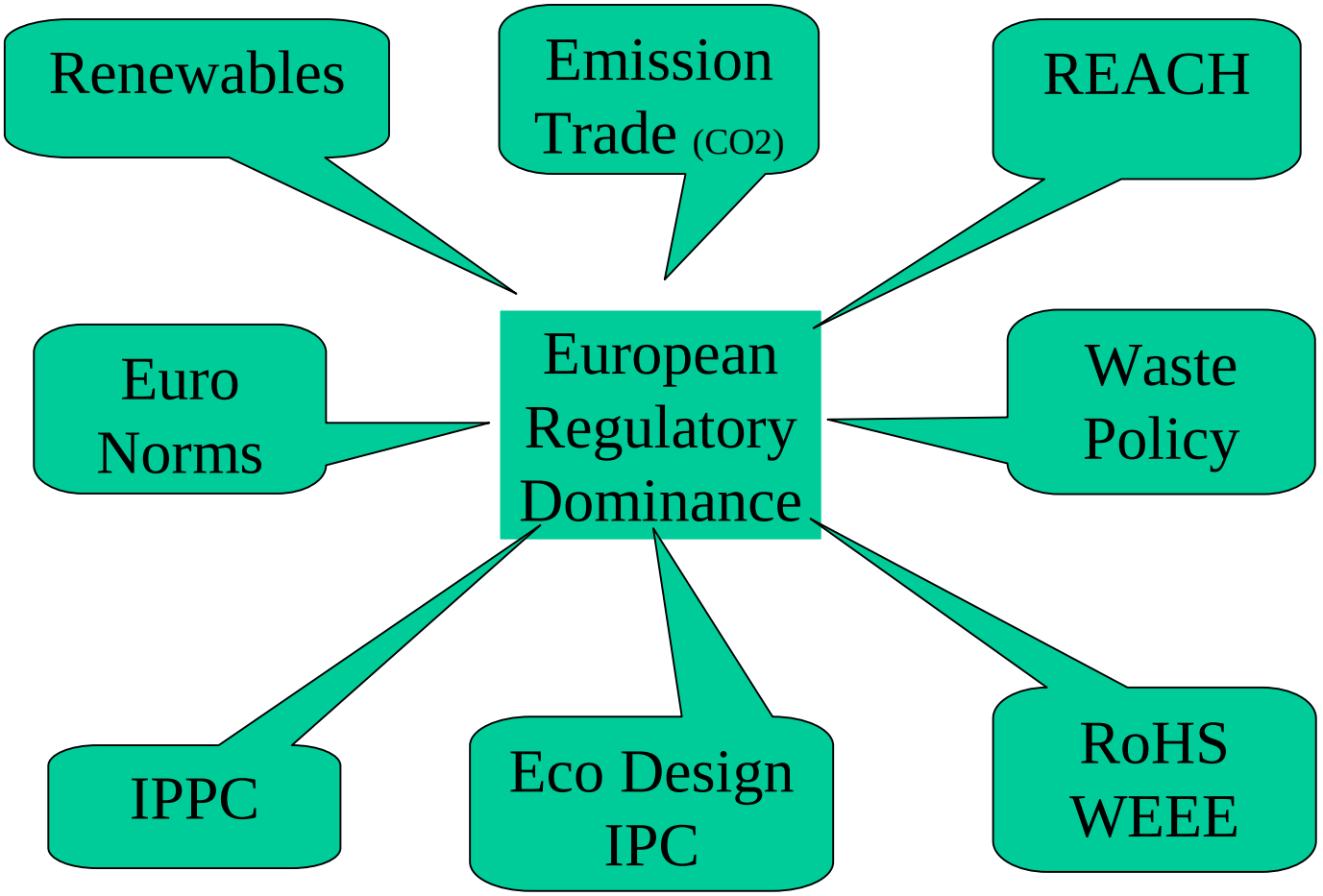
Technological Dominance (B⇒A⇒D⇒C): e.g. CHP Technologies

Autonomous Diffusion (B⇒D): e.g. Incremental improvements of energy efficiency

Regulation and Capitalism

- Hegel: The more a society relies on individual egoism, the more regulation it needs
- Max Weber: The calculability of market conditions crucial

EU: A Green Regulatory Hegemony



Main Exception:
MEPS/Top Runner

M. Jänicke 2007

Innovation-friendly Environmental Governance

Instruments *are innovation-friendly if they ...*

- *provide economic incentives,*
- *act in combination,*
- *are based on strategic planning and goal formulation,*
- *support innovation as a process and take account of the different phases of innovation/diffusion.*

A ***policy style*** *is innovation-friendly if is is ...*

- *based on dialog and consensus,*
- *calculable, reliable, and has continuity,*
- *decisive, proactive, and demanding,*
- *open and flexible,*
- *management-oriented.*

A ***configuration of actors*** *is innovation-friendly, if ...*

- *it favours horizontal and vertical policy integration,*
- *the various objectives of regulation are networked,*
- *the network between regulator and regulated is a tight one,*
- *the relevant stakeholders are included in the network.*

Source: Jänicke et al. 2000

* Proclaimed Leadership in Energy Efficient Technology

- **EU Commission: „to become world leader in renewable energy“ and „the world‘s most energy-efficient region“ (2006)**
- **Japan: „Developing the world‘s best energy-efficient appliances“ (Slogan of the Top-runner Programme, 2002)**
- **„...Norway shall be...world leading (in) environmental friendly energy“ (Minister Enoksen Nov. 2005)**
- **Finnish government commission: make the country “one of the most eco-efficient and competitive societies“ in 2025 (2005)**
- **South Korean government: “…objective of becoming one of the key countries” in environmental technology by 2010 (2003)**
- **Blair (2004): Britain „will take the lead“ in climate Policy, similar Germany (2005) and Sweden.**
- **Scharzenegger: California to become „world leader“ of climate policy (2006).**

Risks Facing Energy Sector Investments

(Source: EEDP BP 06/02, IEA 2003)

Economic risk	Market risk	• Inadequate price and/or demand to cover investment and production costs • Increase in input cost
	Construction risk	• Cost overruns • Project completion delays
	Operation risk	• Insufficient reserves • Unsatisfactory plant performance • Lack of capacity of operating entities • Cost of environmental degradation
	Macroeconomic risk	• Abrupt depreciation or appreciation of exchange rates • Changes in inflation and interest rates
Political risk	Regulatory risk	• Changes in price controls and environmental obligations • Cumbersome administrative procedures
	Transfer-of-profit risk	• Foreign exchange convertibility • Restrictions on transferring funds
	Expropriation or nationalization risk	• Changing title of ownership of the assets
Legal risk	Documentation or contract risk	• Terms and validity of contracts, such as purchase/supply, credit facilities, lending agreements and security/collateral agreements
	Jurisdictional risk	• Choice of jurisdiction • Enforcement risk • Lack of a dispute-settlement mechanism
Force majeure risk		• Natural disaster • Civil unrest • Strikes