

Great transformation towards a (global) low carbon economy

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Berlin, April 2013

1. Low carbon transformation: How fast? Why „Great Transformation“?
 2. Can we manage the transformation/ solve the problem? Five good news, five big challenges
 3. Three transformation areas are key: energy, urbanization, land use
 4. Drivers of the low carbon transformation ... Co-evolution, tipping points and the social contract for sustainability
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„We simply can't scale up the existing growth patterns“ (Michael Spence)

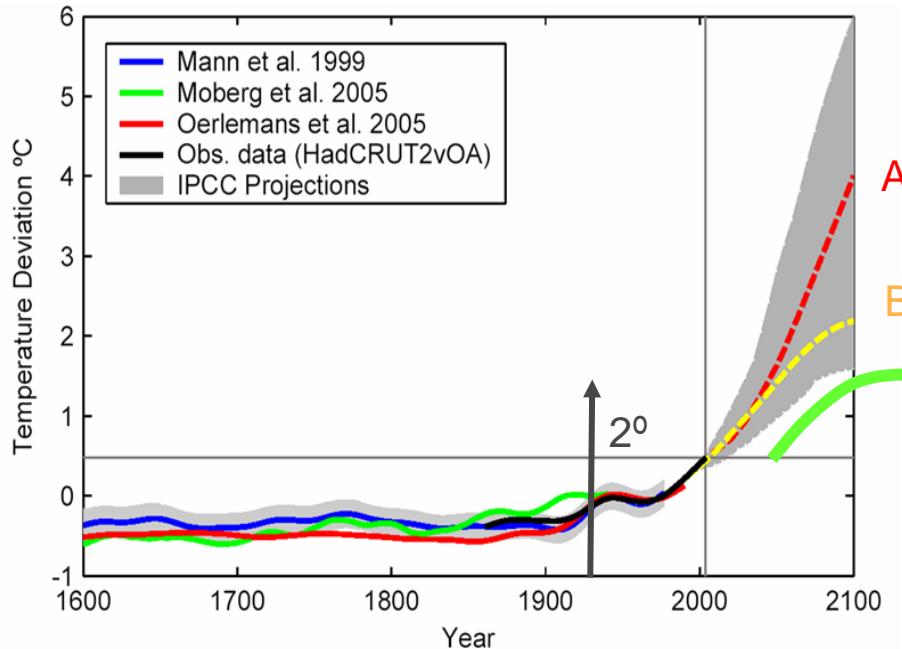
- 9 billion people in 2050
- Global GDP of 60 trillion US % (2010) ... 180 trillion US \$ 2030/40
- Growing global middle classes
- Impacts of dangerous climate change are well known
- 750 Gt Budget
- Planetary boundaries

	SIZE OF THE MIDDLE CLASS, REGIONS (millions of people and global share)					
	2009	2020	2030			
North America	338	18%	333	10%	322	7%
Europe	664	36%	703	22%	680	14%
Central & South America	181	10%	251	8%	313	6%
Asia Pacific	525	28%	1740	54%	3228	66%
Sub-Saharan Africa	32	2%	57	2%	107	2%
Middle East & North Africa	105	6%	165	5%	234	5%
World	1845	100%	3249	100%	4884	100%

Source: Kharas and Gertz (2010)

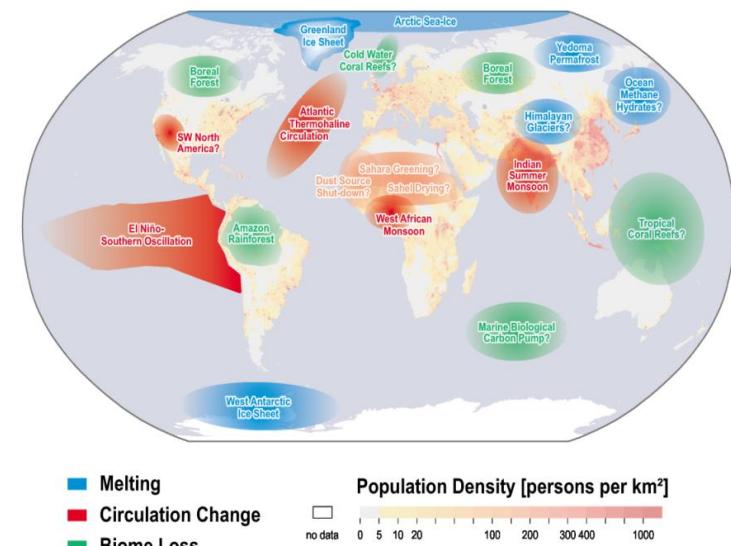
21st Century: the era of the global commons

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„Biggest challenge for international governance, ever.“ (Tom Schelling)

Tipping Points

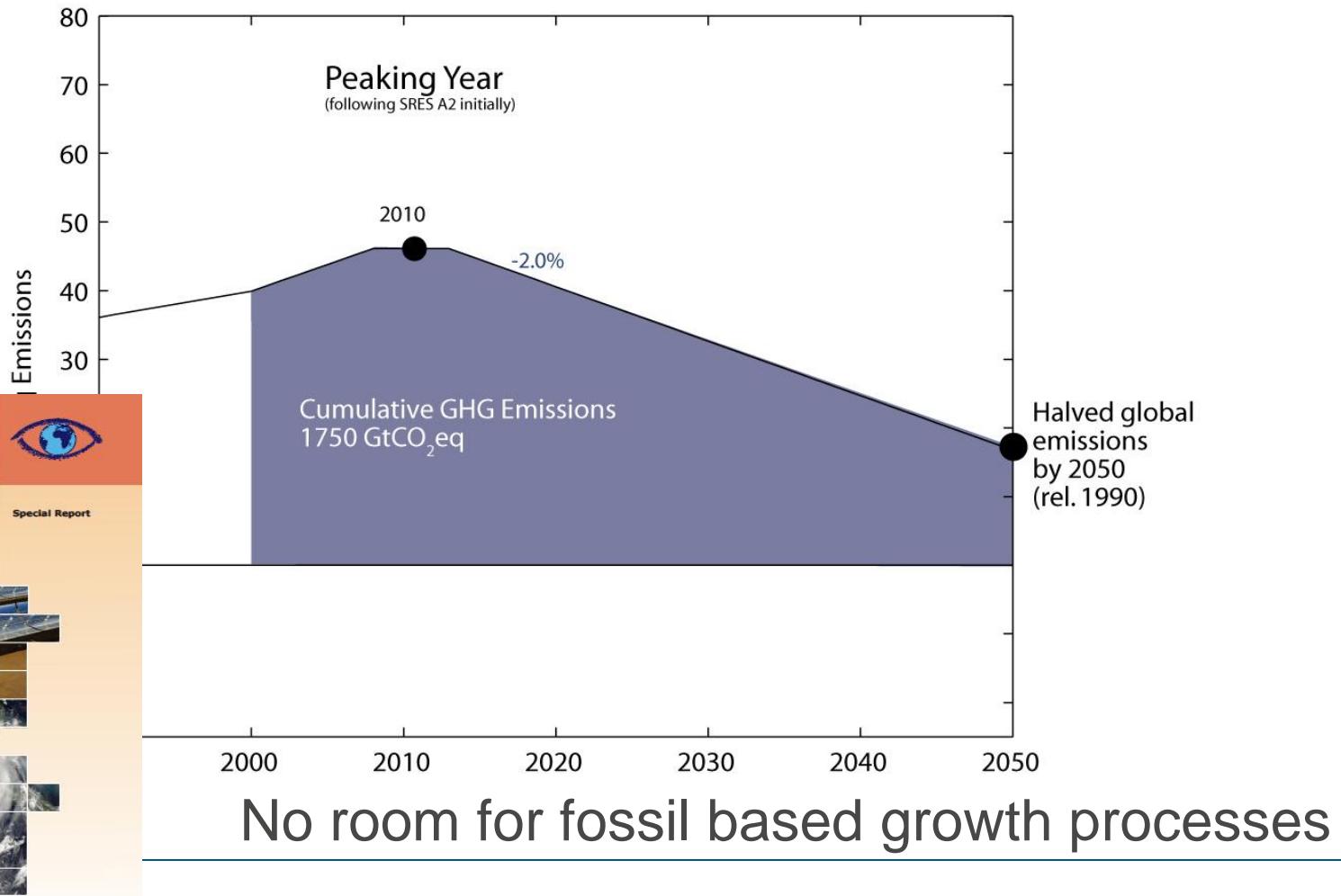


Planetary boundaries

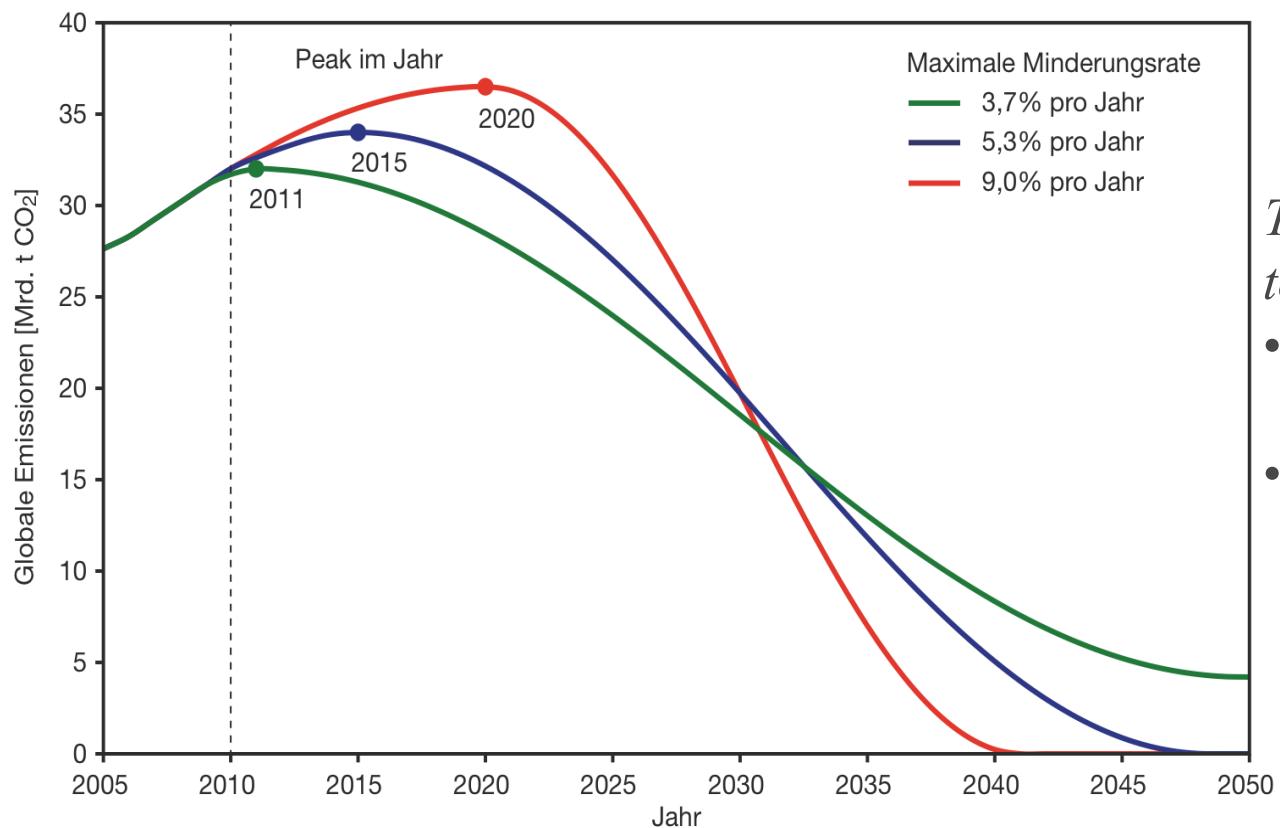
Global greenhouse gas budget: 750 Gt

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... exhausted in 20 years (emissions at current levels)



750 Gigatons – Huge time pressure



*Transformation needs
to be global:*

- *2,5 t per capita 2010 - 2050*
- *110 countries beyond 2 tons*

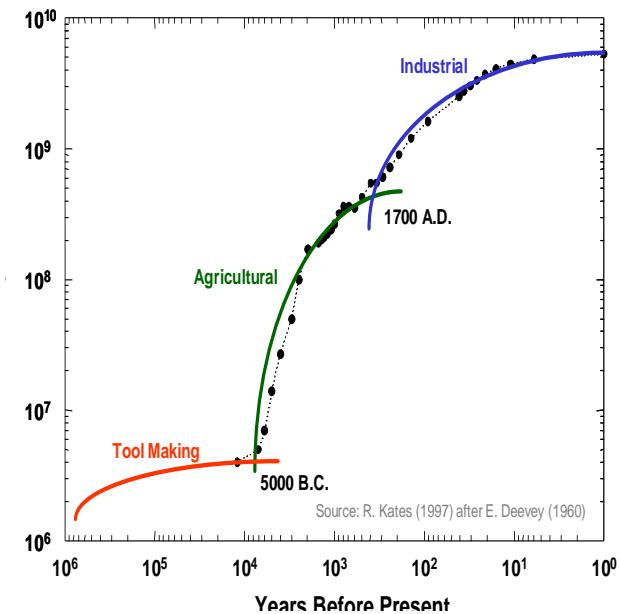
Great transformations in the history of human mankind

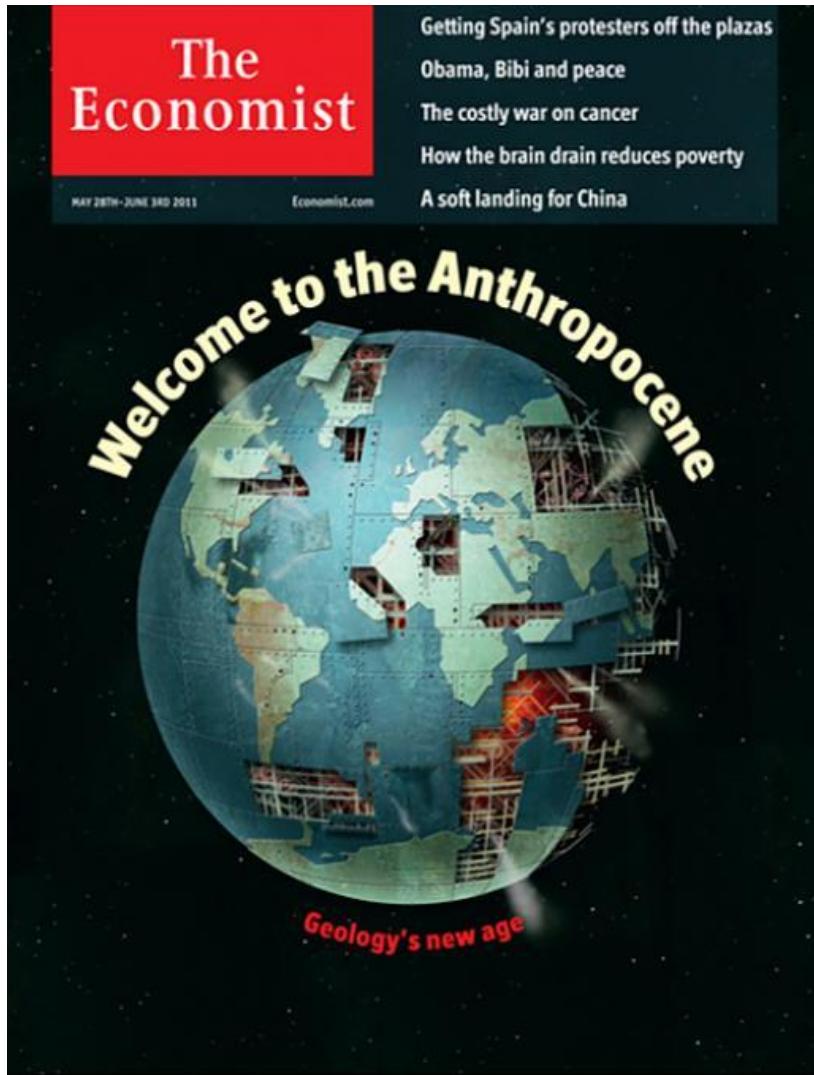
History

- Neolithic revolution ... emergence of agriculture
- Industrial revolution – The fossil energy era

Present Transformation

- Low carbon „within“ the 750 Gt budget
- Planetary boundaries/ anthropocene
- Global
 - ... needs to be managed/ organized:
new social contract
 - new business model for the global economy





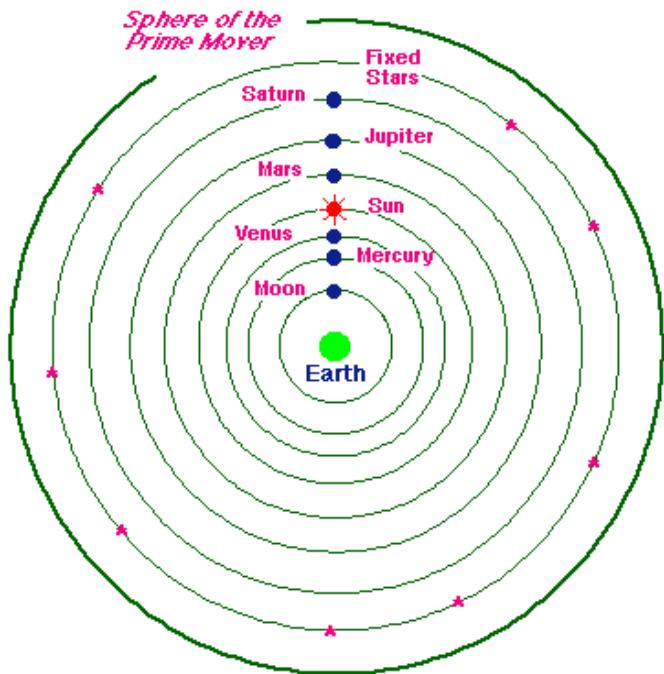
Seit Ende des 20./ Beginn des
21. Jahrhunderts: Mensch als
dominierende Kraft
im Erdsystem (Paul Crutzen)

Herausforderungen:

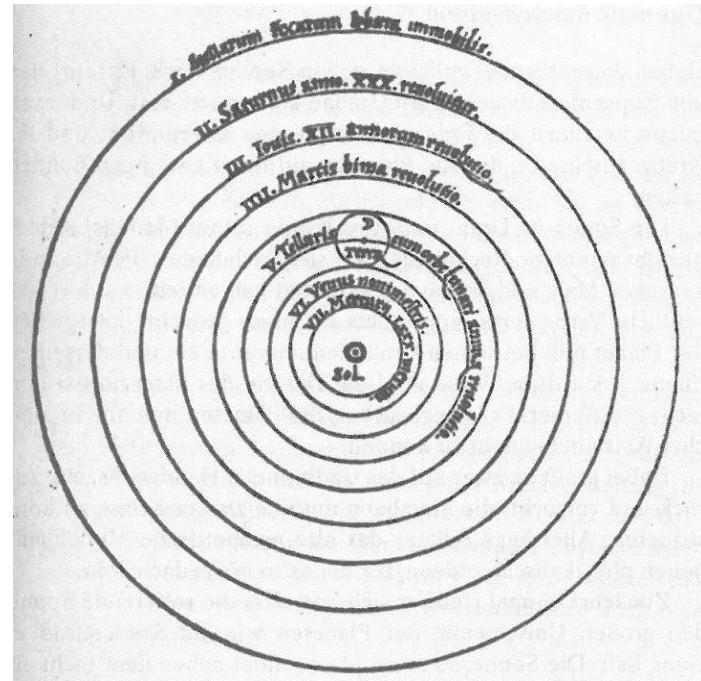
- Erdsystemverantwortung – neues Weltbild (Faktor X > Globalisierung gestalten)
- Zeitskalen (lebende Generationen, zukünftige Generationen, Zeitskalen des Erdsystems)
- 9 Mrd. Menschen, Weltbürgergesellschaft , wechselseitige Verwundbarkeiten, Wohlstand im Anthropozän

From Aristotiles to Copernikus

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Aristotiles' world view (384-322 before Christus)



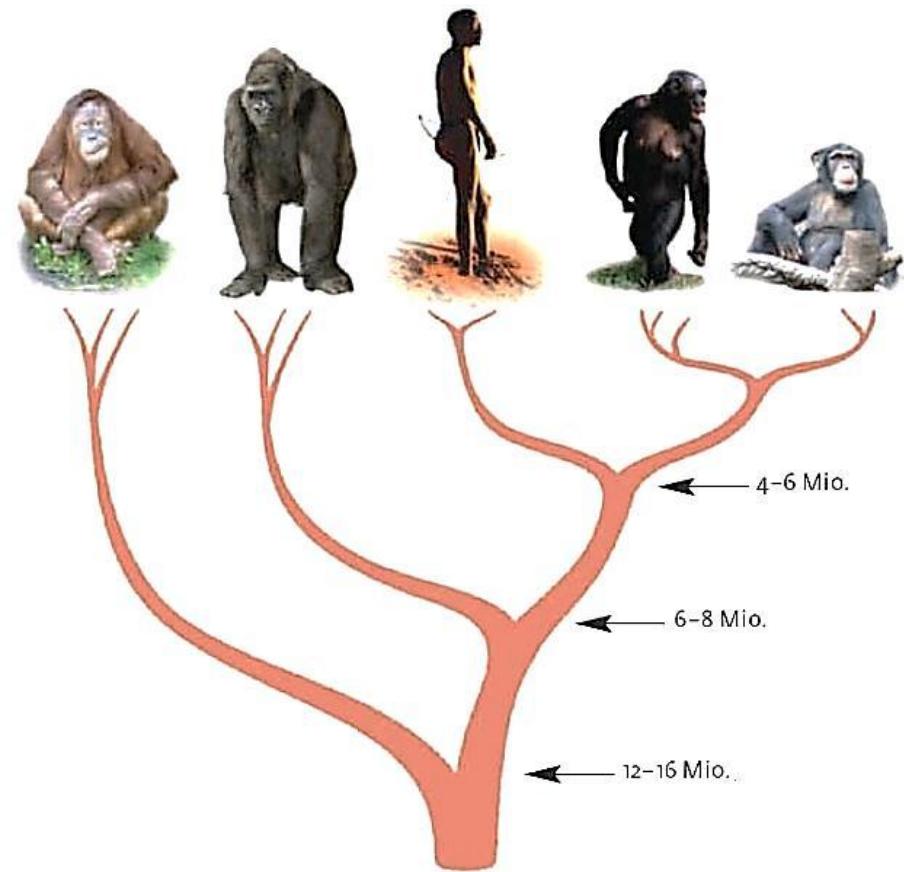
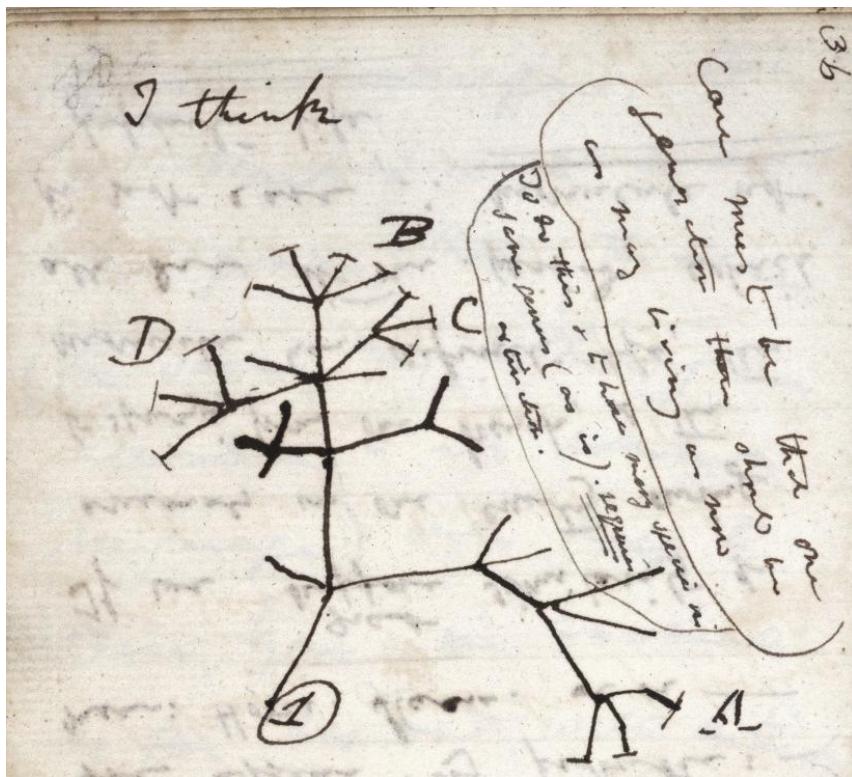
Copernicus' world view (1543)

Source: „Das Weltgeheimnis“, Thomas de Padova

Charles Darwin:

Humans as part of the evolutionary process ... challenging religion

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Darwin's first sketch of the tree of life, found in one of his notebooks from 1837.

Genealogy of hominoids

© Ian Tattersall

The 1990s beginning of a new global era – next stage of evolutionary complexity

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New globalization
Power shifts/ post western

Planetary boundaries/ Anthropocene
Global communication infrastructures

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THE AMERICAN ECONOMIC REVIEW

MARCH 1999

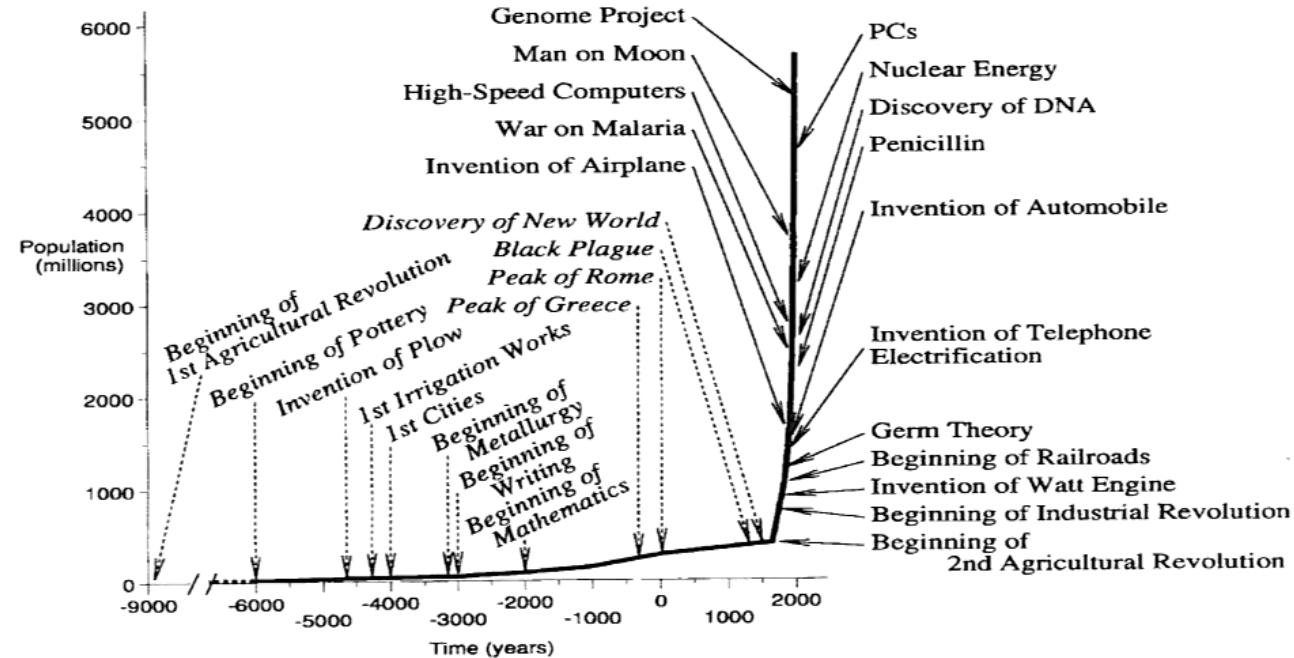


FIGURE 1. THE GROWTH OF THE WORLD POPULATION AND SOME MAJOR EVENTS IN THE HISTORY OF TECHNOLOGY

Notes: There is usually a lag between the invention of a process or a machine and its general application to production.
“Beginning” means the earliest stage of this diffusion process.

Sources: Carl W. Bishop, 1936; T. K. Derry and T. I. William, 1960; Graham Clark, 1961; B. H. Slicher von Bath, 1963; Stuart Piggott, 1965; Glenn T. Trewartha, 1969; William McNeill, 1971; Jacob Bronowski, 1973; Carlo M. Cipolla, 1974; B. M. Fagan, 1977. See also E. A. Wrigley, 1987; Robert C. Allen, 1992, 1994.

Acceleration of innovation
Fossile driven
Nation states
Enlightment/ HR/ democracy
Step by step internationalization
Western driven/ North-South

Drivers of transformations – learning from the past

„Vision“: better future, normative perspectives

Abolition of slavery, European Union

„Technology“: Rapid diffusion of innovations

IT-revolution

„Crisis“

Structural adjustment programmes, financial market reforms after 2008

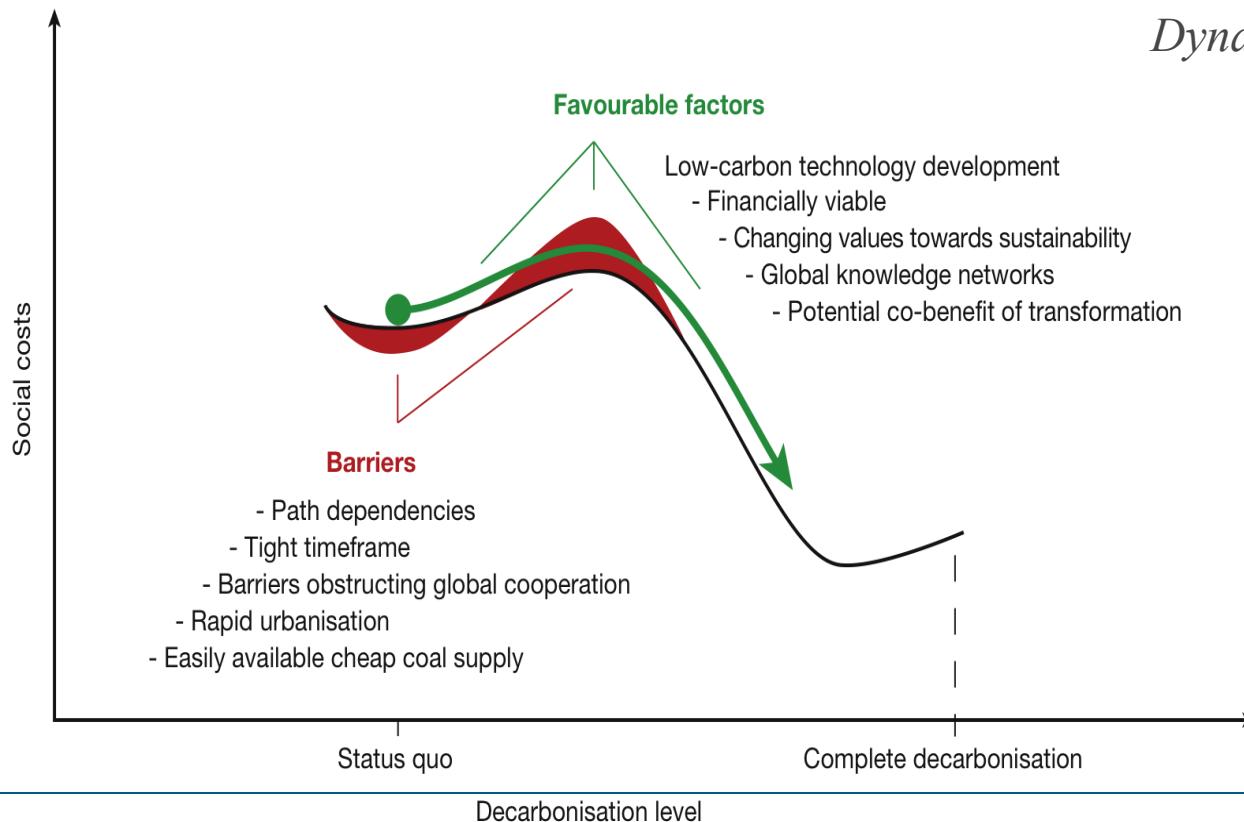
„Knowledge“: research driven, precautionary principle

Protection of the ozone layers

Where do we stand?

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Five good news ... five major challenges



*Technology assessment
Costs
Policy options
Dynamics of the transformation*

What needs to be transformed?

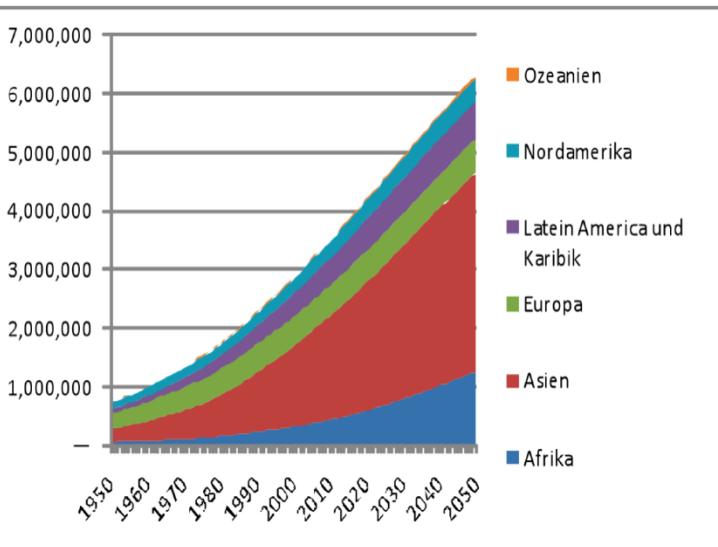
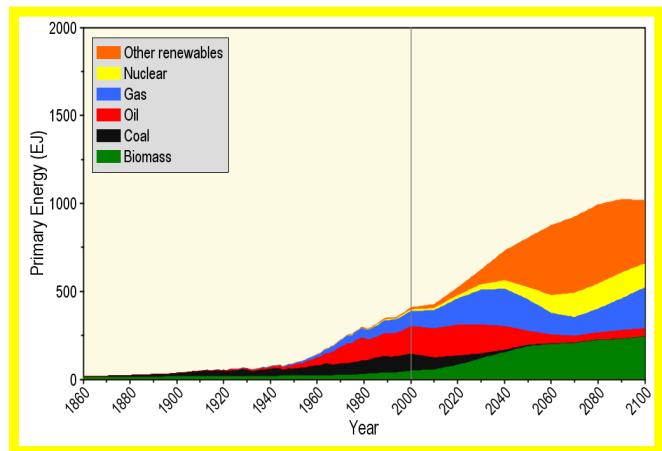
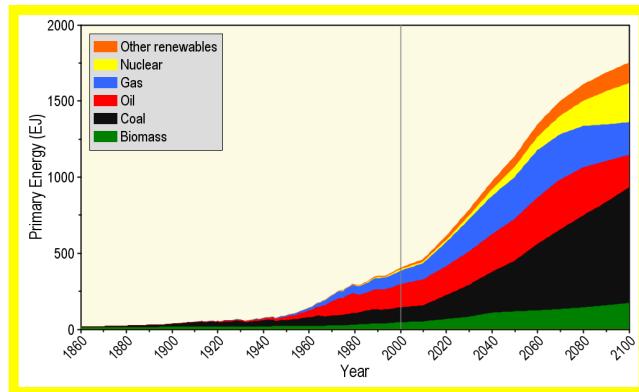
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Three transformation areas: basic structures of the global economy

Energy

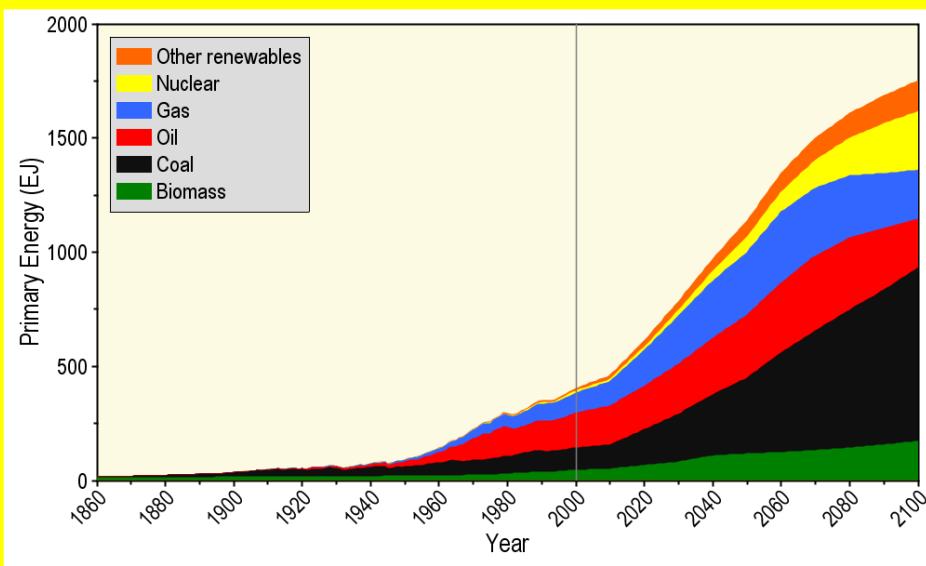
Urbanization

Land use

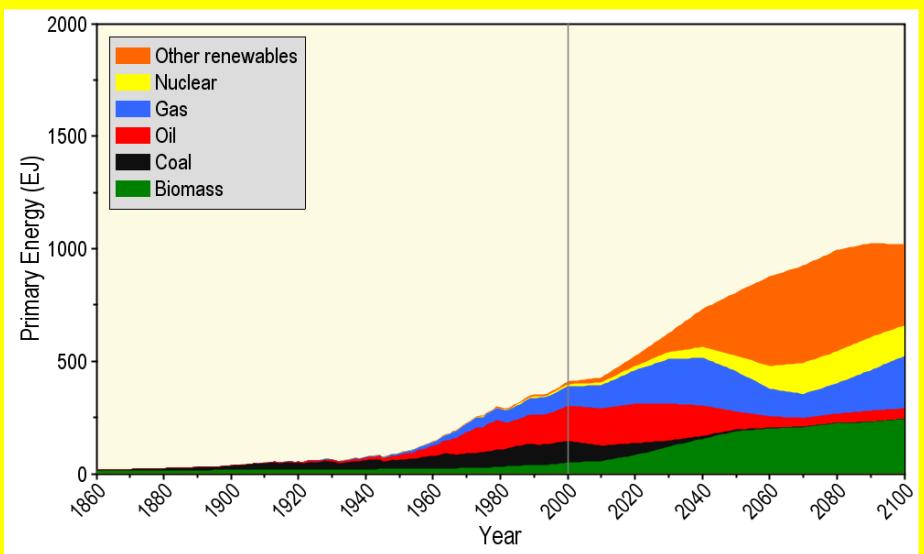


It's about scale and speed!

6° Celsius path



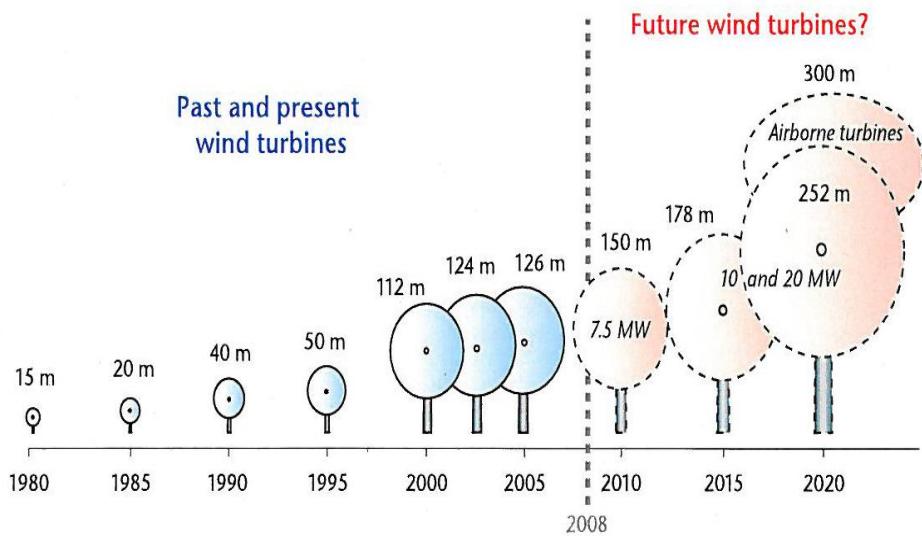
2° Celsius path



- 85/ 15 ... 15/85 (30 % RE by 2030)
- energy efficiency and carbon efficiency need to raise drastically (40 % by 2030)
- stabilize energy consumption: 450-500 EJ (2010: 390 EJ)

Diameter of wind turbines 1990-2020, factor 6

Figure 10: Growth in size of wind turbines since 1980



Energy & Water from Deserts

Source: Hasani et al., 2011

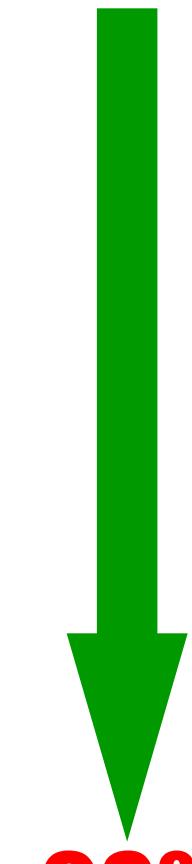
Efficiency through reconstruction

Before reconstruction



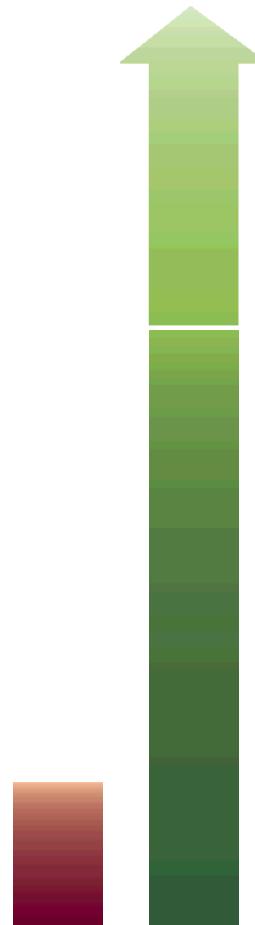
over 150
 $\text{kWh}/(\text{m}^2\text{a})$

Reconstruction according
to the passive house
principle



15 $\text{kWh}/(\text{m}^2\text{a})$

From urban sprawl to high density cities



Space, cities and energy
efficiency

Area Occupied by Various Transport Modes

Automobile



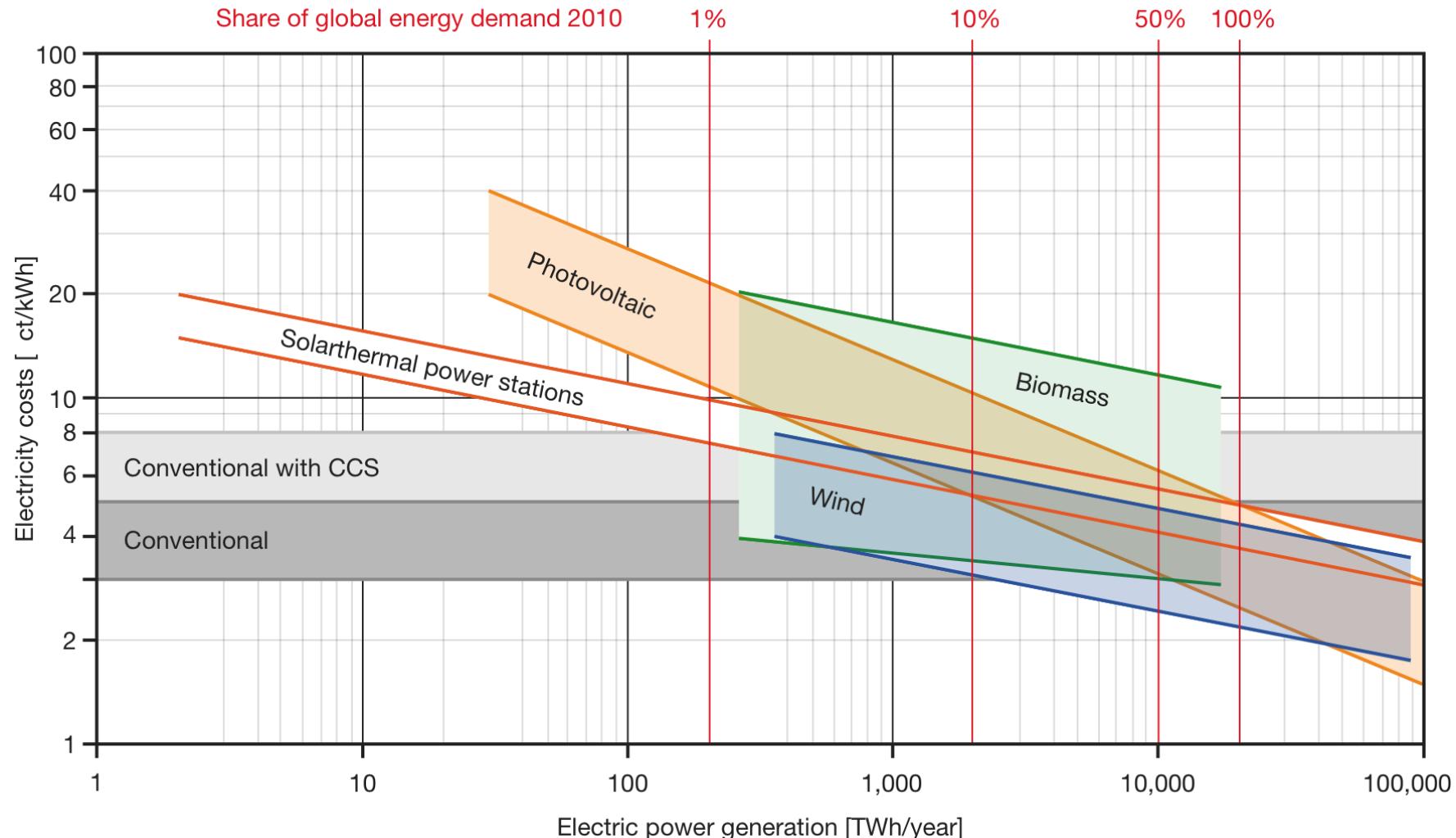
Bicycle



Bus



Potential of Cost Reductions: for Electricity from Renewables: TIPPING – POINT: 15-25 %



Long term costs

Studie/Autoren	Bandbreite für Stabilisierung bei 400-410 ppm CO ₂	Bandbreite für Stabilisierung bei 445-450 ppm CO ₂	Bandbreite für Stabilisierung bei 550 ppm CO ₂
RECIPE Modellvergleich <u>(Edenhofer et al. 2009b)</u>	0.7%-4% des globalen BIP (bis 2100)	0.1%-1.4% des globalen BIP (bis 2100)	
ADAM Modellvergleich <u>(Edenhofer et al. 2010)</u>	max. 2.5% des globalen BIP (bis 2100)		max. 0.8% des globalen BIP (bis 2100)
IPCC Modellvergleich AR4 (Fisher et al. 2007)		max. 5.5% des globalen BIP (bis 2050)	

- Key problem: upfront investments savings later
- Costs for climate damages not involved
- Global subsidies for fossil energy ca. 0,7 %-1,5 % of the global GDP
- Increase the investment ratio

Kosten jeweils angegeben als Anteil am globalen BIP bis 2050 oder 2100 in Gegenwartswerten (abdiskontiert auf ein Basisjahr). Modelle mit endogenem technologischem Fortschritt geben tendenziell niedrigere Kostenschätzungen aus.

Low Carbon –Energie Investitionen

20 % in OECD

26 % China

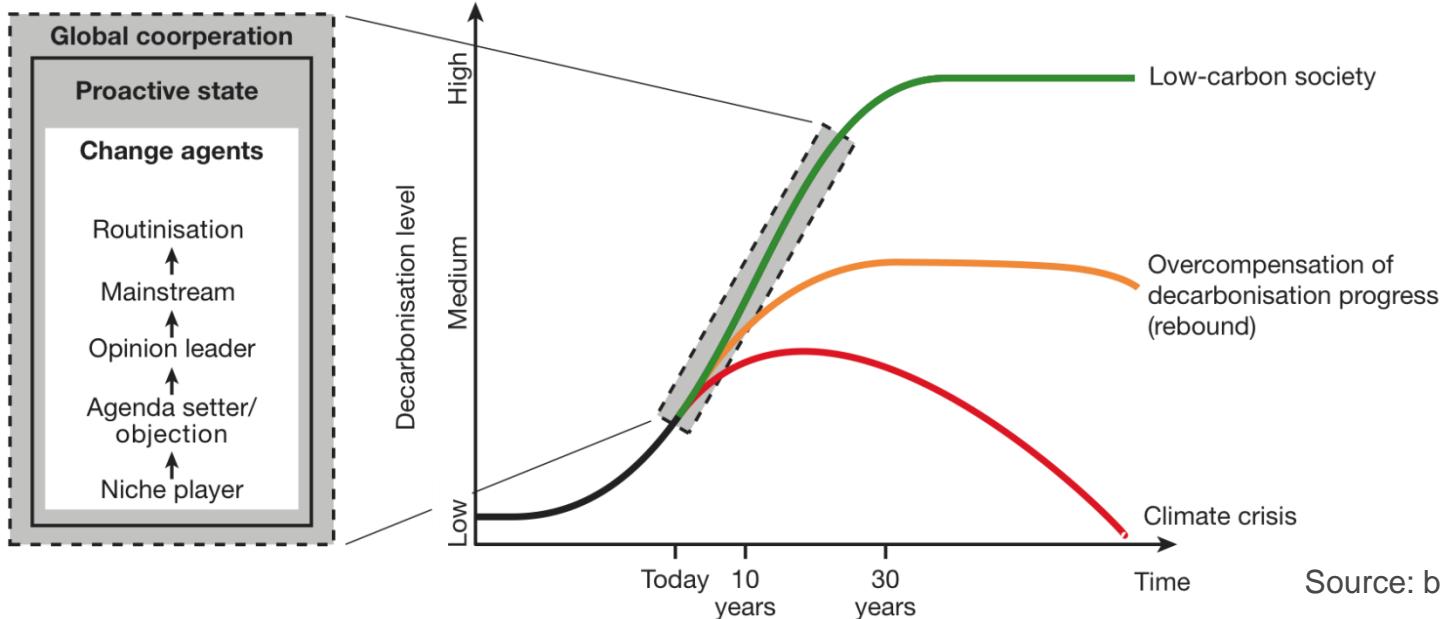
50 % EL/ Schwellenländer

Structure of investments (globally)

- 20 % energy infrastructure
- 50 % buildings/ transport/ mobility
- 15 % low carbon R&D
- 15 % land use, industrial sectors

Managing the Transformation Trajectory

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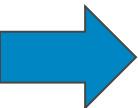
Source: based on Grin et al., 2010

Since the 1970s: “we do have a problem”:

- “Limits to Growth”
- Rio 1992

Driving the transformation

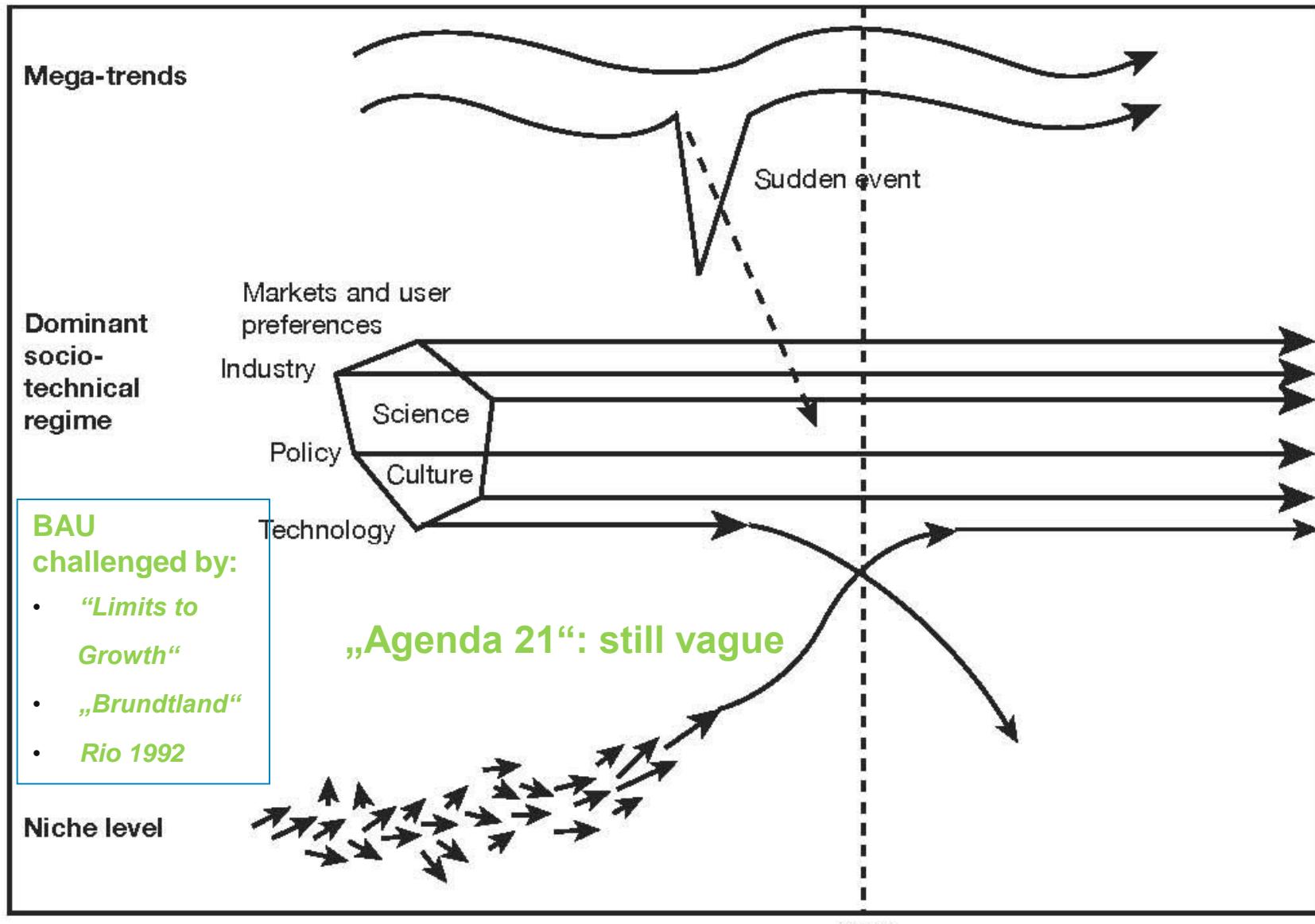
- scale: from pilots to systems
- acceleration
- setting the course: long-term perspectives towards 2050 (roadmaps)
- from sector to system reforms (cities, mobility, energy, lifestyle)



Building a low carbon society ... beyond policy reforms

Rio 1992: Still an Early Stage of the Green Transformation

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Co-evolution: Transformation driven by the accumulation of multiple dynamics

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- Growing number of actors of change
- Shifting norms values / heuristics
- Policy regime

- Green innovation
- International context

I. Legitimacy of BAU eroding/
BAU no option/
Tipping point constellations

Regime shifts „can occur when the system is pushed across some threshold by external and internal dynamics.“ (Ostrom et al. 2008) ... Tipping Point - Constellations

II. Vision:
low carbon narrative



- *legitimacy*
- *concepts*
- *power*
- “*it works*“ (*finance, technologies*)

Co-Evolution, a social contract for sustainability. transformational policies ... mechanisms of change

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- Arenas and drivers of transformation:
1. New narrative
 2. Actors
 3. Innovation
 4. Policy regime
 5. International context
 6. Shifting norms / values



Social contract



I. Legitimacy of BAU eroding

Transformational policies

Co-evolution

- interaction between 1-6
- mutual reinforcement
- from “critical masses” to accumulation of multiple dynamics
- co-evolution strengthening low carbon: legitimacy – concepts – power alliances – “it works” examples

II. Vision:
low carbon narrative

- scaling up
- acceleration
- global diffusion of low carbon concepts

Low carbon becoming the main driving force / new mainstream

- **Transformationsforschung**

- 1) Große Transformation verstehen: Interaktion sozialer Systeme, technischer Systeme, Erdsystem (radikale Multidisziplinarität)
- 2) 360 ° - Perspektive (beyond OECD ... going global)
- 3) stakeholder, Gesellschaft, Politik einbeziehen ...

- **Transformative Forschung**

- neue Antriebsmotoren
- smart grids
- Bildungskonzepte für Nachhaltigkeit
- institutionelle Designs für globale Kooperation



What can be done to make these drivers irreversible? Ten bunches of instruments

- 1 Proactive/ enabling state
- 2 Price for carbon
- 3 Regional energy cooperation
- 4 Internationalize feed in tariffs/
DESERTEC for Africa
- 5 Reduce energy poverty – low
carbon
- 6 Low carbon urbanization
- 7 Low carbon land use
- 8 Finance mechanisms and new
business models
- 9 Low carbon research strategies/
knowledge gaps
- 10 Global governance for the low
carbon transformation

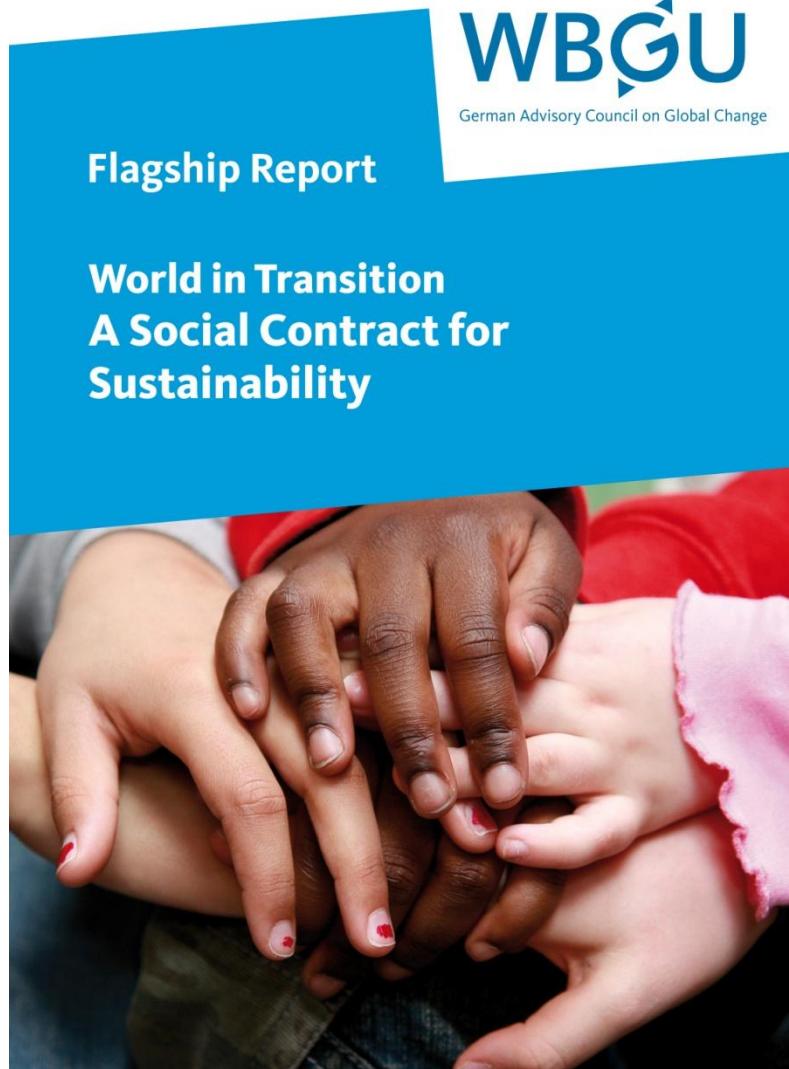


polycentric strategy



focused strategy





English book: January 2012

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