Scenarios
How to make scenarios work?

Examples from the work of UBA

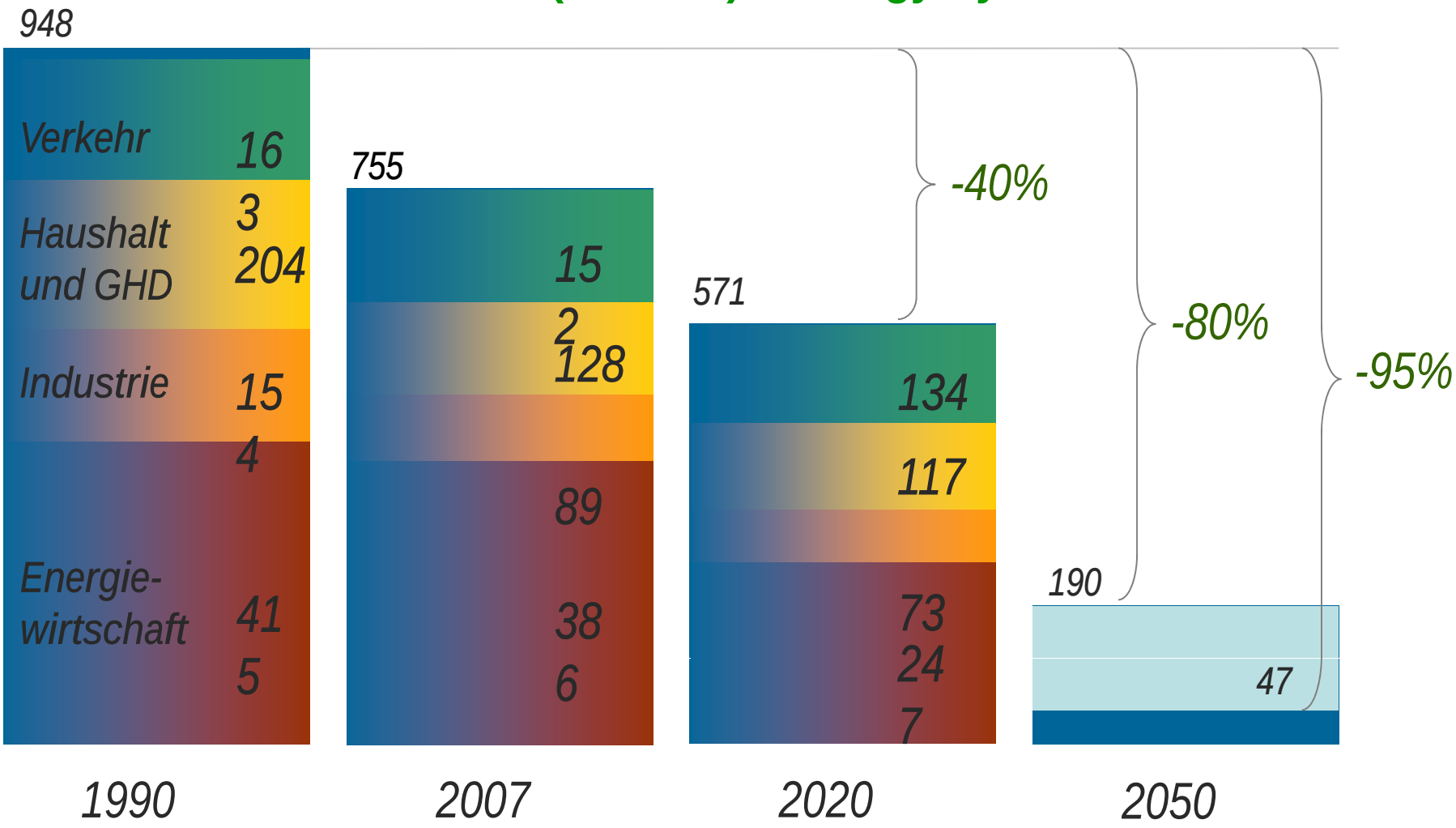
Harry Lehmann

German Federal Environment Agency

Umwelt Bundes Amt
Für Mensch und Umwelt

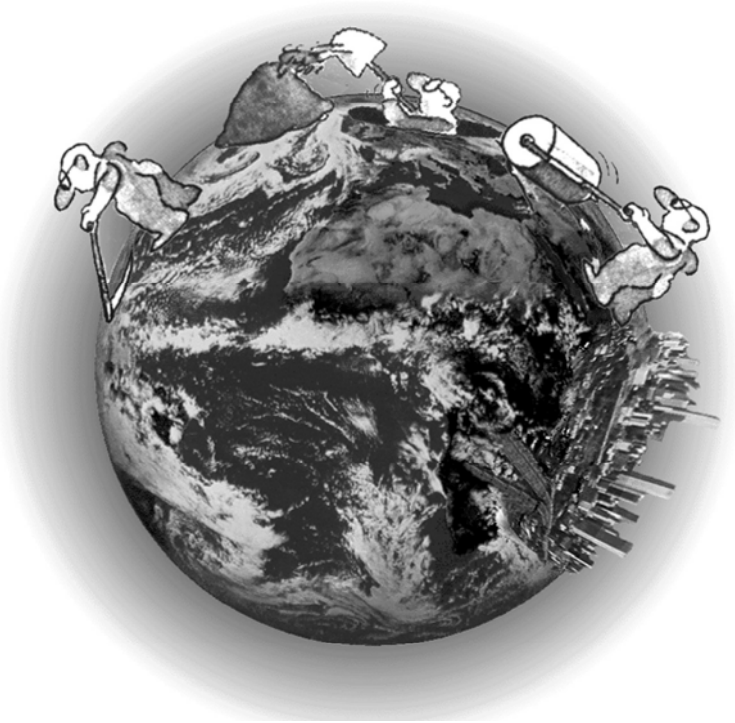
Germany

CO2 Emissions (Million t) – Energy System



Germany 2020

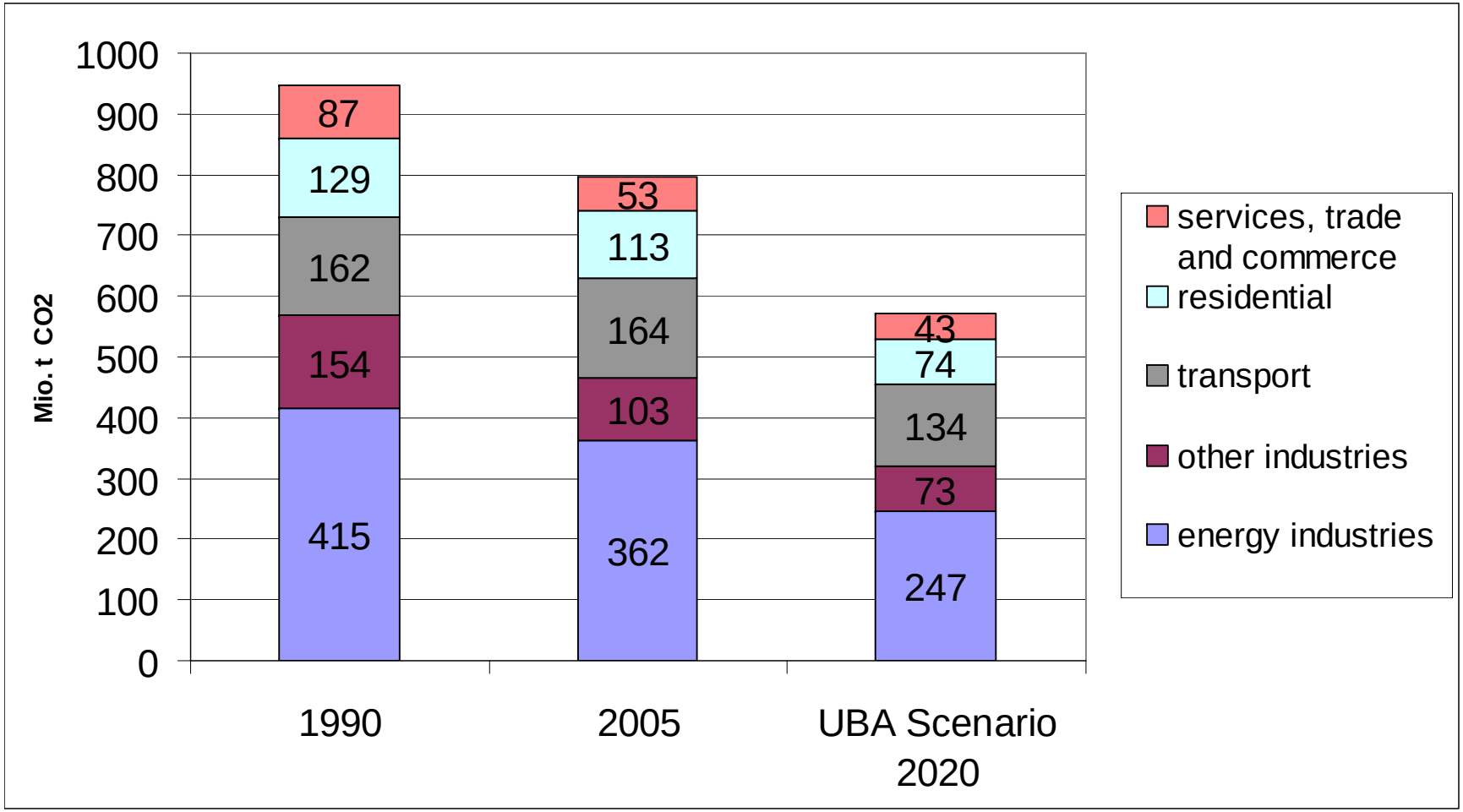
Scenario I



Limits to growth

Source: Harry Lehmann, 1994

UBA Scenario - 2020 - German CO2 Emissions



UBA Scenario - 2020

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- Energetic refurbishment of existing buildings could cut German CO_2 Emissions by 31 Mio t CO2 until 2020.
- Reduction of Electricity Demand by 11% would save 28 Mio t CO2
- 25% of Electricity Demand can be covered by Renewable Energies (Instrument: Feed-In-Tariff (EEG))
- Fuel Switch from Coal to Gas and Solar (with high efficiency) can save 43 Mio t CO2
- Support of Cogeneration (CHP) by a Feed-In-Tariff contributes another 15 Mio t CO2

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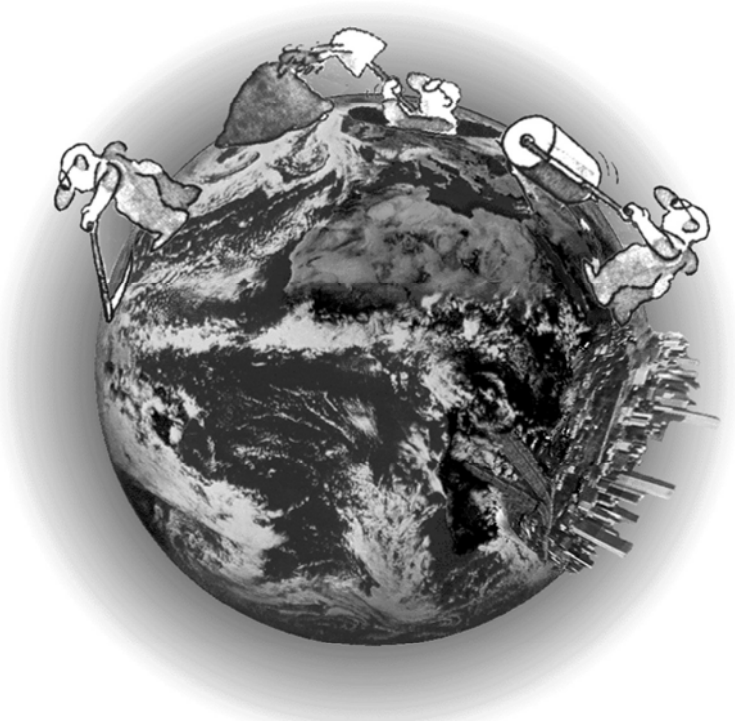
Germany 2050 GHG Free

Scenario II 2010



Limits to growth

Source: Harry Lehmann, 1994

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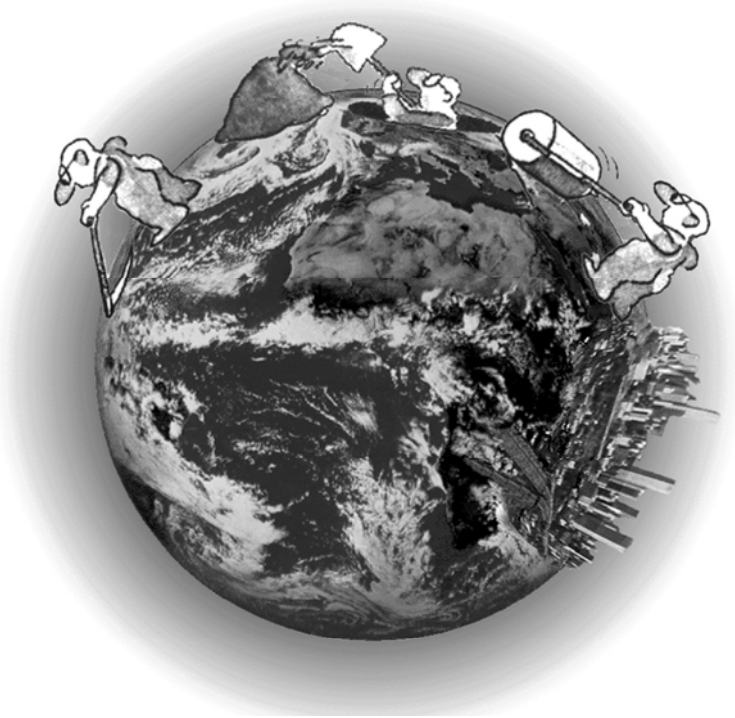
Germany 2050

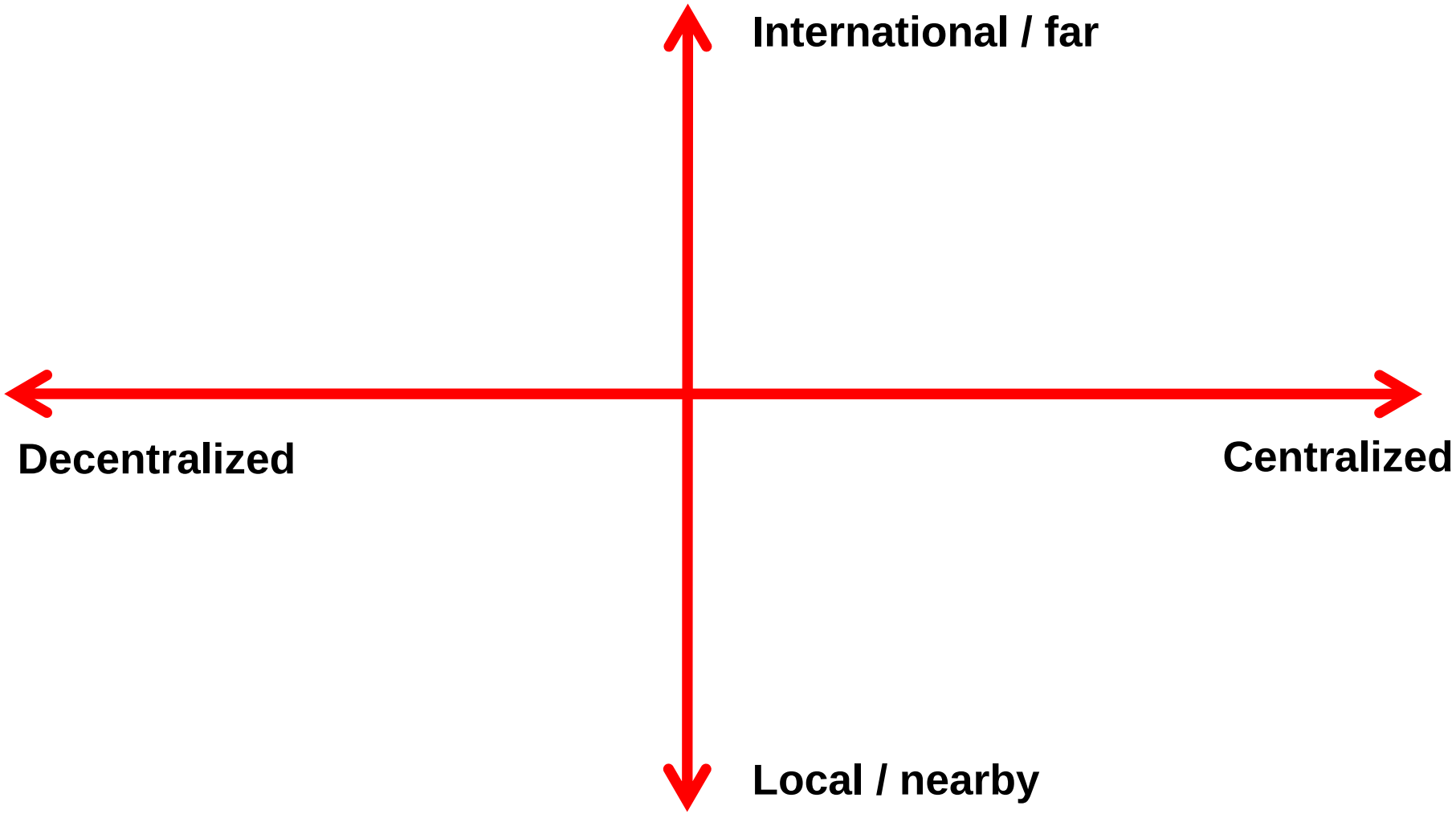
Can a 100% renewable electricity system satisfy total electricity consumption and specific load demands at any point during the year?



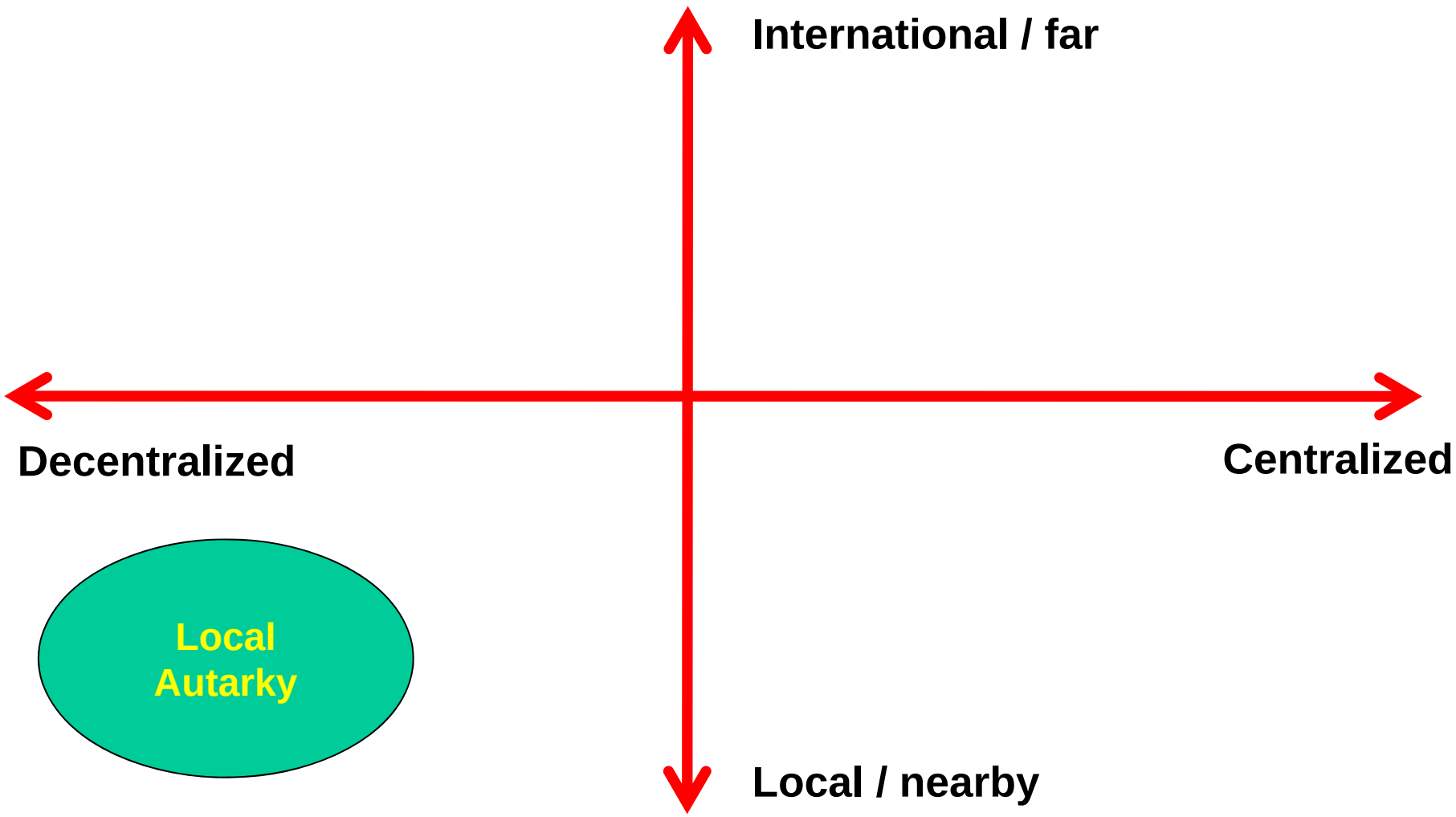
Limits to growth

Source: Harry Lehmann, 1994

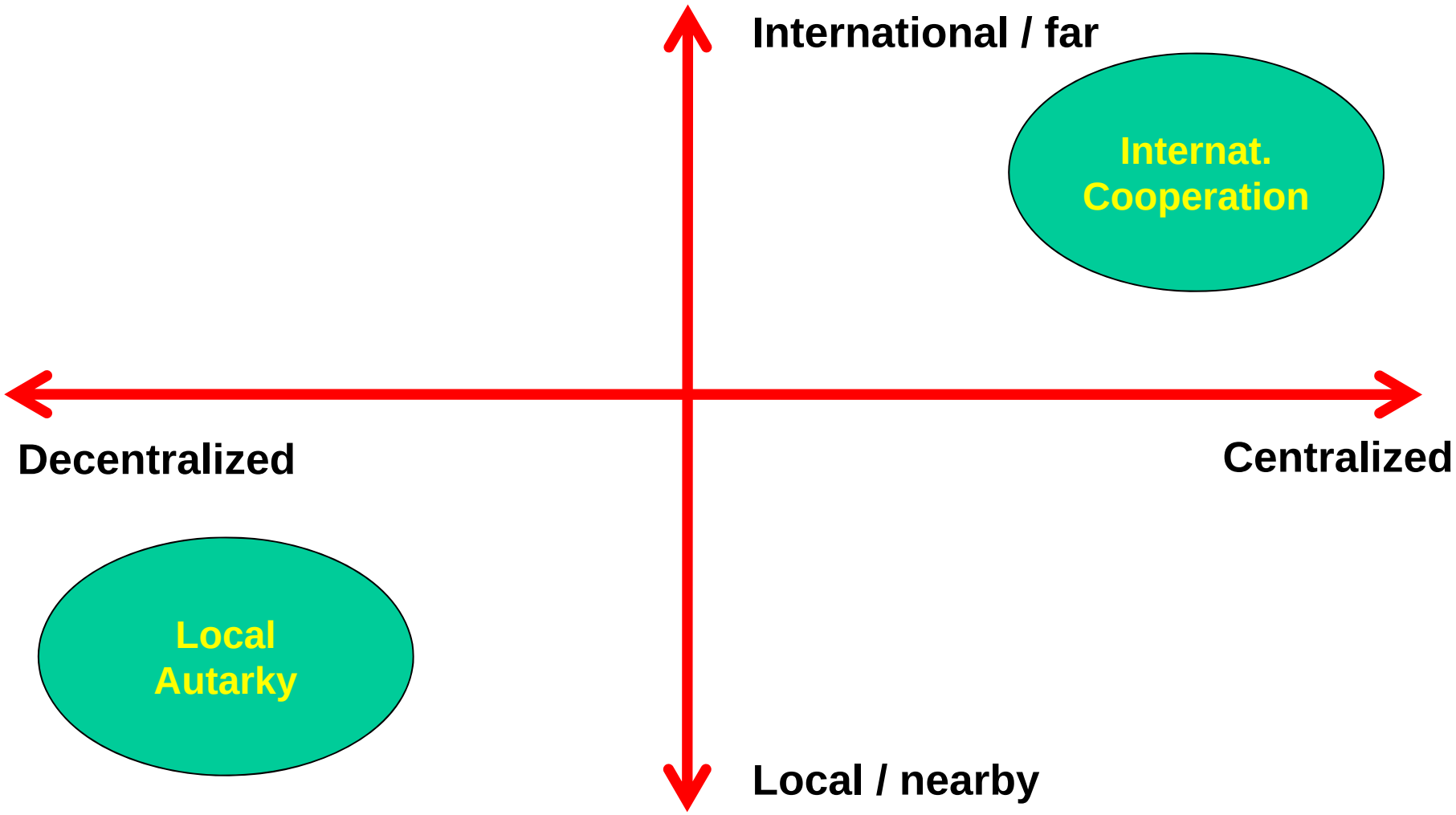
Typical REN Supply System



Typical REN Supply System



Typical REN Supply System



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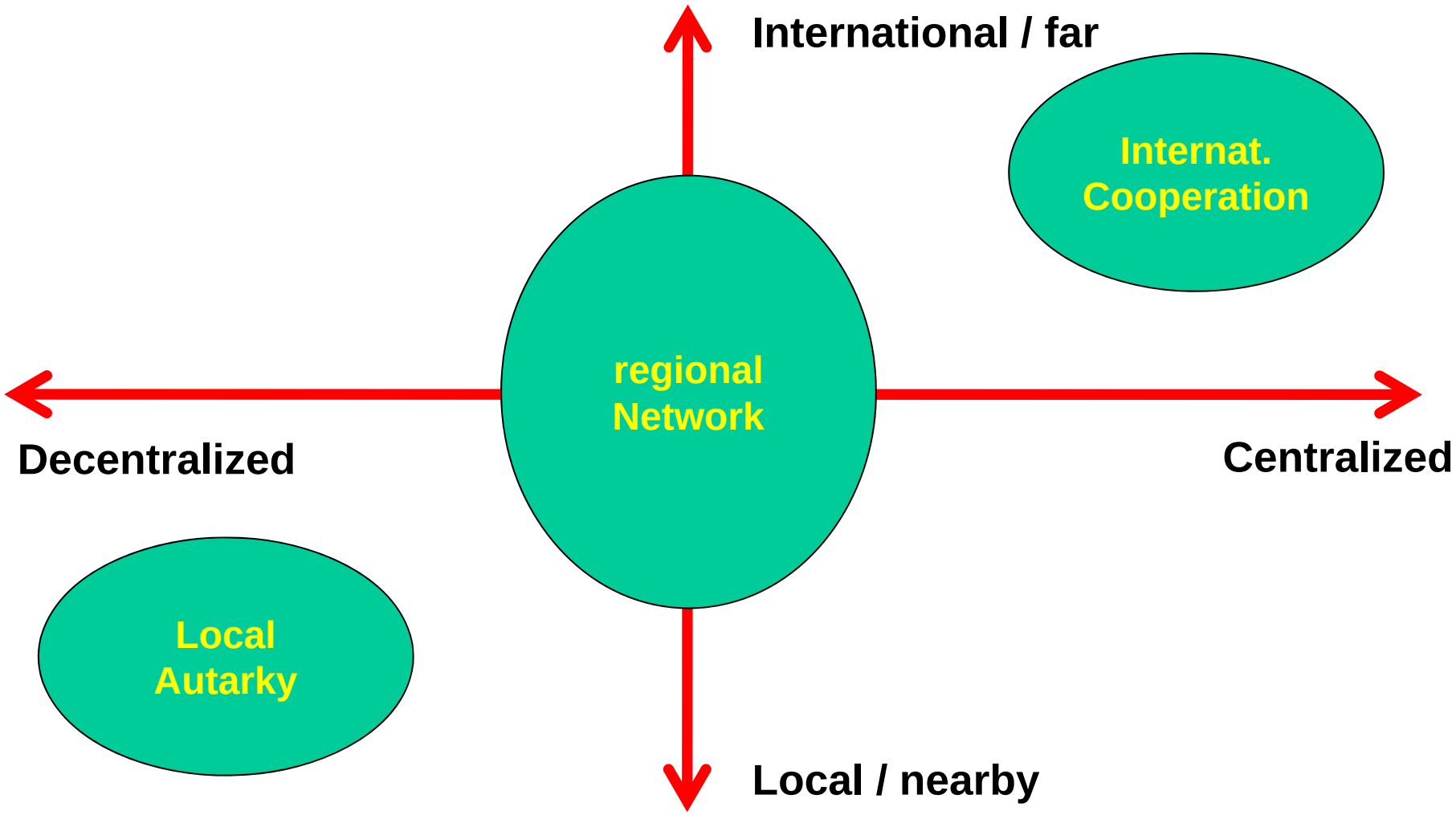

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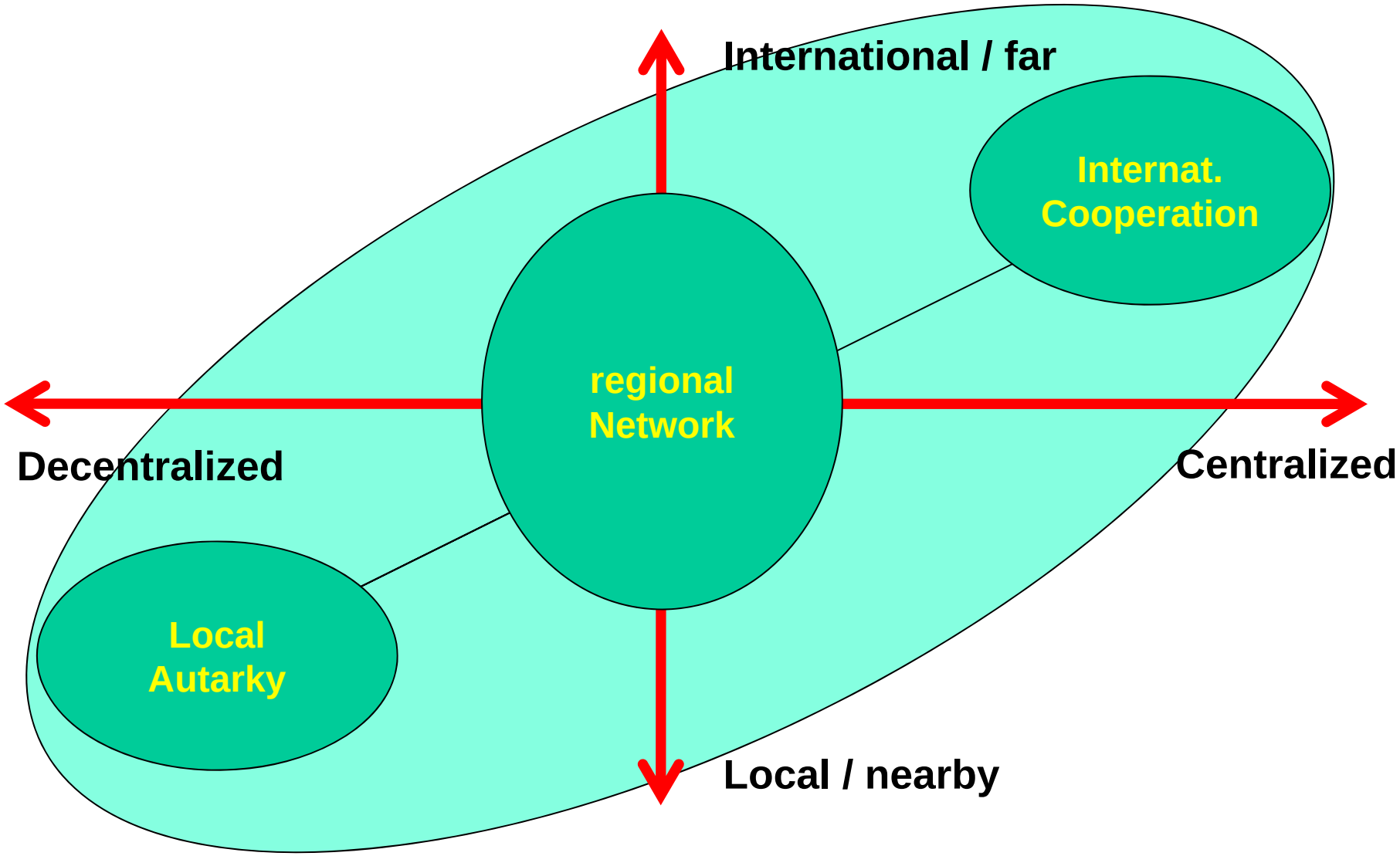
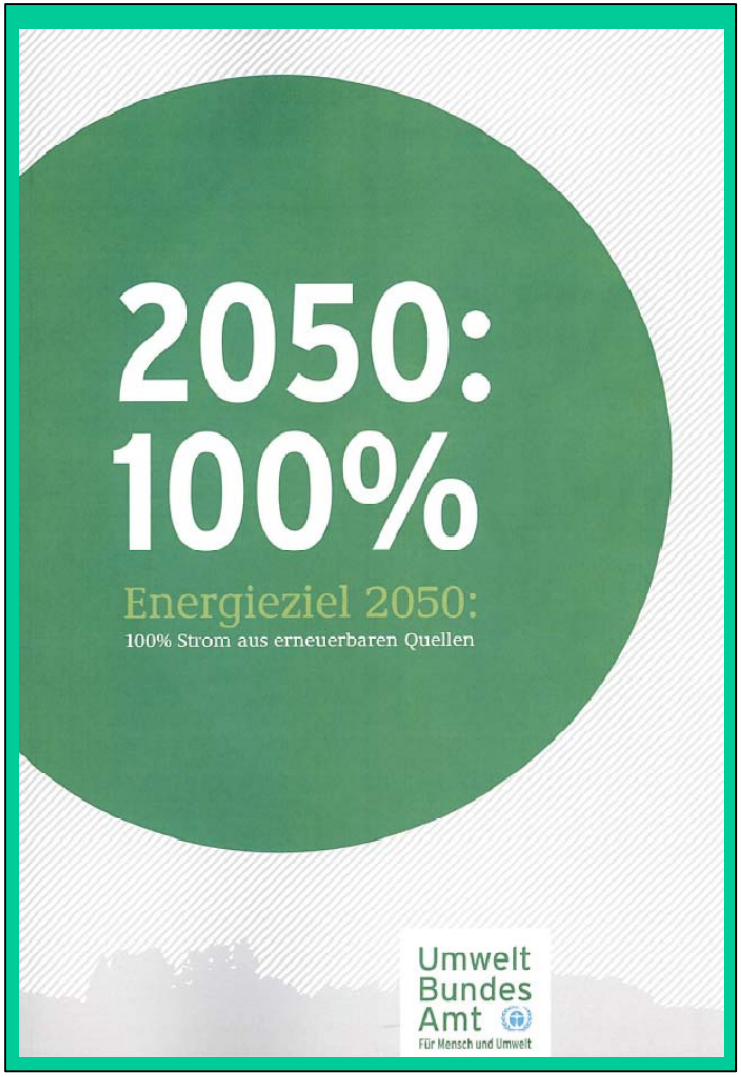


UBA: Germany 2050 Scenarios



UBA (2010) simulation of a decarbonized electricity sectors:

100% renewable electricity supply

the first piece in a national 2050 strategy

Source: UBA, 2010

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Utilization level of renewable energy potentials

in the regions network scenario

	Technical-ecological potential *(conservative estimate)*		Region ´ s network scenario	
	Capacity (GW)	**Output (TWh)**	**Capacity (GW)**	**Output (TWh)**
Photovoltaic	275	240	120	104
Wind energy onshore	60	170	60	170
Wind energy offshore	45	180	45	177
Hydropower	5,2	24	5,2	22
Geothermal energy	6,4	50	6,4	50
Waste biomass (biogas)	as required	23	23,3	11

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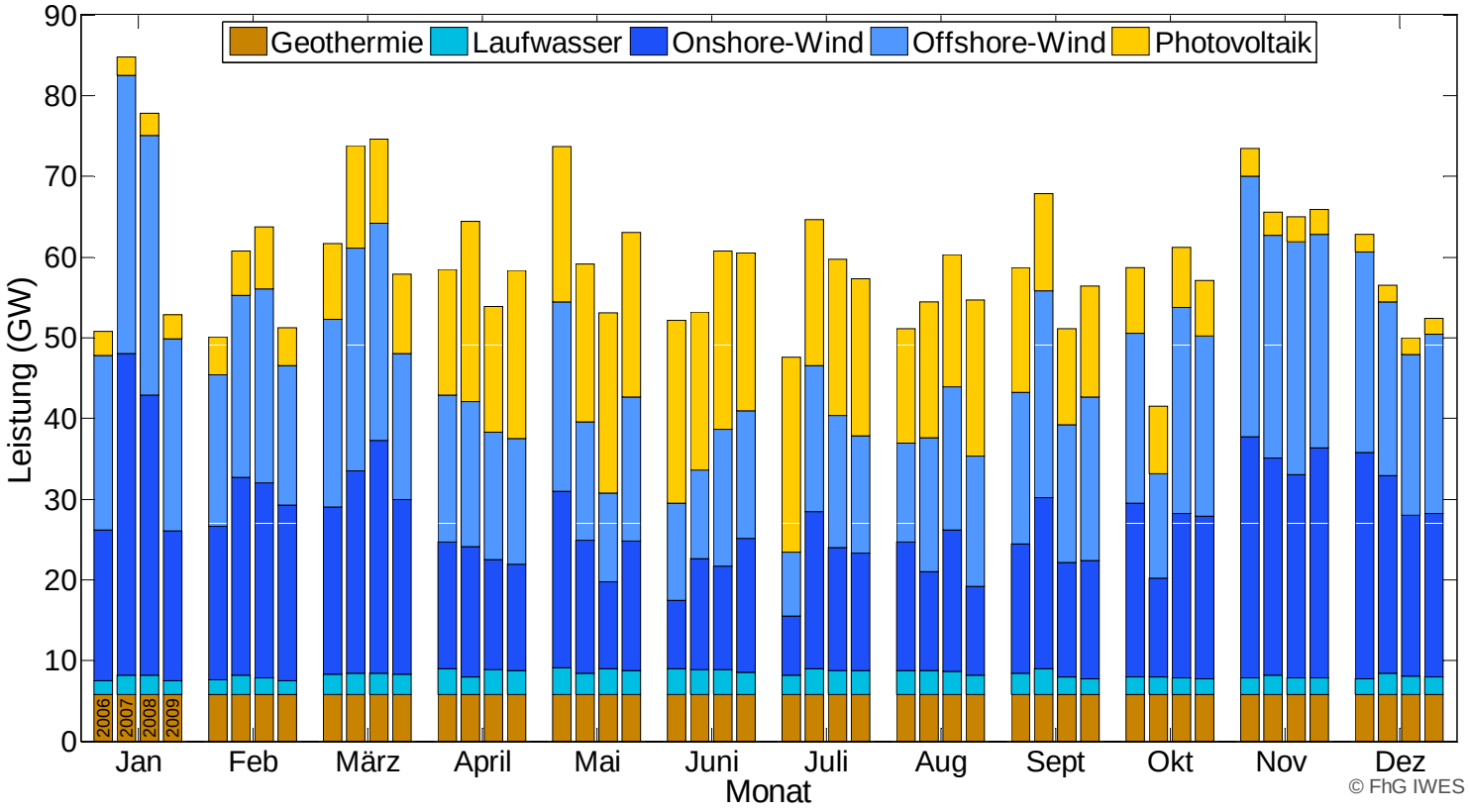
Feed-in of the renewable energies (2006-2009)



Average, monthly feed-in of renewable electricity
from generation capacities in 2050
based on the meteorological years 2006-2009

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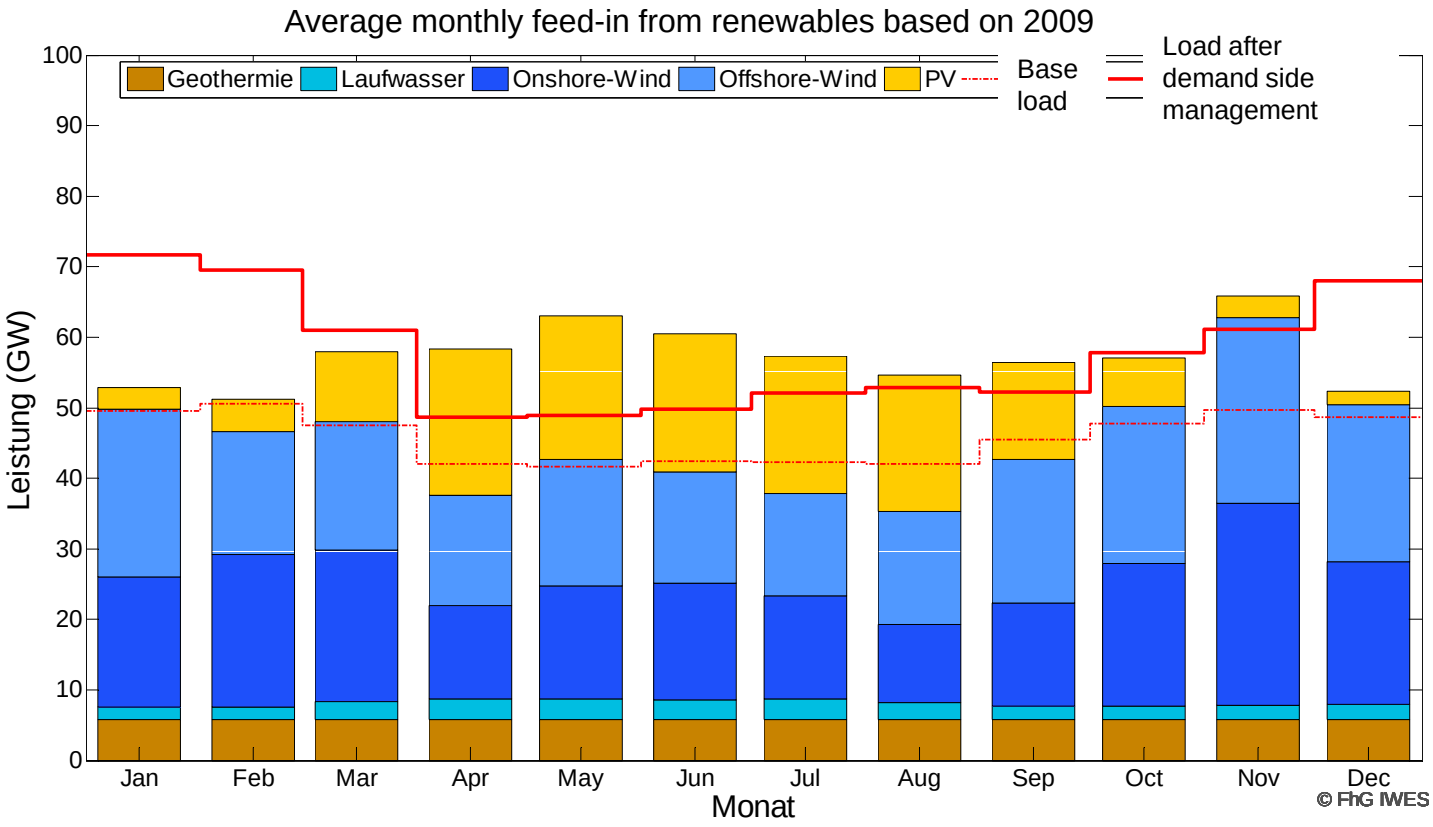
Feed-in of renewable energy in comparison to the load curve



Feed-in [GW] of all RE and load (with and without demand side management) per month in 2050, based on the meteorological year 2009

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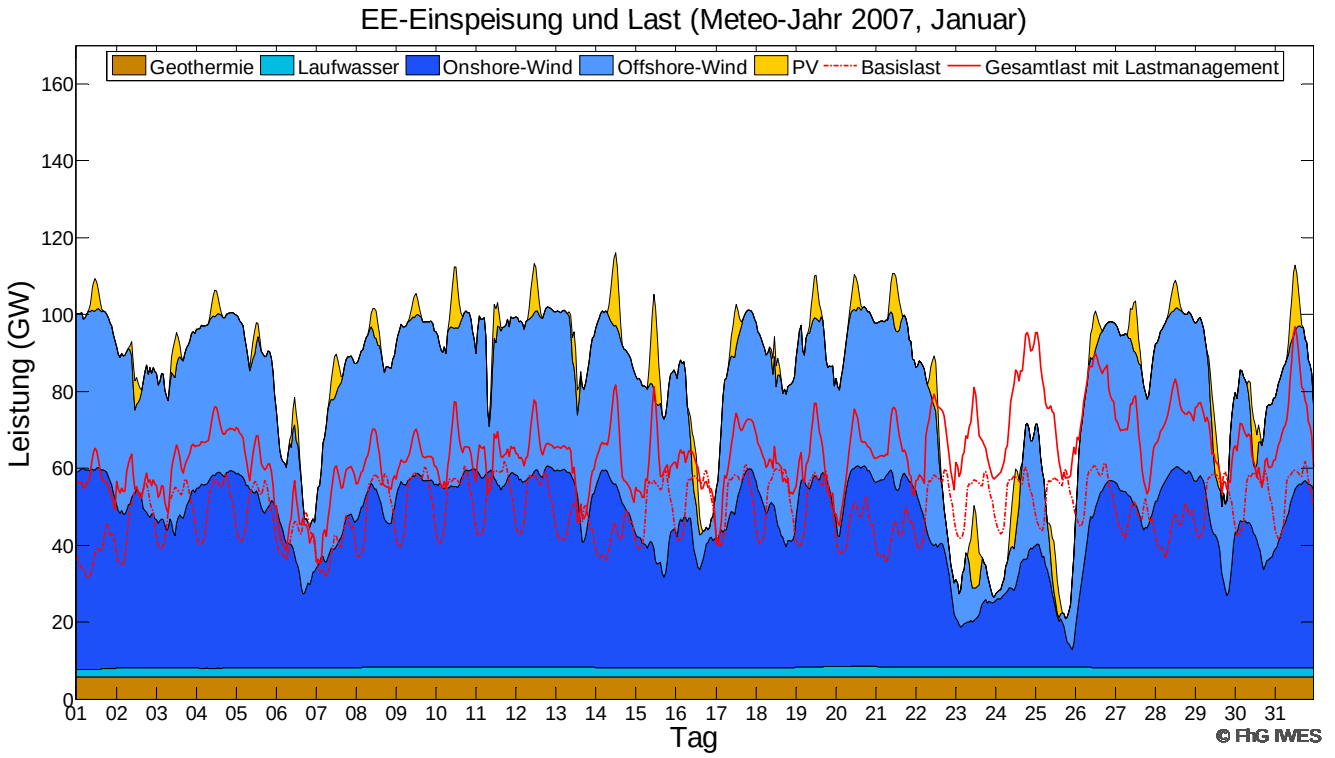
Feed-in of renewable energy and load – per month (winter)



Feed-in [GW] of all RE and the load curve

Example „Winter day“ (December) for the feed-in of renewable energies in 2050, based on the meteorological year 2007

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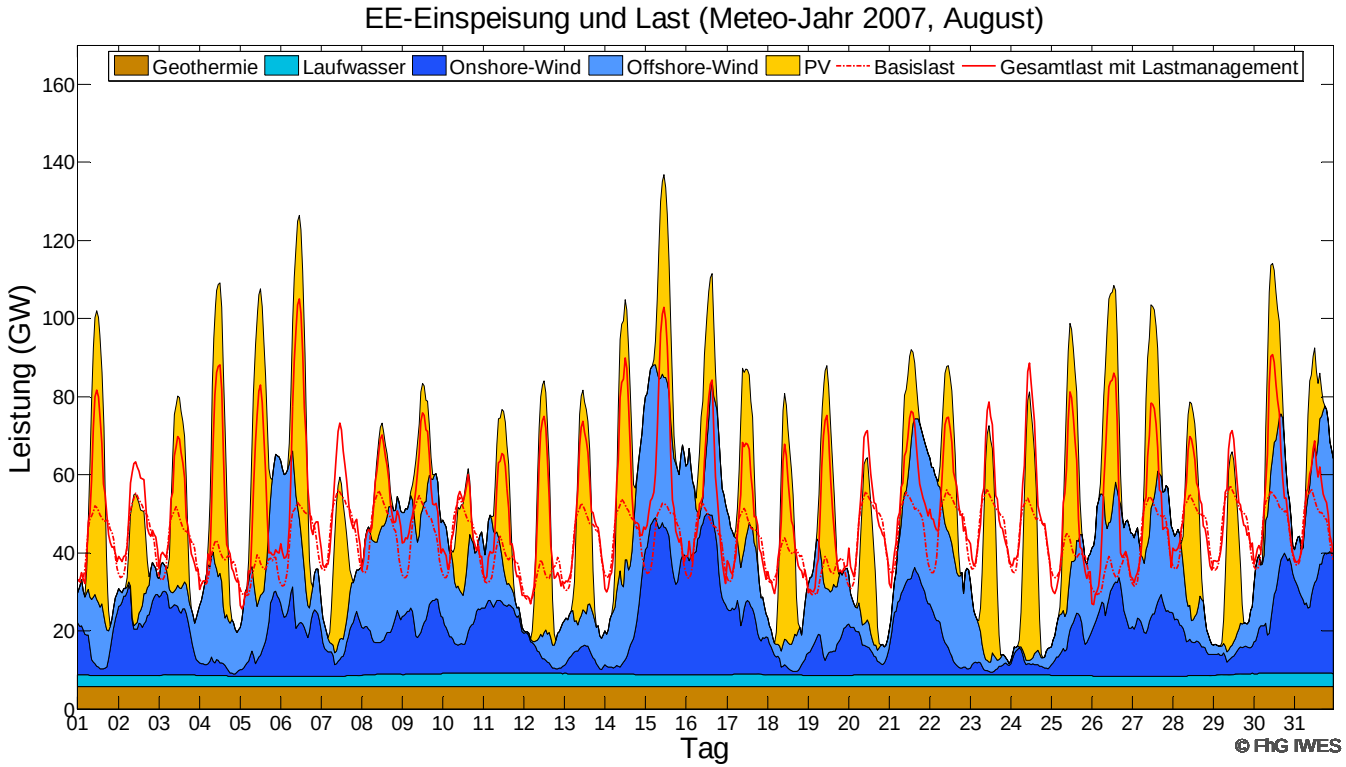
Feed-in of renewable energies and load – per month (summer)



Feed-in [GW] of all RE and load

Example „Summer day“ (August) for the feed-in of renewable energies in 2050, based on the meteorological year 2007

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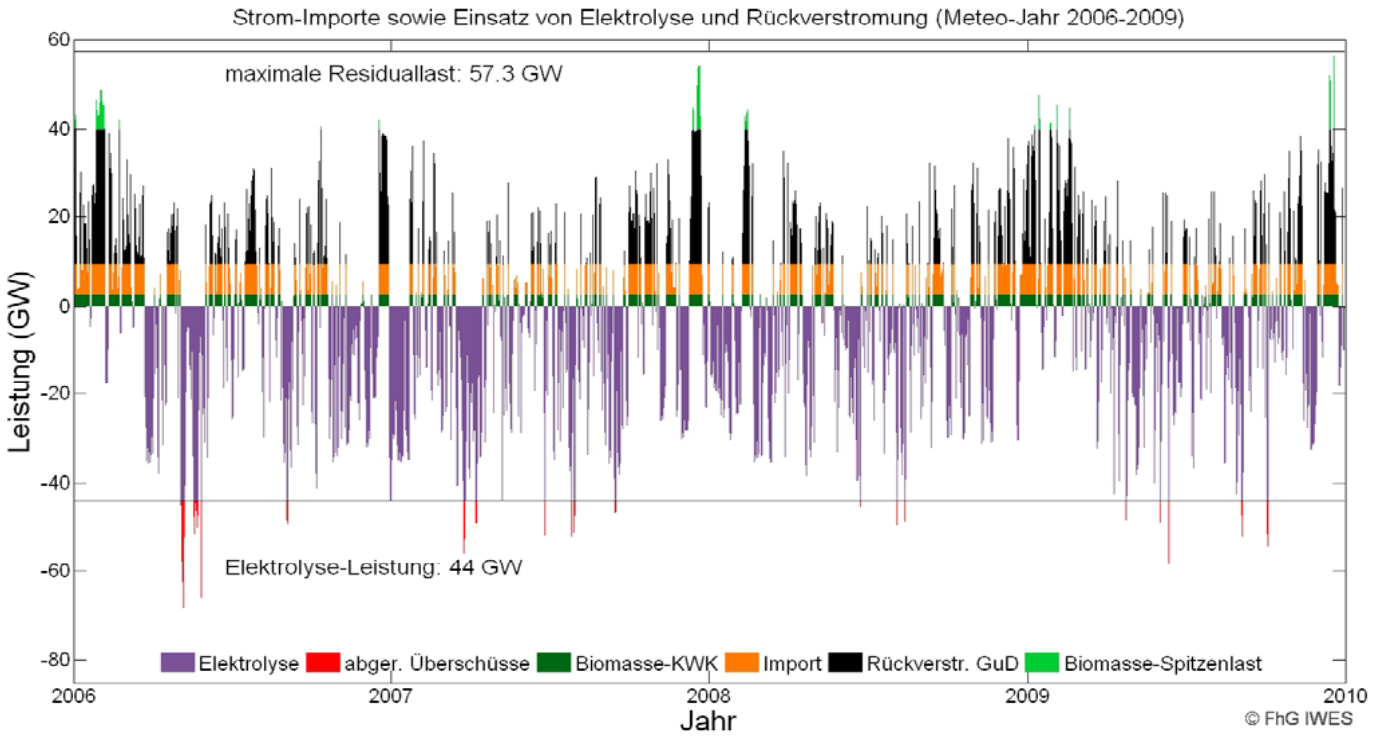
Security of supply



An electricity supply system completely based on RE:

- can provide security of supply on the current level of demand at any time of the year
- can supply the demand for electricity and provide the necessary control reserve
- load fluctuations of RE can be balanced at any time through the use of a variety of RE sources, energy storage and intelligent load management

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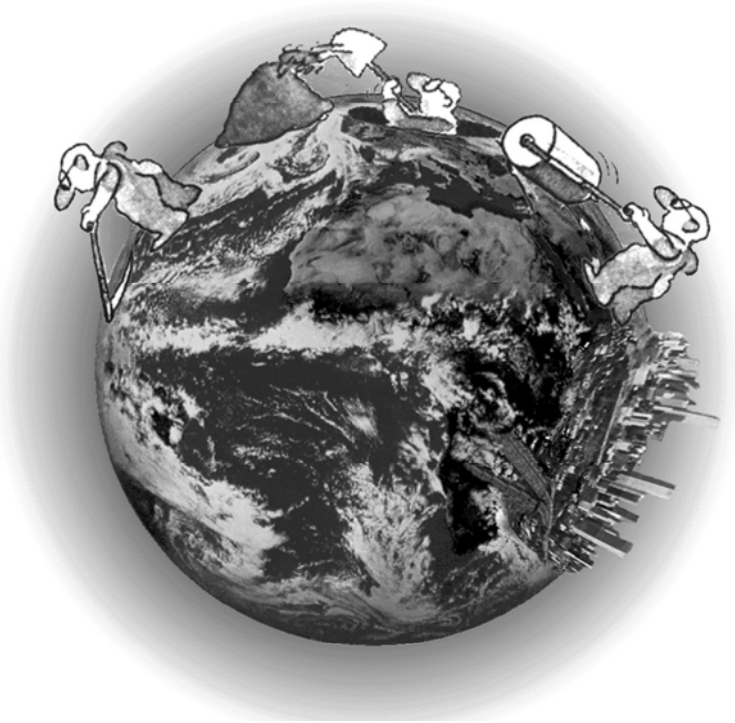
Policy Recommendations



Limits to growth

Source: Harry Lehmann, 1994

Recommendations to policymakers (I)

1. Binding emission reduction and renewables target

- Binding 2050 mitigation targets for GHG
- Clearly defined renewables target

2. Efficient and intelligent use of energy

- Tightening EU product standards
- Introduction of energy management on enterprise level
- Tightening the building regulations on energy conservation
- Tap load management potentials
- Reduce energy demand in the transport sector

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Recommendations to policymakers (II)

3. Adjusting legal and economic framework conditions

- Tightening the emissions trading scheme
- Advancing the energy tax system and abolish subsidies harmful to climate protection
- Supporting the market- and electricity system integration of RE
- Creating an all-encompassing climate act
- Reducing barriers to RE expansion
- Strengthening the role of municipalities and regions
- Availability of grants for the construction of RE and related infrastructure

4. Alignment of spatial planning

- National and regional energy development plans
- Providing sufficient space for wind energy
- Drawing up of a subterranean spatial planning with priority access for sustainable uses

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Recommendations to policymakers (III)

5. Building infrastructure

- Expedite the extension and restructuring of the electricity grid
- Optimising the grid
- Construction of energy storage and its infrastructure

6. Requirements for the conventional energy generation fleet

- No additional construction of coal-fired power plants
- Construction of highly flexible gas power plants as a bridging technology
- Expansion of CHP
- No life time extension for nuclear power plants

7. Research & Development

8. Obtaining social support for the energy transition

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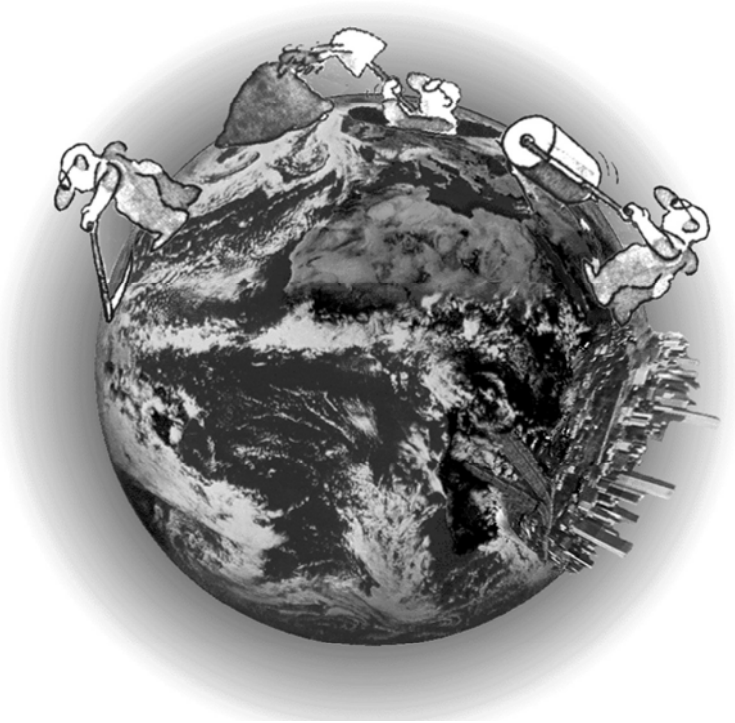
What makes scenarious work ?



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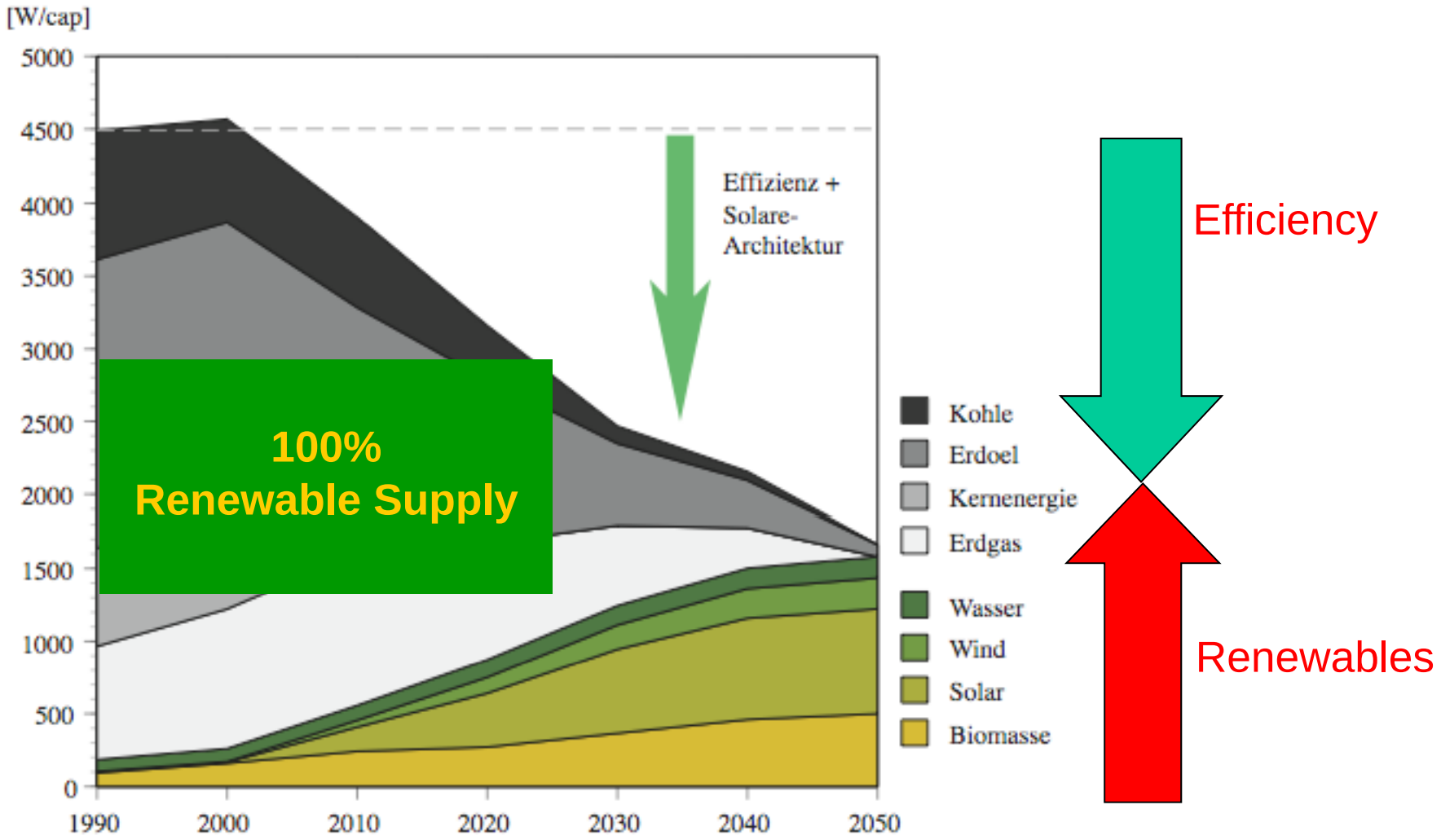
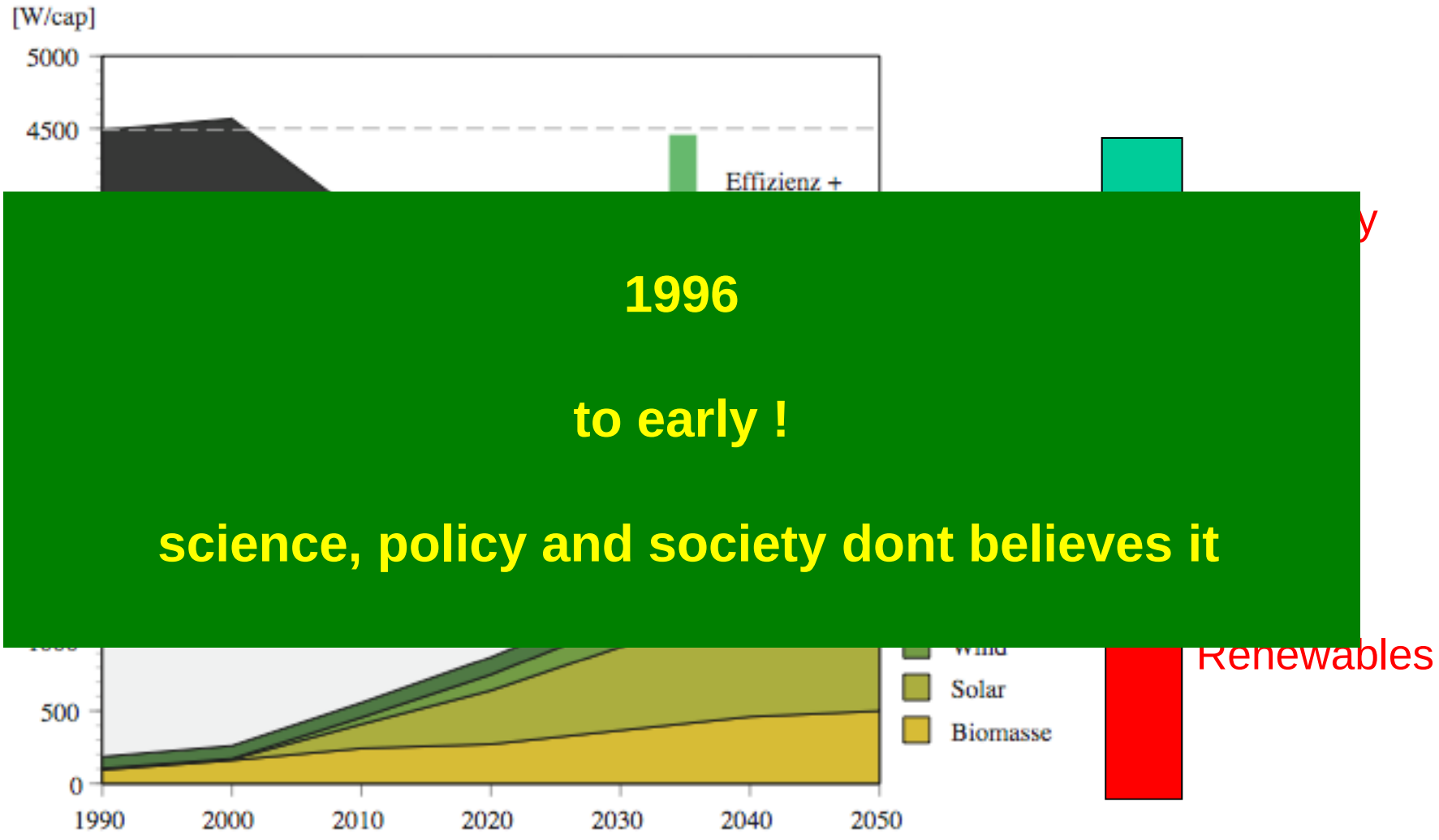
LT Scenarios Europe - 100%



LT Scenarios Europe - 100%



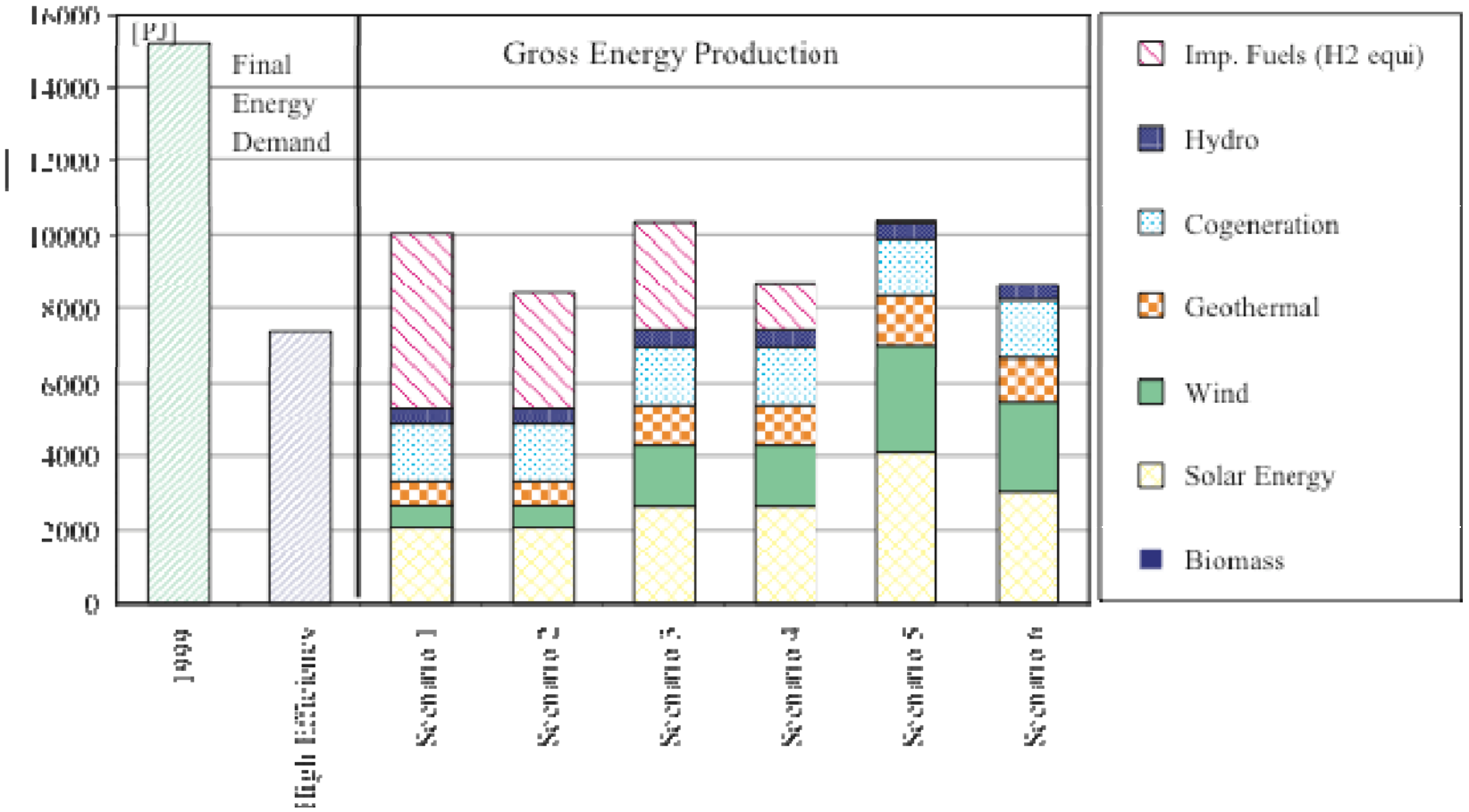
1996

to early !

science, policy and society dont believes it

Japan : Energy Supply in the ERJ Scenarios (2002)

エナジー・リッチ・ジャパン



Source: ERJ, info@energyrichjapan.info

Japan : Energy Supply in the ERJ Scenarios (2002)

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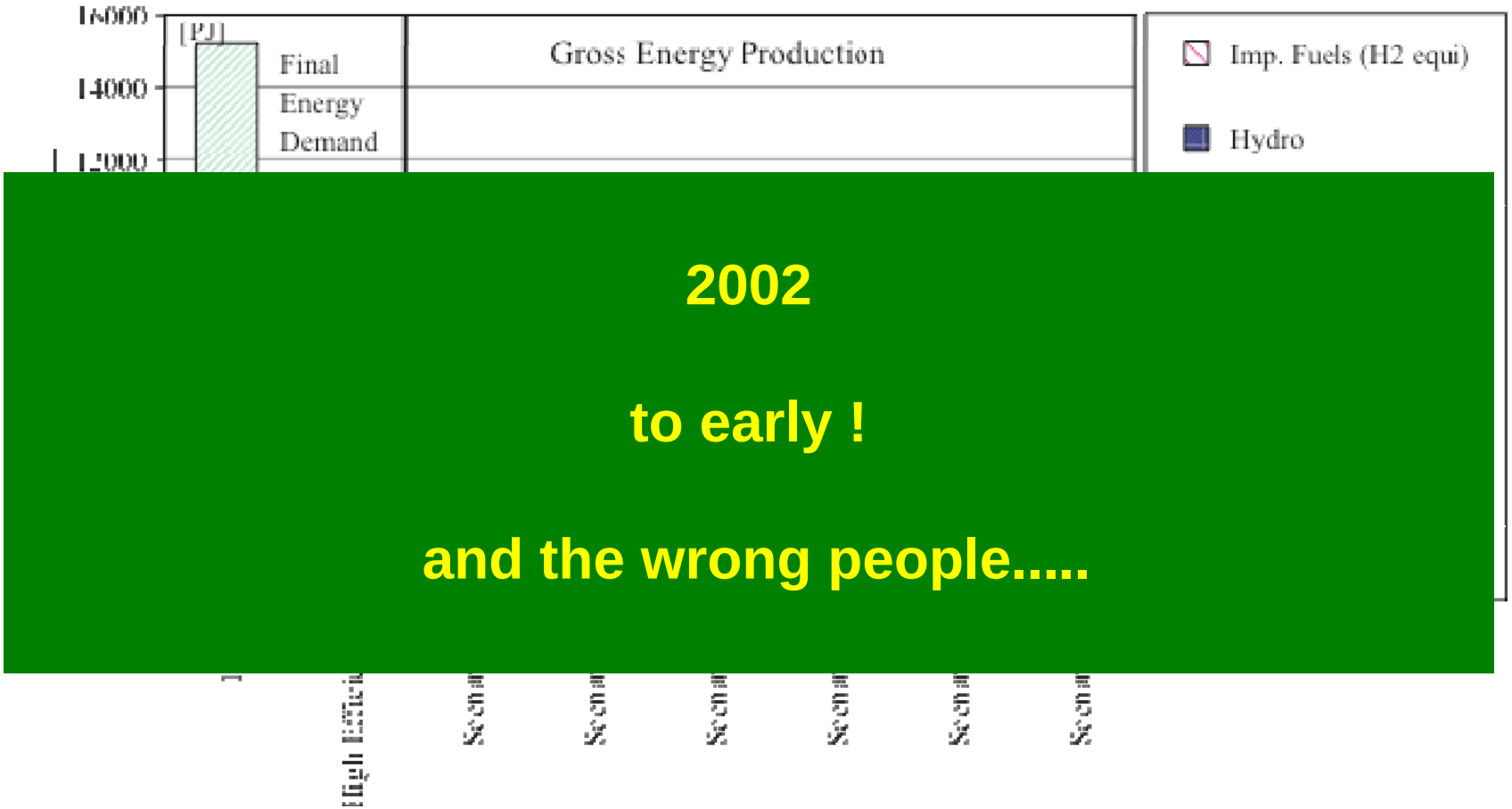


Source: ERJ, info@energyrichjapan.info

Scenarios..... 100% now Mainstream (?)

- „Weiterentwicklung der Ausbaustrategie Erneuerbare Energien: Leitstudie 2009“ (2009)
  - Von: Dr. Nitsch in Kooperation mit dem DLR
  - Für: BMU
- „Energiezukunft 2050“ (2009)
  - Von: Forschungsstelle Energiewirtschaft e.V. (FfE)
  - Für: EnBW, E.ON Energie, RWE Power und Vattenfall Europe.
- „Modell Deutschland Klimaschutz bis 2050“ (2009)
  - Von: Ökoinstitut, Prognos AG und Dr. Ziesing
  - Für: WWF Deutschland
- „Klimaschutz: Plan B 2050“(2009)
  - Von: EUtech
  - Für: Greenpeace, Deustchland
- "Energieszenarien für ein Energiekonzept der Bundesregierung" (2010)
  - Von: EWI, GWS, Prognos
  - Für: Bundesministerium für Wirtschaft und Technologie (BMWi)

And:

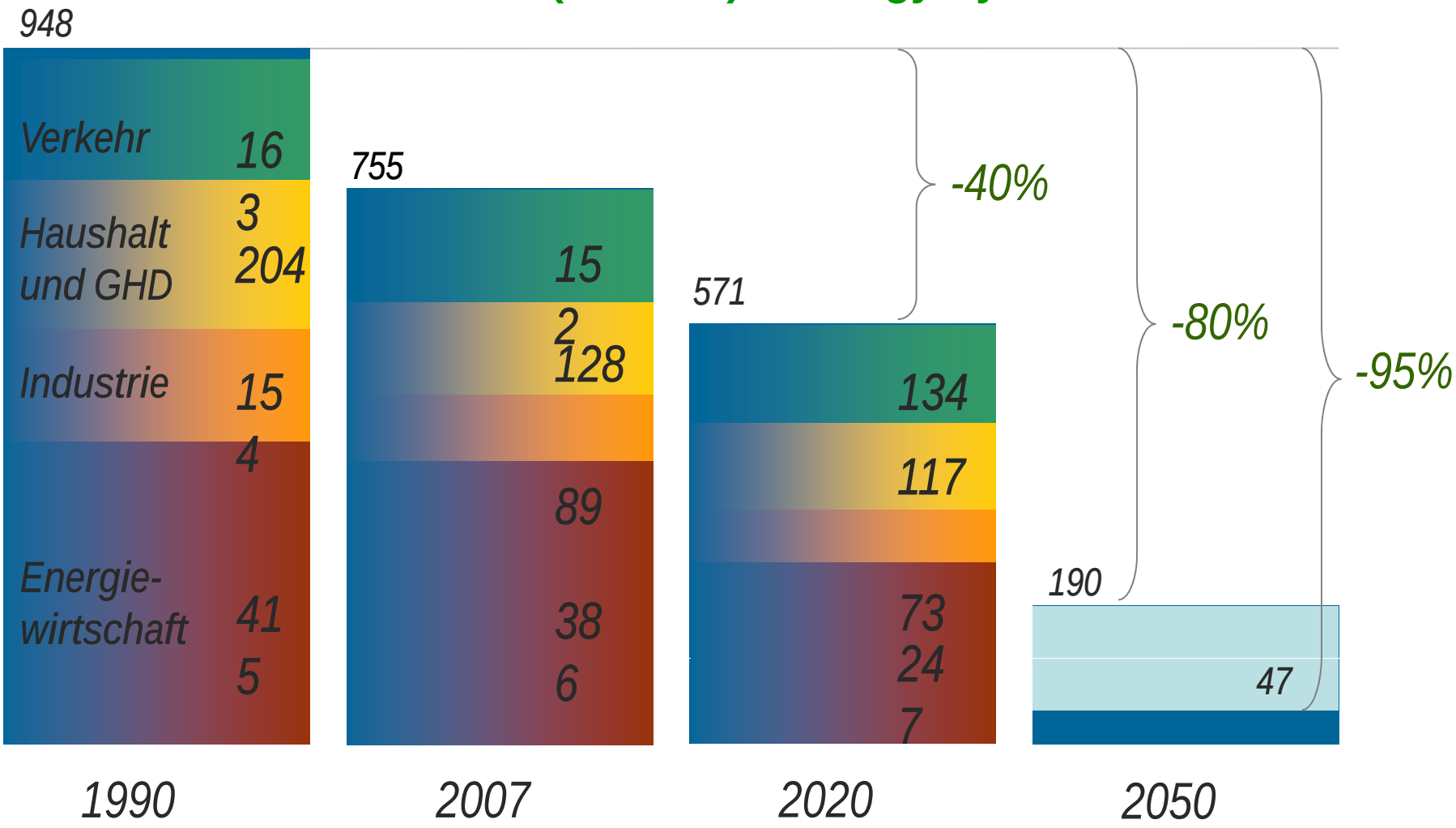
„2050 100%“ (2010)

Federal Environment Agency (UBA)

Source : Jan Burck – Niedrig-Energie-Szenarien für Deutschland – Germanwatch and H.Lehmann

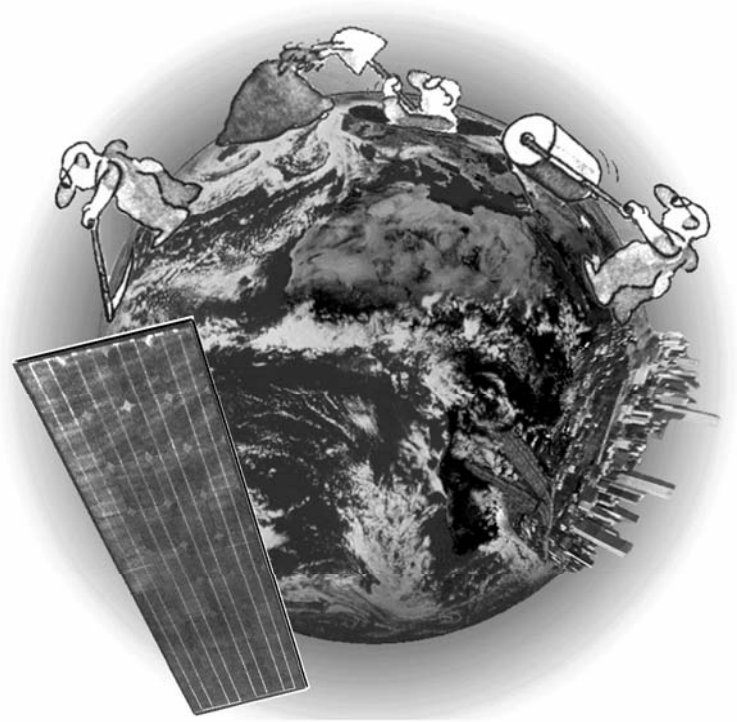
Germany

CO2 Emissions (Million t) – Energy System



Conclusion:

Green House Gas Free society is possible.
Renewable Energy Supply is possible.
Up to 100%



Source: Harry Lehmann, 1994

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