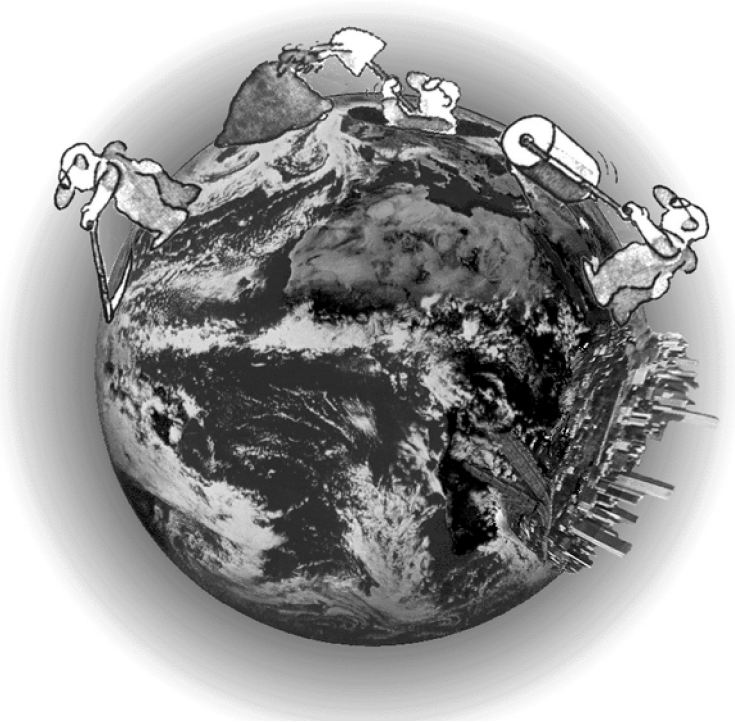
Part 3

Nothing new ... Japan

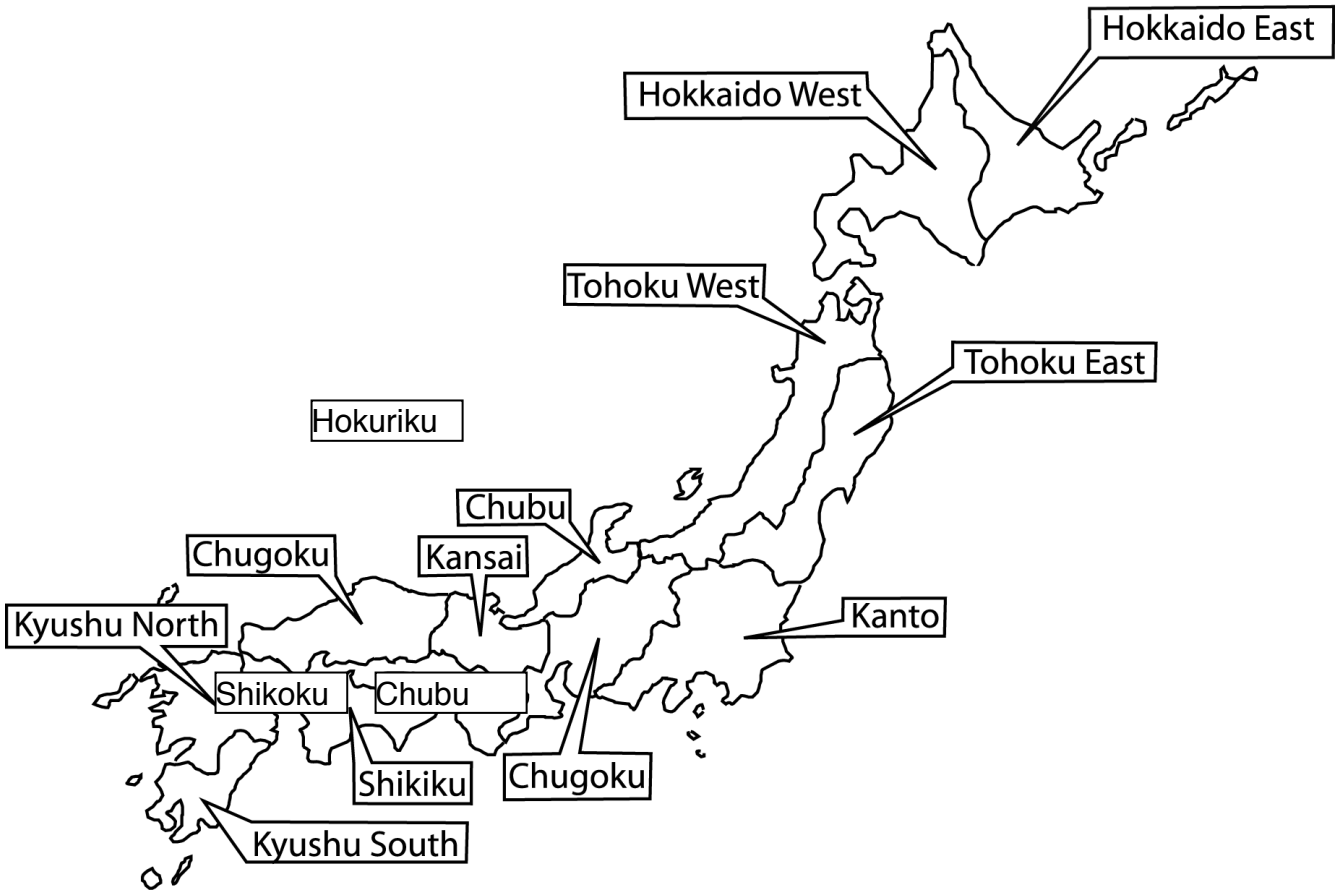


Limits to growth

Source: Harry Lehmann, 1994

Japan

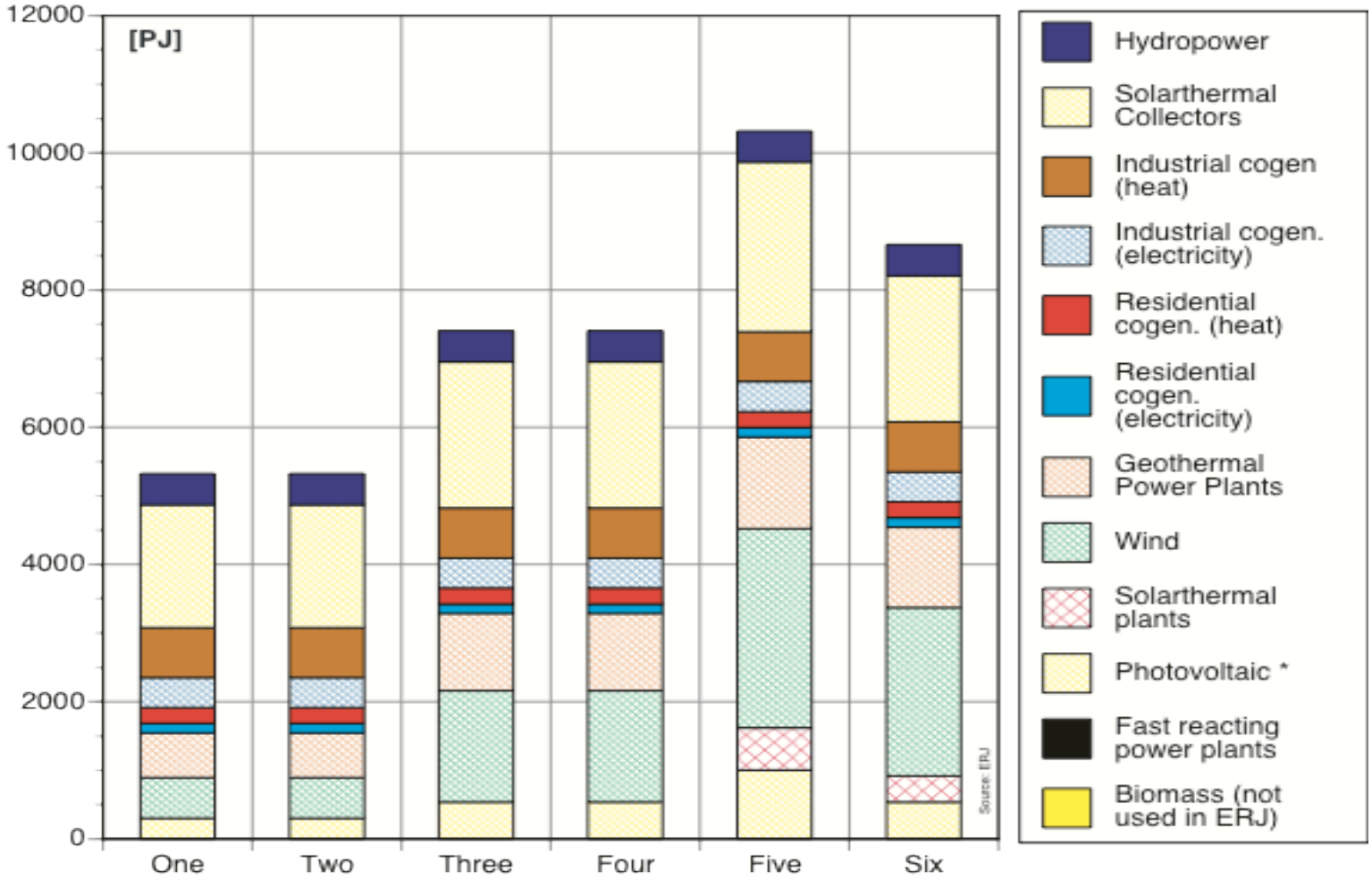
エナジー・リッチ・ジャパン



Brutto Energy Production in ERJ Model

ENERGY RICH JAPAN

エナジー・リッチ・ジャパン

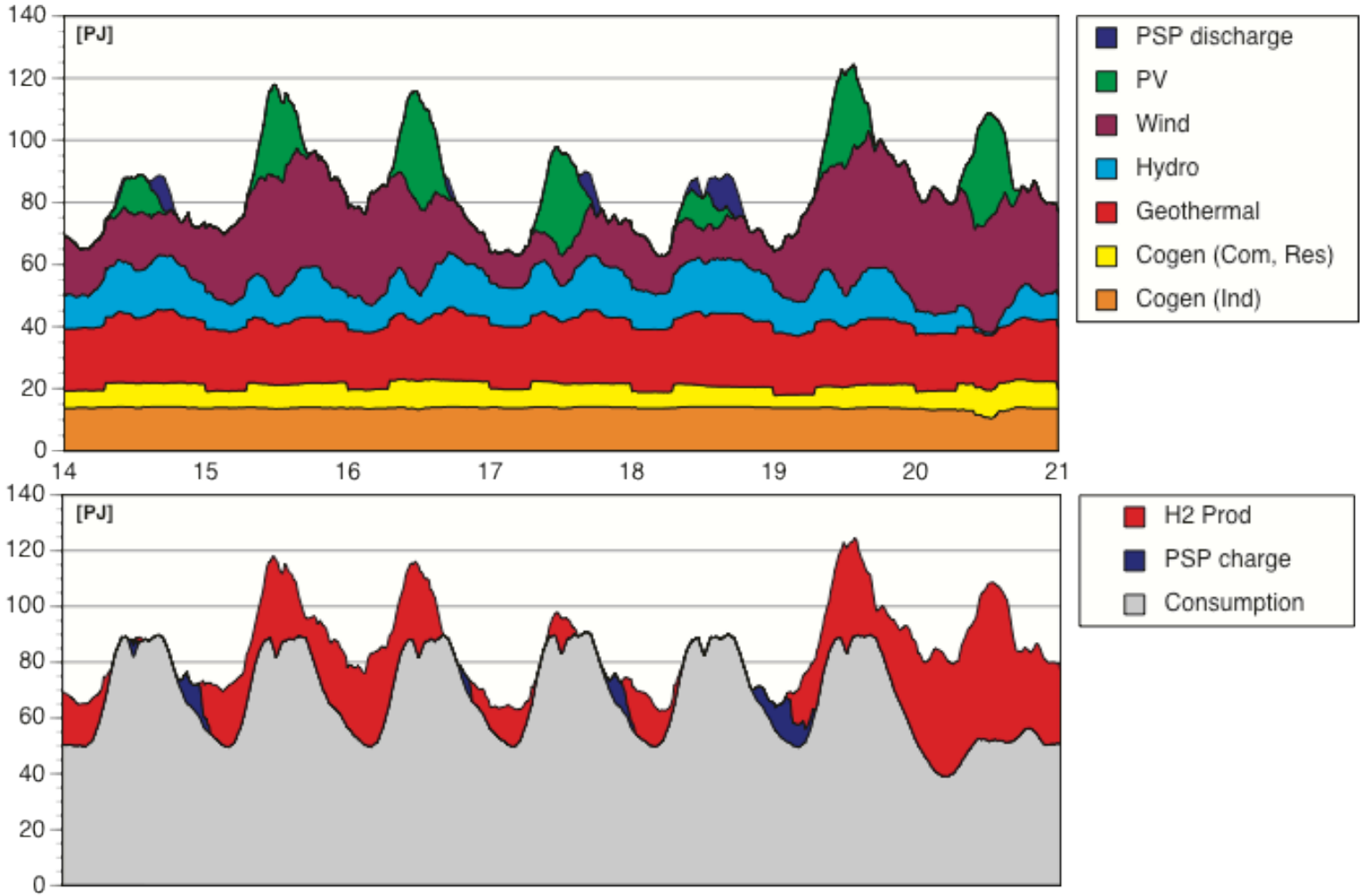


Source: H.Lehmann et.al. – ERJ, www.energyrichjapan.info - 2003

Results: Week 3

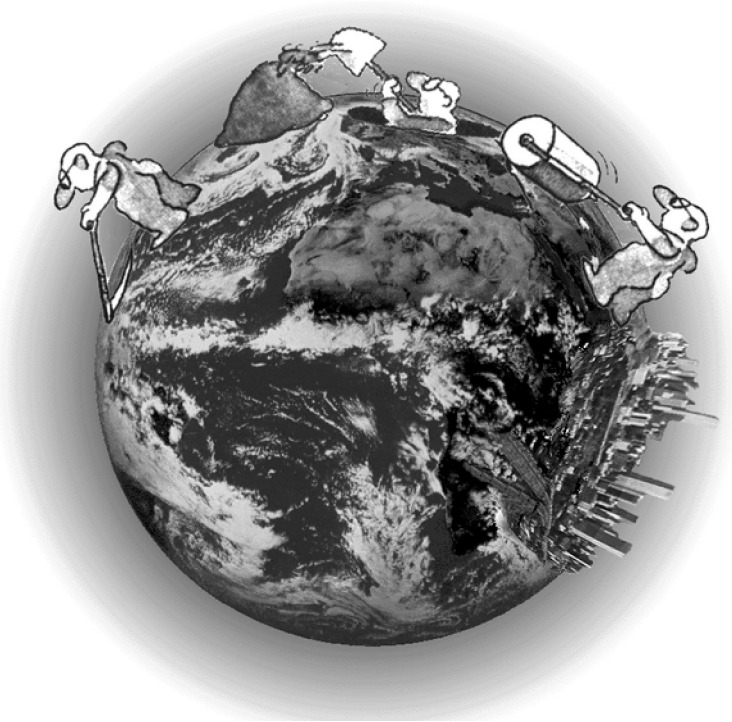
ENERGY RICH JAPAN

エナジー・リッチ・ジャパン



Source: H.Lehmann et.al. – ERJ, www.energyrichjapan.info - 2003

Policy...



Limits to growth

Source: Harry Lehmann, 1994

Recommendations to policymakers

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

Umwelt Bundes Amt
Für Mensch und Umwelt

Recommendations to policymakers

3. Adjusting legal and economic framework conditions

FIT

- 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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Für Mensch und Umwelt

Recommendations to policymakers

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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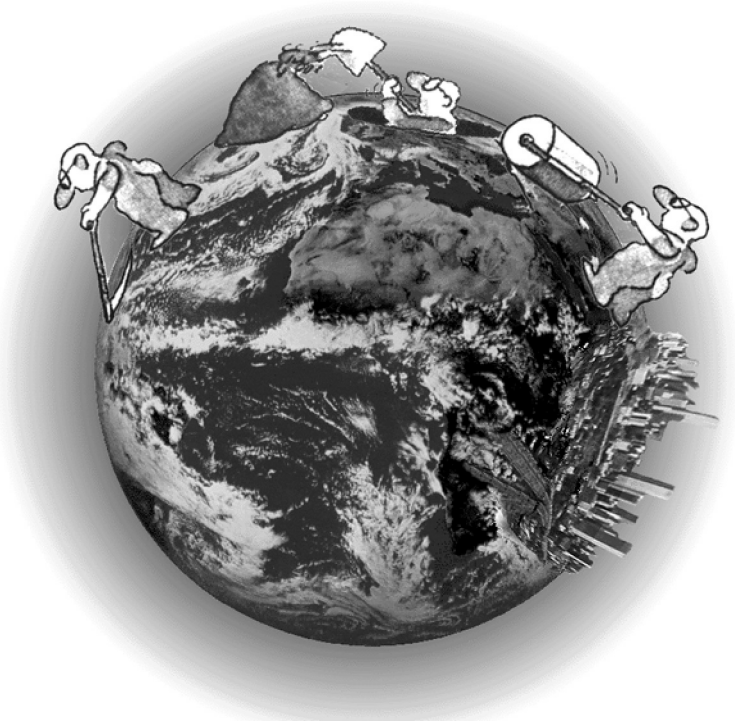
Für Mensch und Umwelt

Regions on their way...



Limits to growth

Source: Harry Lehmann, 1994

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100 % RE-Regions

- The Project *100%-RE-Regions* analysis and support regions and municipalities which have set the medium to long term goal for the development of their energy supply system to the challenge of **100% renewable energy supply**.

- In Germany there are more than one hundred regions and municipalities participating

- The project is funded by the Federal Environment Ministry (BMU)

- Strategic advice is provided by the Federal Environmental Agency (UBA)

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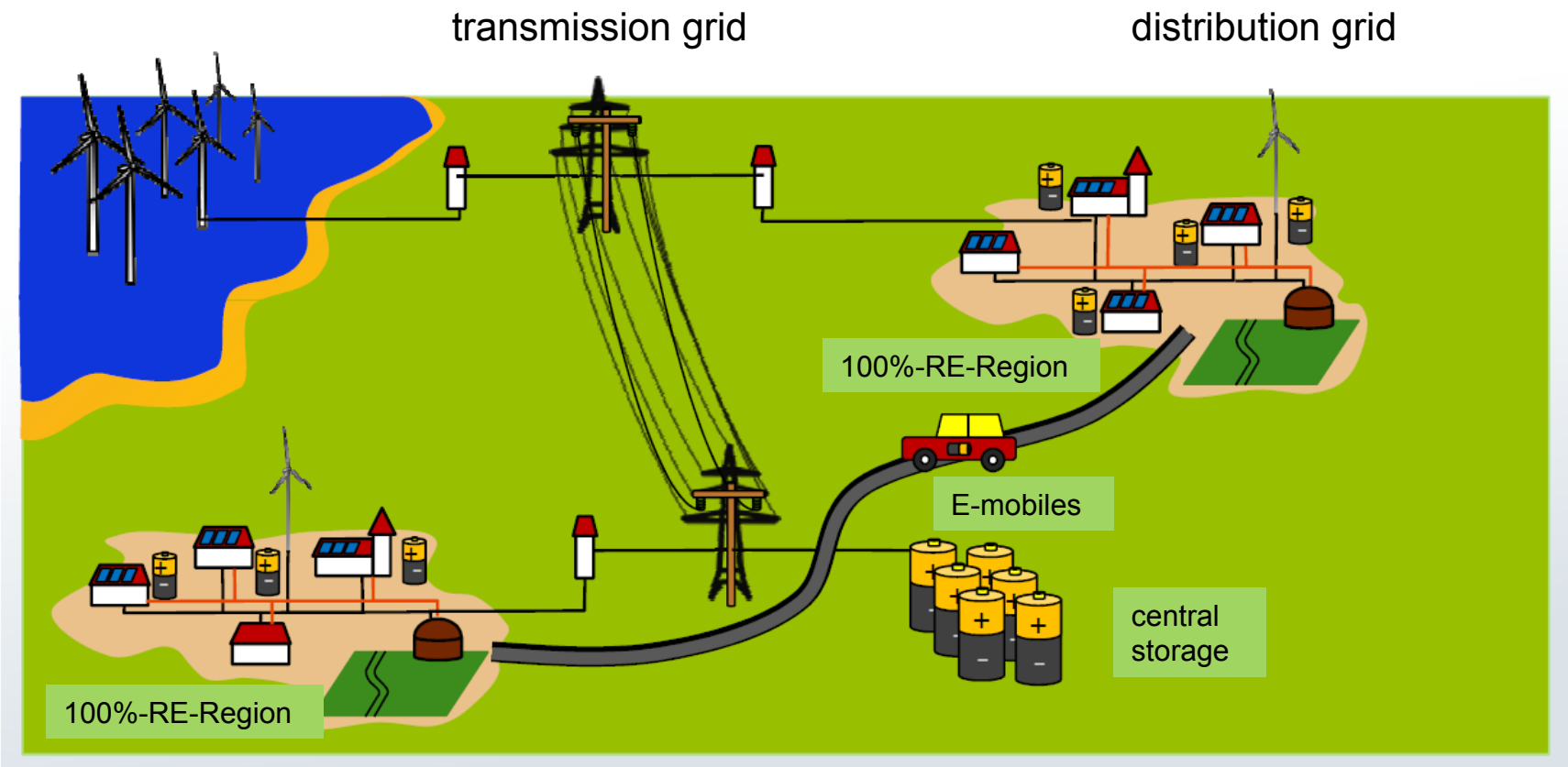
Für Mensch und Umwelt

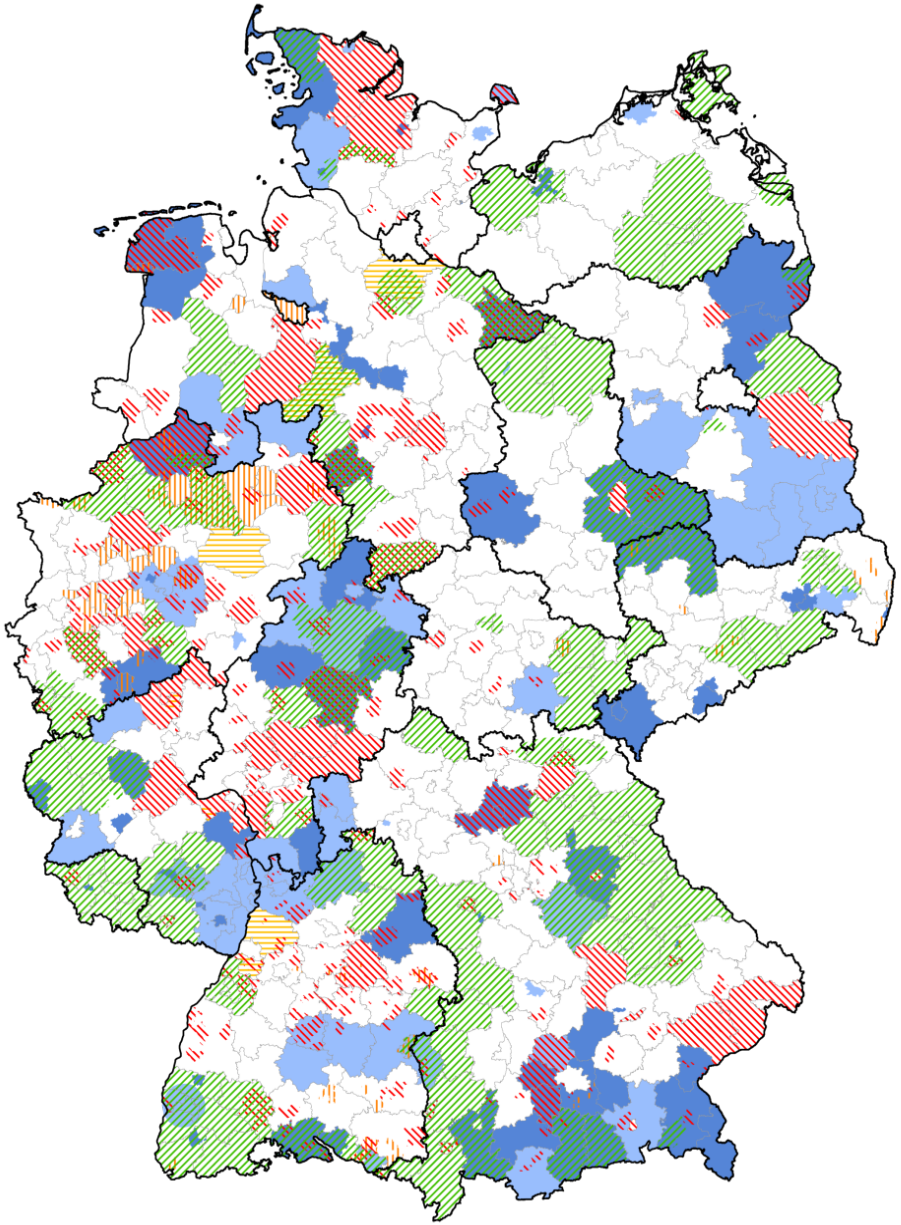
100 % RE-Regions



[Moser, deEnet]

Active Regions

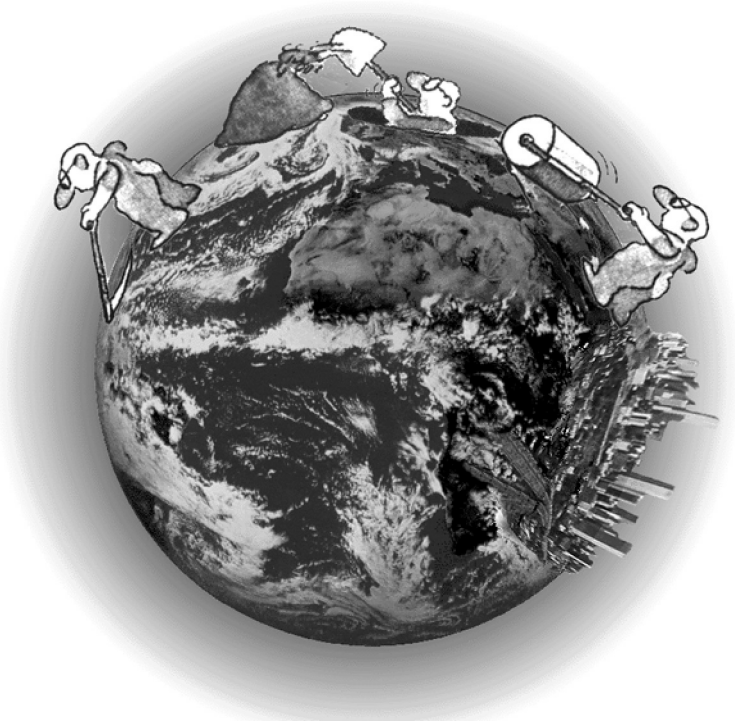
50% of Germany



Energie mit System
deENet

Nuclear Phase out in Germany?

2017 ... 2022



Limits to growth

Source: Harry Lehmann, 1994

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Capacity Power Plants

20,5 GW Nuclear

(8,4 GW switched off 2011)

New capacity until 2020:

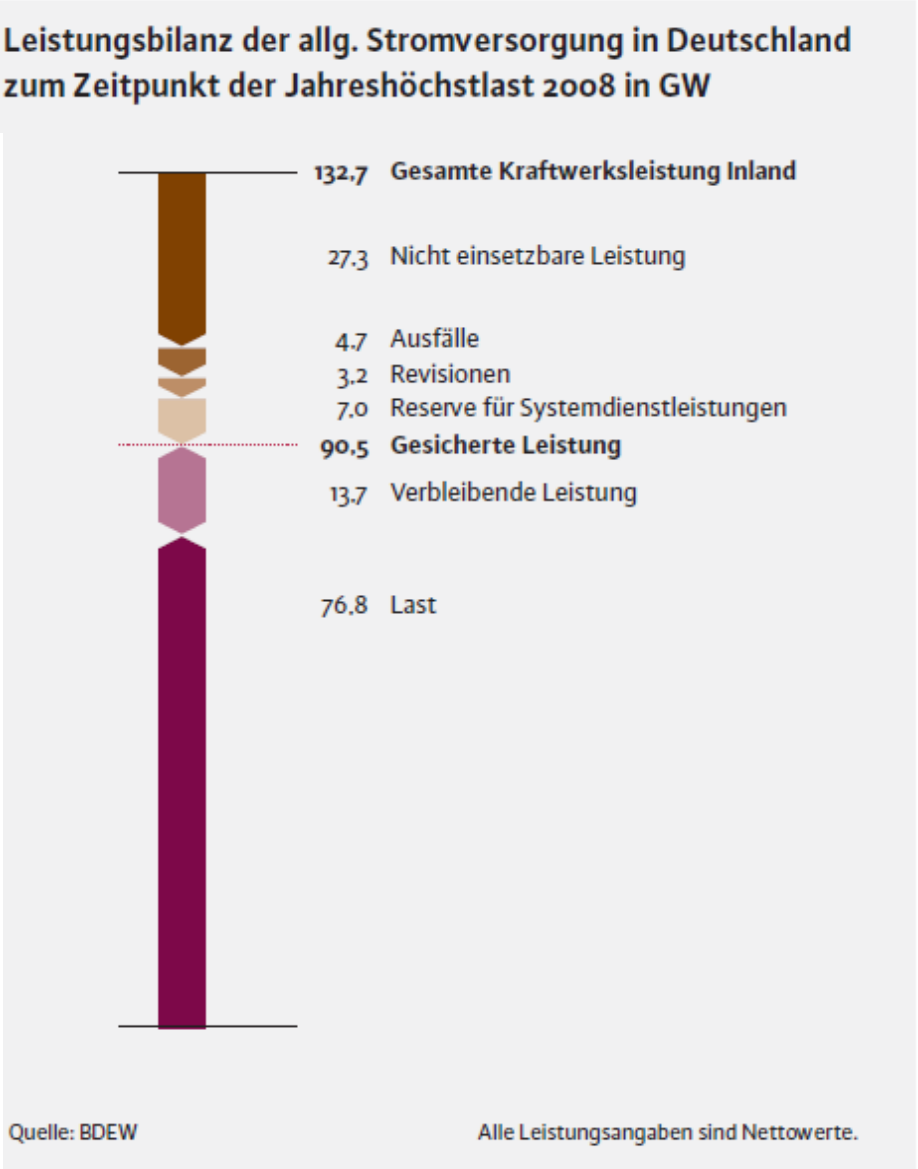
11 GW Gas and Coal

?? Cogeneration

?? Renewables

Phase Out old Coal:

< 6 GW (or retrofit ?)



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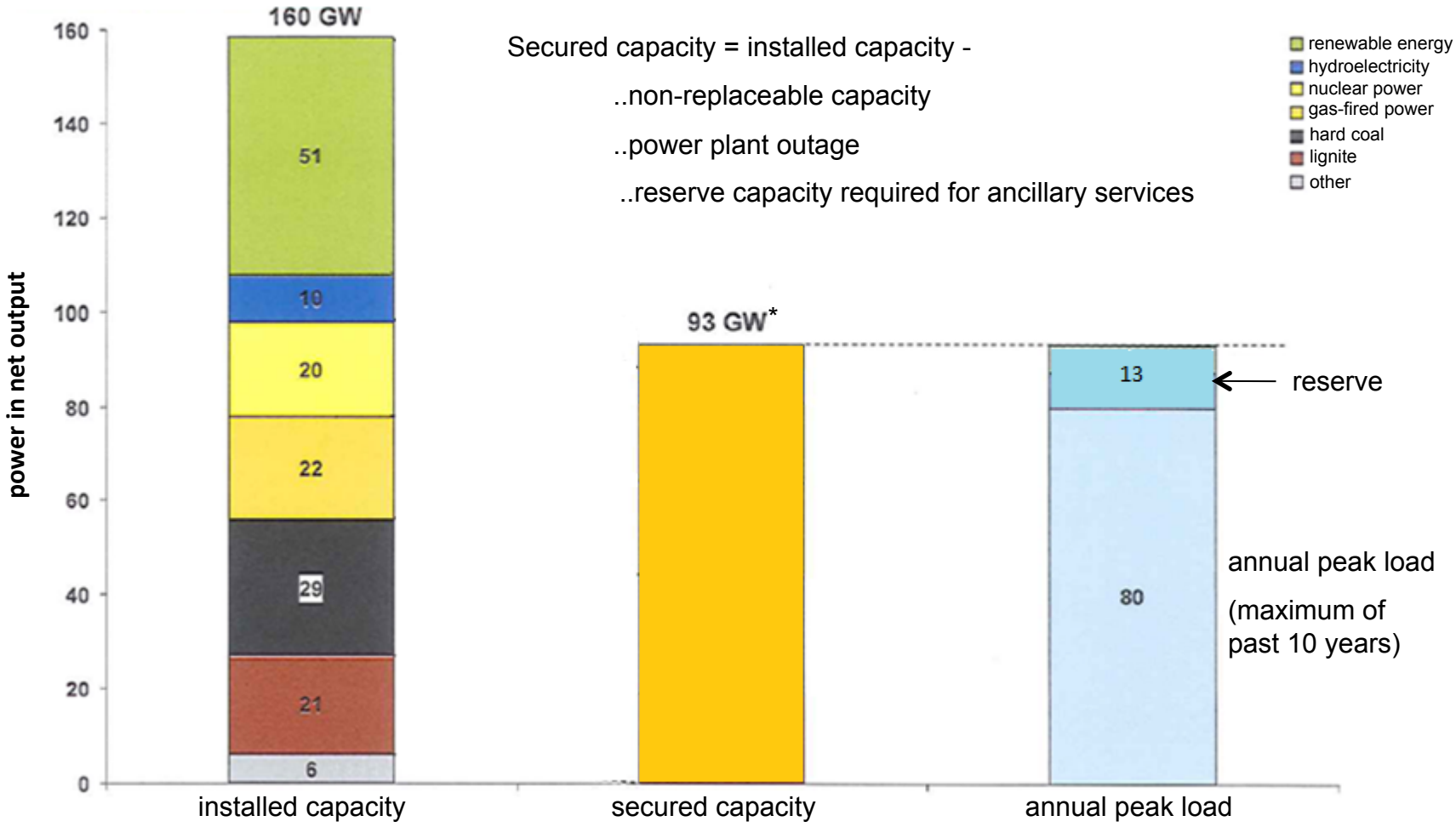
Power supply in Germany - January 2011



Secured capacity = installed capacity -

..non-replaceable capacity

..power plant outage

..reserve capacity required for ancillary services

*without 2,1 GW nuclear power – out of service since 2008

Reference: BMWi, 2011

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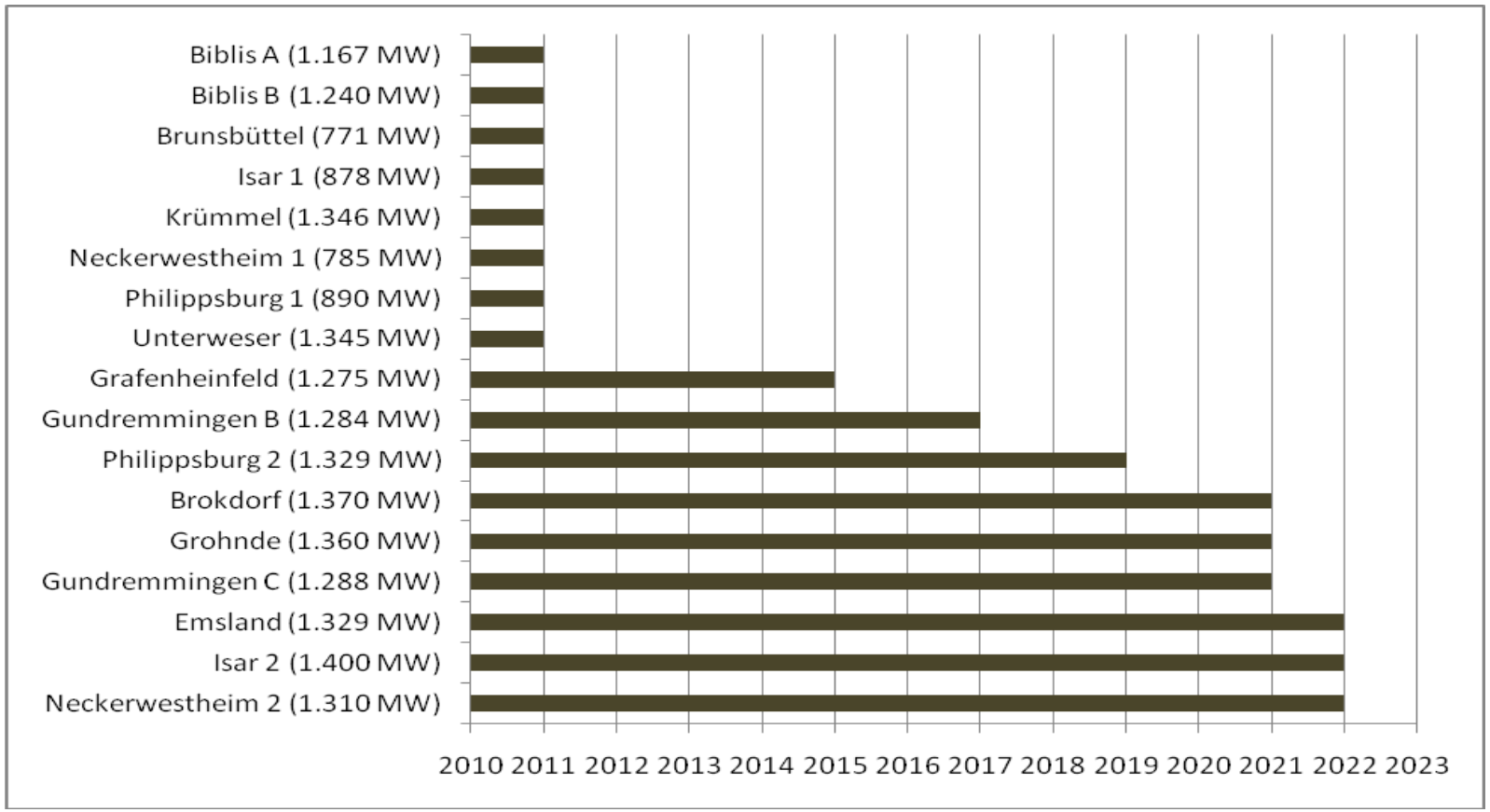
Phase out of the individual nuclear power plants



	2011	2015	2017	2019	2021	2022	total
cut-off in MW	8.422*	1.275	1.284	1.329	4.018	4.039	20.367

Power in net output

*2,1 GW nuclear power out of service since 2008

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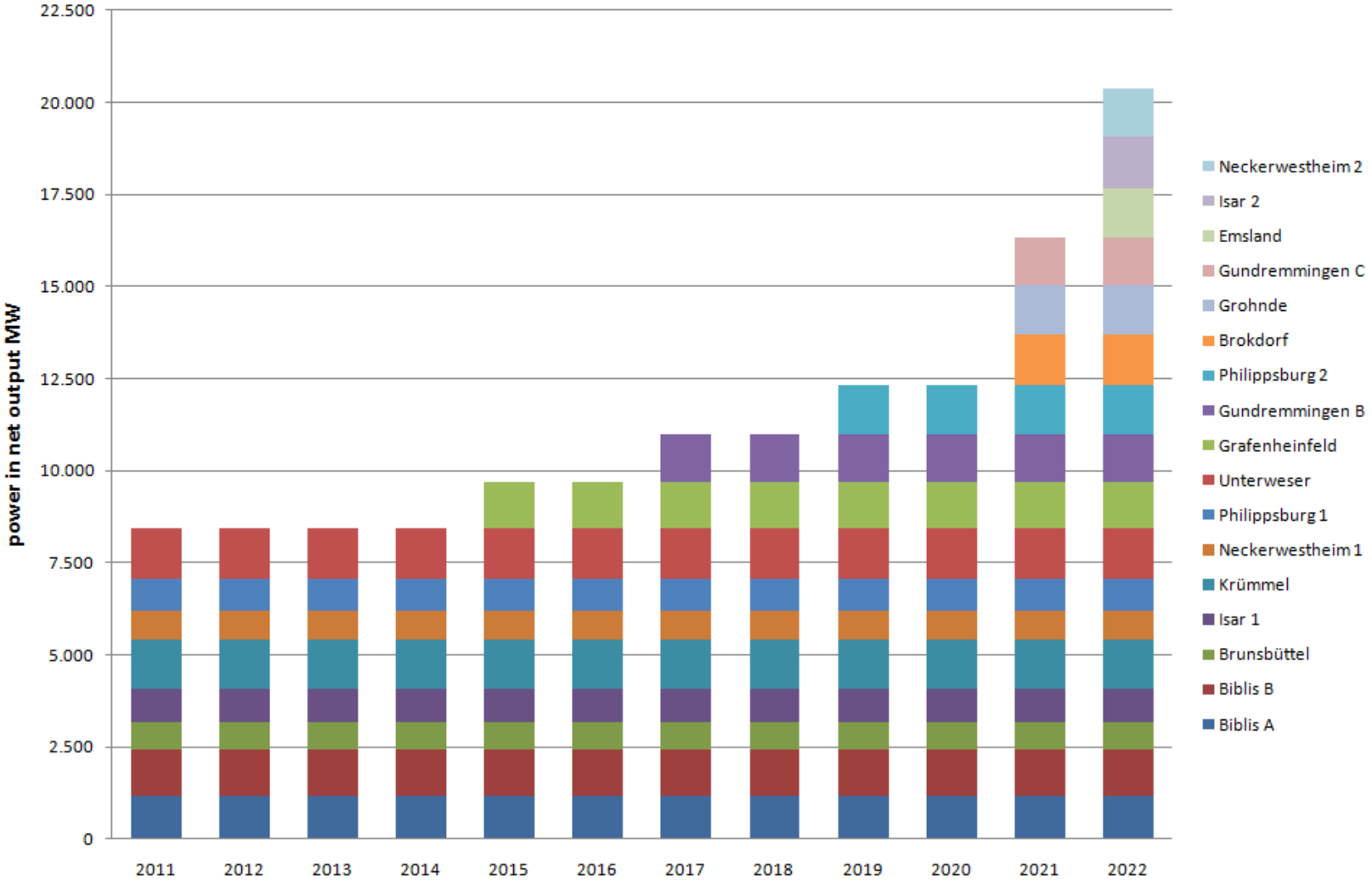
Decommissioning of nuclear power plants



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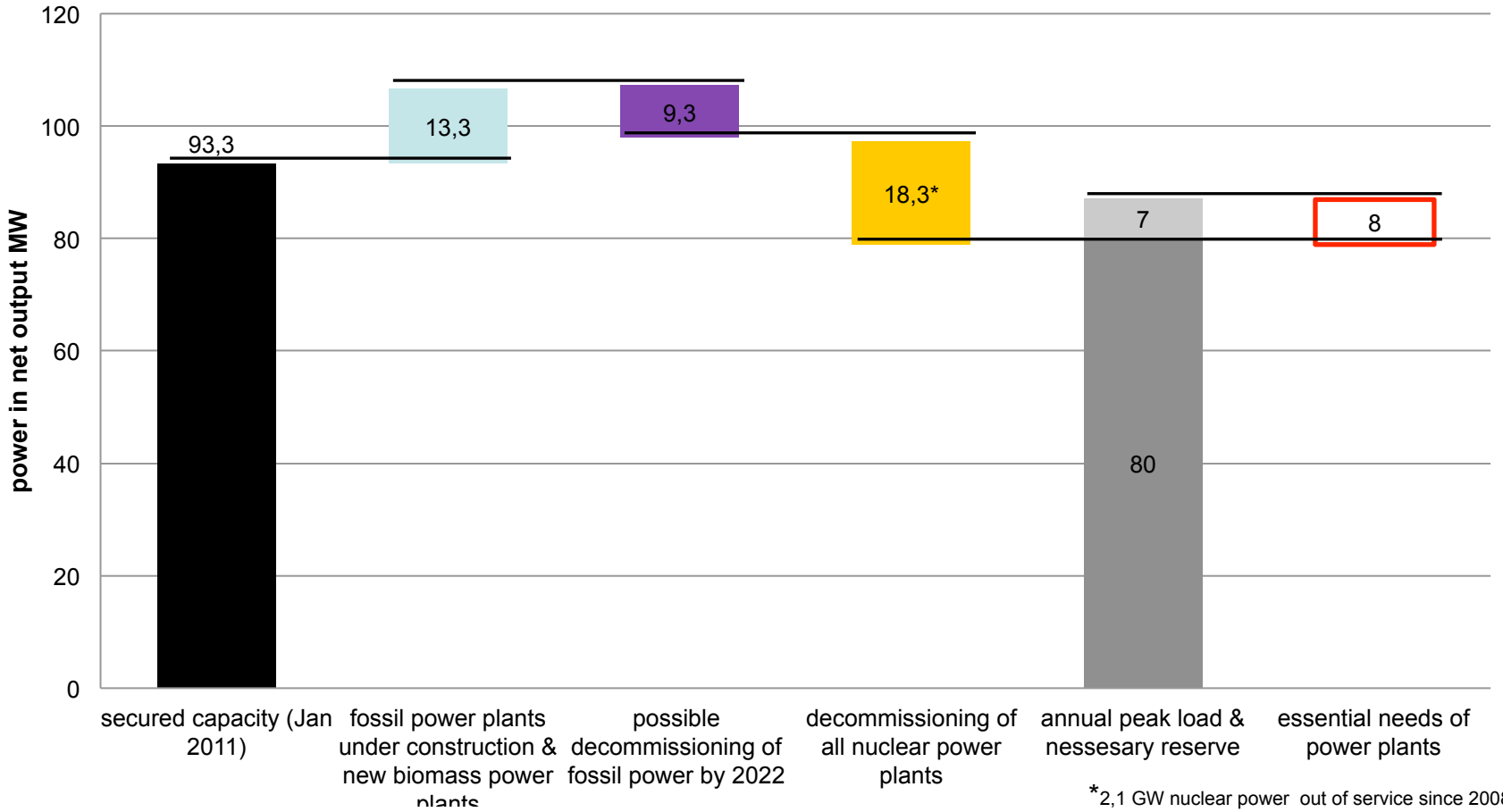
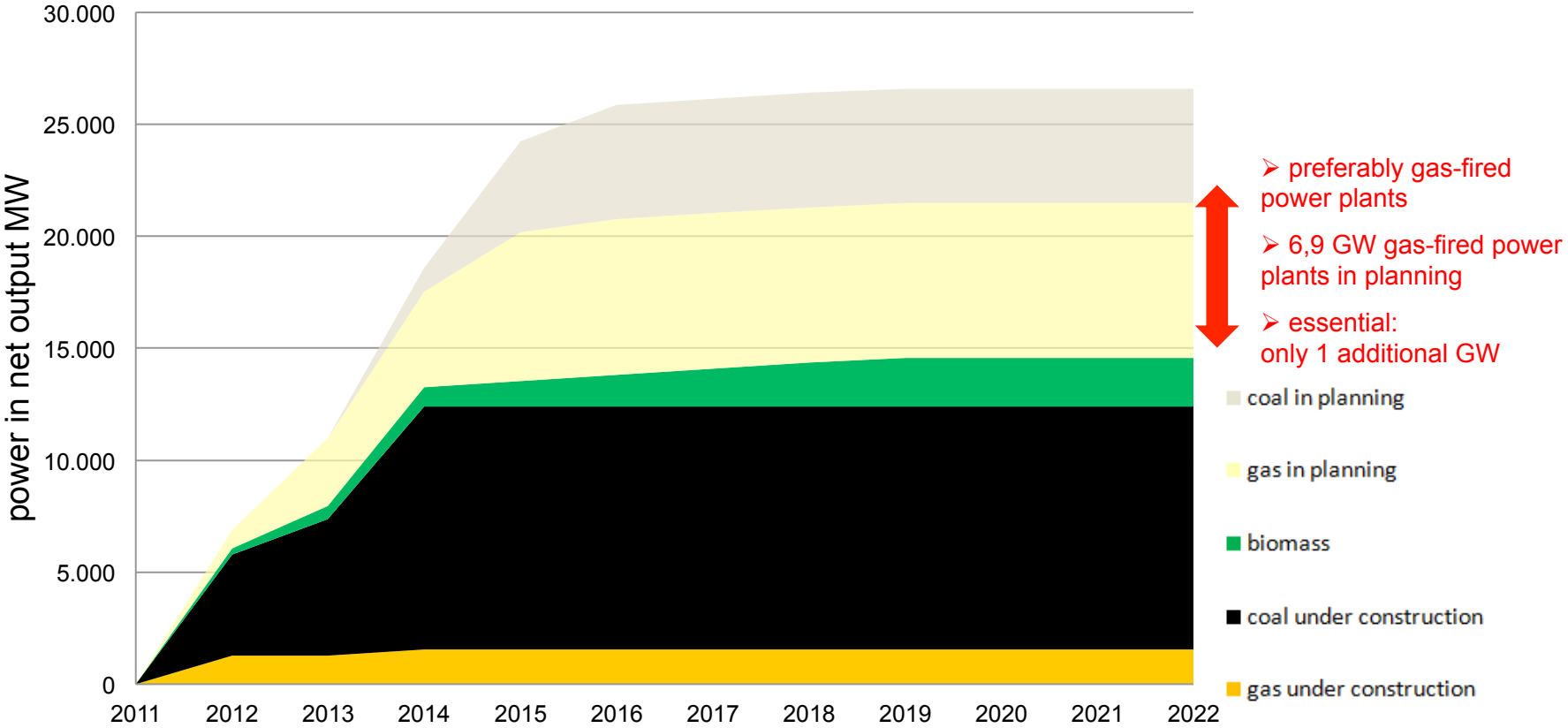
Power supply in Germany - January 2011 to 2022



- essential: additional 8 GW by 2022 to guarantee security of supply
- preferably gas-fired power plants
- 7 GW gas-fired power plants in planning
- additional potential of 3 GW through demand side management

Potential capacity of new power plants



- 1,6 GW gas and 10,8 GW coal-fired plants under construction (0,6 GW gas already running)
- 6,9 GW gas-fired plants in planning
- 5,1 GW coal power plants in planning
- The development is difficult to estimate.
  - Delay in construction
  - New fossil projects and decommissioning subject to market situation

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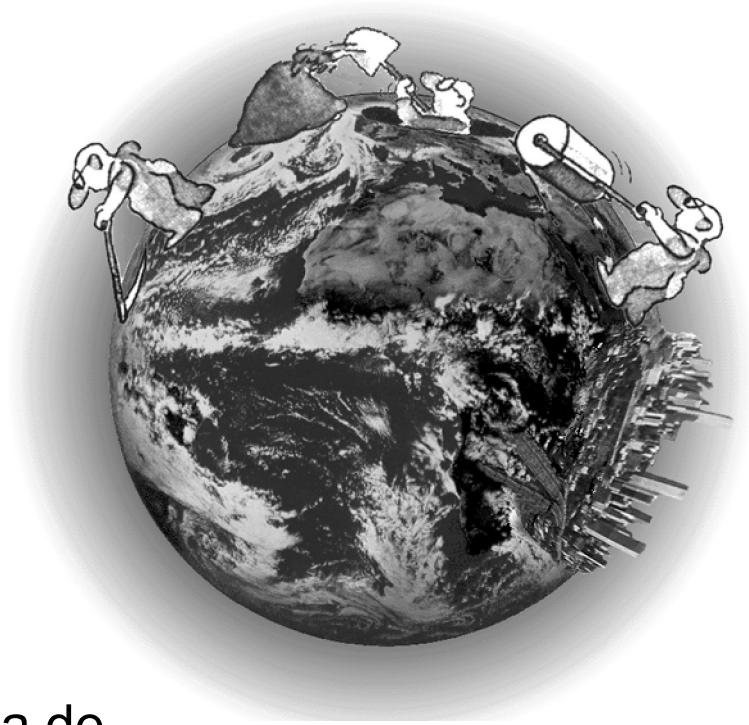
summery

- power supply in Germany in January 2011 → 13 GW reserve
- Phase out of nuclear power is 2022 (total 20,4 GW)
- Power supply in Germany in 2022
  - additional 8 GW needed to guarantee security of supply (national capacity)
  - 6,9 GW gas-fired plants in planning
  - no additional coal power plants necessary
  - additional potential of 3 GW through demand side management to reduce the fossil power plant needed

Economic development in future



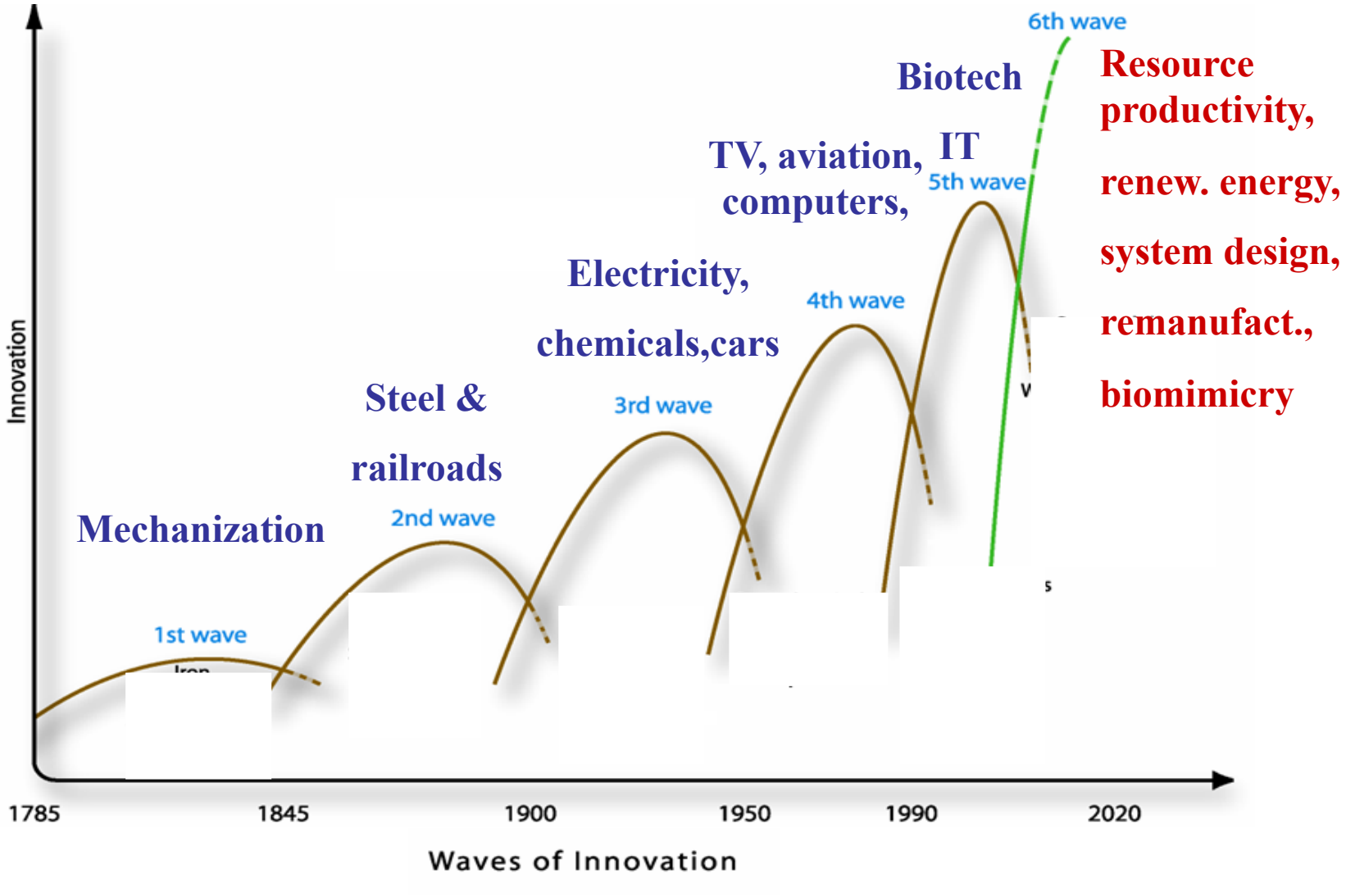
Limits to growth

Source: Harry Lehmann, 1994

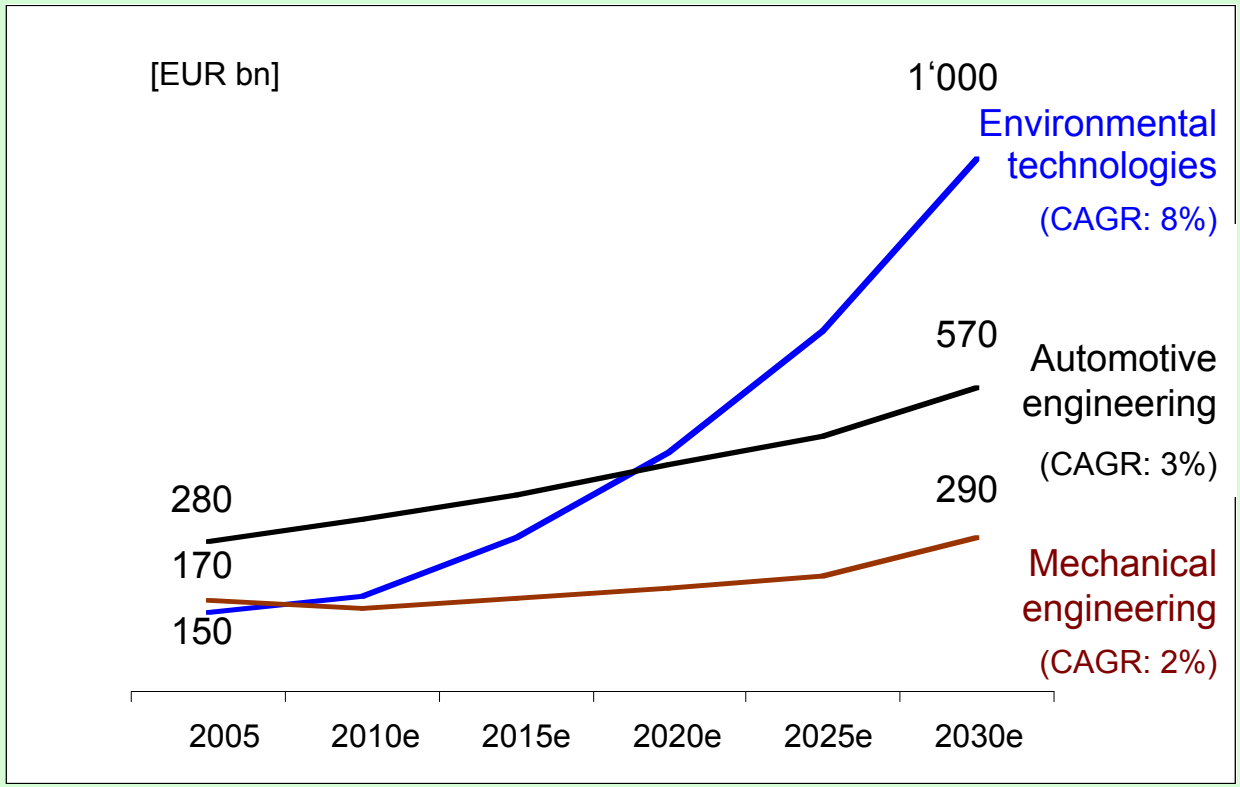
harry.lehmann @ uba.de

The sixth Kondratiev: Resource productivity

(after Charlie Hargroves, Brisbane, Australia)

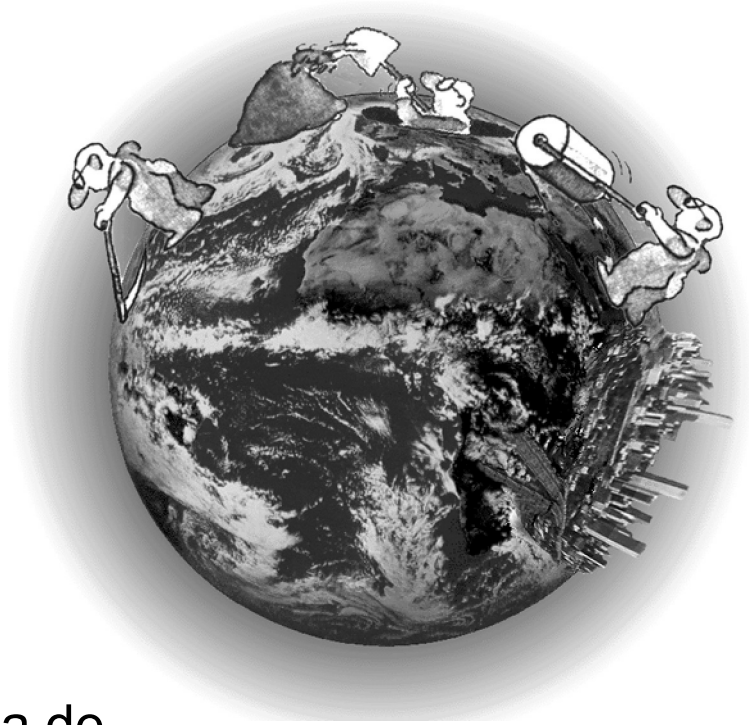


Trend in the German environmental technology industry



Source: Prognos 2006, Roland Berger

Instruments ... FIT



Limits to growth

harry.lehmann @ uba.de

Source: Harry Lehmann, 1994

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Good Reasons for a Feed in Tarif

For several reasons different government administrations in Germany intensified the promotion of RES since 1990. Reasons explicitly stated in the RES Act (2009):

The purpose of this Act is

- *to facilitate a sustainable development of energy supply, particularly for the sake of protecting our climate and the environment,*
- *to reduce the costs of energy supply to the national economy, also by incorporating external long-term effects,*
- *to conserve fossil fuels and*
- *to promote the further development of technologies for the generation of electricity from renewable energy sources.*

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Renewable Energy Sources Act – EEG

basic and necessary features

- **priority connection of installations**
- **priority purchase and distribution of electricity**
- **guaranteed feed-in tariffs**
  - covering extra technology cost and sufficient profit
  - support timeframe long enough to ensure investment security
  - decrease over time (for new installations) enforces cost reduction
- **independence of public budgets – low transfer costs**
  - nation-wide proportional distribution of electricity purchased and corresponding fees to all electricity customers (“EEG-Quota”)
  - EEG defines a legal relationship between private bodies
- **“Exclusive-use” principle**
- **Experience- and Impact Report to German Parliament**

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Incentives steering RES development

- Scaling of feed in tariffs acc. to energy output to enable small scale investment into RES
- Graduated remuneration for particular feedstock choices (e.g. organic waste, liquid manure > cereal) independent from plant size
- Bonuses to incentivize particular choices for (conversion-)technology (e.g. biogas upgrading to biomethane)

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Biomass Sustainability ordinances

Biomass Electricity- & **Biofuel** Sustainability Ordinances

→ German ordinances acc. to RES Directive with a detailed list of conditions.

→ **Sustainability criteria** relate to compliance at environmental level

1. GHG saving level to be achieved
   (initial 35% saving to be increased to 50 % by 2017)

2. Land with high biological value or high carbon stock excluded from feedstock cultivation for biofuels (i.e. primary forest, land for nature protection, natural grassland, wetland, peat land)

3. EU Production of raw materials in accordance with cross compliance rules (EC) No 1782/2003 (§5)

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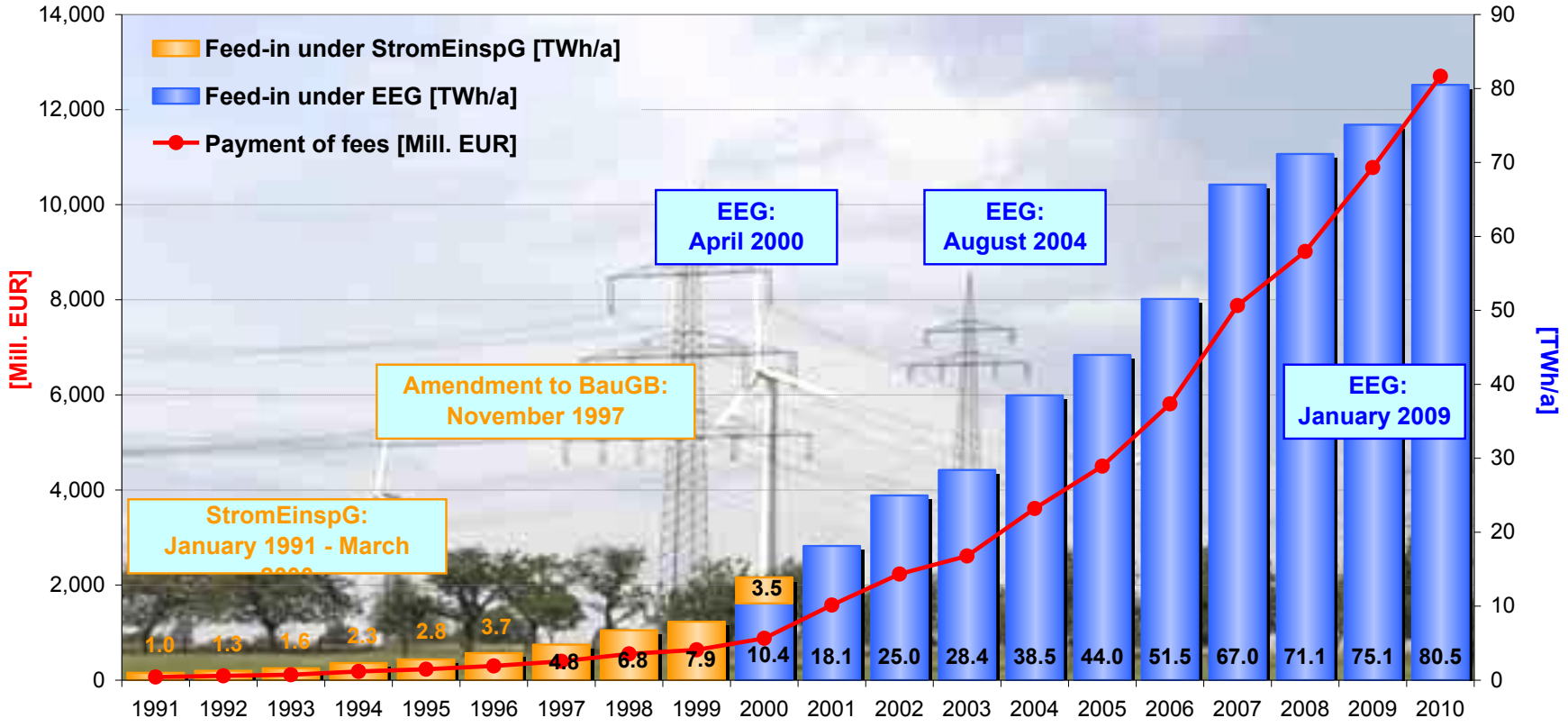
Feed-in and payment under the Electricity Feed Act (StromEinspG) and the Renewable Energy Sources Act (EEG) in Germany



StromEinspG: Act on the Sale of Electricity to the Grid; BauGB: Construction Code; EEG: Renewable Energy Sources Act; 1 TWh = 1 Bill. kWh; Source: BMU-KI III 1 according to Working Group on Renewable Energy Sources-Statistics (AGEE-Stat); Year 2010: provisional estimate (lfnE); image: BMU / Bernd Müller; as at: March 2011; all figures provisional

Source: BMU-KI III 1 - Development of renewable energy sources in Germany in 2010

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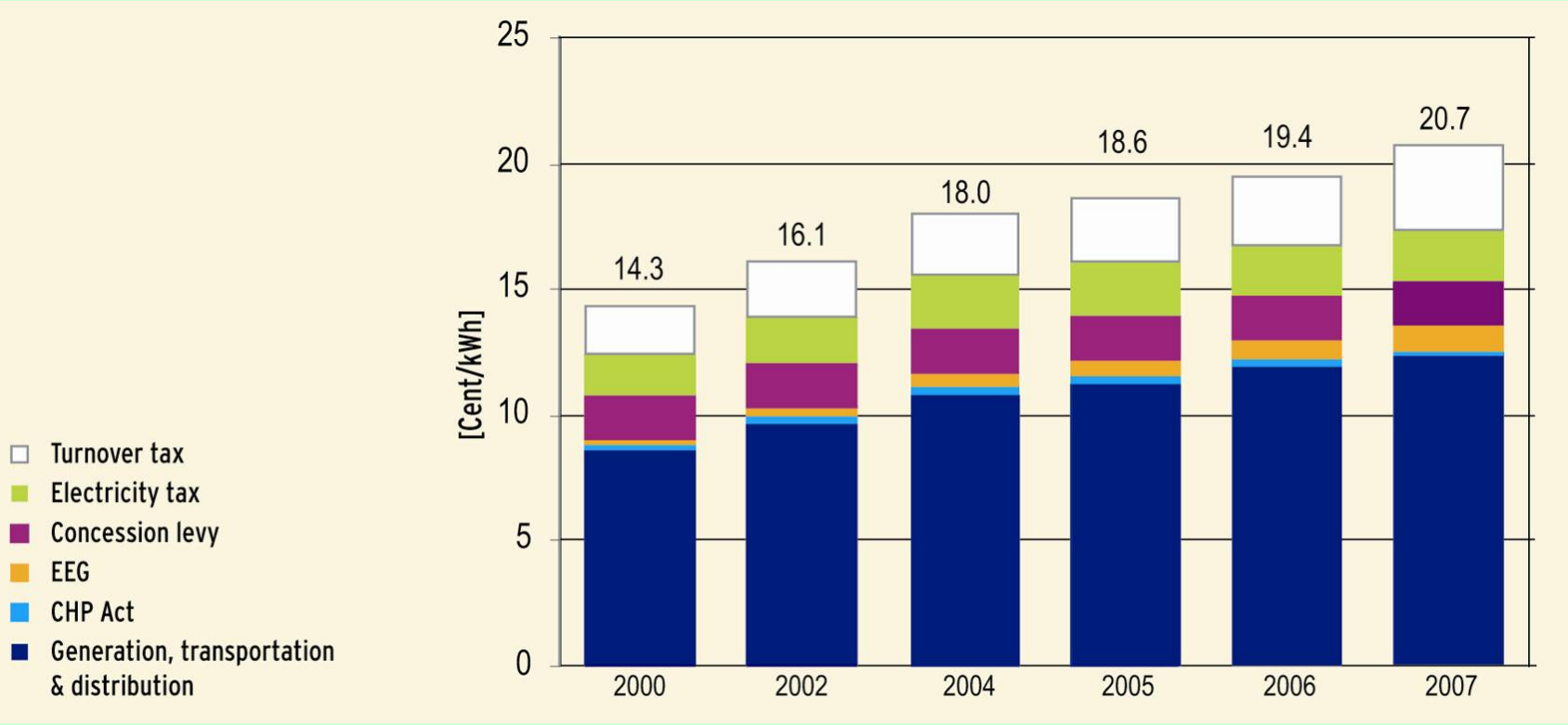
Für Mensch und Umwelt

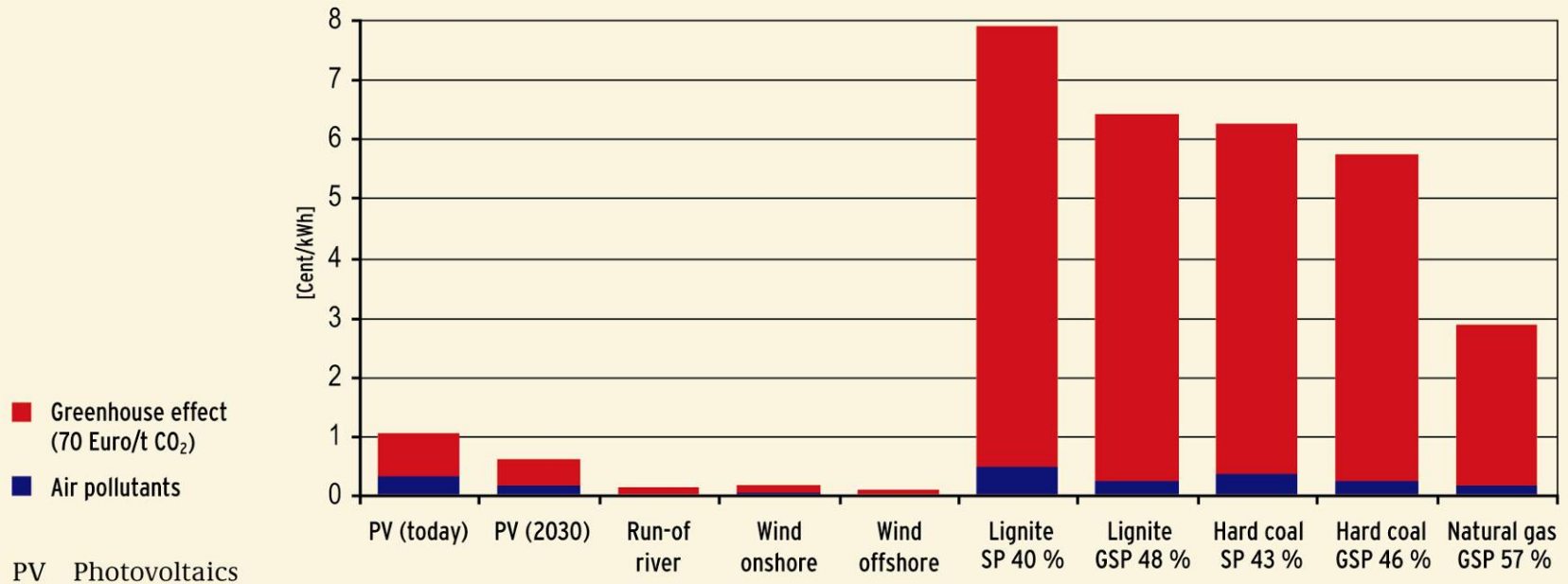
Cost shares for one kilowatt hour (kWh) of electricity for household customers in Germany

Additional costs for customers are only about 1 Eurocent per kWh or about 3 Euros per month per household.



Source: BMU publication „Renewable energy sources in figures“

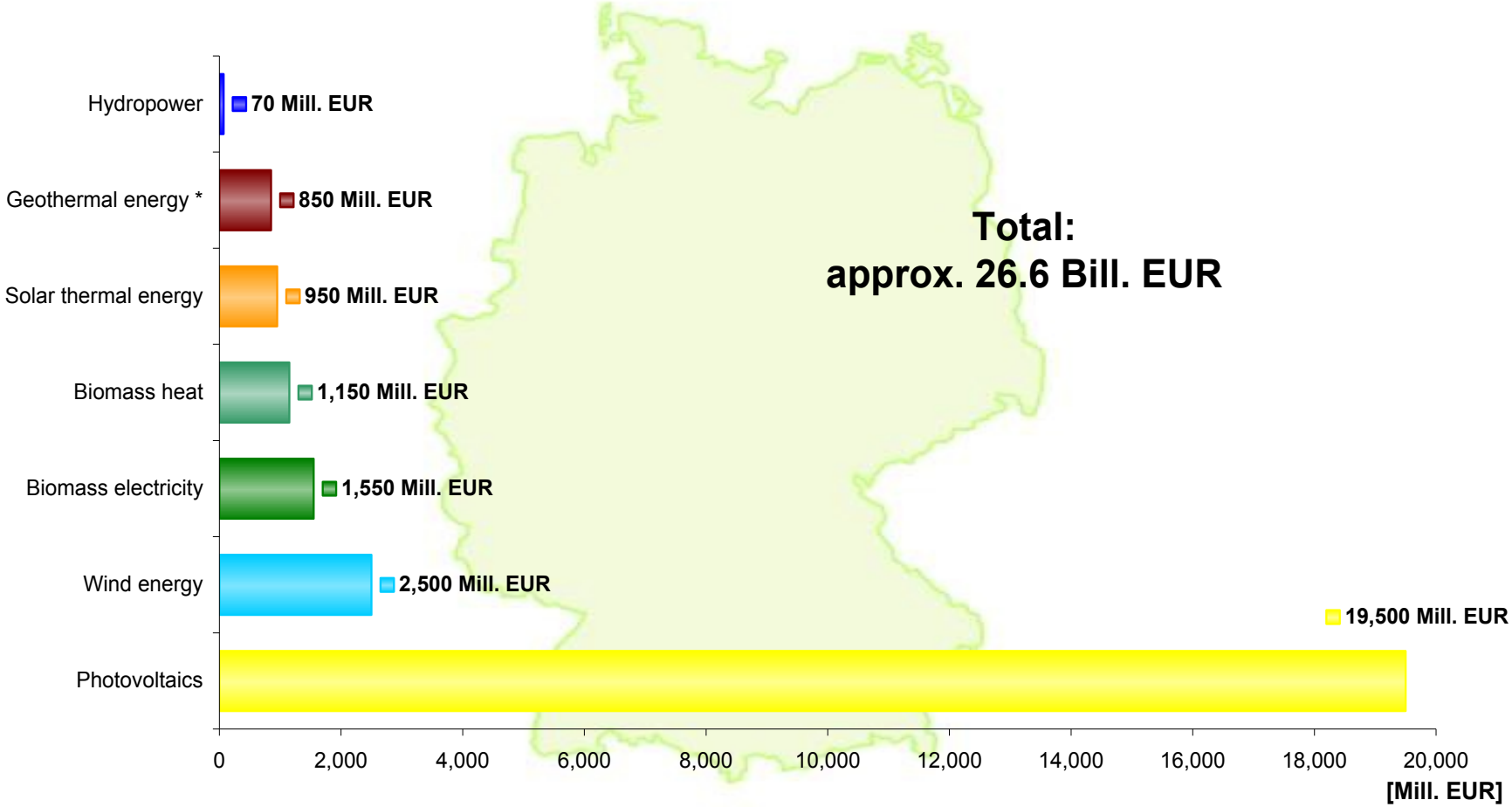
External costs of electricity generation for various options in Germany



PV Photovoltaics
SP Steam power plant
GSP Gas and steam power plant

Source: BMU publication „Renewable energy sources in figures - national and international development", Status: June 2008

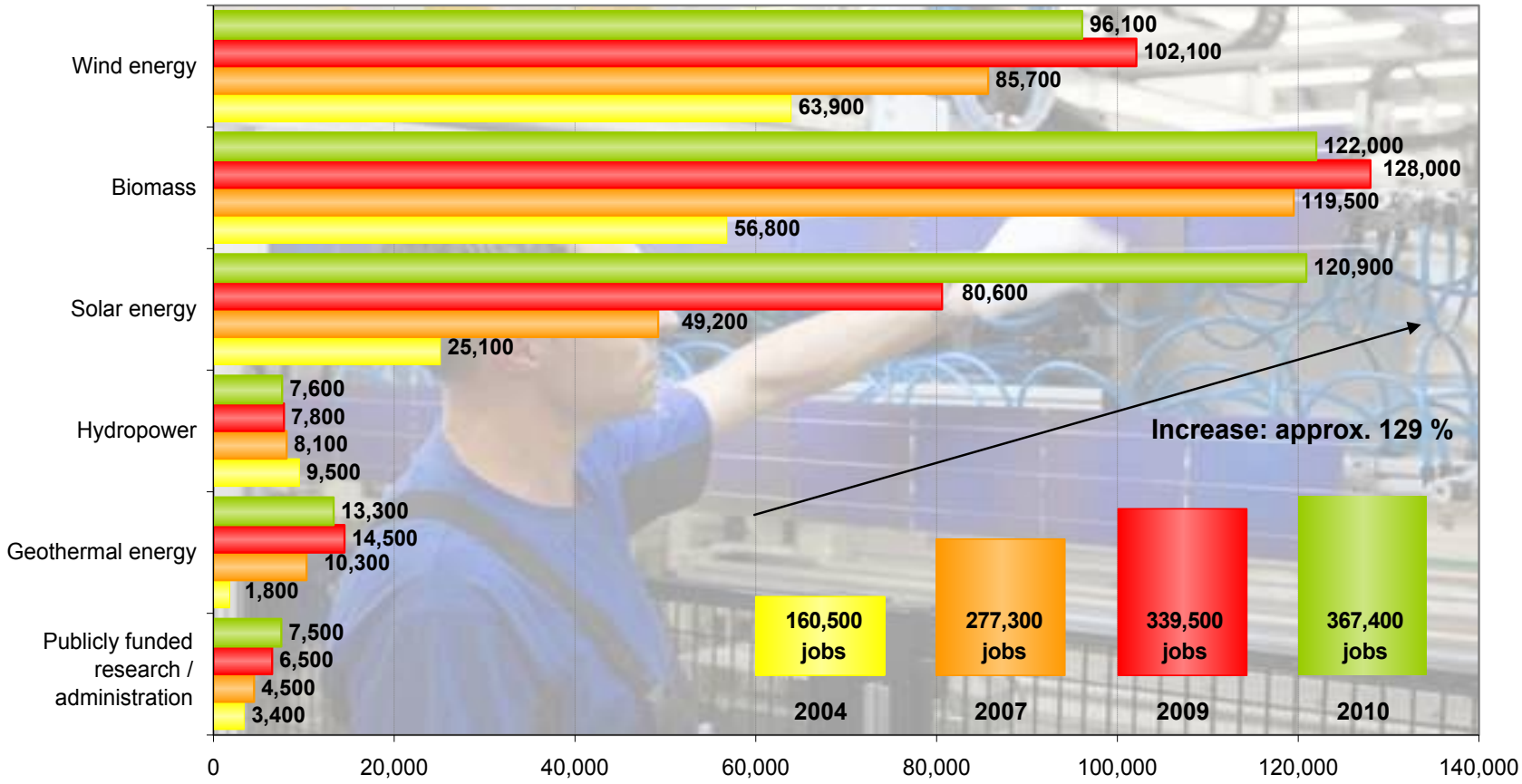
Investments in the construction of renewable energy installations in Germany 2010



* Large plants and heat pumps; deviations in the totals are due to rounding;
Source: BMU-KI III 1 according to the Centre for Solar Energy and Hydrogen Research Baden-Wuerttemberg (ZSW); as at: March 2011; all figures provisional

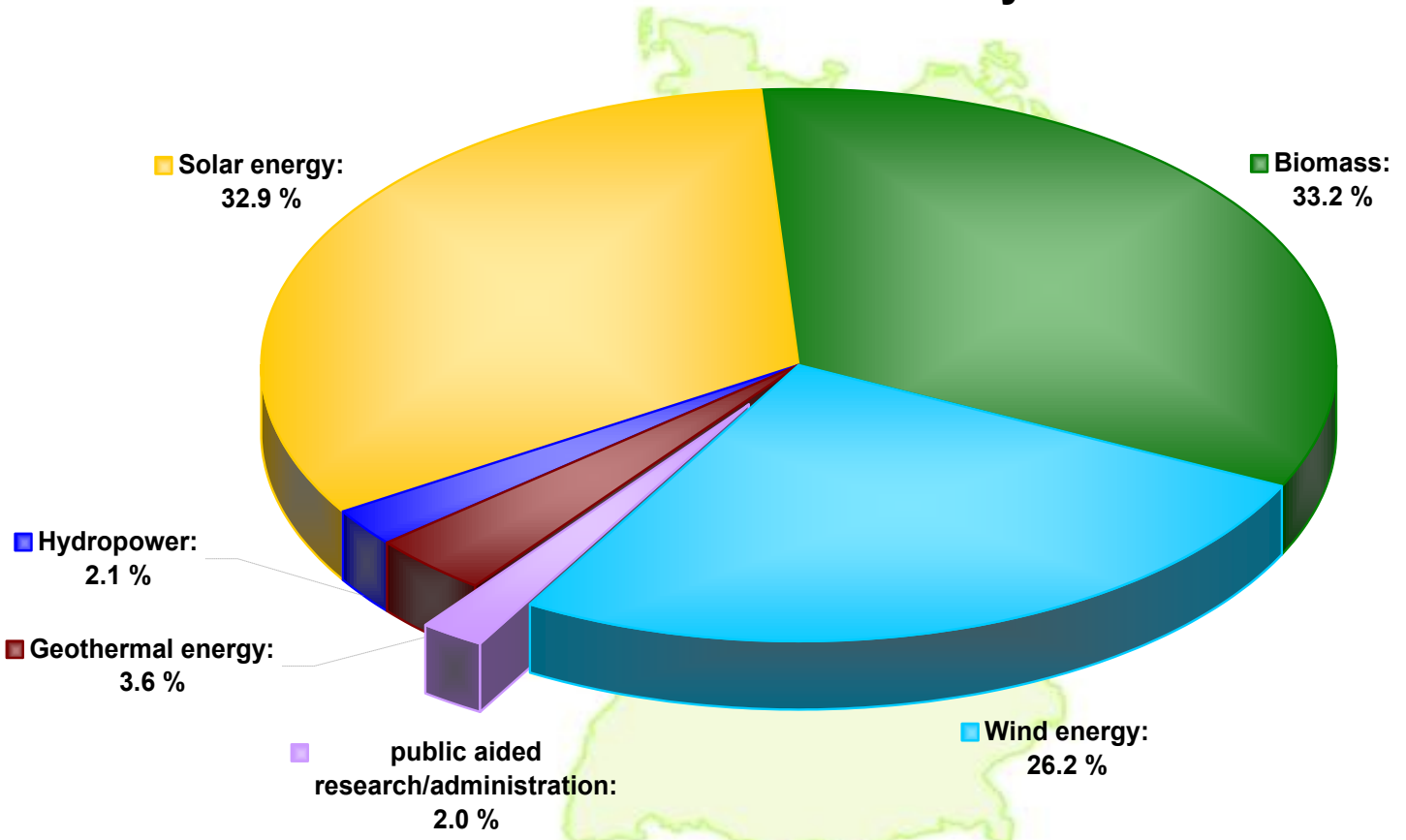
BMU – KI III 1

Jobs in the renewable energy sources sector in Germany



Figures for 2009 and 2010 are provisional estimate; deviations in totals are due to rounding;
Source: O'Sullivan/Edler/van Mark/Nieder/Lehr: "Bruttobeschäftigung durch erneuerbare Energien im Jahr 20010 – eine erste Abschätzung", as at: March 2011; interim report of research project „Kurz- und langfristige Auswirkungen des Ausbaus erneuerbarer Energien auf den deutschen Arbeitsmarkt"; image: BMU / Christoph Busse / transit

Spread of the approx. 367,400 jobs in the renewable energy sources sector in Germany 2010



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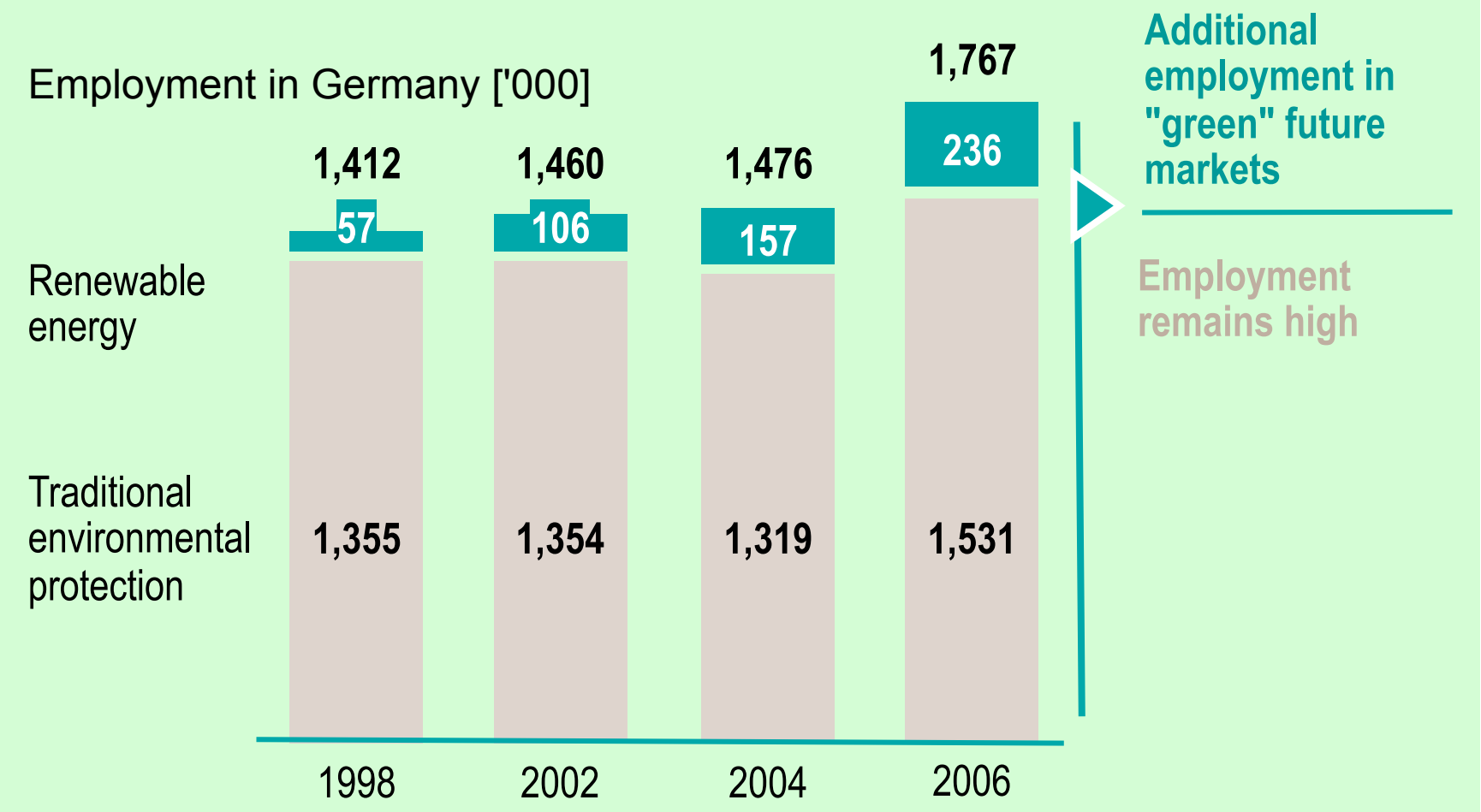
Environmental protection - a chance for more employment



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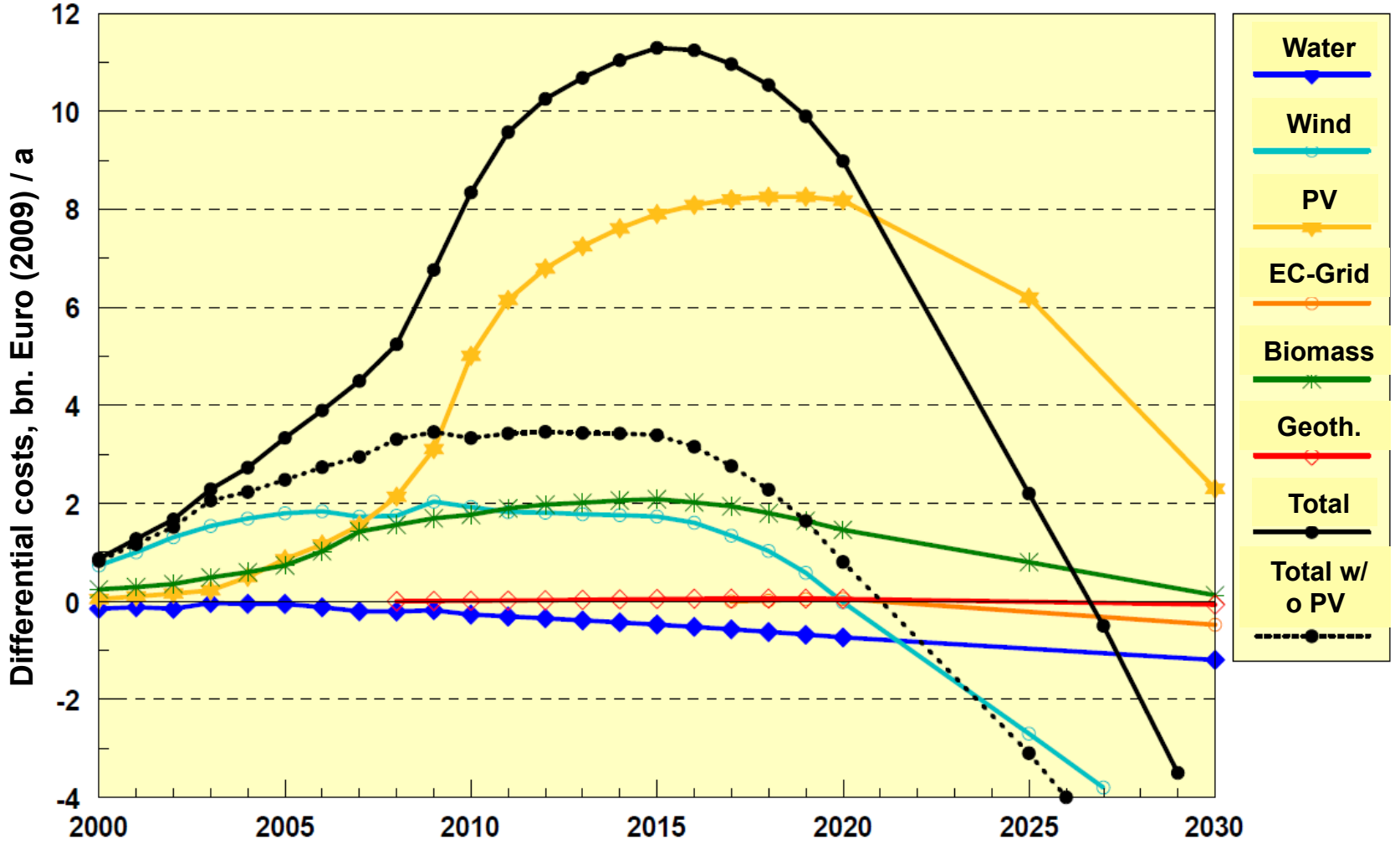
Differential costs of growth scenario



Source: Nitsch, Lead Scenario 2010

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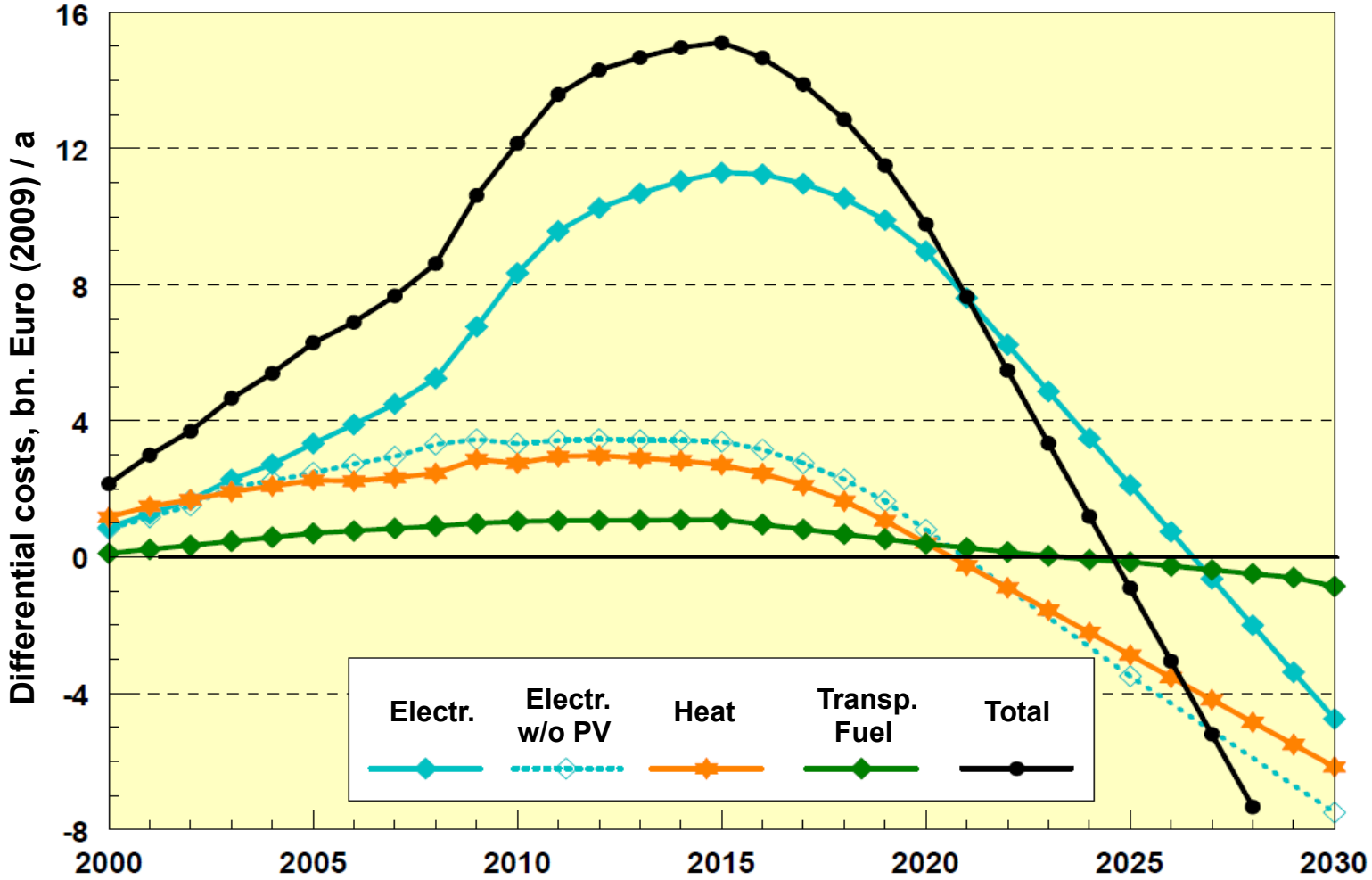
Differential costs of growth scenario



Source: Nitsch, Lead Scenario 2010

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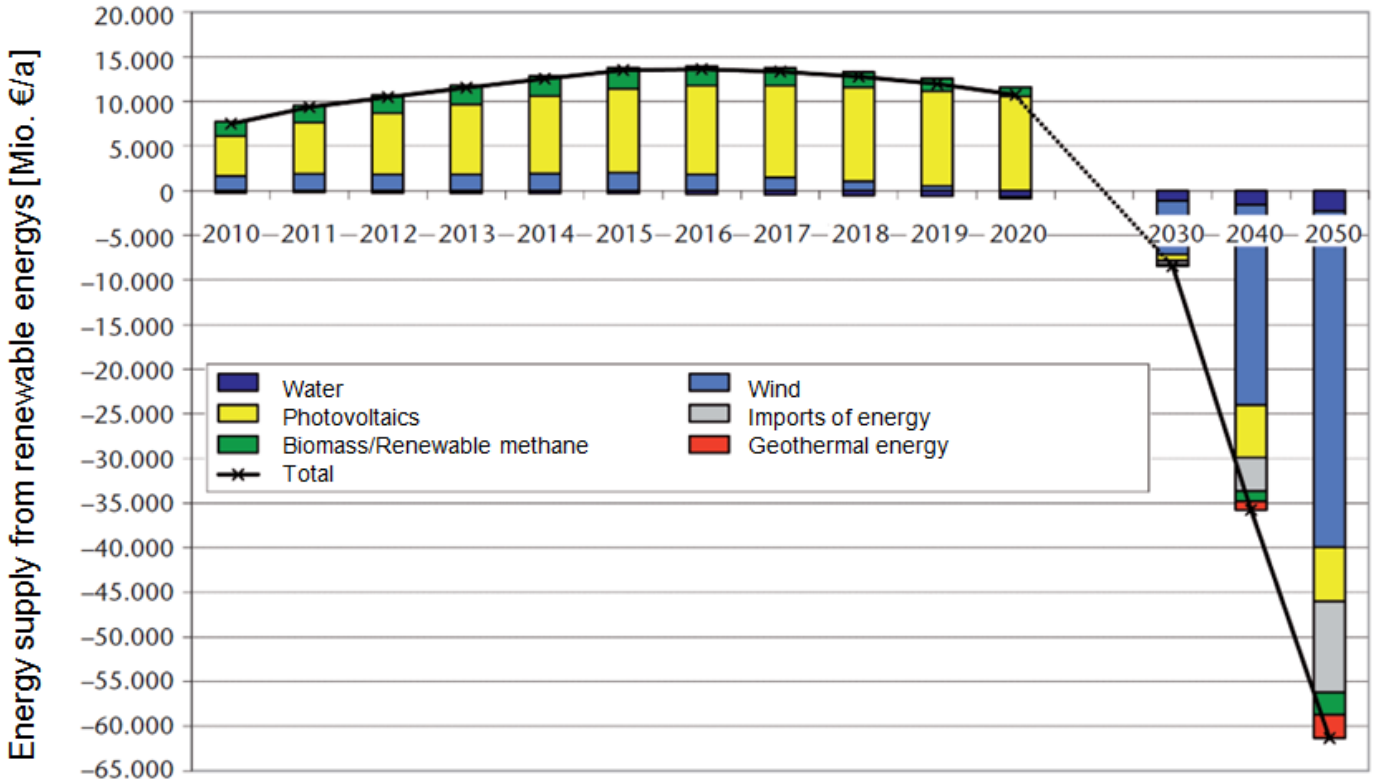
Development of differential costs of renewable electricity generation in Germany, 2010 to 2050



Source: ZSW – Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden Württemberg

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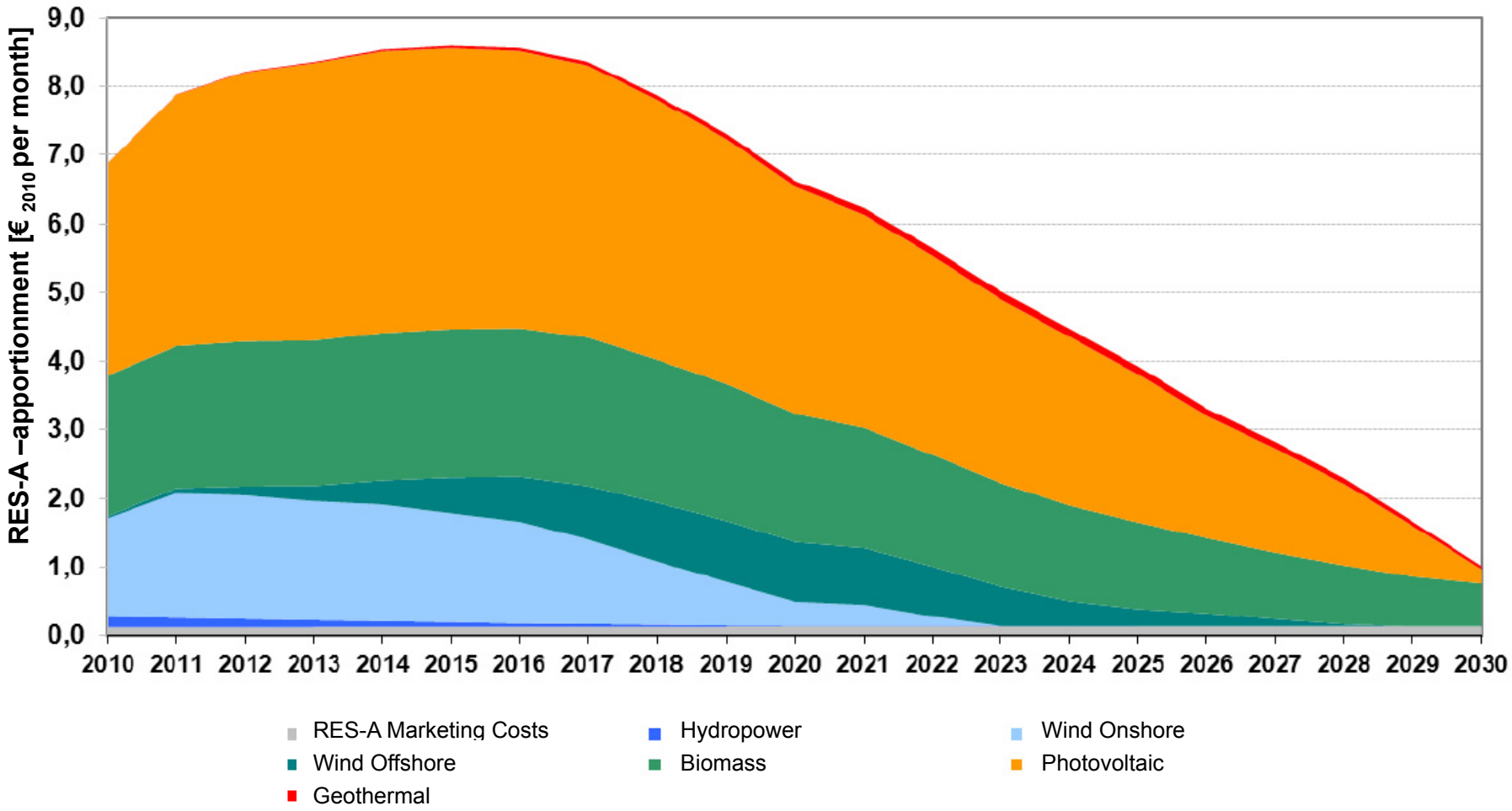
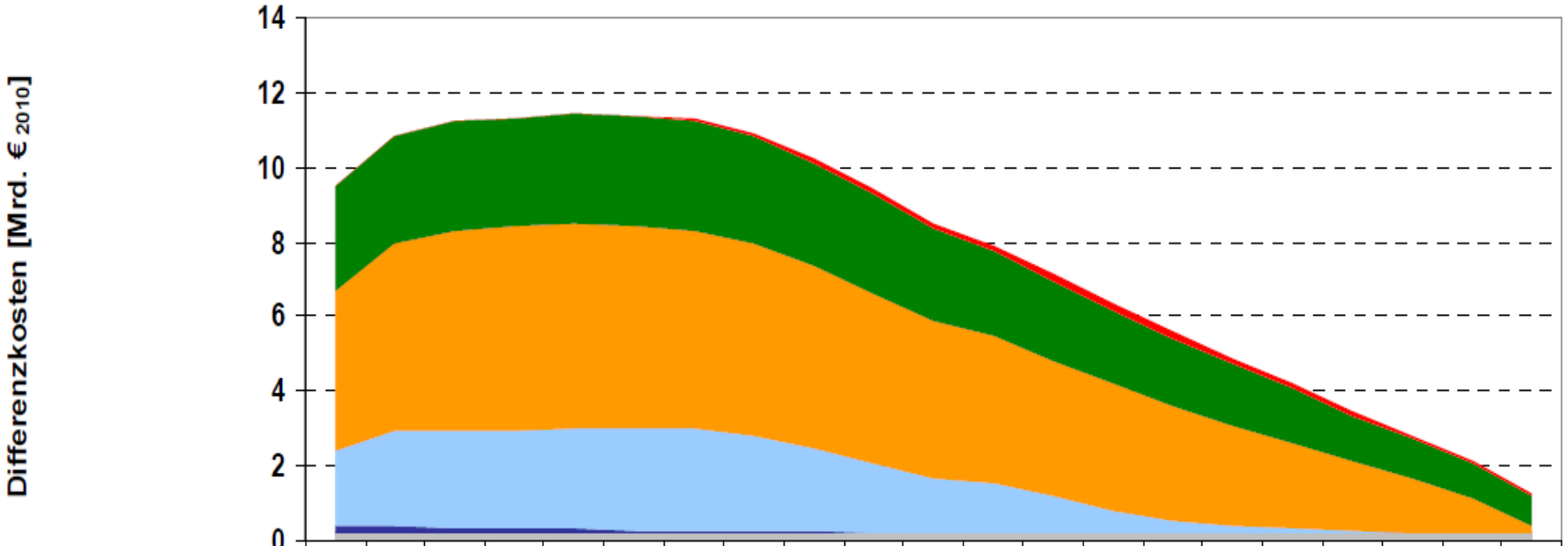
Projection of costs of an average HH (electricity consumption 3.500 kWh/a) due to the RES-A-apportionment until 2030



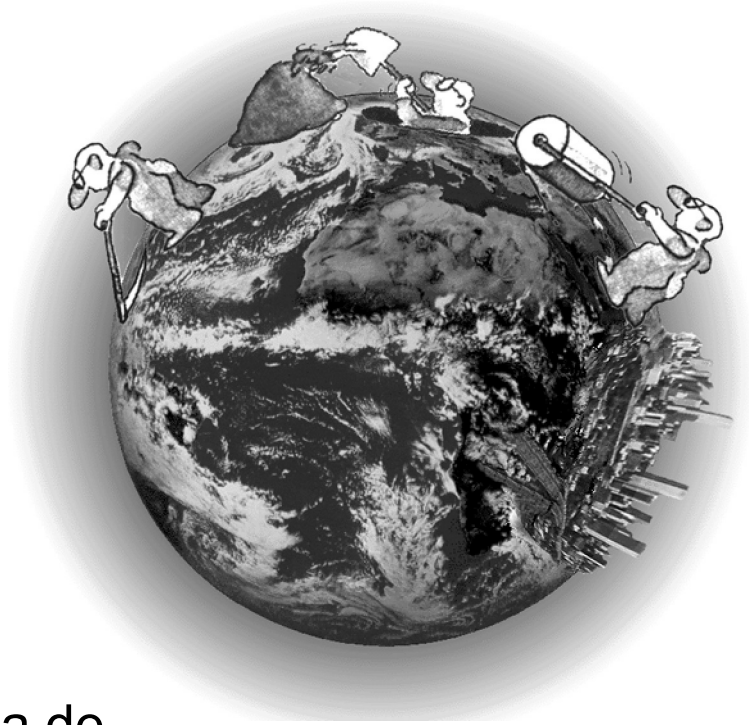
Source: Nitsch, 2010



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Geothermie	0,0	0,0	0,0	0,0	0,0	0,0	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
Biomasse	2,8	2,9	2,9	2,9	2,9	2,9	2,9	2,9	2,8	2,7	2,5	2,3	2,2	2,0	1,8	1,7	1,5	1,2	1,1	0,9	0,8
Fotovoltaik	4,3	5,0	5,3	5,5	5,5	5,4	5,3	5,2	4,9	4,6	4,2	3,9	3,6	3,4	3,1	2,7	2,3	1,9	1,4	1,0	0,2
Windkraft	2,0	2,6	2,6	2,6	2,7	2,7	2,7	2,5	2,2	1,9	1,5	1,3	1,0	0,6	0,3	0,2	0,2	0,1	0,0	0,0	0,0
Wasserkraft	0,2	0,2	0,2	0,1	0,1	0,1	0,1	0,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
EEG-Vermarktungskosten	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2	0,2
Gesamt (Pfad Deutlich)	9,5	10,9	11,2	11,3	11,5	11,4	11,3	11,0	10,2	9,4	8,5	7,9	7,1	6,3	5,6	4,9	4,2	3,5	2,8	2,2	1,3

100% EE are possible !

Thank you



Limits to growth

Source: Harry Lehmann, 1994

harry.lehmann @ uba.de