

Transformation of the energy system in Germany – challenges and opportunities for regional development

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Erneuerbare Energien: Nehmen Sie steigende Preise in Kauf?

in %

Infratest dimap für ARD-Morgenmagazin

The story behind / before the story

The discussion about nuclear energy in Germany –
an everlasting story of controversy

The failure of announcement policies

1970s / 1980s Brokdorf and Gorleben

New political order and discussion cultures





Peter Homann



Vertreibung der Demonstranten mit CH53 Hubschraubern bei der größten Anti-AKW Demo gegen den Bau des AKW Brokdorf / 1981



What do we want to talk about?

- Transformation of the energy system
- Renewable energy sources in Germany
- Renewable energy at regional level – the role of regional planning
- Challenges and opportunities for regional development
- Conclusion

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Transformation of the energy system

Initial situation

- 2000: Decision by German Federal Government to **limit the use of nuclear energy** / nuclear energy as **bridging technology**:
2 aspects: (1) **safety of nuclear power plants** and
(2) economical aspects
- September 2010: Presentation of new a **energy concept** by the Federal Government connected with the decision by the Federal Parliament to **extend the production of nuclear energy**
 - 7 nuclear power plants dating back to the time before 1980:
to produce nuclear energy for another 8 years
 - Remaining newer 10 nuclear power plants:
to produce nuclear energy for another 14 years



Transformation of the energy system

U-turn in energy policy

- March 2011: **Nuclear disaster of Fukushima (Japan)** and increasing public protest against nuclear energy in Germany: **discussion about a change of the energy concept**
- August 2011: Decision by German Federal Government
 - (1) to immediately **shut down** the oldest 8 nuclear power plants
 - (2) total **nuclear phase-out stepwise until 2022**
 - (3) **priority given to the development of renewable energy**
- **Starting point of the transformation of energy system** in Germany ("**Energiewende**")

Transformation of the energy system

- Replacement of nuclear energy and fossil fuels like oil, coal and domestic gas by renewable energy sources like:
Water, wind and solar power, geothermal energy and energy crops.
- **Energy saving** and **higher energy efficiency** as key elements
- Transformation shall be **completed until 2050**;
goal: to provide energy from **renewable energy sources as supporting pillar** of total energy supply

Transformation of the energy system

Quantified objectives

Included in the energy concept (2010)	2020	2030	2040	2050
Share of renewable energy based on gross final energy consumption (Bruttoendenergieverbrauch)	18%	30%	45%	60%
Share of renewable energy based on gross consumption of electricity (Bruttostromverbrauch)	35%	50%	65%	80%
Reduction of greenhouse gas emission in relation to 1990	-40%	-55%	-70%	-80% to -95%
Reduction of primary energy consumption (Primärenergieverbrauch)	-20%			-50%
Reduction of consumption of electricity in relation to 2008 (Stromverbrauch)	-10%			-25%
Reduction of heat demand* (Wärmebedarf) and primary energy demand** (Primärenergiebedarf) in buildings in relation to 2008	-20%*			-80%**
Increase of energy efficiency up to 2.1% per year based on final energy consumption (Endenergieverbrauch)				

Elaborated by the author

Transformation of the energy system

- Replacement of nuclear energy and fossil fuels like oil, coal and domestic gas by renewable energy sources like:
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- **Energy saving** and **higher energy efficiency** as key elements
- Transformation shall be **completed until 2050**;
goal: to provide energy from **renewable energy sources as supporting pillar** of total energy supply
- German strategy seen as unique and path setting:
if transformation succeeds, Germany may be a **leader in environmental technologies** (economic benefits!)
- Climate change **and** high-tech strategy

Transformation of the energy system

General measures

- **Reorganisation** of energy supply – implementing **monitoring** – fostering **research and development** on energy
- **Energy system expansion** as basis for extension of renewable energy / **market and system integration of renewable energy**
- **Energy efficiency** as basis for the reorganisation of energy supply
- **Acceptance of conventional gas and coal power plants** as basis for security of energy supplies
- Reorganisation of energy supply in Germany as a **European challenge** / good foreign policy on energy for safe energy supply

Transformation of the energy system

Added measures after Fukushima

- **Efficient extension** of renewable energy based on better cooperation between conventional power plants and electricity generation from renewable energy sources
- Widening energy storage capacities for a **needs based provision of electricity** from renewable energy sources
- **Wind energy as central module** – development of new criteria (e.g. regarding distances, size)
- **Guarantee of affordable electricity tariffs** by cost efficient extension of the electricity network
- **Promoting energy efficiency** (e.g. public construction contracts)

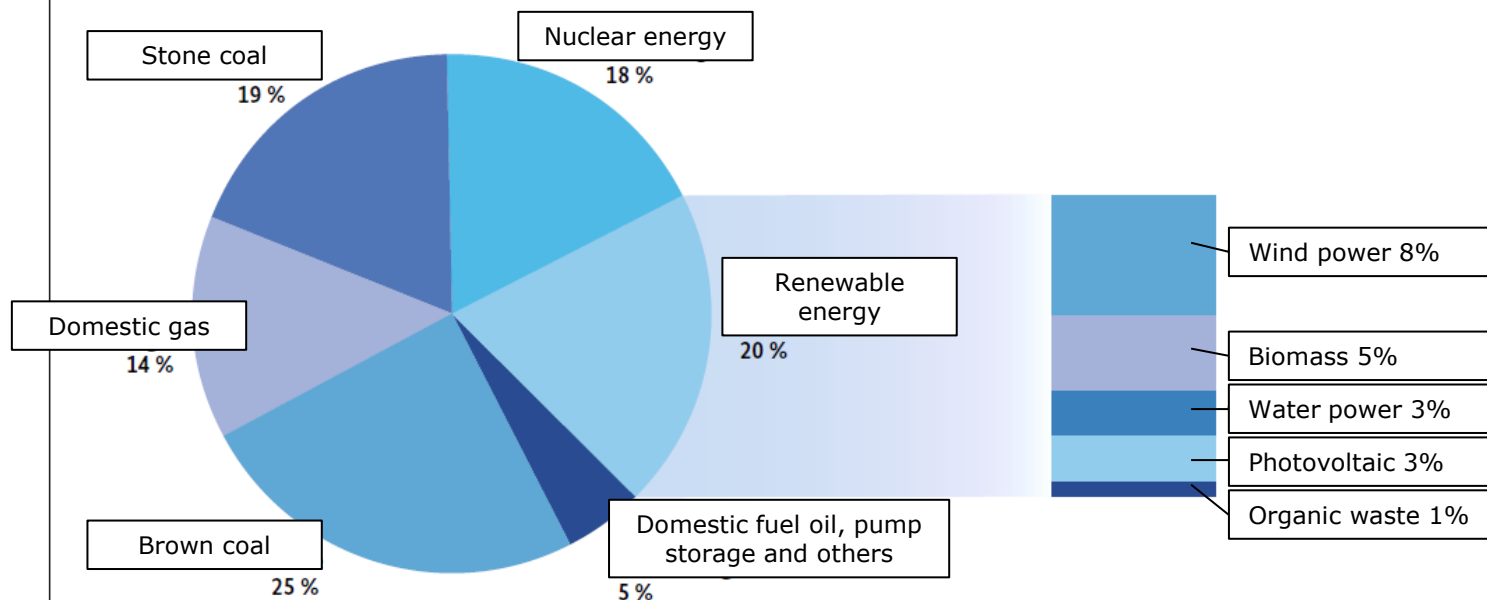
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Renewable energy sources in Germany

Status quo

Cross generation of electricity in Germany 2011 (612 TWh=billion kWh)*

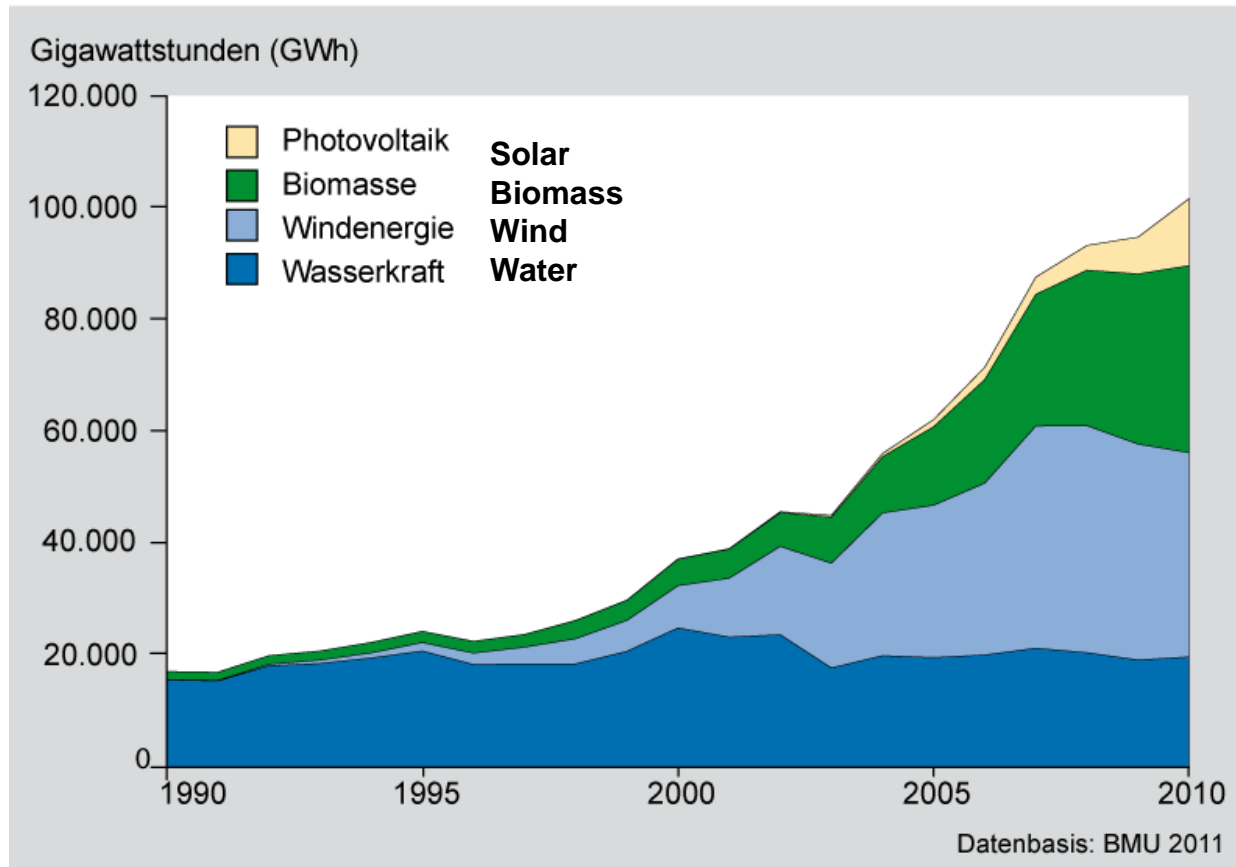


* Vorläufige Angaben (Stand 14.12.2011), z. T. geschätzt. Abweichungen in den Summen durch Rundungen.

Quellen: Arbeitsgemeinschaft Energiebilanzen e. V. (AGEB), Bundesverband der Energie- und Wasserwirtschaft e. V. (BDEW)

Source: BMWi Berlin 2012, Die Energiewende in Deutschland – Mit sicherer, bezahlbarer und umweltschonender Energie ins Jahr 2050, S. 4, **modified by the author.**

Renewable energy 1990-2010



Source: http://www.bbsr.bund.de/cln_032/nn_497574/BBSR/DE/Raumbeobachtung/AktuelleErgebnisse/2012/Erneuerbare/EE__im__Raum.html

Renewable energy sources in Germany

Water, wind and solar power

- Water power (3%): **low future development potentials** / only by reactivation of abandoned locations or modernisation of existing hydroelectric power plants
- Wind power (8%): **high future development potentials** (1998 – 6.000 to 2009 – 21.000 wind energy plants) / average engine output is 2.1 MW per wind energy plant
- Solar power (3%): Share of solar power based on energy consumption is in relation to other renewable energy sources low / mainly used **for preparation of hot water and heating of buildings**



Renewable energy sources in Germany

Geothermal energy and energy crops

- Geothermal energy: **high development potentials for geothermal heat generation** / generation of electricity is still low (high dependency from geological conditions)



Renewable energy sources in Germany

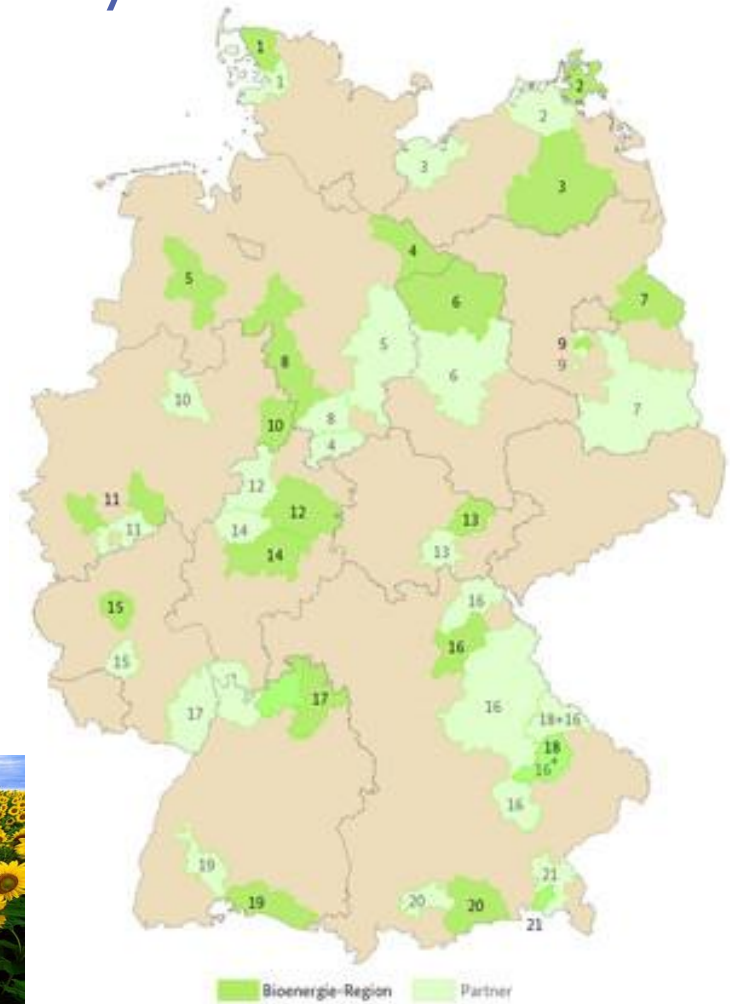
Geothermal energy and energy crops

- Geothermal energy: **high development potentials for geothermal heat generation** / generation of electricity is still low (high dependency from geological conditions)
- Energy crops: steady rise of share based on total energy generation / **production of electricity, heat and fuel** / basic materials are wood, rape, corn, plant and animal remains



Support for bio-energy in Germany

Bioenergie-Regionen, Förderphase 2012 bis 2015





A conflict: Moritzburg Small Hills Area near Dresden

(Lupp et al. 2011)

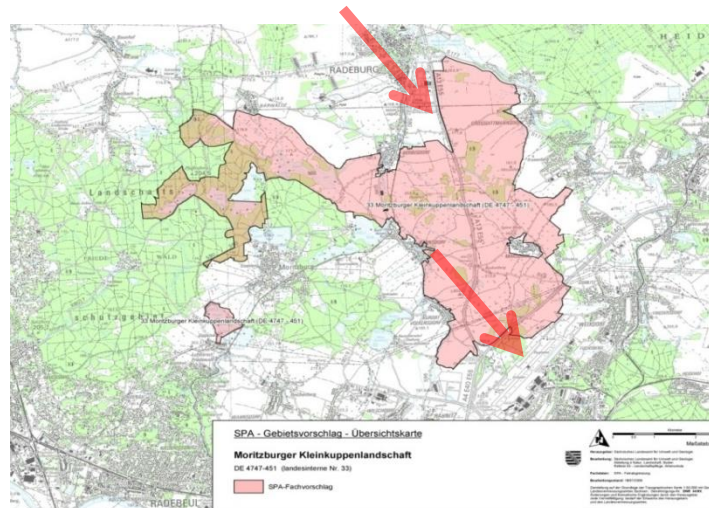


Moritzburg – a Multi Protected Area

- Natura 2000/FFH site (EU protection status) for birds and their habitats of EU interest
- Several small Nature Protection areas (German Federal law)
- Landscape Protection area (German Federal law)
- Rivers and waters protected by EU water directive (EU regulation)
- “Urban Greenbelt for Dresden” in Regional Planning (spatial planning is obligatory in Germany)
- Management plans for this area have been set up due to protection regulations

Biogas in the Moritzburg Small Hilly Landscape

- Radeburg farm co-operative managing most of the Small Hilly landscape farmland constructed a **stable for cattle combined with a biogas plant** in the north of the protected area
- **Construction of a biogas plant** in the North of Dresden by the Energy provider DREWAG, exclusive contract to deliver silage maize with the Radeburg farm co-operative



Consequences

- DREWAG needs **9.500 t maize annually**, that are cultivated in this piece of landscape
- An area of **200–250 ha** is needed to operate the DREWAG, 10% of the fields in Moritzburg without crop rotation
- In **2008**, before the biogas plant was built, already **24%** of the fields were cultivated with maize, mainly fodder for the co-operative's livestock
- 2011, when operation started, the share of maize was **30%**, for operating the second biogas plant at the stable, even more maize has to be cultivated (although this plant will be of smaller dimension and has a higher share of slurry)

Impacts on Ecosystem Services and Biodiversity

- Biodiversity loss by intensification and dense maize fields
- Maize is not a suitable habitat for many bird species
- Flood prevention is lowered (long phase without vegetation, low interception and storage of water)
- Higher erosion
- Providing drinking water for Dresden is affected, due to increased use of fertilizers and nitrate leaching, more effort and money has to be spent to purify water
- Carbon storage of soils is reduced (Maize reduces soil humus!)
- Reduced quality for recreation, vistas and views are blocked by dense 3 m high maize blocks

Renewable energy sources in Germany

Distribution

Regional distribution of renewable generation of electricity in Germany 2010



Installed electric capacity of renewable energy per spatial planning region 2010



Legend for renewable energy sources:

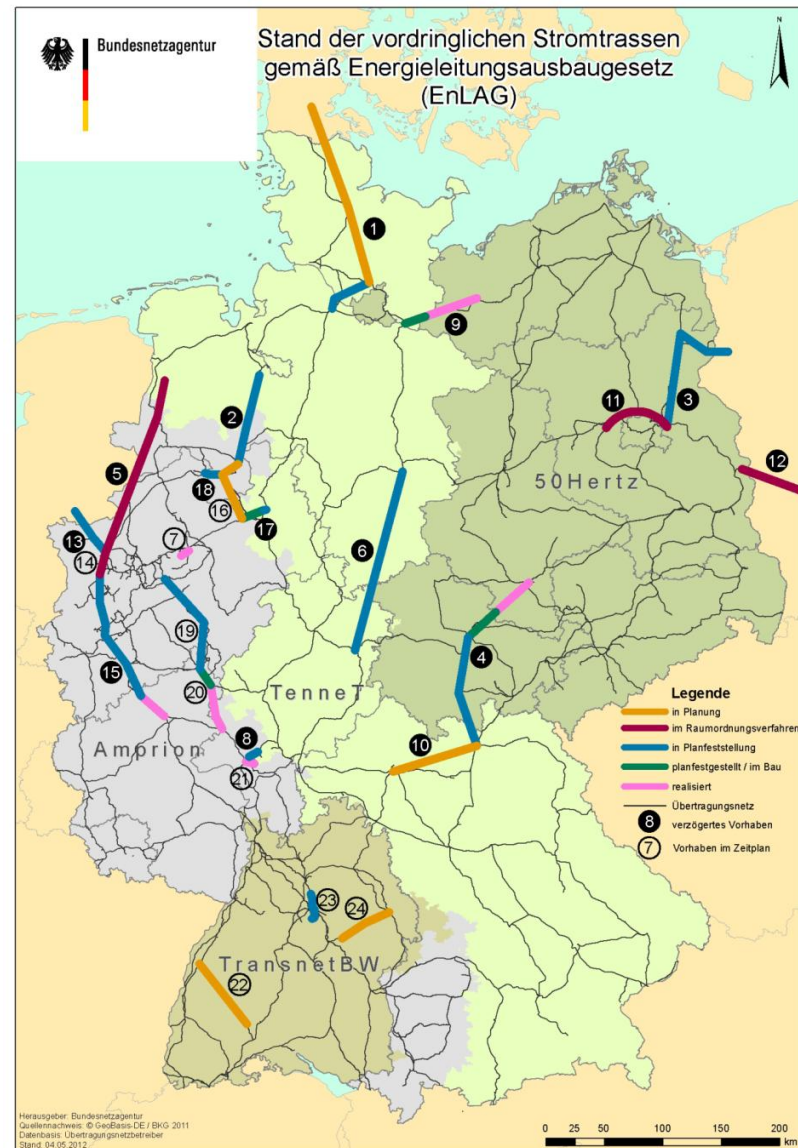
- Biomasse
- Photovoltaik
- Windenergie
- Wasserkraft

- **Disparities by the energy generation volume** based on renewable energy sources
- **Disparities by the mix of renewable energy sources** (spatial availability)
 - Wind power (also offshore in North and Baltic Sea) in the north
 - Water power (height of drop based on mountains) in the south
 - Solar power without geographical limitation, but better conditions in the south

Power Lines

Above or
under ground?

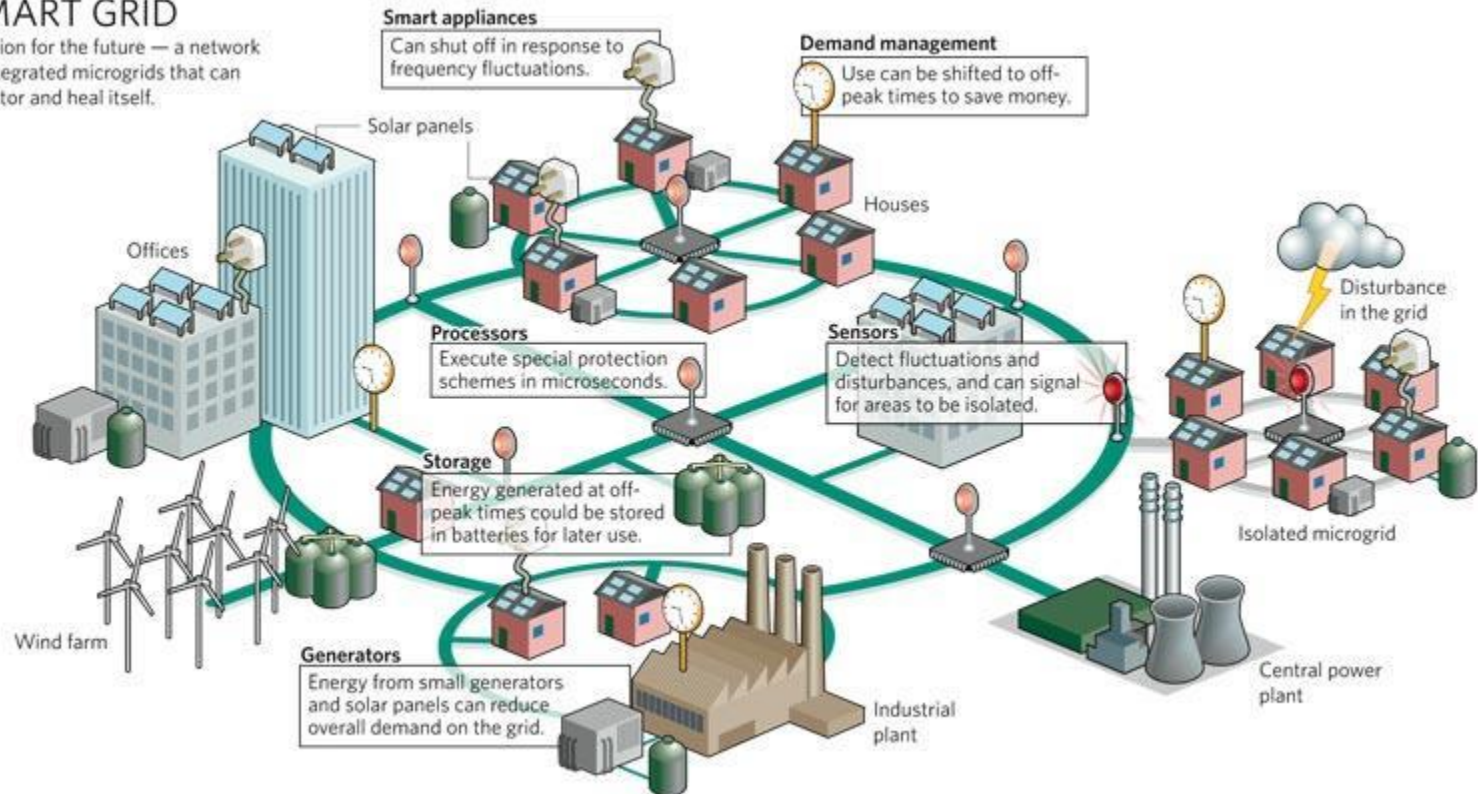
New conflicts
have come up!



Smart Grid

SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.

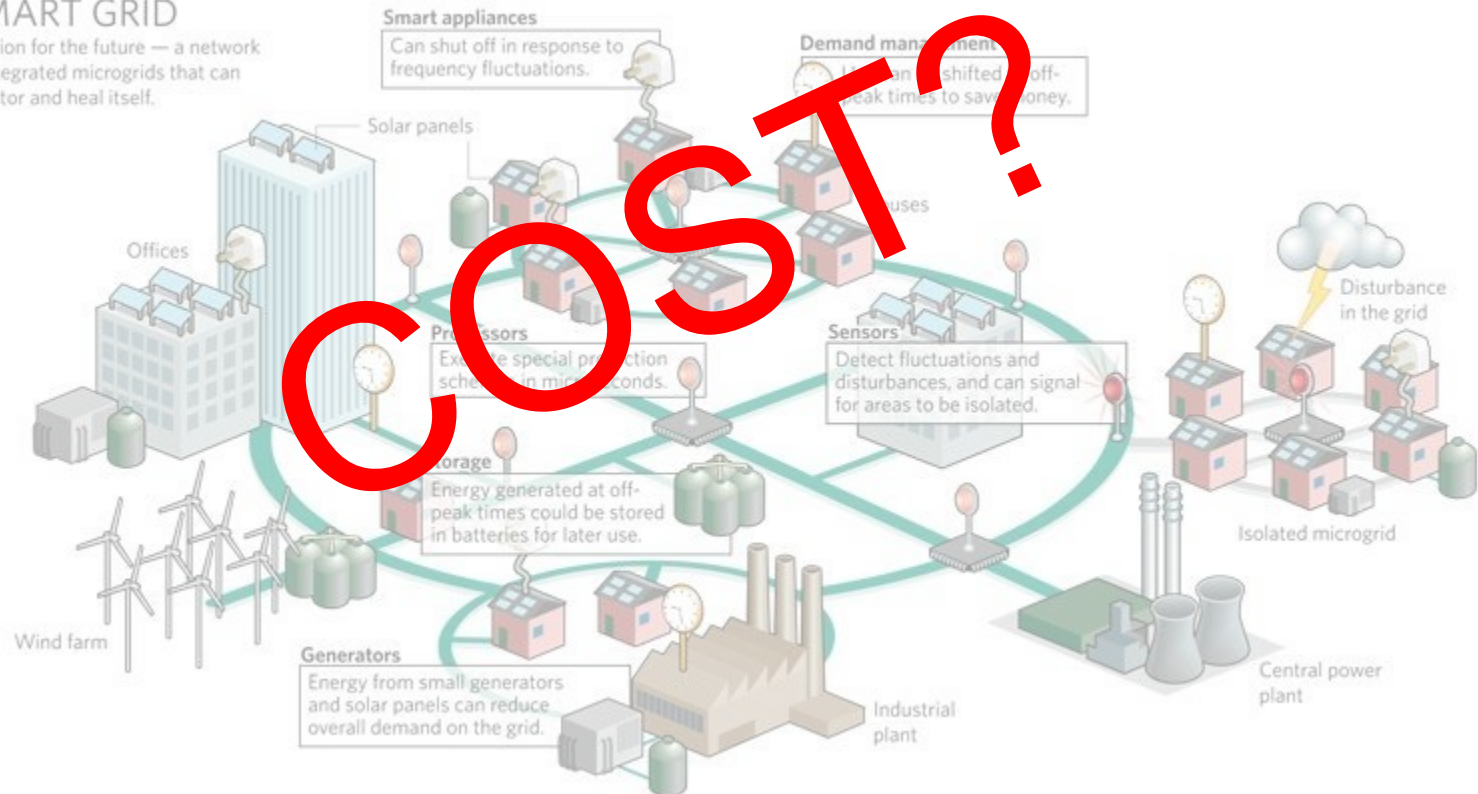


Source: <http://www.smartgrid2030.com/wp-content/uploads/2009/10/SG-Nature.jpg>

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Renewable energy at regional level – the role of regional planning

Duties and responsibilities

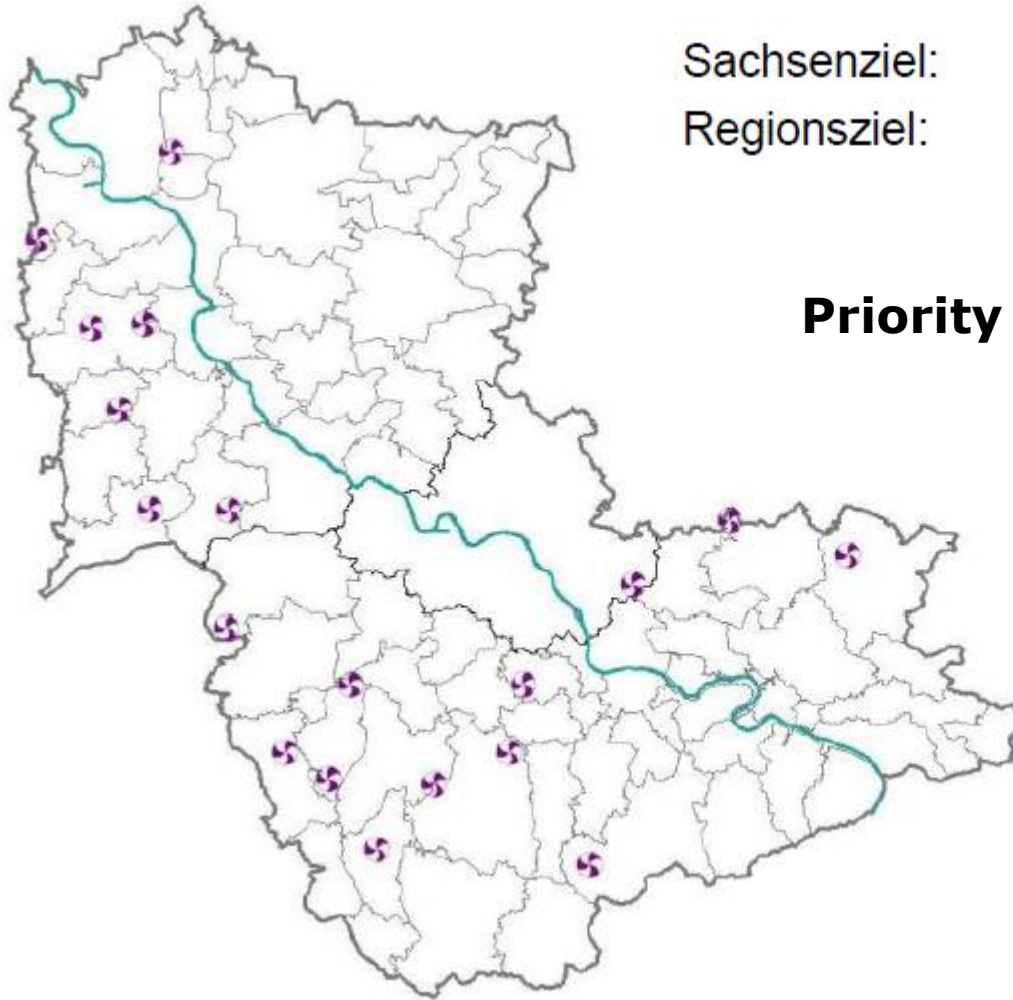
- Structure of prospective energy supply is rather decentralized/ local – **regional level gains more and more in importance**
- Regional level is involved in local breakdown of national goals – **need for action; but also to keep options open**
- Regions are responsible for
 - **Development of local energy concepts,**
 - **Spatial planning with regard to renewable energy**

Renewable energy at regional level – the role of regional planning

Regional planning

- Location aspects regarding renewable energy sources:
formal and informal planning instruments
- **Balancing different demands**, e.g. energy policy and climate policy, economic development, compatibility with space; public acceptance
- One approach: **Regional energy concepts (informal)**
 - Implementation of national goals at regional level
 - Aims: security of energy supplies, environmental sustainability, economic efficiency, mitigation of conflicts
 - From interest: generation, provision and consumption of energy
 - Development aspects are in the foreground / integrated process

Dresden Region



Sachsenziel:

2530 GWh/a im Jahr 2020

Regionsziel:

472 GWh/a im Jahr 2020

Priority areas for wind energy

also:
solar energy

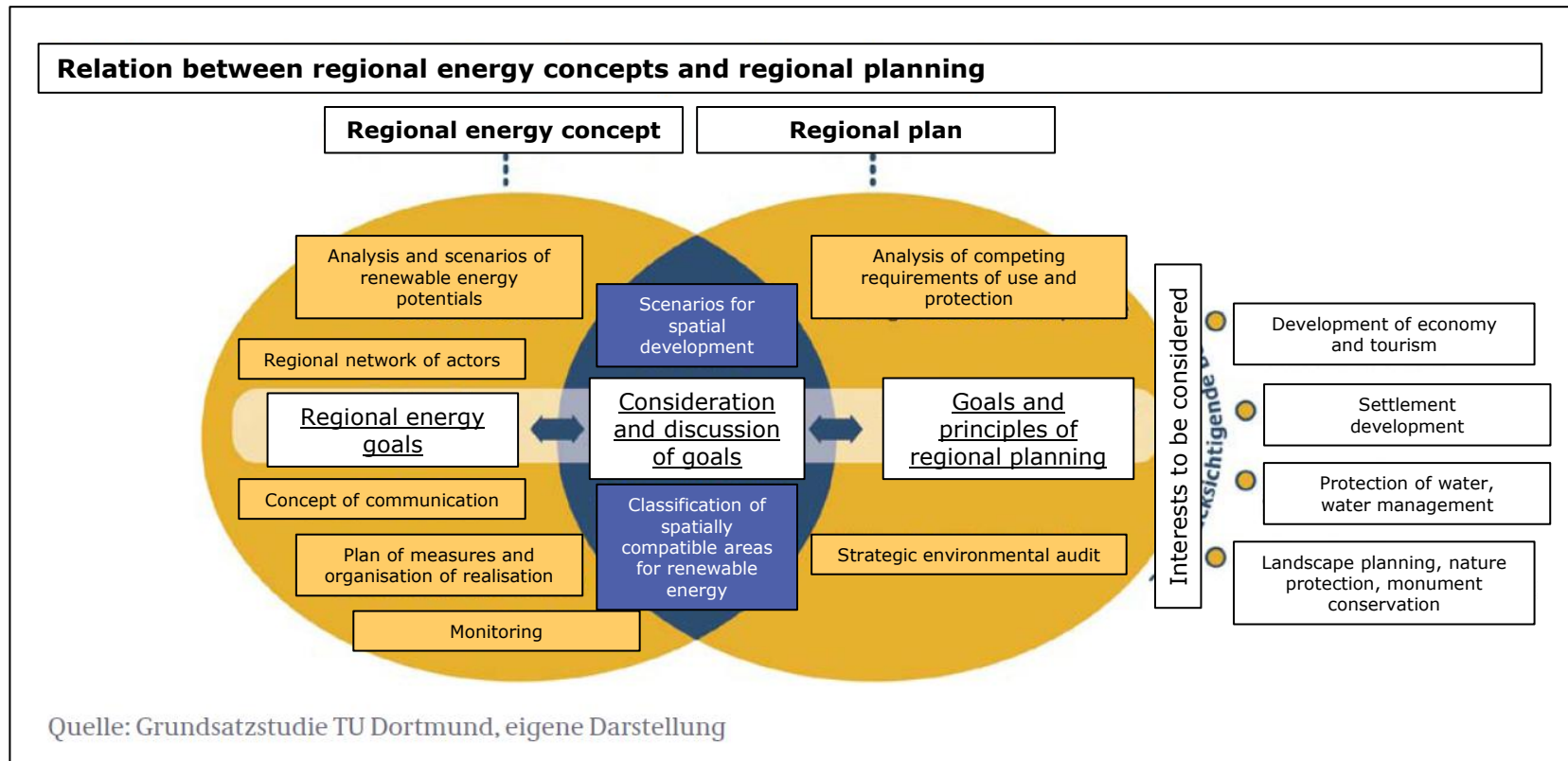
Renewable energy at regional level – the role of regional planning

Regional energy concepts

- **Preparation:** building framework (approach and targets)
- **Communication:** continuous participation of all actors (acceptance and support)
- **Analysis and objectives:** potentials and limits for development of renewable energy in the region
- **Implementation strategies and planning of measures:** coordination of realisation of planned measures (milestones)
- **Monitoring:** stepwise improvement

Renewable energy at regional level – the role of regional planning

Relation to formal regional planning



Source: BMVBS Berlin 2011, Erneuerbare Energien: Zukunftsaufgabe der Regionalplanung, S. 19,
modified by the author.

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Challenges and opportunities for regional development

Challenges

Change of overall
appearance of landscape
(aesthetics)

Land use conflicts (food
guaranty, tourism)

Change of land use

Biodiversity, species

Public conflicts
(acceptance)

Impacts on
nature protection

Impacts on biodiversity

Impacts on
prevention of air pollution

Impacts on
ground water protection

Impacts on
soil protection

Elaborated by the author

Challenges and opportunities for regional development

Challenges

Identification of locations
for
renewable energy

Identification of local
potentials for
renewable energy

Coordination between
different interests –
public participation

**Professional competence concerning
spatial and environmental impacts
of renewable energy equipment**

Identification of energy
demand and supply

Capital investment in
construction of renewable
energy equipment

**Additional costs for energy
from renewable energy sources**

Electricity costs
for consumer

Elaborated by the author

Challenges and opportunities for regional development

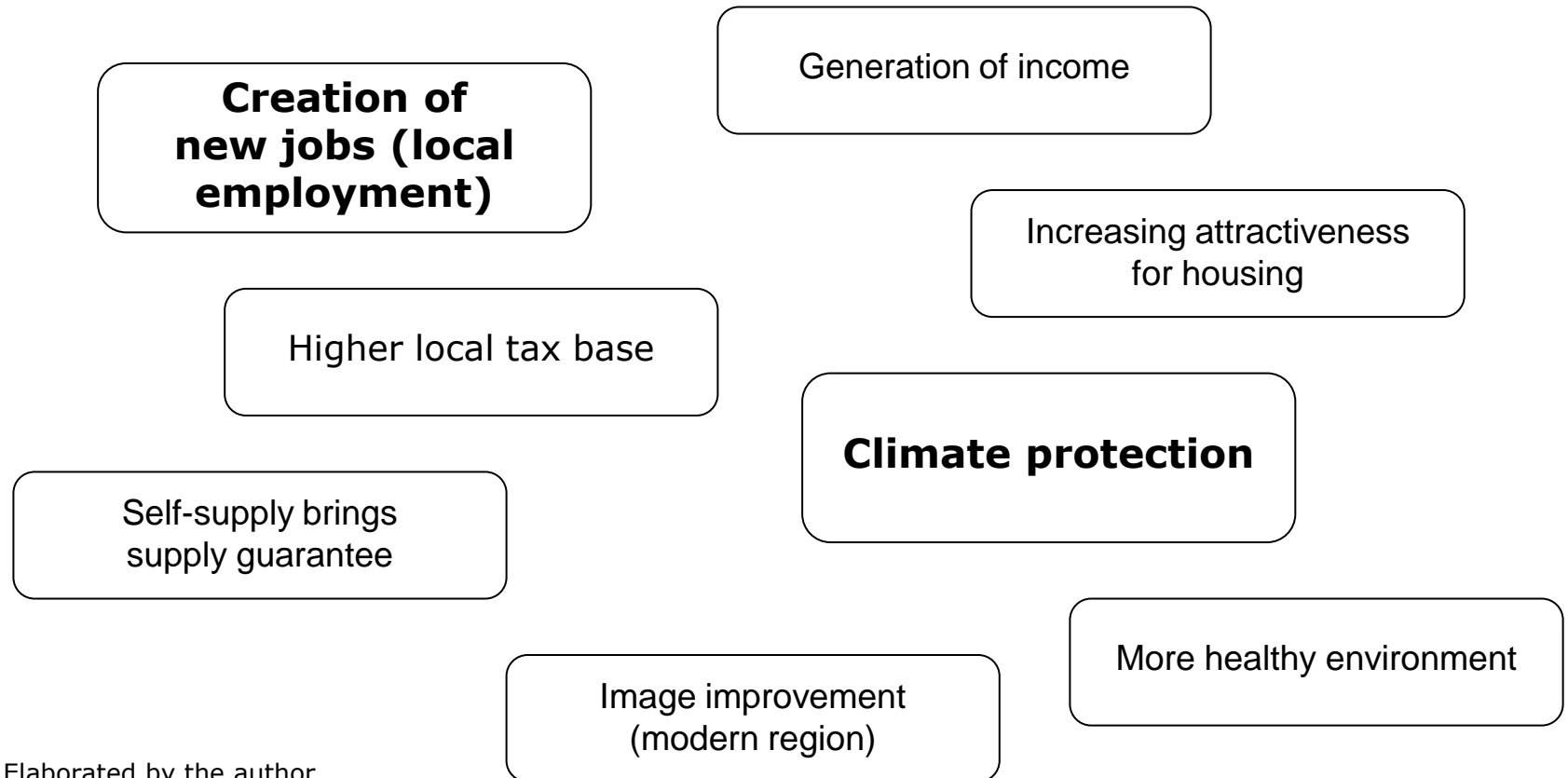
Challenges

Water power	Wind power	Solar power	Biomass / cultivation of Energy crops
Nature protection	Noise	High demand of space	High demand of space
Impacts on wildlife	Shadow print	Soil sealing	Bad smell
	Impacts on wildlife	Competition with agriculture	Noise
	Ice shots		Erosion, fertilizers
Elaborated by the author			Competition with agriculture



Challenges and opportunities for regional development

Opportunities



Elaborated by the author

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Conclusion

Renewable energy in Germany

The extension of **renewable energy is a challenge** because of

- Change of land use,
- Impacts on biodiversity,
- Additional costs and the
- Need for professional competence.

But it is also a chance for

- Economic development,
- Climate protection and
- Future development (peak oil).

Conclusion

Renewable energy in Germany

In order to make **renewable energies a success story**

- Regional planning must be strengthened,
- Communication must be intensified,
- Conflicts have to be solved
- Local potentials must be better identified

A never ending story?



H.Oertel

Thank you very much.

A never ending story?

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