Short-, Mid-Term and Long-Term Challenges to meet German RE Expansion Plans

Revision 2013 – Creating a New Renewable Energy Future

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Introducing Remarks

- Germany`s Energy Transition, in particular expansion of RE, under strong considerations;
- Transition is running: 1) success factor RE share on electricity market 2012 22 % (2000 6 %); some days about 50 %; 2) progress on heat market and energy saving; 3) stagnation in transport sector; 4) some delays on energy effciency and saving
- however: usually only bad news are communicated such as „cost out of control“, „grid expansion fails“, „RE cannot guarantee energy security“ etc.
- electricity flows with neighbouring countries: surplus abroad 17 TWh (2012), in NDL, AUT and SUI (2011 only 6 TWh);
- at present: several controversial discussions in Germany on how to design next steps, even within Ministries, Parliament, political Parties, business sector, researchers or NGO;
- however: strong consensus to proceed on „Energy Transition“ and outstanding role of RE in principle due to several rationales:

Strong Rationales for Energy Transition will overcome short-term Distortions (1)

- sustainable energy security (RE main pillar future energy supply)
- “peace dividend” by RE
- reducing fossil energy imports: financial resources - 6 bn € 2011 - can be used for domestic economic value
- positive economic and social impacts in terms of investments and employment effects: 22,9 bn € investments; 380.000 jobs (2011)
- exploring forecasted market potentials of RE technologies world wide (IPCC, IRENA SE4All et.al.)

Strong Rationales for Energy Transition will overcome short-term Distortions (2)

- reducing cost of inaction (in terms of current OECD activities) or hidden costs of fossil and nuclear power: 80 € per tonne $CO_{2:}$RE cost avoidance by 10 bn € 2011

- reducing more and more serious climate change impacts, in particular natural weather disasters influenced by climate change impacts

- climate change: RE by far strongest pillar for previous and future German GHG-reductions (39% of 27 % GHG reduction in 2011)

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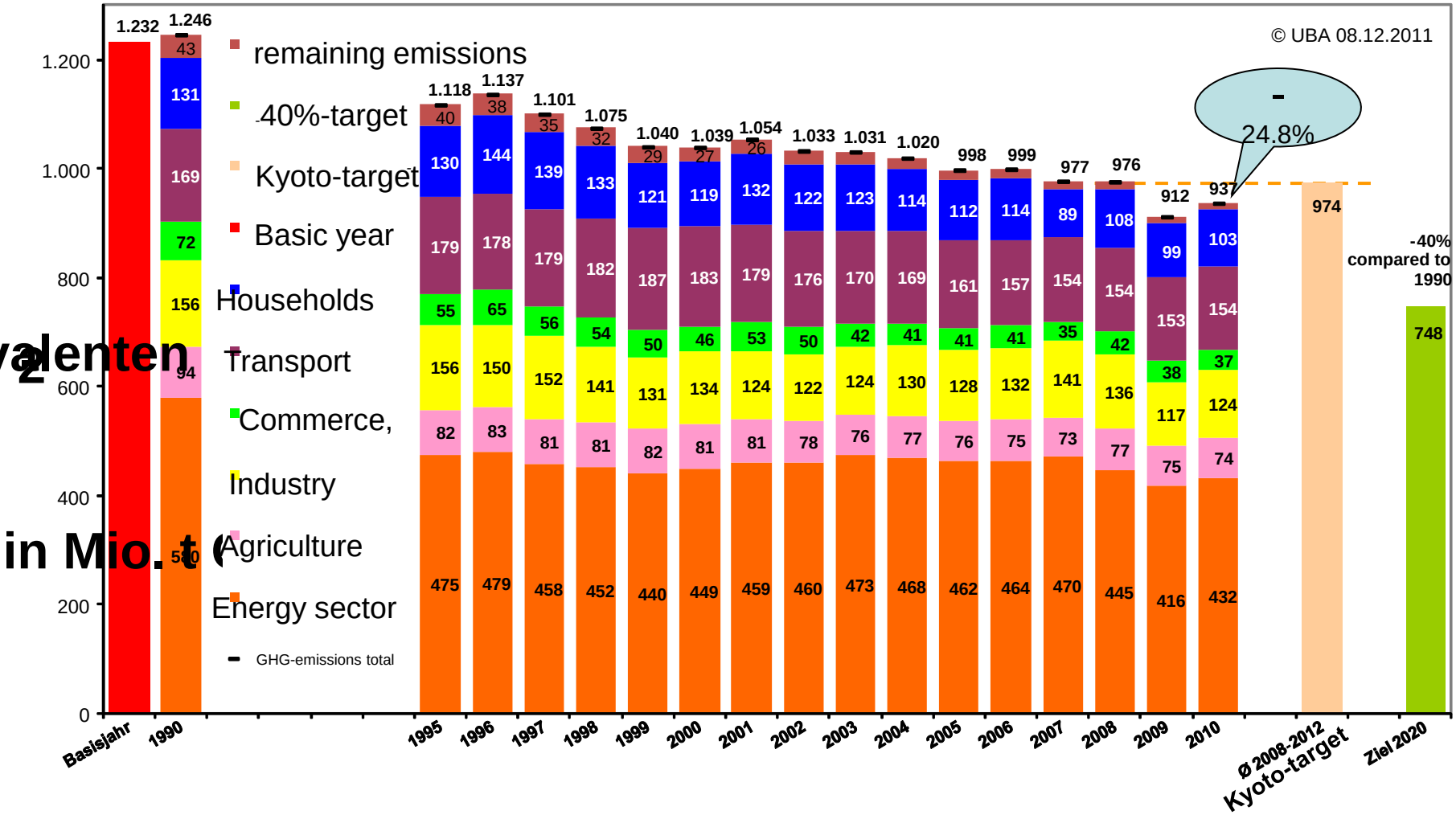
German GHG Emission Trend 1990 – 2011

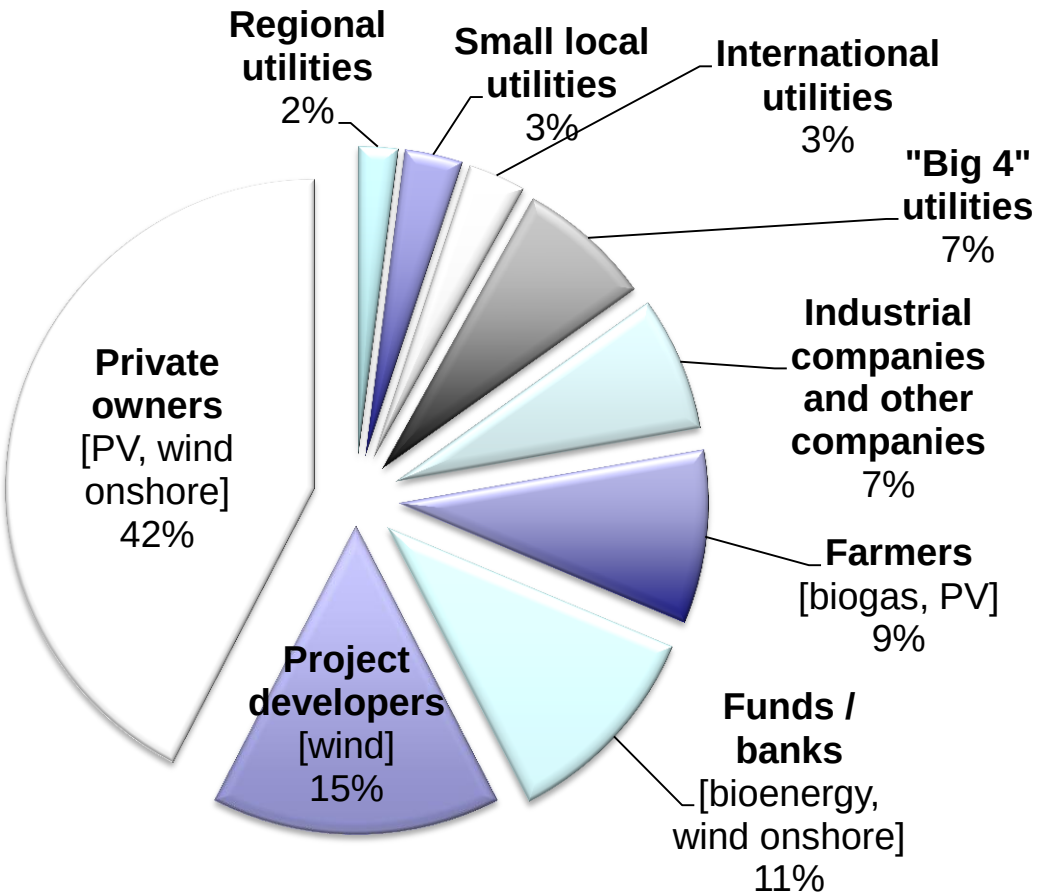
on track to meet Kyoto target (21%): 2011: - 27%



Ownership of RE installations in Germany [2009]

the unknown economic benefit:

2011 50% of investments by small investors



Source: trend:research, 2010: "Anteile einzelner Marktakteure an Erneuerbaren Energien Anlagen in Deutschland"

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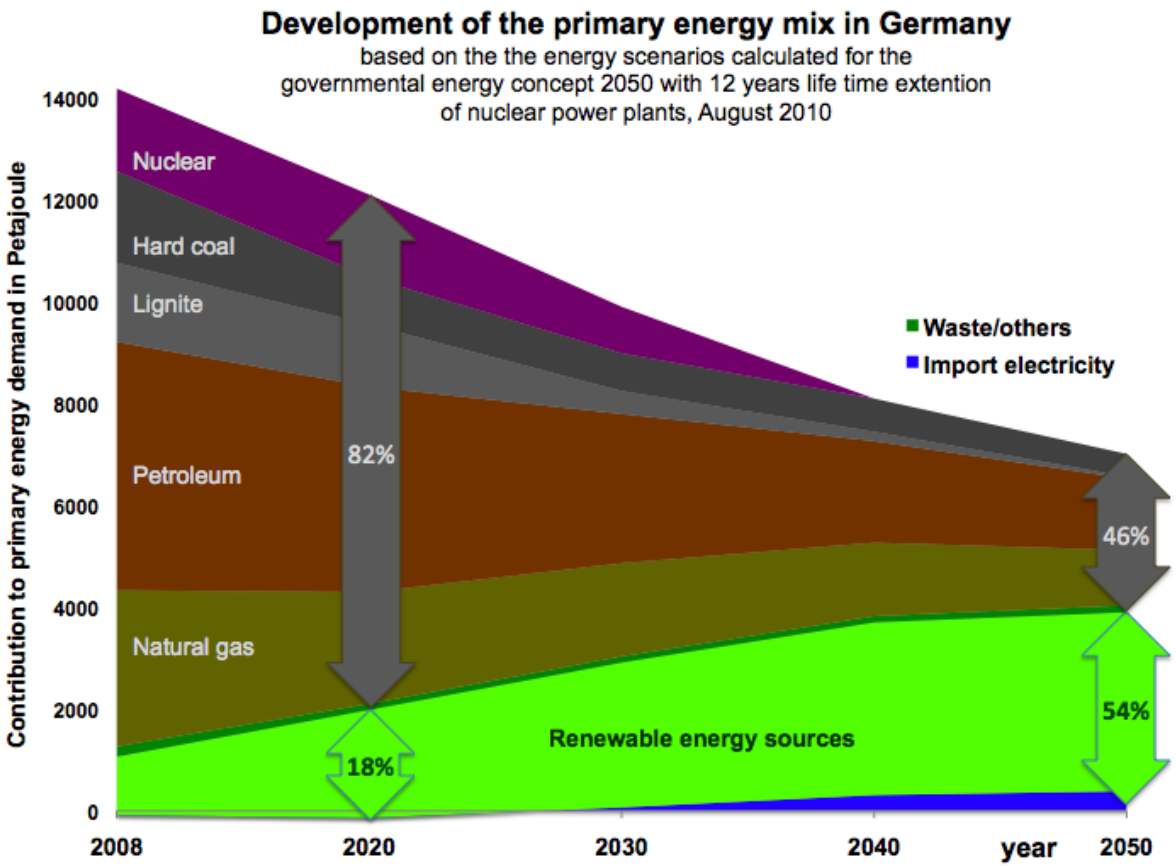
The German Energy Transition: Pillars and Targets

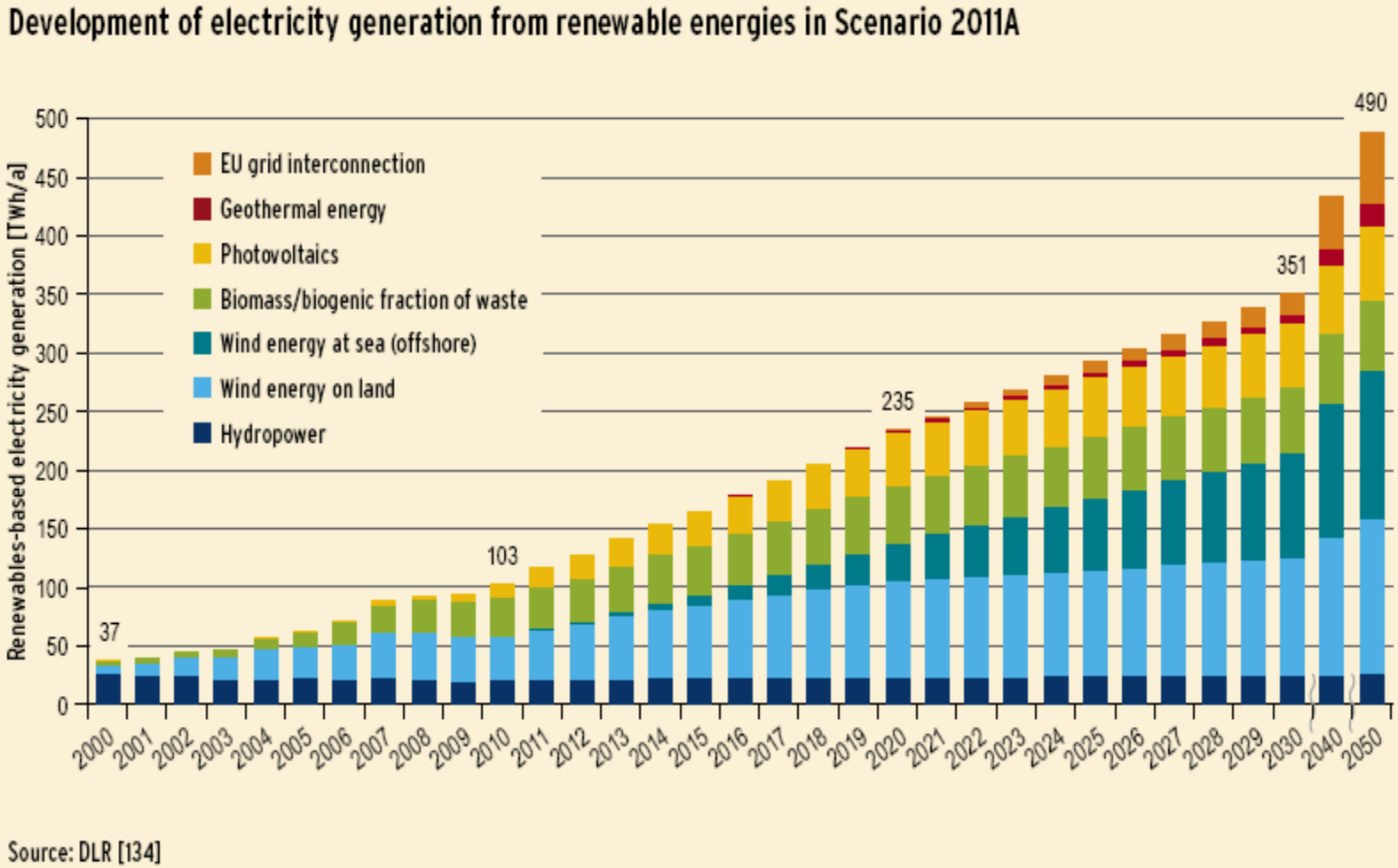
	Climate	Renewable energies		Efficiency		
	Greenhouse gases (vs. 1990)	Share of elec.	Overall share	Primary energy cons.	Energy produc-tivity	Building moderni-zation
2020	- 40%	35%	18%	- 20%	Increase to 2.1%/a	Double 1% → 2%
2030	- 55%	50%	30%			
2040	- 70%	65%	45%			
2050	- 80-95%	80%	60%	- 50%		

German governmental plan for the future energy mix

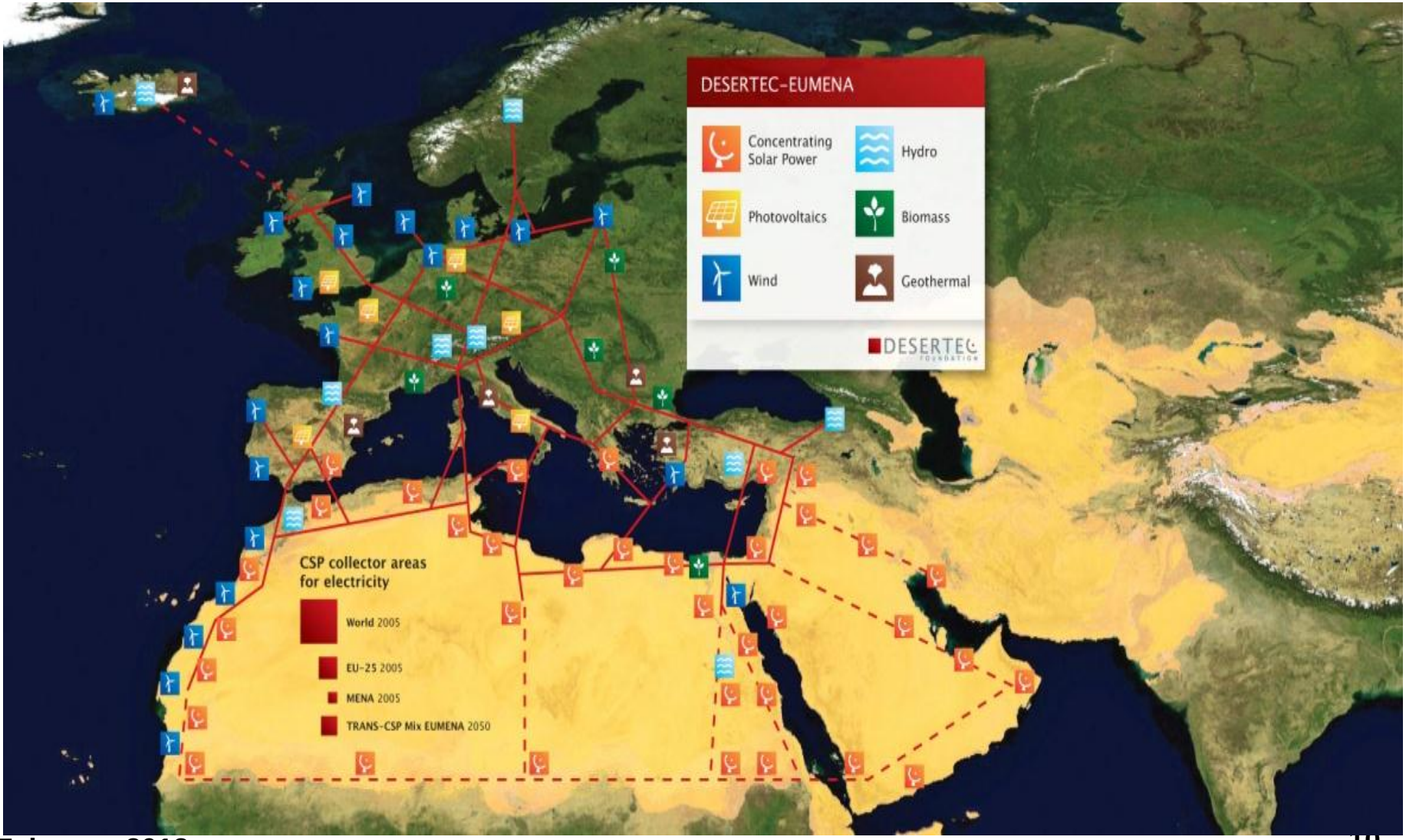
- **Targets for 2050**
  - **Primary energy reduction by 50%**
  - **Min. 60 % RES on primary energy**
  - **Min. 80% RES on electricity production**
- After the disaster in Fukushima, the German government decided to fade out nuclear power until 2022



Future development of RE until 2050



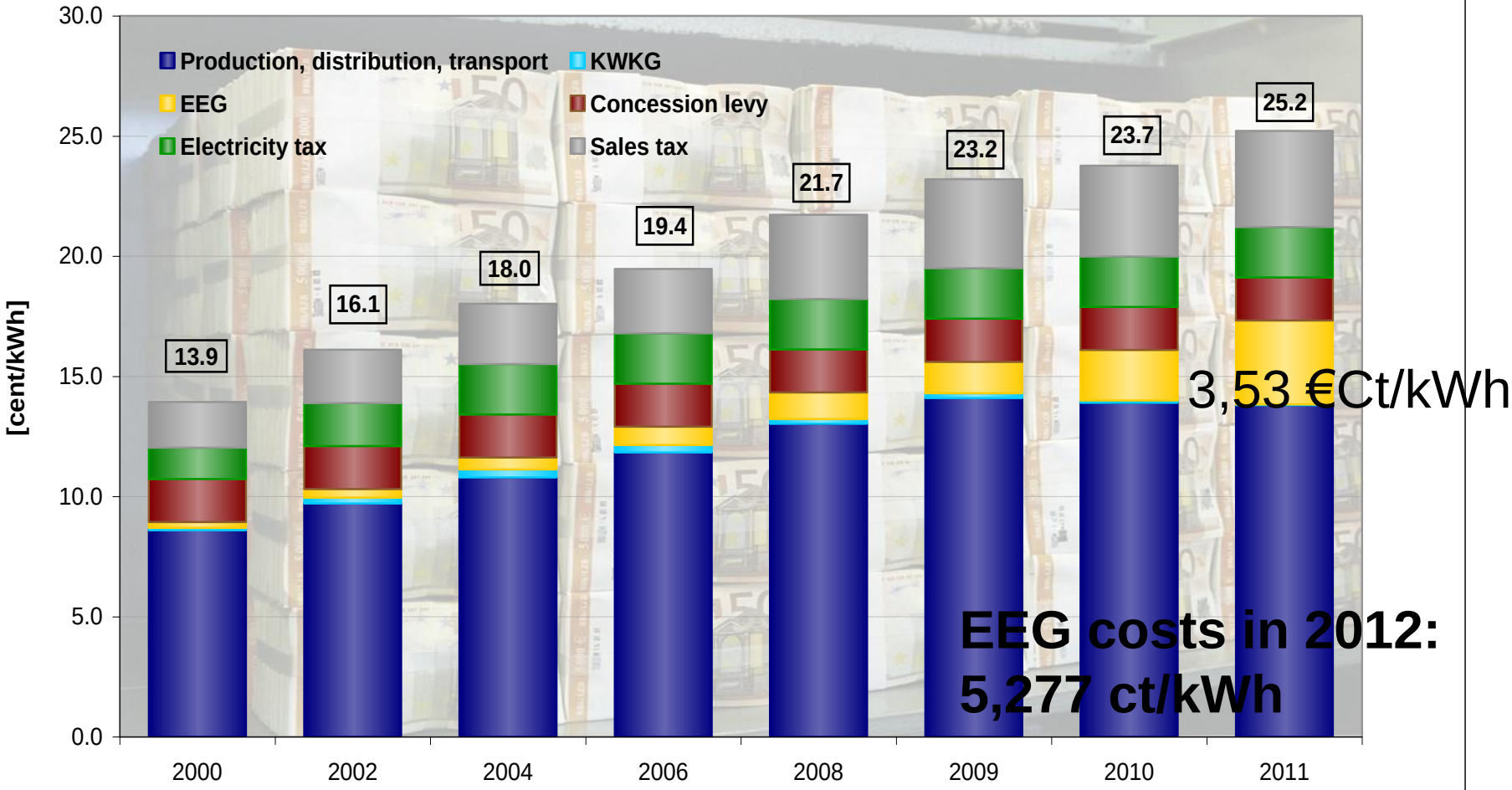
Cross-Linking of Energy Sources



Short-term Challenges: Cost Dimension (1)

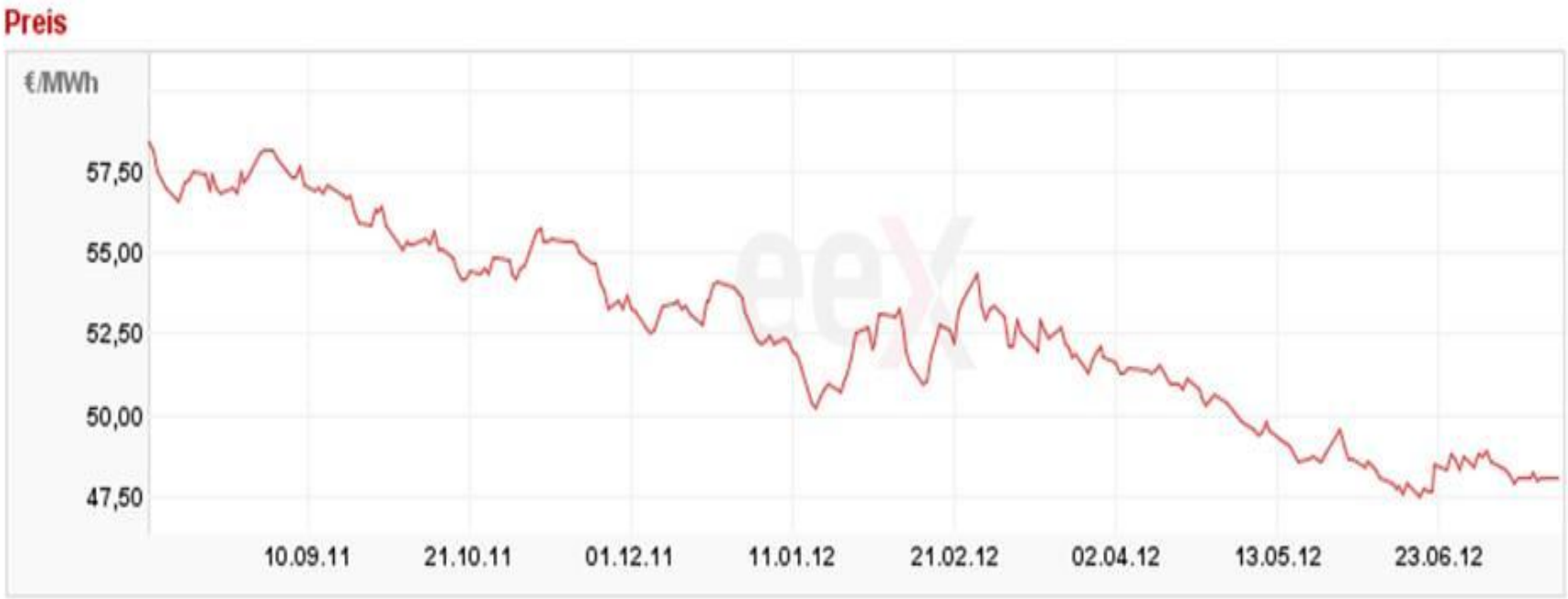
- cost dimension has to be considered differentiated
- short-terms distortions, in particular by PV, increasing compensation mechanism and decreasing market price for electricity (due to growing amount of RE on electricity markets)
- various policy measures to limit costs, in particular PV FIT;
- further surcharge cost limitations under consideration, e.g. list of exempted companies, “freezing” FIT,

Cost components for one kilowatt-hour of electricity for household consumers



Source: BMU - E I 1 according to Institut für neue Energien Teltow (IfnE) and Bundesverband der Energie- und Wasserwirtschaft e.V. (BDEW);
Image: Deutsche Bundesbank; as at: December 2012; all figures provisional

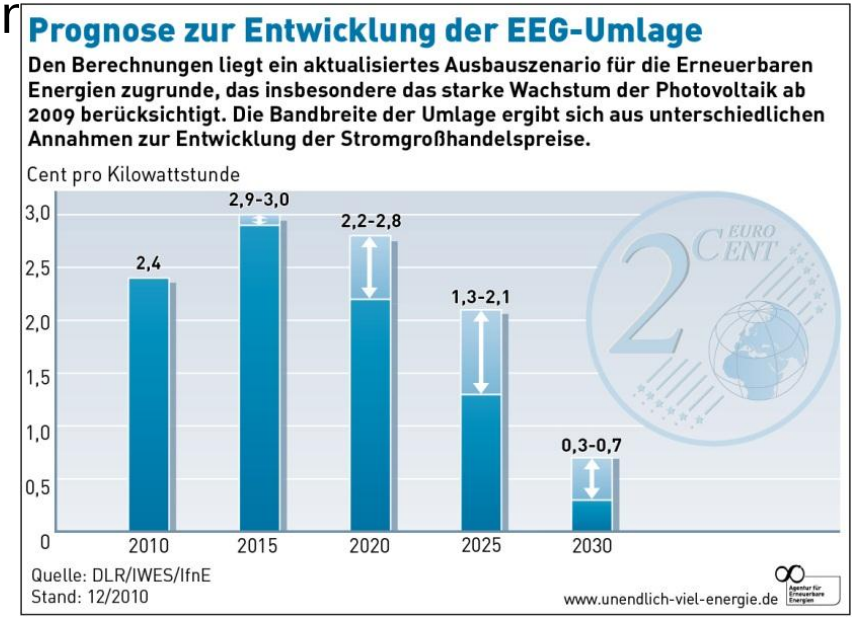
Electricity markets



Baseload futures market (delivery in 2013)

RE cost estimations – A sensitive and open debate

- Prognosis of costs for RE expansion vary in a wide range (development curve, climax - height and year)
- Differences due to different assumptions: scenarios for RE expansion, development of spot market price for electricity, ..



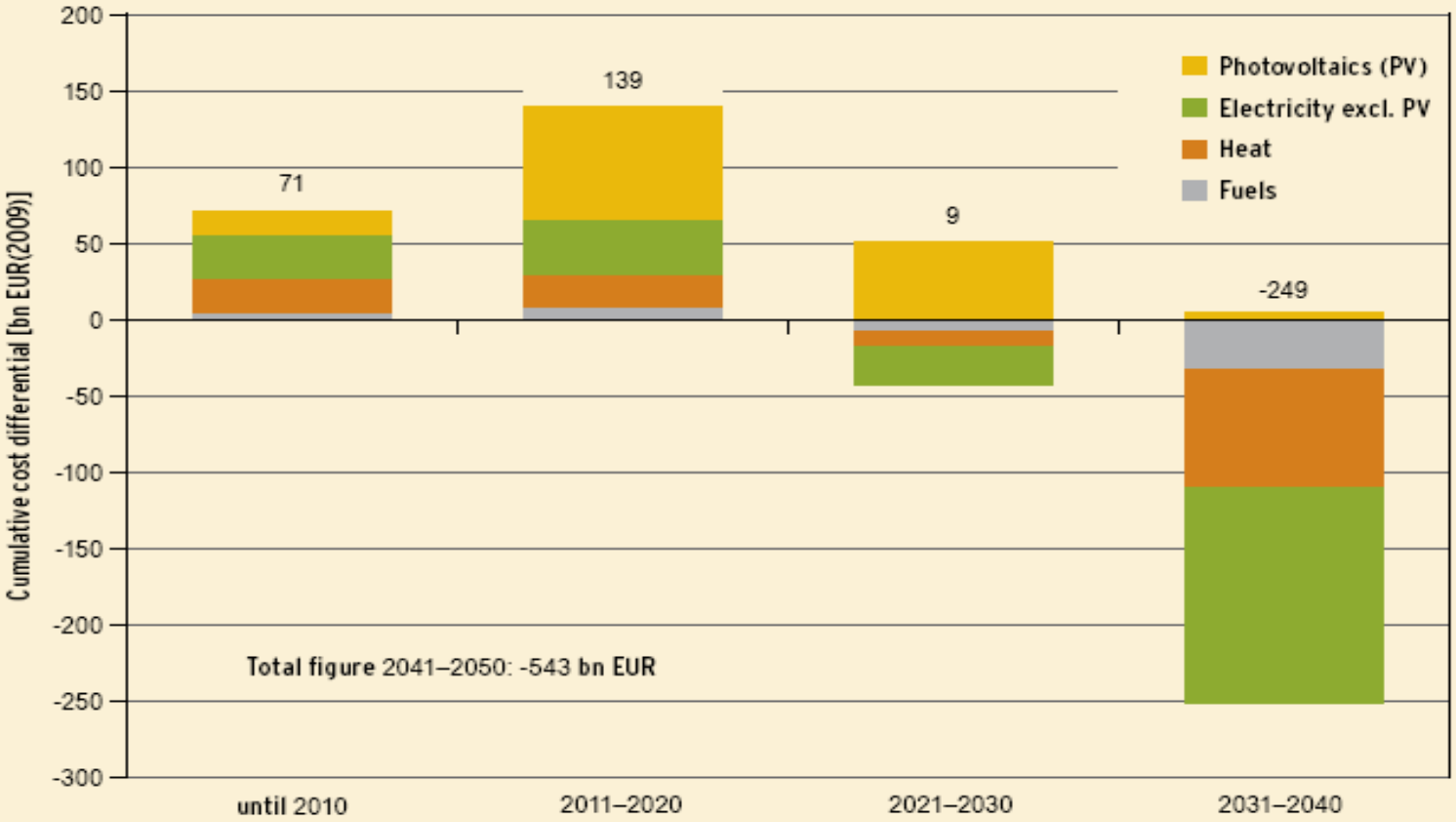
- Additional influences on RE costs and electricity price: „compensation approach" for energy-intensive industries, future Feed-in-Tariffs and instruments, Merit-Order-Effect

Short-term Challenges: Cost Dimension (2)

- well known increasing cost curves of limited fossil fuel resources
- estimated mid- and long-term decreasing cost curves of RE technologies; already achieved 90 % cost reduction for PV and 50 % for wind turbines (1990);
- from 2020 grid parity for wind (onshore), PV and bioenergy is expected;
- hidden costs of nuclear energy often not included in any cost analysis, e.g. disposal of nuclear waste or actual risk assurance

Future estimated cost development of RE

Cumulative system-analytical differential costs of electricity, heat and fuel supply from renewable energy sources [1)]



Note: Compared with a fossil energy system, assuming a future increase in fossil fuel prices in line with price path A: "Marked".
1) Scenario 2011A for 10-year periods

Source: DLR [134]

System Integration of RE: Short-term Challenges (EEG 2012)

- **Market Integration of RE**: “direct sale mechanisms” and “Flexibility Pemium” instead of FIT(widely used for wind and PV “parks”

- **Feed-in management:** RE supply already exceeds electricity demand in certain hours; need for
  - All RES-plants need to be ready to reduce feed-in in case of oversupply
  - Compensation for foregone income
  - PV: Technical requirements vary with plant size

- **Grid code** was changed: more complex frequency management for all RES:
  - Retrofit of more than 300.000 PV systems (>10 kWp capacity), 3 to 4 years, approx. 200 Mio. Euros
  - **Technical standards in energy sector need to be further developed!**

System Integration of RE
Mid-term Challenges: flexible capacity markets

- designing the electricity market for the feed-in and safe supply of fluctuating power generation from wind and PV
- need of flexible thermal power plants, in particular high efficient gas-fired power plants
- very limited generation times require new financial mechanism, e.g. capacity payment or capacity markets

System Integration of RE:

Mid-term Challenges: Grid Expansion

- Upgrading the electricity grid infrastructure: Expansion of the transmission & distribution grids
- **Overlay grid**: North-south routes to carry electricity from wind farms in the north to the consumption centres in the south
- **National grid development plan** according to 3d energy package to be submitted on 3 June 2012
- About 25 bn Euro investments are expected till 2030 to reinforce and connect RES to distribution networks
- Enhancing public acceptance of grid expansion, overcoming administrative hurdles and long procedures
- Creating sufficient incentives for investors (9 % profit on equity) , consideration to participate municipalities and citizens

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Grid expansion

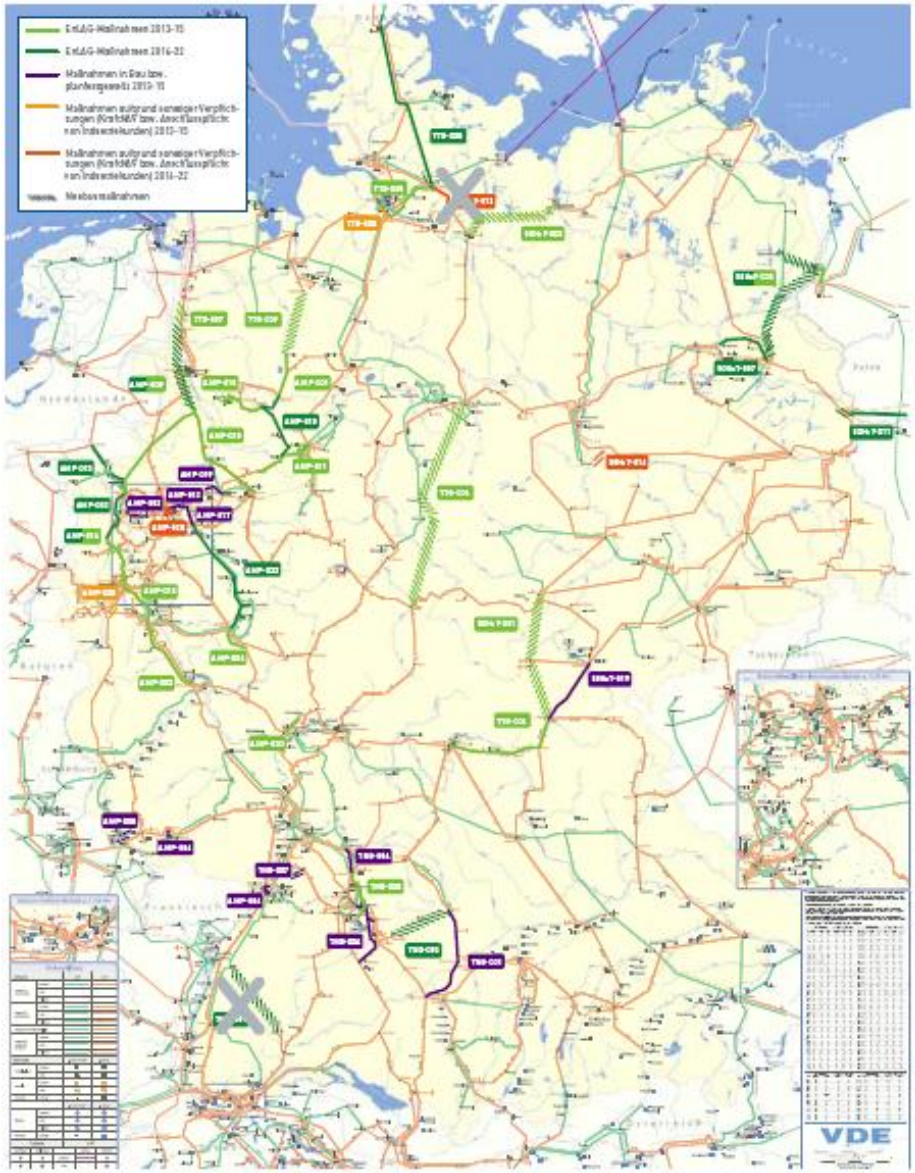

Abb. 9/ Stammnetzübersicht Quelle: VDE Verband der Elektrotechnik Elektronik Informationstechnik e.V. | FNN/Übertragungsnetzbetreiber

Grid development plan 2012

NEP 2012, Stand:August 2012,
www.netzentwicklungsplan.de

4. Grid Development Plan (2012): 4000 km new grids

Grid onshore 20 Mrd. €,
Offshore 12 Mrd.€
3.800 km new grids,
(1.700 AC and 2.100 DC)
4.400 km Upgrading

Support Programmes: Storage

- Storages needed from 2020 onwards
- Research & Development Initiative: 200 Mio. Euro
- New Support Programme for small battery systems in combination with PV-systems:
  - 50 Mio. Euro per year
  - KfW loan programme, subsidies for batteries
  - Start: beginning of 2013

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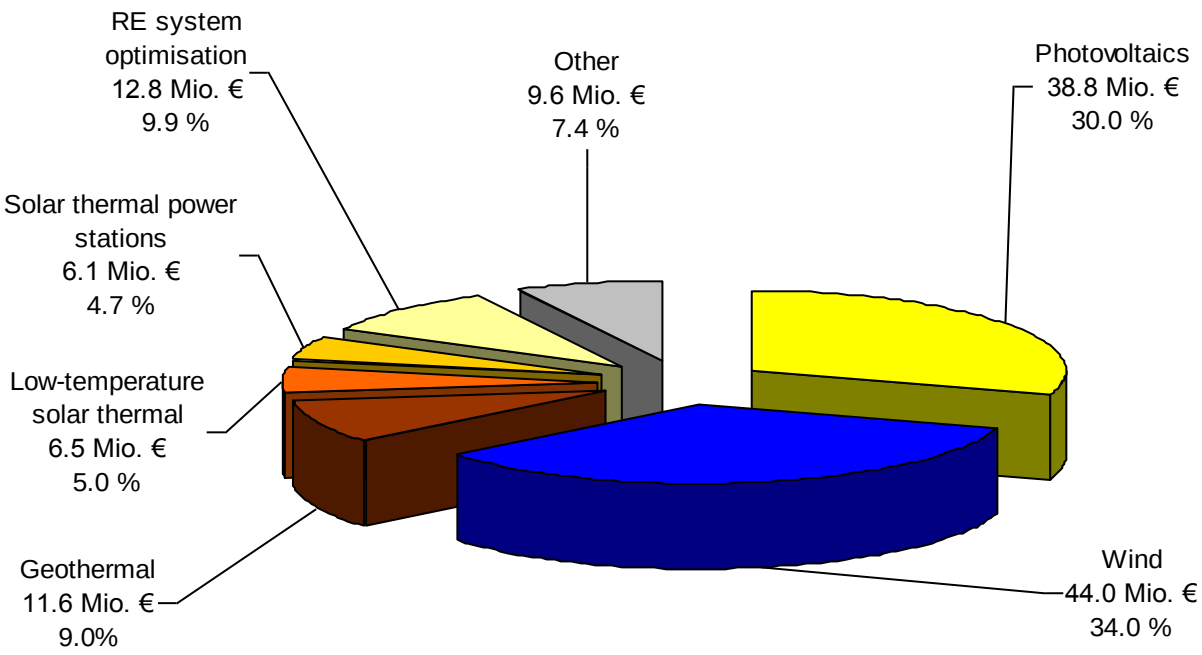
Reseach and Development: BMU calls for tender, close to applications, including companies

Funds deployed for ongoing projects in 2011



Overall Federal Government 6th Energy Research Programme

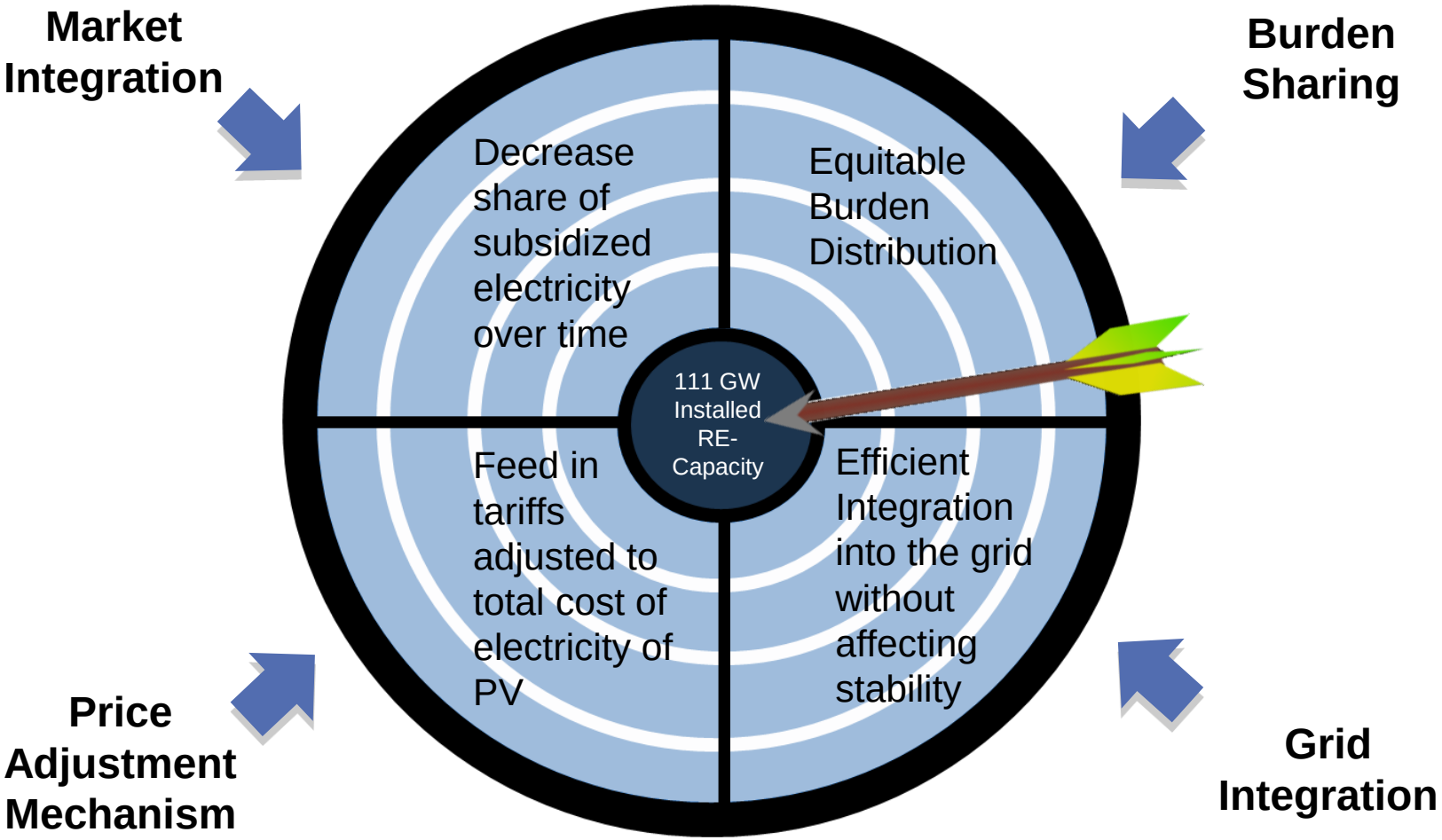
- *€ 3,5 Mrd. for the next 3 years for innovative energy research*
- *Budget for renewable energies 1,3 Mrd. €*

System Integration of RE: Long-term Challenges

- base load power plants for electricity supply (nuclear, coal) will no longer exist, base load of 20-30 GW will be provided by combined power and heat generation;

- expansion of storage technologies: batteries, pumped storage hydro, “power-to-heat” (heat-pumps, “power-to-gas” including hydrogen: focus of current R & D projects;
- new applications have to extended, in particular electro mobility (use of surplus energy from RE, introducing RE in the transport sector);
- smart grid und smart communities for using surplus RE, and reaching more energy efficiency and saving
- load management to avoid peak loads, in particular in industry and commerce, but also in homes (“learning from Japan”).

Long-term Goals of Renewable Energy Regulation



Conclusions

1. continuation of RE development will be the major pillar of German Energy Transition, in particular wind and PV;
2. future role of RE requires a wide variety of economic and technical requirements, in particular capacity markets, grid expansion, storage technologies, new applications;
3. (exaggerated) cost challenges are a short-term issue to be overcome;
4. challenges are well understood and in different stages of action including responsibilities for policy, business, scientific community and civil society;
5. Energy Transition is one of the most important major German post-war „Challenges“.

Thank you for your attention!

More Information:

www.bmu.de/english

www.erneuerbare-energien.de/english