

Parallel Session 1.1

Visions of the transformation of the energy system
A German Perspective



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Overview

German visions and targets for 2050

Challenges of the on-going transformation in the electricity system:

Technical, economical, institutional and stakeholder challenges

Some lessons learnt

German Visions and Targets for the Transformation of the Energy System

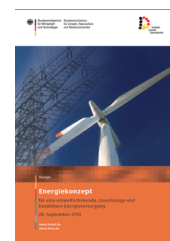
- Decarbonisation of the global economy is needed

G7 2015 Decisions Elmau:

- Decarbonisation globally by 2100
- Achieving a low-carbon global economy
- Innovative technologies and striving for a transformation of the energy sectors by 2050
- Develop national long term low-carbon strategies



- National decarbonisation plan was adopted in 2010 and amended in 2011 (nuclear phase out)
 - Primary energy savings more than 50%
 - 50 %+ RES energy supply
 - 80 – 100 % RES electricity
 - 80 – 90 % GHG emission reduction by 2050 (vs. 1990)



- Broad scientific discourse on the future German energy system
 - More than 20 studies since 2009
 - more than 40 decarbonisation scenarios
 - Meta-studies on-going e.g. by German Academies of Science

Deep decarbonisation scenarios for Germany

Exploing reductions beyond -80%

	Government Target	Renewable Electrification	90 % GHG Reduction	GHG-Neutral
GHG emissions (vs. 1990)	-80% *)	-86% **)	-90% ***)	-95% ***)
Energy efficiency	Very strong efficiency improvements	Strong efficiency improvements	Very strong efficiency improvements	Very strong efficiency improvements
Lifestyle changes	Not considered	Not considered	Considered to a moderate extent	Considered to a moderate extent
domestic RES	Strong increase	Very strong increase	Strong increase	Very strong increase
Substitution of fossil fuels through electricity	Moderate substitution	Strong substitution	Strong substitution	Almost complete substitution
RES-based hydrogen	Not used to a relevant extent	Strongly used	Moderately used	Strongly used
Net imports of electricity	Low net imports	Considerable net imports	Moderate net imports	High net imports
of bioenergy	Moderate net imports	No net imports	Considerable net imports	Considerable net imports
CCS in industry	Not considered	Not considered	Considered	Not considered

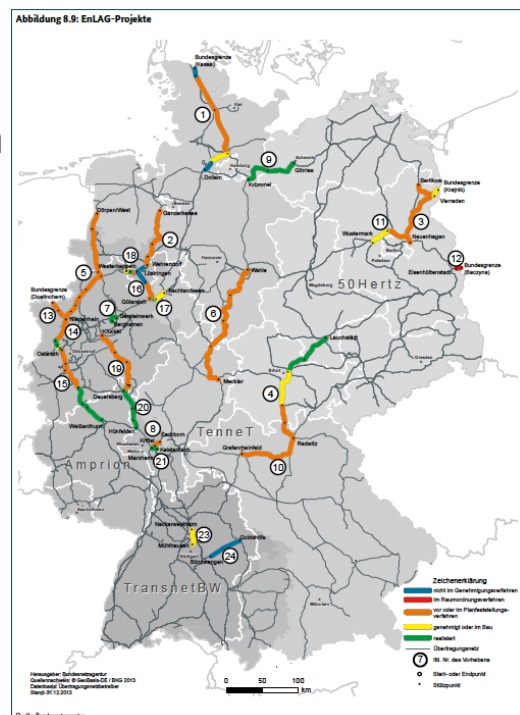
*) energy related GHGs; **) energy & process related GHGs; ***) all GHGs from all sources

Source: WI 2015 DDPP-project modified

TECHNICAL CHALLENGES

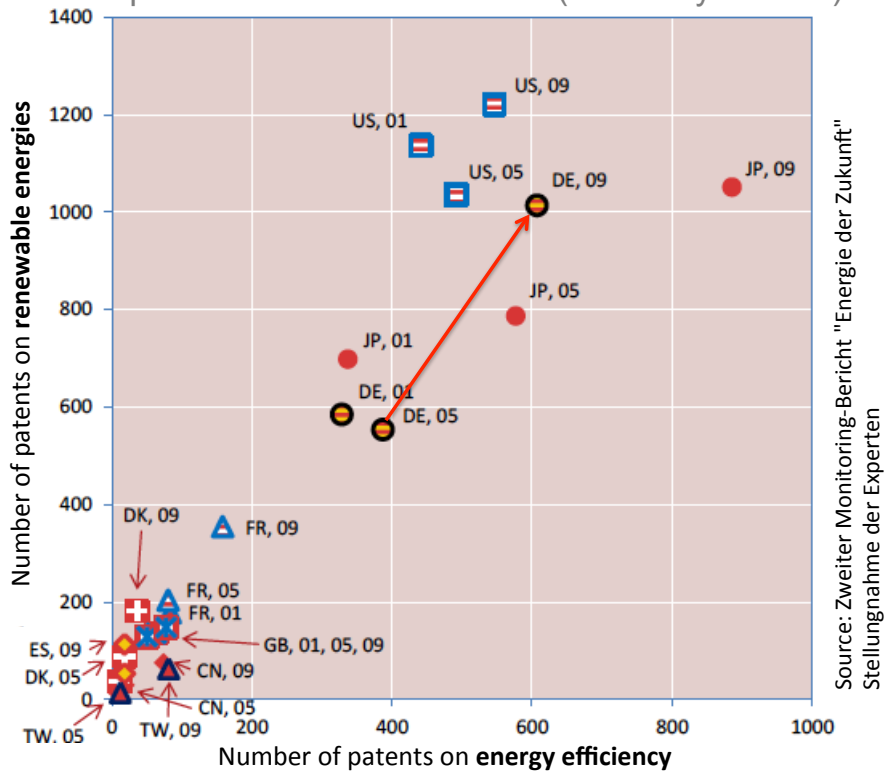
Electricity system transformation: Technical challenges

- Investment into RES generation capacity well on-going
 - (changes in remuneration policy might cause delays)
- Grid expansion delayed but speeding up
- Remaining challenges:
 - Flexibilisation of demand, storage
 - Electrification of other sectors (heat, transport, energy intensive industries)



Innovation effects of transforming the energy system

Increase of patents from 2005 to 2009 (Germany: + 68%)

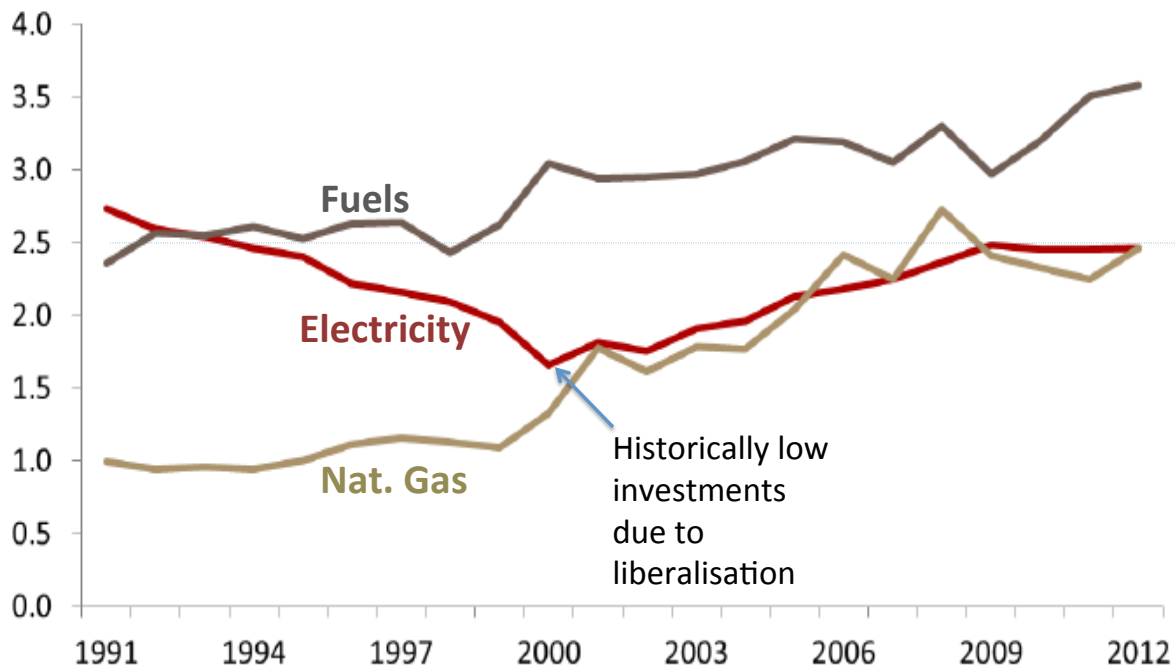


Transformation of the German Energy System

ECONOMIC & MARKET CHALLENGES

Only Moderate Growth of Electricity Expenditures

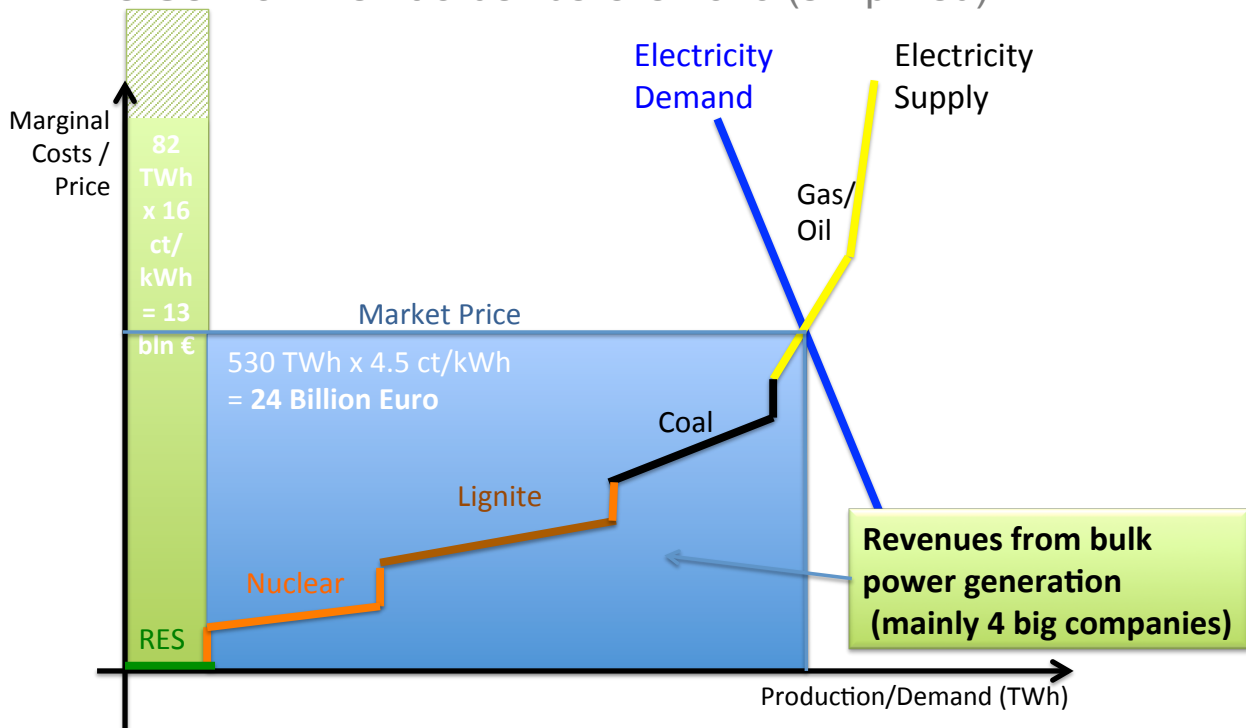
Energy expenditures of final consumers (in % of GDP) 1991 – 2012



Source: Bundesnetzagentur (2014): Zweiter Monitoring-Bericht "Energie der Zukunft"

Effects on the electricity market (energy only)

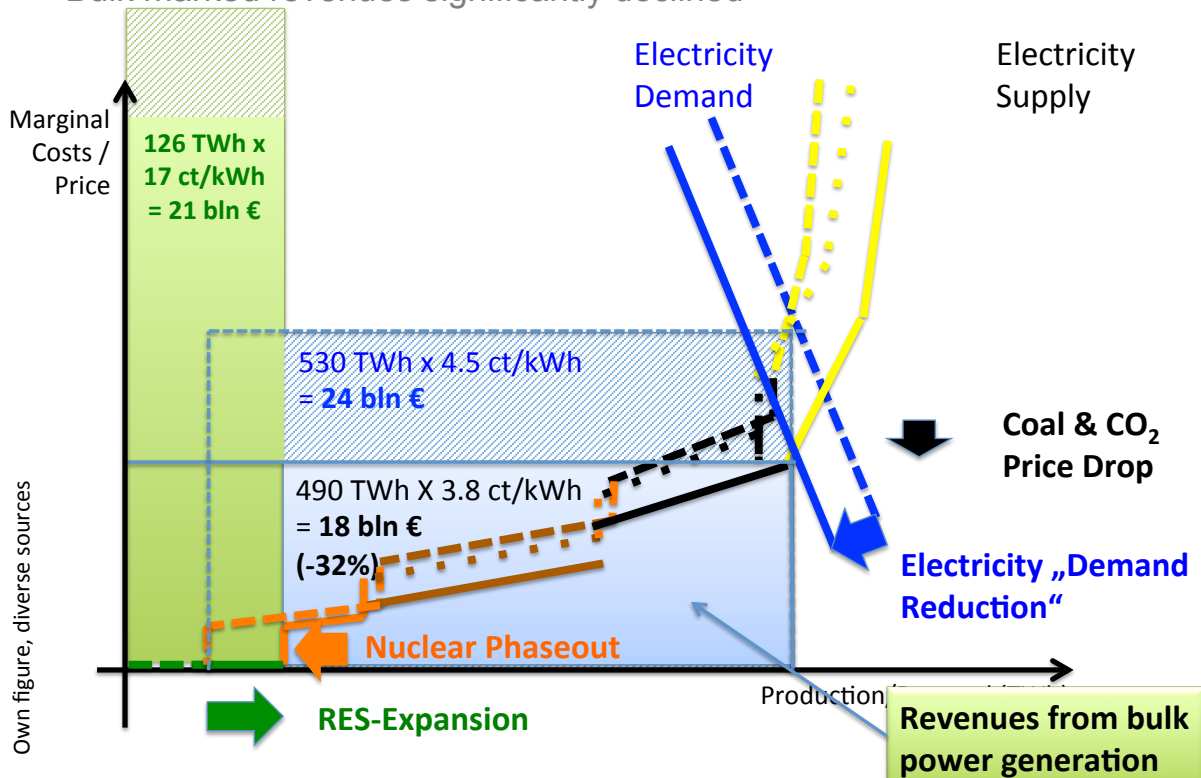
The German merit order before 2010 (simplified)



Own figure, diverse sources

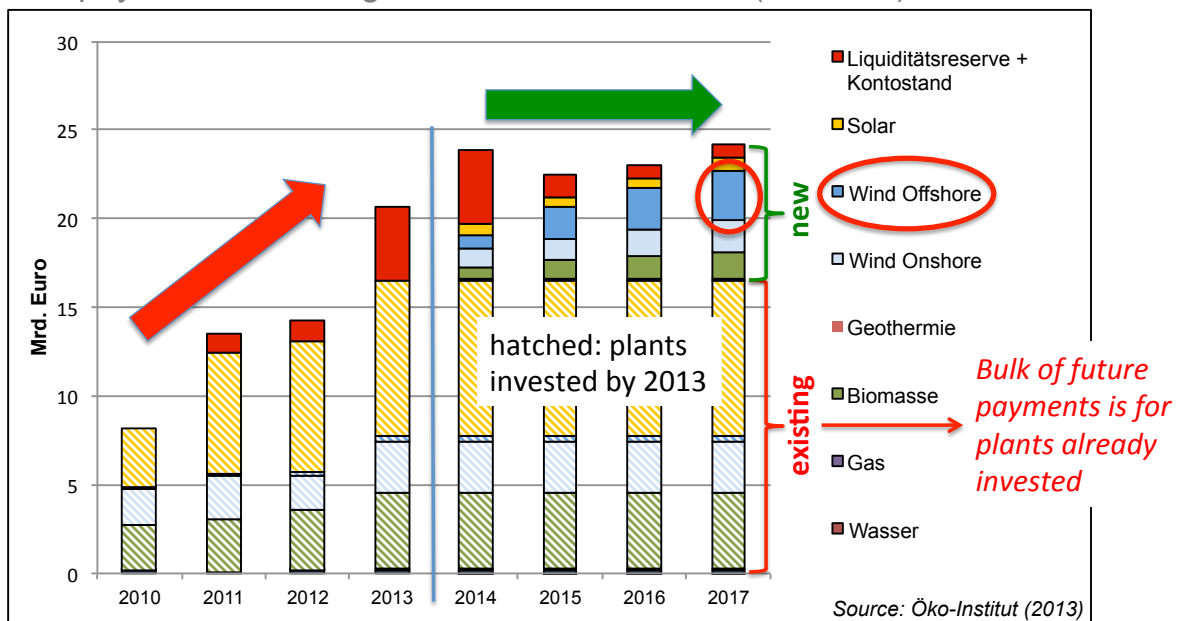
Effects on the electricity market (energy only)

Bulk marked revenues significantly declined



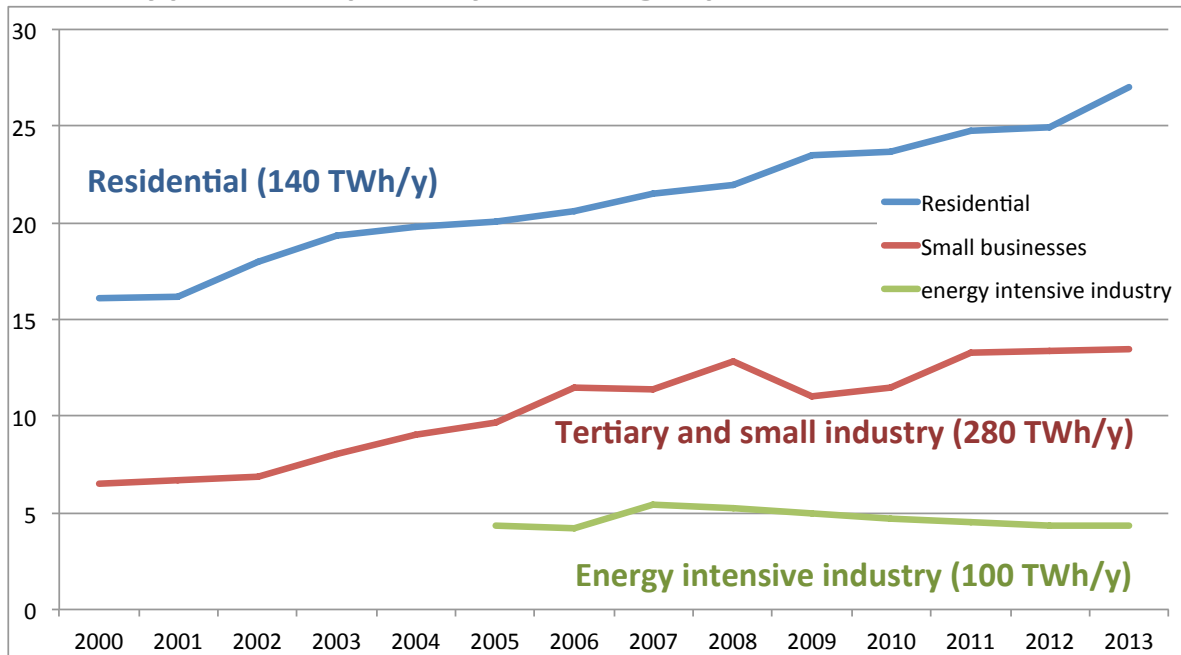
Costs of RES-electricity are expected to level off in spite of further increasing generation

Net payments to RES-generators 2010 to 2017 (estimate)



Divided developments of electricity prices

Electricity price development by customer group, 2000 – 2013 (in ct/kWh)



Source: Bundesnetzagentur (2014): Zweiter Monitoring-Bericht "Energie der Zukunft"

Institutional challenges in the electricity market

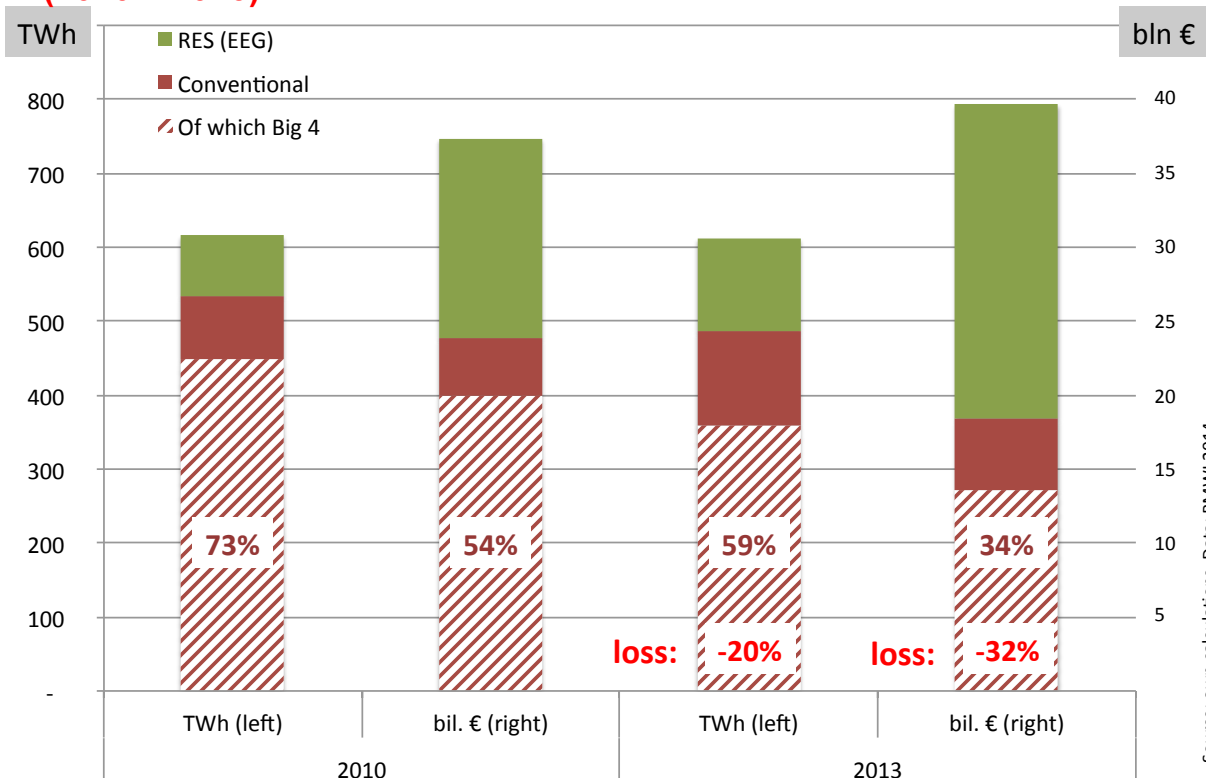
Market regulations have to be adapted to the transformation challenges

- Remuneration of RES generation:
 - Incentives for investment into new RES capacity (and procedure -> from FIT to CFT)
 - Incentives for RES to exploit their potential for system stability
 - Steering of geographical distribution: preferably at sites with sufficient grid capacities
- Conventional generation
 - Adequate incentives for provision of conventional reserve capacity (and procedure, capacity market?)
 - Support for the transformation of traditional market players? (e.g. strapping-premium for coal fired power plants)

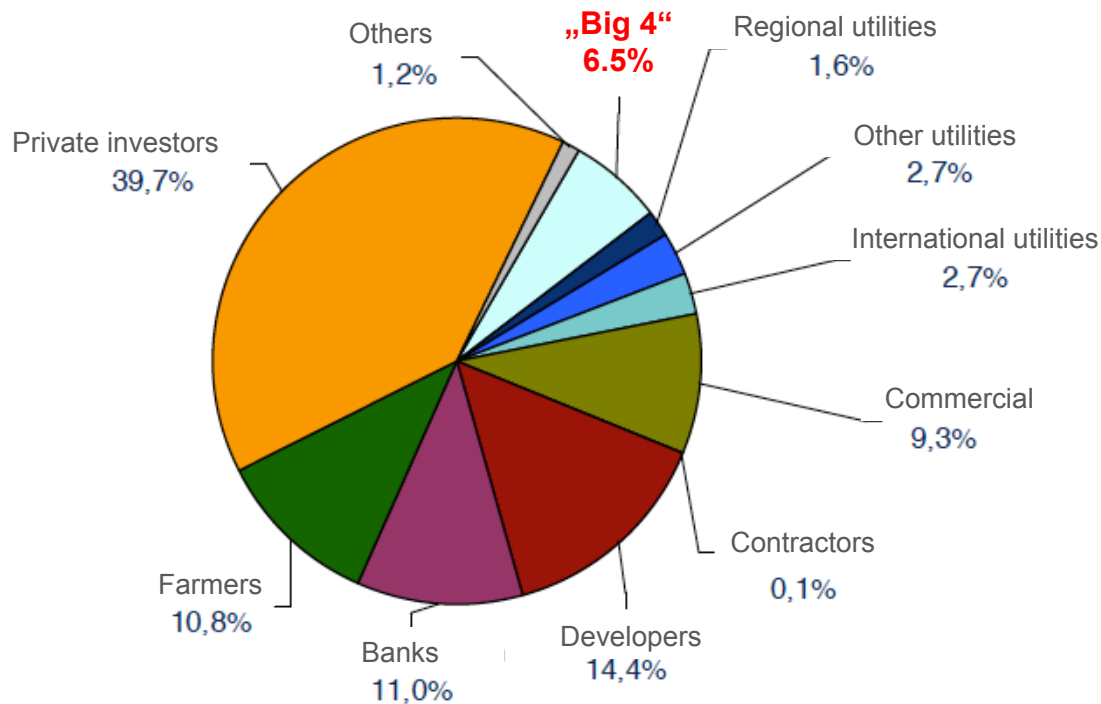
Transformation of the German Energy System

STAKEHOLDER CHALLENGES

Market shares of the „Big 4 Generators“ crashed by 1/3 (2010 – 2013)



Ownership of installed capacity of RES 2010, w/o pumped hydro



Klaus Novik Institut, Trend Research (2011): Marktakteure Erneuerbare – Energien – Anlagen in der Stromerzeugung

Conclusion 1: Transformation of the energy system is possible and attractive

- Germany has ambitious targets to **transform the energy system with a focus on renewable electricity**
 - Targets set already in 2010 (and had discussed these long before)
 - Transformation is on-going and already advanced in the electricity system
 - There are many visions seriously discussed going far beyond that
- The successes in the electricity system offer **important learnings** for others
 - **Technically, there are little limitations** to rapidly converting the system to fluctuating renewables
 - **Additional costs have been rather limited so far** and increases are going to be slow – long term investments will pay off
 - **Economically there have been many advantages** in employment, innovation etc. but also diverse distributional effects

Conclusion 2:

Main challenges are institutional and regarding economic lock ins

- **Problems occur mainly where incumbent companies/sectors (e.g. coal/lignite fired electricity generation) are affected:**
 - **Institutional settings** need to be adapted to support and enable necessary changes
 - Wrong **investment decisions** of the past are the main road-block for the energy transition
 - Tough decisions are needed to quickly **reduce coal** use
 - This will need also decisions to engage the losers of the transition in traditional energy sectors
 - Energy intensive industries deserve particular attention
- Decarbonising **other sectors** (heat, transport, industry) **remains challenging**
- **Energy transformation** has unleashed much of positive momentum in Germany and **provides huge chances globally**

Thank you!

