German Renewable Energy Policy

What can be learned from the German case?

driver – mistakes – challenges

André Poschmann, M.E.S.
Federal Ministry of the Environment,
Nature Conservation and Nuclear Safety




- The importance of targets
- The main driver for RES-E: the Renewable Source Act (EEG)
- RES dynamics in Germany
- What about the support costs?
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- Is a Feed-In as such too expensive?
- One solution option: the German PV example and the flexible cap
- Future challenges when achieving higher amounts of RES-E

The importance of targets

- Clear investment signals
- Reliability
- Avoiding lock-in-effects
- The higher the envisaged RES level the more important become long term targets

The German *Energiewende* Targets

➢ Energiewende sets for the first time clear Roadmap with targets up to 2050

	Climate	Renewable energies		Efficiency		
	Greenhouse gases (vs. 1990)	RES-E share	Overall share	Primary energy cons.	Energy productivity	Building modernization
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%		

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The Renewable Source Act (EEG) and it's main cornerstones

- Low investment risk – low interest rates – high attractiveness
  - financing costsFixed price ("tariff") for every kWh produced
  - for 20 years
  - Guaranteed grid access for RES-E
  - priority transmission and distribution
  - Low administrative burden (e.g. no permission needed for PV roof top)
- Effectiveness AND efficiency via technology specific support
  - developing many future technologies but avoiding over subsidisation
- Reliability: levy financed not public financed
  - Costs are distributed via TSOs to all consumers on their energy bill
- Flexibility: Regular monitoring & adjustments to technology development

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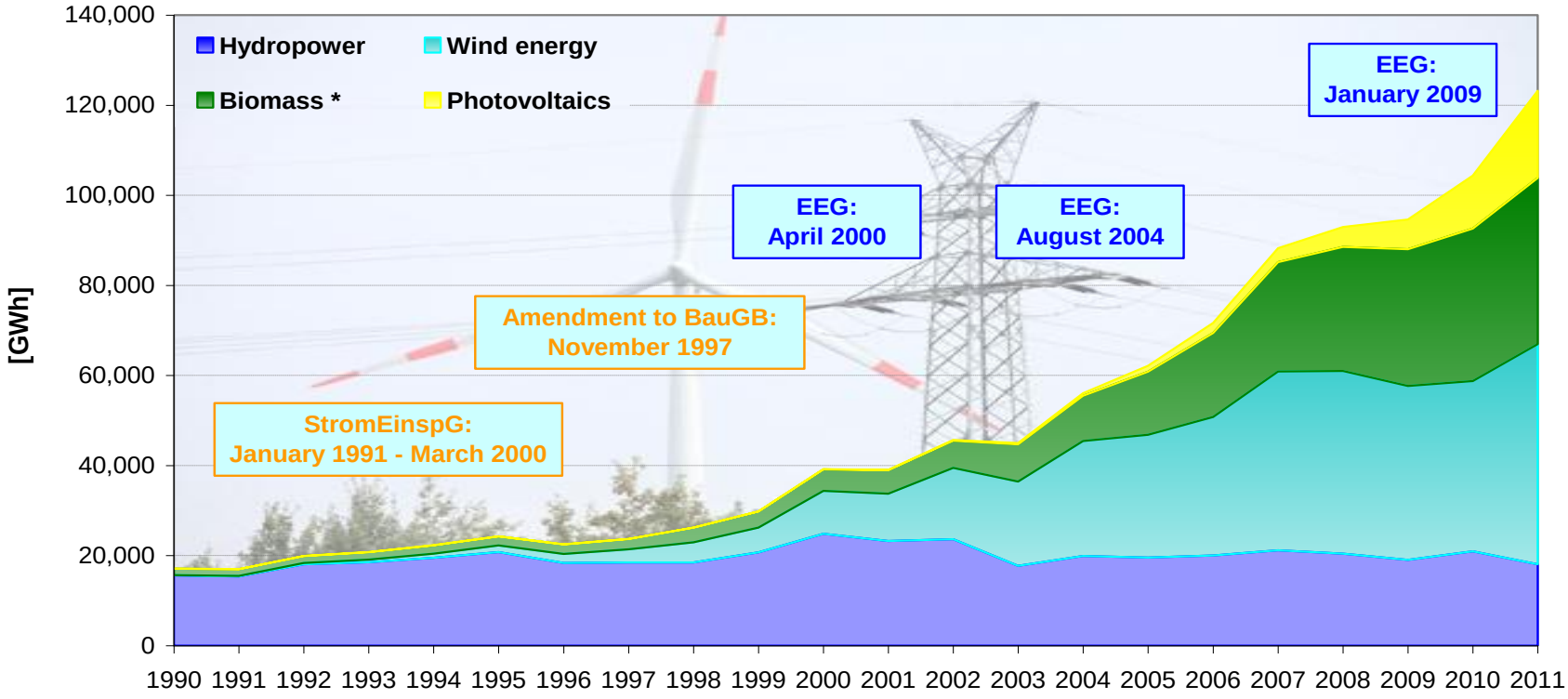
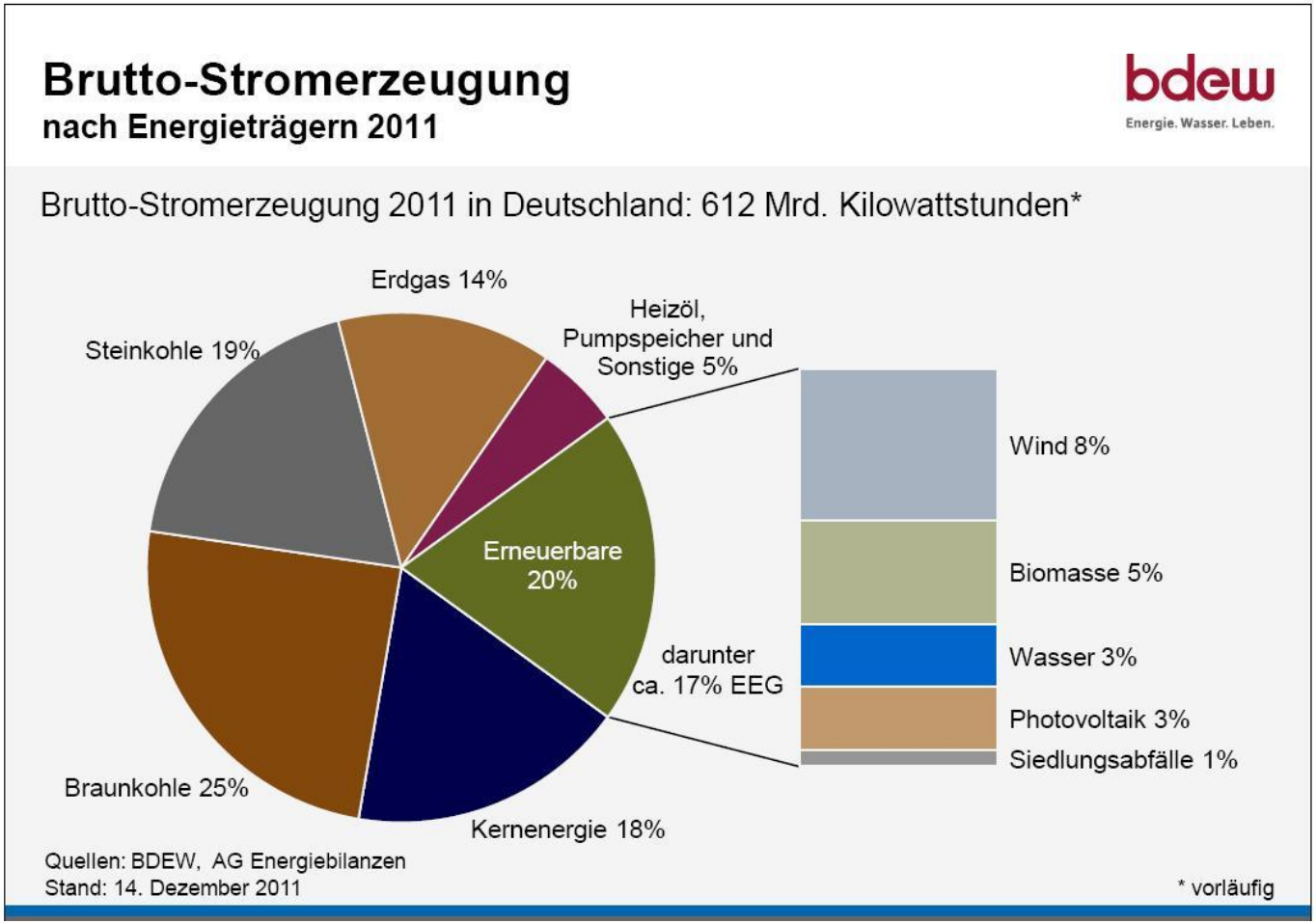
Dynamic growth in RES-E share in electricity consumption

Development of renewables-based electricity generation in Germany since 1990



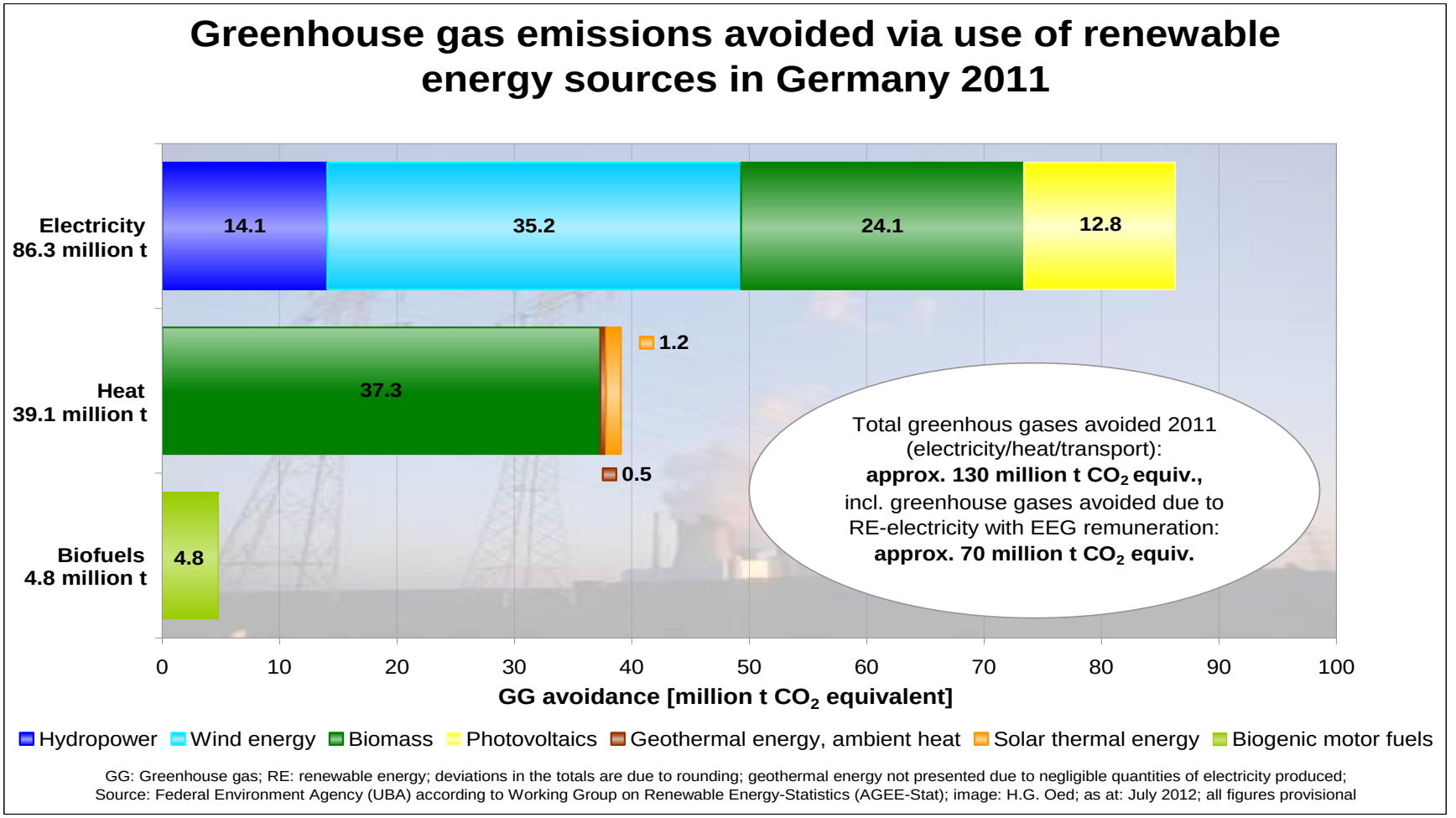
* Solid and liquid biomass, biogas, sewage and landfill gas, biogenic fraction of waste; electricity from geothermal energy not presented due to negligible quantities produced; 1 GWh = 1 Mill. kWh;
StromEinspG: Act on the Sale of Electricity to the Grid; BauGB: Construction Code; EEG: Renewable Energy Sources Act;
Source: BMU-KI III 1 according to Working Group on Renewable Energy-Statistics (AGEE-Stat); image: BMU / Christoph Edelhoff; as at: July 2012; all figures provisional

2011: RES overturned nuclear and became second largest energy source for electricity



Saved costs for climate protection:

- 40€ - 140€ avoided external costs /t CO2
- 5.2 - 13 billion € of saved external costs in 2011



GG: Greenhouse gas; RE: renewable energy; deviations in the totals are due to rounding; geothermal energy not presented due to negligible quantities of electricity produced;
Source: Federal Environment Agency (UBA) according to Working Group on Renewable Energy-Statistics (AGEE-Stat); image: H.G. Oed; as at: July 2012; all figures provisional

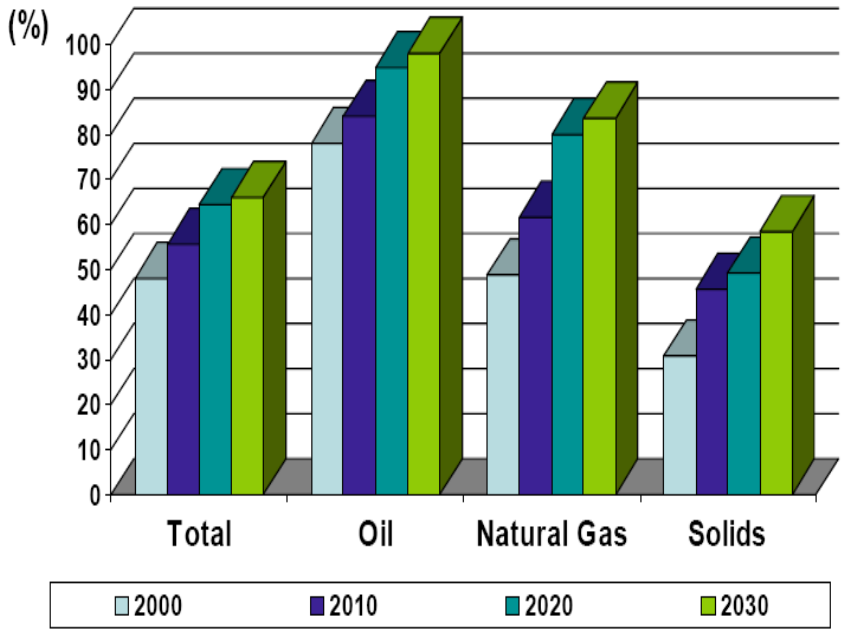
Saved costs for energy imports

Already in 2011

- **at a RES-E share of appr. 20%**
- **And reduced electricity consumption by 6% cp to 2008**

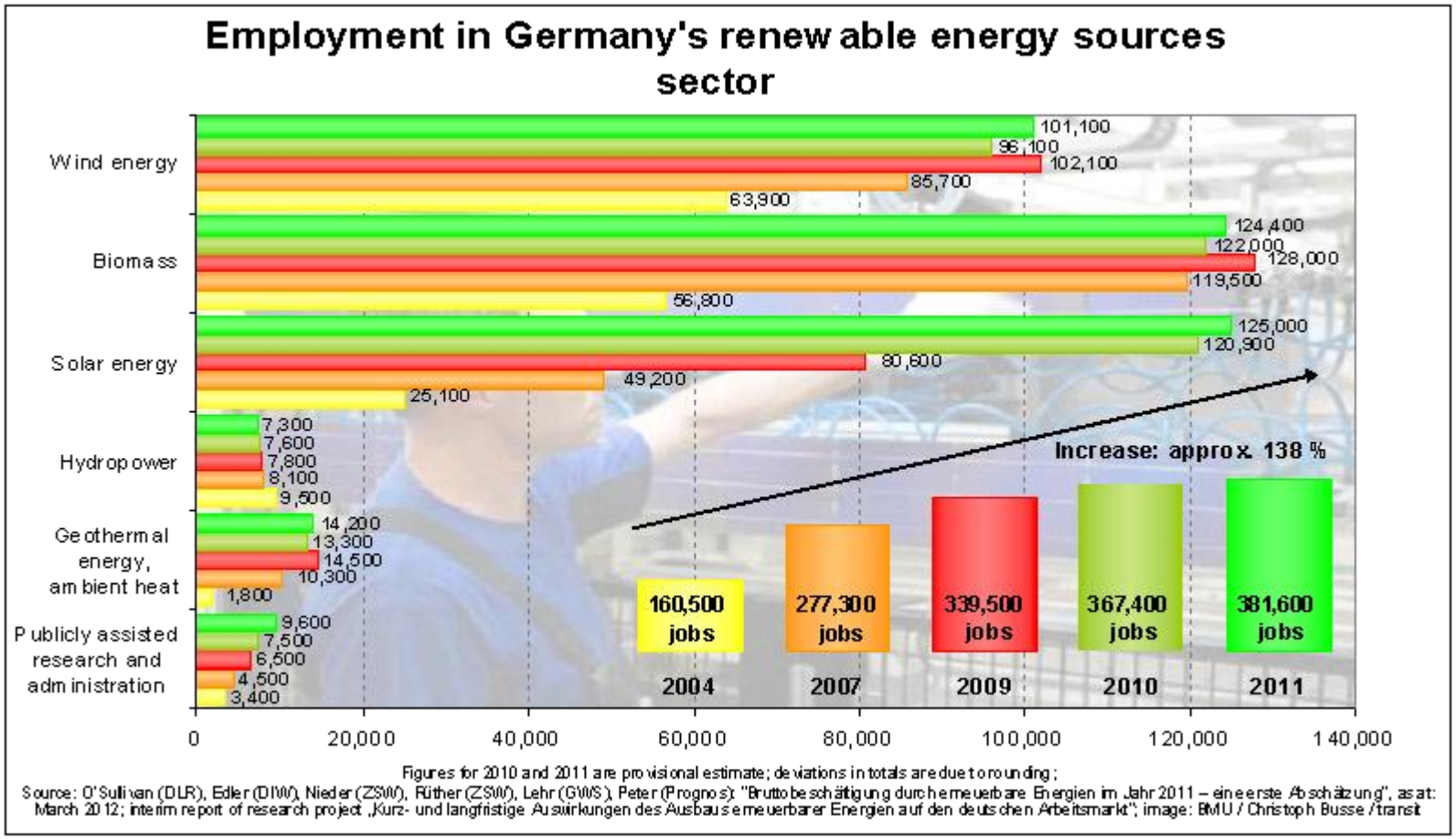
Germany saves
25 bn. €/a of energy imports !

2.10. EU-27 Development of Import Dependence up to 2030 (Baseline Scenario)



Source: European Commission DG TREN, PRIMES

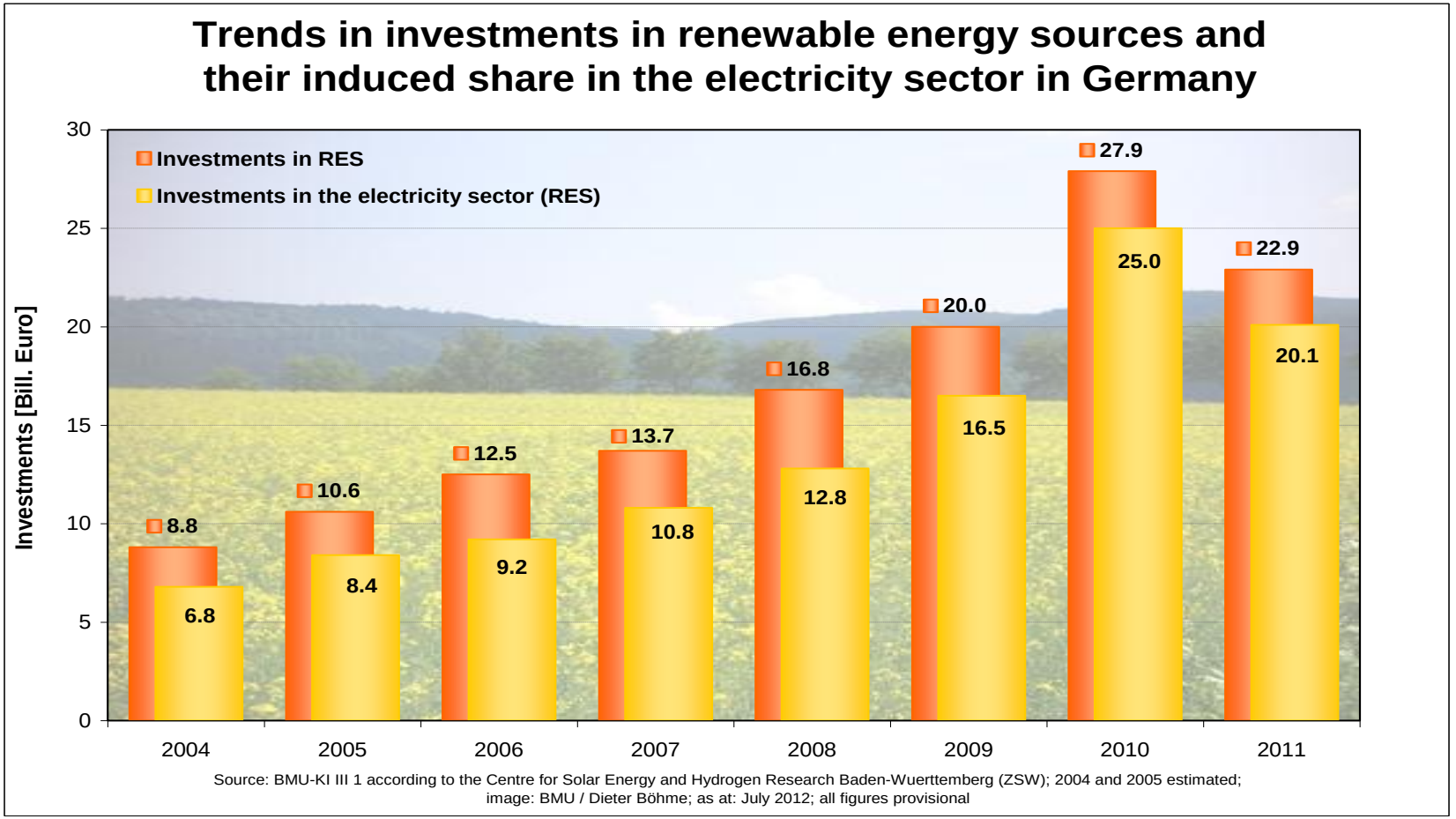
Already in 2011: 380.000 jobs from RES



Figures for 2010 and 2011 are provisional estimate; deviations in totals are due to rounding;
Source: O'Sullivan (DLR), Edler (DIW), Nieder (ZSW), Rüther (ZSW), Lehr (GWS), Peter (Prognos): "Bruttobeschäftigung durch erneuerbare Energien im Jahr 2011 – eine erste Abschätzung", as at: March 2012; interim report of research project „Kurz- und langfristige Auswirkungen des Ausbaus erneuerbarer Energien auf den deutschen Arbeitsmarkt"; image: BMU / Christoph Busse / transit

Inducing broad investments

- allover the country
- particularly also in less developed areas (eg. east Germany or at the costs)



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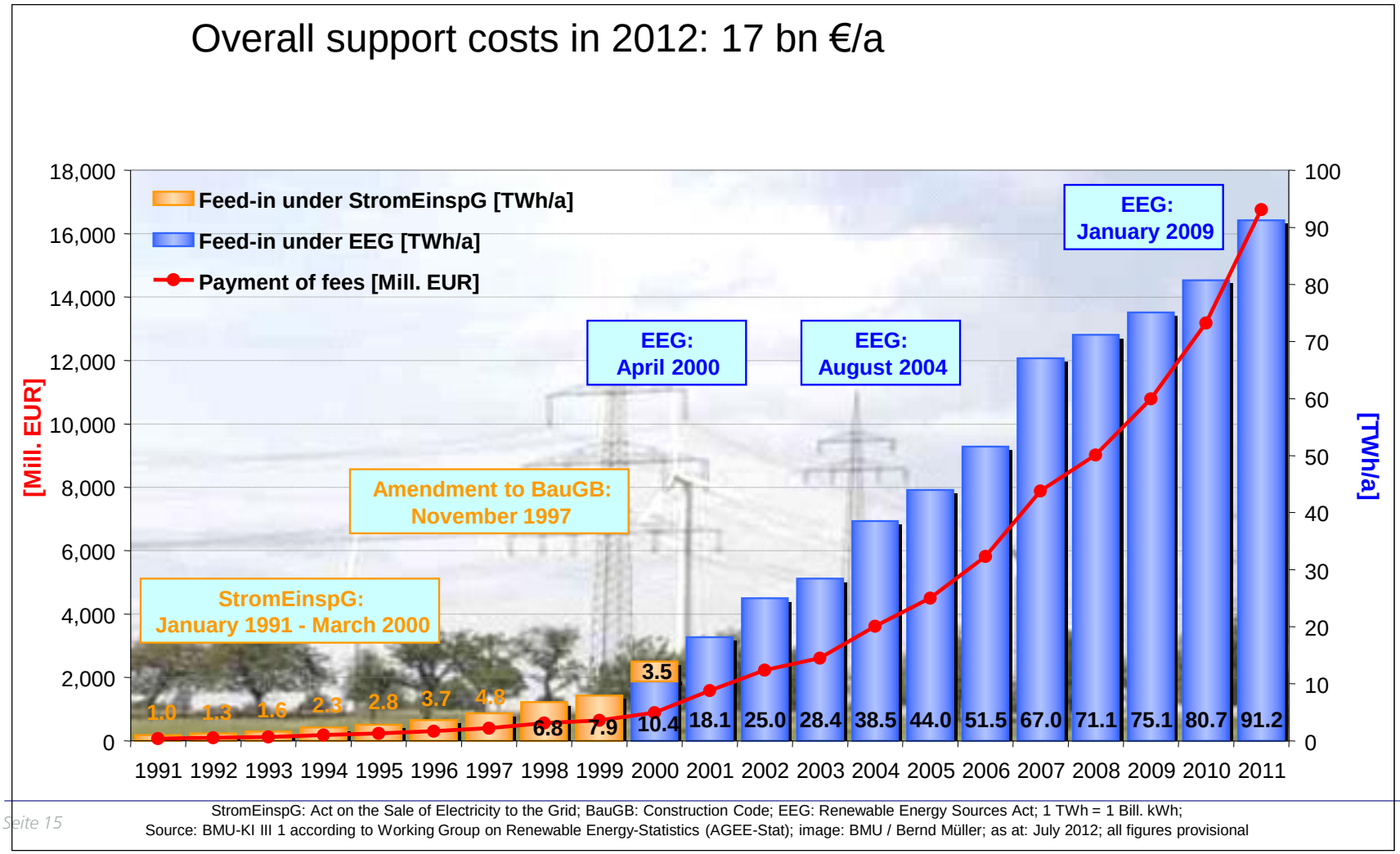
The truth: Germany has paid a lot for RES technology progress



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-Statistics (AGEE-Stat); image: BMU / Bernd Müller; as at: July 2012; all figures provisional

But also true:

- Cost came down, particularly in PV
- A 4 person houshold (3.500 kWh/a) pays only 15 € per month
- Industry profits
  - From lower wholesale power market prices ➔ came down by 2ct/kWh since 2008
  - And energy intensive industry is largely exempted from paying the levy
- Paradoxon: RES-E reduces the wholesale power market price but thereby increases overall support costs (=support payments minus market price for RES-E)

Why? ➔ the ***merit order effect*** of wholesale power markets

Wholesale power market: *Merit order* curve with RES-E

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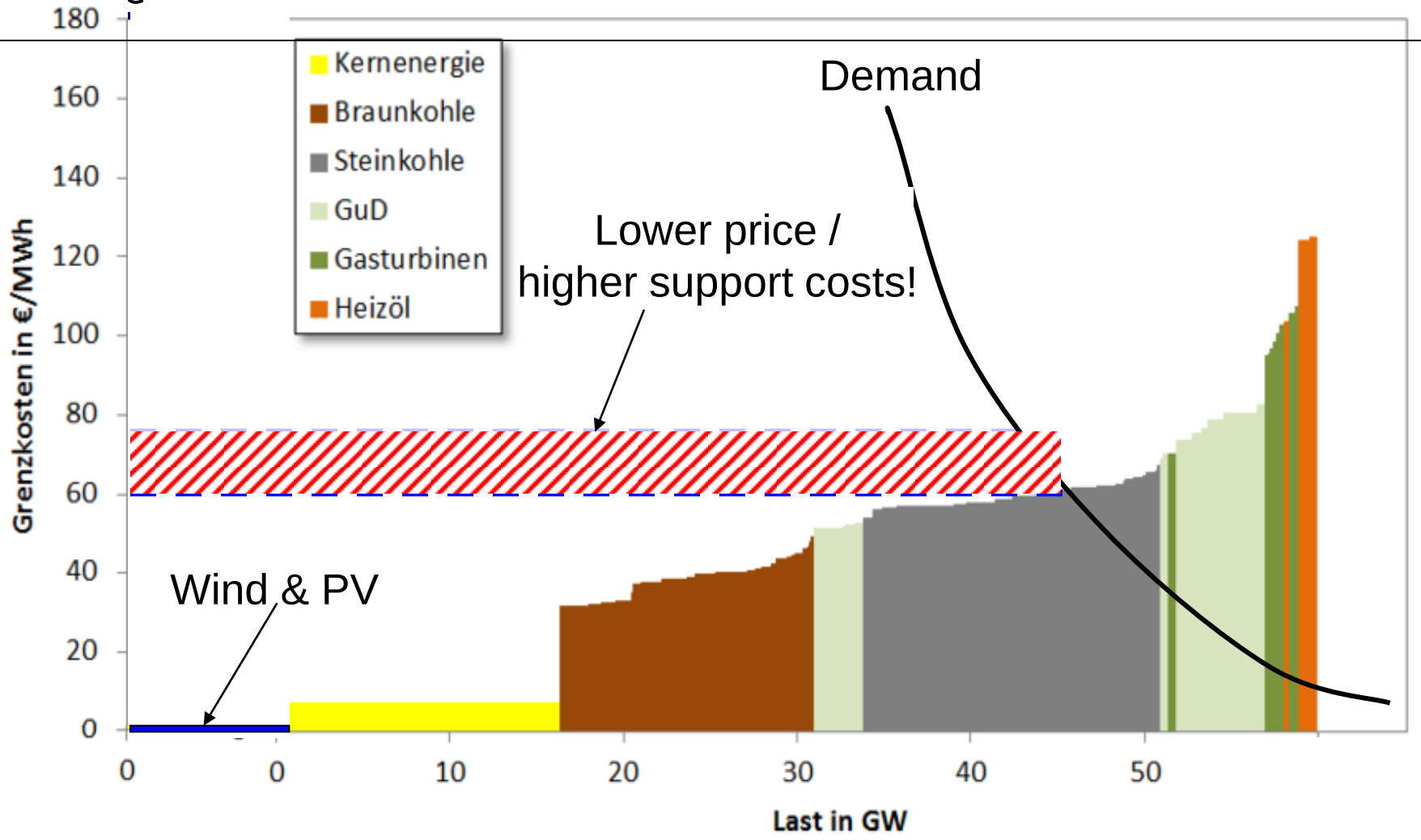
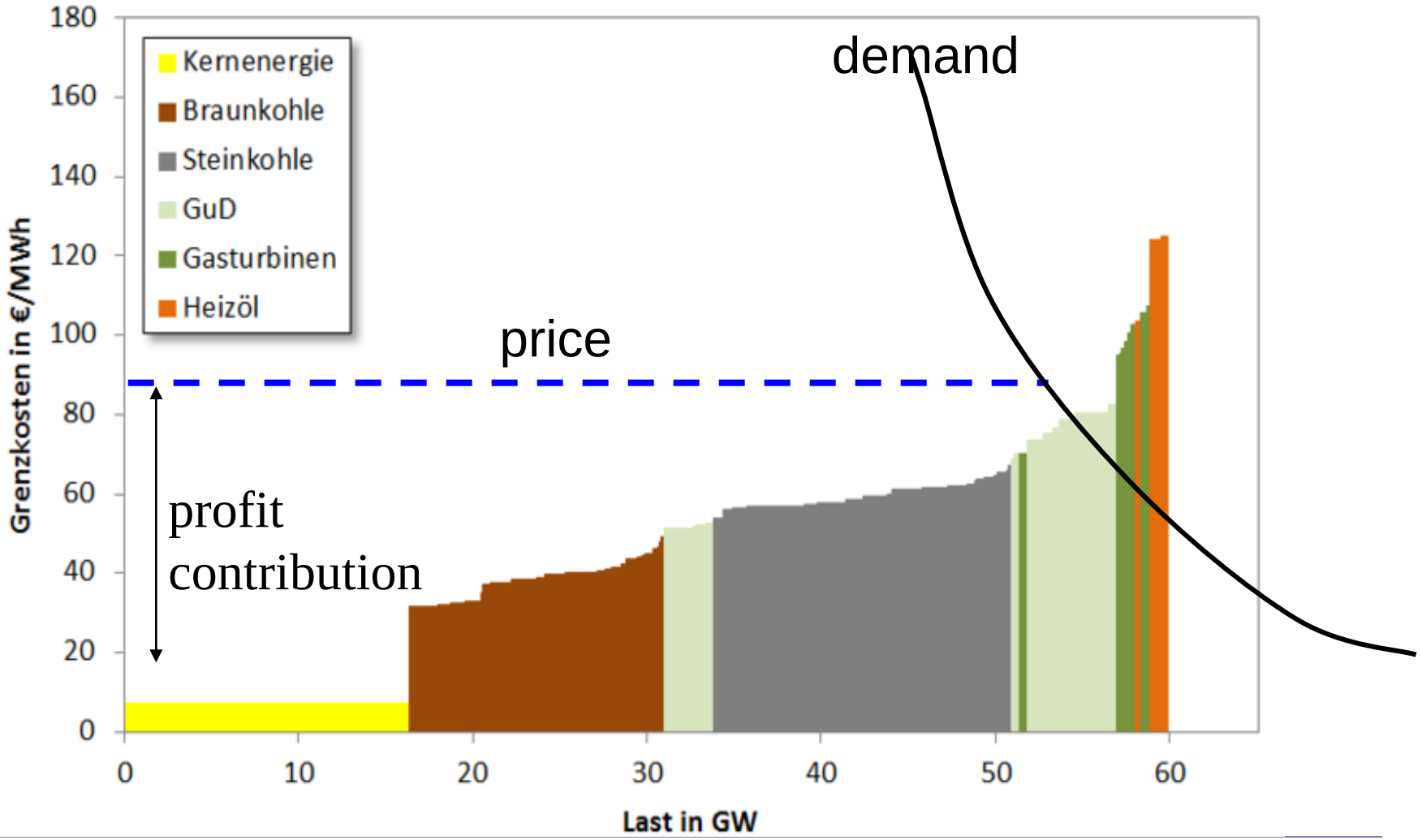
average support payments 150 €/MWh – 60 €/MWh

wholesale price = support costs are 90 €/MWh



Wholesale power market: *Merit order* curve <u>without</u> RES-E

average support payments 150 €/MWh – 90 €/MWh wholesale price → support costs would be 60 €/MWh



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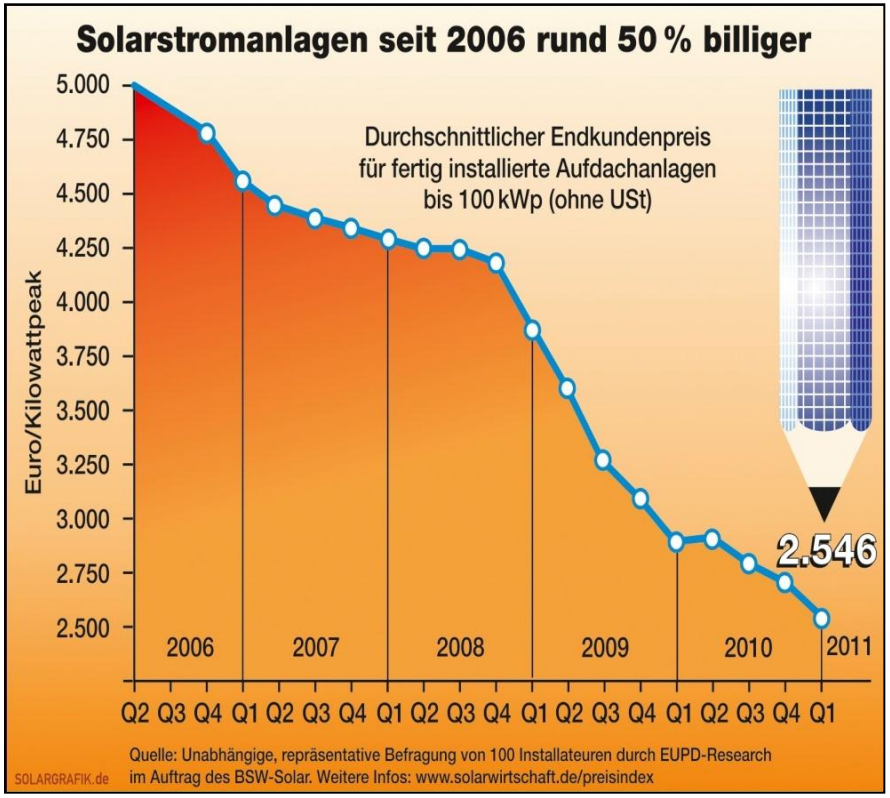
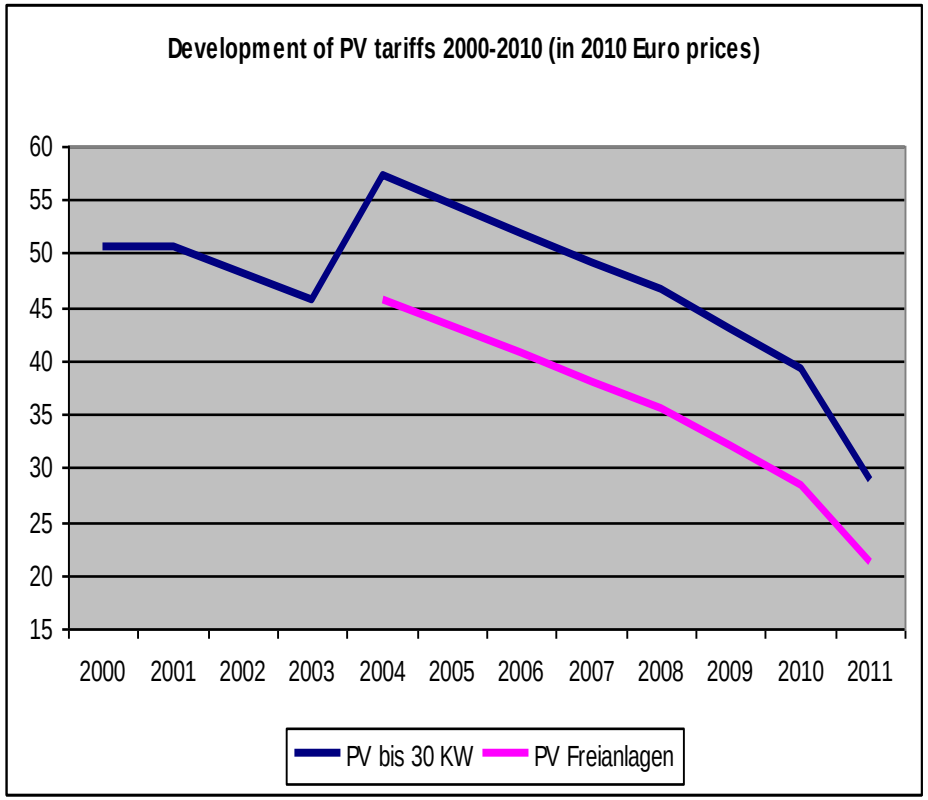
What can we learn from the German support payments?

- First of all: Germany and others financed technology development
  - Costs have come down enormously!
  - e.g. PV costs came down by more than a half

    from 4.000 €/kWp to 1.500 €/kWp or from over 40 ct/kWh to 17-20 ct. kWh today!

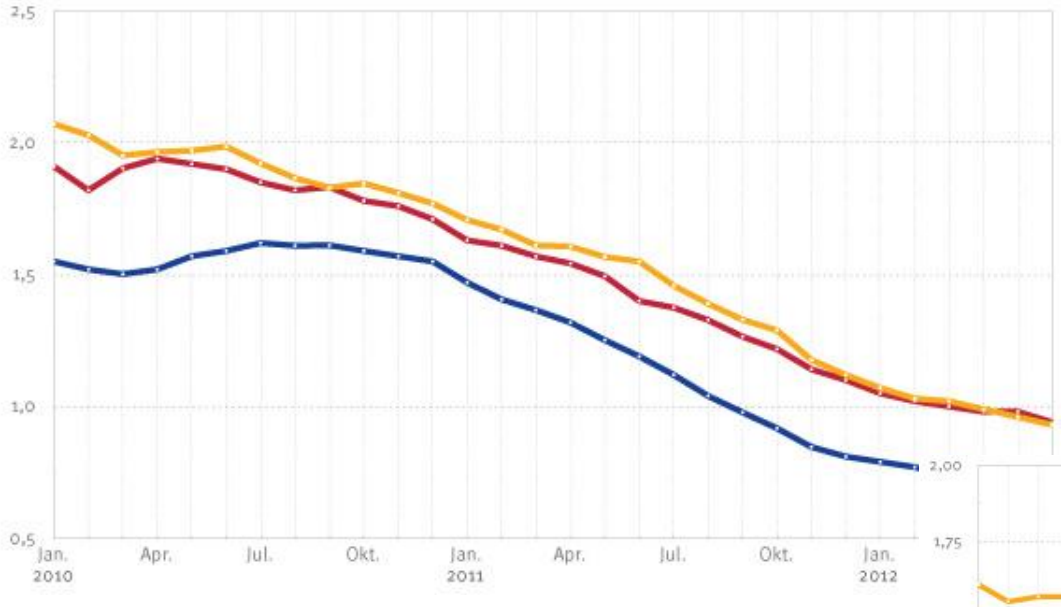
PV costs came down more than 50% since 2006





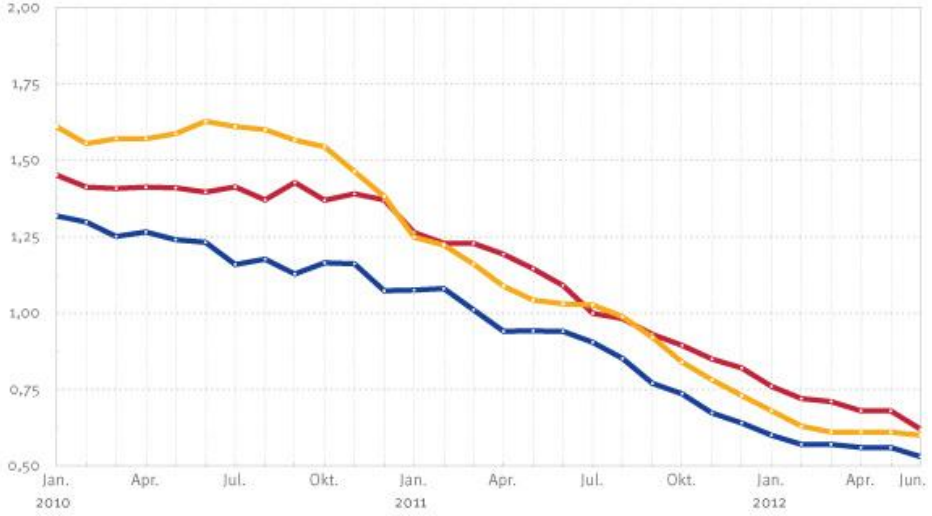
Another slide showing PV cost development

And costs have significantly decreased!
Germany and others have paid most part of the cost for technology development



Dünnschicht

Source PVexchange



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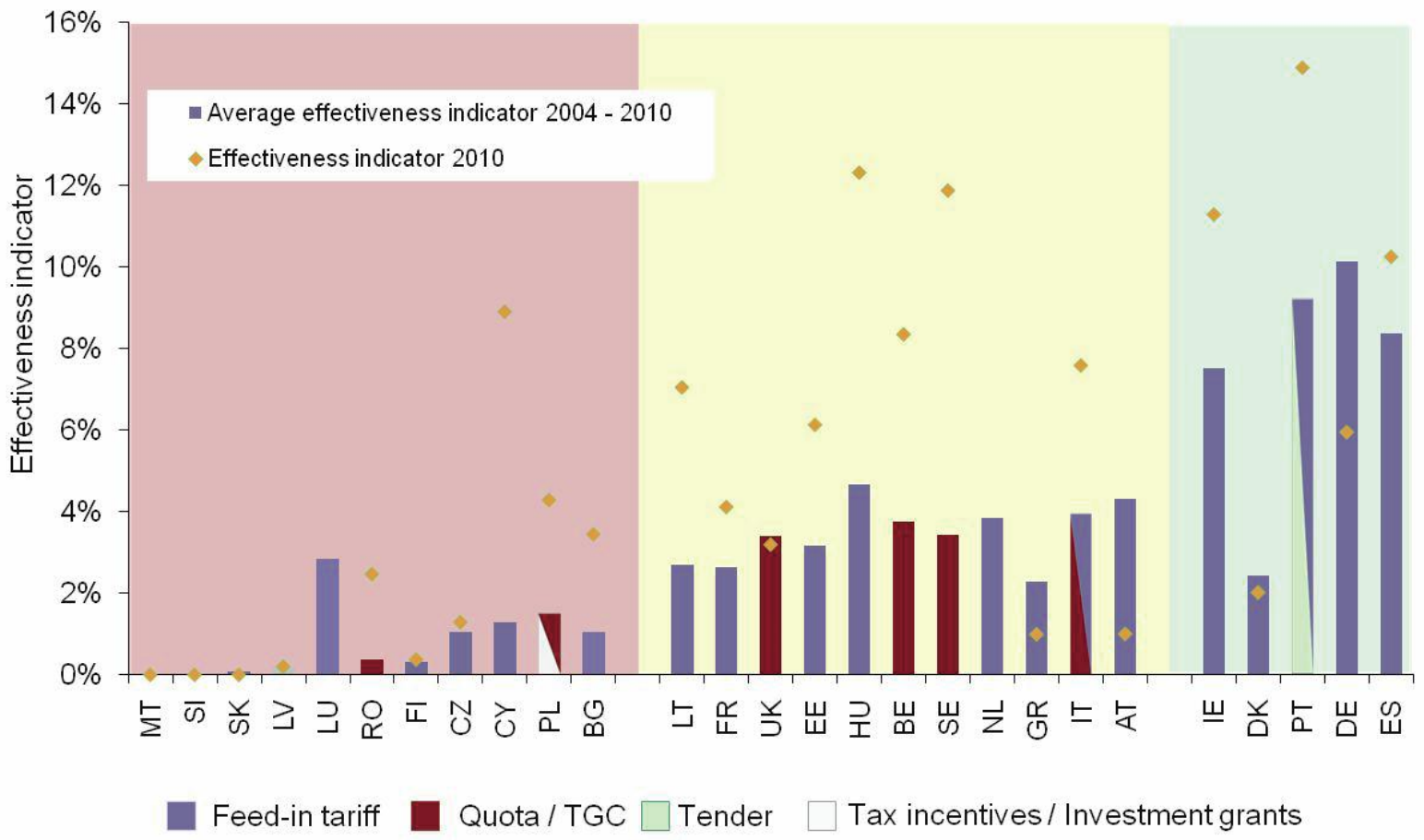
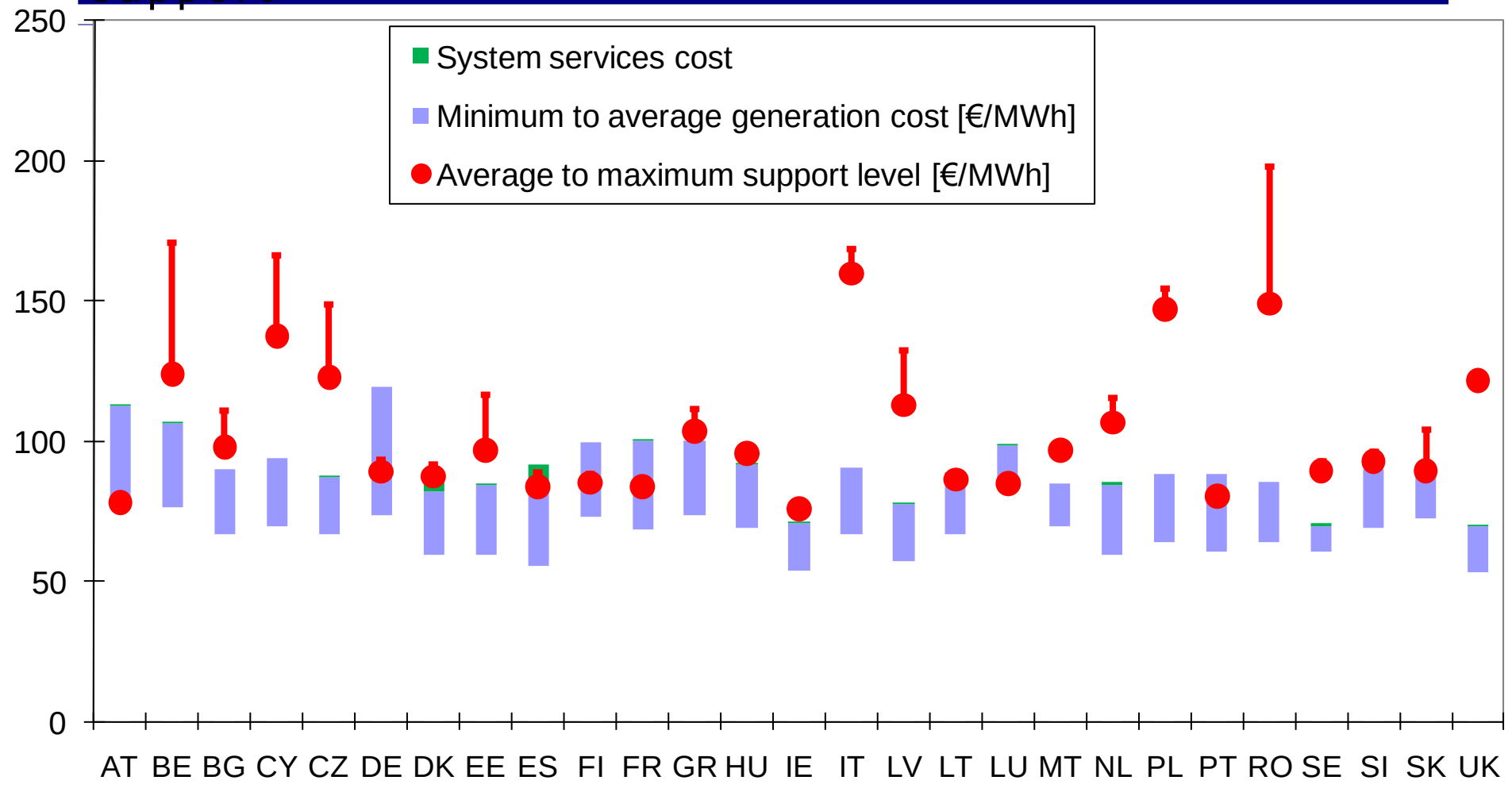
Feed-in are most effective schemes



Policy Effectiveness Indicator for onshore wind power plants in the period 2004 – 2010 (source: Re-shaping)

Feed-in pay the least support level due to
- low interest rates due to low risk
- low oversubsidiation due to technology specific support



What made Germany pay so much then?

➢Feed-in become expensive if they want to develop also less mature technologies such as PV

➢But PV-cost already came down rapidly

➢Furthermore: Germany made mistakes which can be avoided when designing a new support scheme today

- Set up clear annual degression right from the beginning to incentives R&D and technology progress
- Install an **autopilot** when growth becomes too soon too fast, (**cap)**
- Keep tariff adjustment away from long parliamentary processes
- One good solution to meet these 3 points: the German **flexible cap**

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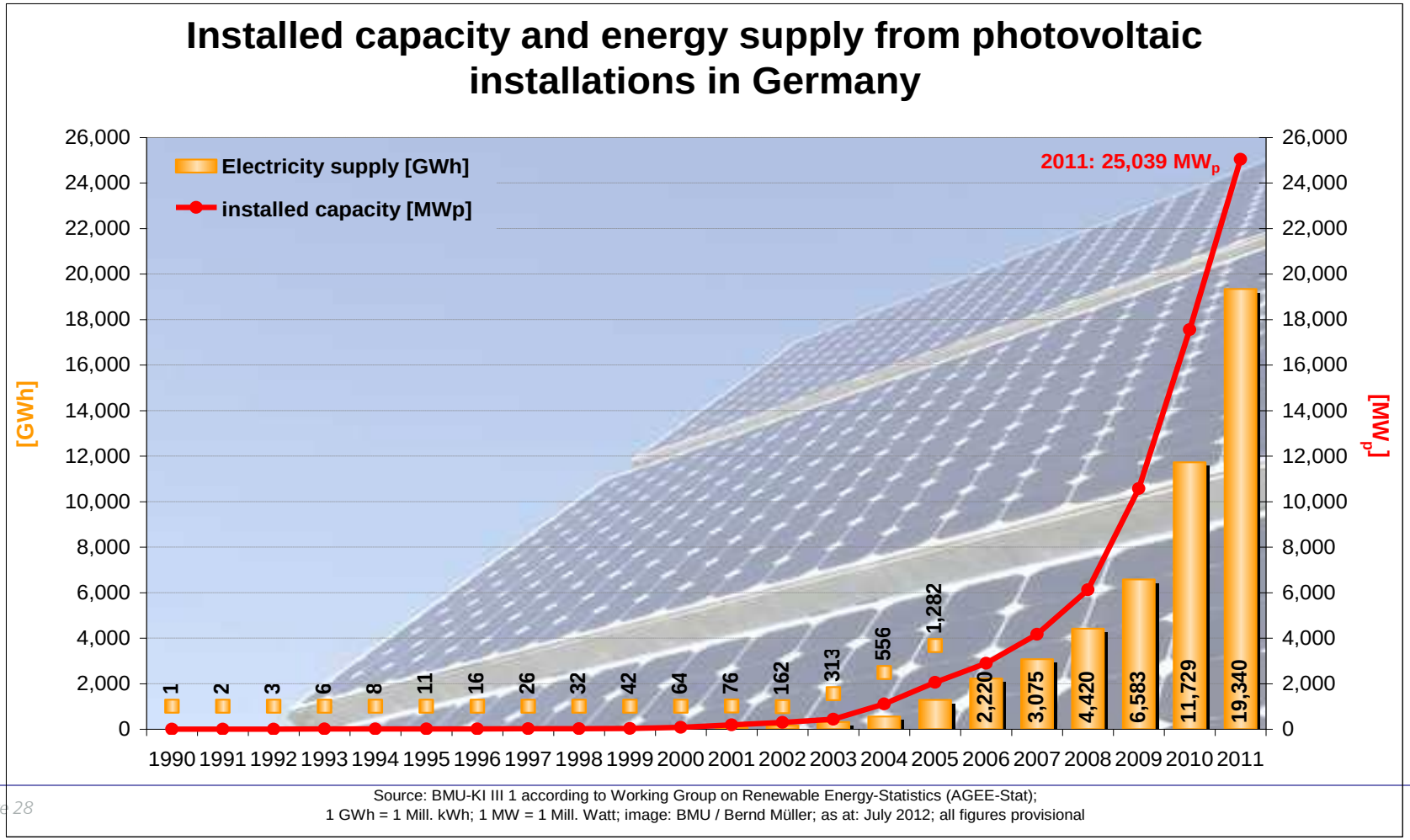
PV in Germany: sudden worldwide boost in technology progress overrun Germany's Feed-in



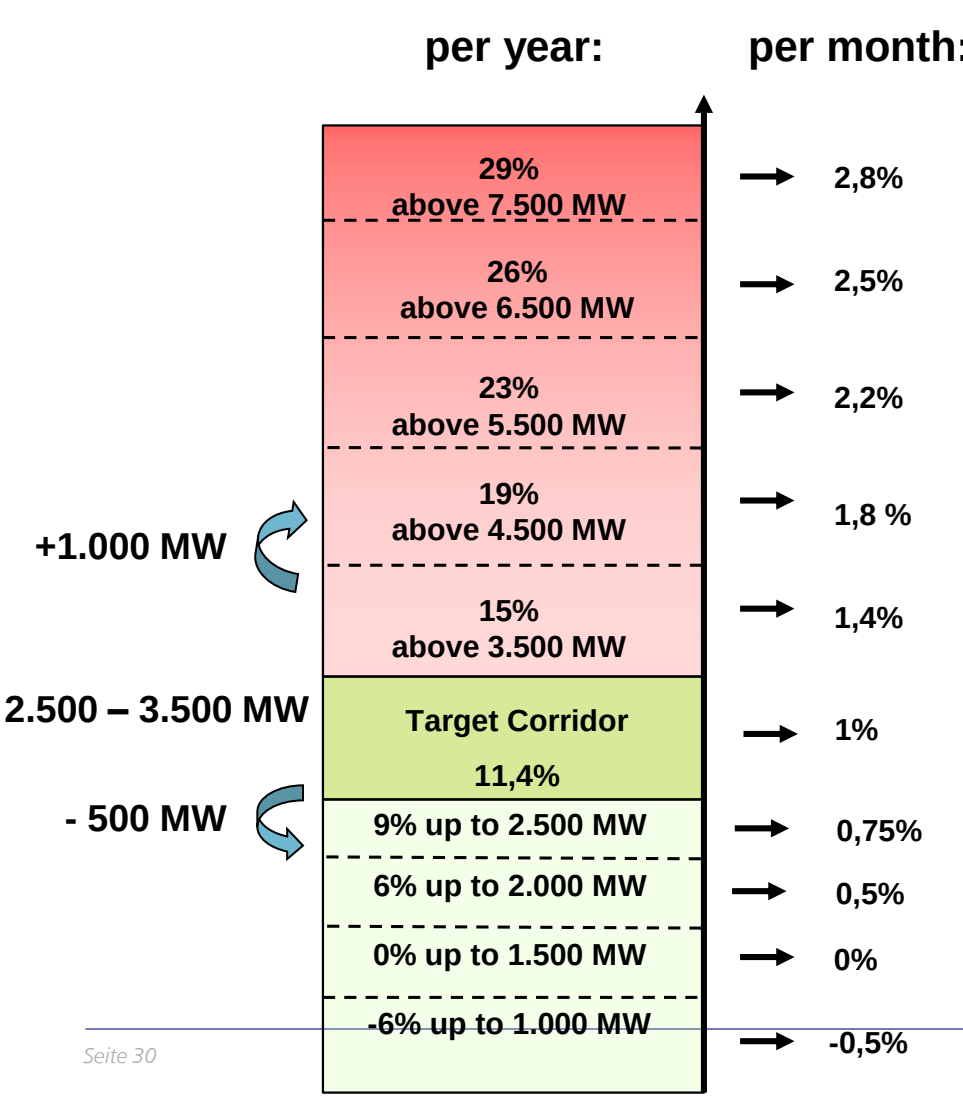
Source: BMU-KI III 1 according to Working Group on Renewable Energy-Statistics (AGEE-Stat);
1 GWh = 1 Mill. kWh; 1 MW = 1 Mill. Watt; image: BMU / Bernd Müller; as at: July 2012; all figures provisional

Cut in Tariffs

As of 1.4. 2012: new PV tariffs between 13 and ~~19 €ct/kWh~~

start of operation	Installed Capacity Roof-Top				Free-Field-Installations	
	up to 30 kW	up to 100 kW	up to 1.000 kW	above 1.000 kW	conversion areas	others
as of 1.4.2012	**19,50 (<10kW)**	**18,50 (< 40kW)**	**16,50**	**13,50 (up to 10MW)**	**13,50**	
New! Market integration model	tariffs paid for x% of annual production		not applicable		not applicable	
	100% (<10kW)	90% (>10kW)				

The German Flexible Cap



- Automatic degression linked to newly installed capacity
  - Without cost-assessment study
  - No parliamentary process
- Basic annual degression: 11,4% until 3.5 GW newly installed
- + 4% automatic degression for each 1 GW installed on top of 3.5 GW
- Degression come into affect monthly
  - To avoid „season sales“
  - based on growth in the last 12 months
- Overall cap of 52 GW Solar PV: Expiration of EEG PV support
- But: continuation of priority feed-in

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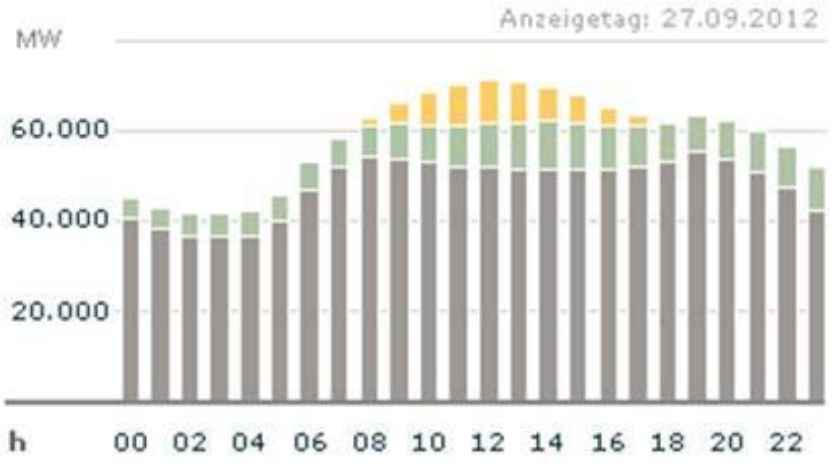
Challenge: RES-E generation does not match demand

Tatsächliche Produktion (Strom)

Geplante Produktion (Strom)



Challenges for higher RES-shares

- **Market integration of RES =** making RES responsive to market signals

- **Need for reliable but also reasonable RES pathways**
  - Need for a constant push
  - System need time to adapt, also public acceptance should not be overburdened
  - "too soon, too fast" increases the risk of stopp and go

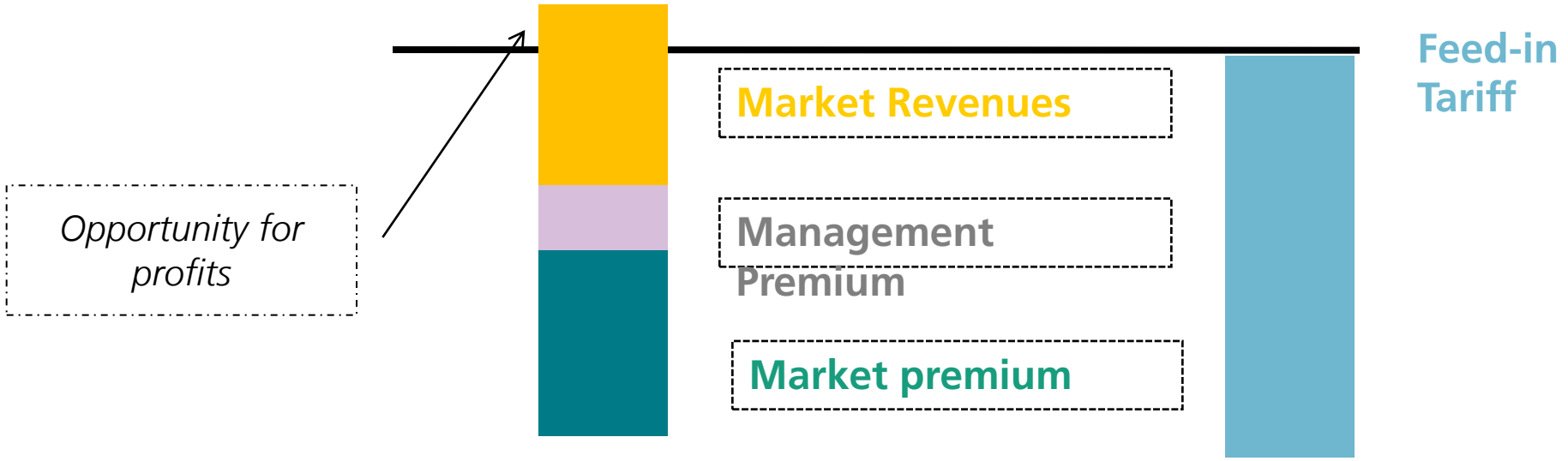
- **Enhancing flexibility of the electricity system**

Need of making RES responsive to market signals

- **weakness of the Feed-in system when having achieved high shares of RES:**
  - An increasing share of RES-E generation does not react to market price signals
  - How to ensure efficiency of the market for plant dispatch?
  - Who are the players for new innovative concepts?

- **One solution: Feed-in Premium**

Principle of a Premium



Sliding premium = premium is claculated on a monthly assumption of the average market price

Integrating RES-E

How does the floating market - premium in Germany work?

Income = Market revenues + support premium

Support premium (calculated monthly at the end of the month) = *Feed-in Tariff* − *Technology weighted benchmark for market revenues* + *Technology specific management premium*

- *Feed-in Tariff*: *Individual tariff of each plant*
- *Technology weighted benchmark for market revenues*: *Monthly average market value for the specific technology*
- *Technology specific management premium*: *Covers the cost of balancing the renewable portfolio*

Integrating RES-E

Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit

Benefits of a FIP cp to FIT

•Market price signal reaches RES-E generators

- Incentives for RES-E generators to adjust to market prices
- Efficient market integration, incentives improved prognosis and balancing

•More player for developing innovative solutions for intelligent pooling ore DSM

•Opens new markets for RES (balancing), optimised use of all electricity markets

Possible Disadvantages of a FIP cp to FIT

• Wind and PV have limited abilities to react to the market signal

•Higher risk = higher costs

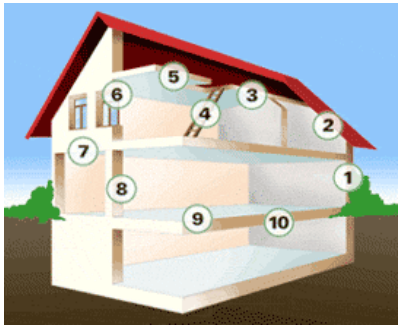
Benefits of FIP cp to quotas

➔ balanced approach for market integration, reduces investors risk

Flexibility optoions I

1. Market integreation of RES
•Making RES-E responsive to market signals (e.g. premium)

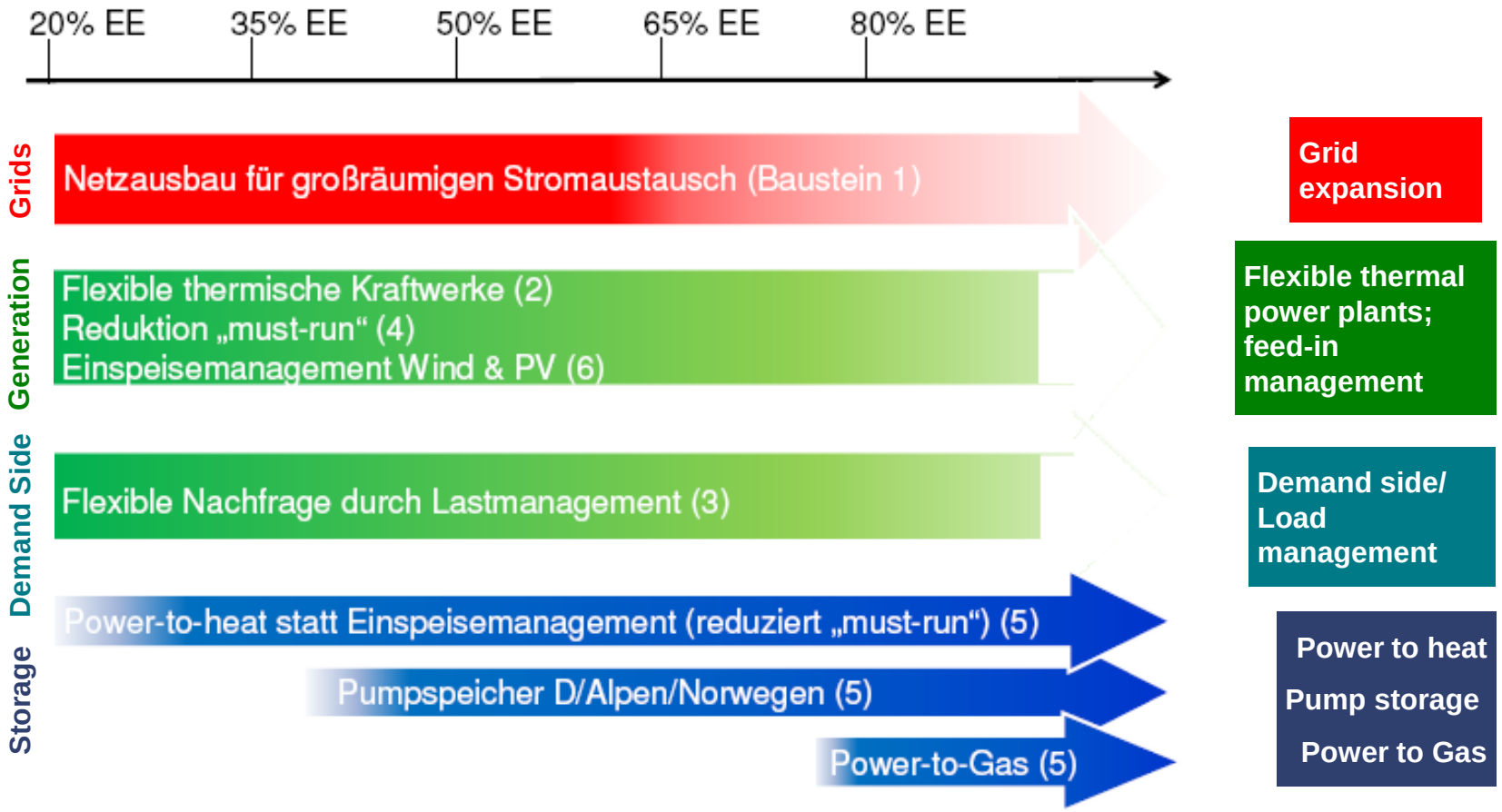
3. Flexibilise demand and enhance Energy Efficiency
•Demand side management
•Energy efficiency is the most affordable option to integrate RES



2. Grid reinforcement
• connecting wind from the north
•with storage in Austria
•and industry in the west etc.

Quelle: BMU

Flexibility optoions II



Conclusions

- To begin with: you need clear investment signals ➔ targets
- Feed-in are most effective AND efficient if designed properly, due to
  - Low risk, low financial costs
- One can start now cheaper now: Technology progress has already be financed to large amounts
- One can learn from other's examples how to limit costs of a Feed-in
  - annual degression right from the beginning
  - Install an autopilot when growth becomes too soon too fast, (**cap)**
  - Keep tariff adjustment away from long parliamentary processes
- Higher shares of RES require enhancing flexibility of the system and market integration of RES


The Germans plan to generate a quarter of their power from solar energy by 2020.
If only we had access to German sunshine!
Wilcox

Thank you for your attention!

More Information:

www.bmu.de/english

www.erneuerbare-energien.de/english