The German „Energiewende“ – Climate Change, Energy Efficiency and more

by

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Low Carbon Markets and the Legacy of Nuclear Power

Salzburg

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The Background

Facts and History

- **1950/60’s: Coal and steel economy**
- **Resource-poor → dependence on raw material imports**
- **Economic backbone: Engineering and Trade**
- **Strong dependence on exports and international ties**
- **Geographical location in the centre of Europe**

„Energiewende“ started in the 70’s

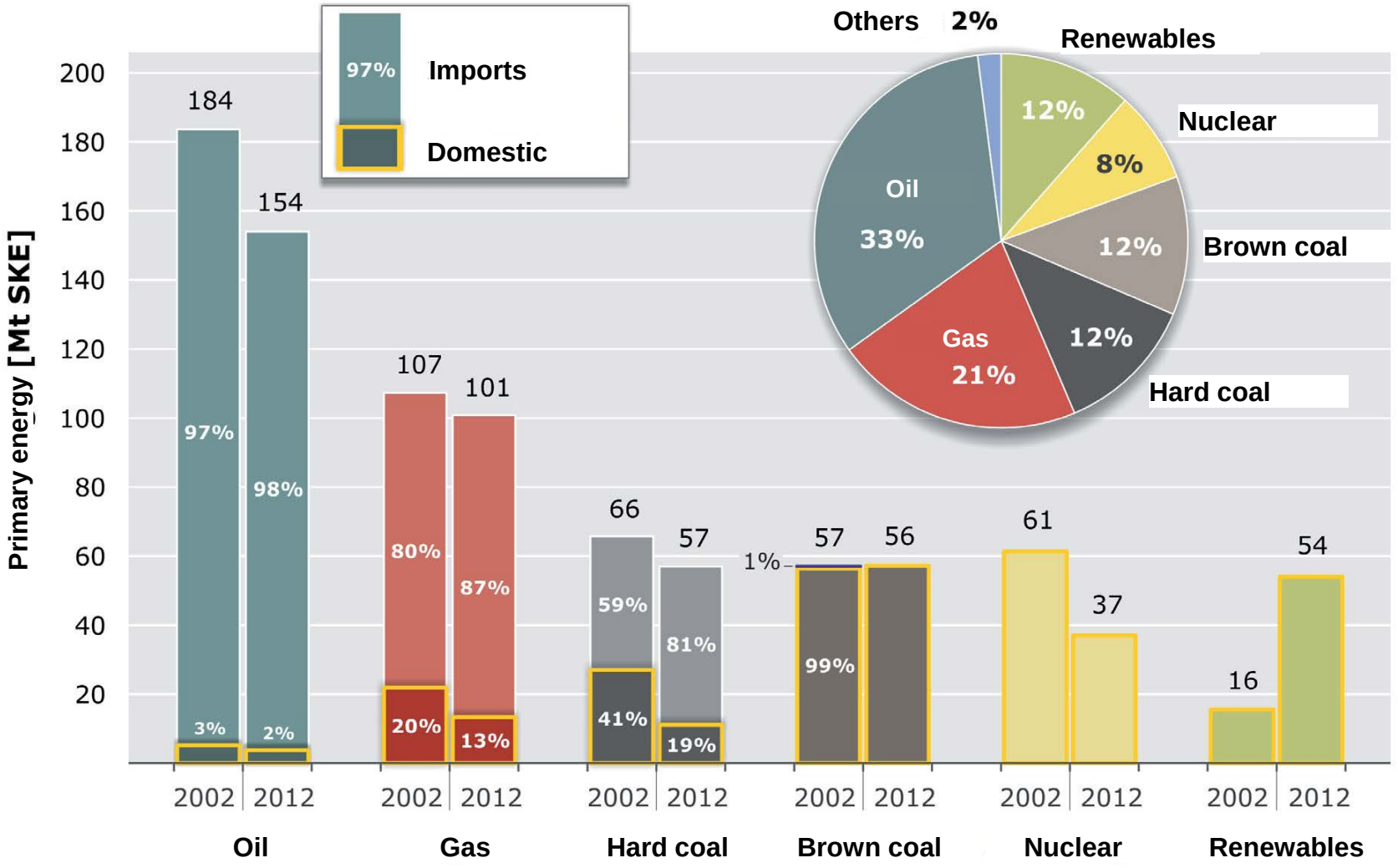
- **1979 Enquête Commission *Future of Nuclear Energy***

  → phase out technically & economically feasible

- **1987 – 1994 Enquête Commissions “*Protection of the Earth’s Atmosphere*”**

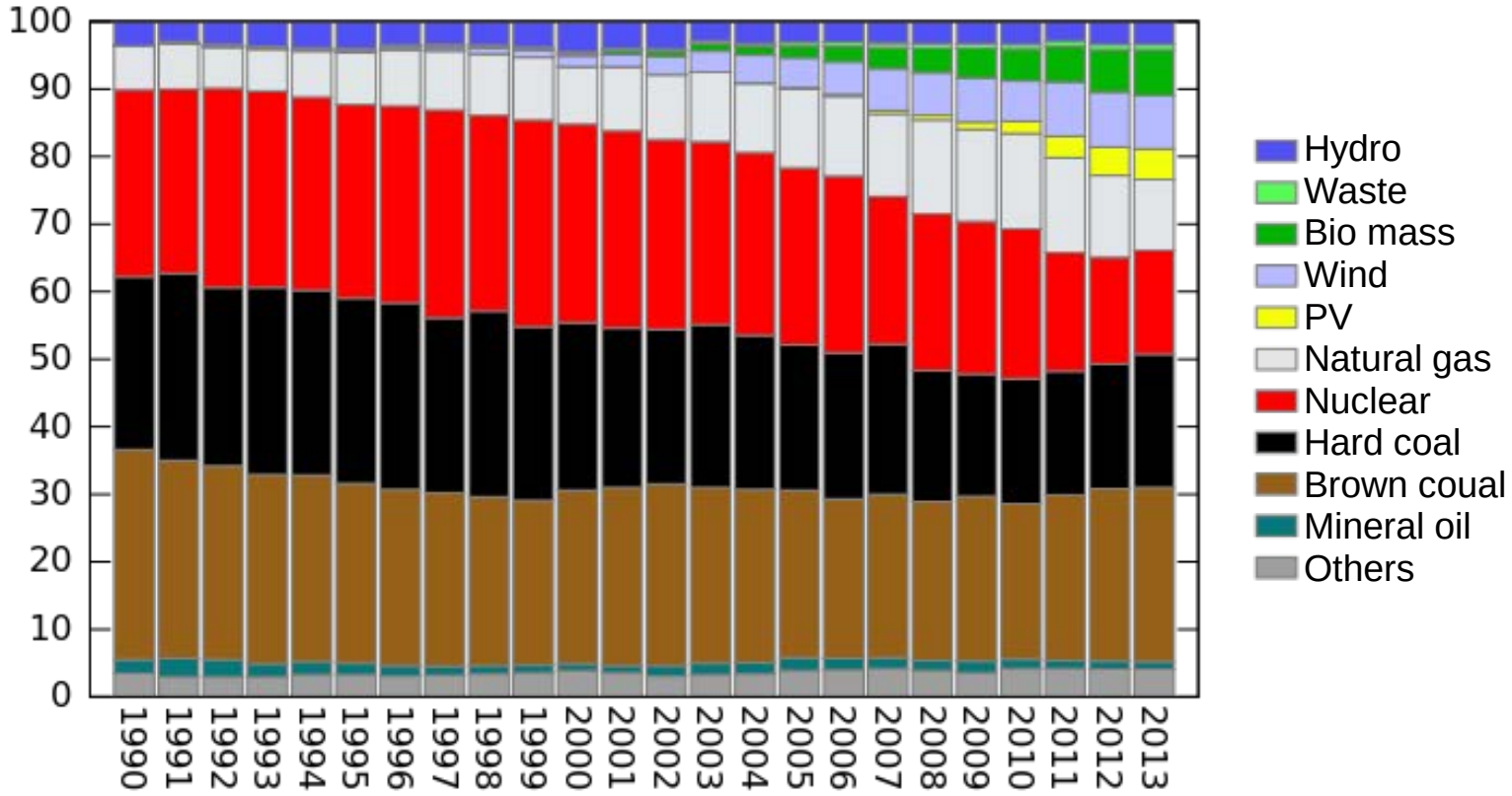
  → Crucial question of Energy Transition

Primary Energy Consumption and Import



Renewable Energy Capacity

Power production in Germany by source 1990 – 2013 (percent)



The Rationale behind the „Energiewende“

Rationale of the German “Energiewende”

- **Broad consensus**: phase out of nuclear until 2022 and base energy system on renewable sources of energy and energy efficiency
- **sustainable climate protection** as key driver
- **economic calculation** as another driver

  –future **competitiveness** will be decided by **costs of energy per GDP**

  –future **independent energy generation at very low costs**

  –**multiplying innovation**: a complete new energy system

  –short term investments – long term benefits
- **comprehensive** and **long term** strategy which ensures **reliability, affordability** and **security of supply**

  –Not “plugging out Nuclear and coal” and “plugging in Renewables” over night but complex overall system change

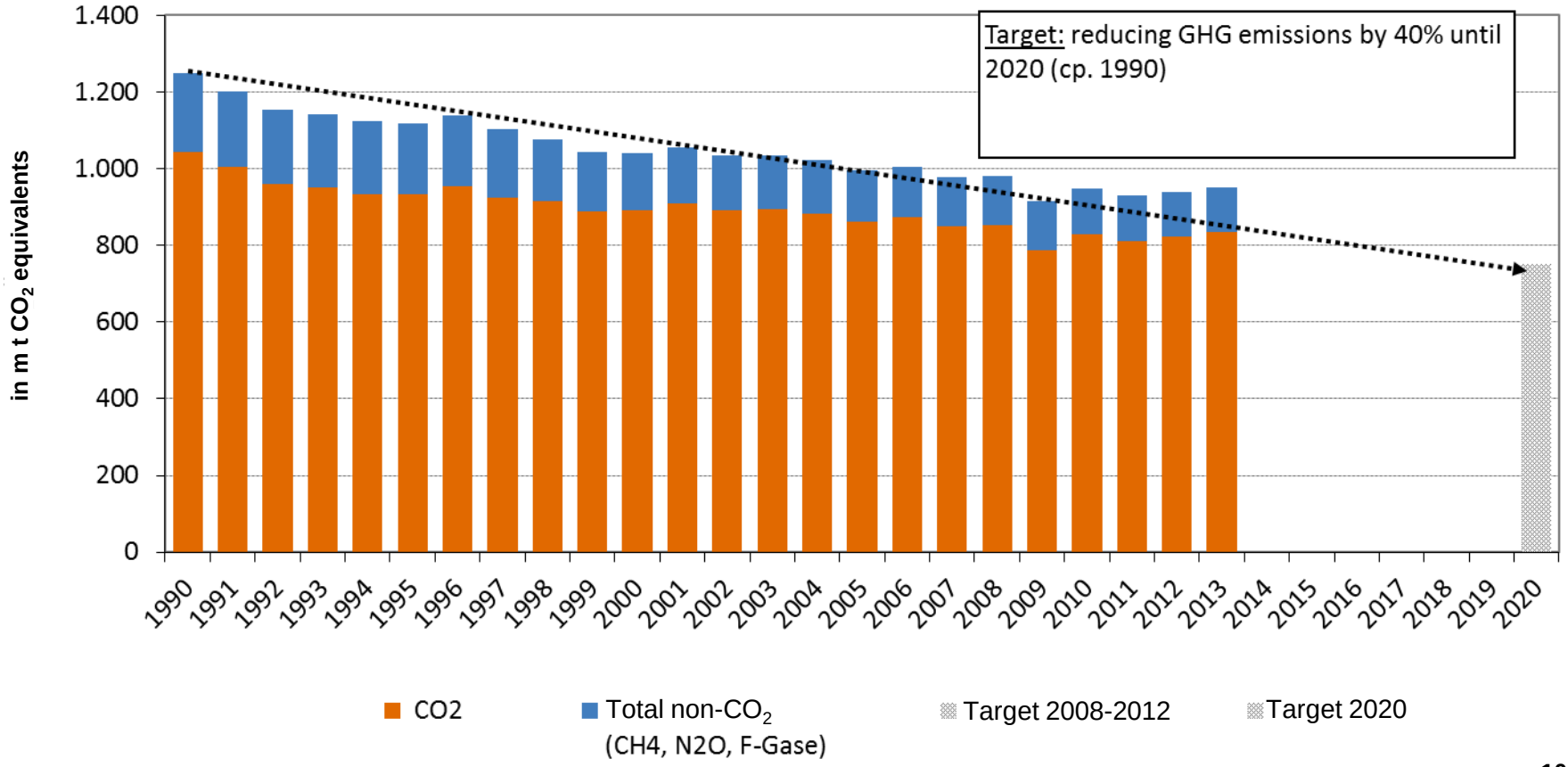
  –energy sector is capital intensive, long term planning periods

Overview on state of implementation of GHG/RE/EE targets

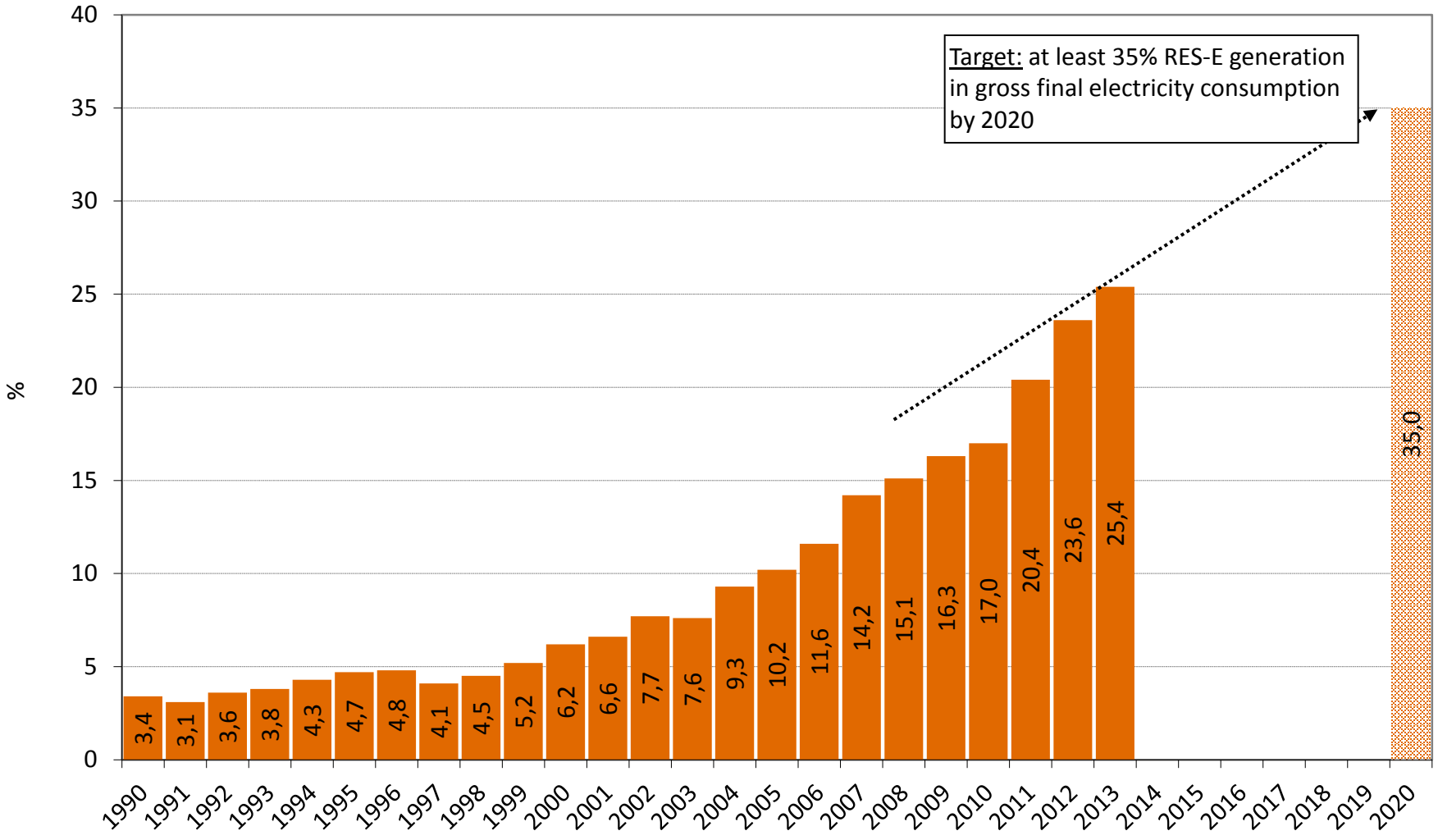
	2013	2020	2050		
GHG Emissions		**2020**	**2030**	**2040**	**2050**
GHG Emissions (cp. 1990)	**-23.8%**	at least -40%	at least -55%	at least -70%	at least -80% to -95%
Renewable Energy					
RES share in gross electricity consumption	**25.4%**	at least 35%	at least 50%	at least 65%	at least 80%
RES share in final energy consumption	**12.4%** (2012)	18%	30%	45%	60%
Energy efficiency					
Primary energy consumption (cp. 2008)	**-3.3%**	-20%	-50%		

GHG emission reduction

- Target: reducing GHG emissions by 40 % until 2020 (cp. to 1990) and by 80-95% until 2050
- 2013: 23.8 % (cp. to 1990, slight increase cp. to 2012)

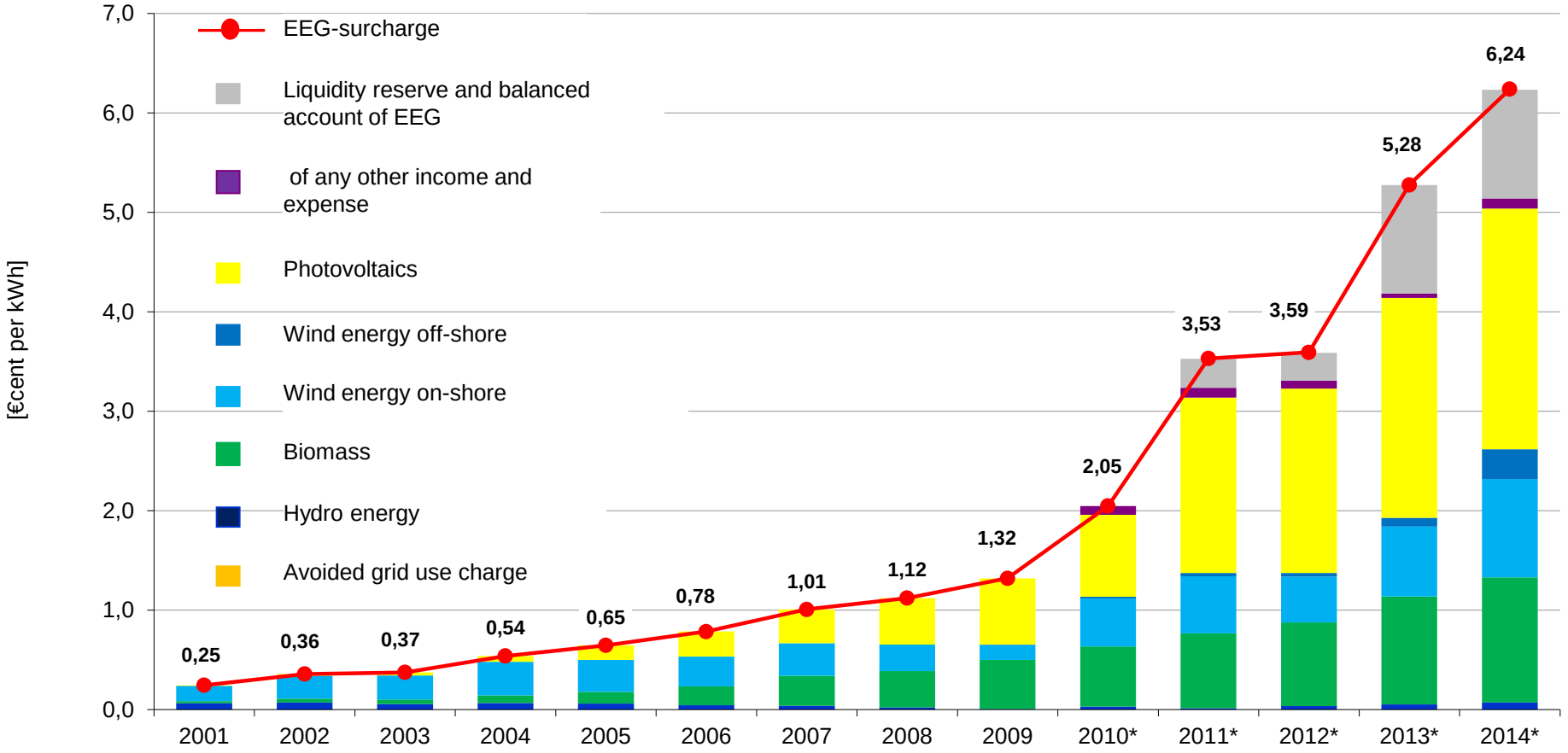


RES surpassed nuclear and became second largest electricity generator (25,4%)



Learning curve for RES technology development has been largely paid

- **Renewable energy surcharge amounts to 6.24 ct/kWh or € 24 bn. p.a.**
- **Main cost driver: financing PV learning curve at former high costs (total installed PV capacity: 35 GW)**

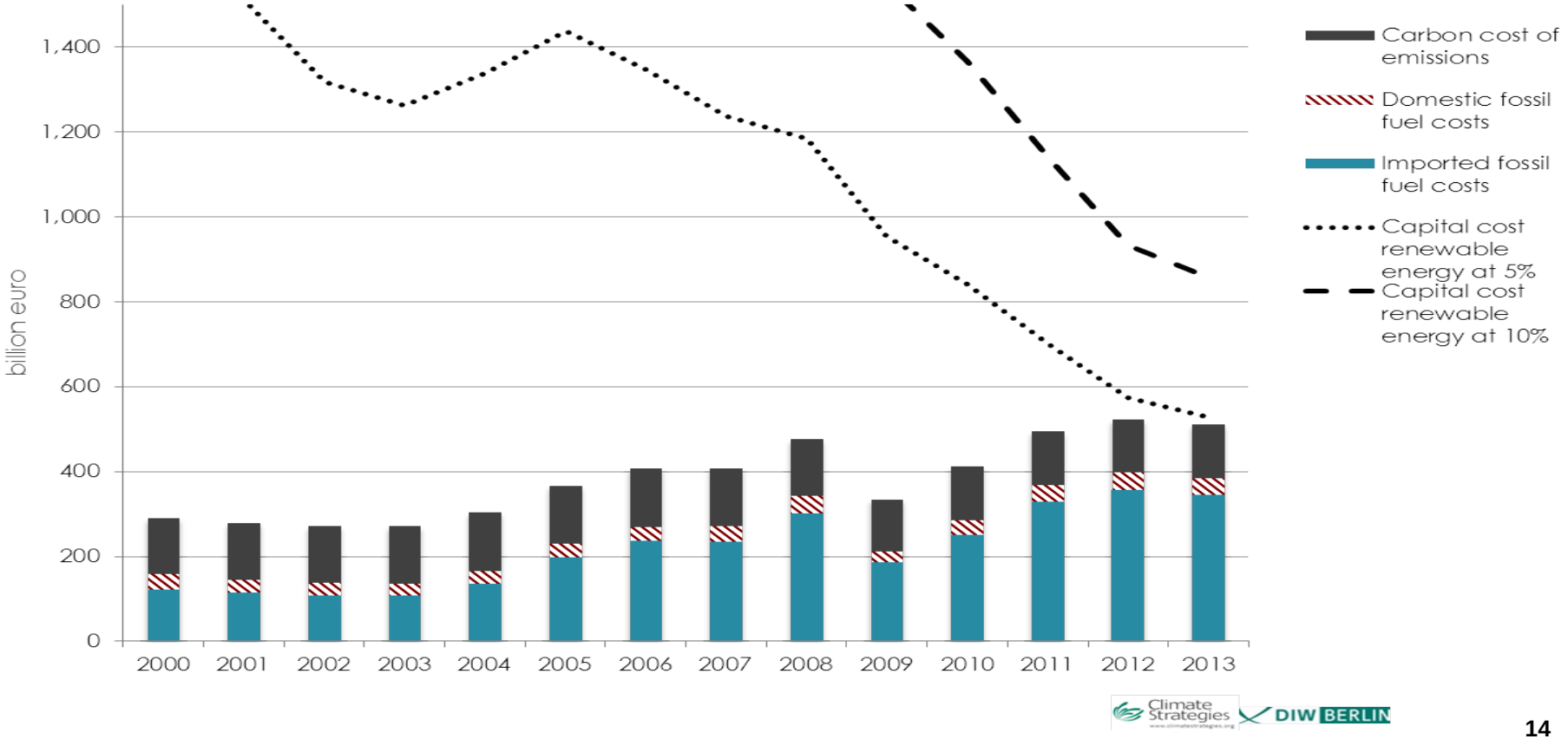


Investments of the past pay off: future Renewables much cheaper – economies of scale / learning curve

	2010	2014	2020
PV (ct./kWh)	24-35	9.5-13.5	~7-10
Wind (ct./kWh)	6-10	5.5 -9	~ 4.5-8

Future investments in Renewables cheaper than fossil fuel costs

- It has become cheaper to invest in RES than to use fossil fuels
- if framework is right (targets/ investment security)
- Fossil fuel costs are “sunk costs”



Improving energy security and fostering economic growth and jobs

- **In Germany RES and efficiency together save 36 bn € fossil fuel costs p.a. (2012) and led to new 800,000 jobs**

- **EU-KOM Impact Assessment for 2030 framework showed: 30% RES-target and ambitious efficiency lead to:**
  - **260 bn € more savings of fossil fuels**
  - **and 500,000 more jobs**

  compared to only 27% RES target and less ambitious efficiency

One of the key drivers: the German Renewable Energies (Renewable Source Act (EEG)

Next steps now towards more market integration and cost control

Other key drivers:

Energy efficiency, Energy security, Reduction of energy imports, creating jobs an economic growth, innovative technology

Reform of the EEG – Key elements

- **Cost and quantity control**
  - **quantity control binding Renewable Energies deployment corridors**
  - **mechanism**
- **Cost-efficiency**
  - **focussing on wind and solar: most efficient technologies**
  - **wind tariffs reduced up to 20%**
- **Increased market integration**
- **Exemptions for industry adjusted**

→ Compatibility with the EU-framework

Deployment corridors for RES control costs and quantity

- **Concrete Renewable Energies corridors in the electricity sector agreed:**
  - **In 2025: between 40% and 45% RES share in electricity**
  - **In 2035: between 55% and 60% RES share in electricity**
- **Consequence:**
  - **Onshore wind capacity: 2.5 GW per year**
  - **Solar energy: 2.5 GW per year**
  - **Offshore wind capacity: 6.5 GW by 2020 and 15 GW by 2030**

→ optimal integration and predictability for investors and the electricity market

Measures for quantity and cost control

- **Step I: “flexible cap” for all technologies**
  - **Automatic tariff reduction if newly installed capacity is above corridor**
  - **Very good experience in the PV sector: tariffs have been reduced by ~70% over the last 5 years: today between 9 – 13 ct/kW (depending on the size of installation)**
  - **“flexible cap” is now extended to wind**

- **Step II: tender scheme as of 2017**
  - **Starting with pilot projects of 400 MW PV (ground mounted) p.a.**
  - **introduction of tender schemes as of 2017 based on experience made**

Cost efficiency

- **Focussing on the most cost efficient technologies: Wind and PV**
- **Onshore wind:**
  - **support levels reduced between 10-20% at very good sites**
  - **bonuses abolished or phased out**
- **Offshore wind:**
  - **“acceleration model” extended until 2019,**
  - **Support reduced by 1 ct/kWh in 2018**
- **PV tariffs already cut by 70% in the last 5 years**

Market integration: mandatory market premium

- Market responsiveness is most important for the internal market
- Market premium ensures market responsiveness; RES operators act in the same way as operators of conventional power plants
- So far market premium was optional
  - 80% of wind and ~ 40% of overall installations used optional premium
  - sufficient experience gained
- market premium becomes mandatory
- Sliding premium ensures balanced risks for Renewable energies operators

Balanced exemptions for industry needed

- **Affordability of transition costs important particularly for energy intensive industry facing international competition**
- **Balanced exemptions needed which**
  - **reflect support costs and**
  - **avoid distortion of competition**
- **Intensive discussions also in the context of state aid**

→ Compatibility with the EU-framework

Exemptions for industry: key elements

- **Conditions**
  - **Undertaking is operating in one of the sectors of the State Aid guideline sector list (reflecting minimum trade intensity and electricity cost intensity)**
  - **Share of electricity costs per unit gross added value is at least 16% (for some undertakings: 20%) → increased from 14% (EEG 2012) in the light of increased EEG-levy**

- **Consequence**
  - **General principle: undertakings pay 15% of the EEG-levy but max. 4% (“cap”) or 0,5% for most energy intensive industries (“super-cap”)**
  - **Every undertaking pays the full EEG-levy for the 1st GWh**
  - **And at least 0.1 ct/kWh for every kWh beyond**

→ ensuring minimum contribution of industry and competetivenes

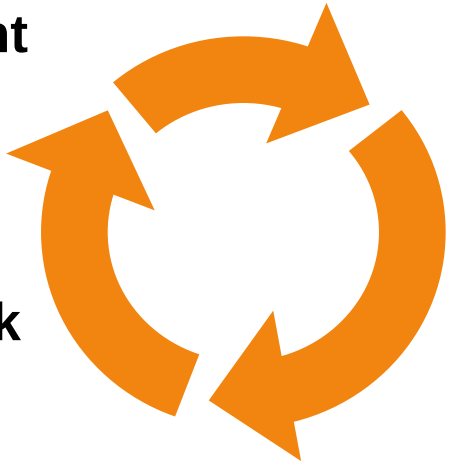
Energiewende: challenges ahead

Renewable energies

- **Cost and quantity control**
- **Coordination with neighbours**

Integrating "Energiewende" in the internal market

- **EU-wide Market integration is most efficient**
- **Foster EU-wide grid reinforcement and market coupling**
- **Supportive EU-framework needed!**



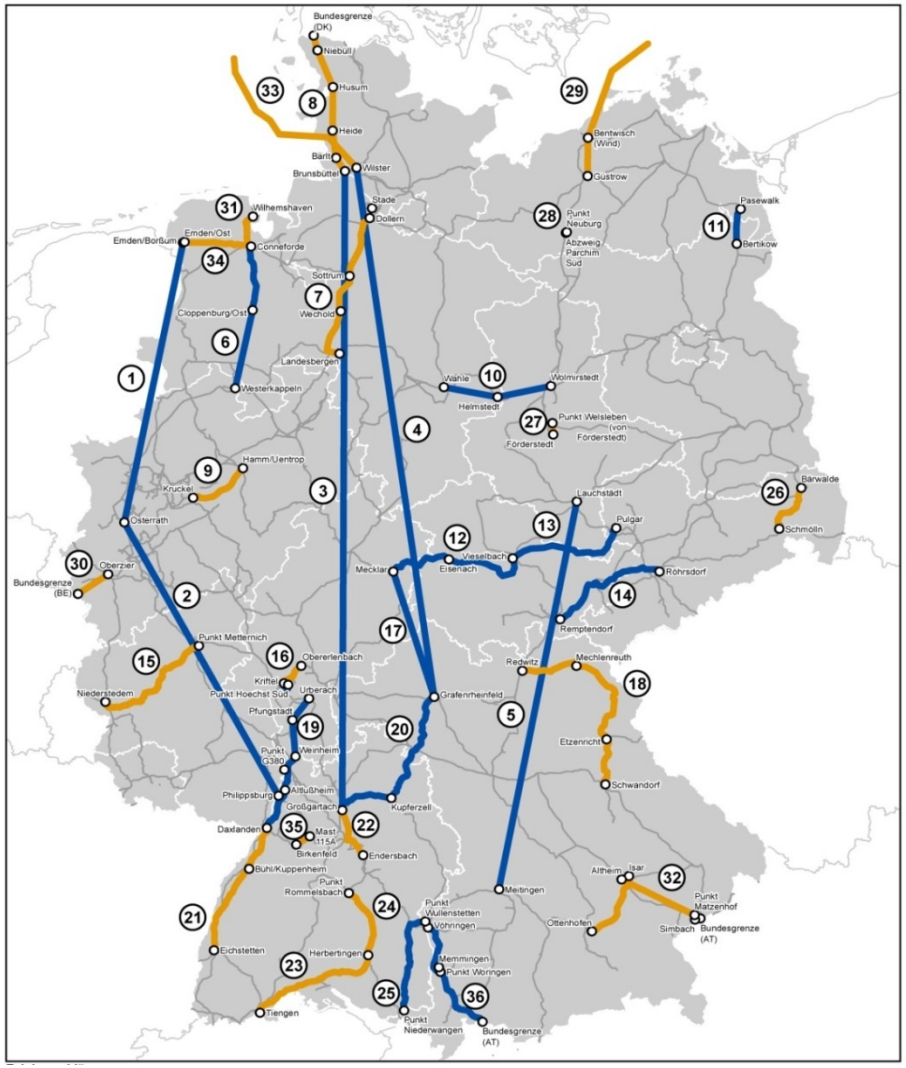
New flexible system needed; energy security is a EU question

- **Making use of the flexibility and balancing options of the internal market is most efficient**
- **Assessment and solution in the European context needed**
- **More regional cooperation**

"Unlock" Energy efficiency potential

- **EE is still lacking behind despite cost-efficiency**
- **Concrete Energy Efficiency Action Plan agreed**

Grids and market coupling are key for market integration



- Challenge within Germany: transport from North to South
- Loop flows: temporary affecting neighbours
- Key: High Voltage DC-transmission lines (and more AC lines)
- Germany introduced comprehensive new planning system for grids
- European market integration most cost efficient
  - Interconnectors (!)
  - Market coupling
  - Liberalisation

Case for Energy Efficiency

- **Future competitiveness will be decided by primary energy/BIP: by 2050 Germany wants to need only half (50%) of todays primary energy for one unit BIP**

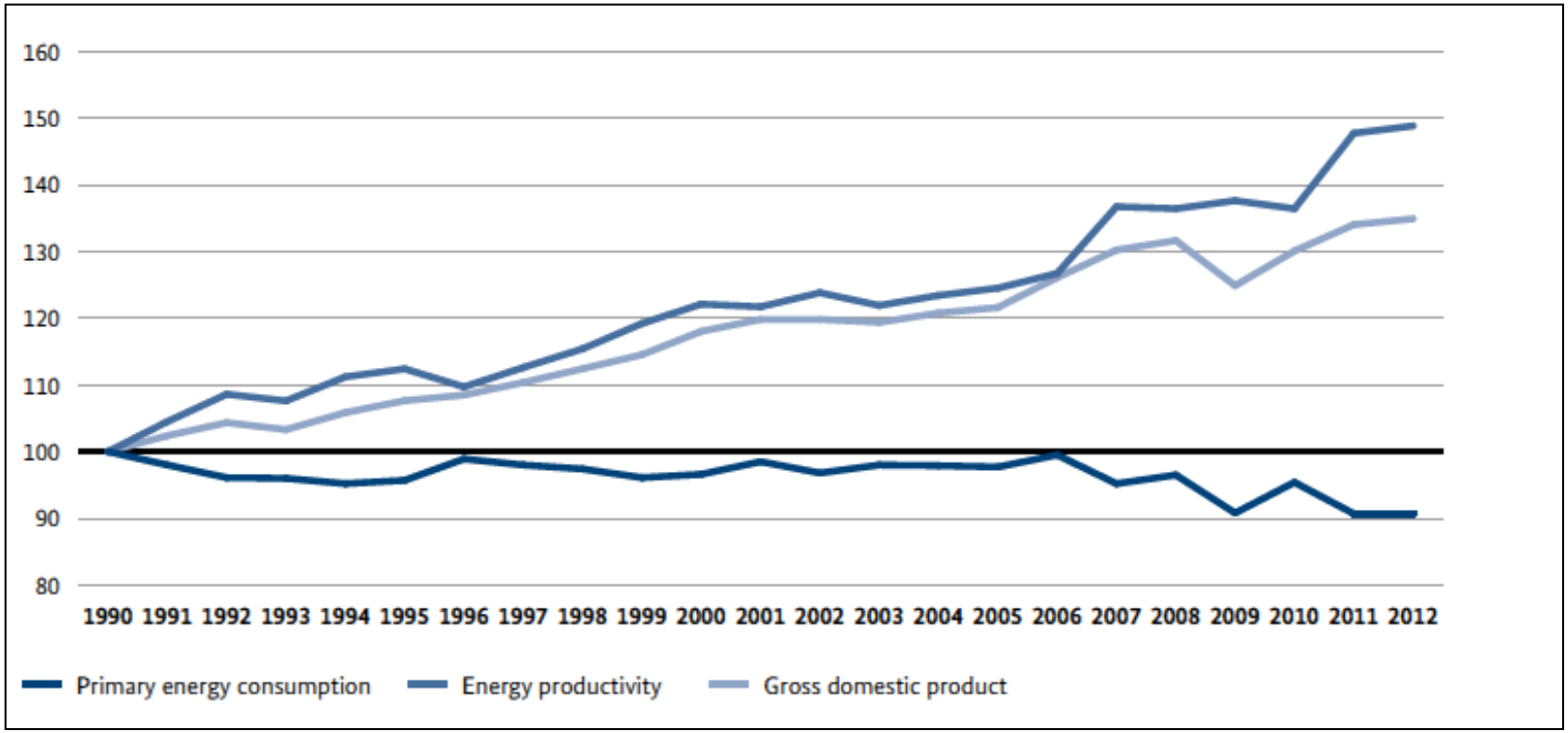
  - **Ambitious climate and RES targets can only be achieved cost-efficiently in combination with energy efficiency**

  - **EU KOM impact assessment for 2030 showed: ambitious energy efficiency can reduce costs for fossil fuel imports by 8 to 34 bn € p.a.**

Germany decoupled growth from energy consumption

Decoupling of economic growth and energy consumption achieved:

- **energy productivity increased by 46% since 1990**
- **primary energy consumption reduced by 3.3 (cp. to 2008) while economy has grown by 50% (since 1990)**

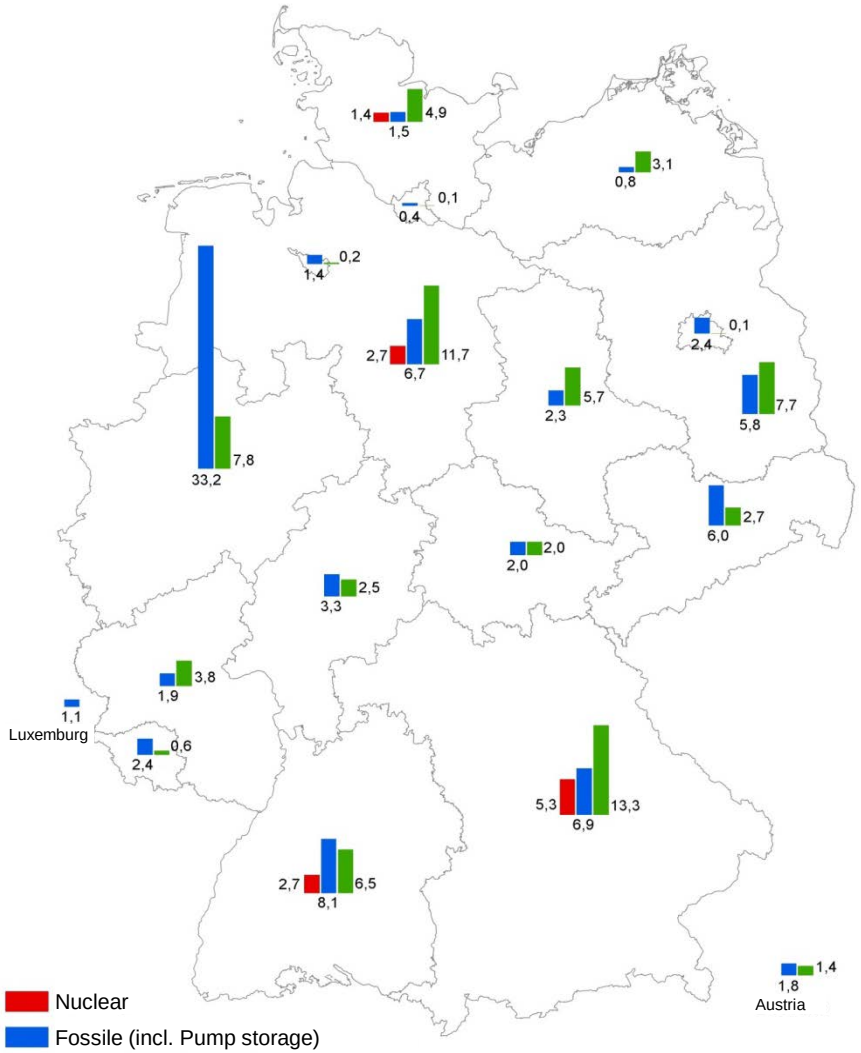


Energy Efficiency – first progress but additional measures needed

- **Concrete measures adopted, e.g.**
  - **Standards for new buildings: Energy Saving Ordinance "EnEV"**
  - **low interest rates and grants for energy efficient new buildings above standard (Program KfW 40, 55, 70)**
  - **Subsidies (1.5 bn €/a 2012 - 2014) for refurbishing buildings (better insulation, more efficient heating)**
  - **Energy "passport" for buildings provides information**

  - **But efficiency is lacking behind Renewable energies deployment, more measures needed**
- **Coalition agreement: developing a concrete Efficiency Action Plan agreed**

Security of supply is not only a national but European task



- **Currently: sufficient generation capacity in Germany despite shut down of 8.6 GW nuclear (~ 102 GW firm capacity cover 82 GW peak load)**
- **Local bootlenecks in Bavaria due to insufficient grid connection (temporary measures adopted)**
- **Discussion on future market design in the EU-context needed**
- **Using all flexibility options of the internal market is most efficient**
  - **generation and demand management**
  - **Grid reinforcment and market coupling**
  - **Regional cooperation**

Need for a supportive European framework

EU Perspective – Climate and Energy 2030

- **Action Programme Climate Change 2020 and "Energiewende" needs to be integrated in the EU-internal market**
  - **Target setting – GHG-reduction, renewables and energy efficiency – Germany: at least 40 % GHG-reduction; at least 30 – 35 % Renewables and at least 30 % energy efficiency**
  - **Market integration**
  - **more coordination**
  - **increased regional cooperation**

- **Action Programme Climate Change 2020 and "Energiewende" also needs a supportive European framework**
  - **Clear and reliable framework → strengthened ETS, targets and reliable governance**
  - **continuous alignment of climate and energy policies**
  - **Need for flexibility to adapt climate policy and energy transition to national circumstances**

Next steps 2030 framework: setting investment signals

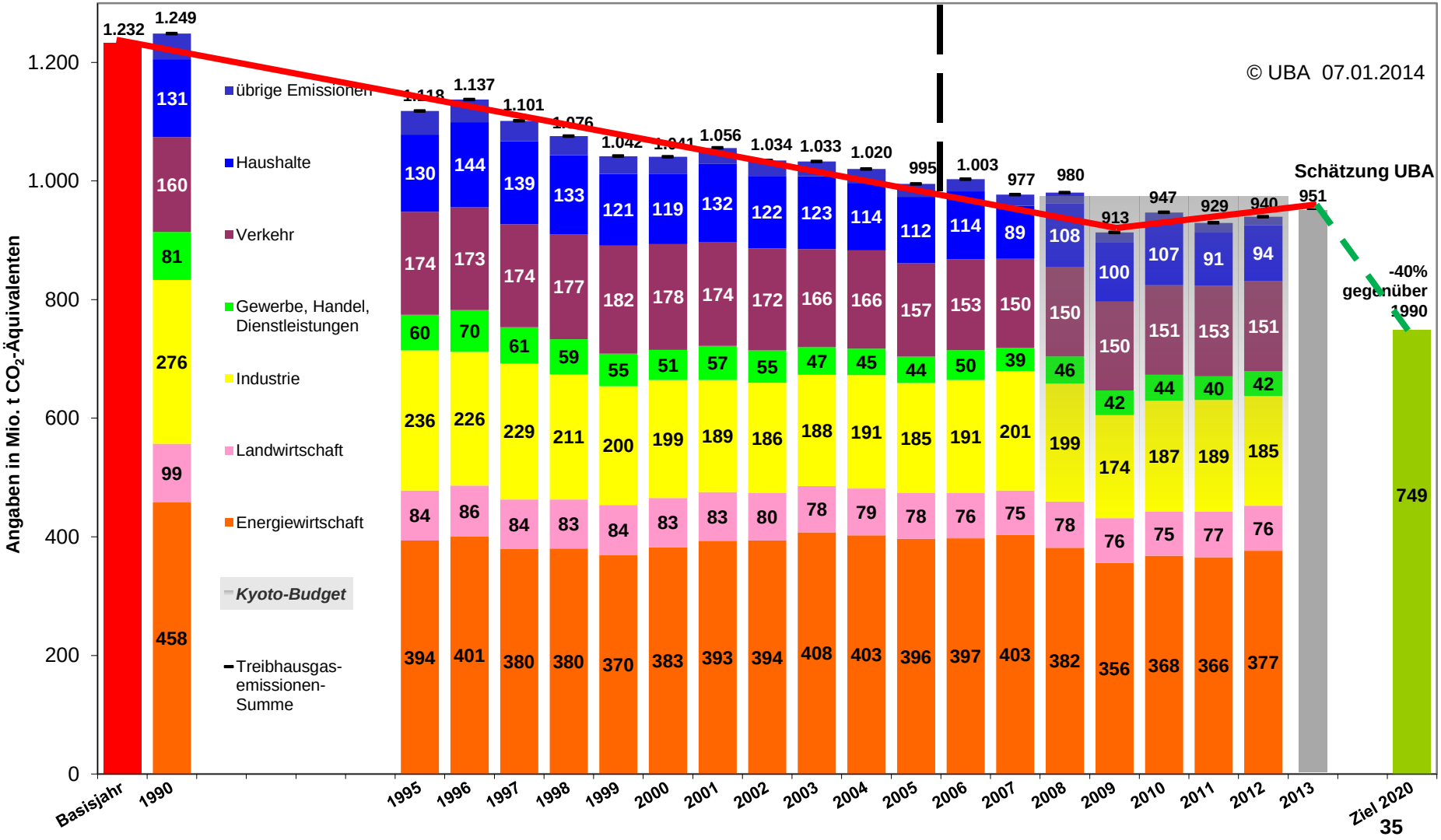
- urgent ETS reform, also taking care of competitiveness
- ambitious 2030 GHG-target of at least 40% (EU domestic)
- also binding targets for RES (at least 30%) and for Energy Efficiency
  - RE+EE more cost-efficient than new nuclear or CCS
  - “no-regrets”: all decarbonisation-scenarios need significant RES and EE (EU Roadmap 2050)
  - Targets allow for predictability, control and a coordinating EU framework
  - a balanced and diversified RES deployment all over Europe ensures most-efficient system costs (less intermittency, less grids and balancing needed)
- more flexibility cp. to 2020 imaginable but also reliability and balanced approach needed → avoid “full-stops” in some countries

The EU Climate and Energy Package 2030

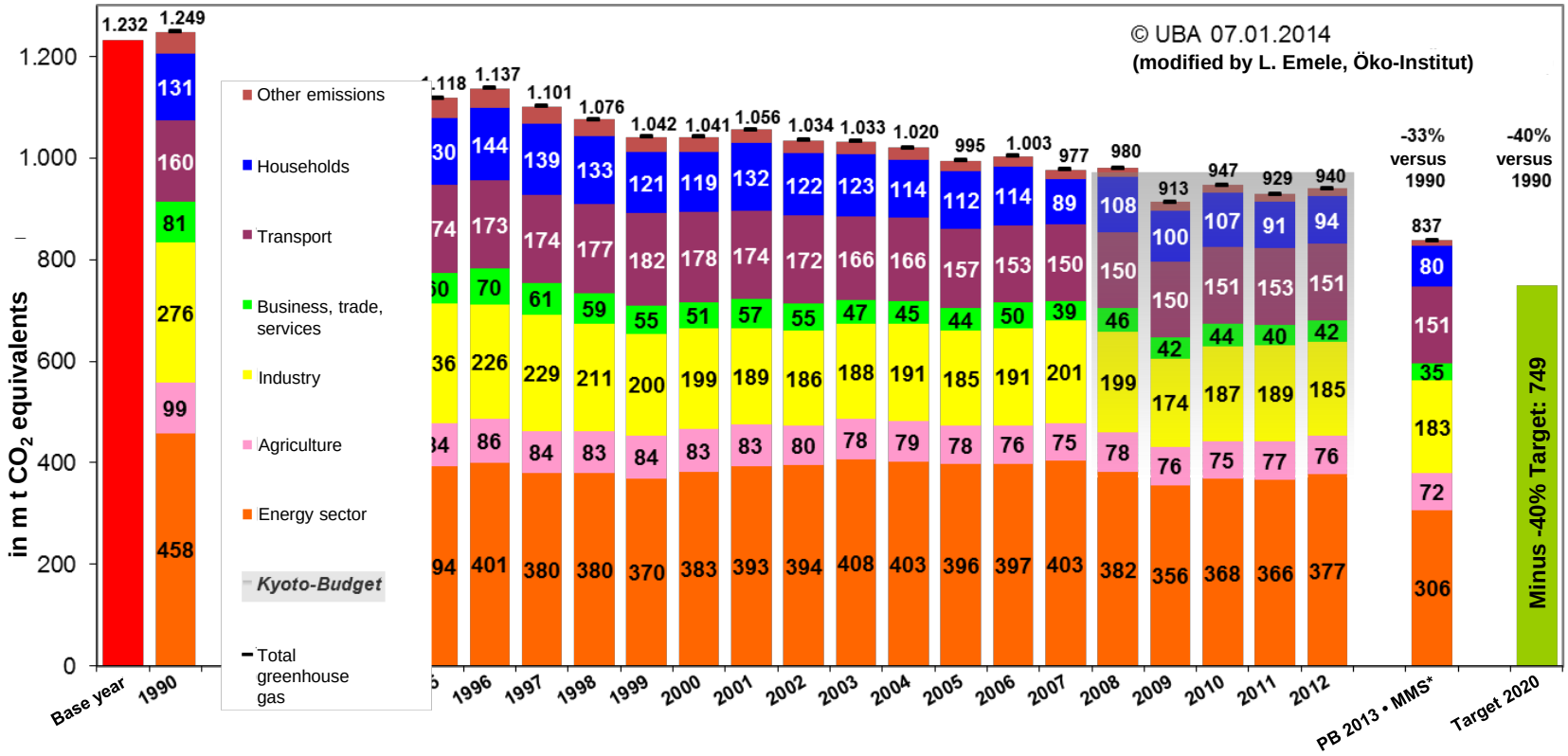
- **Negotiations will go on mid September 2014 (Sherpa mode)**
- **Decision will be taken by the end of October 2014 (European Council – Heads of States)**
- **Numerous activities and initiatives are taking place (bilateral, multilateral, EU-wide)**
- **Peru (2014) and Paris (2015) are targeted**

The new Climate Change Policy

Emission trends in Germany



Projections – Impacts of the present P&M‘s



* „PB 2013 – MMS“ shows a projection based on existing measures (minus 33% versus 1990 to 2020) by sectors

A two step approach

Based on the Coalition Contract (December 2013):

- **The „Action Programm Climate Change 2020“ to comply with the 40 % target**
- **The „Climate Change Plan 2050“ to construct a road to 80 – 95 % GHG reduction by 2050**

Conclusion

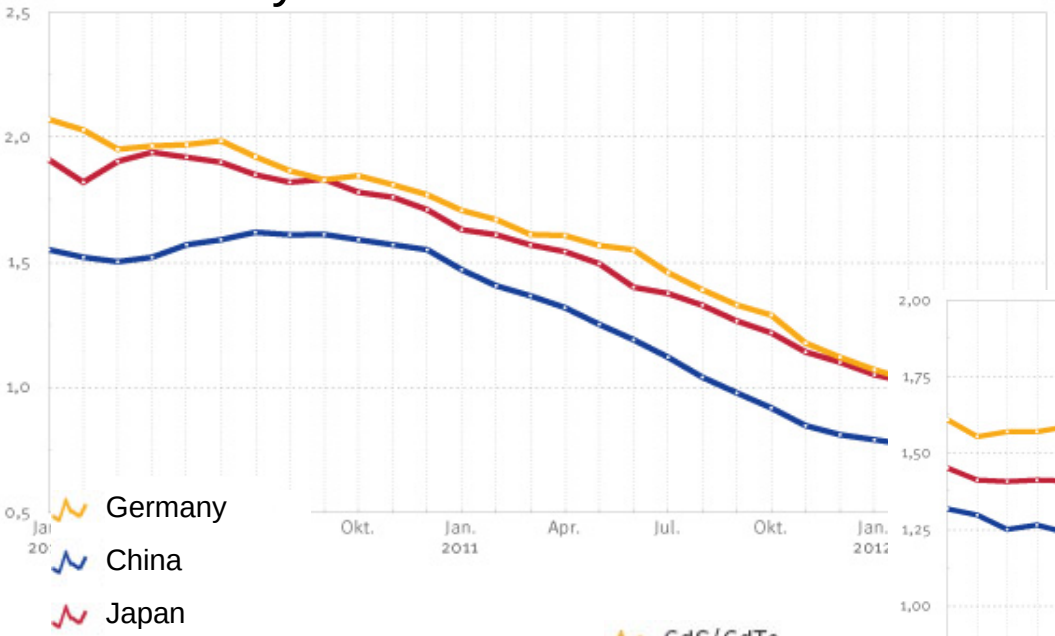
- **Climate Change is the overarching issue – the present development is far away from what is needed**
- **Focussing on Wind, PV and Energy Efficiency is the most cost-efficient decarbonisation approach**
- **Learning curves have largely been paid**
- **Most return on investment: innovation, jobs, energy security**
- **Cost and quantity control measures ensure optimal integration**
- **Energy security needs to be solved in the EU context**
- **More coordination and cooperation needed**
- **supportive EU-2030-framework with strengthened ETS, 2030-targets for GHG, RES and efficiency as the basis for reliability, flexibility, coordination and a balanced approach**

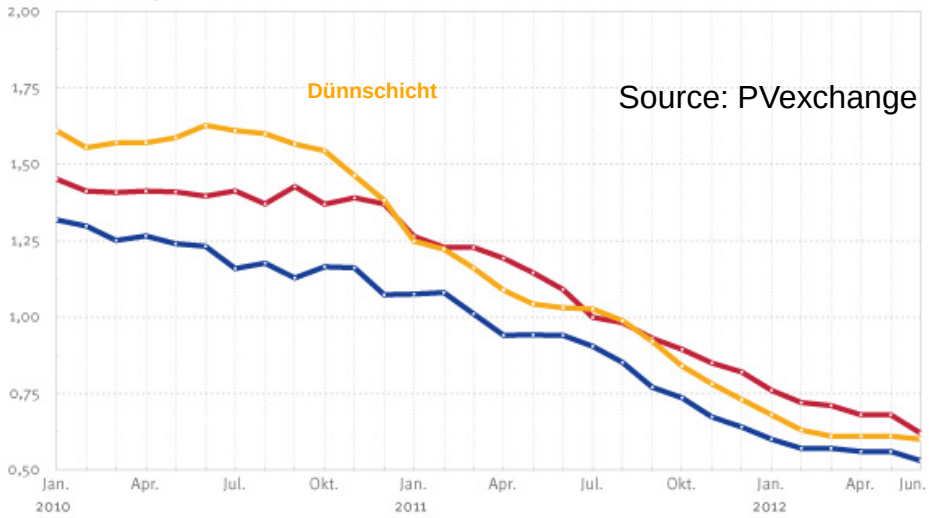
Thank you.

backup

Investments start paying off: PV costs came down

- PV costs came down from ca. 0.48 ct/kWh some years ago to between 0.9 and 0.13 €/kWh for PV today
- PV was the main cost driver; future deployment will be significantly less costly

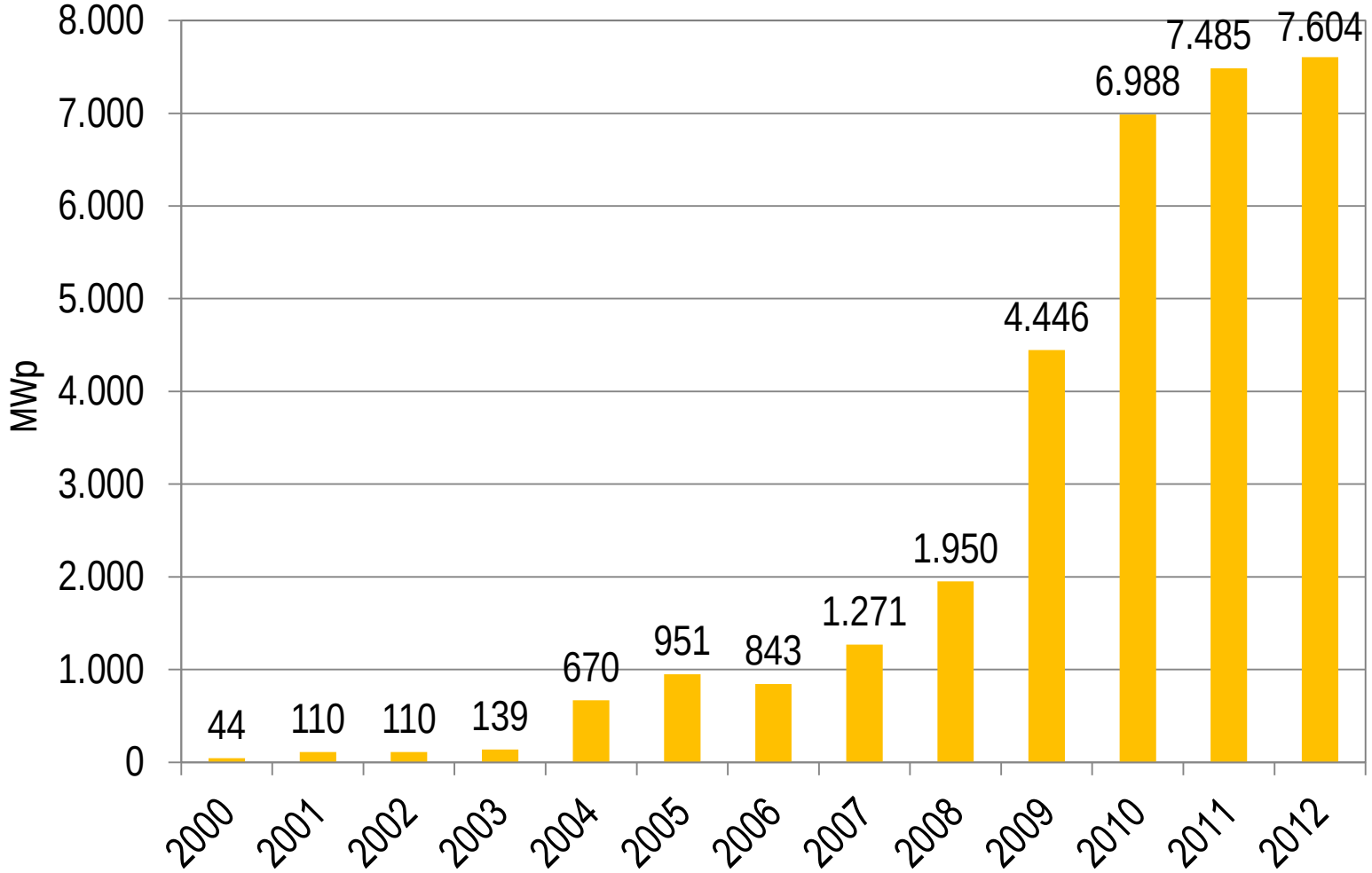




Source: PVexchange

Total capacity of PV has achieved 36 GW today

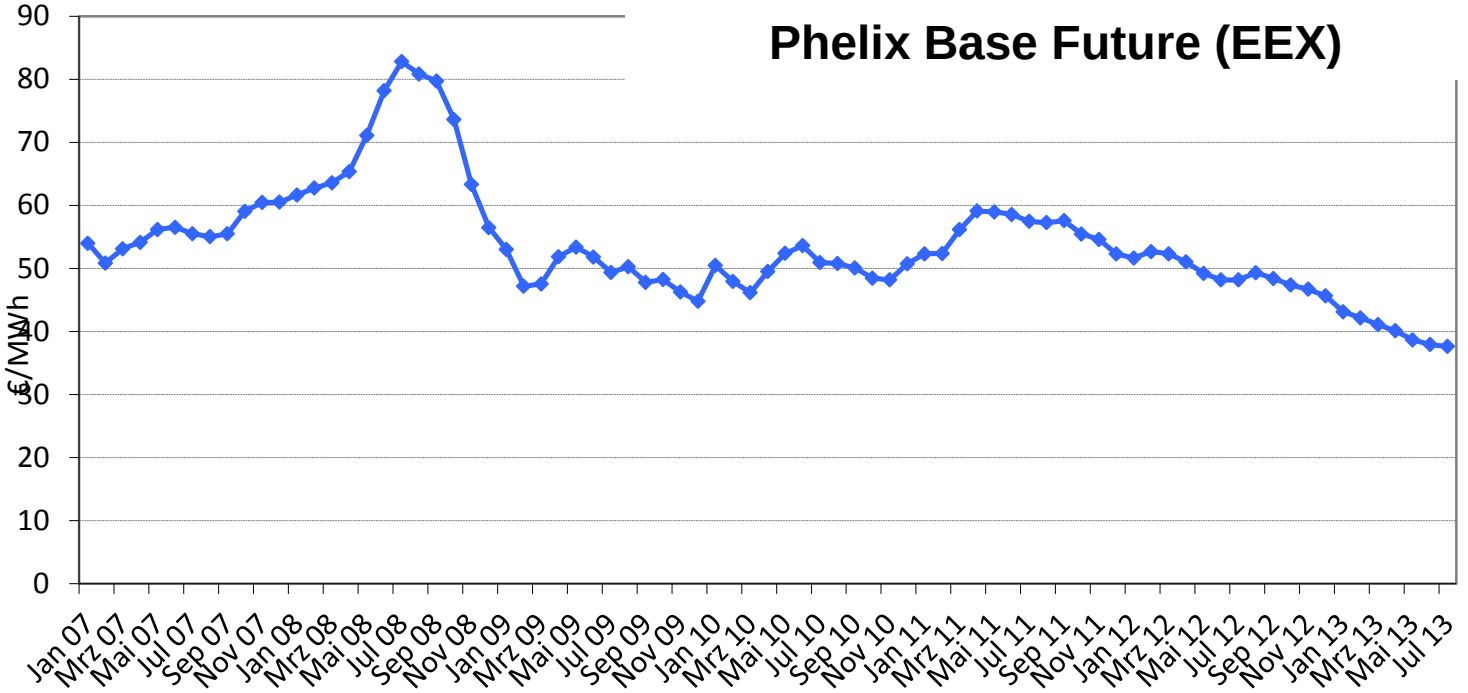
Photovoltaic expansion in Germany (1 / 2)



Source: BMU (2013)

Wholesale power market price will further decline

- Renewable energies are one driver of decreasing power market prices since they have no fossil fuel costs (marginal costs = 0)
- Future price before nuclear phase out decision: 53 €/MWh (Base) and 65 €/MWh (Peak)
- Future price today: c. 36 €/MWh (Base) and ca. 47 €/MWh (Peak)



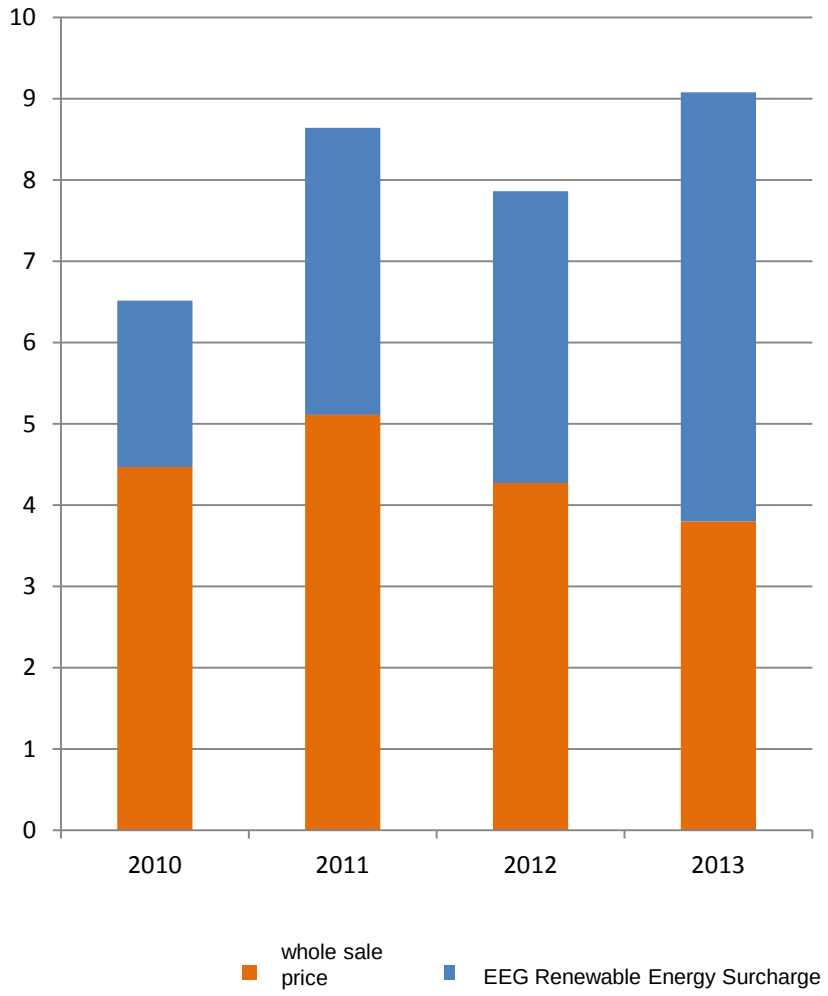
Paradoxon of the Merit order effect

- **Part of the support costs is driven by the lower wholesale power market price that RES cause**

  (overall support costs = support payments - market price for RES-E)

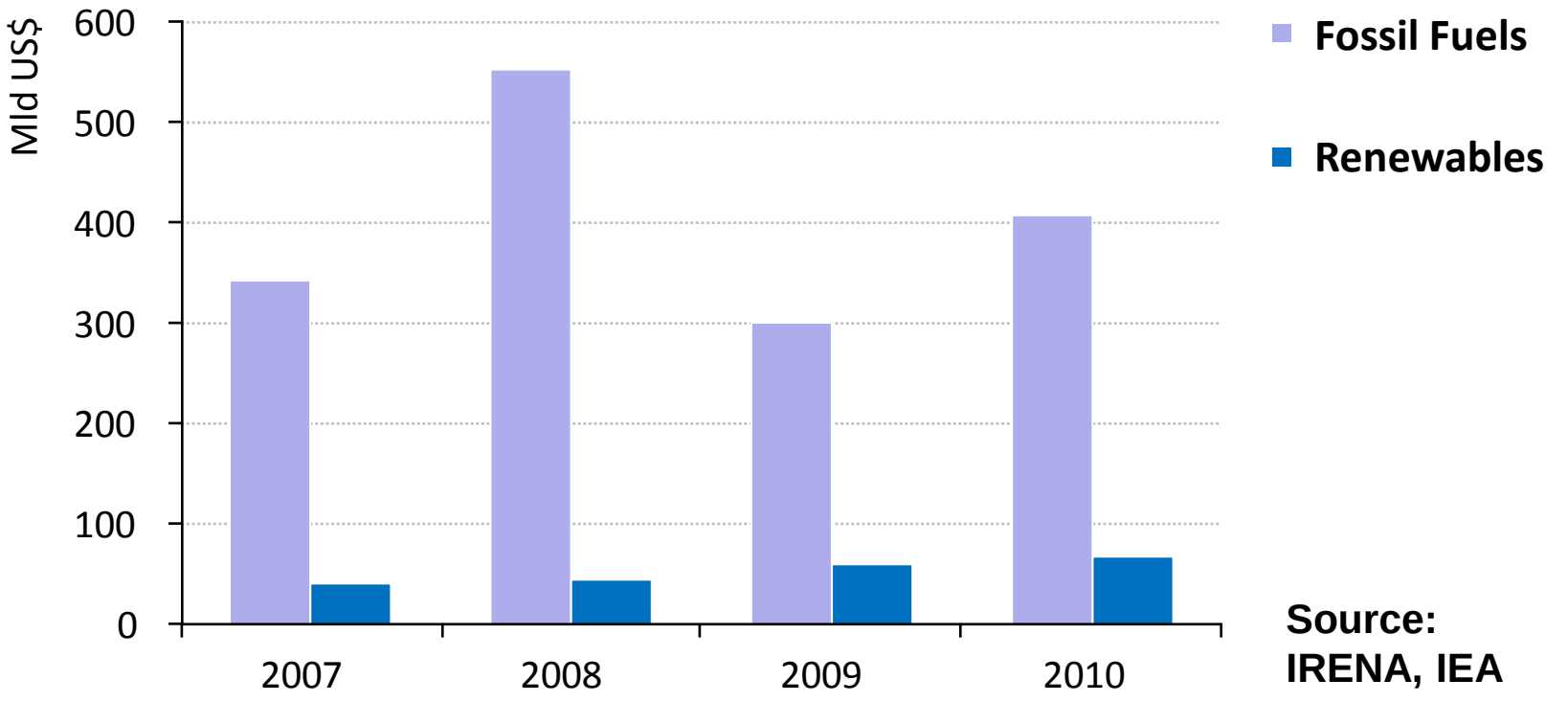
- **Calculation for 2012: MOE = 0.9 ct. kWh**

- **MEO becomes more and more important for support costs**



Investing in the future

Worldwide Subsidies for Fossil Fuels and Renewables (in Billion US$)



Source: IRENA, IEA