

Energy Transition in Germany

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MÉXICO-ALEMANIA

DIÁLOGOS POR UN FUTURO SUSTENTABLE

ENERGIA RENOVABLE

Ciudad de México, 4 de diciembre 2014

Agenda

- **The German “Energiewende”:
Targets, challenges and policies**
 - **Short-term effects**
 - **The monitoring process**
 - **Some conclusions**
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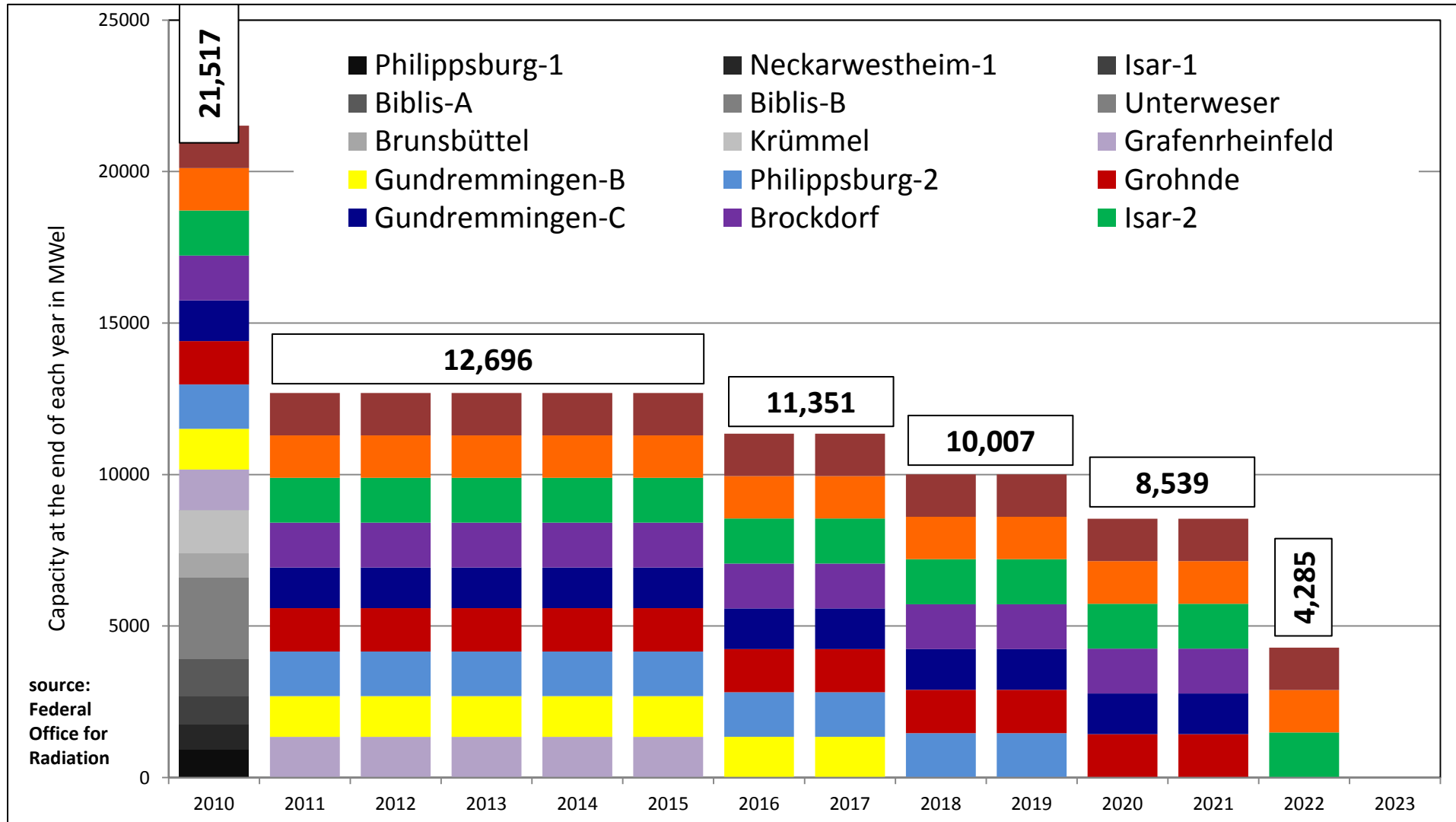
Germany started an ambitious experiment: Finding an environmentally friendly, socially responsible, and resource saving way

- In September 2010 the Federal Government adopted the energy concept which sets out Germany's energy policy until 2050 and specifically lays down measures for the development of renewable energy sources, power grids and energy efficiency.
 - Against the backdrop of the nuclear meltdown at Fukushima in March 2011, the role assigned to nuclear power in the energy concept was reassessed and eight nuclear power plants were shut down.
 - Furthermore, a decision was taken to phase out operation of the remaining nine nuclear power plants by 2022. On 6 June 2011 the Federal Government adopted the energy package which supplements the measures of the energy concept and speeds up its implementation.
 - Policies regarding the low carbon transition of the power sector are part of these decisions.
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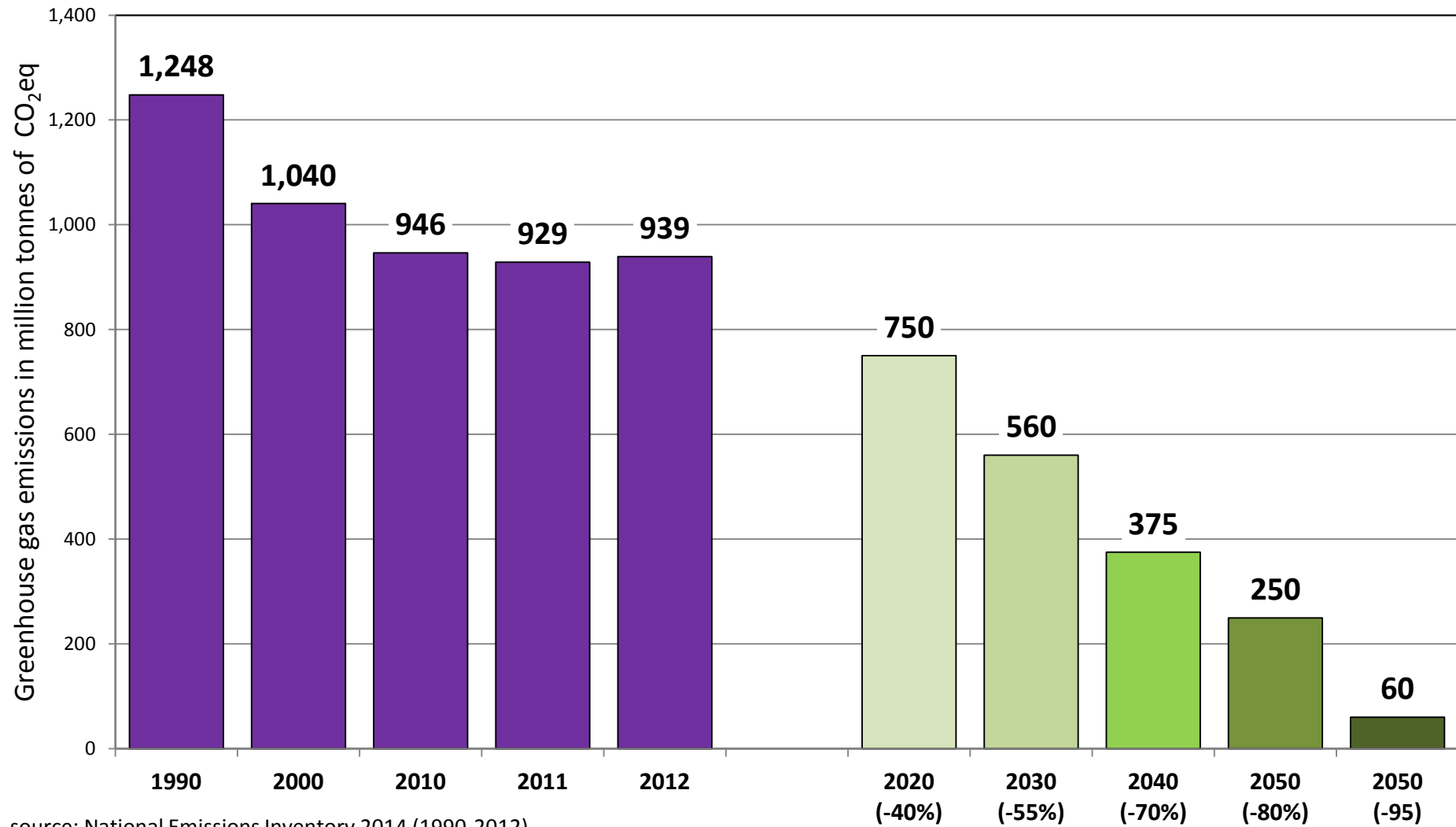
The targets of Germany's energy and climate policy: Phasing-out Nuclear Energy and Decarbonisation of economy and society

| | Base year | 2020 | 2030 | 2040 | 2050 |
|--|-----------|---------------------------------------|--|------|---------------|
| Nuclear power (MW) | 21517 | 8539 | last reactors will be shut down by the end of 2022 | | |
| Greenhouse gas emissions | 1990 | -40% | -55% | -70% | -80% bis -95% |
| | | Share of renewable energies | | | |
| Gross final consumption | xxx | 18% | 30% | 45% | 60% |
| Electricity generation* | xxx | 35% | 50% | 65% | 80% |
| | | Energy consumption/-efficiency | | | |
| Primary energy | 2008 | -20% | xxx | xxx | -50% |
| Space heating | 2008 | -20% | xxx | xxx | -80% |
| Transport | 2005 | -10% | xxx | xxx | -40% |
| Electricity consumption | 2008 | -10% | xxx | xxx | -25% |
| *) According to the coalition agreement: 40-45 % in 2025 and 55-60% in 2035 | | | | | |
| ⇒ CHP share in electricity generation in 2020: 25 % | | | | | |
| ⇒ Final energy productivity: Annual increase of 2.1 % from 2008 to 2050 | | | | | |
| ⇒ Doubling the annual building renovation rate to 2 % of the total building stock | | | | | |
| ⇒ Building stock should be almost climate-neutral by 2050 | | | | | |

The phase-out pathway of nuclear energy in Germany: the last reactors will be shut down at the end of 2022

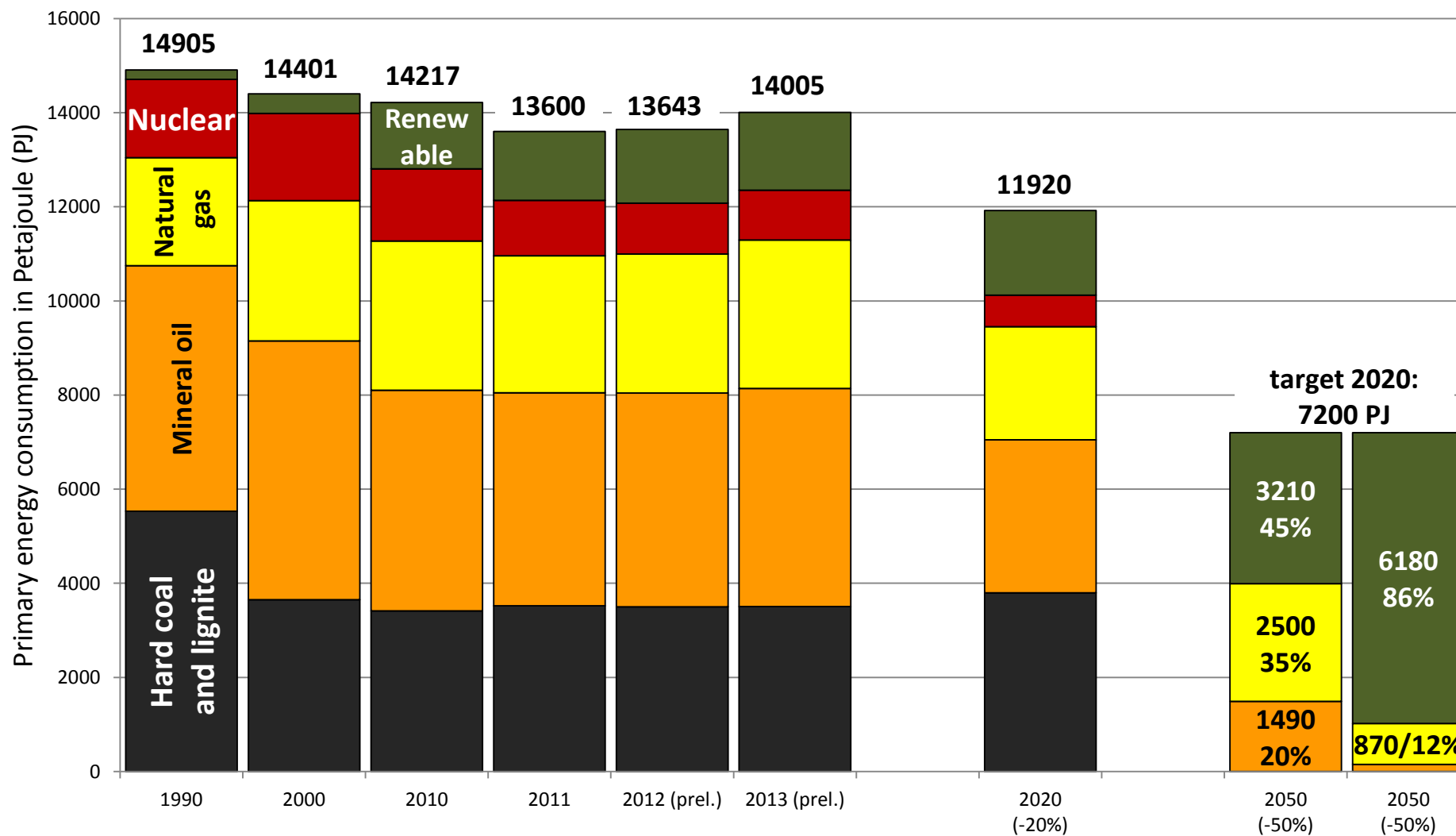


Greenhouse gas emissions in Germany: 1990 to 2012 and targets for 2050



source: National emissions inventory; Government's Energy Concept

Primary energy consumption in Germany: 1990 to 2013 and targets for 2020/2050



sources: Working Group on Energy Balances; Government's Energy Concept

**The two pillars of Germany's
energy transition**

**Renewable
Energies
= rapidly
rising share
of energy
consumption**

**Energy
efficiency
= substantially
reducing
energy
consumption**

Challenges of the energy transition

- The **German energy transition** is much more than phasing out nuclear energy.
 - **The German energy transition means a fundamental reconstruction** of our total energy system
 - The reduction of greenhouse gas emissions by 80 to 95 % means nothing less than a **decarbonised economy and society** and instead of this a society **mainly based on renewable energies.**
 - **Large scale investments** are necessary regarding the transformation of the infrastructure
 - **Market forces alone will not be enough** to make the energy transition a success. The success of the energy transition fundamentally depends on **political decisions.**
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The key tasks for energy system transformation

- **Adapt infrastructure for transport, distribution and storage system** to renewable energy.
 - Development of a **new market design**: supplementing the energy-only market with a capacity market.
 - Launch a **comprehensive program** to sustainably increase **energy efficiency** on both the demand and supply side.
 - Establish a transport infrastructure for **new mobility systems** and use of alternative energy sources (electricity, hydrogen, etc.) as well as improving the vehicle efficiency.
 - Incentives for investments in **climate-neutral buildings**.
 - **Potentially**: Power-to-gas/heat/liquids; use of CCS technology for industrial sectors (eg steel industry)
 - Ultimately: **Make infrastructure fit for the energy transition!**
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Germany's policy in favour of a low carbon economy

- **Regulatory laws** (like Energy saving Act, Energy saving ordinance, Ordinances on heat insulation, on heating installations, energy labelling, renewable energy heat act etc.)
 - **Standards** (i.e. specific CO₂ emissions for cars, Oeko design)
 - **Fiscal regulations** (like energy taxes, ecological tax reform)
 - **Funding** (e.g. direct subsidies, low-interest loans; indirect funding through Feed-In-Tariff for renewable Energy)
 - **Emissions trading** in the context of the European Union
 - **R&D** (e.g. 6th Energy Research Programme of August 2011 with a focus on new energy efficiency technologies).
 - **Voluntary Agreements** (1995 first VA signed by 14 sectors of industry aimed at increasing energy savings and reducing CO₂)
 - **Training&Education** (stimulus programs e.g for specialists in industry)
 - **Information, Motivation and Communication**
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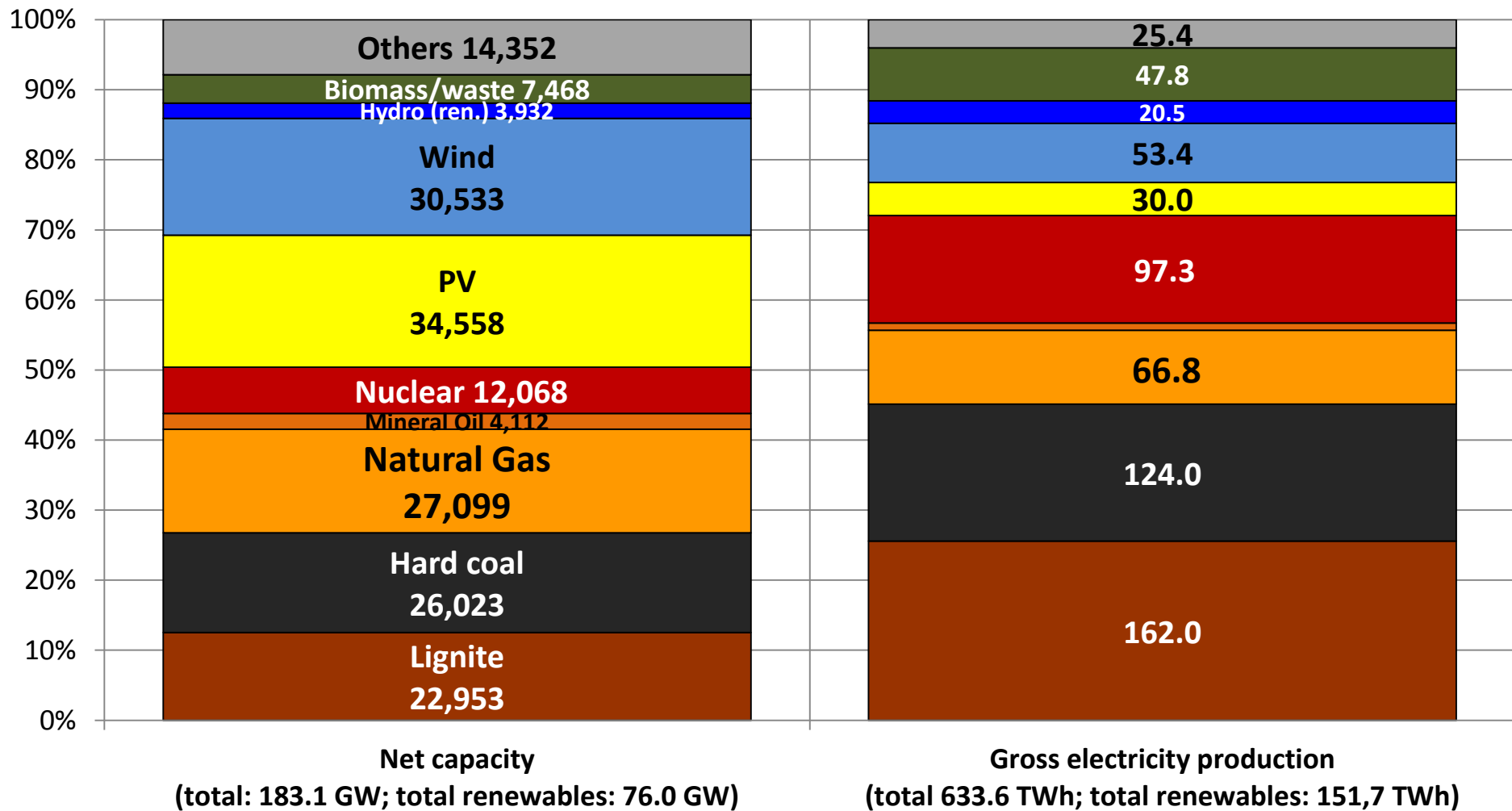
The expected effects of nuclear power phase-out in Germany and the reality

Theoretically the following effects were expected:

- Additional electricity production in other power plants with higher costs **(but: decreasing electricity price)**
- The resulting increase in the price of CO₂ within the framework of pan-EU emissions trading **(but: decreasing CO₂ price)**
- Installation of additional conventional power plant capacities (gas power stations in particular) **(but this did not happen)**
- Shift in the balance of external electricity trading (fewer exports, more imports). **(but: An increasing export surplus)**

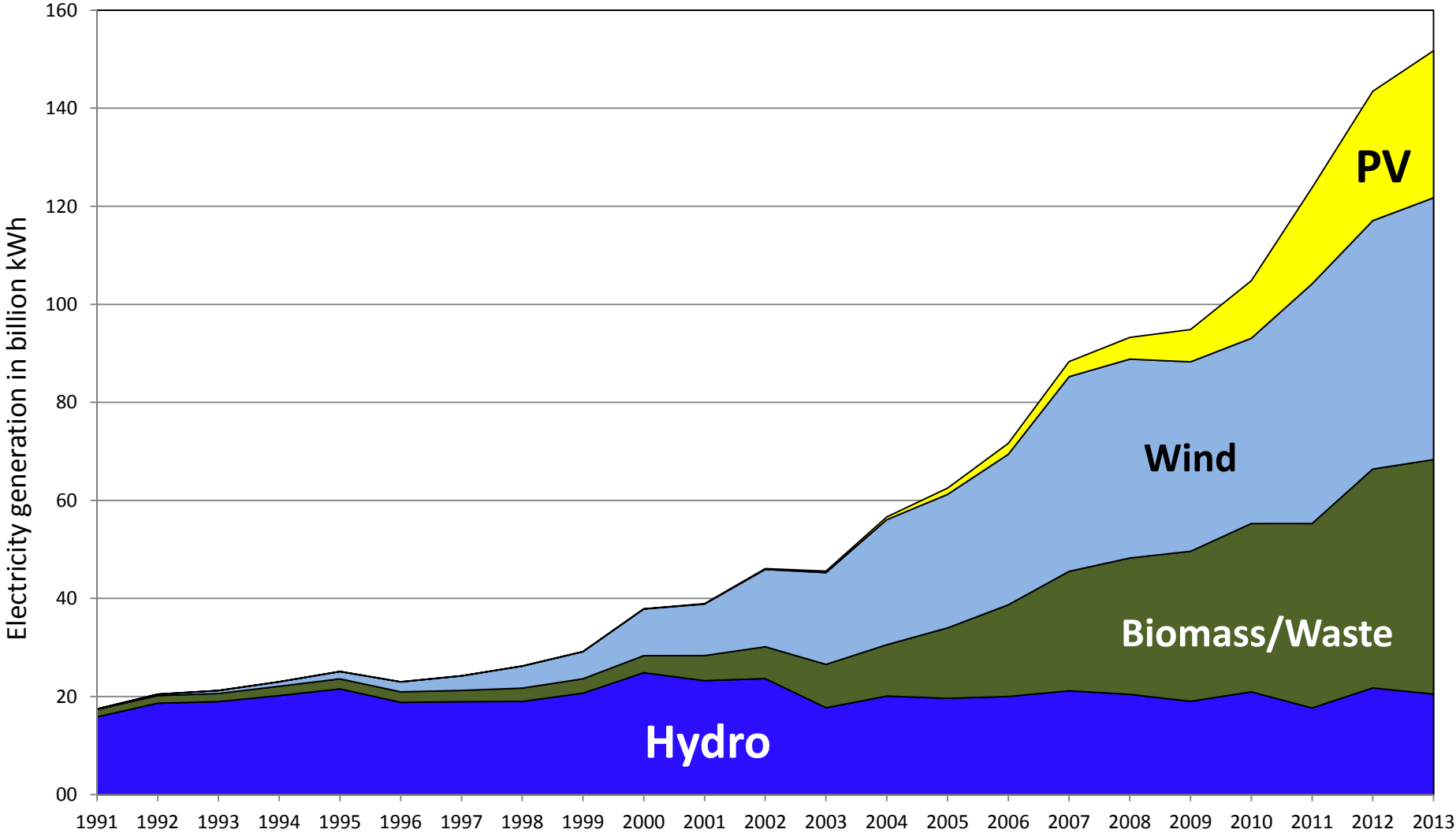
On the other hand, nuclear phase-out eliminates the cost of retrofitting existing nuclear power plants. Together with the increasing share of renewable energies the “merit-order” effect leads to lower electricity prices.

Installed capacity and electricity generation in Germany 2013 by sources



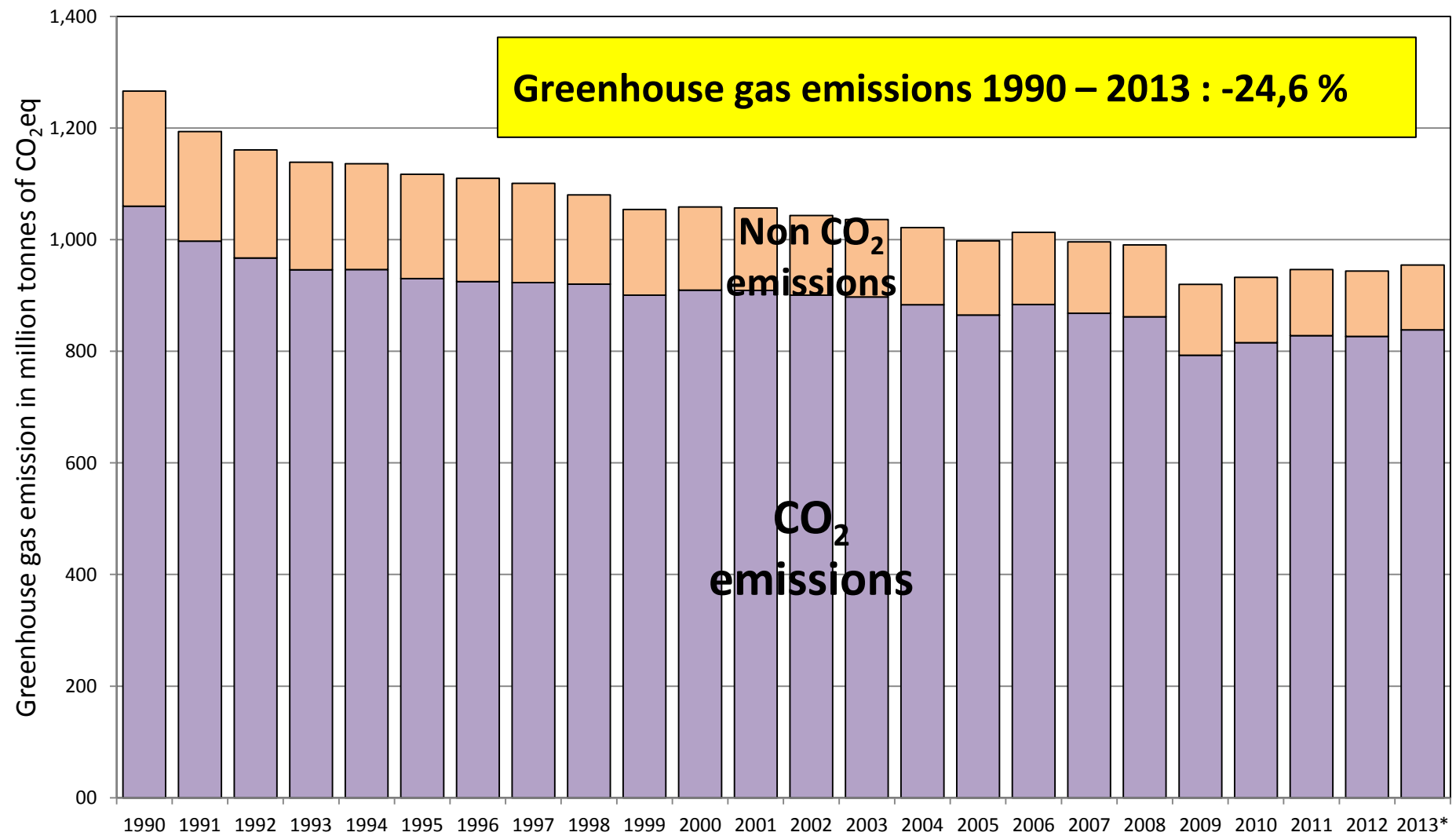
sources: Federal Network Agency; German Association of Energy and Water Industries (BDEW).

Electricity generation in Germany based on renewable energy sources 1991 to 2013



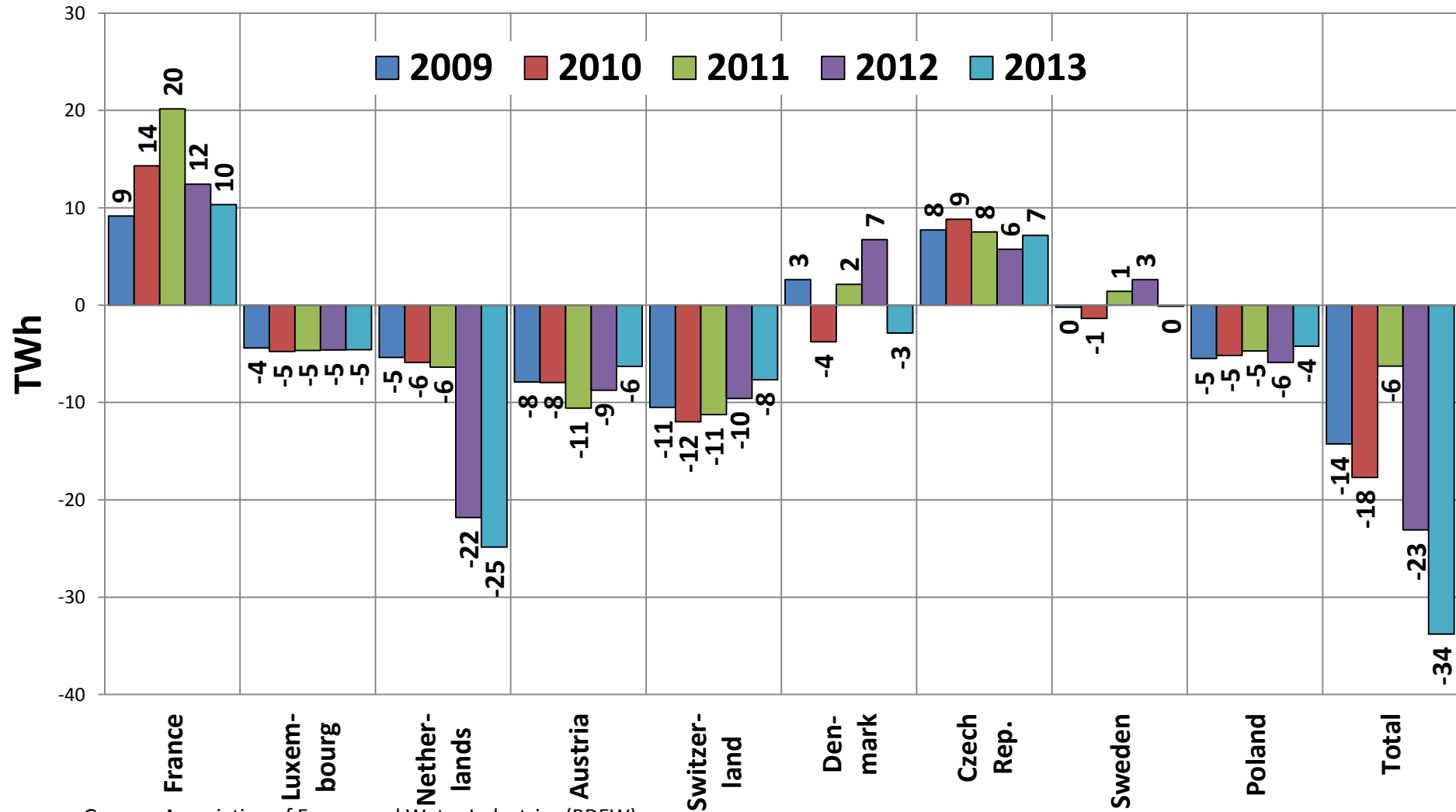
sources: BDEW; AGEESat.

Greenhouse Gas Emissions in Germany 1990 to 2013



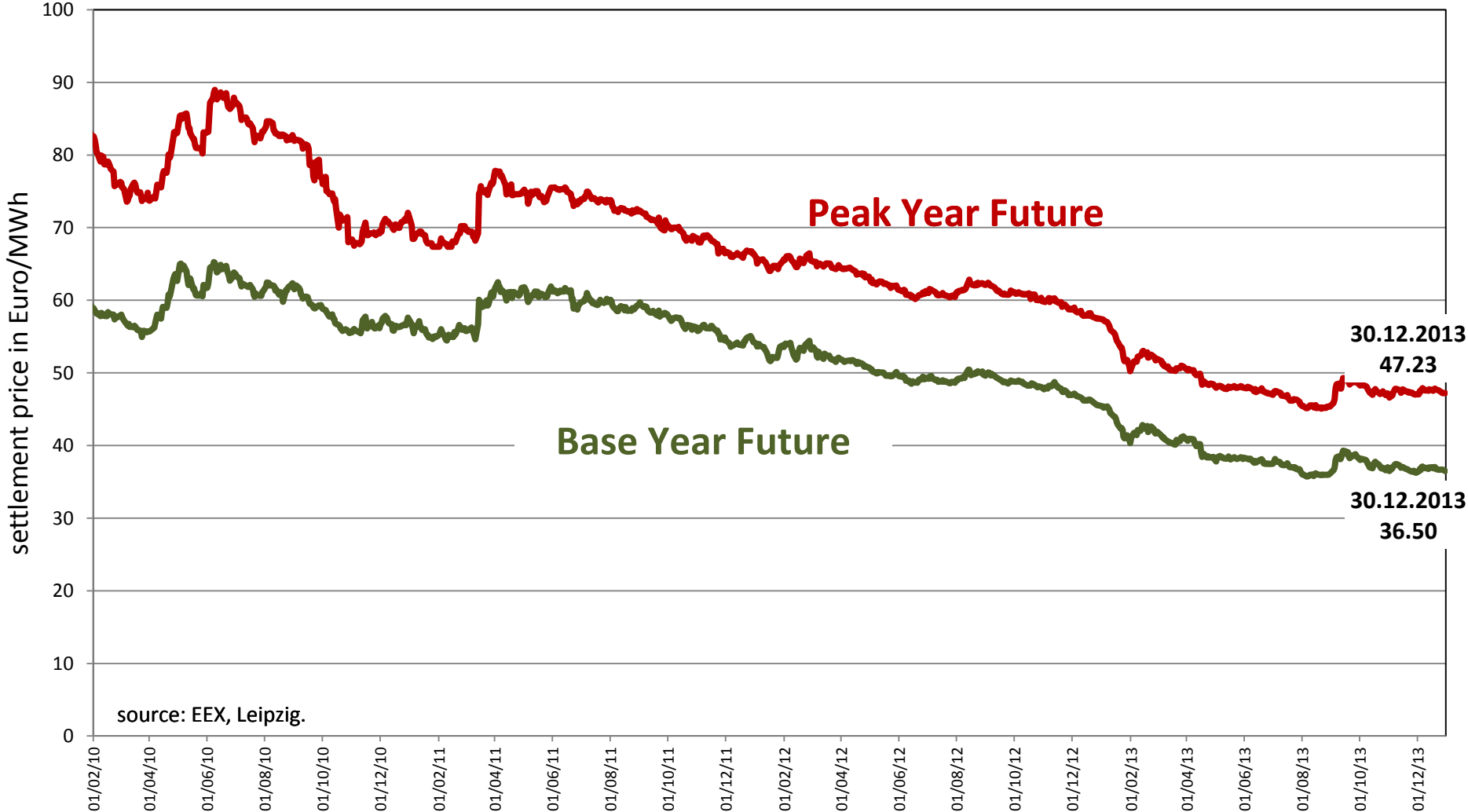
sources: National emissions inventory; author's calculation.

Electricity trade balance in Germany 2009 to 2013 (physical flows)

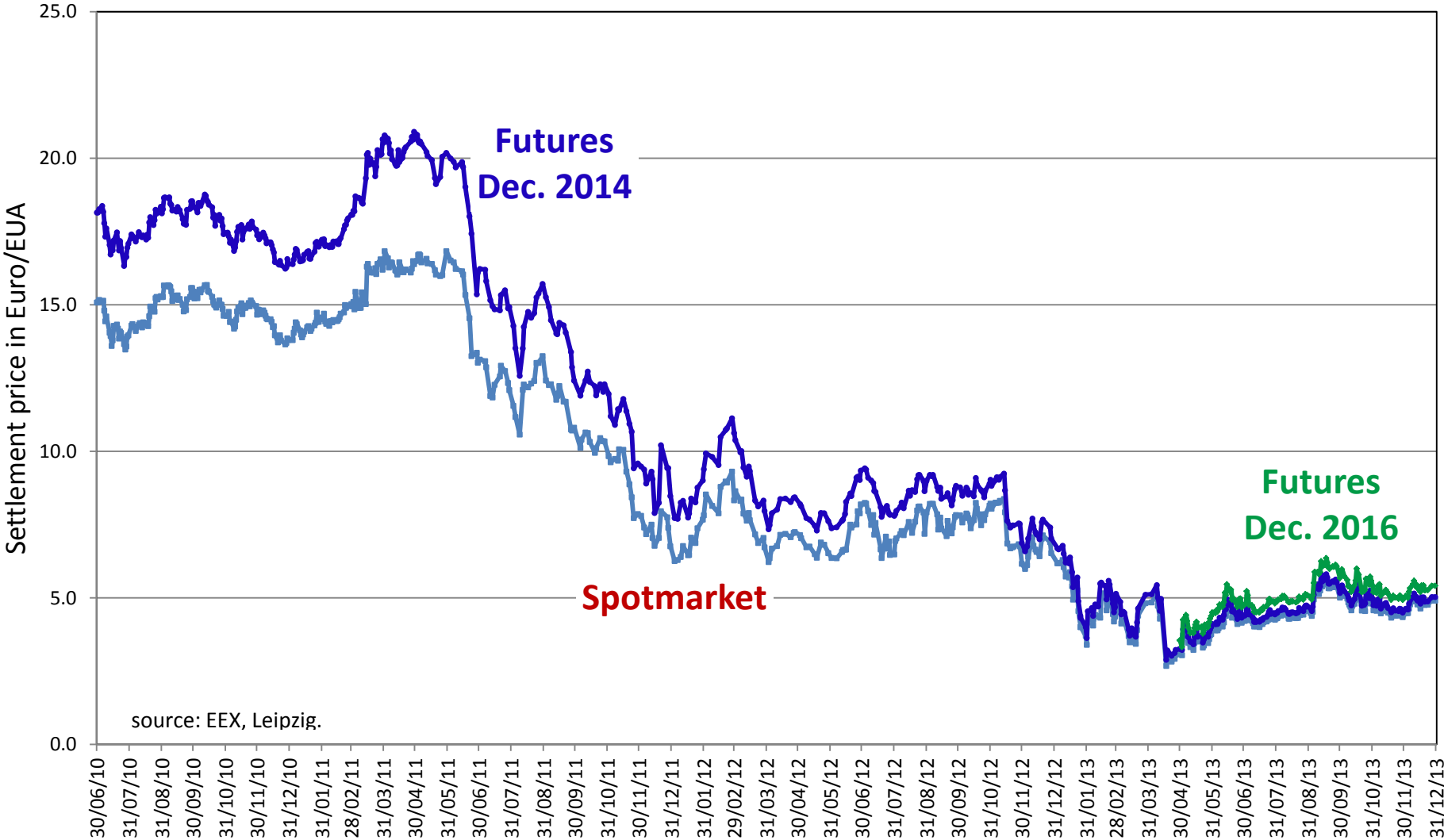


source: German Association of Energy and Water Industries (BDEW).

EEX Power Derivatives: Phelix-Base-Year-Future and Peak-Year-Future 2010 to 2013: Delivery Period: Jan 2015



European carbon spot and future market at EEX 2010 to 2013 (delivery period December 2014 and 2016)



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The Government's Energy Concept



Federal Ministry
of Economics
and Technology

Federal Ministry for the
Environment, Nature Conservation
and Nuclear Safety

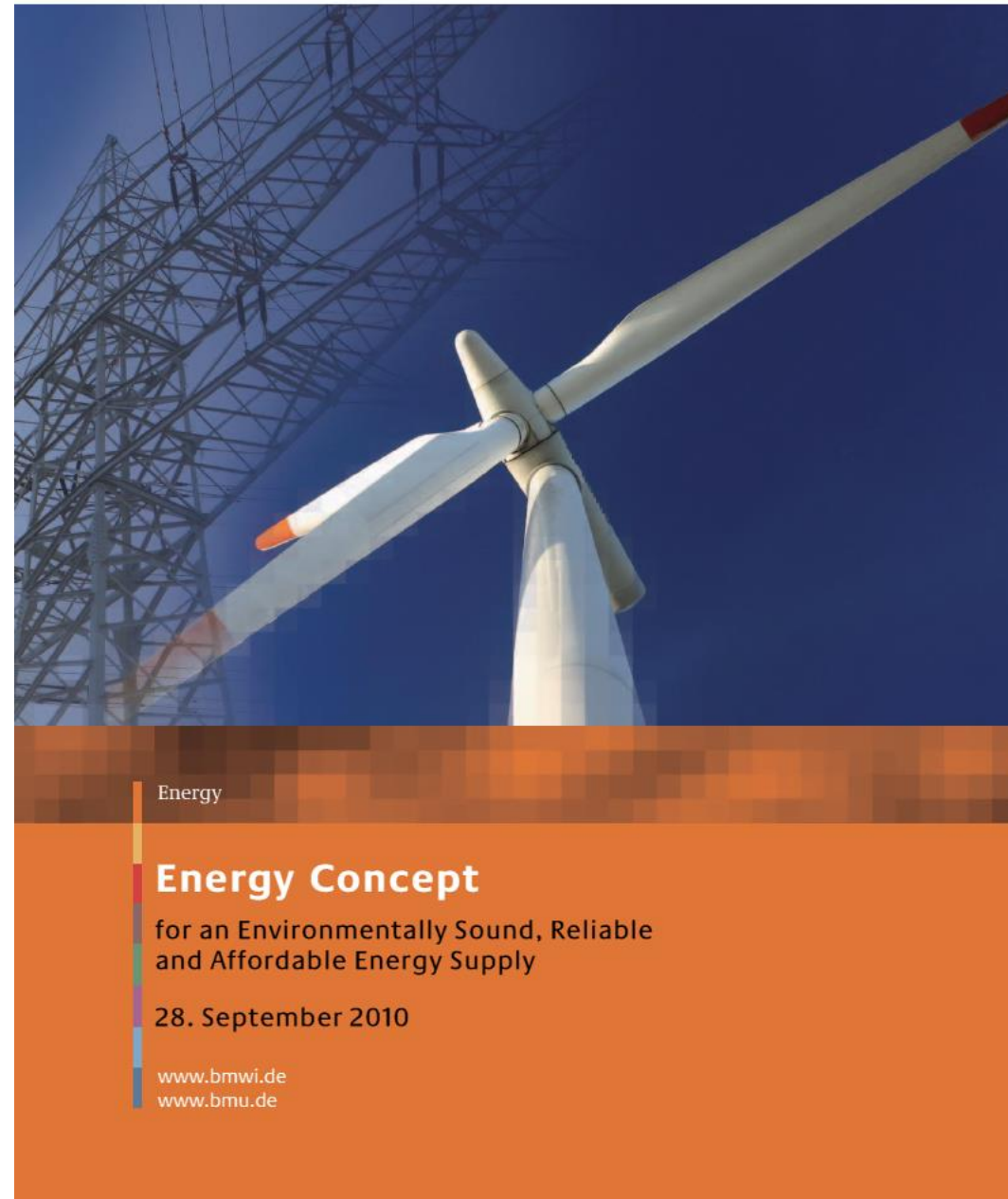


Energy Concept

as of 28 September 2010:

„Securing a reliable, economically viable and environmentally sound energy supply is one of the great challenges of the 21st century. [...]

The German government will use scientifically tested monitoring to determine whether actual progress is within the corridor marked out by the above development path and to what extent action needs to be taken.



The Monitoring Process „Energy of the Future“

- Cabinet decision of October 19, 2011 to establish the “Energy for the Future” monitoring process.
- Two kinds of reports:
 - An annually monitoring report based on facts and figures.
 - A progress report every three years.
- To support the monitoring process an independent four member expert commission was set up within the cabinet’s decision.
- The Government’s report together with the expert commission’s statement will be published and forwarded to the German Parliament and the Federal Council as well as to the public.
- The 1st annual monitoring report was published in December 2012 for the year 2011. The 2nd report followed in April 2014, and the 1st progress report passed the Cabinet on December 3. Each with the statements of the expert commission

Additional policies and measures are necessary to get on the path to achieving the objectives of the energy concept.

- The **climate target** for 2020 (- 40%) will not be achieved without additional measures.
 - Actions to **extend the transmission and distribution grid** for electricity.
 - **Ensuring the power supply** requires new power plants. Given the present and foreseeable market situation, it needs no economic incentives..
 - **Reform of the EEG** is under way but not yet completed.
 - Additional measures to increase **energy efficiency in all sectors**.
 - In particular, to achieve the very ambitious long term objectives for the **building sector** is threatened, if not effective measures are taken additionally.
 - The same applies to the **transport sector**, in which neither a trend of a decline in fuel consumption and CO₂ emissions can be seen nor sufficient political incentives are implemented..
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Conclusion (1):

The energy transition needs an effective and efficient policy mix

- The German energy transition implies a **radical change of the total energy system of supply and demand** which will mainly be based on renewable energies and energy efficiency.
 - Studies show that change is **technically and even economically feasible**. So Germany should remain a competitive business location.
 - To be successful, we need more than a single instrument. It needs an **appropriate “policy mix”**.
 - Within this policy approach the **relevant policies** (mostly at sector level) , their **effectiveness** and their **distributional impacts** must be assessed..
 - The consequences for design of instruments as well as effective, efficient and robust policies have to be identified – to achieve the policy goals.
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Conclusion (2):

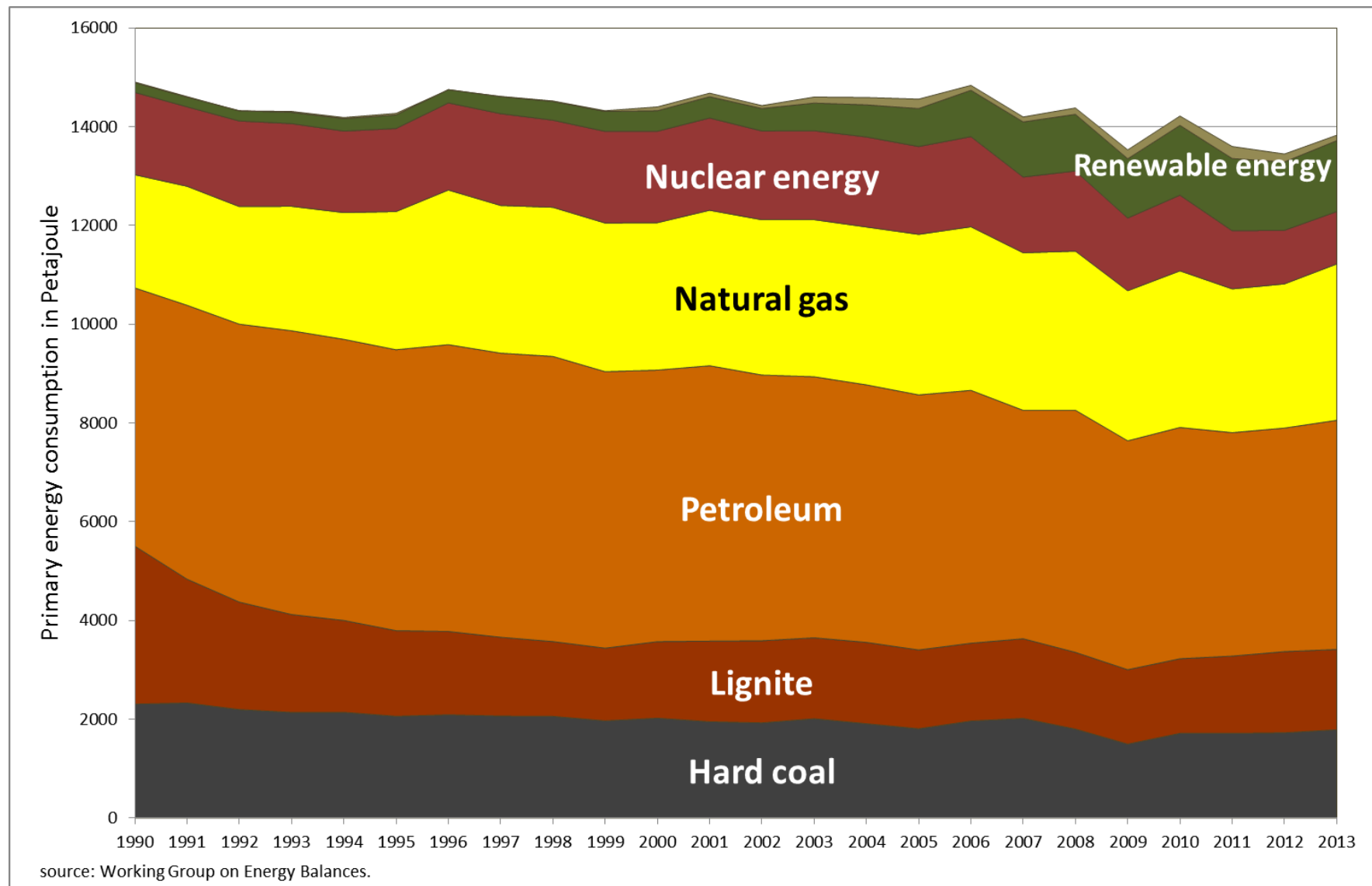
The energy transition also needs a broad acceptance

- There is a **broad consensus** in Germany regarding the **phasing out of nuclear energy** and the **decarbonisation** of the total economy.
 - There is also a broad consensus that **policies and measures** have to **concentrate on energy efficiency and renewable energies**.
 - Although many policies and measures have been implemented up to now, **further efforts are necessary to achieve the targets**. But some **resistance** occurs when people are afraid of additional burdens..
 - The crucial point is the time. Not least for economic reasons we cannot wait forever to implement all the necessary policies and measures. Otherwise we will miss the targets and loose money.
 - Last but not least: A **successful policy needs the acceptance of the people** and their willingness to follow the way for a sustainable and low carbon development.
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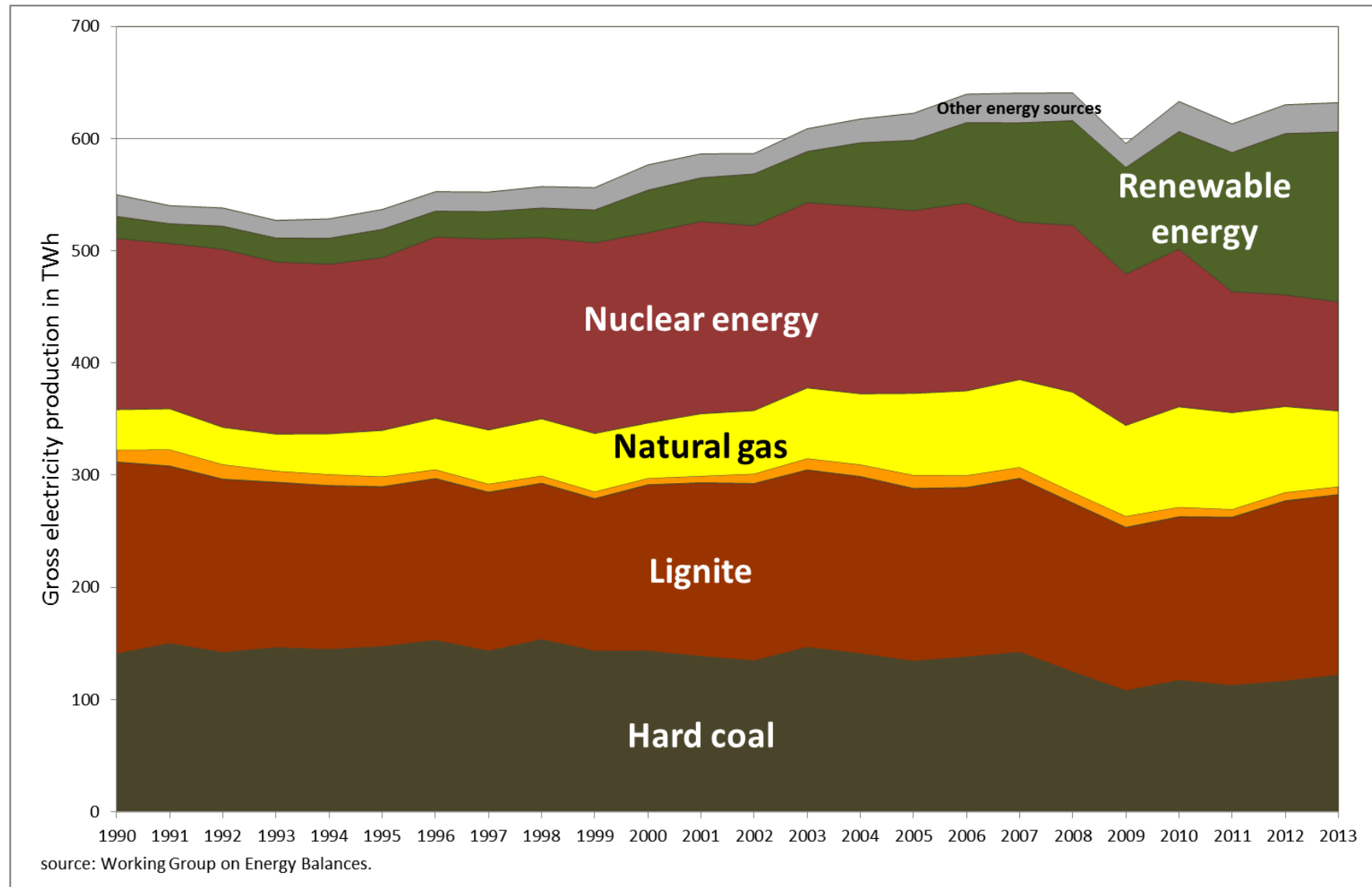


Thanks for listening
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Primary energy consumption in Germany 1990 to 2013



Gross electricity production in Germany 1990 to 2013



Germany's policy towards a low carbon power sector

Direct supporting schemes:

- Supporting the renewable energy sources based on Feed-In-Tariffs
- A Bonus System for Combined Heat and Power Plants (CHP)
- Subsidies for small CHP Plants
- Subsidies for high efficient new power plants (under consideration)
- A act on Carbon Capture and Storage (CCS) passed the parliament, but is not yet in force
- Developing capacity markets instead of kWh-markets only (under discussion)

Policies and measures with indirect effects

- Emissions Trading System
 - R&D Projects regarding CO₂ reduction technologies in the electricity sector
-

Germany's policy towards a low carbon building sector

- Amendment of **Energy Conservation Act** and **Energy Saving Ordinance**
 - Amendment to **Heating Costs Ordinance**
 - **Modernization Program** to reduce CO₂ emissions from buildings (funding for energy-efficient modernization of residential and public buildings)
 - **Energy-efficient modernization of social infrastructure** (a pact between the Federation, the Länder and local authorities with the goal of primary energy savings of up to 50 % per refurbished building)
 - Program for the **energy-efficient modernization of Federal buildings** (realization of the extensive potential for energy and cost savings)
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Germany's policy towards a low carbon transport sector

- Agreement on key elements for **changing basis of vehicle tax** (in order to ensure that the vehicle tax can be based on CO₂ emissions)
 - **Limits for specific CO₂ emissions** for passenger cars (binding CO₂ values, which must be anchored legally at the EU level)
 - **Energy labelling** of passenger cars (clear labelling that also selectively incorporates the EU targets for CO₂ emissions and provides information about the energy efficiency of vehicles on sale.
 - **Reinforcing the influence of the HGV toll** (broader spread and greater differentiation of toll rates by emissions classes, toll rates that recognise the retrofitting of particle-filtering systems. greater coverage of roads below motorway level etc)
-

6th Energy Research Programme of the German Government

- Energy storage for stationary and mobile applications (electrical, chemical, thermal storage)
 - Grids for future electricity supply
 - Power plant technology and CCS technologies
(**Strategic objectives:** optimising system integration of power plant processes; making power plant processes more flexible; increasing efficiency; reducing emissions using CCS technologies; developing new technology options.
Key strategic funding areas: steam power plants; gas turbines and combined cycle power plants; carbon capture; transporting and storing carbon; proof-of-concept studies on the control and load)
 - Management of power plants
 - Fuel cells and hydrogen
 - Renewable energy systems (all sources)
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