

# **The German Monitoring Process of “Energiewende”**

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on the “Energy of the Future” monitoring process

*“Low Carbon Markets and the Legacy of Nuclear Power”*  
20<sup>th</sup> REFORM Group Meeting,  
Schloss Leopoldskron,  
Salzburg, September 01, 2015

# Agenda

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- **The German “Energiewende”:** Targets and challenges
  - **Short-term effects**
  - **The monitoring process: Is Germany on track already?**
  - **Conclusions**
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## Germany started an ambitious experiment: Finding an environmentally friendly, socially responsible, and resource saving way

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- 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 permanently.
  - 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 rationale behind Germany's energy and climate policies and measures

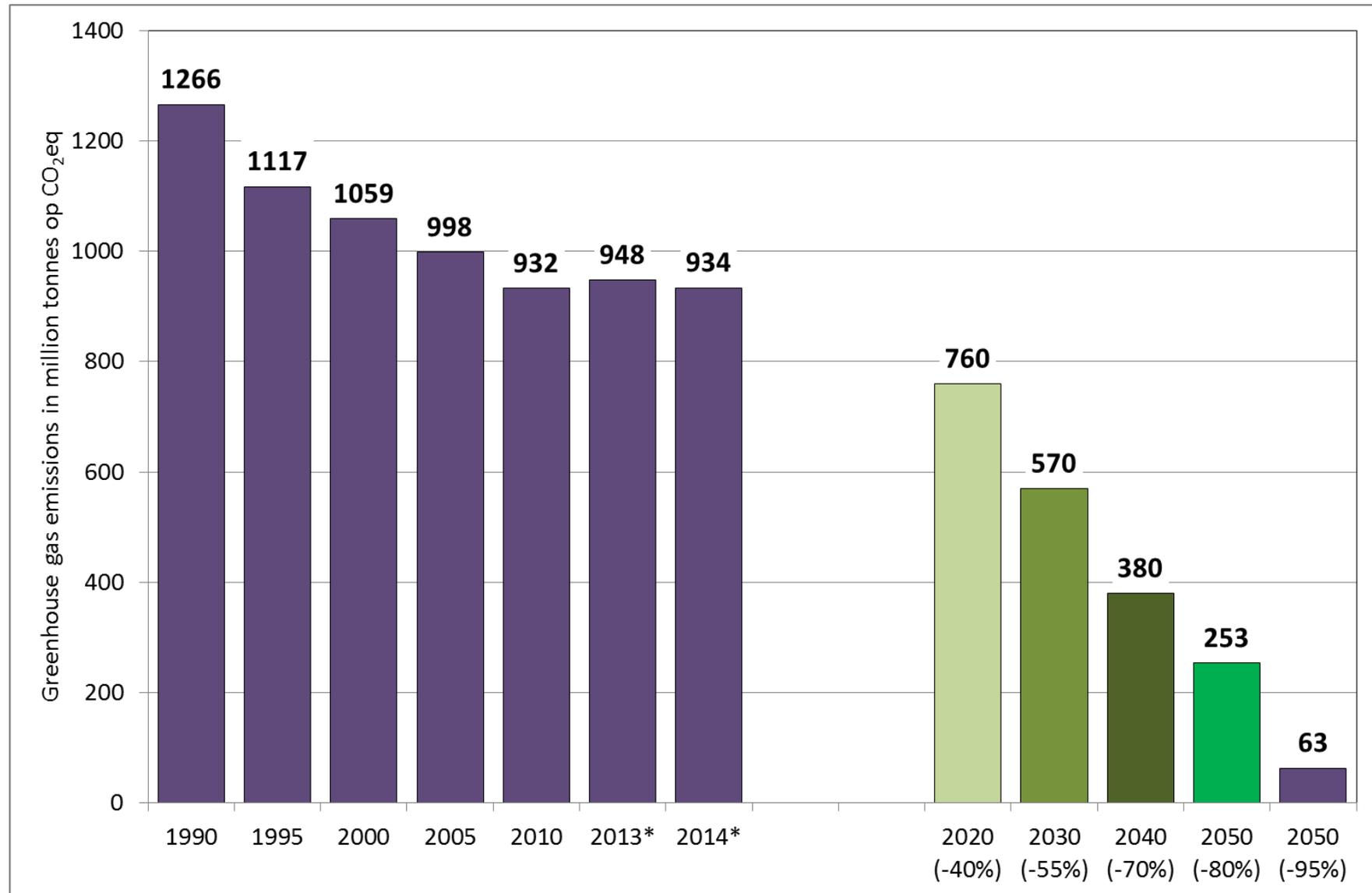
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- Phase-out nuclear energy and an ambitious climate protection are the crucial driving forces for the transformation of the energy system. It sends important signals encouraging investments in innovations and technological progress.
  - In light of the economic and political developments taking place around the world, a "business as usual" approach would present much greater risks than the new ways.
  - Energy prices have been rising, as our oil, gas and coal reserves are fundamentally limited and the number of energy exporters providing reliable energy supplies has been shrinking.
  - Avoid the use of technologies with high risks for nature and human beings.
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# The targets of Germany's energy and climate policy: Phasing-out Nuclear Energy and Decarbonisation of economy and society

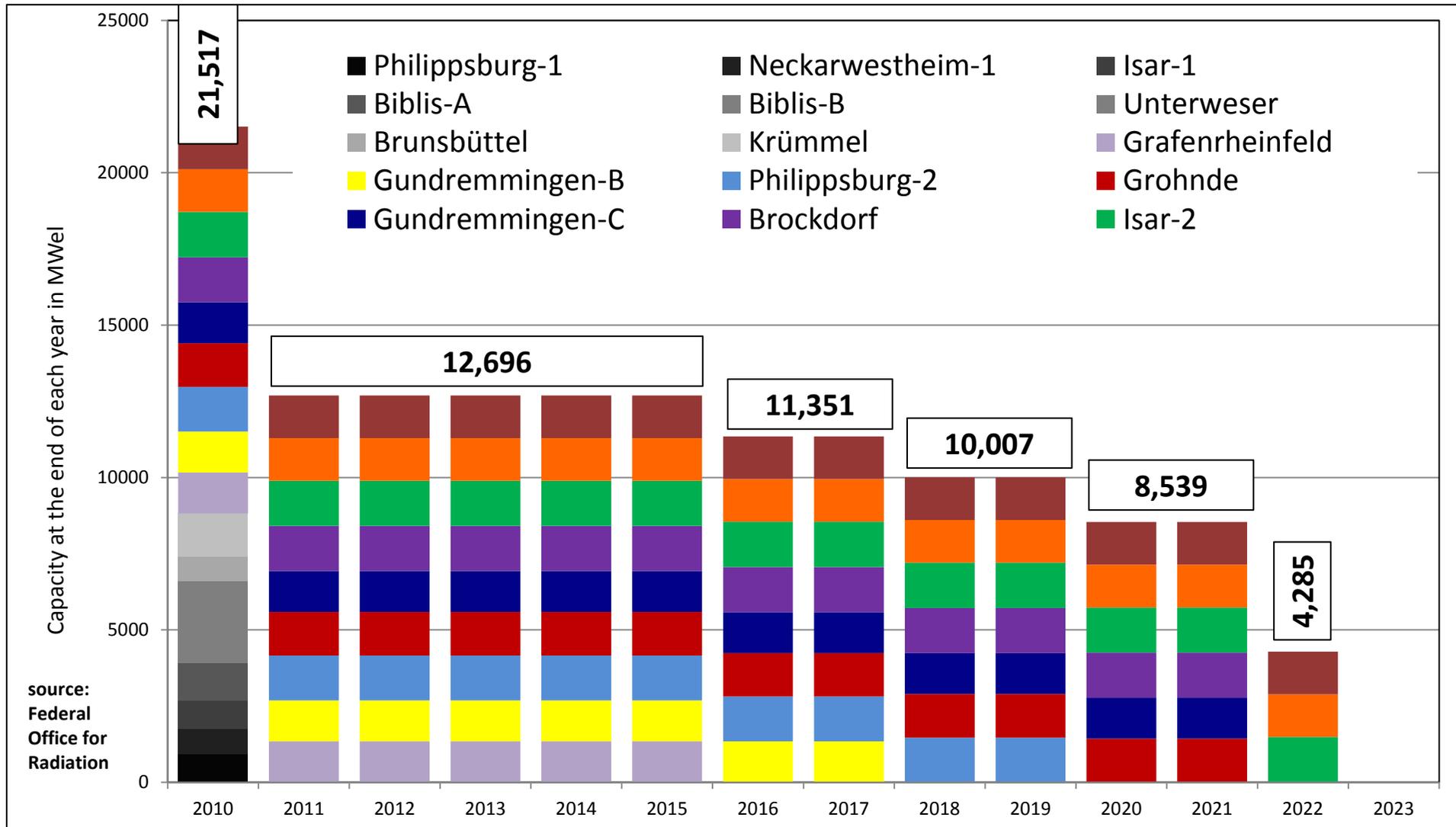
	Base year	2020	2030	2040	2050
<b>Nuclear power (MW)</b>	<b>21517</b>	<b>8539</b>	<b>last reactors will be shut down by the end of 2022</b>		
<b>Greenhouse gas emissions</b>	<b>1990</b>	<b>-40%</b>	<b>-55%</b>	<b>-70%</b>	<b>-80% bis -95%</b>
		<b>Share of renewable energies</b>			
<b>Gross final consumption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

# Greenhouse gas emissions in Germany: 1990 to 2014 and targets for 2050



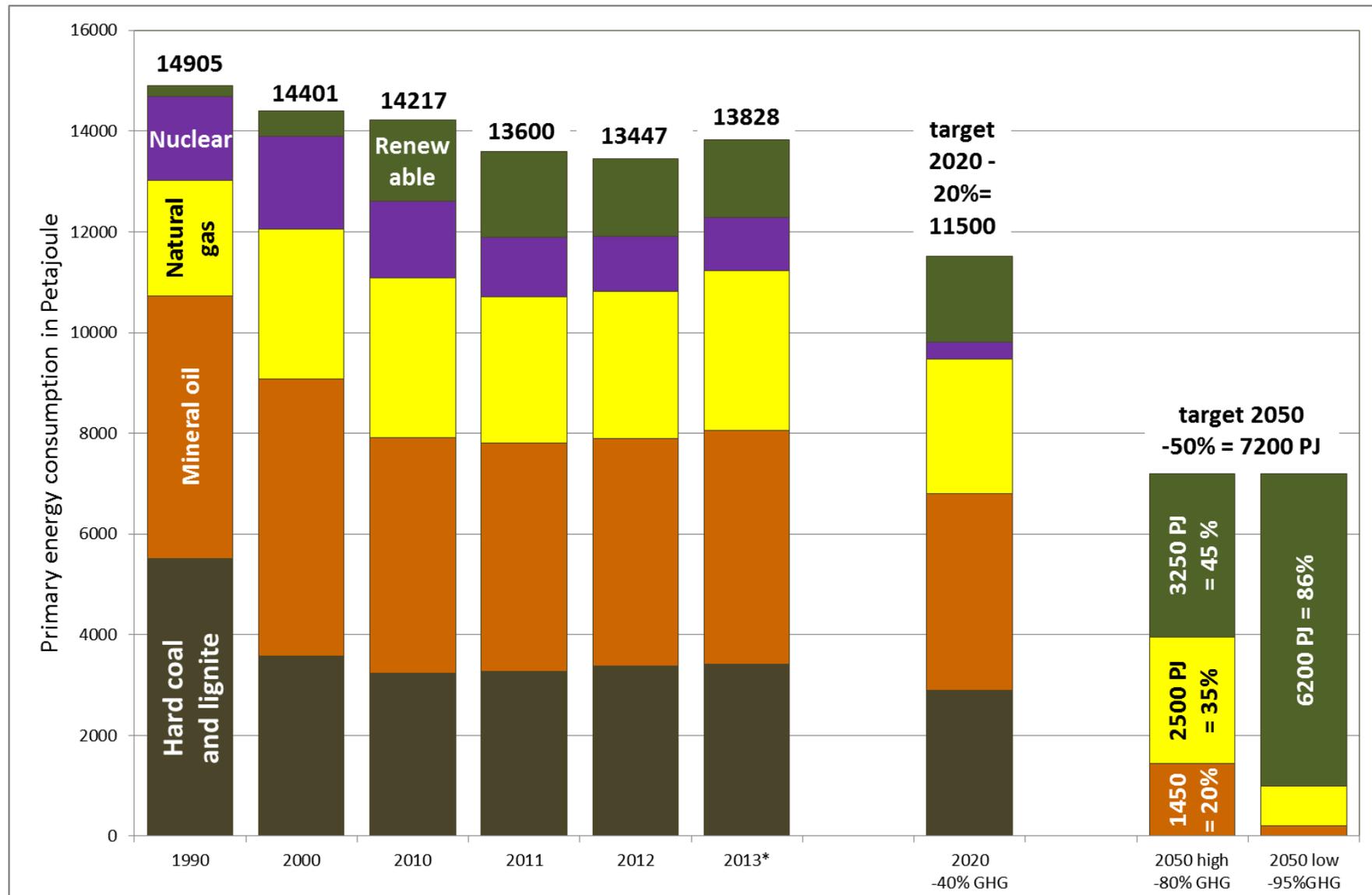
source: Federal Environment Agency; Ziesing (2014 CO<sub>2</sub>); Government's Energy Concept

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



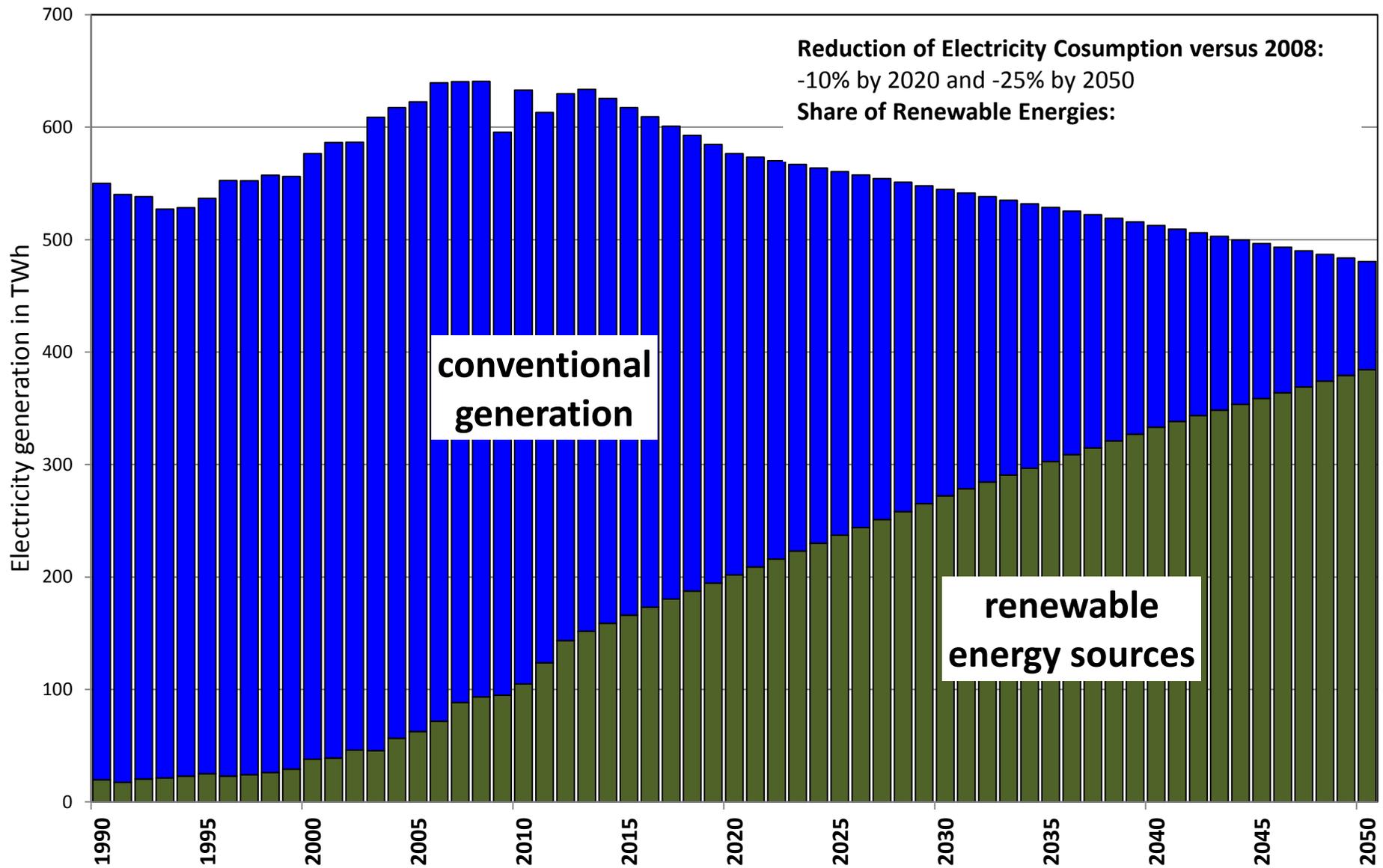
sources: Federal Office for Radiation Protection; Federal Government and Parliament.

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



sources: AGEB; Government's Energy Concept

# The growing share of renewable energies for electricity generation in Germany by 2050



# Challenges of the energy transition

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- The **German energy transition** is much more than phasing out nuclear energy.
  - **Fundamental reconstruction** of our total energy system
  - The reduction of greenhouse gas emissions by 80 to 95 % means nothing less than a widely **fossil und nuclear free economy and society** and instead of this a society **based on renewable energies**.
  - **Large scale investments** necessary regarding the transformation of the infrastructure (generation facilities, grid system, storage systems and overall measures for more energy efficiency in all sectors)
  - **Market forces alone will not be enough** to make the energy transition a success. It needs societal acceptance and effective as well as efficient policies and measures..
  - The success of the energy transition is fundamentally dependent upon **political decisions**.
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# Challenge: Mastering the reconstruction of infrastructure

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- **Conversion of the centralized infrastructure** to a decentralized system with an increasing share of fluctuating generation.
- **Balancing the regional differences** between the consumption centres in southern Germany and the growing supply of electricity, for example, from wind power plants in northern Germany
- **Facilitate the switch to renewable energies** and guarantee a high level of supply security, expansion of the extra-high voltage grid systems is essential. Ensuring sufficient electricity generation capacity
- **Adjustment in the network system** with the proposed extension of the pan-European electricity trade.
- Ultimately: **Make infrastructure fit for the energy transition!**

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# The expected effects of nuclear power phase-out in Germany

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Theoretically the following have the effect of raising costs:

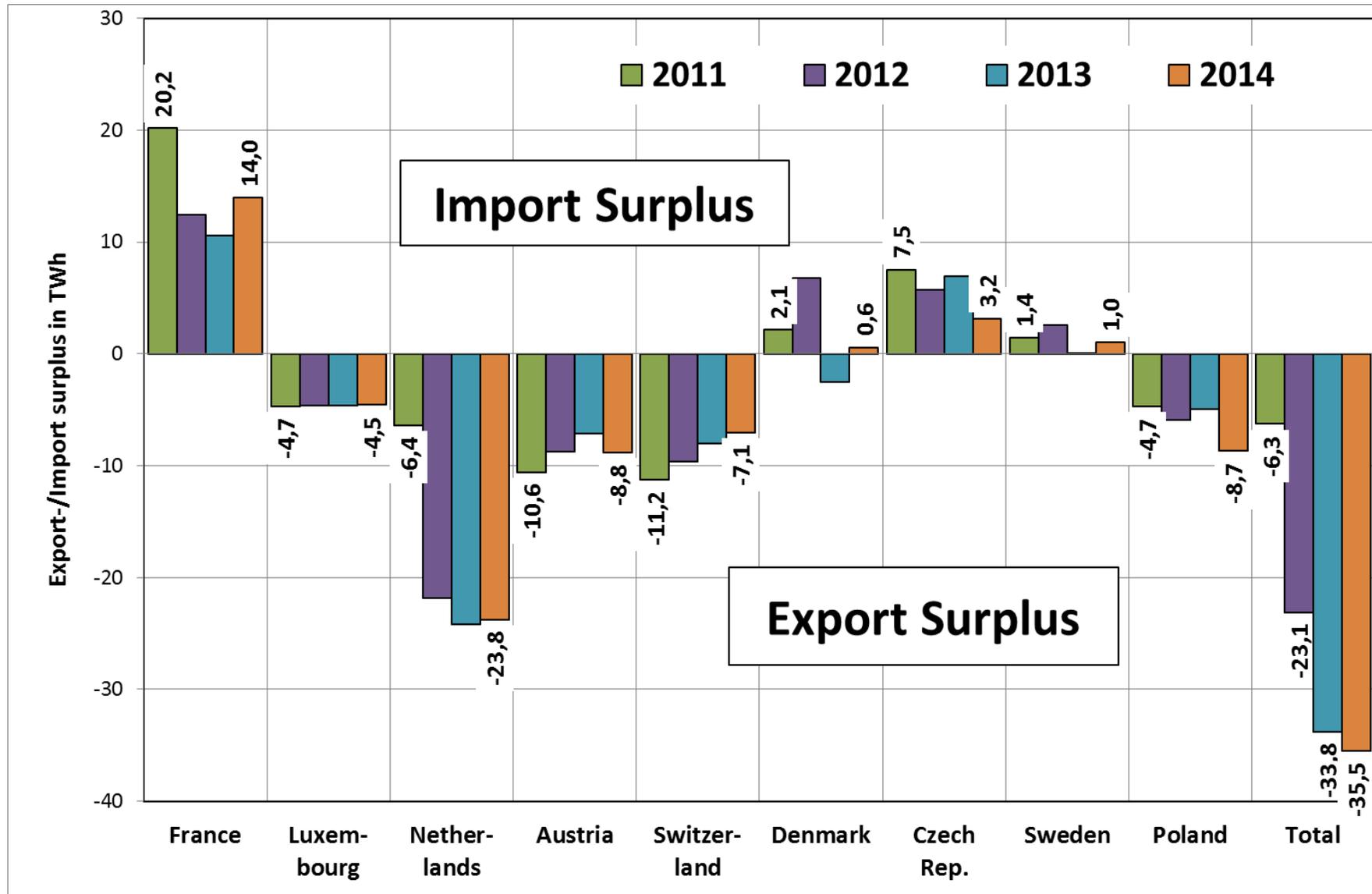
- Additional electricity production in other power plants with generally higher production costs (this did not happen)
- The resulting increase in the price of CO<sub>2</sub> within the framework of pan-EU emissions trading (doubtful regarding the low CO<sub>2</sub> price)
- Installation of additional power plant capacity (gas power stations in particular) (this did not happen)
- Shift in the balance of external electricity trading (fewer exports, more imports). (the opposite was the case)

On the other hand, expediting nuclear phase-out eliminates the cost of retrofitting existing nuclear power plants. This will keep costs down.

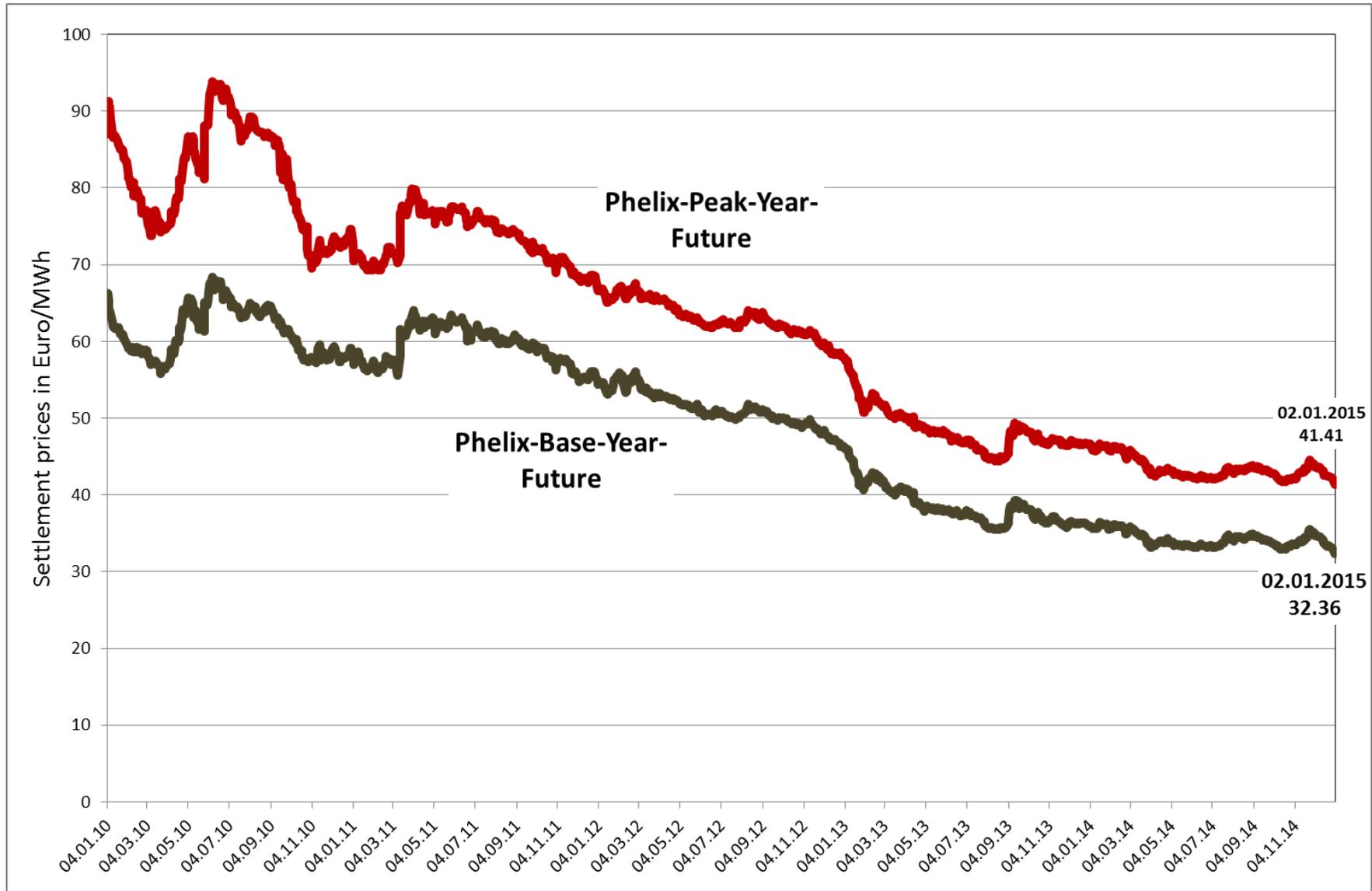
And - together with the increasing share of renewable energies - the “merit-order” effect may lead to lower prices (this happened).

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# Electricity trade balance in Germany 2011 – 2014 (physical flows)



# EEX Power Derivatives: Phelix-Base-Year-Future and Peak-Year-Future 2010 to 2015: Delivery Period: Jan 2016



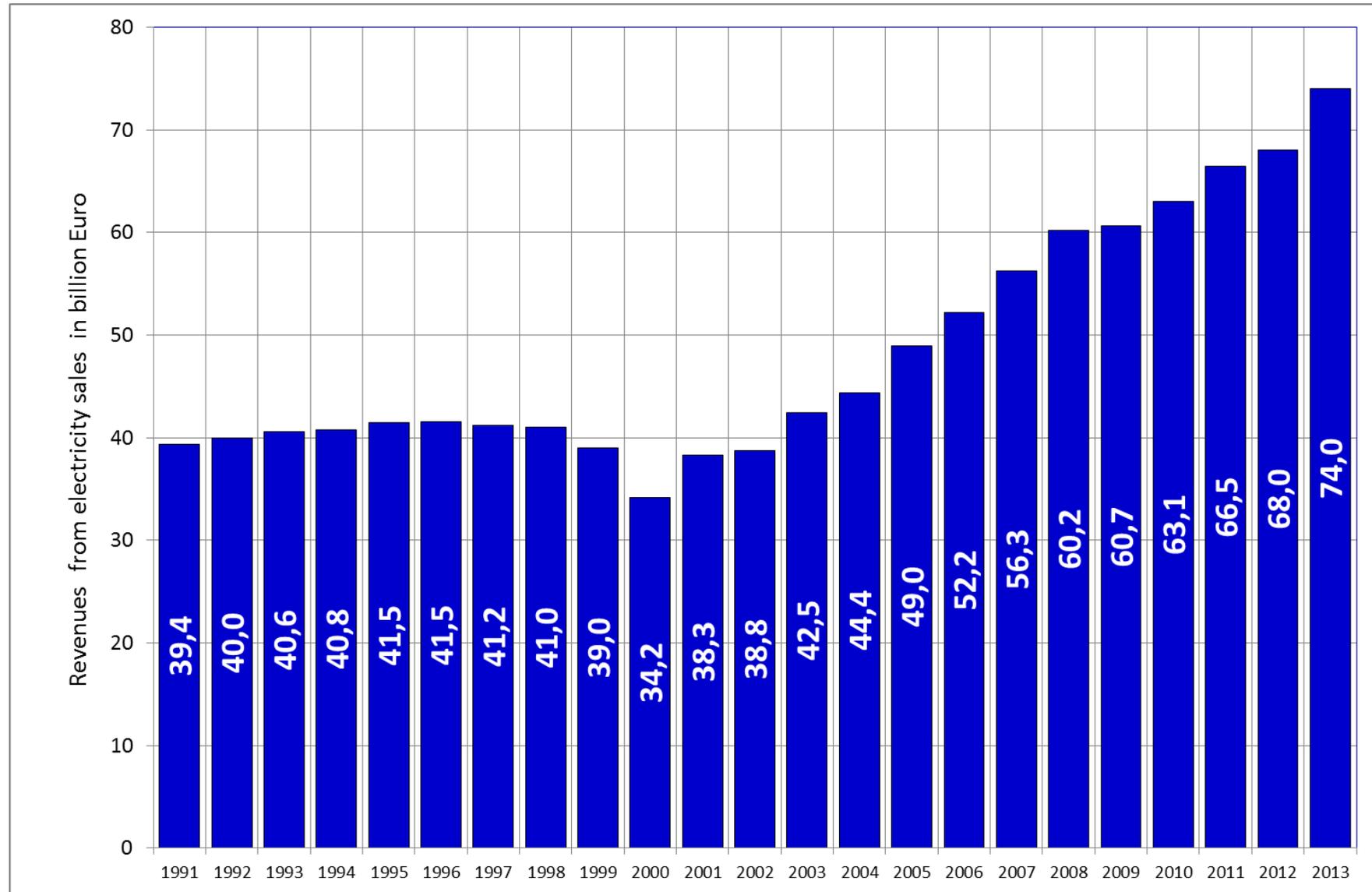
Source: EEX, Leipzig, Germany

# European carbon spot market at EEX 2011 to 2015



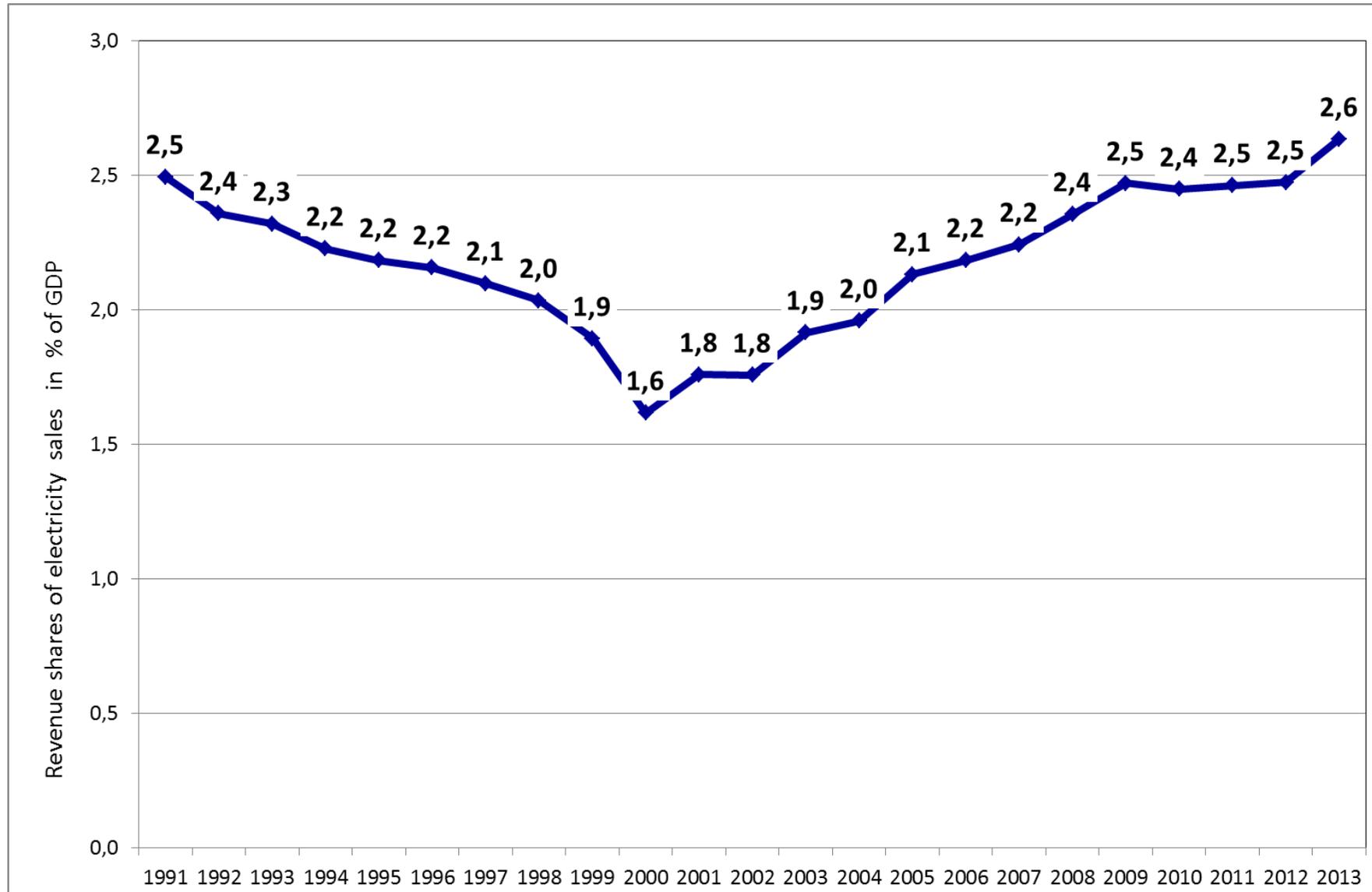
Source: EEX, Leipzig, Germany

# Revenues from electricity sales in Germany 1991-2013



Sources: Federal Statistical Office; author's calculation.

# Revenues from electricity sales in relation of the GDP (at current prices) in Germany 1991-2013



Sources: Federal Statistical Office; author's calculation.

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# 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.*



Energy

## Energy Concept

for an Environmentally Sound, Reliable  
and Affordable Energy Supply

28. September 2010

[www.bmwi.de](http://www.bmwi.de)  
[www.bmu.de](http://www.bmu.de)

## 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 annual monitoring report shall ...

- ... be based on facts
- ... include an assessment of the progress made towards achieving the goals of the energy concept
- ... be elaborated by comparing current and target values
- ... include a tabular overview of policies and measures
- ... use official data provided by the StBA, BAFA, UBA, BNetzA, BKartA, AGEB, AGEE-Stat and others.
- ... concentrate on facts as well as on policies and measures

The three-yearly progress report shall ...

- ... contain a detailed comparison of the present status-quo and the long-term targets
- ... evaluate the status of the implementation of the policies and measures on the base of thorough analyses and specific surveys if necessary
- ... analyse the effectiveness and efficiency of policies and measures which had been implemented
- examine the causes and barriers and propose effective policies and measures

## Organisation of the Monitoring Process

- The **Government report** is prepared by the Federal Ministry for Economic Affairs and Energy (BMWi) and has to be coordinated with the other ministries before the report is submitted to the Cabinet.
- The **Federal Cabinet** adopted the first monitoring report on December 19, 2012 and the second one on April 8, 2014. The first progress report passed the Cabinet on December 06, 2014
- At the same time the **Expert Commission's statements** on the monitoring and progress reports were submitted to the Cabinet as well as to the German Parliament.
- The **Federal Network Agency** acts as the head office and supports the monitoring process

## Members of the Expert Commission on the “Energy of the future” monitoring process

- Prof. Dr. Andreas Löschel (chair)  
Centre for European Economic Research (ZEW), Karlsruhe
- Prof. Dr. Georg Erdmann  
Berlin University of Technology, Dept. for Energy Systems, Berlin
- Prof. Dr. Frithjof Staiß  
Centre for Solar Energy and Hydrogen Research Baden-Württemberg (ZSW), Stuttgart
- Dr. Hans-Joachim Ziesing  
Working Group on Energy Balances (AGEB), Berlin

The Expert Commission is supported by research associates from ZEW, Berlin University, ZSW and Ecologic

Outline of the Government's first report (125 p) = second report (138 p)

1. "Energiewende" and the three goals of energy policy
2. Quantitative targets of the "Energiewende"
3. Development of the energy supply
4. Energy efficiency
5. Renewable energies
6. Power plants
7. Existing grids and grid extension
8. Buildings and Transport
9. Greenhouse gas emissions
10. Energy prices and energy costs
11. Overall economic effects of the "Energiewende"

## Outline of the Commission's first statement (138 p)

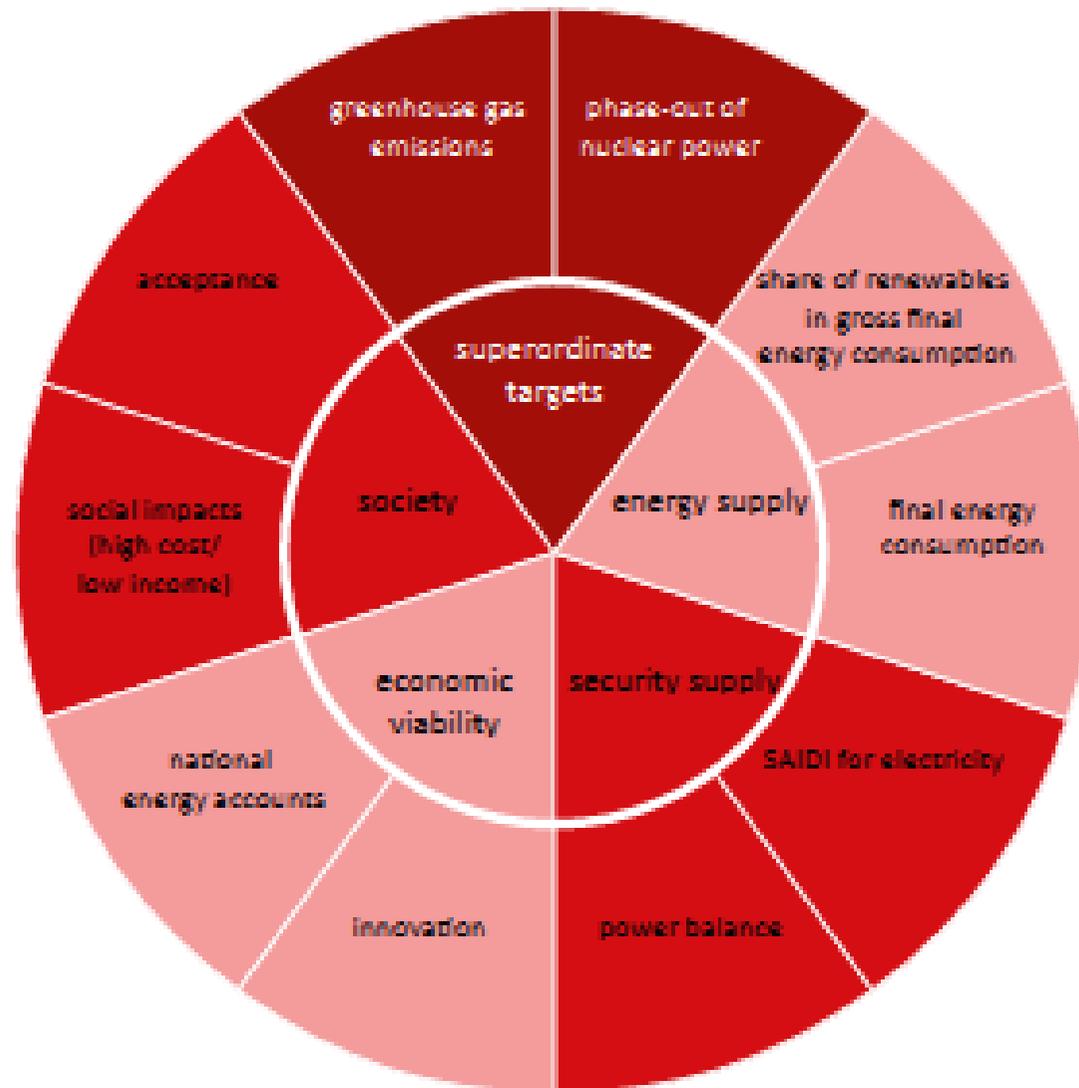
1. About target priorities
2. Monitoring process and the system of indicators
3. Initiatives concerning energy efficiency
4. Progress of renewable energies
5. Environmental impacts of the energy transition
6. Security of supply
7. Economic efficiency of the energy system
8. Macroeconomic effects
9. Coordination between the German and the European energy policy
10. Interactions between the quantitative targets of the German energy concept

## Problems regarding the monitoring

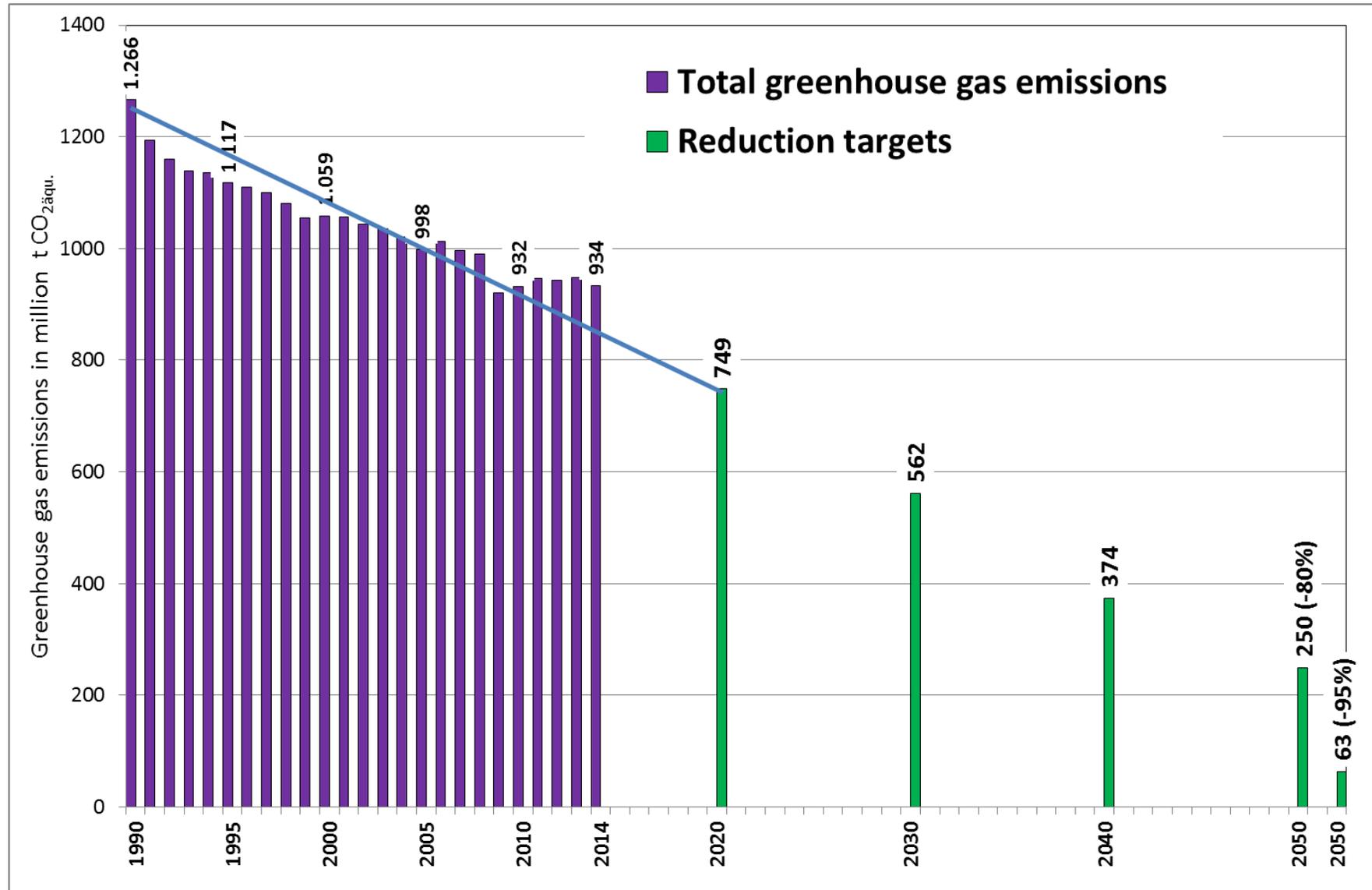
- choice of indicators
- data availability, timeliness, transparency, resilience
- Qualified description of policies and measures
- Cause-and-effect-relationship
- Focussing targets – conflicts of goals – hierarchy of objectives
- Ex-post versus ex-ante analysis

# Lead indicators for the "Energy for the future" monitoring process

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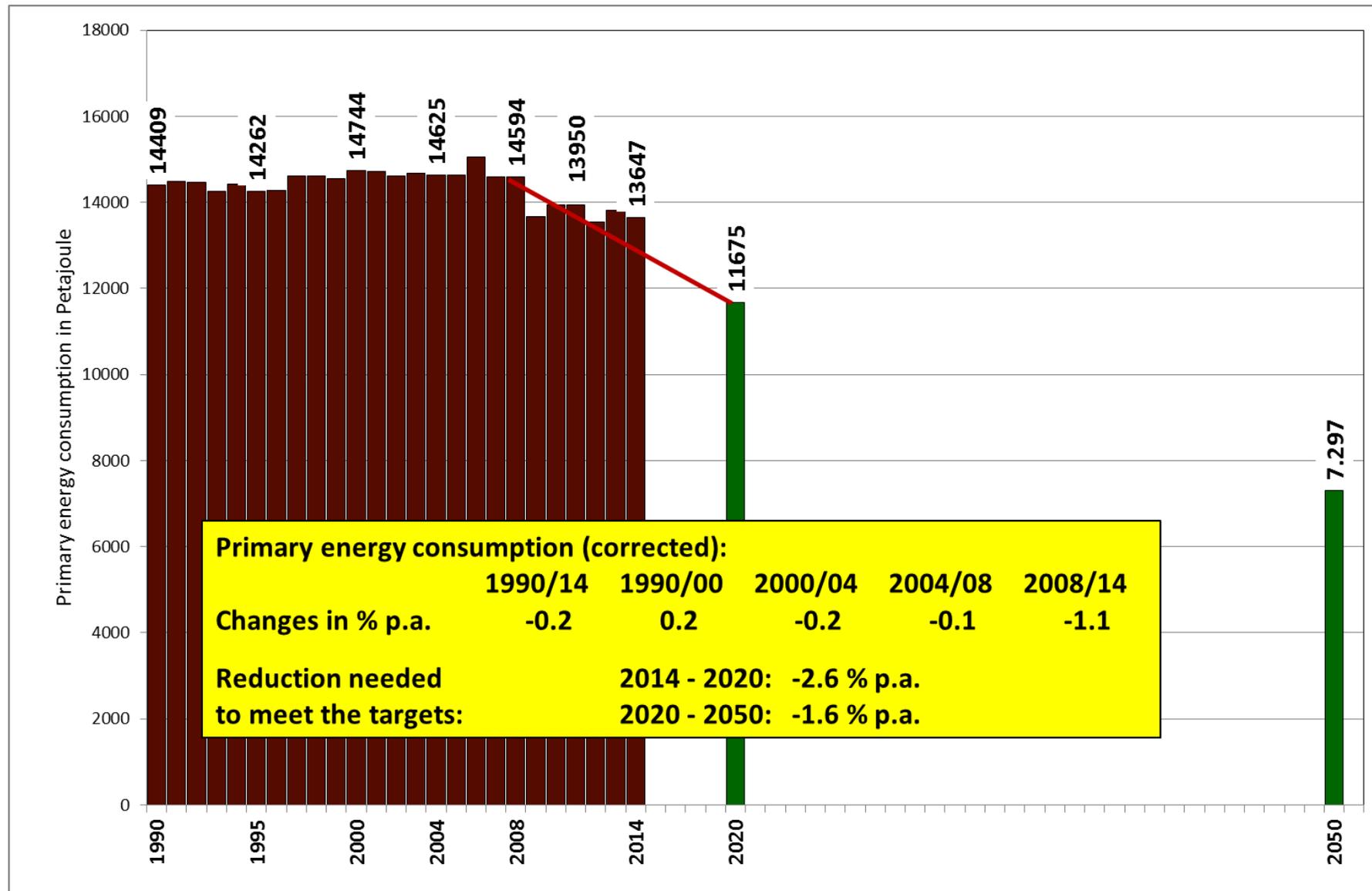


# Greenhouse gas emissions in Germany 1990 – 2014 and targets for 2020, 2030, 2040 and 2050



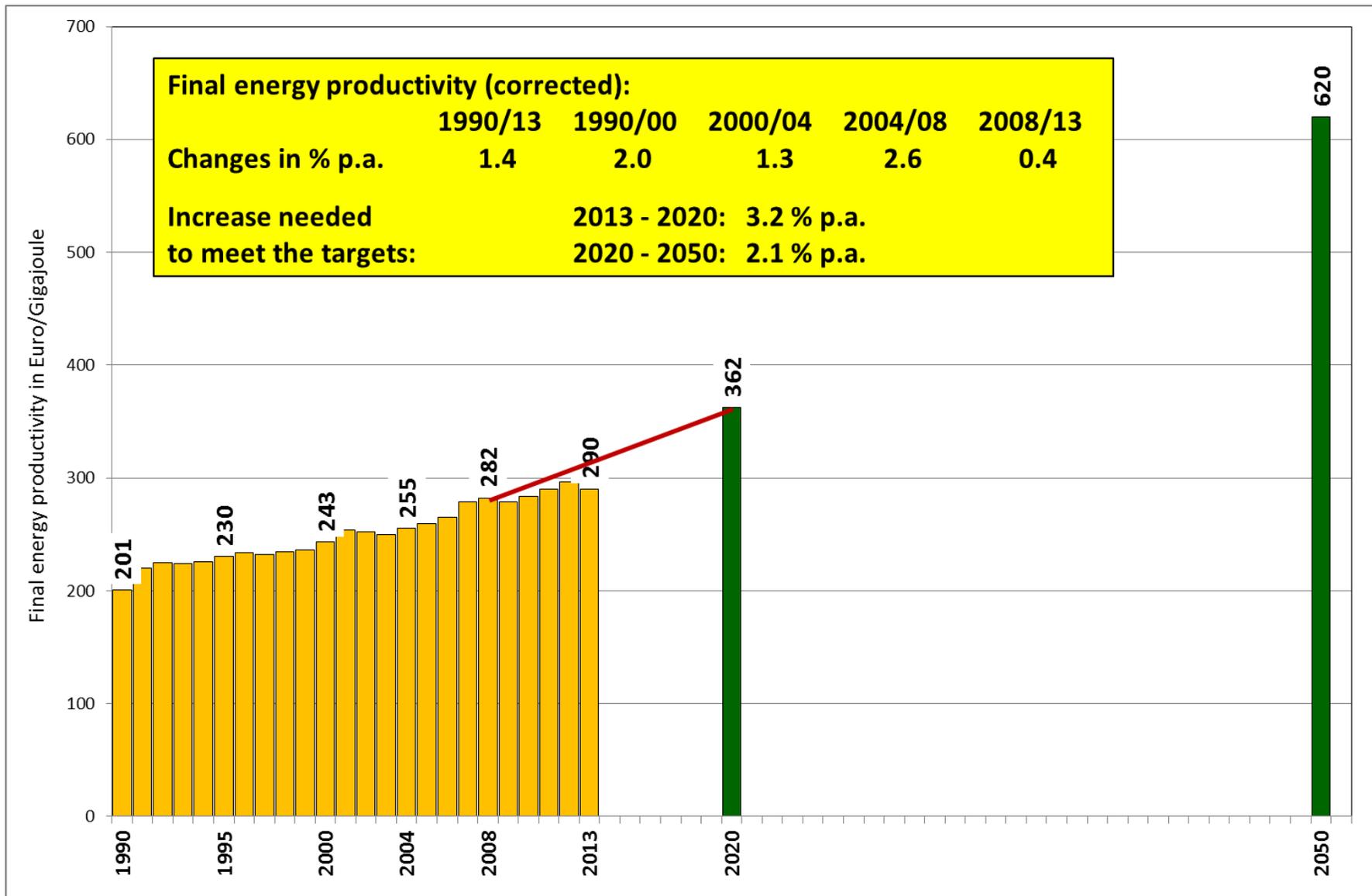
Sources: Federal Government; Federal Environment Agency; author's calculation.

# Primary energy consumption in Germany 1990 – 2014 and targets for 2020 and 2050



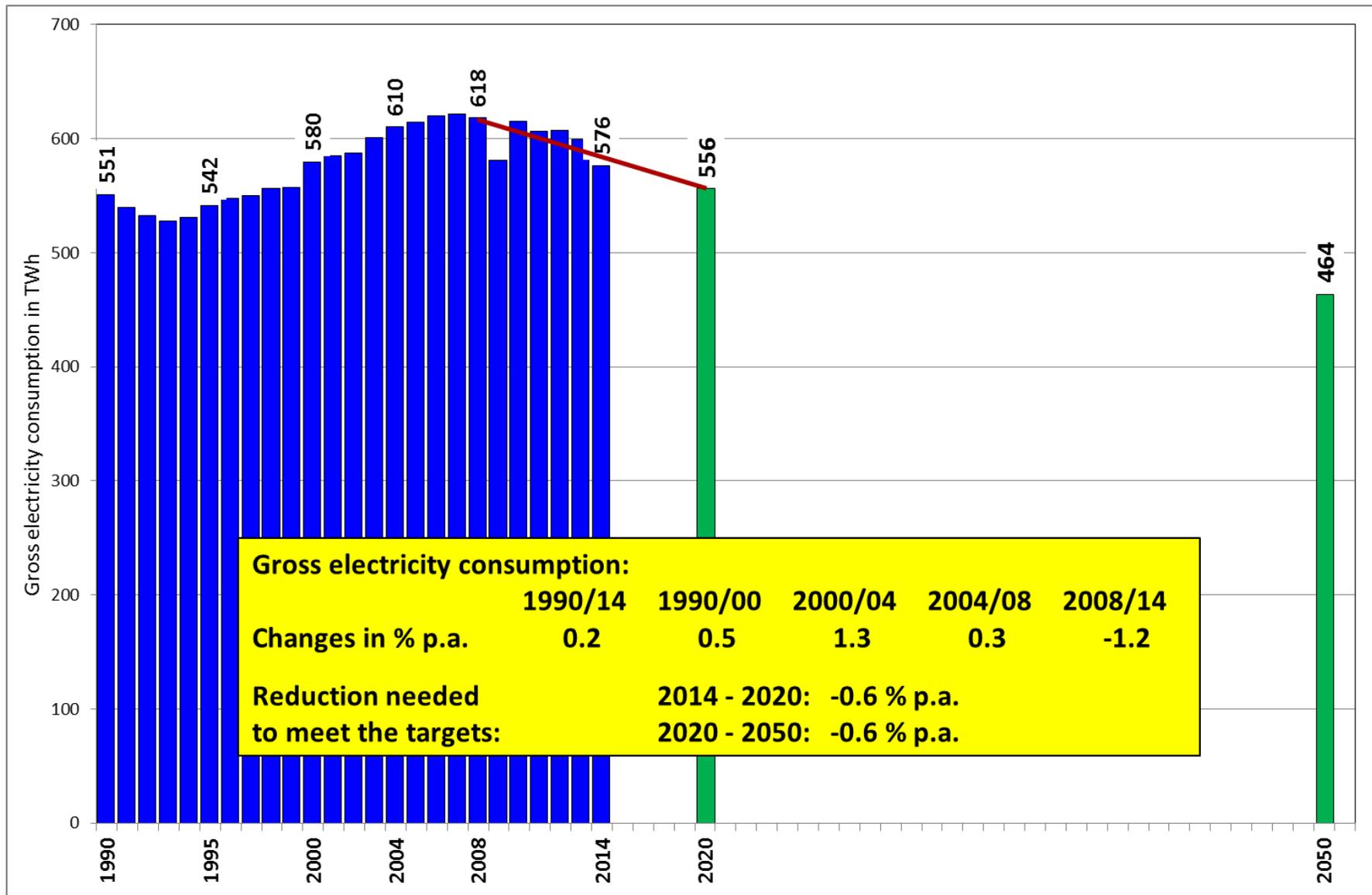
Sources: Federal Government; Working Group on Energy Balances; author's calculation

# Final energy productivity in Germany 1990-2013 and targets 2020 to 2050



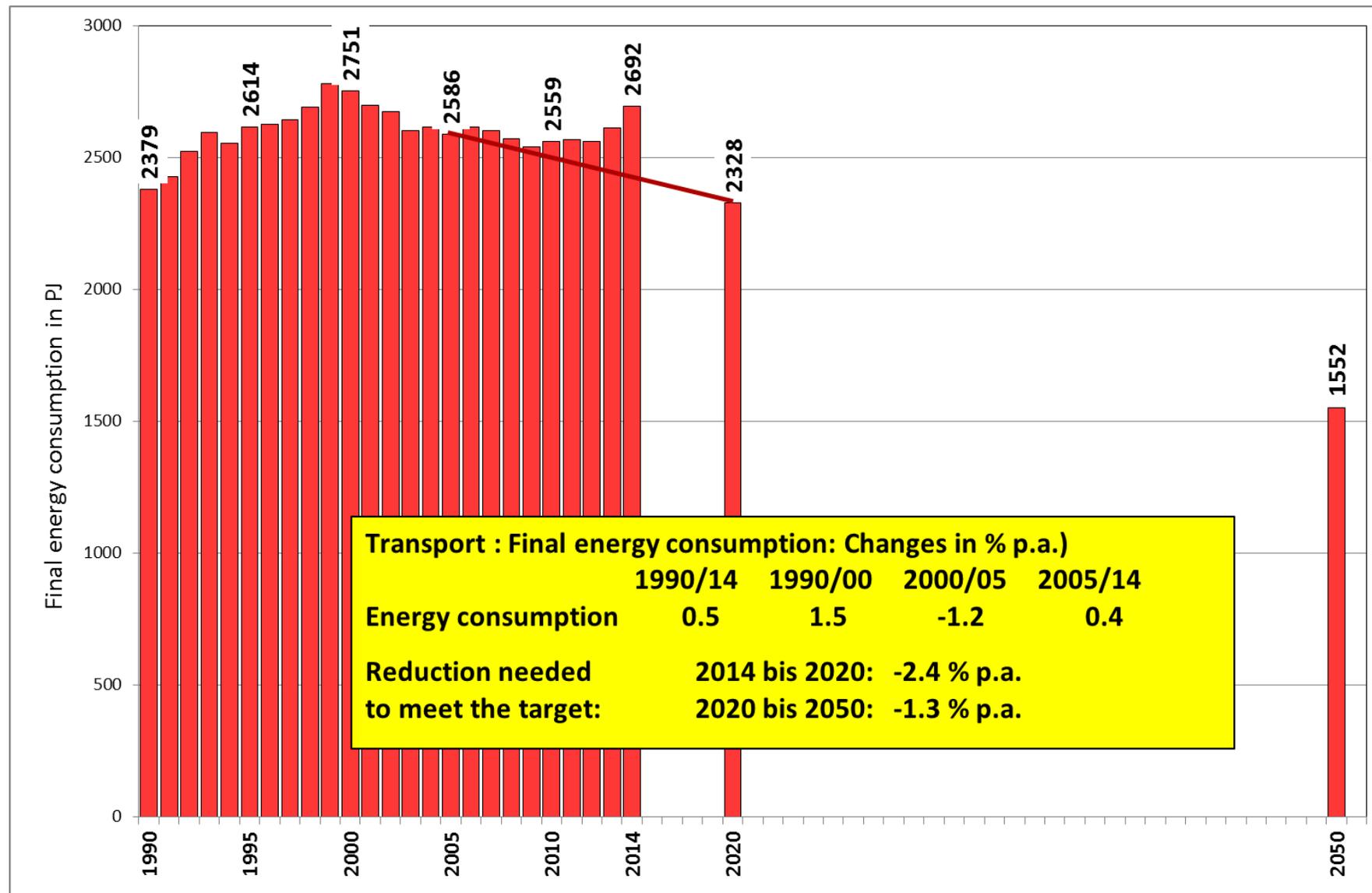
Sources: Federal Government; Federal Statistical Office; author's calculation

# Gross electricity consumption in Germany 1990-2014 and targets for 2020 and 2050



Sources: Federal Government; German Association of Energy and Water Industries (BDEW); author's calculation.

# Energy consumption in transport in Germany 1990 - 2014 and targets for 2020 and 2050



Sources: Federal Government; Working Group on Energy Balances; author's calculation

## The transformation requires very soon additional short-term activities

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- There is a need for action regarding the necessary **extension of the transmission and distribution grid** for electricity.
  - **Ensuring the power supply** requires new power plants. At present there are no economic incentives for any new investment..
  - **Reform of the EEG** ( Renewable energy act) is an ongoing task.
  - The **measures to increase energy efficiency** must be significantly increased in almost all sectors
  - In particular, the very ambitious long term objectives for the **building stock** need a drastic expansion of effective support measures..
  - The same applies to the **transport sector**, in which neither a trend of a decline in fuel consumption and CO<sub>2</sub> emissions can be seen nor sufficient political incentives are implemented..
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Government's reaction: National Action Plan on Energy Efficiency (NAPE) adopted by the German cabinet on 3 December 2014

- Supplying more information and advice on energy efficiency.
- Promoting efficiency investments through granting tax incentives for efficiency measures in residential buildings and special depreciation allowances for commercially-used electric vehicles
- Obligation for large-scale enterprises to conduct energy audits
- Setting standards for new installations and buildings.
- Promoting up to 500 energy-efficiency networks.
- Starting a competitive tendering scheme for energy efficiency

# Government's reaction: Climate Action Programme 2020 adopted by the German cabinet on 3 December 2014

Key policy measures	Contribution to greenhouse gas emission reduction (million t CO <sub>2</sub> equivalent)
National Energy Efficiency Action Plan (NAPE) (without measures in the transport sector)	approx. 25 - 30 million t (including energy efficiency in buildings)
Strategy on climate-friendly building and housing (contains NAPE measures specific to buildings)	In total approx. 5.7 - 10 million t (1.5 - 4.7 million t of which in addition to NAPE)
Measures in the transport sector	approx. 7 - 10 million t
Reduction in non-energy-related emissions in the sectors: <ul style="list-style-type: none"> <li>• industry, commerce/trade/services and waste management</li> <li>• agriculture</li> </ul>	3 - 7.7 million t  3.6 million t
Emissions trading reform	Dependent on decisions at EU level on structure
Further measures, especially in the electricity sector	22 million t
<b>TOTAL:</b>	<b>62 - 78 million t</b>
<b>Climate mitigation gap: 5 to 8 percentage points <math>\cong</math> 62.5 to 100 million tonnes CO<sub>2</sub> equivalent</b>	

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## Conclusion (1):

The energy transition needs an effective and efficient policy mix

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- 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

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- 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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