



Federal Ministry
for Economic Affairs
and Energy

Second Monitoring Report “Energy of the future”

Summary



Imprint

Publisher

Federal Ministry for Economic Affairs
and Energy (BMWi)
Public Relations
11019 Berlin
www.bmwi.de

Design and production

PRpetuum GmbH, Munich

Status

March 2014

Print

MKL Druck GmbH & Co. KG, Ostbevern

Photographs

demachi – Thinkstock (cover), Coloures-Pic – Fotolia (p. 3)

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Public Relations Department
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Foreword

One of the main challenges facing this German government is to bolster prosperity and competitiveness and make Germany one of the most energy-efficient and environmentally friendly economies in the world whilst ensuring energy prices remain affordable.

To this end, the government is systematically and methodically continuing the development towards a nuclear-free energy supply with a constantly increasing share of renewable energy sources and growing energy efficiency. The German government's aim is to turn the Energiewende – the transformation of Germany's energy system – into a driver of progress for Germany as a centre of industry and in doing so to secure sustainable economic prosperity, future-proof jobs, innovation and the modernisation of our country. The 2010 Energy Concept and the June 2011 energy policy decisions continue to apply here.

The Energiewende pursues the aim of lowering greenhouse gas emissions by 80 to 95% by 2050 and of fully phasing out the use of nuclear power by 2022. Furthermore, the German government is championing a sustainable, constant and affordable expansion of renewable energy sources. In addition to this, greater importance must be attached to lowering energy consumption through greater energy efficiency – one of the key elements of the Energiewende. The goal is to reduce primary energy consumption by 20% by 2020 and by 50% by 2050 compared to 2008 levels. There is to be a successive shift towards using mainly renewables to generate energy, so that in 2050 renewables will account for 60% of gross final energy consumption and 80% of gross electricity consumption.

The expansion of renewables has been very dynamic in recent years. Now it is above all a question of better steering this expansion as it continues, making it more cost-efficient and in turn stabilising it.

When restructuring the energy supply, the three dimensions of supply security, affordability and environmental soundness must all be ensured equally. This energy policy triangle must remain the basis and benchmark for all energy policy instruments and the targets must be tailored to each other in a balanced way.

The transformation towards a new energy era is making headway. In 2012, renewables were the second largest source of electricity. Greenhouse gas emissions had been lowered by 24.7% by 2012 compared to 1990 levels. Adjusted for temperature and inventory effects, primary energy consumption went down by one per cent compared to the previous year. The 2012 amendments to the Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG) made it possible to reduce the costs of support for new installations considerably, especially in terms of photovoltaic feed-in tariffs.

Nonetheless, restructuring the entire energy supply does continue to imply challenges, which will also make repeated adjustments necessary to ensure the triangle of targets of a reliable, affordable and environmentally sound energy supply is upheld.



1. The “Energy of the future” monitoring process

To ensure that the development of the Energiewende is monitored continuously and in depth, the German government established the “Energy of the future” monitoring process. In this process, a fact-based overview is used to take regular stock of the implementation of the measures contained in the Energy Concept and progress made in attaining the targets. This is designed to be a long-term process. The second monitoring report presented here relates the facts and the implementation status of the measures to date. Every three years – for the first time at the end of 2014 – a synopsis will be compiled in the form of a progress report in which the implementation status will be examined in terms of the overall context and, where appropriate, new measures will be proposed. One of the tasks of the monitoring process is to consolidate the wide range of statistical information available on energy into a manageable number of select key indicators to make it understandable.

An independent commission comprising four renowned energy experts supports the monitoring process scientifically. The commission comprises Professor Dr. Andreas Löschel (chair), Professor Dr. Georg Erdmann, Professor Dr. Frithjof Staiß and Dr. Hans-Joachim Ziesing. In its first opinion, the expert commission submitted a host of proposals, which in part have already been taken on board in the second monitoring report.

The second monitoring report, unless otherwise specified, is based on data which was able to be taken into account up until 31 December 2013. The data is freely available in file form on the Internet pages of the Federal Network Agency relating to the “Energy of the future” monitoring report.

2. Energy policy targets

The triangle of energy policy targets with its equal targets of security of supply, affordability and environmental soundness remains the basis and benchmark for all energy policy instruments. The German government is continuing the development towards an energy supply free from nuclear power with a constantly growing proportion of

renewables and increasing energy efficiency systematically and methodically.

In addition to the phase-out of nuclear energy by 2022, the energy policy targets contained in table 1 continue to apply.

Table 1: Status quo and quantitative Energiewende targets

Category	2011	2012	2020	2050		
				2030	2040	2050
Greenhouse gas emissions						
Greenhouse gas emissions (compared to 1990)	-25.6%	-24.7%	at least -40%	at least -55%	at least -70%	at least -80% to -95%
Renewable energies						
Share in gross electricity consumption	20.4%	23.6%	at least 35%	at least 50% (2025: 40 to 45%)	at least 65% (2035: 55 to 60%)	at least 80%
Share in gross final energy consumption	11.5%	12.4%	18%	30%	45%	60%
Efficiency						
Primary energy consumption (compared to 2008)	-5.4%	-4.3%	-20%		-50%	
Gross electricity consumption (compared to 2008)	-1.8%	-1.9%	-10%		-25%	
Share of electricity generation from combined heat and power plants	17.0%	17.3%	25%			
Final energy productivity	1.7% per annum (2008–2011)	1.1% per annum (2008–2012)	2.1% per annum (2008–2050)			
Buildings						
Primary energy requirement	–	–	–		around -80%	
Heat requirement	–	–	-20%		–	
Rate of modernisation	approx. 1%	approx. 1%		doubling of levels to 2% per annum		
Transport						
Final energy consumption (compared to 2005)	-0.7%	-0.6%	-10%		-40%	
Number of electric vehicles	6,547	10,078	1 million	6 million		–

3. Measures to implement the Energiewende

To achieve the ambitious long-term targets contained in the Energy Concept of 28 September 2010, various measures were set in motion in the individual fields of action required to transform Germany's energy system. These measures are designed to create the right framework conditions for each specific sector.

The Energiewende is a task for the whole of society and affects all political levels. Successfully restructuring our energy supply requires effective steering and coordinated, concerted action by all relevant stakeholders, both at the federal level and that of the Länder, from business and industry and society in general. Furthermore, implementing the Energiewende in the context of the European single market for electricity and gas makes a close exchange with our neighbours and at European Union level necessary. Only then and by ensuring a high degree of transparency can acceptance be secured for the process and its aims and objectives.

- To improve coordination inside the German government, the competencies for the area of energy policy have been pooled at the new Federal Ministry for Economic Affairs and Energy.
- The state secretary steering group, the conference of economics and environmental ministers, the summit with the Federal Chancellor and the State Premiers of the Länder, and the meeting in preparation of this held by the Head of the Federal Chancellery with the Heads of the Länder Chancelleries enabled the political decision makers to take stock of progress to date and coordinate future projects.
- In bilateral talks, in the various European Union council formats and in close exchange with the European Commission, the German government regularly discusses the Energiewende targets and their implementation. Here, particular attention is paid to challenges relating to the single market, for instance in the area of cross-border grid expansion or with regard to framework conditions for support for renewable energies. Above and beyond this, the German government endeavours to ensure that the continued development of the European climate and energy framework supports the Energiewende in Germany and its integration into the European single market for electricity and gas.
- On high-level specialist panels, the German government is in constant contact and exchange with representatives from the Länder, business and industry, society and the scientific community. Particularly worth mentioning here are the „Future-oriented Grids” platform, the Power Plant Forum *inter alia* with the “Strategic Reserve” expert dialogue, the “Renewable Energies” platform, the “Energy Efficiency” dialogue forum, the “New Energy Technologies” coordination platform, the “Energiewende” research platform and the “Dialogue on the Renewable Energy Sources Act”.
- In order to step up the exchange further, the German government plans to set up further panels such as the “Energiewende Forum (Energy Council)” and the “Nature conservation and the Energiewende” centre of excellence.

For renewables, the expansion over the last few years has been very dynamic. Now it is first and foremost a matter of better steering and stabilising the continued expansion whilst making it more cost-efficient.

- With the overhaul of the Renewable Energy Sources Act (EEG) in 2014, the scale and speed of the increase in costs is to be noticeably checked. To this end in the revised Act the German government sets forth a reliable expansion corridor (see table 1). The corridor for expansion enables better linkage to the expansion of the grid. In addition to this, the intention is to improve cost-efficiency, in particular by avoiding over-subsidisation, a continual rollback of funding, concentrating the special equalisation scheme on electricity-intensive companies competing on the international stage and a balanced provision for auto-generation of electricity.
- Furthermore, financial support is to focus more on economic viability. For this purpose by 2017 at the latest, a binding direct marketing obligation on the basis of the sliding market premium will be introduced for all new installations of 100 kW and over. There is also a pilot tender project under way to the tune of 400 MW of solar park installations to gather experience with tender models and this tender design and to verify whether and to what extent the Energiewende targets can be attained more cost-effectively this way. By 2017 at the latest, the financial support for renewables and the level thereof is to be determined competitively by means of technology-specific tenders.

- Two revisions of the EEG in 2012 already allowed costs to be contained and the market and system integration of renewables to be improved. PV capacity expansion was stabilised and the costs of feed-in tariffs were significantly lowered. In addition to this, the decision was taken to stop PV support once an installed output of 52 GW has been attained. Increasing market integration thanks to the introduction of the market premium is a key step towards cutting costs.
- In the field of offshore wind power, compensation provisions have been enacted for delayed grid connection. Furthermore, the German government adopted the offshore grid development plan.
- In the heat sector, the German government presented the first report taking stock of the experiences with the Renewable Energies Heat Act (Erneuerbare-Energien-Wärmegesetz), which examines *inter alia* the attainment status of the statutory target. The market incentive scheme rounds off the Renewable Energies Heat Act.
- In the transport sector, the share of energy from renewables is provided mainly by biofuels. Here, the Biofuels Quotas Act (Biokraftstoffquotengesetz) stipulates the minimum amount of biofuels to be used. It is rounded off by the Biofuels Sustainability Ordinance (Biokraftstoff-Nachhaltigkeitsverordnung).

For a reliable electricity supply, power plants have to be able to generate sufficient electricity at any given time.

- With the “Winter Act” to ensure security of supply and the Ordinance on Reserve Power Plants (Reservekraftwerksverordnung), the German government has taken steps to ensure Germany has a secure energy supply.
- The amended Combined Heat and Power Act (Kraft-Wärme-Kopplungs-Gesetz) enables continued support for highly efficient combined heat and power generation.
- The German government is pushing research and development for storage technologies forward and has made 200 million euros available for the “Energy Storage Funding Initiative” as part of the 6th Energy Research Programme. At the end of 2013, the relevant federal ministries had approved 255 innovative research projects totalling 181 million euros in the field of energy storage.

Accelerated grid expansion is essential to the success of the Energiewende. The German government has therefore put in place the framework conditions for accelerated expansion of the grid.

- The amended Energy Industry Act (Energiewirtschaftsgesetz - EnWG), the Grid Expansion Acceleration Act (Netzausbaubeschleunigungsgesetz - NABEG) and the Federal Requirements Planning Act (Bundesbedarfsplangesetz - BBPlG) lay the foundation for the coordinated, accelerated and transparent expansion of the electricity grids. The Federal Requirement Plan is the central instrument for the expansion of transmission systems and stipulates the necessary and priority projects for the energy industry and accelerates the procedures entailed. Extensive and broad involvement of citizens is one of the key features of the new provisions.
- The expansion of transmission lines for renewable electricity inside Germany and across national borders is of particular importance in the BBPlG, also with a view to trading electricity with our neighbours.
- The Ordinance on Agreements on Interruptible Loads (Verordnung über Vereinbarungen zu abschaltbaren Lasten - AbLaV) is designed to increase system stability by enabling system operators to remove industrial loads from the grid flexibly in critical situations.

The German government used various instruments to enhance energy efficiency.

- Information and advice: for instance on-site energy advice for owners of residential buildings, energy advice services for consumer advice centres, the Energy Efficiency Initiative, the Electricity Saving Initiative and specific advice and support services for low-income households
- Various funding and support measures: for instance KfW (the government-owned development bank) funding schemes
- Regulatory policy frameworks: for instance the amendment of the Energy Saving Ordinance (Energieeinsparverordnung - EnEV)
- Fiscal policy provisions: for instance, the revised tax cap provision for the most energy-intensive users in the Energy Tax Act and Electricity Tax Act (Energiesteuer- und Stromsteuergesetz)
- The German government will continue to bolster the key role played by energy efficiency as the second pillar of the Energiewende and ensure proper implementation

of the EU Energy Efficiency Directive with new measures as well. The course adopted of boosting energy efficiency through a philosophy of “requirements and incentives” combining standards, information and stimulus, will be continued in 2014 with a National Action Plan on Energy Efficiency and reviewed by an annual monitoring process.

The building sector harbours huge potential for improving efficiency, but high annual investments are required to leverage it.

- The Energy Saving Ordinance (Energieeinsparverordnung - EnEV) sets out minimum requirements in terms of the energy properties of building shells and systems technology for new buildings and larger-scale modernisations of existing buildings.
- Since 2009, the Renewable Energies Heat Act (Erneuerbare-Energien-WärmeGesetz – EEWärmeG) has obligated owners of new buildings to cover a portion of heat energy needs with renewables.
- Various KfW support schemes promote improved energy efficiency in buildings.

In the transport sector, alongside the EU regulations to limit CO₂ emissions for new cars and light commercial vehicles, key elements are the Motor Vehicle Taxation Act (Kraftfahrzeugsteuergesetz), CO₂ labelling, the Mobility and Fuel Strategy and the National Innovation Scheme for Hydrogen and Fuel Cell Technology.

To lower greenhouse gas emissions, the German government is focusing mainly on two strategies: first of all increasing energy efficiency and second, constantly expanding renewables so they become the main pillar of our energy supply. In addition to this, the German government has taken a host of measures to attain its climate protection targets.

- Emissions trading is an important overarching instrument in Germany and in Europe which aims to reduce CO₂ emissions by 21% by 2020 compared to 2005 levels. The instrument covers around 50% of German greenhouse gas emissions. The German government has set itself the objective of promoting an effective emissions trading system at European level.

- Various measures were pursued to fund climate protection, for instance the establishment of the Energy and Climate Fund.
- There are projects and schemes to protect the climate as part of the National Climate Protection Initiative.
- In the context of international activities for climate protection, the International Climate Protection Initiative (ICI) is particularly worth highlighting.

With its Energiewende, Germany is making a special contribution to developing energy technology which also serves the pan-European climate and energy targets. But the Energiewende also has a price tag. This makes endeavours to ensure the costs remain reasonable and ultimately affordable all the more important. The German government attaches particular importance to the cost dynamics of implementing the Energiewende. It is crucial that a level playing field be secured for companies producing in Germany which have to compete on the European and global stage, also so that companies are not tempted to move abroad. Private households and companies that do not receive special support are also reliant on affordable energy prices.

- The special equalisation scheme allows electricity-intensive companies from the manufacturing industry competing at an international level to apply for a cap on the EEG surcharge. The 2012 EEG amendment extended the scope of application of this provision, whilst only slightly increasing the total amount of electricity exempt.
- From 2013 onwards, electricity-intensive companies competing internationally are reimbursed for part of their increased electricity costs resulting from the EU emissions trading scheme. The German provision received approval under legislation governing the provision of state support in July 2013.
- The revision of the Ordinance on Electricity Grid Charges (Stromnetzentgeltverordnung) created planning and legal certainty for grid charges. In particular, the introduction of staggered grid charges means electricity consumers using high levels of energy also have to contribute more to covering grid costs.
- The amendment to the Energy Tax Act and the Electricity Tax Act, and the amendment to the Aviation Tax Act (Luftverkehrssteuergesetz) mean that companies from the manufacturing sector now only receive a tax cap on energy tax and electricity tax if they meet certain efficiency requirements.

4. Key findings of the second monitoring report

Energy consumption and energy efficiency

- Primary energy consumption was lowered by 4.3% between 2008 and 2012. Compared to the previous year, in 2012 primary energy consumption rose by 1.2% to 13,757 PJ due to the cold weather conditions. Adjusted for temperature and stocking effects, however, primary energy consumption fell by 1.0% compared to the year before.
- In 2012, gross electricity consumption totalled 605.6 TWh and was therefore at the same level as in 2011. Compared to the reference year 2008 it fell by 1.9%.
- Final energy productivity (ratio of real GDP to final energy consumption) rose in the period from 2008 to 2012 by an average of 1.1% per annum. This means that the increase in energy efficiency will have to be improved if the German government's target of an average annual increase of 2.1% by 2020 is to be achieved.

Renewable energies

- In 2012 too, the dynamic expansion of renewables continued. Its share in gross final energy consumption rose to 12.4% in 2012. Germany was thus on track towards the expansion targets set out in the Energy Concept in 2012 as well.

- The share of renewables in gross electricity consumption rose to 23.6% in 2012. This makes renewables the second largest source of electricity in Germany after lignite.
- The heat market accounts for more than half of final energy consumption. The share of renewables in the provision of heat climbed from 4.0 to 10.0% between 2000 and 2012.
- The EEG surcharge levied in 2012 to support electricity from renewable energies was 3.59 ct/kWh. The actual differential costs in 2012 amounted to 16.0 billion euros. In 2013 the EEG surcharge levied was 5.28 ct/kWh. The differential costs on the basis of the projections by the transmission system operators totalled 16.2 billion euros. The German government has not yet received the final figures for the actual differential costs calculated for the calendar year 2013.
- The tariff payments for plants installed over the last few years make up the largest share of the EEG surcharge. Compared to existing plants, the new plants added in 2012 and 2013 account for a relatively low share as the aforesaid measures taken by the German government to lower costs and stabilise expansion are bearing fruit.
- Two revisions of the EEG in 2012 enabled costs to be contained and the market and system integration of renewables to be improved. Whilst just a few years ago the feed-in tariffs were between 32 and 43 ct/kWh, most recently they were between 9.4 and 13.5 ct/kWh.

Figure 1: Development of economy-wide primary and final energy productivity

in euros/GJ

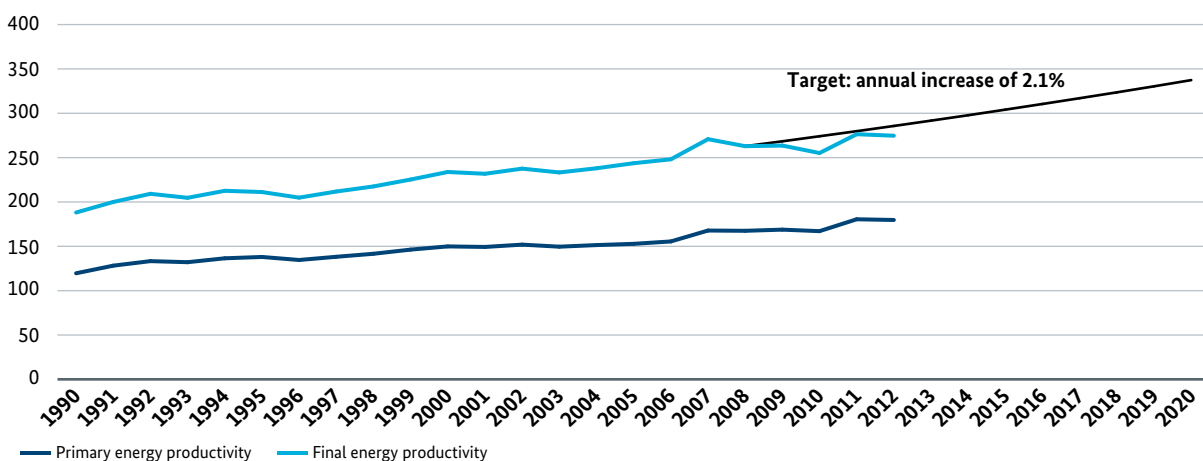
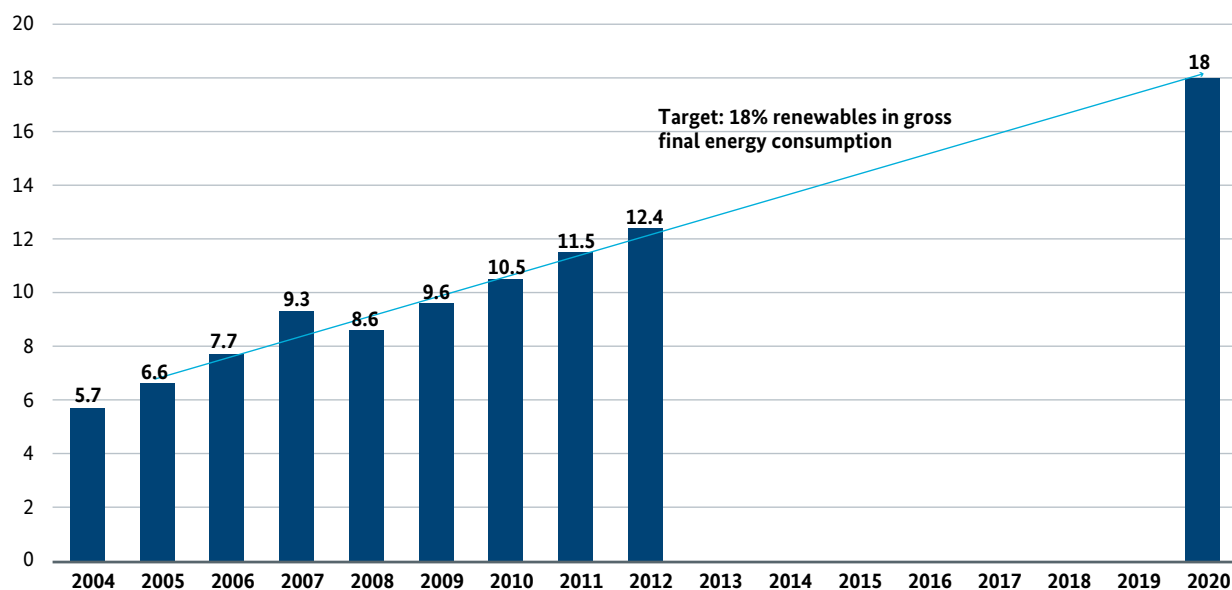


Figure 2: Development of the share of renewables in gross final energy consumption

Figures in per cent



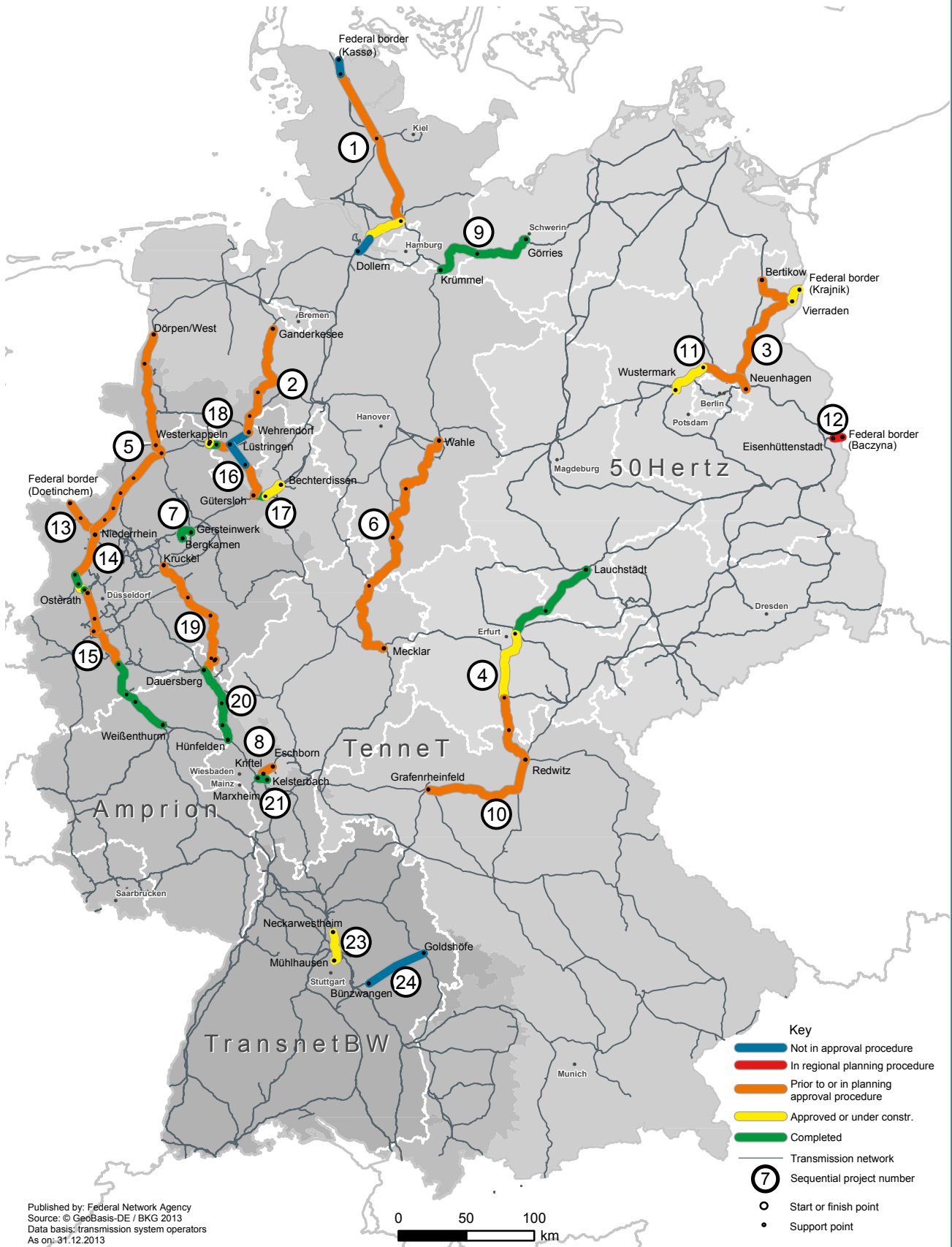
Source: Federal Ministry of Environment 2013 based on AGEE data. As in December 2013. Reference year of EU Directive 2009/28 EC is 2005

- A lower stock market price for electricity increases the differential costs borne by consumers. In 2012 the lower stock market price contributed significantly to the higher EEG surcharge. If the EEG surcharge and the spot market price at the electricity exchange are taken together, then one sees that the total of the two had increased to a far lower degree since 2010 than the EEG surcharge.

Power plants and grids

- In 2012, security of supply in the area of electricity, i.e. the constant and sufficient supply of energy to households and business and industry was ensured. The electricity supply in Germany is one of the most reliable in the world.
- The German energy supply remains reliant on imported energy. The structure of Germany's primary energy supply continues to be broadly diversified, however, so neither primary energy consumption nor electricity generation in Germany is dominated by an individual energy source. In this area, too, supply was secure at all times in spite of rising commodities prices.
- The structural change in the stock of German power plants continued in the year under review of 2012. Whilst the primary energy consumption of fossil energy sources and of nuclear power fell by around 8.5% between 2008 and 2012, primary energy consumption of renewable energy sources rose by around 39% during the same period. Currently, fossil energy sources – especially coal (lignite and hard coal) – combined with nuclear energy provide the largest share of the electricity produced in Germany. In 2012 conventional power plants contributed around 75% to electricity generation in Germany and renewables around 25%. The restructuring of the energy supply towards more renewable energies will continue to change the traditional energy mix.
- To successfully integrate the growing share of renewable energies, to integrate new conventional power plants and to consolidate the European electricity trade, the rapid expansion and restructuring of the electricity grids in Germany and Europe is of key importance. Grid bottlenecks during the winter of 2012/2013 made repeated intervention by the transmission system operators necessary to maintain system reliability. Grid stability was ensured at all times however.
- The situation in southern Germany is likely to remain tense for the moment. The planned grid expansion can improve this situation structurally and should therefore be implemented swiftly and with high priority. The requisite lines are already included in the 2009 Energy Line Extension Act (Energieleitungsausbaugesetz) and the approval procedures are already under way at the Länder authorities.

Figure 3: Status of the expansion of energy lines pursuant to the Energy Line Extension Act (EnLAG)



Published by: Federal Network Agency
 Source: © GeoBasis-DE / BKG 2013
 Data basis: transmission system operators
 As on: 31.12.2013

Buildings

- Building-related final energy consumption totalled 3,305 PJ in 2012 and thus accounted for 36.7% of total final energy consumption.
- After adjustments for temperature, in 2012 specific final energy consumption for private households for room heating was around 146.7 kWh/m². Specific energy consumption for heating adjusted for differences in temperature was thus around 25% lower than it was ten years earlier.

Transport

- Final energy consumption in the transport sector totalled 2,571 PJ in 2012, this means that compared to the target's reference year of 2005 final energy consumption fell by just 0.6%.
- However, passenger and freight kilometres travelled have increased by around 4 and 9% respectively since 2005.
- Since 1990, the specific final energy consumption in the transport sector (based on passenger and freight kilometres travelled) has fallen by an average of 2.9% per annum.

Greenhouse gas emissions

- In the context of its international commitment from the Kyoto Protocol, Germany had reduced its greenhouse gases by 24.7% by 2012 compared to the reference year of 1990. On average, emissions were 23.6% lower from

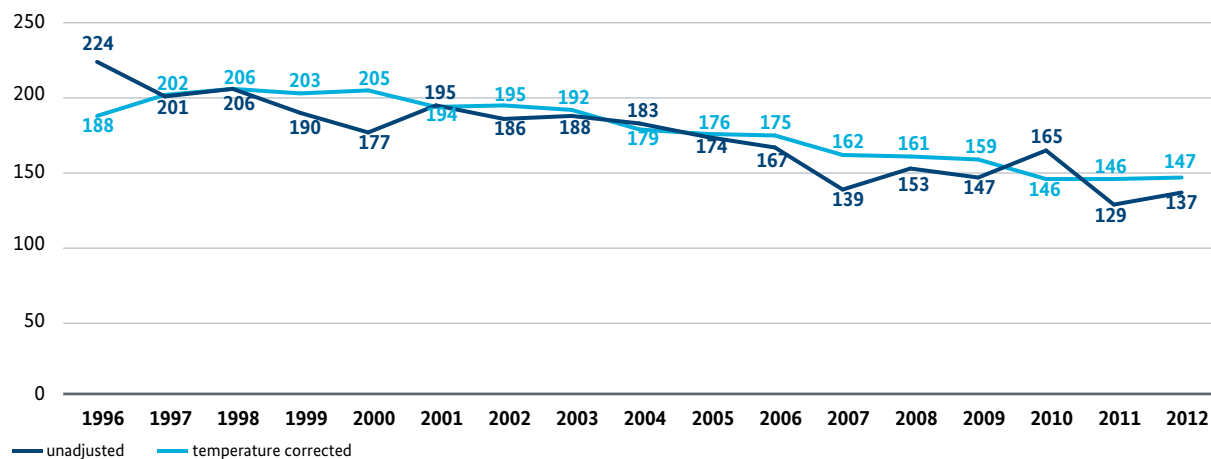
2008 to 2012 than in the reference year. As such Germany more than met its Kyoto target (21% on average for 2008 to 2012).

- In the energy sector, which at over 80% is the most significant source of greenhouse gas emissions in Germany, it has been above all the switch to lower-emission energy sources and increased efficiency that have contributed to this reduction.
- The CO₂ certificate price in the European emissions trading system averaged at around 7.47 euros in 2012. The reason was above all a surplus of certificates due to the impacts of the financial and economic crisis and the use of international project credits.

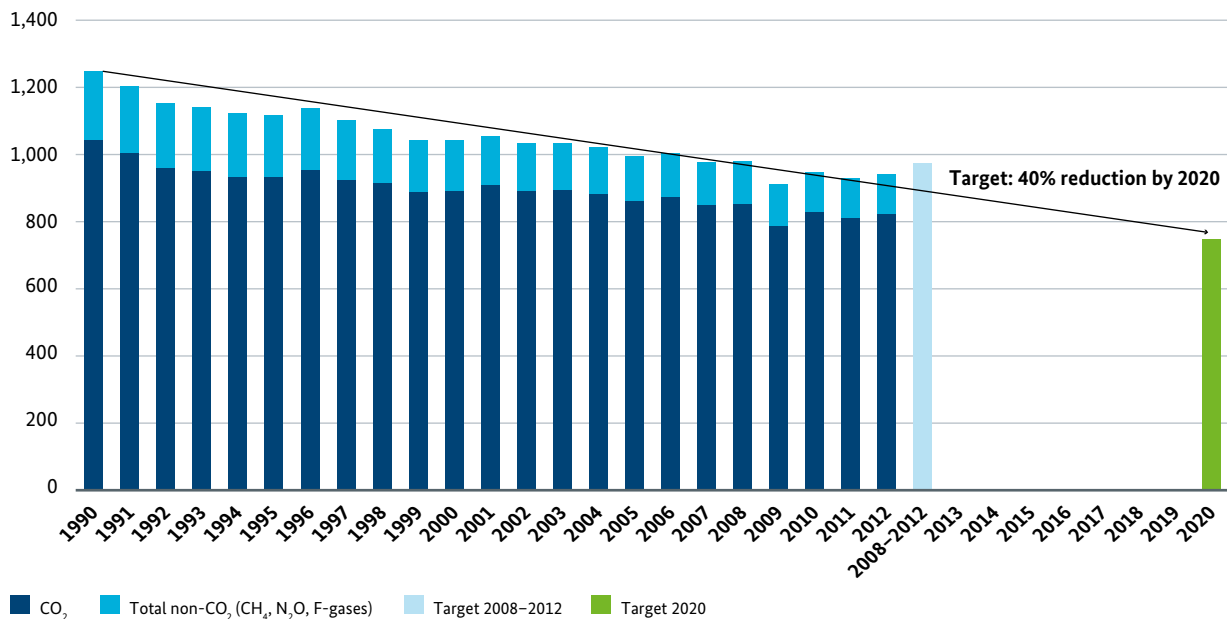
Energy prices, energy costs and macroeconomic effects of the Energiewende

- In 2012, the general trend of rising raw materials prices continued. The record international prices for crude oil in particular translated in part into major spikes in heating oil and fuel prices.
- Stock market electricity prices fell by between 12 and 17% on average for the year. An important reason for this was the continued rise in the amount of electricity on offer thanks to renewables. Final consumer prices for electricity rose for private households and for most commercial and industrial customers, also against the backdrop of higher price components introduced by the government.
- Energy costs for households increased both in absolute figures and as a proportion of income. Car use above

Figure 4: Development of the specific final energy consumption for the generation of heating power for private homes in kWh/m²



Source: AGEB, Federal Statistical Office

Figure 5: Development of greenhouse gas emissionsCO₂ equivalent in million tonnes

Source: Federal Environment, as in January 2014

all had a major influence on costs. The proportion of income spent on electricity and gas costs was lower by comparison.

- Energy procurement costs for industry in Germany rose in 2012 by 1.6%. Electricity-intensive commercial and industrial customers pay very varying electricity prices as these are negotiated individually between the electricity provider and the electricity consumer depending on the volumes ordered and the order continuity.
- For the economy as a whole, energy expenditure increased in relation to gross domestic product. The German economy's spending on electricity in relation to gross domestic product is at the level of 1992.
- Macro-economically, investments in renewables and energy efficiency are one of the most important drivers of the Energiewende. In 2012, the estimated level of investment in the area of renewables was 19.5 billion euros. Investments in energy efficiency are being promoted in particular by public support schemes, in particular by the 3.5 billion euros provided for energy efficiency measures by the government-owned Kreditanstalt für Wiederaufbau development bank.
- The expansion of renewables and increased energy efficiency have contributed to savings in primary fossil energy sources in Germany. The German economy, which is low on its own raw materials, is reliant on importing primary fossil energy sources, which may face further price increases. In light of this, reducing the

imports of fossil energies contributes to reducing Germany's exposure to international price and volume risks.

- Investments in renewables and energy efficiency impact employment thanks to increasing demand in other economic sectors. This contributes to job creation in various areas.
- One of the most important categories of Energiewende benefits is the prevention of greenhouse gas emissions and air pollutants and the problems they entail. The permanent reduction of greenhouse gas emissions on an economically viable scale makes a vital contribution to preventing climate change.
- The German government is systematically gearing energy research to the Energiewende. The Energy Research Programme builds on new crosscutting and system-oriented research approaches. In 2012 research expenditure amounted to 708 million euros. More than 70% of this went into promoting energy efficiency and renewable energies.

