



Federal Ministry  
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# The Energy of the Future

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*Fourth “Energy Transition” Monitoring Report – Summary*



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# Central messages from the Fourth Monitoring Report

- Energy consumption **fell by 4.7% in 2014** from the 2013 level. Much of this reduction can be attributed to the mild winter of 2014. At 13,132 petajoules, **energy consumption** reached its **lowest level since 1990**.
- **Renewables** are Germany's **number-one source of electricity**. In the first half of 2015, the proportion of electricity consumption covered by renewable energy rose **above 30%** for the first time. Germany is on course to meet its renewable electricity consumption targets. The level of the **EEG surcharge** has **stabilised**.
- On average, Germany's **energy efficiency increased** by an annual **1.6%** between 2008 and 2014, which is less than the 2.1% envisaged by the Federal Government in its Energy Concept. **Further action** is required here. For this reason, the Federal Government brought together and strengthened the efforts to boost energy efficiency in the **National Action Plan on Energy Efficiency** adopted on 3 December 2014.
- **Final energy consumption** in the **transport** sector was approx. **1.7% higher** in 2014 than in 2005. If Germany is to attain its target of cutting final energy consumption by 10% from the 2005 figure, **further efforts** will be required.
- For the first time in more than ten years, the **electricity prices** for household customers **fell at the beginning of 2015**. For **industrial and commercial customers** not covered by special arrangements, electricity prices remained virtually **constant** in 2014. **Trading prices for electricity** were **down** by a further 10% last year and have continued to fall in 2015.
- In 2014, Germany **imported fossil fuels** worth **approx. €81 billion**, down from the 2013 figure of around €95 billion. Whilst much of these savings can be attributed to lower commodity prices, Germany has also cut down on the volume of these imports.

# 1 Monitoring the energy transition

**The Energy for the Future monitoring process reviews the energy transition on an ongoing and systematic basis: Where do we stand, and what are the next steps?**

The focus is on three monitoring tasks:

- **Overview:** The monitoring process provides a fact-based overview of the current status of progress with regard to implementation of the energy reforms. It condenses the reams of statistical information on energy that have been collected into a smaller, more manageable number of selected indicators.
- **Evaluation:** Ongoing reports analyse whether the targets set out in the Federal Government's Energy Concept are being met and what effect the measures are having. In areas where the targets are likely to be missed, measures are proposed to enable these targets to be met.
- **Outlook:** The monitoring process also looks ahead to the next few years. To this end, the Federal Government produces summary progress reports every three years, presenting likely developments and deriving recommendations for action.

**The Fourth Monitoring Report documents the status of the energy transition in 2014.** At the heart of the monitoring process for the energy transition is the Monitoring Report, which provides new facts and figures about the energy transition.

**An independent commission of experts provides the Federal Government with advice.** Working on a scientific basis, the commission comments on the Federal Government's monitoring and progress reports. Prof. Dr. Andreas Löschel is the chair of the commission. Other members are Prof. Dr. Georg Erdmann, Prof. Dr. Frithjof Staiß and Dr. Hans-Joachim Ziesing.

## 2 Objectives of the energy reforms






By pursuing the energy transition, the Federal Government is leading Germany towards a future with a secure, economic and environmentally compatible energy supply. The orientation for the energy transition – and thus the basis for its monitoring – is provided by the Federal Government's Energy Concept, further decisions by the Bundestag, and European rules.

The Monitoring Report studies the quantitative targets and the other goals and policies affecting the energy transition:

The monitoring process for the energy transition is based on publicly available, verifiable data. It is undertaken using indicators which present the current status / development over time of the energy transition. The data used can be found at [bmwi.de](http://bmwi.de).

A points system is used to assess the progress made in terms of the quantitative targets of the energy transition. Firstly, the development of the indicators since 2008 is extrapolated on a linear basis. On the basis of percentage

**Table: Quantitative targets of the energy transition and status quo (2014)**

	2014	2020	2030	2040	2050
<b>Greenhouse gas emissions</b>					
Greenhouse gas emissions (compared with 1990)	-27 %	at least -40 %	at least -55 %	at least -70 %	at least -80 bis -95 %
<b>Renewable energy</b>					
Share of gross final energy consumption	13.5 %	18 %	30 %	45 %	60 %
Share of gross electricity consumption	27.4 %	at least 35 %	at least 50 % Renewable Energy Sources Act 2025: 40–45 %	at least 65 % Renewable Energy Sources Act 2025: 55–60 %	at least 80 %
Share of heat consumption	12.0 %	14 %			
Share in transport sector	5.6 %				
<b>Efficiency and consumption</b>					
Primary energy consumption (compared with 2008)	-8.7 %	-20 %			
Final energy productivity (2008-2050)	1.6 %/year (2008-2014)	2,1 %/year (2008-2050)			
Gross electricity consumption (compared with 2008)	-4.6 %	-10 %			
Primary energy consumption in buildings (compared with 2008)	-14.8 %				
Heat consumption in buildings (compared with 2008)	-12.4 %	-20 %			
Final energy consumption: transport (compared with 2005)	1.7 %	-10 %			

Source: In-house figures from the Federal Ministry for Economic Affairs and Energy, October 2015

deviations of the extrapolated figures from the target figures in 2020, points are awarded as follows for this report: 5 points if the target is met or the deviation is less than 10%; 4 points if the deviation is between 10 and 20%; 3 points if the deviation is between 20 and 40%; 2 points if the deviation is between 40 and 60%; and 1 point if the calculated deviation exceeds 60%.

**The evaluation scheme applied here cannot replace complex, model-based forecasts.** But this system offers the advantage of a comparatively simple and comprehensible depiction of the current status of key energy transition variables.

**The future impact of measures which are currently being implemented is not reflected in this assessment of whether targets are met.** They may yet have an impact, and the actual development can deviate from the extrapolated path in response to political and economic influences.

**Table: Targets and policies affecting the energy transition**

<b>Security of supply</b>	Covering Germany's energy needs at all times.
<b>Nuclear energy phase-out</b>	Switching off the last nuclear power plants at the end of 2022.
<b>Affordability, competitiveness</b>	Maintaining affordability of energy and ensuring Germany's competitiveness.
<b>Grid expansion</b>	Expanding and modernising grids to meet demand.
<b>Energy research, innovation</b>	Fostering forward-looking innovations for the restructuring of the energy supply.
<b>Investment, growth, employment</b>	Retaining jobs in Germany and laying the foundations for sustainable growth and quality of life.

Source: In-house figures from the Federal Ministry for Economic Affairs and Energy, October 2015

## 3 Renewable energy

### Where do we stand?

**Renewables are to become the mainstay of our energy supply.** In 2014, the gross final energy delivered by renewable sources amounted to 335 TWh. Renewables covered 13.5% of gross final energy consumption.

**Renewables were Germany's number-one source of electricity in 2014.** At 161 TWh, renewables accounted for 27.4% of Germany's gross electricity consumption. Onshore and offshore wind provided 9.7%, biomass 8.3% and photovoltaics 6%. Overall, Germany is on course to meet its renewable electricity consumption targets. The trend seen in previous years is continued.

**At 12.0% in 2014, the share of renewable energy in total heat consumption is already approaching the 2020 target of 14%.** Overall heat consumption dropped in 2014. This also affected the amount of heat generated by renewable energy. In 2014, the amount of heat generated from renewable sources dropped to approx. 140 TWh. Biomass remained the leading source of heat.

**The use of renewables in the transport sector rose moderately in 2014.** In view of energy consumption of 36 TWh, the share of renewable energy in the sector rose slightly to 5.6%.

**The EEG surcharge has stabilised since 2014.** Between 2012 and 2014, the EEG surcharge rose significantly, from 3.59 cents/kWh to 6.24 cents/kWh. In contrast, the period since 2014 is characterised by stabilisation. In 2015, the surcharge dropped to 6.17 cents/kWh. In 2016, it will be 6.35 cents/kWh.





## What are the next steps?

**The reform of the Renewable Energy Sources Act (EEG) in 2014 has made the Act fit for the future:**

- The statutory deployment corridor provides a reliable basis for planning.
- The financial assistance is focusing on the low-cost technologies, i.e. wind and solar power.
- The direct marketing requirement for new installations is improving their market integration.
- The green electricity privilege was abolished.
- The rules on self-supply were adjusted.
- The Special Equalisation Scheme was revised.
- The level of funding will be determined via competitive auctions from 2017.

**The revision of the Market Incentive Programme in 2015 strengthens the position of renewable energy in the heat market.** The funding has been improved in order to encourage more private, commercial and municipal investment in installations to generate heat from renewable energy.

**The funding of biofuel in the transport sector is being oriented more towards climate change mitigation as a key steering target:**

- The change to the assessment basis on 1 January 2015 means that the question of whether biofuels meet their target is mainly judged by their climate footprint. Greenhouse gas emissions by the fossil-based gasoline and diesel fuels and biofuels must be reduced proportionately.
- The 10% target for renewable energy in the transport sector is also to be attained via the greenhouse gas quota.

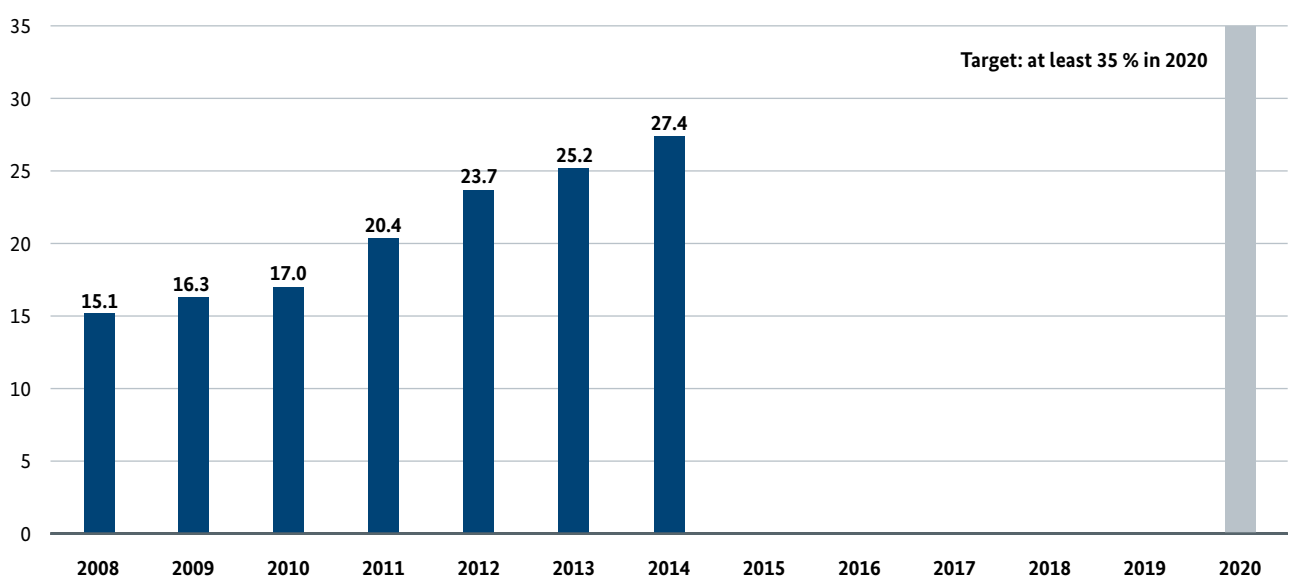
In order to attain further reductions in emissions, the measures adopted in the 2020 Climate Action Programme for the railway sector will be strengthened, and greater support will go towards electric mobility.

### Diagram: Meeting the target for renewable energy in gross energy consumption

**2020 target** Renewable energy to provide at least 35% of gross electricity consumption

**Status in 2014** 27.4%

Share of gross electricity consumption



Source: Working group on renewable energy statistics, August 2015

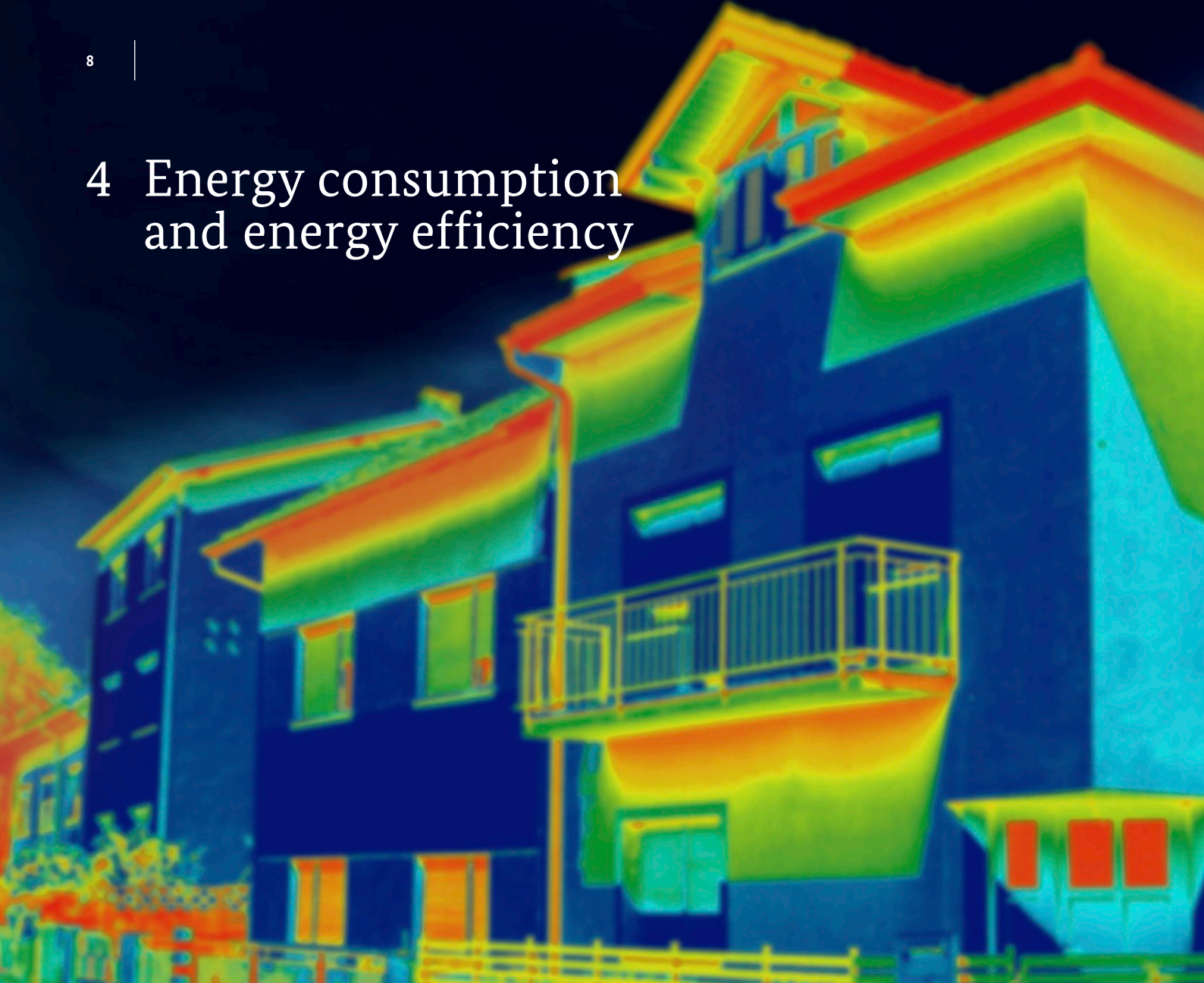
Trend



Measure

Renewable Energy Sources Act

## 4 Energy consumption and energy efficiency



### Where do we stand?

**Primary energy consumption fell sharply in 2014.** At 13,132 PJ, it was at its lowest since German reunification. In unadjusted terms, this marks a fall of 5% against 2013; adjusted for the weather, the drop was 1.6%. Compared with the reference year, 2008, primary energy consumption in Germany fell by 8.7% by 2014, or somewhat less than half of the envisaged overall target.

**Final energy productivity was higher than in the year before.** In 2014, 7.8% more goods and services were produced per unit of final energy than in the year before. Final energy productivity increased by an annual 1.6% between 2008 and 2014, below the target of 2.1%.

**Gross electricity consumption dropped to 590 TWh in 2014.** Gross electricity consumption means the total quantity of electricity consumed in Germany. It fell by 1.6% in 2014 in year-on-year terms and was down by 4.6% against the reference year of 2008. This is rather less than half of the 2020 reduction target of 10%.

### What are the next steps?

**The National Action Plan on Energy Efficiency (NAPE) is the driving force for further energy conservation.** By 2020, primary energy consumption is to fall by 20% compared with 2008.

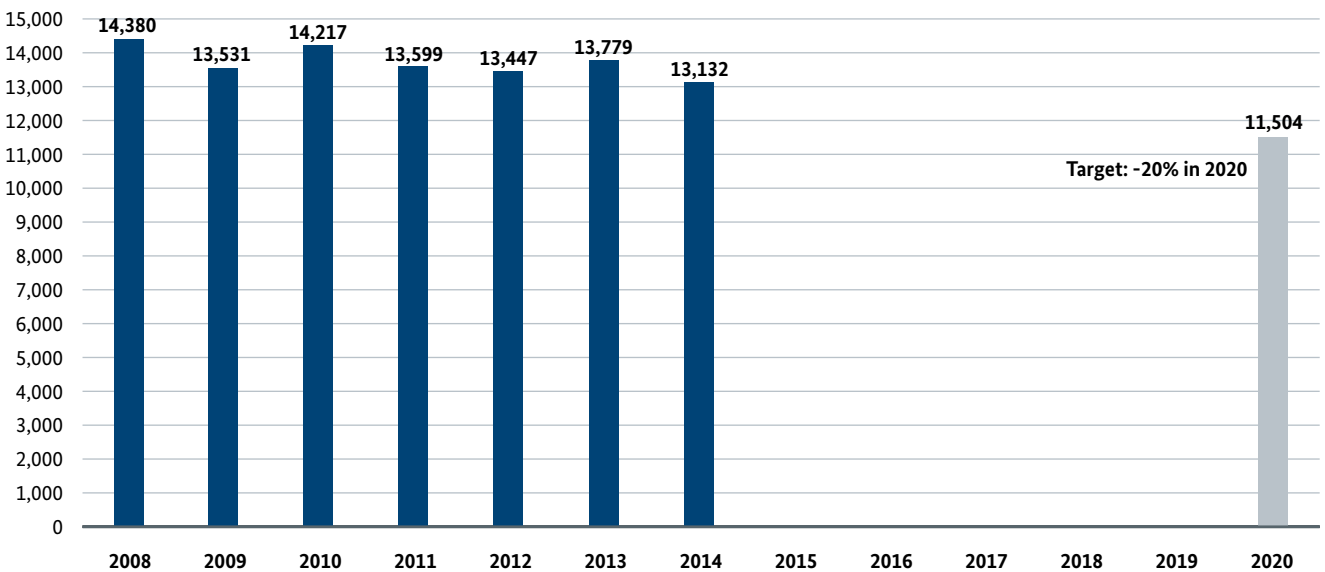
The main measures contained in the NAPE include the following:

- Improved funding for quality assurance and optimisation of the existing energy advice will boost the potential for energy-efficient renovation measures.
- The new version of the CO<sub>2</sub> building renovation programme intensifies the incentives to refurbish residential property and focuses more on commercial and municipal/social buildings.

- The competitive tendering scheme in electrical energy efficiency, called STEP up!, aims to reduce electricity consumption by promoting electricity-related measures across technologies, actors and sectors.
- The funding for energy conservation contracting makes it easier to expand the availability of loan guarantees.
- The revision of the KfW Efficiency Programme entitled “Production facilities and processes” offers tailored assistance for energy-efficient production facilities and production processes.
- The “Energy Efficiency Networks” initiative fosters highly profitable investment in energy efficiency via network-based approaches.
- The national “Top Runner Initiative” is a campaign to speed up times-to-market for energy-efficient products (“top runners”).
- The requirement for non-SMEs to undertake energy audits under the new version of the Energy Services Act of 2015 helps companies to pinpoint potential improvements in corporate energy supply systems.
- The National Efficiency Label for heating boilers provides consumers with information about the efficiency of their boiler and fosters an increase in the replacement rate of old, inefficient boilers.
- As an alternative to the tax assistance envisaged in the NAPE, the new “Energy Efficiency Incentive Programme” complements the existing funding mechanisms (CO<sub>2</sub> Building Modernisation Programme and Market Incentive Programme) and acts as a catalyst for them. The federal funding of €165 million/year is to be used alternatively for the funding of further efficiency measures in the building sector. The main focus of support is on the replacement of heating systems and the installation of ventilation systems to avoid damage to buildings.

**Diagram: Meeting the reduction target for primary energy consumption**  
**2020 target** 20% reduction in primary energy consumption (compared with 2008)  
**Status in 2014** -8.7%

Petajoules



Source: Working Group on Energy Balances (AGEB), September 2015

## 5 Buildings



### Where do we stand?

**Final energy consumption in buildings (i.e. heating energy) dropped by 12.4% in 2014 compared with the preceding year.** This is largely due to the mild weather, but also to progress on efficiency. Energy demand for heating was down by a total of 12.3% from 2008. Given a linear extrapolation of the development in energy consumption between 2008 and 2014, it is unlikely that the target of cutting heating energy demand by 20% by 2020 will be reached.

**Primary energy requirements were 11.8% lower in 2014 than in the year before.** Primary energy requirements were down by a total of 14.8% from the 2008 reference year.

### What are the next steps?

**The implementation of the National Action Plan on Energy Efficiency (NAPE) will further reduce energy consumption:** the Efficiency Strategy for Buildings and the strategy entitled “Climate-friendly Building and Housing” of the 2020 Climate Action Programme point the way to a virtually climate-neutral building stock by 2050. This means that the non-renewable segment of primary energy consumption is to fall by 80% from approx. 1,200 TWh in base year 2008 to around 240 TWh in 2050. To this end, a target corridor is being developed, permitting various combinations of reductions in final energy consumption and the increased use of renewable energy.

Further central measures in the building sector include:

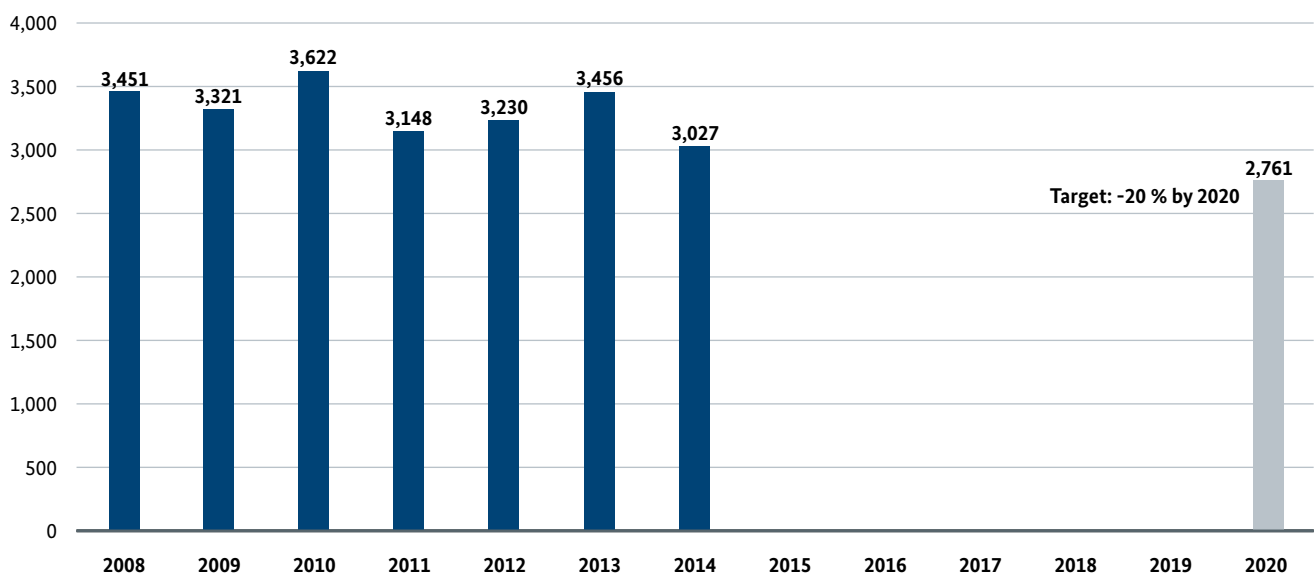
- The revision of the Energy Saving Ordinance (EnEV) is fostering the construction of nearly zero energy buildings: from 2016, the primary energy requirements for new buildings will be raised by an average of 25%.
- The CO<sub>2</sub> building renovation programme will dispose of annual funding of €2 billion from 2015.
- Energy information and advice, a core element of efficiency policy, were strengthened via a package of new funding programmes.
- The revision of the Market Incentive Programme (MAP) will speed up the installation of more renewable energy heating facilities via improved financial incentives, and the programme will be extended more into the commercial sector. With funding exceeding €300 million a year, the Market Incentive Programme (MAP) is the central instrument to expand the use of renewable energy on the heat market.
- The planned “Energy Efficiency” Incentive Programme with funding of €165 million a year should give a fresh boost to efficient heating.
- The introduction of renovation roadmaps for specific buildings will strengthen the comprehensive and holistic renovation of the entire building in one go.

#### Diagram: Meeting the target for heating energy demand

**2020 target** 20% reduction in heating energy demand (compared with 2008)

**Status in 2014** -12.4%

Petajoules



Source: Working Group on Energy Balances (AGEB), May 2015

Trend



Measure

National Action Plan on Energy Efficiency, Buildings Strategy, Climate Action Plan

# 6 Transport

## Where do we stand?

**Taking all modes of transport together, final energy consumption in the transport sector was approx. 1.7% higher in 2014 than in 2005.** If Germany is to attain its target of cutting final energy consumption by 10% from the 2005 figure, further efforts will be required.

## What are the next steps?

**The transport sector is already contributing in various ways towards the realisation of the goals set out in the Federal Government's Energy Concept.** Additional measures will be needed so that further reductions in final energy consumption and carbon emissions can be attained by 2020 and beyond.

### Central measures in the transport sector include:

The mobility and fuel strategy is currently being developed further: it is a decisive instrument for the implementation of the energy transition in the transport sector.

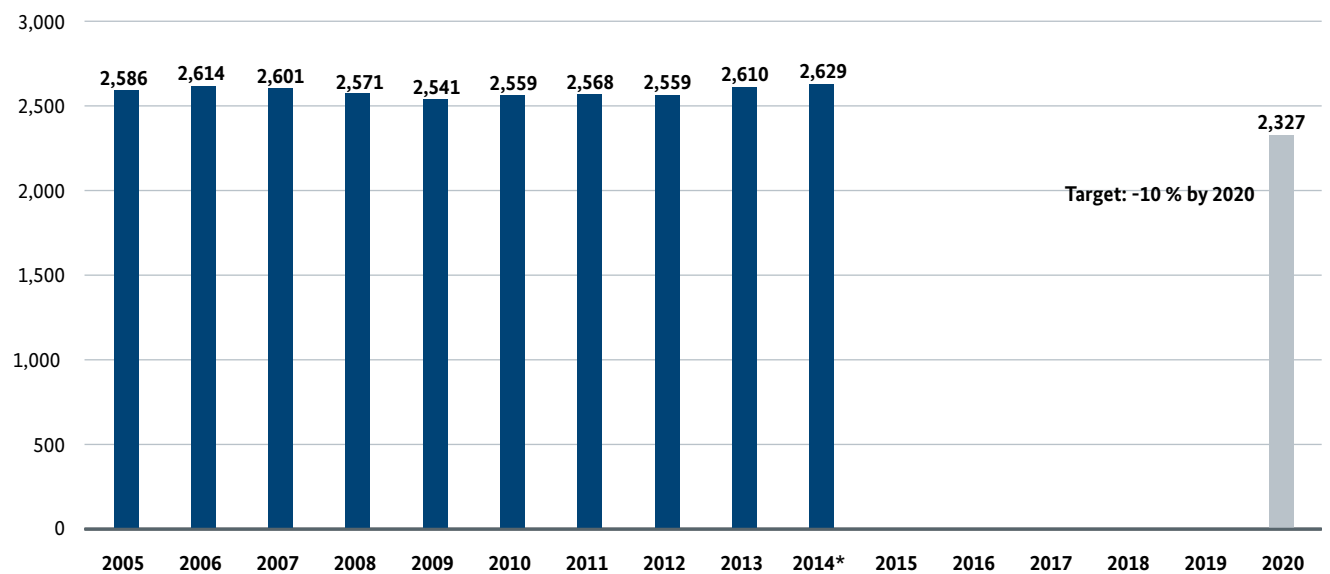
- In order to help roll out the widespread availability of recharging infrastructure for electric vehicles, including for longer journeys, the 430 or so manned service stations on autobahns are to be equipped with rapid charging stations. The first three rapid charging stations were taken into service at Köschinger Forst service station on the A9 in September 2015.
- Implementation of the Directive on the deployment of alternative fuels infrastructure.
- Pilot projects and support for maritime and inland shipping in order to stimulate demand for liquefied natural gas (LNG) and thus to promote the availability of LNG refuelling infrastructure. A pilot project to convert a ship's engine to LNG has been launched.
- Adoption of the 2015 Electric Mobility Act. Promotion of multimodal transport via the expansion of existing and building of new handling facilities.
- The National Action Plan on Energy Efficiency and the 2020 Climate Action Plan also introduced specific measures for the transport sector which will be effective as early as 2020. These particularly involve:
  - climate-friendly approach to freight transport
  - rail transport: railway infrastructure is to be increasingly expanded.
  - climate-friendly approach to passenger transport: boosting local public transport, bicycle and pedestrian traffic, promotion of alternative propulsion in local public transport, promotion of in-company mobility management. Low fuel consumption driving is to be supported, as is carsharing. The Carsharing Act is to create the possibility to give carsharing privileges in road traffic.

**Diagram: Meeting the target for final energy consumption in the transport sector**

**2020 target** 10% reduction in final energy consumption (compared with 2005)

**Status in 2014** 1.7%

Petajoules



Source: Working Group on Energy Balances (AGEB), September 2015 (2014 figures provisional)

**Trend** ● ● ● ● ●

**Measure** 2020 Climate Action Programme, mobility and fuel strategy

## 7 Greenhouse gas emissions



### Where do we stand?

**Germany's greenhouse gas emissions were lower in 2014 than in the year before.** A total of 912 million tonnes of CO<sub>2</sub> equivalent were emitted. That is 4.3% down in year-on-year terms.

**Germany is pursuing ambitious climate change mitigation targets.** Germany's national targets are more ambitious than the European and international commitments for 2020. Greenhouse gas emissions are already down approx. 27% compared to 1990. Projections suggest that the measures adopted and implemented up to autumn 2014 can bring about a reduction in greenhouse gases of around 33 to 34% by 2020, with an uncertainty of +/-1 percentage point. The identified climate change mitigation gap of 5 to 8 percentage points for 2020 is confirmed in the current 2015 German projection report.

**Energy accounted for 84.7% of greenhouse gas emissions in Germany in 2014.** The other greenhouse gas emissions derived from agriculture (7.1%), industrial processes (6.8%) and waste management (1.2%).

**The overall trend in energy-related carbon emissions is pointing downwards.** In 2014, they dropped by 4.8% in year-on-year terms to 752 million tonnes.

**Despite rising economic output, Germany is emitting less and less greenhouse gases.** Back in 1991, approx. 0.59 million tonnes of CO<sub>2</sub> equivalent were emitted for each billion euros of gross domestic product; the 2014 figure was just 0.33 million tonnes of CO<sub>2</sub> equivalent. This represents a decline of around 43%.





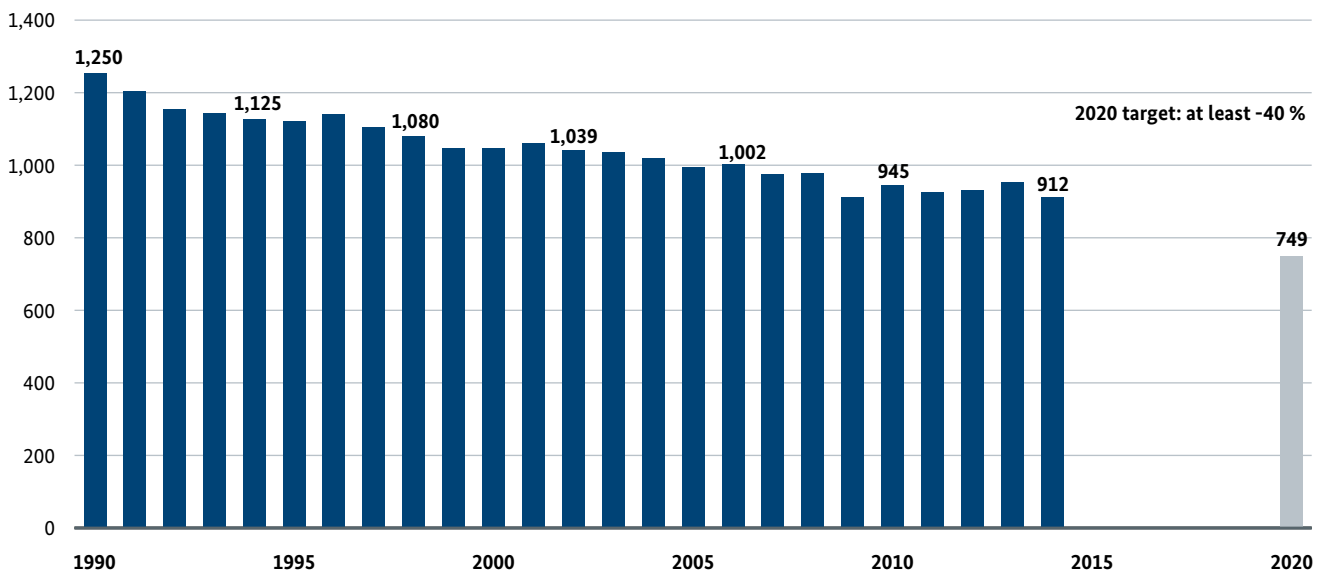
### What are the next steps?

In order to attain the 2020 target of at least 40% less greenhouse gas emissions, the Federal Government adopted further measures in December 2014 in its 2020 Climate Action Programme.

- The Action Programme established a total of more than a hundred separate measures and covers all sectors.
- The implementation of the central policies of the Action Programme is expected to contribute between 62 and 78 million tonnes of CO<sub>2</sub> equivalent towards closing the climate mitigation gap.
- Plans are already well advanced for almost all of the measures in the Action Programme. Some measures have already been fully implemented. The current implementation status is described in detail in the 2015 climate change mitigation report (Klimaschutzbericht 2015).

**Diagram:** Meeting the target for greenhouse gas emissions in Germany  
**2020 target** Reduction in greenhouse gas emissions of at least 40% (compared with 1990)  
**Status in 2014** -27%

Mt CO<sub>2</sub> equivalent



Source: Federal Environment Agency, May 2015 (2014 figures provisional)

**Trend** ● ● ● ● ●

**Measure** 2020 Climate Action Programme

## 8 Power plants and security of supply

### Where do we stand?

**Germany's electricity supply is undergoing radical change.** At present, conventional energy sources generate approx. 74% of Germany's electricity. However, the ongoing expansion of renewable energy and the phase-out of nuclear energy for power generation will change the composition of the electricity mix.

**The installed generation capacity of renewable energy rose further in 2014, whilst that of conventional power stations remained constant.** The nominal capacity of power generation installations connected to the German grid amounted to a total of 196 GW in 2014. Renewable energy installations had a net nominal capacity of 90 GW in 2014, marking an 8% increase in year-on-year terms.

**In June 2015, the nuclear power plant in Grafenrheinfeld was taken off the grid.** The Grafenrheinfeld nuclear power plant had a gross nominal capacity of 1,345 MW. The remaining eight nuclear power plants, with gross generation capacity of 11.4 GW, will be gradually phased out up to the end of 2022 at the latest.

**In the market area of relevance to Germany, which includes the neighbouring countries, there is sufficient capacity available, so that a high level of energy security is ensured.** There will continue to be adequate capacity in this area in the coming years. According to the latest findings, smoothing effects resulting from electricity trading in the European internal market can make a significant contribution towards security of supply.



### What are the next steps?

In order to ensure security of supply for the long term, the existing electricity market is to be developed into an “electricity market 2.0” by the Federal Government’s proposed Electricity Market Act. In this market, market mechanisms are being strengthened and the integration of renewable energy facilitated. Also, demand side management, higher energy efficiency and electricity trading with the neighbouring countries can boost security of supply.

The roadmap for the electricity market 2.0 is as follows:

- The White Paper “An electricity market for the energy transition” published in July 2015 is the outcome of a broad and transparent discussion process in Germany and with the European neighbours on how to organise the electricity market of the future.
- The Electricity Market Act was adopted by the cabinet in November 2015. The relevant legislative process is to be completed in spring 2016.

The revision of the CHP Act is creating important incentives for investment in modern power plant technology:

- The aim is to make the future funding of CHP (cogeneration of heat and power) compatible with the other goals of the energy transition. To this end, the Federal Government has proposed that controllable electricity generation should serve as the point of reference for the expansion target for CHP of 25% up to 2020.
- The level of support for new CHP installations is being raised to €1.5 billion a year.
- To help meet the Federal Government’s climate targets, support is being targeted at conversion to particularly low-carbon generation based on gas.
- The CHP Act was adopted by the cabinet in September 2015. The relevant legislative process is to be completed in early 2016.

## 9 Affordable energy and a level playing field

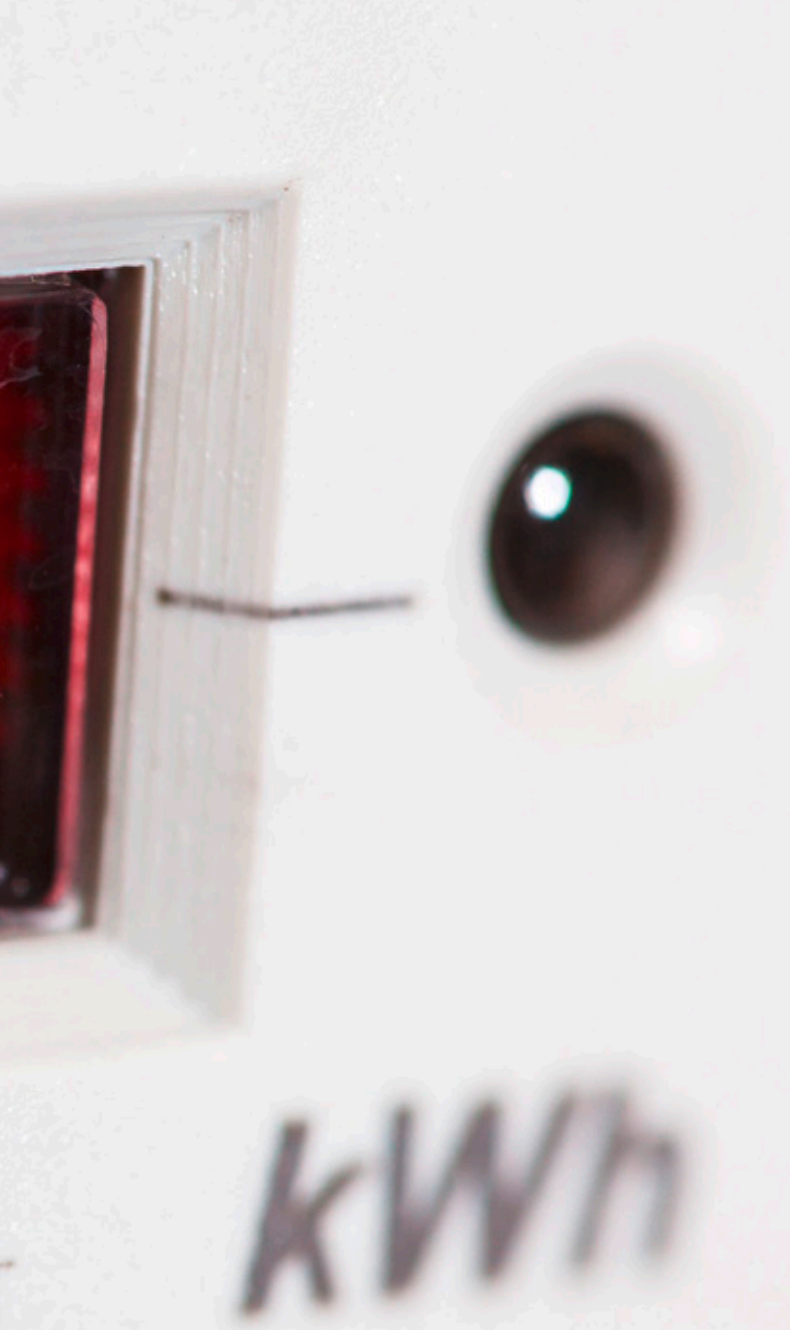


### Where do we stand?

**After years of rising energy prices, energy prices and costs for many companies and households fell slightly.** Falling prices on the international oil and gas markets, and also reforms like the revision of the Renewable Energy Sources Act in 2014, are impacting on consumer prices: for the first time in more than ten years, the electricity prices for household customers fell at the beginning of 2015. For industrial and commercial customers not covered by special arrangements, electricity prices remained virtually constant in 2014. On average, trading prices for electricity were down 10% last year, and they have continued to fall in 2015.

**The electricity prices for many commercial and industrial customers in Germany were above the EU average in 2014.** For industrial customers, the level of relief from the reduction in charges and surcharges depends chiefly on the ratio of electricity costs to gross output and turnover.

**The costs of providing primary energy dropped by approx. 12% in year-on-year terms in 2014 to €112 billion.** The costs of imported energy stood at €81 billion. In 2013, energy imports had cost €94 billion.



## What are the next steps?

**An economically sensible implementation of the energy transition will play a major role in maintaining public acceptance of the energy transition and in boosting our country's competitiveness.** For this reason, we continue to be faced with the task of improving the preconditions for affordable energy prices and costs.

- The reforms launched by the Federal Government mean that the components of the energy prices resulting from government policies can be better stabilised. This particularly refers to the EEG surcharge.
- Energy conservation will be the basis for falling energy expenditure in future. To this end, the Federal Government is launching a wide-ranging package of measures in the National Action Plan on Energy Efficiency. Furthermore, the switch to cheaper electricity or gas providers / tariffs can be a way to reduce spending on energy. Almost 2.6 million residential customers took advantage of this in 2014 and switched electricity provider.
- Affordability is always influenced by international price movements. In order to reduce dependency on individual sources of supply, the Federal Government aims to develop new suppliers of energy and new transport routes. To this end, the Federal Government is engaged in many bilateral energy partnerships and plays an active role in multilateral energy organisations and forums.

### **Companies which manufacture in Germany and face international competition need a level playing field.**

Arrangements to reduce energy prices and costs make an indispensable contribution towards maintaining Germany's industrial base.

- The electricity price compensation assists companies where there is a danger that they will relocate their production if the costs of EU emissions trading are passed on to them in their electricity price.
- According to the Special Equalisation Scheme, which was revised in 2014, manufacturing companies can apply for a limit to the EEG surcharge if they can demonstrate that they face intensive international competition.
- The reductions in the CHP surcharge relieve the burden on final consumers whose electricity consumption is particularly high, and certain companies in the goods-producing sector. Companies in these categories can also apply for tax exemptions on the basis of the Energy Tax Act and the Electricity Tax Act. The revised version of the CHP Act is currently being reviewed by the European Commission in terms of state aid rules.

## 10 Grid infrastructure

### Where do we stand?

**It is necessary to expand the grid at all voltage levels.** The increased amount of renewable energy and the growing level of cross-border electricity trading in Europe are creating fresh challenges for the electricity grid operators, and this is resulting in an urgent need for further expansion and modernisation of the electricity grids at all voltage levels.

**The figures on grid expansion in Germany show a clear trend: building work is underway.** But the work is not proceeding quickly enough. Only around one quarter of the power lines needed – according to the Power Grid Expansion Act – to serve as the “start network” have been finished.

**Grid infrastructure remains reliable in Germany in terms of grid stability and quality.** Despite growing demands on the grid relating to the expansion of renewable energy, security of supply remains at a record level. In the European and global comparison, Germany remains a leader in terms of its very high grid quality.

### What are the next steps?

**The draft law amending the legislation governing the construction of energy grids increases the possibilities for the use of underground cables.** In March 2015, the federal cabinet decided that, particularly in order to avoid conflicts with nature conservation, pilot projects can be laid underground in certain sections of the grid. In October 2015, the cabinet adopted a new wording according to which new “electricity highways” (high-voltage direct current (HVDC) lines) are in future to be planned primarily as underground cables. This has put the policies in place for greater public acceptance and needs-based grid expansion.





**The revision of the incentive regulation aims to create a positive climate for necessary investment in the distribution grids, and at the same time to provide effective incentives for efficient grid operation.** The Federal Network Agency's evaluation report on incentive regulation and the findings of the study by the Energy Grids Platform entitled "Modern distribution grids for Germany" will feed into the further development of incentive regulation.

**The Act on the Digitisation of the Energy Transition aims to use smart metering systems and modern meters as elements to promote the integration of renewable energy into the electricity grid and to save electricity:** in February 2015, the Federal Ministry for Economic Affairs and Energy presented key points for a package of measures on the use of smart meters. The draft legislation was adopted by the federal cabinet in November.



## 11 Energy research and innovation

### Where do we stand?

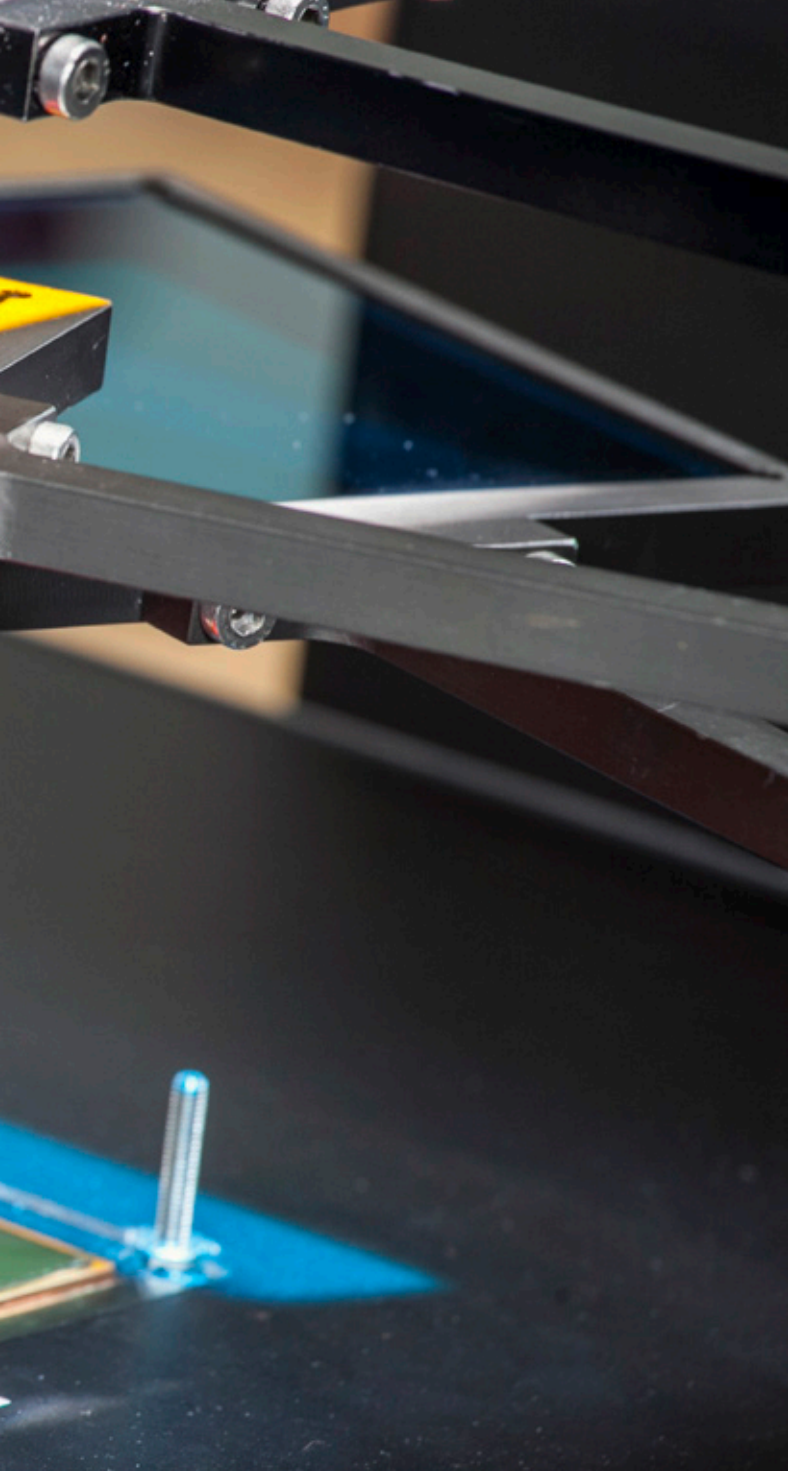
**The energy system of the future will be fundamentally different from what we have today.** A successful energy transition can only be achieved via a host of technical innovations, and research and development is required to create the preconditions for this.

**Investment in research and innovation is crucial for corporate competitiveness.** In the field of publicly co-funded research and development projects alone, companies invested €160 million in the search for innovative energy technologies in 2014. The total volume of private-sector investment is presumably much higher. Research and development is primarily the responsibility of the business community.

**More than €819 million was provided in the context of the 6th Energy Research Programme of the Federal Government in 2014.** More than 73% of this went into energy efficiency and renewable energy sources. The “Research for Sustainable Development” framework programme, which was revised in 2014, supports the shift towards a sustainable energy system.

**Promising research findings are the starting point for new, marketable energy technologies.** Examples of the increasing spread of innovative technologies which foster higher operating efficiency, lower costs or lower resource inputs can be found throughout the energy transition. For example, innovations in renewable energy technologies cut the costs of power generation.





**There has been a trend in recent years towards the use of more efficient electrical appliances.** Generally, people tend to purchase electrical products offering the highest levels of efficiency in all market segments.

## What are the next steps?

**Public research funding is helping energy research, advances in technology and innovative activities in the private sector, in research establishments and in universities and colleges.**

- The Federal Government's energy research programme is being developed further. From 2013 to 2016, about €4.4 billion in energy research funding is being provided to promote the research and development of modern energy technology. "Copernicus projects", which are to start in 2016, are intended to bring about a sustainable energy system which uses outstanding technology and is economically competitive, and which is accepted by society.
- Research projects are increasingly networked at European and international level: cooperation at European level takes place under the umbrella of the European Commission's SET (Strategic Energy Technology) Plan (e.g. on smart grids and smart cities). International cooperation takes place in the context of International Energy Agency programmes.
- The national "Research and Innovation Platform" is continuing the existing dialogue forums with stakeholders from business, science and government. The "Energy Transition Research Forum" is providing targeted science-based advice to policy-makers.

**In order to make innovative technologies more cost-effective and to pave their way to the market, it is important to back them with an appropriate policy framework.**

- It is important to keep updating rules and regulations as this can result in obsolete efficiency standards and inefficient technologies being gradually taken off the market.
- Targeted funding measures support the market entry of innovative technologies. Current measures cover a range of technology areas from decentralised battery storage to certain heating technologies, the integration of biomass into existing energy systems, and key enabling technologies and infrastructure for electric mobility.



## 12 Investment, growth and jobs

### Where do we stand?

2014 was another year in which billions were invested in the restructuring of the energy supply. This is particularly true of measures to improve the energy performance of buildings, to increase the amount of renewable energy, and to expand the electricity grids. All of these investments are primarily being undertaken by private-sector investors. In this way, the energy transition is making a contribution towards the overall level of investment in Germany.

**Investment in the context of the energy transition has a far-reaching impact on other sectors.** Via upstream interlinkages, it generates added value in many areas of the economy. This investment represents the main positive

influence exerted by the energy transition on economic growth. A further important stimulus derives from foreign trade in energy commodities and energy technologies.

**The energy transition is helping to change employment structures.** Employment remains at a high level in areas like renewable energy and conventional power supply. According to an estimate by Prognos (2015), the energy industry employs at least 537,000 people. The energy industry is a horizontal sector and impacts on jobs in a number of other parts of the economy, e.g. in those which deliver capital goods for the energy supply.



### What are the next steps?

**Investment is a key to higher competitiveness, lasting prosperity and a better quality of life.** It is important to continue the energy transition in a successful and cost-efficient manner. A clear and stable policy framework makes it easier for investors and planners to operate. In particular, the Federal Government has improved these conditions via the Renewable Energy Sources Act, which was revised in 2014, the current Electricity Market Act and the investment-friendly policies on transmission and distribution grids. The National Action Plan on Energy Efficiency provides for immediate action and further-reaching processes in order to stimulate higher private-sector investment in efficiency technologies.

**The energy transition is making Germany less dependent on oil and gas imports.** Large volumes of the fossil fuels consumed in Germany are imported. Renewable energy is increasingly replacing fossil primary energy sources. At the same time, the improved energy efficiency is reducing energy demand. Despite the restructuring of its energy

supply, Germany remains open for imports of energy commodities and energy technologies from abroad. Diversification of energy supply sources and transport routes for the raw materials continues to be a prime objective for the Federal Government.

**The energy transition is creating new jobs in many parts of Germany's economy.** Investment in the various aspects of the energy transition will permit the creation of even more new jobs. The Federal Government is aiming to provide a stable policy framework so that the level of investment and employment will remain high and develop sustainably in the coming years.

