Federal Ministry for the
Environment, Nature Conservation,
Building and Nuclear Safety

Climate Action Report 2016

On the German government's Climate Action Programme 2020

Imprint

Published by
Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB)
Public Relations Division · 11055 Berlin · Germany
Email: service@bmub.bund.de · Website: www.bmub.bund.de/english

Edited by
BMUB, Division KI I 1

Design
design.idee, Büro für Gestaltung, Erfurt

Printed by
Druck- und Verlagshaus Zarbock GmbH & Co. KG

Picture credits
See page 115

Date
December 2016

First Print
1,000 copies

Where to order this publication
Publikationsversand der Bundesregierung
Postfach 48 10 09 · 18132 Rostock · Germany
Tel.: +49 30 / 18 272 272 1 · Fax: +49 30 / 18 10 272 272 1
Email: publikationen@bundesregierung.de
Website: www.bmub.bund.de/en/service/publications

Climate Action Report

2016

On the German government's
Climate Action Programme 2020

2016

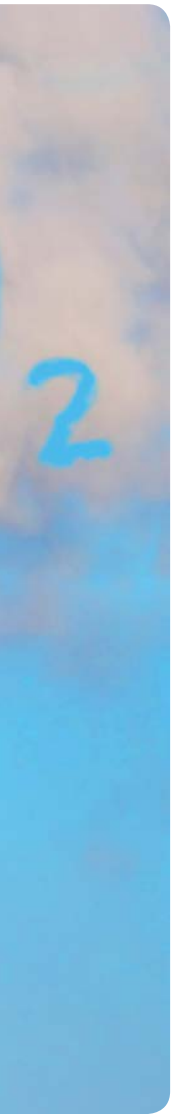
Contents

1 Executive summary

Germany is committed

to reducing its greenhouse gas emissions by at least 40 percent below 1990 levels by 2020. This equates to an overall reduction of around 500 million tonnes of carbon dioxide (CO_2) equivalents, down to 750 million tonnes. Recent estimates by the Federal Environment Agency indicate that by 2015, Germany had succeeded in reducing its greenhouse gas emissions by around 27 percent against 1990 levels to 908 million tonnes of CO_2 equivalents. In order to meet its target, in December 2014 the German government adopted the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE), which makes a key contribution to the Action Programme. At the same time, it decided to monitor implementation of the measures listed in the Climate Action Programme 2020 in a continual process, and to publish an annual Climate Action Report detailing the progress of implementation, the latest emission trends, and impacts on reductions. The German government is fulfilling this commitment for the second year by publishing this Climate Action Report 2016.

The German government drafted the Climate Action Programme 2020 having previously identified a climate change mitigation gap of between five and eight percentage points. Without the measures set out in the Action Programme, Germany's 2015 Projection Report, published in March 2015, indicates a reduction corridor of between 32 and 35 percent compared with 1990. This



therefore reaffirms the mitigation gap and the need for ambitious, focused implementation of the measures set out in the Action Programme.

The Climate Action Programme aims to close this gap by between 62 and 78 million tonnes of CO_2 equivalents, as the total contribution of more than 100 individual measures. Almost 70 percent of the measures adopted in the Climate Action Programme have now been implemented in full, and implementation of the others is underway.

The quantification in this Climate Action Report 2016 was carried out by a consortium of experts commissioned by the Federal Environment Ministry. This interim status assessment suggests that the measures in the Climate Action Programme are already taking effect, and are expected to contribute significantly towards mitigating the gap. Taking into account the current implementation and planning status of the individual measures, experts currently estimate the total reduction effect at between 47 and 58 million tonnes of CO_2 equivalents for the year 2020. This estimate entails a number of uncertainties linked to the assumptions made and the anticipated effects. A number of other ongoing and planned studies will be taken into account in future assessments.

The 2015 Projection Report was updated in September 2016 to incorporate the results of a scenario, suggesting that with ambitious and optimised implementation, the combined reduction effect of all measures in the Climate Action Programme 2020 could total just under 60 million tonnes of CO_2 equivalents. This latest projection indicates a mitigation gap of between 37 and 40 percent in 2020. The range reflects uncertainties about the development of key influencing factors such as economic growth, fuel prices, the balance of external electricity trading, and population development. Taking into account current trends in these factors and the estimated reduction effects of the action programme under the current implementation and planning status, the reduction is likely to be in the bottom half of this range, although it must be stressed that the aforementioned projections and estimates still involve many uncertainties. Nevertheless, target achievement remains within our grasp.

With this in mind, the German government is stressing the need for consistent implementation of the adopted measures in order to actually meet the reduction targets with the measures set out in the Climate Action Programme 2020. It will also be continuously monitoring implementation of the measures and gauging their reduction effects. Based on the projections and estimates to be updated next year (including the 2017 Projection Report, the Climate Action Report 2017 with updated quantification) and the reductions from individual action areas set out in the Climate Action Programme 2020, from 2018 the German government will be able to take targeted corrective action where necessary, also within the context of implementing the Climate Action Plan 2050.

As well as benefiting the climate, the measures in the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE) also offer potential economic benefits. For example, more efficient use of fossil fuels will help to significantly reduce our dependency on imports, encourage the development of new technologies and create lasting value added. Not least, this will also protect jobs in many sectors, and exploit new employment potential.

A study commissioned by the Federal Environment Ministry suggests that, provided its assumption are accurate, the net cash value of the energy costs saved (over their service life) through implementing the measures of the Action Programme and the National Action Plan on Energy Efficiency could exceed the required investments by almost 150 billion euros. Furthermore, reduced fuel imports could slash import costs by 3.5 billion euros in 2020, primarily thanks to fewer imports of oil. This positive impetus would also extend to the labour market. In particular, the growing demand for goods and services – for example, in the construction sector – could produce net workforce growth of just under 430,000 new jobs.

These results highlight the opportunities for the German economy and society associated with the adopted climate measures. In this connection, 2020 should be viewed as a stepping stone en route to extensive greenhouse gas neutrality by 2050. The 2050 Climate Action Plan contains important guidance for the period after 2020. Both the Action Programme and the Climate Action Plan are based on the guiding principle of climate action as a strategy for social and economic modernisation.

2 Introduction

Climate change is one of the greatest challenges now facing humankind. Primarily as a result of burning fossil fuels, the concentration of greenhouse gases in the atmosphere has risen sharply since industrialisation began. The resultant global warming and its consequences for ecosystems, the economy and society are already being felt around the globe. The impacts of climate change are already threatening entire regions with drought, flooding, storms and heatwaves, and in future will become one of the most significant causes of migration.

The international community has therefore committed to do everything in its power to limit climate change and its impacts. The Paris Agreement, which entered into force on 4 November 2016, sends a clear signal in this regard. Almost every government in the world has signed the convention and undertaken to limit the global temperature rise to well below two degrees above pre-industrial levels, and below 1.5 degrees if at all possible. This necessitates a rapid trend reversal and a radical reduction in global emissions of greenhouse gases. The global goal of greenhouse gas neutrality in the course of this century as laid down in the Paris Agreement underscores this necessity.

The German government is aware of Germany's role and responsibilities in this process. Its Climate Action Plan 2050 is designed to help Germany become extensively greenhouse gas-neutral by the middle of the century, and outlines specific models for the various areas of action leading up to 2050. The Climate Action Plan also outlines robust transformation pathways for all areas of action, and in particular, reinforces the

target of at least a 55 percent reduction in greenhouse gas emissions by 2030 compared with 1990 levels, by setting sector-specific targets, together with a range of other milestones and strategic measures.

The interim target of at least a 40 percent reduction by 2020 compared with 1990 levels represents an important milestone for subsequent reductions and climate targets after 2020. To help ensure that it is met, in December 2014 the German government adopted the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE), which makes a significant contribution to the Action Programme and to meeting climate targets. The identification of a climate change mitigation gap of between five and eight percentage points by 2020 provided the starting point for these resolutions. Germany's 2015 Projection Report reaffirms this gap and the need for consistent implementation of the measures adopted in the Climate Action Programme 2020 if we are to meet our reduction targets with individual measures.

The German government continuously monitors implementation of the measures in the action programme, and publishes its findings in an annual Climate Action Report. This report outlines current emission trends in the various action areas, assesses the implementation status of measures in the Action Programme, and forecasts the reduction effects achievable by 2020.

The first Climate Action Report was published in November 2015, but it did not include a projection of the reductions achievable with the individual measures in the Action Programme. The Climate Action Report 2016 includes this information for the first time.

The German government has tasked the Climate Action Alliance (*Aktionsbündnis Klimaschutz*), comprising representatives from all groups of society, with the BMUB as lead agency, with assisting implementation of the measures adopted and identifying further opportunities for action. The idea is that the Action Alliance will help to ensure that the target of at least a 40 percent reduction in greenhouse gas emissions in Germany is met by 2020. The Action Alliance has commented on the BMUB's draft Climate Action Report 2016 and its progress assessment, and members' opinions have been incorporated into the German government's policies for implementing the Action Programme (see BMUB website).

It is not in the scope of the Climate Action Reports to make statements on the effects of climate change in Germany or related adaptation measures. The German government regularly reports on this in its progress reports on the German Strategy for Adaptation to Climate Change. The first Progress Report on the German Strategy for Adaptation to Climate Change was adopted by the Federal Cabinet on 16 December 2015. Further information can be found on the BMUB website (see www.bmub.bund.de/P216-1/).

3 Cross-cutting climate action reporting

Germany reports at regular intervals on past emission trends and projections of future emission development as part of its obligations under the Framework Convention on Climate Change and the European Monitoring Regulation.

Germany's achievement of greenhouse gas reduction targets is therefore subject to continuous, transparent reviews.

Since the 2015 report on greenhouse gas emissions in 2013, the calculation and reporting of greenhouse gas emissions have been extensively modified, as per the resolutions of the Conferences of the Parties to the UNFCC. Most of these revisions result from the mandatory application of the 2006 IPCC Guidelines on Greenhouse Gas Inventories, which, as well as amending the methods used to calculate greenhouse gas emissions, also include greenhouse gases not previously covered by the inventory. Additional source groups have also been incorporated, expanding the spectrum of emissions to be reported. This has furthermore led to amendments to the reported emissions for the years 1990 to 2012. Examples include the calculation of Greenhouse Warming Potential for nitrous oxide and, to a lesser extent, methane.

The German government incorporated these amendments into its first Climate Action Report in 2015, and direct comparability between more recent publications, such as the first two Climate Action Reports, and older reports or publications is therefore limited.

3.1 Climate action reporting – Description of reporting obligations

Comprehensive and continual reporting is needed in order to gauge progress in reducing greenhouse gas emissions. The United Nations Framework Convention on Climate Change and the Kyoto Protocol require the Parties to set up national reporting systems on greenhouse gas emissions, which provide the basis for setting

reduction commitments and also facilitate robust comparisons of the efforts being made by the Parties. Alongside greenhouse gas inventories, reports on climate targets and strategies, climate change mitigation and adaptation measures, education and research, and financial and technical development cooperation also play a key role in international reporting.

The key reports at international and European level are:

- The **National Inventory Report** on greenhouse gas emissions throughout Germany since 1990 meets Germany's obligation to prepare and publish national greenhouse gas inventories under the United Nations Framework Convention on Climate Change and the Kyoto Protocol (annual).

- The **Projection Report** models the possible emission-reducing effect of climate action over the next 20 years in a range of different scenarios. It is a reporting obligation for Member States of the European Union (every two years).

- The **National Communication** to the United Nations Framework Convention on Climate Change provides comprehensive reporting on national framework conditions, greenhouse gas emissions, climate change mitigation measures and projections, as well as adaptation to climate change, research and financial and technical development cooperation (every four years).

- The **Biennial Report** updates the principal content of the National Communications (every two years), but with a focus on documenting progress towards achieving climate targets and financing.

These reporting obligations have been continuously updated over the last 20 years, at both European and international level, and are also gaining increasing importance for developing countries and emerging economies. The scientific and methodological basis for greenhouse gas reporting is also constantly updated in line with recommendations by the Intergovernmental Panel on Climate Change (IPCC), thereby ensuring that calculations of greenhouse gas emissions are always based on the latest scientific knowledge.

In addition to the aforementioned reporting obligations at European and international level, other obligations at national level are designed to monitor climate and energy policy strategy measures within the context of national targets:

- The **Monitoring Report** on the energy transition assesses target achievement progress and the implementation status of energy transition measures, with a view to ensuring a reliable, economical and sustainable energy supply, so that corrective action may be taken where necessary (annual).

- To accompany implementation of the German government's Climate Action Programme 2020, the **Climate Action Report** reports on the implementation status and emission trends in the designated action areas, as well as the anticipated reduction effects by 2020 (annual).

- The German government will continue publishing its annual climate action reports **even beyond 2020** to regularly review the implementation of and compliance with greenhouse gas reduction targets, so that corrective action can be taken where necessary. Following the established format, the Climate Action Reports outline the implementation status of current measures under the Climate Action Plan 2050, emission trends in the designated action areas, and the estimated reduction effects in subsequent stages.

3.2 Emission trends – National Inventory Report on Greenhouse Gas Emissions

Between 1990 and 2014, Germany succeeded in reducing its emissions of greenhouse gases by almost 28 percent, fulfilling its pledges from the first commitment period of the Kyoto Protocol to reduce greenhouse gas emissions by an average of 21 percent between 2008 and 2012 compared to 1990 levels. Following a slight increase in emissions in 2013, in 2014 levels were down by more than 4.6 percent year-on-year. Weather-related influences leading to fluctuating carbon dioxide emissions from households and the commerce, trade and services sectors were a significant factor here.

By contrast, the Federal Environment Agency estimates that emissions rose by 0.7 percent or 6.3 million tonnes of CO_2 equivalents year-on-year in 2015. A colder winter than in 2014 was offset by reduced emissions from the electricity industry with its growing focus on renewable energies. This equates to a decrease of around 27 percent compared to 1990.

A comparison of individual greenhouse gases indicates a significant reduction in the dominant (in quantitative terms) greenhouse gases, the most significant being methane emissions. The main reasons for the trends since 1990 are:

- A change to lower-emission liquid and gaseous fuels
- Increased substitution of fossil fuels with renewable energy sources
- More efficient plants and facilities
- Changes in livestock rearing conditions and a reduction in livestock populations
- Compliance with statutory provisions on waste management.

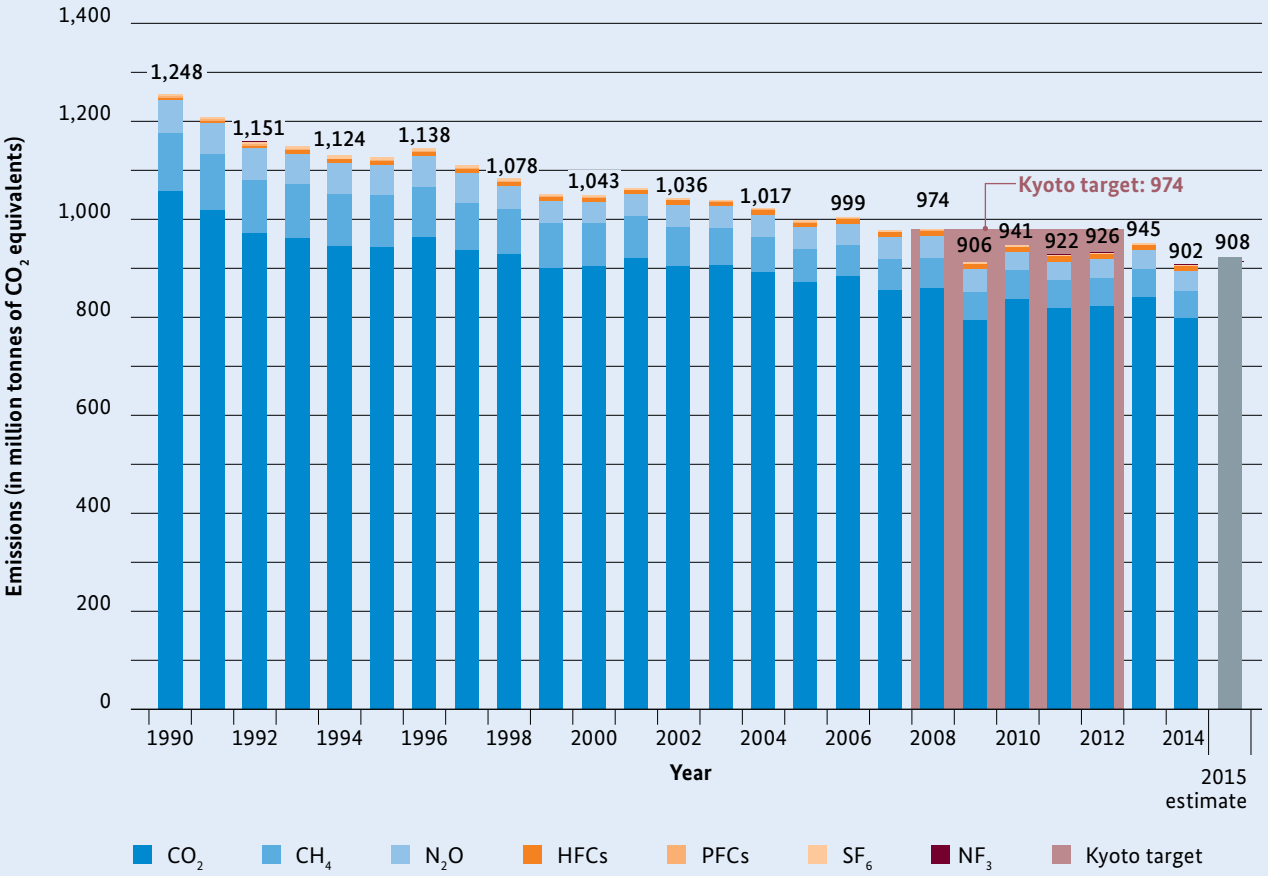
Economic fluctuations in certain sectors had a particularly pronounced influence on overall emissions between 2008 and 2013. For example, from 2008 onwards, the global economic crisis began to impact the German economy, and hence also emissions.

As far as individual greenhouse gases are concerned, carbon dioxide – the vast majority of which is caused by stationary and mobile combustion processes – is the most dominant. Above-average decrease in other greenhouse gases mean that CO_2 emissions as a share of overall greenhouse gas emissions are now almost four percentage points higher than in 1990, accounting for almost 90 percent.

Methane (CH_4) emissions, most of which are caused by livestock rearing, fuel distribution (natural gas industry) and landfills (waste management), accounted for 6.2 percent of greenhouse gas emissions in 2014. Emissions of nitrous oxide (N_2O), released primarily by agriculture, industrial processes and the combustion of fossil fuels, amounted to 4.3 percent of greenhouse gas emissions. Fluorinated greenhouse gases (known as F-gases) contributed about 1.6 percent.

This distribution spectrum of greenhouse gas emissions is typical of a highly industrialised country.

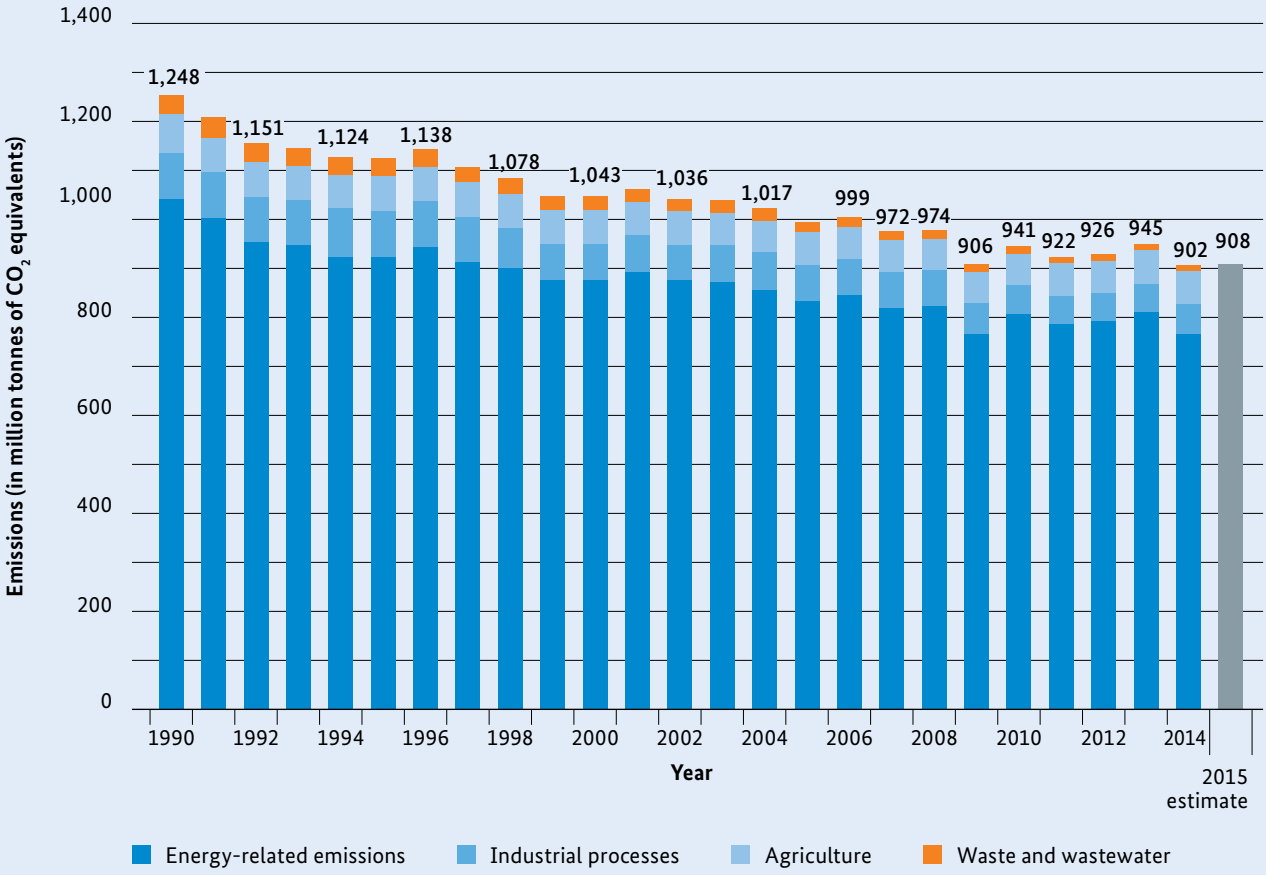
Figure 1: Emission trends in Germany since 1990, by greenhouse gas



Source: Federal Environment Agency (UBA), July 2016

An analysis of individual components reaffirms this trend in varying degrees. Compared with emissions in the base year (1995 for F-gases and NF_3 [nitrogen trifluoride], 1990 for all others), the changes in 2014 include a 24.6 percent decrease in the case of carbon dioxide (CO_2), a 53 percent decrease for methane (CH_4) and a 40.4 percent decrease for N_2O. By contrast, the trend for F-gases is less uniform. Depending on the introduction of new technologies and the use of substitutes, emissions decreased by 47.5 percent in the case of sulfur hexafluoride (SF_6) and by 88.8 percent in the case of perfluorocarbons (PFCs) compared with 1995, whereas emissions of hydrofluorocarbons (HFCs) rose significantly by 30.1 percent, and NF_3 by 283.4 percent. However, the contribution of F-gases to overall emissions remains low. A comparison of individual source and sink categories listed in the greenhouse gas inventory indicates that energy-related emissions dominate. Over time, absolute quantities of these emissions decreased steadily. Most deviations from the trend are weather-related. Differences in ambient temperature patterns, especially in winter, influence heating behaviour and hence the amount of energy used for heating, which in turn impacts annual energy-related emission trends.

Figure 2: Emission trends in Germany since 1990, by source group



Source: Federal Environment Agency (UBA), July 2016

3.3 Projected emission trends

Every two years, Germany submits an estimate of the medium-term development of greenhouse gas emissions in a Projection Report. The scenarios in these reports currently extend to 2035, with the current report focusing on the results for 2020. The Projection Report generally provides model calculations for two scenarios: the with-measures scenario (WMS), which incorporates all measures adopted and implemented or initiated by a specific date (August 2014); and the with-additional-measures scenario (WAMS), which includes the impacts of additional adopted or planned climate measures. The model calculations depend on the assumptions made and the underlying data selected. Additionally, sensitivity analyses measure the extent to which differences for example in economic growth, population development and fuel prices could impact greenhouse gas emission trends. The 2015 Projection Report was officially presented in March 2015, and supplemented in October 2016 to include the WAMS.

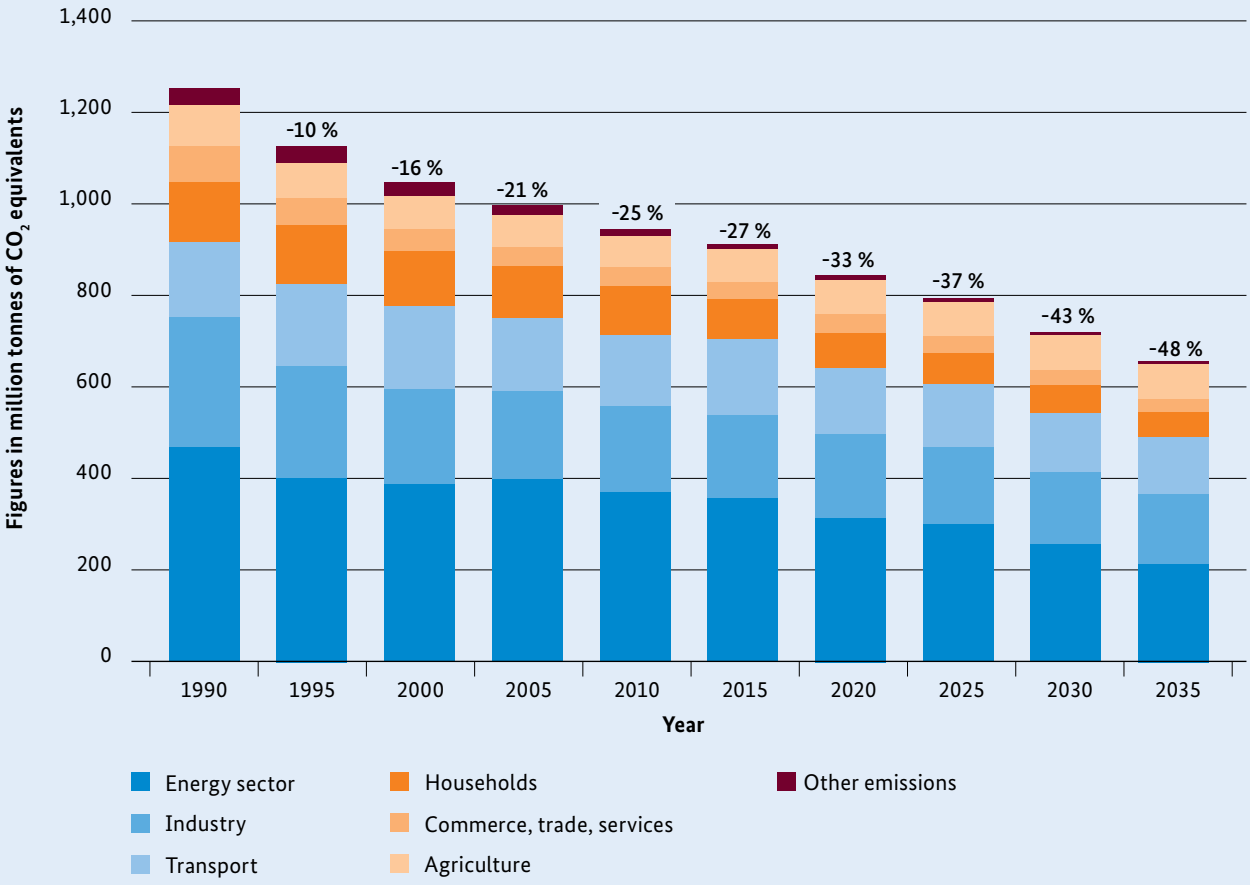
The German government incorporates the results from the Projection Report into its climate policy discussions; however, the results outlined below do not necessarily reflect the views of the German government.

3.3.1 Projected emission trends – Including measures up to 2014 (excluding the Climate Action Programme 2020)

The with-measures scenario (WMS) considers all measures taken by 31 August 2014. As such, it does not include the measures adopted under the Climate Action Programme 2020. In evaluating the emission reductions achieved with the various measures, this scenario is compared with the (hypothetical) trend which would have occurred without these measures, and without corresponding updates to existing policies and measures. In accordance with international agreements on greenhouse gas reporting, emissions from land use, land-use change, forestry, and international aviation and shipping are not included in the calculations, although the latter is shown in the report for information purposes.

The WMS indicates a 33 percent reduction in greenhouse gas emissions between 1990 and 2020, equating to just under 408 million tonnes of CO_2 equivalents. Alternative assumptions, for example with regard to energy prices or population growth (sensitivity analyses), produce a potential emission reduction corridor of between 31.9 and 35 percent between 1990 and 2020. This reaffirms the climate change mitigation gap of between five and eight percentage points which the Climate Action Programme 2020 aims to close.

Figure 3: Development of total greenhouse gas emissions by source category, 1990 to 2035, under the with-measures scenario



Source: German Projection Report 2015, as required by Regulation (EU) No 525/2013 (online: cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envv_vp1a/160928_PB2015_MWMS.final.pdf). Figures 1990 to 2015: actual emissions (2015 UBA estimate). From 2020: projections under the with-additional-measures scenario (WAMS)

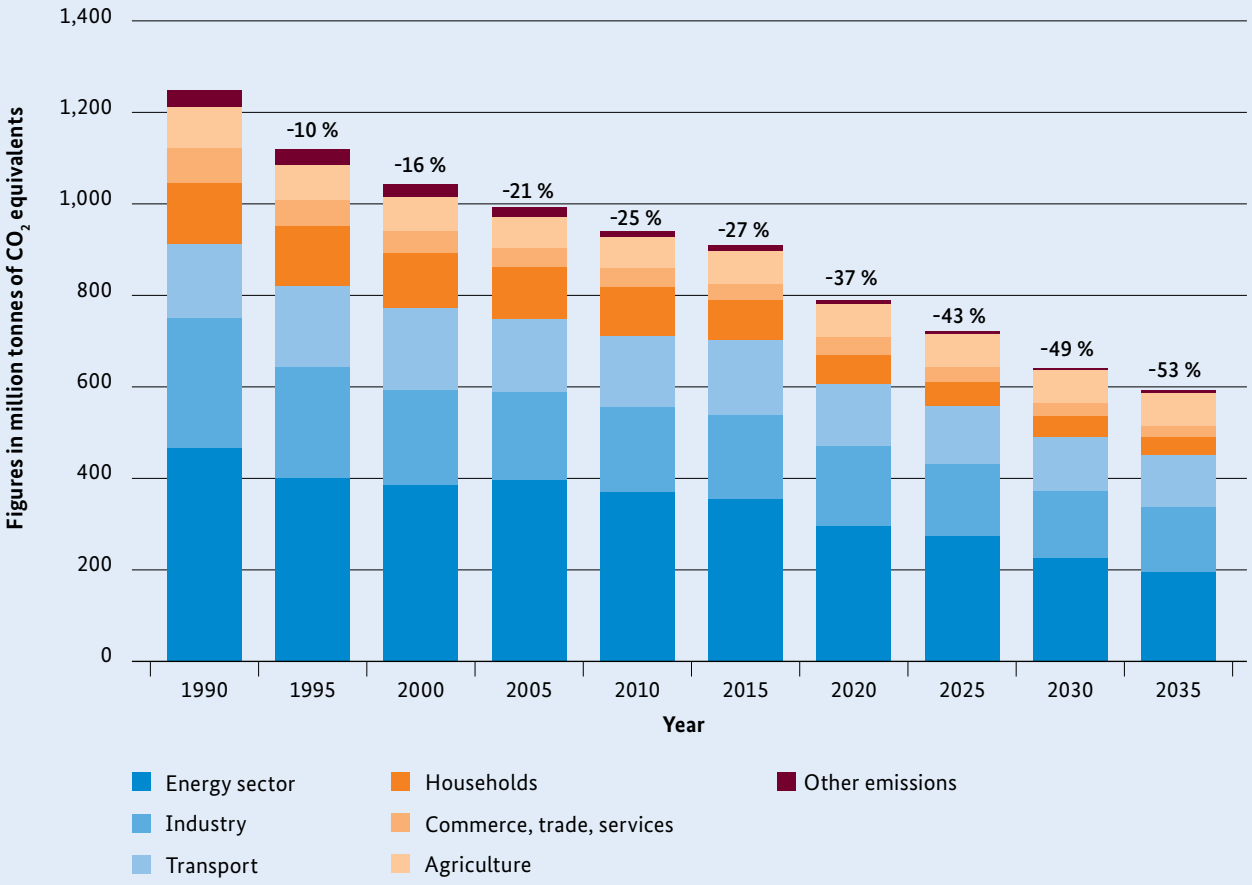
The model calculations in the WMS indicate that the majority of emission reductions are achieved in the energy sector (reduction of 153 million tonnes of CO_2 equivalents between 1990 and 2020) and in households (54 million tonnes of CO_2 equivalents), transport (19 million tonnes) and industry (102 million tonnes); the waste management sector achieves a total reduction of 29 million tonnes of CO_2 equivalents.

3.3.2 Projected emission trends – Including measures in the Climate Action Programme 2020

Alongside the WMS, the with-additional-measures scenario (WAMS) also takes into account the policy measures adopted with the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE). These scenarios assume complete and ambitious implementation of the measures in the action programme and the NAPE.

Under the WAMS total greenhouse gas emissions (excluding land use, land-use change and forestry,

Figure 4: Development of total greenhouse gas emissions by source category, 1990 to 2035, under the with additional-measures scenario (WAMS)



Source: German Projection Report 2015, as required by Regulation (EU) No 525/2013 (online: cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envv_vp1a/160928_PB2015_MWMS.final.pdf). Figures1990 to 2015: actual emissions (2015 UBA estimate). From 2020: projections under the with-additional-measures scenario (WAMS)

international shipping and aviation) are reduced by around 460 million tonnes of CO_2 equivalents between 1990 and 2020, equating to a 37.4 percent reduction and thus closing the mitigation gap by around 60 million tonnes of CO_2 equivalents. Economic development, fuel prices and other framework conditions, such as the electricity export balance and population development, may influence actual emission trends. An analysis of differing potential trends under these framework conditions produces a potential emissions reduction corridor of between 37 percent (higher population growth coupled with higher fuel prices) and 40.4 percent (lower economic growth accompanied by a lower electricity export balance) in 2020. This clearly shows that the 40 percent target is still attainable.

A sector comparison based on the results of the WAMS reveals that almost 40 percent of the emission reductions achieved between 1990 and 2020 are attributable to the energy sector; in absolute terms, emissions in 2020 are reduced by around 170 million tonnes of CO_2 equivalents compared with the 1990 baseline.

Table 1: Development of total greenhouse gases by source category: Actual emissions until 2015 and projected emissions under the WAMS[1]

	1990	2015	2020	2025	2030	2035
	Million tonnes of CO_2 equivalents					
Energy sector	466	355	296	273	225	196
Industry	283	182	174	158	147	140
Households	163	164	137	127	119	114
Transport	131	89	63	52	45	40
Commerce, trade, services	78	35	38	33	28	24
Agriculture	88	72	72	72	72	72
Others	38	12	9	7	6	6
Total	**1,248**	**909**	**789**	**722**	**642**	**592**
versus 1990	–	*-27 %*	*-37 %*	*-42 %*	*-49 %*	*-53 %*
	up to 40.4 %					

1 Actual emissions until 2015 using GWPs from IPCC AR4, thereafter projections using GWPs from IPCC AR2 (see 2015 Projection Report).

Source: German Projection Report 2015, as required by Regulation (EU) No 525/2013 (online: cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/envvqlq8w/2005 to 2012: Actual emissions. From 2015: Projection

The model calculation indicates that the second-largest contributor to the estimated absolute reduction in emissions is industry, where energy- and process-related emissions could be reduced by around 110 million tonnes of CO_2 equivalents (39 percent) by 2020 compared with 1990.

Private households are the third-largest contributors, reducing emissions by 52 percent or 68 million tonnes of CO_2 equivalents by 2020 versus 1990 levels.

With a reduction of just under 26 million tonnes of CO_2 equivalents (approximately 16 percent) by 2020 versus 1990, the transport sector is the fourth-largest contributor under the WAMS, but its share of overall emissions looks set to increase from 13 percent in 1990 to around 17 percent by 2020. At the same time, the growing share of electric mobility would relocate some transport emissions to the energy sector, where public electricity generation is reported.

In agriculture, by contrast, the WAMS projection suggests only minimal reductions in emissions. Although emissions from this sector fall by a good 18 percent (16 million tonnes of CO_2 equivalents) by 2015 compared with 1990, they will remain constant in subsequent years at around 72 million tonnes of CO_2 equivalents.

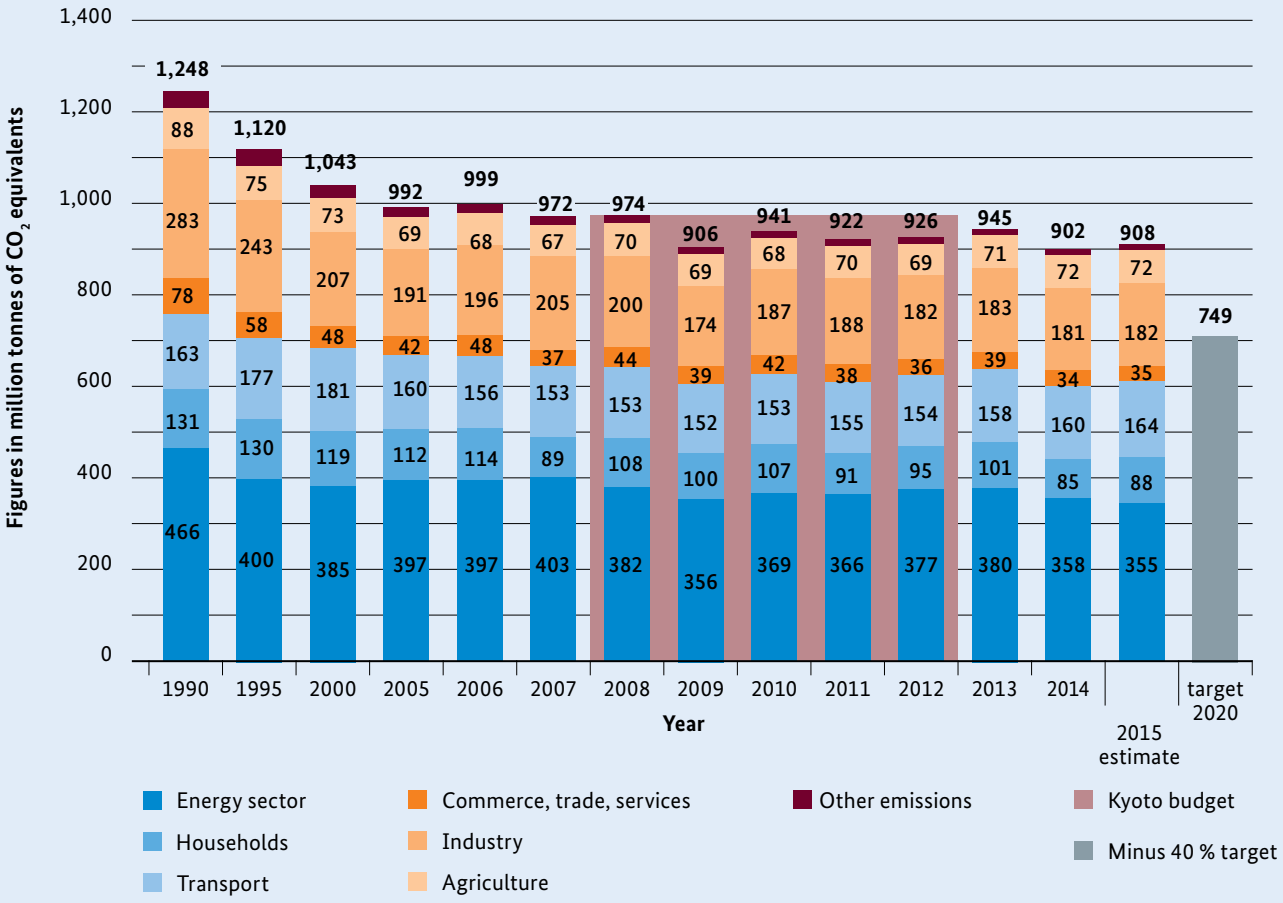
The projection indicates a potential reduction in emissions from the waste management sector of almost 80 percent between 1990 and 2020, the highest relative contribution.

Under this projection, assuming ambitious and ideal implementation, the action programme could contribute almost 60 million tonnes of CO_2 equivalents to closing the climate change mitigation gap in 2020. With this in mind, the German government is stressing the need for consistent implementation of the adopted measures in order to actually achieve these reductions.

4 Areas of action and emission trends – Sectoral analysis

The Climate Action Programme 2020 **allocates emissions to sectors** on the basis of the "source principle", that is where they are generated. For example, emissions resulting from electricity consumption in private households are caused by fossil fuels being burned in a power station, and are therefore allocated to the energy industry. According to initial estimates by the Federal Environment Agency, between 2014 and 2015, Germany's total emissions increased from 902 million tonnes to just over 908 million tonnes of CO_2 equivalents. The sectoral breakdown for 2015 shows the energy industry as the highest emitter of greenhouse gases, accounting for just over 39 percent. The second-highest emitter was industry at 20 percent, followed by the transport sector at 18 percent, and households (direct emissions from residential buildings) at almost ten percent. This is followed by agriculture at eight percent and the commerce/trade/services sector at around four percent. Other emissions (one percent) originate primarily from the waste management sector.

Figure 5: Development of greenhouse gas emissions in Germany, 1990 to 2014, and estimates for 2015 by sector as defined in the Climate Action Programme 2020



Source: Federal Environment Agency (UBA) 2016

4.1 Energy industry

This sector includes all the emissions produced by burning fossil fuels in power stations to supply electricity and heat to public grids, as well as fugitive emissions from the energy industry. As previously mentioned, this also includes emissions resulting from electricity consumption by private households, transport, industry (except self-generated electricity and heat) and the commerce/trade/services sector.

At 358 million tonnes of CO_2 equivalents, accounting for almost 40 percent of total emissions, the energy industry was the highest emitter of greenhouse gases in 2014. This proportion has remained largely constant compared with previous years. Whereas CH_4 emissions decreased as a result of increased energy recovery from coal mine gas, CO_2 emissions, which account for about 98 percent of total GHG emissions in the energy industry, stagnated.

Table 2: Comparison of trends in total greenhouse gas emissions in Germany[1] (Information on absolute emission levels in millions of tonnes of CO_2 equivalents)

Sector	Emissions 1990	Emissions 2014		Emissions 2015 (estimate)		Trend 1990 to 2015	Trend 2014 to 2015	"With measures" projection 2020, absolute and change versus 1990 (without action programme measures)		"With additional measures" projection 2020, absolute, and change versus 1990 (with action programme measures)	
	absolut	absolut	[%]	absolut	[%]	[%]	[%]	absolut	[%]	absolut	[%]
Energy sector	466	358	40 %	355	39 %	-24 %	-1 %	313	-33 %	296	-37 %
Industry	283	181	20 %	182	20 %	-36 %	+0 %	181	-36 %	174	-39 %
Transport	163	160	18 %	164	18 %	+0 %	+2 %	144	-12 %	137	-16 %
Households	131	85	9 %	88	10 %	-33 %	+4 %	77	-41 %	63	-52 %
Commerce, trade, services	78	34	4 %	35	4 %	-55 %	+5 %	40	-48 %	38	-51 %
Agriculture	88	72	8 %	72	8 %	-18 %	+1 %	76	-14 %	72	-18 %
Other emissions	38	13	1 %	12	1 %	-69 %	-5 %	9	-77 %	9	-78 %
Total	**1,248**	**902**	**100 %**	**908**	**100 %**	**-27 %**	**+1 %**	**841**	**-33 %**	**789**	**-37 %**

1 Actual emissions until 2015 using GWPs from IPCC AR4, thereafter projections using GWPs from IPCC AR2 (see 2015 Projection Report).

Source: German Projection Report 2015 and own diagram

Recent estimates indicate that emissions from the energy industry fell by less than one percent in 2015 compared with 2014, to 355 million tonnes of CO_2 equivalents. The main reason for this is that less coal was used. However, since 2015 was an unusually mild year, it cannot be assumed that this trend was necessarily the result of the measures implemented.

The key climate change mitigation measures in the energy industry are emissions trading, the expansion of renewable energy and more widespread use of cogeneration, and the gradual reduction of lignite-fired power plant capacity on the supply side, combined with measures reducing electricity, heat and cooling demand from power stations in the public energy supply system (increasing energy efficiency).

The 2015 Projection Report, under the with-additional-measures scenario (WAMS) incorporating the measures implemented under the Climate Action Programme 2020 and the NAPE, suggests a reduction in emissions from the energy industry to around 296 million tonnes of CO_2 equivalents by 2020, which equates to an additional reduction of 17 million tonnes compared with the WMS. At the time of modelling, the planned additional efficiency measures in industry and rail traffic, among others, had yet to be formulated in detail, and therefore were not included in the WAMS calculations. Where necessary, additional reductions of up to 1.5 million tonnes of CO_2 equivalents are to be realised by placing lignite power plants in decommissioning/standby. Overall, these measures could reduce emissions by as much as seven million tonnes of CO_2 in 2020.

4.2 Industry

The industry sector includes emissions from combustion processes and from customer-generated electricity in the manufacturing industry, as well as emissions from commercial and industrial processes and product use (including fluorinated greenhouse gases). In

accordance with the principle of allocation by source, emissions from externally supplied electricity are allocated to the energy sector, as are all related measures.

As in previous years, industry was the second-highest emitter after the energy sector. In 2015, emissions remained virtually unchanged against 2014, at 182 million tonnes of CO_2 equivalents (20 percent). The minimal increase in absolute levels in 2015 to 182 million tonnes of CO_2 equivalents only reduced its relative share by a minimal amount.

Industry made progress in reducing emissions, particularly in the 1990s, cutting GHG emissions by around 101 million tonnes of CO_2 equivalents (approximately 36 percent) compared with 1990 levels.

Alongside emissions trading, the most important climate change mitigation measures in this sector are incentives to boost energy productivity, the increased use of renewable energies, and regulations for reducing emissions of fluorinated greenhouse gases. Industry plays a pivotal role if we are to achieve ambitious implementation of the NAPE and the EU Energy Efficiency Directive (EED).

Including the measures in the NAPE and the Climate Action Programme, the 2015 Projection Report suggests that emissions from the industry sector could be reduced to around 174 million tonnes of CO_2 equivalents by 2020, an additional reduction of seven million tonnes compared to the with-measures scenario (WMS).

4.3 Commerce/trade/services

This sector includes all emissions from combustion processes in the commerce/trade/services sector (also known as the small-scale consumer sector), most of which originate from heat supply (fuels for space heating, cooking and hot water). Consequently, emission trends for this sector are very weather-dependent.

The commerce/trade/services sector accounted for a minimal share of less than four percent of Germany's total emissions in 2014, at 34 million tonnes of CO_2 equivalents. The available estimates suggest that emissions increased slightly between 2014 and 2015 to just over 35 million tonnes of CO_2 equivalents, primarily due to the weather. Nevertheless, between 1990 and 2015 this sector achieved a significantly above-average

reduction in its emissions of 55 percent, primarily by imposing energy-efficiency requirements on buildings, processes and products.

The 2015 Projection Report suggests that with ambitious implementation of the measures in the Climate Action Programme 2020 and the NAPE, greenhouse gas emissions in the commerce/trade/services sector could total around 38 million tonnes by 2020, two million tonnes less than under the WMS scenario. The existing building stock, particularly non-residential buildings, offers considerable technical and financial potential for the commerce/trade/services sector. As well as improving energy efficiency in heat and electricity consumption, additional emissions could also be reduced via the use of renewable energies.

4.4 Households

In the household sector, heating and hot water supply in residential buildings are almost solely responsible for direct emissions (excluding electricity and district heating). As such, emission trends here too are subject to distinct weather-related fluctuations.

From 1990 to 2014, direct emissions in this sector decreased by 35 percent to 85 million tonnes of CO_2 equivalents. As a result of weather conditions, the reduction in 2015 versus 1990 was slightly lower, at just over 88 million tonnes of CO_2 equivalents (almost 33 percent). The overall positive trend is primarily attributable to the refurbishment of existing buildings and changes to heating systems.

Effective incentives for energy-efficient building refurbishments, the continuing growth in the use of renewable energy sources, and the harnessing of medium- and long-term potential by implementing integrated neighbourhood strategies as part of energy-efficient urban redevelopment schemes, as well as in the public utilities sector (such as heat recovery from grey water), play a particularly important role in reducing emissions. Electricity-saving measures may also help to reduce emissions in the energy sector.

Key mechanisms include the Energy Saving Act, the Energy Saving Ordinance, the Heating Cost Ordinance, the Renewable Energies Heat Act, the Small Firing Installations Ordinance (1st Ordinance Implementing the Federal Immission Control Act, BImSchV), the EU Ecodesign and Energy Labelling Directives, taxation of energy products for heating purposes, together with grant programmes such as the low-carbon building refurbishment programme and the market incentive programme to promote the use of renewable energies in the heating market.

Allowing for measures under the Climate Action Programme 2020 and the NAPE, the current German Projection Report forecasts significant emission reductions of up to 63 million tonnes of CO_2 equivalents in 2020 under the with-additional-measures scenario (WAMS), equating to an additional 14 million tonnes compared with the WMS. The prerequisite for this is an ambitious implementation of the climate measures planned under the NAPE and the Climate Action Programme 2020.

4.5 Transport

Emissions in the transport sector are caused by fuel combustion in road and rail transport and domestic shipping and aviation. The transport sector does not include the use of fuel in agricultural, forestry and fisheries (which are reported under the agriculture sector), nor does it include GHG emissions from international aviation and shipping, where continuous growth is forecast. The main factors influencing greenhouse gas emissions in this sector are traffic volume, energy consumption, and the type of fuels used (fossil carbon content).

In the base year 1990, domestic transport accounted for 13 percent of Germany's GHG emissions, with 163 million tonnes of CO_2 equivalents. This figure peaked at 185 million tonnes of CO_2 equivalents in 1999, and then decreased until 2009. Since 2010, emissions have once again risen continuously and, according to recent estimates, slightly exceeded 1990 levels in 2015 at just under 164 million tonnes of CO_2 equivalents. This sector now accounts for 18 percent of total emissions.

The 2015 Projection Report suggests that with full and successful implementation of the with-additional-measures scenario and the measures in the Climate Action Programme 2020 and the NAPE, emissions in the transport sector (not counting emissions from international transport) could be reduced to around 137 million tonnes of CO_2 equivalents, an additional reduction of seven million tonnes compared with the WMS. Electric mobility based on renewable energies and alternative fuels offers considerable potential in this regard, along with modal shifts from motorised individual mobility to public transport, cycling and walking, and in the case of freight traffic, from road to rail. Meanwhile, in international aviation and shipping, emissions are projected to increase from 33 million tonnes of CO_2 equivalents in 2012 to 39 million tonnes in 2020.

4.6 Agriculture

The Climate Action Programme 2020 counts methane and nitrous oxide emissions from animal husbandry and fertilizer management, together with carbon dioxide emissions from agricultural fuel use[1], as emissions from the agriculture sector.

From 1990 to 2014, GHG emissions in this sector decreased by around 18 percent from 88 to 72 million tonnes of CO_2 equivalents. In 2015, initial estimates

1 The German inventory report shows fuel emissions from agriculture under energy-related emissions.

suggest that they totalled more than 72 million tonnes of CO_2 equivalents, leaving their share of total emissions virtually unchanged at just under eight percent.

Previous reductions in agriculture are primarily due to the decline in animal husbandry in east Germany after 1990, environmental standards under the EU Common Agricultural Policy, better fertiliser management, and more appropriate stocking rates for livestock. Further reductions could be achieved, for example, by expanding organic farming and improving nitrogen use efficiency.

The 2015 Projection Report, under the with-additional-measures scenario (WAMS) including measures under the Climate Action Programme 2020 and the NAPE, suggests that emissions will remain virtually unchanged by 2020 compared with 2015, at around 72 million tonnes of CO_2 equivalents. This equates to an additional reduction of four million tonnes compared with the with-measures scenario (WMS). Under the WMS (that is excluding measures under the action programme), a slight increase in emissions to around 76 million tonnes of CO_2 equivalents is anticipated. This is counteracted by a decrease in the use of mineral nitrogen fertilisers between 2015 and 2020 to a surplus of 78 kilogram of nitrogen per hectare of farmland (down from 101 kilogram of nitrogen per hectare in 2012), and an increase in organic farming to 0.4 percent of all agricultural land.

4.7 Land use, land use change and forestry

Emissions from agricultural soils (for example, caused by ploughing up grassland) and emissions and storage of carbon in forestry are not currently included in assessments of whether climate targets have been met.[2] However, in the medium term, the potential for additional climate action in this sector should be explored. Conserving and improving the sink performance of forests offers significant potential, along with sustainable forest management and, closely related to this, wood use, conserving permanent grassland, protecting peatlands and supporting natural forest development.

However, the accounting of emissions in this sector compared with other sectors poses major methodological difficulties. Taking all emissions and sequestration into account, on balance this sector can currently still be classed as a sink.

4.8 Other emissions

This sector primarily records methane and nitrous oxide emissions from the waste management and water sectors. Gas emitted by waste landfills accounts for 75 percent of emissions in this sector, wastewater treatment 18 percent, and composting and mechanical-biological treatment (MBT) of waste seven percent.

Since 1990, emissions in this sector have fallen by around two-thirds, from 38 million tonnes of CO_2 equivalents to twelve million tonnes in 2015. At one percent of total emissions, they currently make only a minor contribution to climate-relevant emissions in Germany. These significantly above-average reductions were achieved primarily by making it illegal to landfill organically degradable municipal waste and by stepping up recycling rates. Other consumer-side measures aimed at boosting resource efficiency also impacted other sectors such as households, industry and the energy sector.

According to the 2015 Projection Report, under the with-additional-measures scenario incorporating the measures in the Climate Action Programme 2020 and the NAPE, emissions in this sector could be reduced to around 8.3 million tonnes of CO_2 equivalents, 0.4 million tonnes more than under the WMS. This is the estimated effect of the action programme's funding for direct landfill aeration under the National Climate Initiative's Local Authorities Guideline.

2 Following the source principle, emissions avoided due to the material and energy recovery of wood and other biomass are not reported under agriculture.

5 Implementation of key policy measures under the Climate Action Programme 2020

Below, we assess the **implementation status of all measures in the Climate Action Programme 2020** (including the National Action Plan on Energy Efficiency [NAPE]) at the time of preparing this Climate Action Report (editorial deadline: 31 October 2016). The order in which they are described largely follows that of the action programme.

Where individual measures adopted under the Climate Action Programme 2020 or the National Action Plan on Energy Efficiency (NAPE) have been replaced by alternative measures, or additional, supplementary measures adopted, these are also outlined.

We have also included details of the reduction effects. The Federal Environment Ministry commissioned a consortium of experts with gauging the reduction effects of individual measures. This was based on a variety of data sources and methodologies, including an ex-ante assessment of the effects of the Climate Action Programme 2020 and the NAPE, the calculations contained in the 2015 Projection Report, and the quantifications in the scientific assessment of the Climate Action Programme 2020 likewise commissioned by the Federal Environment Ministry. The experts' findings allow for the current planning and (where available) implementation status of individual measures, but entail a number of uncertainties regarding the assumptions made and the anticipated effects. There are also various other ongoing and planned studies which will be incorporated into future assessments. The estimate

presented here is no substitute for a detailed, empirically based (ex-post) evaluation of individual measures; it is merely a rough estimate of the effects (ex-ante) looking forward to the target year 2020. The German government believes that more extensive studies and estimates are needed to fully gauge individual contributions. The report on this scientific assessment, including descriptions of the main quantification methods used, may be found on the BMUB website.

Appropriate financial backing is pivotal to the successful implementation of these 110-plus measures, particularly the funding measures adopted under the action programme and the NAPE. This topic is therefore dealt with separately in the following section.

5.1 Financing the measures set out in the Climate Action Programme 2020

The German government uses a tried and tested mix of instruments in its Action Programme, combining regulatory law, economic incentives, funding programmes, advice and information.

A significant proportion of the funding programme measures are financed from the additional funds set aside by the German government in 2015. For example, from 2016 onwards, funding under the National Climate Initiative will be topped up by 150 million euros per annum to allow for measures in the Climate Action Programme 2020. Around 2.5 billion euros in total has been set aside for the years 2016 to 2020 for implementing NAPE measures.

There are currently more than twelve billion euros available up to 2020 for new measures under the Climate Action Programme 2020 and the NAPE, around five billion of which is earmarked for climate-friendly building and housing (including building-related measures under the NAPE), more than 1.7 billion euros for transport, more than 135 million euros for reducing non-energy-related emissions from industry and the commerce/trade/services sector, and a further 85 million euros for agriculture.

Additionally, up until 2020, more than 1.2 billion euros will be channelled into long-term research projects in the energy sector, precautionary research into climate change, socio-ecological research, and research in the construction sector. NAPE will be supplemented by a raft of additional measures to boost energy efficiency in buildings, local authorities, industry and rail transport, with the aim of cutting emissions by 5.5 million tonnes of CO_2 equivalents through other measures, particularly in the electricity industry (see section 5.4.2). Between 2016 and 2020 the total Federal Ministry for Economic Affairs and Energy (BMWi) budget for all on-going and new efficiency measures is around 17 billion euros (as at November 2016).

In setting aside significant funds for implementing the action programme and NAPE measures, the German government continues to send an unequivocal signal for more climate action, underscoring its importance for Germany in terms of sustainable growth, investment and jobs (see section 8).

Overall, these measures are incorporated into the budgets and financial plans of each government department (including temporary and permanent posts) with the proviso that the necessary budget funds are available.

The German government has incorporated the required funding of measures under the Action Programme and NAPE until 2020 into the federal budget for 2017 and the 2017 financial plan for the Energy and Climate Fund.

5.2 Measures under the Climate Action Programme 2020

Around 70 percent of the 110 or so measures have already been fully implemented since December 2014. Implementation of all other measures is underway. Table 3 shows the central policy measures under the action programme and their reduction contributions, as per the current implementation and planning status, as quantified and estimated by the consortium of experts. We compare these with the reduction contributions outlined in the action programme of December 2014 (estimates for 2020 excluding the measures in the action programme).

Table 3: Greenhouse gas reduction effects of central policy measures under the action programme, as estimated by the action programme (as per 12/2014) and according to recent estimates by the consortium of experts, compared with the projection for 2020 without measures under the action programme

Key policy measures	Contribution to the reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
	Contribution according to original estimate, as at December 2014	Contribution according to recent expert estimate (rounded figures)
National Action Plan on Energy Efficiency (NAPE) excluding measures in the transport sector	approximately 25 to 30 (including energy efficiency in buildings)	25 to 30 (including energy efficiency in buildings)
Climate-friendly building and housing strategy plus energy modernisation roadmaps of the Federation, Länder and municipalities	approximately 5.7 to 10 in total (of which 1.5 to 4.7 in addition to NAPE)	4.2 to 5.0 in total (of which 0.8 in addition to NAPE)
Measures in the **transport sector**	approximately 7 to 10	1.15 to 1.6
Reduction of non-energy-related emissions from the following sectors:		
Industry, commerce/trade/services	2.5 to 5.2	1.2 to 2.5
Waste management	0.5 to 2.5	0.05
Agriculture[1]	3.6	0.6 to 2.1
Reform of the emissions trading system	Dependent on formulation at EU level	
Other measures, especially in the electricity sector	22	18.3 to 19.5
Consultation, awareness raising and initiatives at all levels on climate action		0.23 to 1.8
Total	**62 to 78**	**47 to 58**

1 The reduction contributions estimated in December 2014 are based on the emission factors for nitrous oxide valid at that time for international reporting. These have since been adjusted and used as a basis for the Climate Action Report 2016 estimates.

Source: German Projection Report 2015 and own diagram

The experts' estimates of the reduction effect of the Climate Action Programme 2020 measures entail a number of uncertainties, particularly in the early/initial phases of implementation. Nevertheless, this interim status indicates that the Climate Action Programme is already taking effect and can be expected to make a significant contribution towards closing the mitigation gap although the indications are that the contribution is smaller than that estimated in the 2015 Projection Report with ambitious and ideal implementation, at just under 60 million tonnes of CO_2 equivalents (see section 3.3.2). Given current trends in influencing factors such as economic growth and net electricity export balance, and taking into account our quantification of the reduction effects of the action programme based on the current implementation and planning status, the reduction is likely to be in the bottom half of the projected range of 37 to 40 percent. It must be noted, however, that the aforementioned projections and estimates entail major uncertainties.

Nevertheless, target achievement is still within our grasp. The German government is therefore stressing the need for consistent implementation of the adopted measures if we are to meet our reduction targets with the measures in the Climate Action Programme 2020. The German government will also continue to monitor the implementation of measures. Based on the projections and estimates due to be updated next year (including the 2017 Projection Report and the Climate Action Report 2017 with updated quantification) and the reduction contributions of the individual areas in the Climate Action Programme 2020 from 2018 the German government will be able to take targeted

corrective action where necessary, also within the context of implementing the Climate Action Plan 2050.

5.3 Emissions trading, European and international climate policy

Germany's climate policy is embedded in European and international agreements and legal obligations. Germany acknowledges its special responsibility as one of the leading industrial nations and an economically powerful EU Member State, and in this regard, lends important impetus to European and international climate policy.

5.3.1 International cooperation

The 21st meeting of the Conference of the Parties to the UNFCCC (COP21) on 12 December 2015 in Paris adopted the text for a new climate agreement, a historic landmark in strengthening climate action and sustainable development. The Paris Agreement entered into force on 4 November 2016, and was ratified by Germany and the EU on 5 October 2016. It represents a turning point in international climate action as the first climate agreement to obligate all countries collectively. To date, 195 countries have submitted their nationally determined contributions (NDCs) to the United Nations. With the agreement's entry into force and individual ratification, the international community has made a binding commitment to limit global warming to well below two degrees above pre-industrial levels, ideally 1.5 degrees. For the first time, fostering climate resilience and making finance flows consistent with a pathway towards the necessary reductions in greenhouse gas emissions and climate-resilient development is anchored as a binding international target in the Paris Convention.

Additionally, countries worldwide have set themselves the target of becoming greenhouse gas-neutral in the second half of this century – that is to not emit more greenhouse gases than can be sequestered in sinks. As illustrated by the IPCC scenarios, this will necessitate a decarbonisation of energy systems worldwide by the middle of the century. However, it even goes beyond this, since the target formulation included all greenhouse gas emissions, even though some emissions, for example from agriculture, cannot be reduced to zero.

The Paris Agreement gives all countries the clear task of consistently implementing the climate measures needed. It also breaks down the formerly rigid division between industrialised countries and newly industrialising/developing countries, while at the same time reaffirming the leading role of industrialised countries.

The Paris Agreement includes a five-year review and ambition mechanism to regularly reassess whether individual countries' nationally determined contributions are sufficient. The European Union's NDC must be re-submitted or updated by 2020, and from 2025 a more ambitious contribution must be formulated for the period after 2030. These provisions, together with a uniform, robust and transparent reporting system for all countries, coupled with progress in implementing NDCs and climate funding, aim to ensure that the goal of greenhouse gas neutrality can be achieved.

The Paris Agreement secures support for vulnerable countries in their climate action and adaptation measures in the form of funding, technology transfer and capacity-building.

The Paris Agreement sends an important signal to society and the global economy, and hence to all private and government stakeholders. It obligates the German government to proactively ensure implementation at both national and EU level.

Building on the agreement's huge success and unexpectedly early entry into force, the 22nd meeting of the Conference of the Parties to the Framework Convention on Climate Change (COP 22) in Marrakech (Morocco) in November 2016 was dedicated to its implementation. The parties adopted a work programme up to 2018, setting out the issues for negotiation and individual stages with regard to mitigation, adaptation, financing, transparency and capacity building, as well as formulation of the ambition mechanism referred to in the agreement. Another important outcome of the summit was the NDC partnership initiated by Germany and Morocco, aimed at supporting developing countries in particular in implementing the convention.

In reality, the NDCs submitted so far by individual countries vary significantly in their level of ambition and hence also in their CO_2 avoidance costs. In implementing the Paris Agreement, the German government is therefore continuing to call for uniform global competitive conditions. Germany is also a member of the World Bank's Carbon Pricing Leadership Coalition, which advocates global CO_2 pricing instruments.

At the Petersberg Climate Dialogue (3 to 5 July, 2016 in Berlin), hosted by the German government, numerous countries and representatives from industry and civil

society worldwide discussed the steps needed to implement the Paris Agreement. At the meeting, it became clear that climate action is being taken by governments worldwide, and that industry and the financial sector are likewise adjusting to the new framework conditions.

5.3.2 Cooperation within the EU

Climate action is a key policy area within the European Union. The EU is on track to exceed its current binding target of reducing greenhouse gas emissions by 20 percent by 2020 compared with 1990 levels. By 2015, an EU-wide reduction of around 22 percent had already been achieved. In October 2014, the European Council adopted a new target to succeed the 2020 target, of cutting greenhouse gas emissions within the EU to at least 40 percent below 1990 levels by 2030. This target is based on a cost-efficient reduction path for meeting the two degree upper limit as set out in the European Commission's Roadmap for moving to a competitive low-carbon economy in 2050. Like the 2020 target, the climate target for 2030 will be met by a combination of the EU Emissions Trading System (ETS), which primarily applies to large segments of industry and the energy sector, and binding national targets for the sectors not covered by the ETS (primarily transport, buildings and agriculture) within the context of the Effort Sharing Regulation (ESR).

In addition to the climate target, the EU's climate and energy framework also sets out other targets for 2030, including boosting the share of renewables to at least 27 percent of final energy consumption, and increasing energy efficiency to reduce primary energy consumption by at least 27 percent compared to the reference projection, with the option of raising this to 30 percent. This in turn reflects the structure of the 2020 climate and energy package, which also contains targets for renewables (20 percent) and energy efficiency (20 percent).

On 6 March 2015, the EU adopted its 2030 climate target (intended nationally determined contribution, INDC) as its contribution to the planned international climate agreement, and submitted it to the UNFCCC secretariat. With the agreement's entry into force, the INDC was converted into the EU's actual contribution (NDC).

Following the EU Commission's legislative proposal to revise the EU ETS in line with the new 2030 climate target in July 2015 (see section 5.3.3), the proposal for EU target sharing (ESR) was published on 20 July 2016. This sets out the national climate targets for sectors not covered by the ETS. Under a 2014 resolution by the European Commission, reduction targets are distributed among the Member States within a range of 0 to minus 40 percent. For Germany, the proposal envisages a reduction of minus 38 percent compared with 2005. The land use, land use changes and forestry (LULUCF) sector will be incorporated into the EU climate and energy policy framework in a separate legislative text (LULUCF Regulation). The Commission's proposed ESR allows for the limited flexible use of credits from the LULUCF Regulation. Both Commission proposals are currently being debated in the Council and EU Parliament.

5.3.3 Emissions trading

The emissions trading system (ETS) is a key pillar of European climate policy. It covers the majority of emissions from industry and the energy sector, and was extended in 2012 to include aviation within Europe. In Germany, the vast majority of installations in the industry and energy sector (around 1,900) participate in emissions trading.

Emissions trading is an EU-wide mechanism, and is not structurally designed to selectively reduce emissions in specific countries and sectors in order to meet national climate targets. However, it does create central incentives to cut emissions via the CO_2 price, which in turn supports the achievement of national climate targets.

The economic and financial crises in recent years, coupled with an influx of international project certificates, led to high numbers of surplus allowances, leading to very low CO_2 prices, which severely weakened the incentive effect of the ETS for investing in low-emission technologies. For this reason, before adopting the Climate Action Programme 2020, the EU introduced so-called backloading to remove some 900 million emission allowances from the market by 2016. However, this was only the first step in a structural reform of the ETS, aimed at eliminating the accumulated surpluses in the medium term and making the ETS more flexible to cope with greater fluctuations in demand and hence in prices.

To this end, in 2015 the European Parliament and the Council adopted the EU Commission's proposal to introduce a market stability reserve (MSR). From 2017 onwards, the surpluses from the previous year will be calculated, and the following year – starting on 1 January 2019 – the quantity of emission allowances to be auctioned will be reduced or increased accordingly, if surpluses are above or below defined threshold values. The market stability reserve will absorb surplus quantities, and/or issue additional quantities for auction.

In 2017, the EU Commission is planning to amend the Auction Regulation implementing the resolution on the market stability reserve, with effects on the auction calendar and its term, among other things. Furthermore, a number of amendments to the Emissions Trading Directive will be incorporated into the ongoing process to formulate the 4th trading period of EU emissions trading.

Although the market stability reserve failed to enter into force in 2017 as hoped, the compromise reached – of introducing the market stability reserve by 2019 and transferring the existing backloaded allowances and any allowances remaining from the previous trading period into the market stability reserve – is seen by Germany as an important step towards stabilising emissions trading as a climate change mitigation instrument in Europe. Additional steps to create a price signal based on scarcity must follow. The reform begun with the MSR must be continued and implemented.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Dependent on formulation at EU level
Contribution according to experts' recent estimates	

5.4 Electricity generation and climate action

The climate-friendly generation of final energy and its efficient use are the supporting pillars of the energy transition. The German government believes that its climate targets cannot be achieved without a convergence of the two.

The energy sector – particularly electricity suppliers – has a particular responsibility to meet these goals. For this reason, the German government's Climate Action Programme 2020 addresses other measures in this sector which it hopes will additionally reduce greenhouse gas emissions alongside emissions trading. At the same time, the National Action Plan on Energy Efficiency (NAPE) also includes measures to reduce electricity consumption (see section 5.5).

5.4.1 Renewable energies

In 2015, the use of renewable energies in the electricity sector helped to avoid around 120 million tonnes of CO_2 equivalents in greenhouse gas emissions. Wind energy, biomass and photovoltaics were the principal contributors towards mitigating climate change. The Renewable Energy Sources Act (EEG) created the regulatory framework for the further targeted expansion of renewables. The 2016 reform of the EEG (EEG 2017) is designed to ensure effective planning and control. The Act was adopted by the Bundestag on 8 July 2016, and will enter into force on 1 January 2017.

The revised EEG centres around the introduction of competitive tendering as an instrument for controlling volumes. This had already been introduced in EEG 2014, initially for ground-mounted photovoltaic systems, and the 2016 amendment to the EEG now extends competitive tendering to most (renewable) energies as of 2017. The aim is to achieve the targeted expansion corridor of 40 to 45 percent renewables in the electricity supply by 2025, and 55 to 60 percent by 2035, as cost-effectively as possible. For example, despite a further year-on-year increase in the share of renewable electricity in gross electricity consumption to 31.6 percent or 187 terawatt hours in 2015, consumer electricity prices remained largely stable. Companies with a partial exemption from government price components (such as the EEG surcharge and grid charges) additionally benefit from a significant drop in spot electricity prices, which were on a par with 2003 levels in the first half of 2016 thanks to the increased feed-in of electricity from renewables (in the 2.5 cent per kilowatt-hour range).

In 2015 and 2016, five successful bidding processes were carried out for pilot projects in ground-mounted photovoltaic systems. From the first round on 1 April 2015 to the fifth round on 1 August 2016, the average successful bid decreased from 9.17 cent per kilowatt-hour to 7.25 cent per kilowatt-hour. The sixth and final pilot, for 125 megawatts, was offered for tender on 1 December 2016.

Overall, the progress report on these pilots submitted by the German government in the first half of 2016, as required under section 99 of EEG 2014, was positive. It includes recommendations for calculating the level of financial subsidies from tenders (including other technologies) and the volume of electricity that must be offered for tender if we are to reach our expansion targets for renewables. For a final assessment of the pilot phase, we must await details of the implementation rate of the pilot projects awarded. From the first two rounds of tendering, as at August 2016, 25 and 27 percent of the winning bids respectively had been implemented; the binding deadline for implementation is within 24 months of receiving the tender. The implementation rate at the end of this two-year period cannot be predicted as yet. We assume that many projects will not commence operation until towards the end of the implementation period. Given the positive overall assessment, EEG 2017 will retain the tendering process for ground-mounted PV systems and, as outlined above, will also extend this to other technologies.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Foreseeable development reflects projections without the action programme
Contribution according to experts' recent estimates	

5.4.2 Other measures, especially in the electricity sector

Alongside emissions trading and the expansion of renewables, other measures in the electricity sector are expected to reduce greenhouse gas emissions by an additional 22 million tonnes of CO_2 equivalents by 2020.

To this end, on 1 July 2015, the coalition government adopted a package which included measures in the electricity generation sector (decommissioning/standby mode, CHP) as well as other energy efficiency-related measures above and beyond the NAPE (buildings, industry, municipalities, rail transport), as well as those which have already been translated into valid regulatory law, such as decommissioning/standby mode and the revision of the CHP act (KWK-G).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	22.0
Contribution according to experts' recent estimates including the contribution of CHP (section 5.4.3)	18.3 to 19.5

5.4.2.1 Decommissioning/standby mode

More than 50 percent of the reduction under this raft of measures is attributable to "standby mode". Lignite-fired power plants with a total capacity of 2.7 gigawatt will be gradually and provisionally decommissioned for four years, and placed on standby as back-up electricity, after which they will be permanently decommissioned. The operators will be compensated. This measure is part of the Electricity Market Act (section 13g) adopted by the Bundestag on 24 June 2016. It concerns the following generating plants, which together account for around 13 percent of the total lignite power plant capacity in Germany.

Table 4: Overview of lignite-fired power plants for decommissioning undersection 13g of the Electricity Market Act

Key date	Power plant
By 1 October 2016	Buschhaus
By 1 October 2017	Frimmersdorf, Block P and Q
By 1 October 2018	Niederaußem, Block E and F
	Jänschwalde, Block F
By 1 October 2019	Neurath, Block C
	Jänschwalde, Block E

If this measure alone does not meet the target reduction of 12.5 million tonnes of CO_2 equivalents, the power plant operators will be required to implement additional savings of up to 1.5 million tonnes of CO_2 equivalents per annum in total, starting in 2019.

The decommissioning plan was duly notified to the EU Commission and declared compatible with state aid legislation in an official notice dated 24 May 2016. The first power plant (Buschhaus, Mibrag) entered standby mode on 1 October 2016 and was provisionally shut down.

Measures in the power generating sector relating to additional support for CHP plants are discussed in greater detail in section 5.4.3.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Envisaged contribution under the Electricity Market Act	12.5
Contribution according to experts' recent estimates (this figure is derived from assumptions regarding the development of electricity demand, the quantity of electricity from CHP plants, and the number of hard coal power plants in operation)	Up to 12.5

5.4.2.2 Efficiency in buildings

Another pillar of the coalition government's resolution of 1 July 2015 to reduce emissions by a further 22 million tonnes of CO_2 equivalents concerns additional energy efficiency-related measures in buildings. It belongs in this segment but goes above and beyond the energy efficiency measures for buildings outlined in section 5.6.2.

The funding programme launched in August 2016 to promote optimised heating with high-efficiency pumps and hydraulic balancing hopes to encourage the replacement of up to two million inefficient pumps in buildings by 2020. Heating optimisation will also be supported by hydraulic balancing alongside other low-investment measures (such as the replacement of thermostat valves) in up to 200,000 heating systems. A combination of pump replacement and heating optimisation is also possible. The plans suggest that this could save around 1.8 million tonnes of CO_2 equivalents by 2020. A further 0.7 million tonnes of CO_2 equivalents, the reduction originally envisaged for the

buildings sector, is to be saved via measures in industry (see section 5.4.2.5).

The programme is incorporated into the BMWi's energy efficiency campaign.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Envisaged contribution as per the coalition government's resolution of 1 July 2015	1.8
Contribution according to experts' recent estimates	1.8

5.4.2.3 Efficiency in municipalities

Another element of the package of measures agreed on 1 July 2015 in a key issues paper outlining principles for a successful implementation of the energy transition is supporting energy efficiency and climate action in the municipal sector. Overall, it is hoped that this can achieve an additional reduction of one million tonnes of CO_2 equivalents. With targeted support from the Federation, the plan is to create incentives that will maximise the potential for boosting energy efficiency and reducing greenhouse gas emissions. To this end,

in April 2016, a funding call to invest in model climate projects at local authority level was published under the National Climate Initiative. The selection of ideas is now complete, and 29 projects were invited to submit a funding application, with approval scheduled for late 2016/early 2017. At the end of 2016, a further funding call was published, and project outlines are invited during 2017 and 2018.

This measure also includes projects under the local authority guideline of the National Climate Initiative (see section 5.6.6.2), particularly investment projects in local authorities, childcare facilities, schools, child and youth welfare facilities as well as sports facilities (especially projects to upgrade the lighting and air-conditioning systems).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Envisaged contribution as per the coalition government's resolution of 1 July 2015	1.0
Contribution according to experts' recent estimates (quantification depends on the subsequent formulation of approved projects, so this is a conservative estimate.)	0.12 to 0.24

5.4.2.4 Efficiency of rail transport

The envisaged measures to boost the energy efficiency of Germany's railways are designed to save an additional one million tonnes of CO_2 equivalents.

A funding directive will enter into force in December 2016. The first funding applications may be submitted from 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Envisaged contribution as per the coalition government's resolution of 1 July 2015	1.0
Contribution according to experts' recent estimates (no funding applications have been submitted as yet, so estimates are conservative, given the high level of uncertainty)	0.16 to 0.24

5.4.2.5 Efficiency in industry

As well as boosting energy efficiency in buildings, local authorities and rail transport, the additional efficiency package that emerged from the coalition government's resolutions of 1 July last year also focuses on promoting energy efficiency in industry. Industry's contribution under "other measures, especially in the electricity sector" is estimated at an additional one million tonnes of CO_2 equivalents. A further 0.7 million tonnes of CO_2 equivalents, the reduction originally envisaged for the buildings sector, will be saved via measures in industry.

Regarding the specific implementation of this package of measures, a programme for preventing and using waste heat entered into force in May 2016 as part of the campaign to use waste heat. Further information on this topic may be found in section 5.5.1.4.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Envisaged contribution as per the coalition government's decision of 1 July 2015 Plus 0.7 million tonnes of CO_2 equivalents	1.0 0.7
Contribution according to experts' recent estimates (estimated contribution of increased funding for the programme on generic technologies, see section 5.5.1.4).	0.75

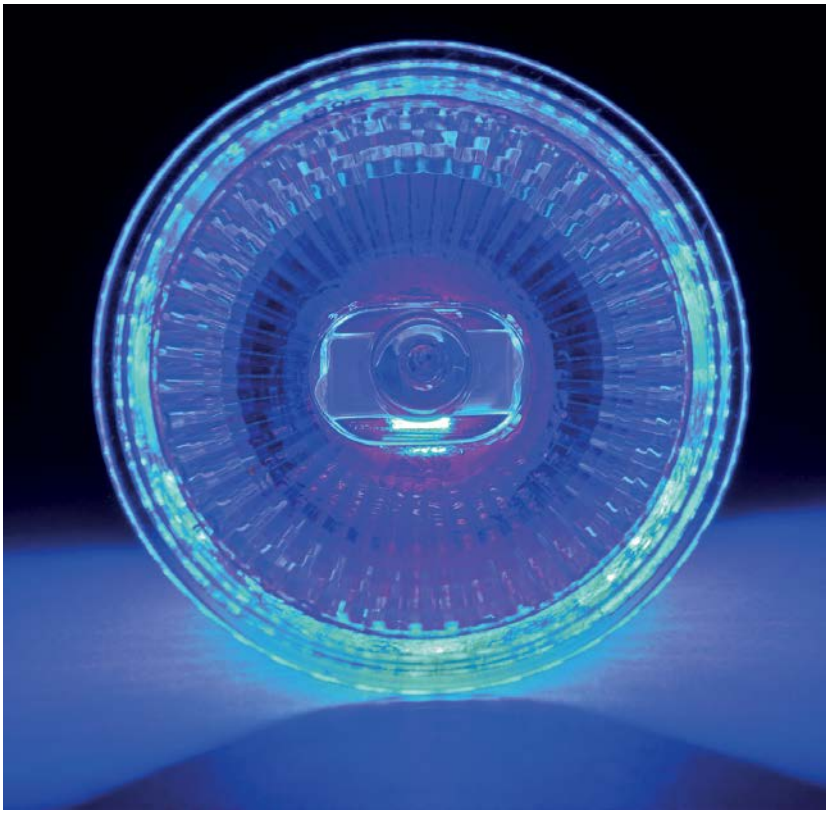
5.4.3 Combined heat and power generation

Systems that cogenerate heat and electricity in highly efficient heat and power plants (CHP) are one of the mainstays of a forward-thinking, climate-friendly energy supply based on the efficient use of fuels. The German government is therefore committed to providing suitable framework conditions for high proportions of CHP energy. Thanks in part to the consistently updated CHP Act, the share of electricity generated in this way has risen moderately (with fluctuations) in recent years, despite the growing challenges of an evolving energy market. Nevertheless, the current upheaval on the electricity market necessitates constant adjustment of the statutory framework conditions to ensure the cost-effective future operation of CHP plants, in the interests of energy efficiency and the climate targets for 2020.

The German government sent a clear signal in this regard with the amended CHP Act which entered into force on 1 January 2016. Inter alia, the act advocates replacing existing coal-fired CHP plants with gas-fired ones. It also supports the modernisation and upgrading of CHP plants to use gas and other fuels. As well as stabilising the overall share of electricity generated in CHP plants, this also sends a clear signal in favour of low-carbon fuels and reducing carbon dioxide emissions in the energy industry.

Moreover, during the course of implementing "other measures – especially in the electricity sector" (see section 5.4.2) while updating the CHP Act in 2016, the German government resolved to redouble its efforts to stabilise the expansion and conversion of cogeneration plants. To this end, the support for CHP plants will be increased from 750 million euros to 1.5 billion euros per calendar year. This included 500 million euros for the previously mentioned conversion of existing coal-fired CHP plants to natural gas, and the construction of new CHP plants based on natural gas. Existing CHP plants in the public grid which already run on natural gas and are no longer eligible for funding will also be supported for a limited period (2016 to 2019). Coal-based plants are generally excluded.

On 24 October 2016, the European Commission approved the funding criteria of the updated CHP Act, so it can now be applied with retroactive effect as of 1 January 2016. The adjustments required under state aid legislation are currently being transposed into a law to amend the CHP Act. The legislative procedure is scheduled for completion in December 2016, with the amendment act expected to enter into force on 1 January 2017.



Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Envisaged contribution under the Climate Action Programme 2020	Unquantifiable
Envisaged contribution as per the coalition government's resolution of 1 July 2015 (see section 5.4.2)	4.0
Contribution according to experts' recent estimates	3 to 4

5.4.4 LED lead market initiative

Light emitting diodes (LEDs) are a cost-effective and energy-efficient lighting option. Use of LEDs has steadily increased, not least thanks to the constant reduction in prices in recent years. Private households in particular are increasingly opting for this efficient form of lighting.

In the public sector, however, many local authorities are still failing to tap into the potential savings with

LEDs both outside and inside, due to a lack of information. The LED lead market initiative (LED-LMI) was created by the BMUB to remove these non-financial obstacles.

To accompany this, in 2015 funding was awarded to a three-year LED-LMI project, the findings from which will be continuously incorporated into the National Climate Initiative.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.01
Contribution according to experts' recent estimates	Impossible to estimate

5.5 National Action Plan on Energy Efficiency

Boosting efficiency, that is reducing final energy demand and thereby the primary energy used to meet that demand, plays a vital role in reducing greenhouse gas emissions. Alongside the aforementioned additional measures focusing on energy efficiency in the electricity sector (see section 5.4.2), the measures outlined in the National Action Plan on Energy Efficiency (NAPE) represent the largest contribution towards meeting the targets of the Climate Action Programme 2020, with a reduction target of 25 to 30 million tonnes of CO_2 equivalents. While the reduction effects of the NAPE on energy consumption are being examined in a separate monitoring process, this Climate Action Report concentrates on the effects of individual NAPE measures to reduce greenhouse gas emissions. This is not intended to replace a detailed evaluation of individual measures, which is scheduled for 2017.

The NAPE is divided into the following areas:

- Energy saving as a business opportunity and way of generating returns on investment (see section 5.5.1)
- Individual responsibility for increasing energy efficiency (see section 5.5.2)
- Energy efficiency in buildings (see section 5.6.2)

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 including other immediate measures, measures as of October 2012, and estimated effects of ongoing work processes	25 to 30
Contribution according to experts' recent estimates	25 to 30

5.5.1 Energy-saving as a business opportunity and way of generating returns on investment

5.5.1.1 Introduction of a competitive tendering system for energy efficiency

Competitive tendering procedures for efficiency measures use the forces of a functioning market to harness savings potential, and motivate stakeholders to identify cost-effective efficiency potential for themselves.

The programme "Saving electricity as part of competitive tendering procedures: Making use of the potential for energy efficiency – STEP up!", launched on 1 June 2016 by the BMWi, promotes electricity savings by using high-efficiency technology. Funding is awarded to measures that achieve the highest saving per euro of funding, that is the maximum ratio of saving to funding cost (euro per kilowatt-hour). This competitive concept means that funding goes to the most efficient measures and each project only receives as much funding as it needs. This maximises the number of projects supported, and avoids overfunding.

Essentially, the programme is open to all stakeholders and technologies, and is designed to cover all sectors (open tender). There are also closed tenders focusing on specific sectors, target groups, technologies or issues with known high potential and obstacles.

The closed tender in the first round (1 June to 31 August 2016) was dedicated to the energy-efficient refurbishment of elevator installations. The closed tender in the second round, currently ongoing (1 October 2016 to 31 January 2017) is dedicated to the implementation of efficiency measures within the context of contracting.

In future, there are plans to offer two three-month tenders each year, one in spring (March to May), and one in autumn (September to November).

The results of the pilot phase (2016 to the end of 2018) will be evaluated and used to improve this mechanism. We expect to see initial interim results from this evaluation by the end of 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	1.5 to 3.1
Contribution according to experts' recent estimates	2.7

5.5.1.2 Promoting contracting – indemnity bonds provided by guarantee banks for contract funding/funding programme for energy-saving contracting

Contracting in the area of energy efficiency (energy saving contracting) or energy supply (supply contracting) can contribute significantly towards maximising existing efficiency potential, for example of technical facilities or properties. In such cases, the measures are not carried out by the owner of the facility or property, but by an external service-provider or energy supplier specialising in this field. However, it is often particularly difficult to fund (secure loans for) energy saving contracting measures, due to risks such as long contract periods, warranties, or high investment risks for the contractor.

For this reason, in adopting the National Action Plan on Energy Efficiency (NAPE), the German government has decided to extend the indemnity bonds offered by the Länder-owned guarantee banks, and to amend the counter-guarantees made by the Federal and Land governments accordingly. In 2015, Federation and Länder agreed to back corresponding indemnity bonds offered by Länder-owned guarantee banks. Parallel to this, a funding guideline on energy-saving contracting was initiated with the aim of improving the advice available to local authorities and small and medium-sized enterprises (SMEs) on funding options for energy-saving contracting.

This funding guideline by the Federal Office for Economic Affairs and Export Control (BAFA), created in 2015, provides basic guidance, implementation advice and tendering advice in the area of energy-saving contracting.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	0.3 to 0.5
Contribution according to experts' recent estimates	0.3

5.5.1.3 Developing the KfW energy efficiency programmes

The energy efficiency programmes offer low-interest loans as an incentive to boost energy efficiency in production facilities and processes.

The updated programme, effective as of July 2015, now bases the level of funding on the amount of energy saved (entry level and premium level). Updated guidance on the funding programme is published on the KfW (Reconstruction Loan Corporation) website. To date, some 400 loans have been offered under this programme.

The above programme is aimed at processes. Energy-efficient refurbishment or new construction of buildings for commercial purposes are funded

through the CO_2 Building Rehabilitation Programme (see section 5.6.2.3).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	2.0
Contribution according to experts' recent estimates	2.8

5.5.1.4 Campaign to use waste heat

A large proportion (around two-thirds) of the energy used in industry is for process heat used in the manufacturing and processing of products. As the thermal energy in process heat is rarely utilised in full, industry produces large quantities of unused waste heat. It can often be cost-effective to use this waste heat, and the aim is therefore to make this technically feasible in the interests of boosting overall efficiency.

The German government has already given a clear commitment to exploiting the use of waste heat as energy in the Climate Action Programme and the National Action Plan on Energy Efficiency (NAPE). The coalition committee's decisions of 1 July 2015 further reinforced this with additional efficiency measures, including some in industry (see section 5.4.2.5). As a result of these decisions the "campaign to use waste heat" has been significantly stepped up as a comprehensive initiative for preventing and using waste heat. An extended programme has been established which supports measures for preventing and using waste heat, particularly within companies. It also funds the external use of waste heat, and the conversion of waste heat into electricity.

In this context, the updated funding guidelines regarding high-efficiency cross-cutting technologies and energy consulting for small and medium-sized enterprises were also extended.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates (disregarding the savings from the industry package of 1 July 2015, see section 5.4.2.5)	0.25

5.5.1.5 Pilot programme for energy-saving meters

Besides funding energy-saving measures, the German government's NAPE also resolved to initiate pilot projects promoting digital solutions for energy efficiency and related business models ("energy-saving meters"). This includes supporting pilot programmes by companies that use digital assistants to quantify energy savings (energy-saving meters) and possibly trial and demonstrate new financing and business models aimed at energy efficiency. The German government feels that energy-saving meters are essential for measuring energy savings accurately, cost-effectively and without favouring any particular technology, thereby incentivising particularly cost-effective savings.

Digitisation can boost energy efficiency in multiple ways, one of which is by better informing consumers and planners. This creates new opportunities for analysis, user information, and the development of energy efficiency services which would previously have been technically/organisationally impossible or too expensive. For example, the pilot programme for energy-saving meters launched in May 2016 supports innovative, IT-based pilot projects to minimise energy consumption using energy services based on the digital collection and processing of energy consumption data. Digitisation also facilitates optimisation of load and supply and associated business models which were supported by the pilot programme for energy-saving meters. New organisational and control systems for industrial production processes (Industry 4.0) can also be used to optimise energy use.

The corresponding funding announcement was published on 20 May 2016 and entered into force the following day. An evaluation and controlling project to analyse the results of the pilot project was also offered for tender. Invitations to tender for a corresponding IT interface are currently under preparation.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.08

5.5.1.6 Improving the conditions for energy services

Energy services offer many opportunities for investing in energy efficiency and energy-saving technologies. Although these are often profitable within a manageable time frame, obstacles evidently remain. In adopting the National Action Plan on Energy Efficiency (NAPE), the German government committed to eliminating these obstacles.

By working with the stakeholders concerned, it aims to radically improve the conditions for the effectiveness of energy services.

As before, all public properties with energy costs in excess of 100,000 euros will be analysed to determine their suitability for contracting. This is to be addressed by 2020 unless alternative measures would produce equivalent energy savings. Properties used by the military are reviewed on a local, case-by-case basis.

The kick-off event for the crucial dialogue processes with the Länder on contracting took place in November 2015. In 2016, the dialogue process included a number of specialist workshops, an annual meeting in November, networking between Länder stakeholders, and the preparation of practical guides such as a sample contract, calculation aids and a guide to energy-efficient contracting. Selected pilot regions (North Rhine-Westphalia, Lower Saxony, Saxony-Anhalt and Rhineland-Palatinate) will also be showcased as part of this process, with the aim of implementing regional centres of excellence for contracting to act as a point of contact for local authorities and the public sector.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.5.1.7 New financing concepts

In the past, investments in measures to improve energy efficiency and thus enhance climate action have often failed due to a lack of, or trapped, liquidity, and because of company decision rules on payback periods for investments.

The efficiency module mod:EEM developed under the National Climate Initiative paves the way for the introduction of environmental and energy management systems, particularly in small and medium-sized enterprises. It systematically encourages companies to implement energy efficiency measures by auditing their energy consumption.

Also in 2015, a working group on "Innovative Financing Concepts" was set up as part of the BMWi's Energy Efficiency Platform. Like the working groups "Advice and Information", "Legal Framework for Energy Efficiency Services", "Competitive Tendering Model" and "Systemic Issues", this group also meets at least twice a year to discuss key issues and formulate recommendations for the plenary session. For example, the working group "Innovative Financing Concepts" has written a number of papers on

- Project bundling
- Risk hedging
- Balance sheet-neutral financing.

Further information on the energy efficiency platform and the individual task forces may be found on the BMWi website.[3]

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014 Contribution according to experts' recent estimates	Flanking measure

Strengthening research to improve energy efficiency

In order to ensure that we continue to consistently and cost-effectively exploit energy efficiency potential, the German government supports application-related, project-oriented research. The resolutions of the NAPE were designed to further expand funding in this area.

For example, research networks have already been set up for the following areas:

- Buildings and neighbourhoods
- Electricity grids
- System analysis
- Renewable energies
- Trade and industry
- Flexible energy transformation.

Additional topics will be added. The research networks are designed to accompany the energy research programme.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014 Contribution according to experts' recent estimates	Flanking measure

Reviewing the efficiency requirement of the Act on the Prevention of Harmful Effects on the Environment Caused by Air Pollution, Noise, Vibration and Similar Phenomena (BImSchG), including optimising its enforcement

When implementing licensing procedures, the competent authorities are required to verify that operators of the installations concerned meet the requirement under section 5 (1) no. 4 of the BImSchG to use energy sparingly and efficiently.

3 www.bmwi.de/Redaktion/EN/Dossier/energy-efficiency.html

Given the complexity of the installations and their technical differences, it is not always easy for the competent authority to evaluate the licensing application. Furthermore, the requirements based on current standards are not sufficiently detailed.

The German government is therefore planning to commission a number of research projects to establish sound decision-making foundations and tools to determine operator obligations on energy efficiency and their legal basis.

It will also commission a research project regarding enhancement of energy efficiency in industrial installations in the hope of gaining insights into ways of reducing the energy consumption of particularly energy-intensive plants by calculating and using the energy potential in existing waste heat streams. The findings from this project will form the basis for the necessary technical developments and suitable policy measures for improving the framework conditions for waste heat use, and hence for increasing energy efficiency among energy-intensive industries.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.5.1.10 Continuing existing programmes to promote energy-efficient production (cross-cutting technologies in SMEs, optimisation of production processes)

There is still major potential to improve efficiency in trade and industry. Since 2014, SMEs have been eligible for grants to invest in high-efficiency cross-cutting technologies; this was extended to large companies in 2016. In 2016, the term of the programme was extended under the resolutions adopted in the National Action Plan on Energy Efficiency (NAPE). The programme provides funding for both individual measures and system-related measures, such as the use of high-efficiency pumps, motors and compressors, and heat recovery systems.

Additionally, since 2014 the BMWi has supported the use of energy-efficient, climate-friendly production processes in industry so as to incentivise energy-efficient, environmentally and climate-friendly choices when investing in production processes.

The experiences to date are now being assessed and reviewed, particularly in the course of amending the funding guideline in line with the planned additional measures for industry agreed by the coalition committee on 1 July 2015 (see section 5.4.2.5).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not reported separately
Contribution according to experts' recent estimates	4.6

5.5.1.11 Energy Efficiency Act

The German government has announced its intention of investigating the potential of an energy efficiency act for effective implementation of the NAPE. In particular, it will investigate the extent to which such legislation could combine the existing regulations and implementation of the targets set out in the coalition agreement, including evaluation.

To this end, it will first be necessary to take stock of the relevant regulations in energy efficiency law. A suitable project has been commissioned, the results of which will be continuously incorporated into the Green Paper/White Paper process on energy efficiency. The Green Paper on Energy Efficiency was published in August 2016 by the BMWi, as the basis for updating energy efficiency policy in Germany.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.5.2 Individual responsibility for increasing energy efficiency

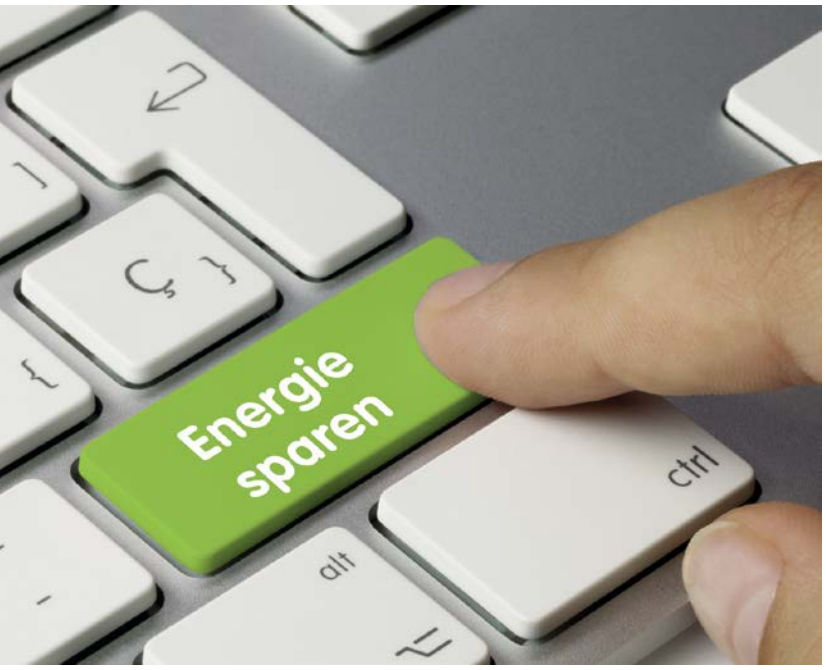
5.5.2.1 Energy efficiency networks initiative

The energy efficiency networks initiative aims to establish 500 energy efficiency networks for companies by 2020. Within these networks, participating companies set joint efficiency targets, and are supported by energy consultants and facilitators.

The networks initiative by the German government and 21 German industry associations is based on uniform minimum standards governing its work. Interested companies are recruited by industry associations and organisations, who may also act as network initiators in individual cases.

Immediately after the adoption of the National Action Plan on Energy Efficiency (NAPE), on 3 December 2014 the agreement on which the network initiative is based was signed by the German government and participating industry associations.

The German government (BMWi) provides funding for an executive office set up in December 2015 and has also increased its financial support for the LEEN 100 plus project as part of the BMUB's National Climate Initiative. A best practice guide on the work of the networks was published in the same year, and the initiative also launched its Internet portal.



Smaller working parties under the direction of the executive office provide support to networks in SMEs, help set up new networks, and assist with PR work. Representatives of the Federation, Länder and industry associations have agreed to coordinate collaboration on establishing regional networks. Special formats have been devised to appeal specifically to SMEs.

The first annual conference took place on 20 September 2016 to showcase the current status of the initiative and encourage dialogue among stakeholders. The German government estimates that more than 100 networks in total will have been set up by the end of 2016, around 70 of them in 2016 alone.

An invitation to tender for an accompanying monitoring project will be issued in 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	5.0
Contribution according to experts' recent estimates (Because small companies can also participate, the savings per company will probably be reduced compared with the December 2014 estimate.)	1.5 to 2.5

5.5.2.2 Advice on local authority energy efficiency networks

By promoting local authority energy efficiency networks, the German government hopes to encourage the selective exchange of experience between local authority decision-makers on energy efficiency issues. The funding programme itself will support and accompany the establishment and operation of these networks.

A funding guideline by the Federal Office of Economics and Export Control (BAFA) entered into force on 1 January 2015. However, it has now been decided that energy efficiency issues for local authorities will be combined under a single umbrella.

A new funding guideline on energy advice and energy efficiency networks for local authorities and non-profit organisations has been in place since 1 January 2016, and combines the following measures:

- Advice on local authority energy efficiency networks
- Energy efficiency in wastewater treatment (see section 5.5.2.9) and
- Energy advice for local authorities (see section 5.6.2.5).

The current implementation status of the funding guideline and the evaluation results are outlined in section 5.6.2.5 (energy advice for local authorities). From 2017, the modules for promoting local authority energy efficiency networks and energy efficiency in wastewater treatment will be transferred to the responsibility of the BMUB as part of the National Climate Initiative. Funding will then be extended to include local authority resource efficiency networks.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not reported separately
Contribution according to experts' recent estimates	0.45

5.5.2.3 EU energy labelling and ecodesign

Energy labelling and ecodesign set out energy efficiency requirements at EU level, and also help to reduce carbon emissions. The latest amendment to the EU Energy Labelling Directive aims to reassess and readjust energy efficiency classes, particularly for product groups that already occupy the best efficiency classes.

The EU Commission's draft regulation on this topic submitted in summer 2015 includes plans to return to the A- to G-label and the introduction of a product database. At the end of November 2015, the Council essentially supported and built on the EU Commission's position, adopting its own draft regulation at its first reading.

With the European Parliament having given its position on this issue in July 2016, including a preference for statutory time limits for the regrading process and support for the EU Commission's proposed database, trialogue negotiations have now begun. Although agreement has not yet been reached, the German government is hopeful that the new directive can enter into force in mid-2017.

Please note that the reduction contribution shown below was estimated for the NAPE as a combined result for the measures "EU energy labelling and ecodesign" and "National Top-Runner Initiative (NTRI)", at 5.1 million tonnes of CO_2 equivalents. The updated estimate for both measures can be found in section 5.5.2.4.

5.5.2.4 National Top-Runner Initiative

Under the NAPE, the National Top-Runner Initiative (NTRI) will be developed as an energy efficiency tool to provide information, promote dialogue and inject new ideas in conjunction with the continued development of the EU energy label.

It will act along the entire value chain to accelerate the market penetration of high-quality services and products, thus helping to lower energy consumption.

The initiative was launched on 1 January 2016, followed by the public kick-off conference on 14 June 2016. The aim is to jointly develop and implement the NTRI by 2018 with the involvement of efficiency stakeholders, including the following measures:

- **Retail**
  Dealer network and dialogue event, training and information, information about the EU energy label and ecodesign, as well as point-of-sale activities for consumers
- **Manufacturers**
  (Innovation) workshops with start-ups and established manufacturers, information for manufacturers on energy-efficient products, the EU label and ecodesign
- **Consumers**
  Advertising and communication for top runners and the efficient use of products, information and event-based campaigns, product finder for top runner products

The NTRI is administered and supported by the Federal Office of Economics and Export Control. An accompanying evaluation will calculate the savings effects associated with the NTRI, with initial results expected towards the end of 2017.

The BMWi has also set in motion a project to identify deficiencies and priority areas among products where energy consumption is a relevant issue. The project aims to validate test methods and, where applicable, propose improvements. The Federal Institute for Materials Research and Testing has been tasked with executing the project, consulting independent product testing laboratories where necessary, and evaluating the results. The Länder will be able to utilise the results of the product tests for their own market monitoring.

Please note that the reduction contribution shown below was estimated by the NAPE as a combined result for the measures "EU energy labelling and ecodesign" and "National Top-Runner Initiative (NTRI)", at 5.1 million tonnes of CO_2 equivalents.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014 National Top-Runner Initiative, EU energy labelling and ecodesign (see section 5.5.2.3)	5.1
Contribution according to experts' recent estimates	2.8 to 3.1

5.5.2.5 Mandatory energy audits for non-SMEs (implementation of Article 8 of the Energy Efficiency Directive)

Among large companies in particular, the potential for efficiency and for reducing greenhouse gases is considerable, given their high energy demand and in-house capacities.

Article 8 of the EU Energy Efficiency Directive (EED) requires companies classed by the EU as non-SMEs to either

- Carry out an energy audit in compliance with DIN EN 16247-1 at regular four-year intervals (the first time being no later than 5 December 2015), or
- Introduce and implement an energy management system according to ISO [Information Security Officer] 50 001, or alternatively
- Implement an environmental management scheme in line with EMAS.

The Federal Office of Economics and Export Control (BAFA) is responsible for enforcement, and commenced random inspections in early 2016. For companies that introduce an energy management system to ISO 50 001 or an environmental management scheme in line with EMAS, the deadline expires on 31 December 2016. An accompanying evaluation of the effects of the Act and its implementation is expected to yield initial results during 2016.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	3.4
Contribution according to experts' recent estimates	1.7 to 2.9

5.5.2.6 Building on the initiative to support SMEs in implementing Germany's energy transition and climate change mitigation policy

The energy transition poses new challenges for almost all sectors of the economy. Since 2013, an initiative has been in place to support SMEs in implementing Germany's energy transition. With the adoption of the NAPE, the German government resolved to continue this initiative beyond 2015 as the initiative to support SMEs in implementing Germany's energy transition and climate change mitigation policy. As a collaborative venture between the Association of German Chambers of Commerce and Industry (DIHK), the German Confederation of Skilled Crafts (ZDH), the Federal Ministry for Economic Affairs and Energy (BMWi) and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), it offers training and networking projects for small and medium-sized enterprises in the skilled trades and industry, along with practical assistance when implementing energy efficiency and climate action measures.

The continuation of the SME initiative was launched on 1 January 2016 to follow on directly from the preceding project. Like its predecessor, the SME

initiative 2.0 is designed as a collaborative project, with funding of the project partners DIHK and ZDH being shared equally between the BMUB, as part of the National Climate Initiative, and the BMWi.

Between now and the scheduled end of the project in 2018:

- The successful energy scout project will be extended
- The service point for SMEs will be continued
- Company employees will be trained in mobility management
- Companies and students in the field of environment, energy and climate studies will be put in touch with one another.

There are also plans to incorporate other partners via the transfer workshops, update existing toolboxes and guides and combine these into an energy efficiency toolbox, and to re-develop a new Energy Book.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.2 bis 0.4

5.5.2.7 Developing the programme to provide energy advice to SMEs

As part of broadening energy advice services, energy advice for SMEs in particular is to be expanded and intensified. Existing funding options will be extended and adapted in line with the Energy Efficiency Directive 2012/27/EU (EED).

Under this measure, the funding programme to provide energy advice to SMEs was adapted in 2015 in line with the requirements of the energy audit as set out in Annex VI of the Energy Efficiency Directive 2012/27/EU. The maximum level of funding was also increased, and the term of the programme extended to 2019. Under the amended programme, it is now also possible to receive funding for waste heat utilisation concepts, and for assistance in the implementation of measures.

To ensure a high quality of energy advice, all consultation reports are currently reviewed for content and technical quality and where necessary returned to the consultants for improvements.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	2.6 to 4.4

5.5.2.8 National efficiency label for old heating systems

The German government believes that the replacement of inefficient, old heating systems offers significant potential for substantially reducing greenhouse gas emissions. By introducing a national efficiency label for old heating systems, it hopes to motivate owners of buildings to replace inefficient systems, also with a view of the potential fuel cost savings. During implementation, from 2016 various players (heating engineers, heating inspectors, building energy advisors) will be able to voluntarily issue a new energy label to old boilers; this will become a mandatory requirement for chief heating inspectors from 2017 onwards.

The amendment to the Energy Consumption Labelling Act (EnVKG) required to implement the national efficiency label for old heating systems was successfully concluded in 2015. This paved the way for introduction of an (initially voluntary) labelling system for boilers more than 15 years old by heating engineers, heating inspectors and building energy advisors on 1 January 2016. The mandatory requirement for labelling by chief heating inspectors is scheduled for introduction on 1 January 2017. This scheme will be implemented and administered by the Federal Office of Economics and Export Control (BAFA). An evaluation of the measure is planned, with the first results anticipated on or after the end of 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	0.7
Contribution according to experts' recent estimates	1.06

5.5.2.9 Energy efficiency in the wastewater treatment sector

Studies have revealed significant potential for efficiency and for reducing greenhouse gas emissions in the wastewater treatment sector. This has prompted the German government to fund energy checks and analyses among local authorities. It will also investigate whether energy checks and analyses should be made mandatory for local authority wastewater treatment facilities in future.

The measure will focus initially on promoting energy checks and analyses, so that in stage two (three years later), mandatory checks and analyses can be introduced.

Since 1 January 2016, funds have been made available under the newly created funding guideline on energy advice and energy efficiency networks for local authorities and non-profit organisations, which combines the following measures:

- Advising on local authority energy efficiency networks (see section 5.5.2.2)
- Energy efficiency in the wastewater treatment sector
- Energy advice for local authorities (see section 5.6.2.5).

From 2017, the funding guideline modules for local authority energy efficiency networks and energy efficiency in wastewater treatment will be transferred into the National Climate Initiative under the competency of the BMUB.

Section 5.6.2.5 outlines the current implementation status of the funding guideline and its evaluation results (energy consulting for local authorities).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	Estimate not yet possible

5.5.2.10 Advice: Consolidation and quality assurance

As verified by the National Action Plan on Energy Efficiency (NAPE) and the Climate Action Programme, the German government provides extensive and direct support for investments in energy efficiency and climate change mitigation measures.

However, in order to maximise utilisation of the many different types of efficiency potential that undoubtedly exist, as well as providing comprehensive information (likewise improved under the action programme and the NAPE), we must also ensure highly qualified advice, both for the preparation and implementation of efficiency and climate change mitigation measures. In order to highlight this and improve the quality and effectiveness of measures, the German government has undertaken to review all existing advisory schemes for intelligibility, effectiveness and any additional requirements that may be necessary consolidating them where appropriate. Quality assurance tools will also be broadened and, where necessary, new quality standards and suitable criteria defined, with the aim of ensuring an appropriately high standard of advice. Adapting the programmes to the specific target groups is considered equally as important as complying with the regulations in the Energy Efficiency Directive.

When the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE) were adopted energy efficiency experts (advisors) working on federal government funding programmes were already registered on an approved government list. This expert list is a way of ensuring quality assurance and training standards, because advisors must provide regular evidence of continuing professional development.

The funding conditions for on-site energy advice for residential buildings and energy consulting for SMEs were improved in 2015. The task force on "Advice and Information" under the Energy Efficiency Platform is also debating the possible introduction of a job profile for energy advisors.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.5.2.11 Developing key performance indicators and benchmarks in the commercial sector and for households

One of the key requirements for assessing climate change mitigation and energy efficiency potential is the ability to identify current energy consumption levels, predict future energy consumption levels and compare both of these with recognised, objective references (benchmarks). Various industries and individual companies already work with corresponding benchmarks.

Certification to ISO 50001 requires an energy management system to have key in-house performance indicators. ISO 50006 provides important information about developing effective performance indicators for the effective monitoring of improved energy utilisation and enhanced energy efficiency.

The German government aims to develop and communicate high quality comparative performance figures and recognised standards and benchmarks in the commerce/trade/service sectors and industry. A range of research projects on this issue are currently being implemented.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.5.2.12 Energy efficiency in information and communications technology

As well as massively increasing the available computing capacity, the huge technological progress in the information and communications technology (ICT) sector has also created significant efficiency potential (reduction in specific electricity consumption). At the same time, the constant expansion of the IT infrastructure and growing volume of devices in use has led to an overall increase in demand for electricity and cooling in this field. A study commissioned by the BMWi on the development of ICT-related electricity demand in Germany (2015) predicted a sharp rise in electricity demand between now and 2025, particularly for data centres and telecommunications networks. The German government recognises the need for suitable measures to counteract this trend.

In the ICT sector, measures are being implemented in several sub-stages. Initially, a dialogue process with relevant stakeholders from academia and industry will identify suitable measures and instruments to boost the efficiency of data centres and telecommunications networks. Workshops on potential efficiency measures in data centres were held in June and October 2016. The results of the dialogue process are being evaluated and a draft outline of measures to boost the efficiency of data centres and telecommunications networks is expected to be presented in the first quarter of 2017.

The Federal Environment Agency will assist the BMWi in the subsequent formulation and implementation of this package of measures from 2017, inter alia by carrying out two studies:

- One will develop key performance indicators on the electricity consumption and efficiency of data centres, and identify and implement appropriate reference and demonstration projects to obtain further conclusions and draw up best practices
- One will explore telecommunications networks, with a particular view to determining which applications still use outmoded network technology, so that suitable options for deactivating inefficient systems can be identified.

The results will also be evaluated within the framework of an accompanying project, with initial results anticipated in the second half of 2019.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	Estimate not yet possible

5.5.2.13 Energy advice for agricultural businesses

Understanding the opportunities for energy efficiency among those affected, that is the operators, owners and users of facilities, buildings and services, is crucial if we are to tap into the potential energy savings. This knowledge must be translated into qualified advice and tailored to the specific industry. In order to maximise efficiency potential in agriculture, the German government has decided to step up its energy advice for farmers and create a funding programme for energy consulting in this sector.

The programme to boost energy efficiency in agriculture and horticulture, launched on 1 January 2016

(due to run from 2016 to 2018), includes measures to promote energy advice by consultants authorised by the Federal Office for Agriculture and Food (BLE) as the implementing agency. The aim is to create customised, individual energy-saving concepts which will encourage greater investments in energy efficiency (see section 5.5.2.14). "Energy efficiency roundtables" will also be encouraged as a forum for knowledge-sharing.

By the end of 2016, 218 consulting applications for total funding of more than 800,000 euros had been submitted. The funding guideline was readjusted to reflect the technical requirements in October 2016.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.5.2.14 Reinstating the federal programme to promote energy efficiency in agriculture and horticulture

Energy advice must be followed up with the regular implementation of appropriate energy efficiency measures. From 2009 to 2012, the BMUB and BMEL operated a joint funding programme to promote the implementation of such measures.

Under the NAPE, the German government decided to reinstate the funding programme, initially for the period 2016 to 2018. Under this scheme, the implementation of specific measures will be funded initially until 2018 as part of a two-phase process (see also section 5.5.2.13) under the umbrella of a guideline (launched on 1 January 2016).

The programme includes funding for modernisation (individual measures and systematic optimisation) and for the construction of new low-energy buildings for horticultural production. It contains a detailed description of individual measures eligible for funding that do not require energy advice pursuant to section 5.5.2.13.

By the end of November 2016, 328 applications for funding of 14 million euros had been received, with a total investment volume of more than 60 million euros. The funding guideline was readjusted to reflect technical requirements in October 2016.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.18

5.5.2.15 Promoting energy efficiency managers to harness potential for example in business and industrial parks

The German government firmly believes that the neighbourhood approach, that is considering groups of buildings and properties in close proximity to one another, is vital for achieving its energy transition and climate targets. This is not confined to residential neighbourhoods, where more and more cross-building approaches will be conceived, analysed, funded and implemented in future; it also encompasses mixed neighbourhoods of trade, commerce, services, industry and residential buildings, or purely commercial areas.

There are plans to establish energy efficiency managers, tasked with identifying cross-company energy efficiency potential, with a similar role to that of climate and redevelopment managers in (residential) neighbourhoods (see section 5.6.6.1). Their tasks will include analysing the data for participating companies, identifying and advising on funding programmes, identifying possible cost-effective efficiency approaches, and supporting the specific implementation of measures.

With the integrated approach of the Energy-Efficient Urban Redevelopment Programme, moreover, selected mixed live-and-work neighbourhoods may also be considered under the energy efficiency advice scheme for commercial properties. The government is currently exploring broadening the programme with a stronger focus on commercial districts.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.5.2.16 Sector-specific efficiency campaigns

Many of the instruments already mentioned in the areas of climate action and energy efficiency are not directed at specific sectors or industries. Sector-specific measures could additionally help to maximise existing emissions and savings potential, not just because they are tailored to a specific technology, but also and in particular because they directly address affected stakeholders in that industry.

Through its efficiency campaigns, supported by the relevant industry associations, the German government's aim is to

- Provide information
- Intensify advice on energy efficiency in specific industries
- Identify cost drivers
- Explore funding opportunities
- Establish networks with which to ultimately
- Implement efficiency measures more widely.

To this end, in 2016, BMWi developed a broad-based information, communications and activation approach on the topic of energy efficiency, including the information campaign "Germany makes it efficient", launched in May 2016 (see section 5.6.2.2).

DEHOGA's (German Association of Hotels and Restaurants) energy and climate action programme, which includes numerous practical energy-saving tips, investment and profitability assessment tools, energy saving leaflets, close collaboration with qualified energy experts and energy efficiency networks, as well as participation in environmental checks for the hotel and catering business, is still running successfully. An animated 3D "virtual" hotel has also been developed, providing interactive information on all aspects of modern household technology and user behaviour. To date, on-site energy consultations have achieved savings of ten million euros. In early 2017, an electronic trading platform for regional products will be set up in close collaboration with existing regional initiatives. The NAPE highlights the DEHOGA energy campaign as an example of good practice for other sector-based campaigns. Under Germany's presidency of the Convention Concerning the Protection of the Alps, the experiences gained in the energy campaign have been shared with the alpine region, a key destination for German tourists. An initiative for climate action and energy efficiency in the hotel and hospitality trade throughout the alpine region has been launched. Another project supports the introduction of energy management systems in alpine hotels, including an alternative system tailored to small and medium businesses established under the Tax Cap and Efficiency System Ordinance (SpaEfV). Moreover, a BMUB National Climate Initiative project with the German retail sector is now at the approval stage.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	Impossible to quantify at present

5.5.2.17 Pilot project on using a new methodology to establish key energy efficiency parameters in companies and support for dissemination

This pilot project will be implemented as part of the development of key performance indicators and benchmarks in the industrial-commercial sector and for households (see section 5.5.2.11). A methodology commissioned by the BMUB for developing energy efficiency parameters in companies will be field-tested in a pilot phase. Key energy efficiency parameters will be devised and applied in companies in many areas of industry, commerce, trade and services using the methodology developed in this project, as a contribution to climate action. The field test is aimed at validating the suitability of the methodology, not only for demonstration projects but also for industry-wide use in companies of different sizes, including SMEs.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6 Climate-friendly Building and Housing Strategy

The Climate-Friendly Building and Housing Strategy seeks an integrated, cross-cutting approach that combines more radical climate action with energy efficiency and the integration of renewable energies into buildings. Alongside energy efficiency and the integration of renewable energies, the strategy will also address more general issues relating to housing, neighbourhood and urban development, development of rural areas, and the challenges associated with demographic change.

The German government believes that its climate targets can only be met if all facets of living – climate-friendly building, energy-efficient neighbourhood and urban development, energy efficiency and the integration of renewable energies into buildings – are harmonised.

The Energy Efficiency Strategy for Buildings, adopted by the German government in late 2015 (see section 5.6.2.14) combines increased energy efficiency and the use of renewable energies for heating as an approach for meeting its goal of a virtually climate-neutral building stock by 2050. The climate-friendly building and housing strategy, as set out in the German government's Climate Action Plan 2050, combines the results from the energy-efficiency strategy for buildings with the aforementioned overarching issues, and was adopted by the German government on 14 November 2016 as part of the Climate Action Plan 2050 (see section 10).

Both these strategic approaches address the long-term goal of a virtually climate-neutral building stock by 2050. Given the long service life of buildings, the German government feels it is important to take early, targeted action in this sector to avoid bad investments.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 of which 1.5 to 4.7 million tonnes of CO_2 equivalents in addition to the NAPE plus energy modernisation roadmaps of the Federation, Länder and municipalities (see section 5.12.4)	5.7 to 10.0
Contribution according to experts' recent estimates of which in addition to NAPE plus energy modernisation road-maps of the Federation, Länder and municipalities	4.2 to 5.0 0.8 No contribution anticipated by 2020

5.6.1 Long-term goal: Climate-neutral building stock

Another aim of the German government's Climate-Friendly Building and Housing Strategy is to create the necessary long-term framework conditions for individuals, villages, towns, cities and neighbourhoods to achieve a virtually climate-neutral building stock. Alongside purely energy-related issues, greater consideration must also be given to cultural, social and economic effects. The affordability of housing, also with a view to demographic development, ecological criteria et cetera, plus a growing desire for flexibility, are particularly important in this context.

These aspects are therefore addressed in the Climate-Friendly Building and Housing strategy, as set out in the German government's Climate Action Plan 2050.

A reliable and valid overview of the underlying data is also pivotal to the long-term strategy.

The German government therefore feels it is vital to broaden its knowledge of building data, so as to derive further concrete measures for achieving a virtually climate-neutral building stock by 2050. Particularly in the area of non-residential buildings, our knowledge of the energy and structural properties of existing buildings is very limited.

As an initial step, a concept has been drawn up for a data survey of the building stock, which will gather basic statistical data on non-residential buildings and conduct empirical analyses of the energy profiles of selected building types. This, together with a timetable for the data survey, is currently being reviewed at government level.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6.2 Energy efficiency in buildings

Reducing final energy consumption by ensuring minimal losses from energy use in buildings is the mainstay of the German government's efficiency policy for buildings.

The lower the demand for final energy through efficient use, the lower too the demand for (fossil) primary energy and consequently the greater the reductions in greenhouse gas emissions, depending on the fuel used.

Below, we outline the energy efficiency measures for buildings adopted by the German government with the NAPE, including their implementation status, as part of the climate-friendly building and housing strategy.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	4.2 to 5.3
Contribution according to experts' recent estimates	3.4 to 4.2

5.6.2.1 Quality assurance and optimisation/development of existing energy advisory schemes

Growing demands on energy efficiency also lead to increased quality requirements for planning and executing efficiency measures. User acceptance of buildings relies on the quality and care with which they are executed, particularly when existing buildings are refurbished. For this reason, it is crucial that the various stages in a refurbishment decision are closely interlinked, as is the case with energy advice and the CO_2 Building Rehabilitation Programme. In this way, it is possible to ensure that funding is available at every stage of investment, from an initial consultation (such as building and heating check-ups) and specific on-site advice to the support of refurbishment schemes, so that high quality standards can be maintained.

During the course of improving energy advisory schemes, in particular, the action programme requires that:

- Funding conditions are improved
- Property owning groups are included in funding
- Funding is made available for the preparation of individual modernisation roadmaps.

The funding guideline on on-site advice, which had been amended in line with the German government's decision on the NAPE, entered into force at the end of the first quarter of 2015.

In 2017, once the relevant software is ready, the individual modernisation roadmap for residential buildings currently under preparation will be incorporated into the on-site advisory scheme. This will be followed by a method to facilitate the preparation of individual modernisation roadmaps for non-residential buildings as well.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	0.2
Contribution according to experts' recent estimates (This estimate entails a high level of uncertainty; the 2017 programme evaluation report will facilitate a more valid estimate; we have therefore opted for a conservative estimate here.)	0.06

5.6.2.2 Incentive programme for energy efficiency

The National Action Plan on Energy Efficiency allows for future funding for energy-efficient building refurbishment with one billion euros of tax incentives per annum over a ten-year period.

However, the Federation, Länder and local authorities have yet to finalise agreement on counter-financing this measure.

In order to help ensure that energy and climate targets are nevertheless met, the German government has decided that the federal funding set aside for tax incentives will initially be channelled into efficiency measures for buildings instead, and has created the "incentive programme for energy efficiency" (grants programme). The programme, launched on 1 January 2016, aims to complement and strengthen the existing funding landscape (low-carbon building refurbishment programme and market incentive programme for renewable energy sources). Duplication of funding is ruled out.

Overall, the package comprises four key focal points:

- Market launch of innovative fuel cell heating (for new and existing buildings)
- Introduction of ventilation systems (ventilation package) combined with refurbishment of the

building shell to prevent structural damage (such as mould)

- Replacing inefficient heaters with efficient models (heater package); this also includes measures for optimising the heating system (heating and heat distribution) and improving its overall efficiency potential

- A communications and activation campaign on energy efficiency.

Implementation will be accompanied by evaluations, which will be partially integrated into evaluations under the CO_2 Building Rehabilitation Programme (see section 5.6.2.3) and the market incentive programme for renewable energy sources (see section 5.6.2.11).

The heating package was launched on 1 January 2016 alongside the low-carbon building refurbishment programme of the KfW and the market incentive programme for renewable energy sources of the Federal Office of Economics and Export Control (BAFA), together with the ventilation package (installation of a ventilation system combined with measures on the building shell). The KfW funding programme "energy-efficient building and refurbishment – fuel cell grant" for fuel cells up to five Kilowatt-electric was launched on 31 August 2016.

The communications and activation campaign "Germany makes it efficient" was launched on 12 May 2016. Two media campaigns from May to July and October/November 2016 focused on heating, refurbishment and energy-efficient products. Online advertisements and comprehensive performance marketing are ongoing. A comprehensive website and a hotline act as the first points of contact for energy consumers. Further campaigns are planned for 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014 This figure includes the estimated reduction effect of tax rebates for building refurbishments adopted under the NAPE.	2.1
Contribution according to experts' recent estimates	0.9

5.6.2.3 Continuing, consolidating and topping up the low-carbon building refurbishment programme up to 2018, including introduction of the Efficiency House Plus funding standard

Between 2006 and 2015, almost 4.1 million homes were built or refurbished under the low-carbon building refurbishment programme and associated KfW funding programmes for energy-efficient new builds and modernisation. Investments totalled more than 220 billion euros. More than 2,300 energy-saving measures on buildings in social or local authority infrastructures were also funded. Measured over a useful life of 30 years, this translates into a reduction of around 8.2 million tonnes of CO_2 equivalents per annum.

In order to maintain momentum and lend additional impetus, the German government has agreed to top up funding by 200 million euros per annum.

Two years after the decisions on NAPE, the measure has now been implemented in full. Last year, the KfW funding schemes were adjusted to reflect the increased investment (energy-related) costs and maintain the funding impetus despite low market interest rates, particularly with increased grants for individual measures and comprehensive refurbishment to Efficiency House standards. For loan-based funding schemes, a repayment grant has been introduced for energy-efficient individual measures, and repayment grants in general have been increased. The loan caps were likewise significantly increased, and in some cases doubled. Access to this type of funding for homeowner associations was publicised and made easier under the Regulations on state aid (the EU's de-minimis regulation).

Among non-residential buildings the KfW energy efficiency programme energy efficient building and refurbishment for commercial buildings and IKK/IKU – energy efficient refurbishment for municipal buildings and social facilities (non-residential buildings) were created/extended for commercial buildings.

Finally, the new funding standard "Efficiency House 40 Plus" was rolled out in the residential building sector in April 2016. Each year, implementation is evaluated by the KfW with the involvement of the BMWi.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	0.7
Contribution according to experts' recent estimates	0.7

5.6.2.4 Heating check-ups

The German government has resolved that voluntary heating check-ups should be used to analyse complete heating systems with a view to energy efficiency, identify any weaknesses, and provide suggestions on how to remedy them and boost efficiency.

An in-depth review of the heating check-up to EN 15378 developed by the industry concluded that government support above and beyond the measures already in place to increase energy efficiency in

buildings would not be constructive. In particular, the high implementation costs and the possible fragmented nature of the programme were cited as barriers, and the German government has therefore opted not to undertake any further research in this regard.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.03

5.6.2.5 Energy advice for local authorities

Public buildings can and should play a highly visible role in implementing the objectives of the energy transition. Local authorities and local authority-owned properties play a key role in this respect. This applies not only because the German government sees huge potential here for energy efficiency and climate change mitigation, but also because public institutions, in particular, act as role models, and their expedient and cost-effective measures for boosting efficiency could be transferred to private residential and non-residential buildings as well. The refurbishment of existing buildings is pivotal to this approach. It is also important to provide energy advice that is tailored to the specific needs of local authority properties. Local authority buildings (and facilities) are often highly complex and heterogeneous.

For this reason, the German government's National Action Plan on Energy Efficiency (NAPE) includes the introduction of a funding programme tailored to the specific needs of local authorities and local authority properties.

Through the guideline on energy advice and energy efficiency networks for local authorities and non-profit organisations the German government has funded a wide range of measures at municipal level since early 2016. The guideline also include measures for the creation of local authority networks (see section 5.5.2.2) and on energy-efficient municipal wastewater treatment (see section 5.5.2.9), combining three of the measures adopted under the NAPE into one funding guideline. Local authority networks (module 1) give employees the opportunity to find out about experiences with energy efficiency-boosting measures in neighbouring communities and to apply them in their own communities.

Funding module 2 (energy advice) is designed to try and clear the investment backlog for local authority buildings and facilities by highlighting specific measures. With new build, local authorities receive assistance in implementing the nearly zero-energy building standard in accordance with the EU Buildings Directive and support in presenting the public sector as a role model for energy efficiency.

Furthermore, wastewater treatment plants are among the biggest energy consumers in a local authority, and as such offer major potential savings. However, the operations in a wastewater treatment plant are so complex that extensive expert knowledge is needed for optimisation. This prompted the German government to incorporate funding for the energy analysis of wastewater treatment plants into the guideline.

The guideline will be enforced by the Federal Office of Economics and Export Control (BAFA), and essentially covers the funding of

- Energy efficiency networks in local authorities (module 1)
- Energy advice for an energy-efficient modernisation strategy for non-residential buildings (module 2)
- Advice on the construction of new non-residential buildings (module 2) and
- Energy analyses for public wastewater treatment plants (module 3).

To date the guideline has funded some 100 local authority energy efficiency networks and by the end of October 2016 had given around 300 funding commitments for energy advice in non-residential local authority buildings (module 2). From 2017 onwards, the funding guideline modules for local authority energy efficiency networks and energy efficiency in wastewater treatment will be transferred into the National Climate Initiative under the competency of the BMUB, while the advice module for energy-efficient modernisation and new build remains with the BMWi.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.04

5.6.2.6 Updating the Energy Conservation Act

Alongside the measures already mentioned to support energy-efficient, climate-friendly buildings by implementing the Strategy for Climate-Friendly Building and Housing, the standards of the Energy Conservation Act (EnEG), the Energy Conservation Ordinance (EnEV) and the Renewable Energies Heat Act (EEWärmeG) are pivotal to achieving the goal of a virtually climate-neutral building stock.

The Energy Conservation Act is being updated in line with the German government's strategy, with a view to defining the future standard for a nearly zero-energy building. The Energy Conservation Act, the Energy Conservation Ordinance and the Renewable Energies Act are to be combined into a single act, creating a uniform system of requirements incorporating renewable energies. Standardisation will make application and enforcement easier.

Regulation of the nearly zero-energy building is a key issue.

The amendment defines the nearly zero-energy standard, initially for newly built, non-residential local authority buildings. Time is of the essence here, since under the provisions of the EU Buildings Directive, from 2019 onwards, these must be constructed as nearly zero-energy buildings. Adopting an ambitious standard should reflect the public sector's function as a role model in energy-efficient, sustainable building.

In a second amendment step, the provisions on nearly zero-energy buildings for new builds in the private sector will be implemented ahead of the 2021 deadline. The provisions of the EU Buildings Directive on nearly zero-energy buildings do not apply until January 2021 in this sector. The efficiency principle is not affected.

The Energy Conservation Act will also be updated to give better consideration to sustainability and, in particular, the climate effects of buildings. There are also plans that will allow particularly efficient, sustainable heating supply solutions – including neighbourhood solutions – to be incorporated more effectively into the energy assessment of buildings in future.

The Federal Ministry for Economic Affairs and Energy is currently debating the draft Act with the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, and the revised text is scheduled for adoption in the current legislative period.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.07

5.6.2.7 Comparison between the Energy Conservation Ordinance (EnEV) and the Renewable Energies Heat Act (EEWärmeG)

The energy requirements of buildings are currently governed by two ordinances. The Energy Conservation Act (EnEG), together with the Energy Conservation Ordinance (EnEV), outline the structural and technical regulations for buildings, while the Renewable Energies Heat Act (EEWärmeG) stipulates that all new buildings must use a specified quota of renewable energies for heating. The coexistence of these different regulations leads to problems in application and enforcement, particularly as they are not fully coordinated with one another.

An expert report was commissioned to investigate the more effective integration of efficiency and renewable energy requirements, the options for better enforcement, and opportunities for simplification.

This comparison formed part of the preparations for updating the Energy Conservation Act, and is now complete (see section 5.6.2.6).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
According to an estimate by the NAPE, as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.8 to 1.6

5.6.2.8 Energy saving legislation III – Improving the Heating Costs Ordinance (review)

The German government believes that reliable, direct information on heating energy comparisons (including hot water supply) can additionally motivate consumers to use energy sparingly.

With this in mind, the German government's National Action Plan on Energy Efficiency (NAPE) resolved to review the central regulatory mechanism in this regard, the Heating Costs Ordinance, to determine whether developing the legal provisions on billing and consumption information, with due regard for the efficiency principle, could usefully help to increase energy savings.

A field trial into the effects of a mid-year consumption bulletin, with the participation of an energy supplier, the German Energy Agency, the German Tenants' Association and the BMUB, is currently underway, aimed at achieving medium- to long-term familiarisation effects for customers. This is particular relevant since it could influence their assessment of the bulletin's cost-effectiveness.

While the field trial is underway, there are no plans to lay down mandatory mid-year consumption data as a requirement in the Heating Costs Ordinance.

Researchers also investigated refining heating bills to create greater transparency for consumers and debated the issue with the *Bündnis für bezahlbares Wohnen und Bauen* (Alliance for Affordable Housing and Living), among others. A follow-on process was agreed with industry representatives from the meter reading companies, the housing industry and the German Tenants' Association to develop a transparent and standardised heating bill.

5.6.2.9 Tenancy law

By 2050, the German government wants to achieve a virtually climate-neutral building stock in Germany. The energy-efficient upgrading of buildings is pivotal to achieving this goal. However, landlords are only willing to carry out energy modernisation in rented homes if the investments are affordable and economical. The option of increasing the rent following modernisation work is therefore an important consideration. Tenants likewise benefit from energy-efficient modernisation if their heating-inclusive rent falls or remains largely unchanged. However, for extensive modernisation work, the rent increase may significantly outstrip the cost savings of lower energy consumption and in individual cases tenants may struggle financially. As well as trimming the energy consumption of existing buildings, the German government is also committed to providing affordable housing.

In order to increase acceptance of modernisation among tenants and protect them from unaffordable rent increases, the German government, in accordance with the proposals made in the coalition agreement, is planning to revise the regulations on post-modernisation rent increases, including the hardship clause. These changes are designed to protect tenants from unaffordable rent increases. In implementing the agreed amendments for post-modernisation rent increases, care must be taken to ensure that this does not adversely impact the incentives under tenancy law to carry out energy-efficient modernisation.

In April 2016, the Federal Ministry of Justice and Consumer Protection (BMJV) submitted a proposal for a further amendment to tenancy law which is currently being debated in parliament.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6.2.10 Individual refurbishment timetables for residential and non-residential buildings

Growing demands on usage, a higher level of technology, and complex structural measures must all be harmonised when refurbishing residential buildings, and coordinated with other parameters, such as the owner's financial resources, and a step-by-step timetable drawn up. Mindful of its target of a virtually climate-neutral building stock by 2050, the German government has decided to develop a standardised framework for refurbishment as a voluntary tool enabling building owners to identify the best technical and financial options for their building.

In June 2015, a consortium was tasked with preparing an expert report on a standardised methodology for individual refurbishment timetables for residential buildings, setting out the timeline for coordinated individual measures. The methodology, including a diagram, component assessment and documentation, has now been drawn up and integrated into the energy consultancy software. The software is currently undergoing practical trials and should become available by early 2017 as a modernisation roadmap to support on-site advice, with suitable funding.

5.6.2.11 Updating the market incentive programme for renewable energies

As well as reducing useful energy demand in buildings in general, the remaining energy demand must be covered by low-emission, renewable energies wherever possible if we are to meet our goal of a virtually climate-neutral building stock. To improve support for renewable energy use in buildings, the German government decided to update the market incentive programme for renewable energies in the heating market (MIP) as the key element of its strategy.

Even before the NAPE resolutions, the MIP was a significant contributor to Germany's climate targets, by motivating and supporting private individuals, companies and local authorities to invest in sustainable heating and cooling technology based on renewable energies in order to meet their requirements. The MAP therefore also contributes to the target enshrined in the EEWärmeG of a 14 percent of final energy consumption for heating and cooling from renewables by 2020. MIP funding takes two forms: Installations at the lower end of the output range receive investment grants from the Federal Office of Economics and Export Control (BAFA), while larger

installations receive reduced interest loans from BAFA with repayment grants from the KfW.

The updated MIP entered into force on 1 April 2015, extending and improving the available funding and making it more attractive. Since then, we have seen a significant rise in applications. The CO_2 savings from MIP-funded installations totalled just over 815 thousand tonnes of CO_2 equivalents per annum for systems installed in 2013, and just over 650 thousand tonnes of CO_2 equivalents per annum for systems installed in 2014.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Not shown
Contribution according to experts' recent estimates	0.8

5.6.2.12 Prompt establishment of new technical standards – Development of system components

This measure under the National Action Plan on Energy Efficiency (NAPE) aims to ensure the prompt introduction of new, innovative technical standards, prompted by the realisation that long delays can occur between the development of products and their market launch, particularly among buildings. In consequence, potential for simplification and hence efficiency remains untapped. Using standard system components could offer an opportunity to construct buildings both cost-efficiently and with a consistent technical quality.

In 2015 the German government commissioned an expert report to explore the key requirements for faster introduction of innovative technical standards. The study, now complete, highlights the importance of technical standards for maximising energy efficiency potential in selected industries. It measures how component standardisation improves the energy efficiency of the overall system, how innovative new components may be incorporated more quickly into existing solutions using defined system requirements, and how suitable technical standards can be established more quickly.

The report incorporates all aspects of the planning, construction, refurbishment and operation of buildings, covering a broad range of aspects such as product development and market access standards, standardised planning tools and dimensioning aids, and the lack of standards concerning the transparency and usability of products and procedures.

The results will be incorporated into updating the KfW funding programme "energy-efficient refurbishment" and the Energy Conservation Act (EnEV – see section 5.6.2.6). Selected results were also used to prepare the energy efficiency strategy for buildings (see section 5.6.2.14).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6.2.13 Research network on energy in buildings and neighbourhoods

New ideas, concepts and technologies are the engine of the German economy. The German government is committed to promoting and consolidating the development of new ideas, and translating them into practice as quickly as possible. As in other areas, research into buildings is a driving force for helping to implement the climate transition.

The research network on energy in buildings and neighbourhoods was instigated to consolidate the flow of information in both directions (between research and practice) so that, firstly, results from research can be transposed rapidly into practice, and secondly, research receives practical feedback on current challenges.

The research network on energy in buildings and neighbourhoods was created in 2015, with 670 experts from various backgrounds who meet in nine working groups to discuss specific research requirements and future funding strategies. They also discuss ways of consolidating and improving research projects that are already underway.

One outcome of the process so far has been the funding initiative "Solar Construction/Energy-Efficient Towns and Cities", launched in 2016, tasked with finding solutions for implementing the energy transition in towns, neighbourhoods and communities.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6.2.14 Energy efficiency strategy for buildings (ESG)

The energy efficiency strategy for buildings shows how a virtually climate-neutral building stock could be achieved by 2050 through a combination of energy efficiency and the integration of renewable energies. It is the German government's strategy document for the energy transition in building. As well as looking at technical and energy-related aspects, it also offers some initial economic approaches, highlighting possible interfaces with other sectors.

The Climate Action Plan 2050 builds on the outcome of the ESG. The energy efficiency strategy for buildings examines two possible development scenarios: the efficiency scenario, and the renewables scenario. A target corridor is drawn between these two scenarios, within which the aim of a virtually climate-neutral building stock by 2050 can be achieved via different paths. While the efficiency scenario is based on (the maximum possible) efforts with regard to efficiency, the renewables scenario is based on the more widespread use of renewable energies up to the predicted limit of their potential. The results of the energy efficiency strategy for buildings will be addressed in the strategy for climate-friendly building and housing.

Additionally, specific measures in this strategy, some of which were already adopted in the NAPE, are to be consolidated and fleshed out. Since the adoption of the energy efficiency strategy for buildings, the funding initiative "energy-efficient buildings 2050 – innovative projects for a virtually climate-neutral building stock by 2050" (see section 5.6.2.15), the funding programme "heating optimisation (pump replacement in buildings and hydraulic balancing)" (launched April to August 2016, see section 5.4.2.2) and the consulting mechanism "individual modernisation roadmaps for buildings" (see section 5.6.2.10) have been initiated.

The efficiency strategy does not see itself as a rigid instrument, but instead will be continually refined en route to achieving the goal of a virtually climate-neutral building stock by 2050. As well as monitoring the efficiency strategy within the context of energy transition, there will be a more in-depth, independent evaluation of the ESG in 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6.2.15 Innovative projects for a virtually climate-neutral building stock by 2050

To accompany the energy efficiency strategy for buildings (see section 5.6.2.14), the programme "energy-efficient buildings 2050 – innovative projects for a virtually climate-neutral building stock by 2050" supports innovative model projects aimed at achieving a virtually climate-neutral building stock by 2050. The idea is to demonstrate what is already technically feasible, financially viable, legally possible and appropriate with these projects, with a view to wider social use. A corresponding funding announcement was published in March 2016. Projects will be evaluated under the "energy in buildings and neighbourhoods" research network (see section 5.6.2.13).

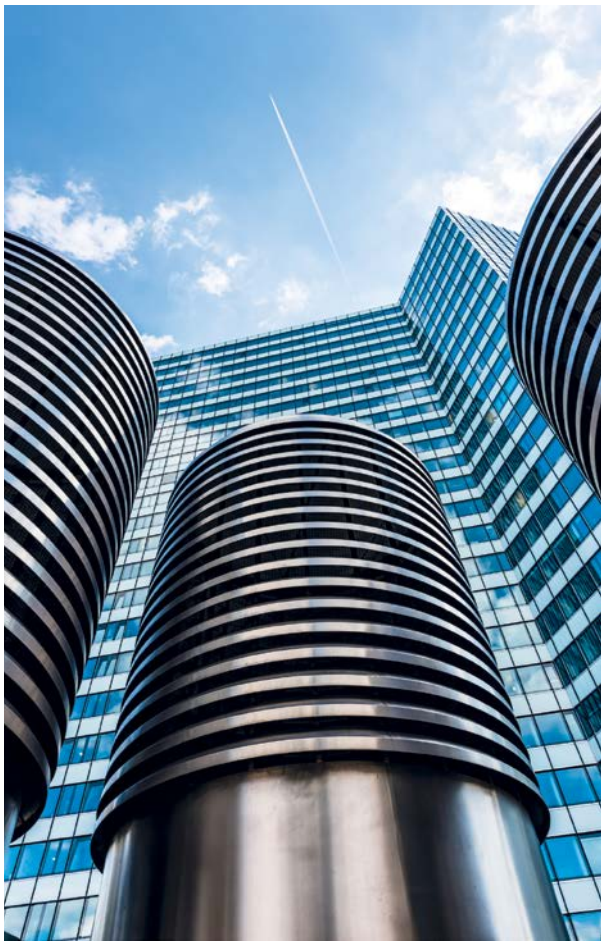
Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	None, as this is a new measure from the ESG
Contribution according to experts' recent estimates	0.02

5.6.2.16 Package of measures: Air-conditioning and ventilation equipment

Besides direct heating systems, air-conditioning and ventilation systems in buildings also often hold major potential for energy efficiency. However, there are a number of obstacles which make it more difficult to tap into this efficiency potential. These include:

- Lack of knowledge among building owners
- Highly complex nature of the technical systems
- Lack of clarity regarding the funding landscape
- Regulatory provisions/standards and their inadequate enforcement.

Alongside the measures already adopted under the National Action Plan on Energy Efficiency (NAPE), the German government is also committed to overcoming these obstacles.



In early 2016 three workshops took place with representatives of the air-conditioning and ventilation industry, stakeholders and the public sector to address potential action areas. A study was commissioned to gauge the potential of ventilation technology to contribute to achievement of a climate-neutral building stock by 2050, and offer technical advice in the climate control and ventilation technology sector. The associated potential savings are being quantified within the framework of the accompanying evaluation (yet to be offered for tender), and interim results of the evaluation are anticipated towards the end of 2018/beginning of 2019.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	None, as this is a new measure from the ESG
Contribution according to experts' recent estimates	Flanking measure

5.6.3 Training initiative for building efficiency

5.6.3.1 BUILD UP Skills

The German government believes that energy-efficient living spaces and non-residential buildings must be professionally planned and executed. A high standard of training is vital to ensure high quality planning and execution. The introduction of new technologies, innovations in construction and the changing demands of users also require a constant flow of information and continuous training and development of all parties involved.

The German government has therefore set itself the goal of entering into dialogue with all the relevant stakeholders, following on from the results of the European construction initiative BUILD UP Skills. Under the BUILD UP Skills initiative, the German Confederation of Skilled Crafts (ZDH) in cooperation with six consortium partners analysed training needs in the construction sector, particularly with a view to achieving the agreed climate and energy targets. At the closing presentation, the associations outlined a number of key measures designed to

- Identify and coordinate future training needs early on
- Improve cooperation across the different trades
- Improve the level of skills training in the trades
- Support small and medium-sized enterprises (SMEs) with their human resources development
- Increase the level of participation in continuing professional development.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6.3.2 ESF programme contribution

In addition to the BUILD UP Skills initiative, carried out by individual trade associations, the German government has also decided to promote cross-trade training for both "trainees" and "trainers" with informal, practical courses held outside the college environment.

The funding programme established under the European Social Fund (ESF) to this end, "vocational training for sustainable development – key green skills to facilitate climate-friendly and resource-efficient working practices (BBNE)" is the first to explicitly focus on environmental and climate aspects.

The programme is divided into two action areas, "cross-trade training" and "each job is green". The aim is firstly to strengthen collaboration among trainees in the various different trades that build and refurbish climate-friendly, low-energy buildings, and secondly to fund work camps and roadshows to provide more information about climate-friendly and resource-efficient jobs.

Under this programme, launched in 2015, 14 projects have already been approved and launched in an initial funding round for the period 2015 to 2018.

All projects aim to be translated into practice very quickly. The first work camps took place in spring 2016, and were followed in summer 2016 by a number of courses for young people to find out about and road-test the greening of jobs. Cross-trade training began a trial phase in January 2016, and by July 2016 numerous trainees and trainers had qualified in cross-cutting topics. The exhibitions are due to open in November 2016 and February 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution according to the NAPE as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.6.4 Climate-friendly housing for low-income households

The German government is committed to making climate-friendly forms of living accessible to as many people as possible. However, low-income households often cannot afford the rent on a flat which has been energy-modernised. For this reason, the German government has decided

- To investigate the possibility of adding a climate component to housing benefit
- To consider a corresponding supplement to basic income support under German Social Code (SGB) II and XII (gross rent including heating).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (combined estimate of the reduction effects of 'climate component for housing benefit' (see section 5.6.4.1) and 'supplement to SGB II and SGB XII' (see section 5.6.4.2))	0.4
Contribution according to experts' recent estimates	0.23
From climate component for housing benefit (see section 5.6.4.1)	0.03
From supplement to SGB II and SGB XII (see section 5.6.4.2)	0.2

5.6.4.1 Climate component in housing benefit

For many homes that have undergone energy efficiency modernisation, the gross rent excluding heating exceeds the maximum monthly amount for housing benefit, which means that these homes are often not affordable for households that rely on housing benefit.

In order to balance this out and make it possible for housing benefit recipients to take advantage of energy-modernised living spaces, the German government's Climate Action Programme 2020 includes an investigation into the introduction of an additional climate component in collaboration with the Länder.

In 2015 the German government commissioned a research project to explore the available options for introducing a climate component to housing benefit which would address the problem as a whole and draw up recommended actions. Initial results from this project are now available and have already been discussed at length with the relevant experts. The final results, together with possible recommended actions, are expected during 2016.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (not shown separately, joint estimate combined with a supplement to SGB II and SGB XII (see section 5.6.4.2))	–
Contribution according to experts' recent estimates	0.03

5.6.4.2 Supplementing SGB II and SGB XII

For recipients of income support benefits the cost of living is currently calculated primarily on the basis of rent excluding heating. This means that energy-modernised homes are often unaffordable for those on income support because of their higher rent excluding heating costs (even though heating costs are lower). In the long term, therefore, these households could be stuck in unmodernised housing stock. Under its Climate Action Programme 2020, the German government therefore decided to explore the possibility of supplementing the German Social Code (SGB II and XII) during the course of simplification. The idea would be to use a single concept (gross rent including heating) to calculate the cost of accommodation and heating when setting basic income support levels for job-seekers under book II (SGB II) and social security benefits under book XII (SGB XII).

Initial results from this 2015 research project are now available, and are already being discussed with selected local authorities. The German government anticipates that the concluding report published in 2017 will outline a number of proposals for further investigation.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (not shown separately, joint estimate combined with the climate component for housing benefit (see section 5.6.4.1))	–
Contribution according to experts' recent estimates	0.2

5.6.5 Rents maps

The German government would like to see more detailed guidelines on the preparation and content of reference rents to ensure legal clarity. The Climate Action Programme 2020 requires an investigation into whether and how the rent map can give greater consideration to the standard of energy-related fittings and energy performance when drawing up rent maps, since the market currently makes no distinction on this basis.

The Federal Ministry of Justice and Consumer Protection (BMJV) has drawn up initial proposals, which were incorporated into a draft act to update tenancy law presented to the government departments in April 2016, together with an accompanying draft ordinance on the content and process of preparing and adjusting rents maps. The drafts are currently being coordinated within the government.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	Savings not anticipated until after 2020, therefore no estimate here

5.6.6 Energy efficiency and climate action in local authorities

Beyond the aforementioned measures for individual buildings, the German government is also committed to supporting energy efficiency projects in neighbourhood and urban planning and at local authority level. Through its programmes on

- Energy-efficient urban redevelopment (see section 5.6.6.1)
- The Local Authorities Guideline (see section 5.6.6.2) and
- The refurbishment of facilities for sports, youth and culture (see section 5.6.6.3),

the BMUB provides extensive support for both to general projects and, in the case of the latter, model projects.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.9 to 3.2
Contribution according to experts' recent estimates	0.52
From the Energy-Efficient Urban Redevelopment Programme (see section 5.6.6.1)	0.08
From climate action in municipalities – Local Authorities Guideline (see section 5.6.6.2)	0.4
From the federal programme for the refurbishment of facilities for sports, youth and culture (see section 5.6.6.3)	0.04

5.6.6.1 Energy-efficient urban redevelopment

Since late 2011, the German government has supported integrated neighbourhood strategies and neighbourhood redevelopment managers, together with energy-efficient supply systems for neighbourhoods (especially heat supply), backed by a comprehensive range of

measures to improve energy efficiency in buildings and local authority infrastructure.

Under the Climate Action Programme 2020, the German government promised to continue developing its successful programme for energy-efficient urban redevelopment through to 2020, and to increase funding levels.

Based partly on an evaluation of 63 pilot projects aimed at practical implementation of the programme, the following short-term improvements and adjustments were implemented in 2015:

- Option to extend the rehabilitation management scheme from three to five years
- Introduction of repayment grants for the energy-efficient neighbourhood utilities sub-programme
- Support for cooling supply and
- Incorporating age-appropriate conversion (elimination of barriers) and affordable living as general incentives for the neighbourhood concepts.

By the end of 2016, since the programme's launch in mid-November 2011, these two sub-programmes ("subsidies for integrated neighbourhood strategies and rehabilitation managers" and "energy-efficient supply systems for neighbourhoods") had issued some 1050 funding commitments with a volume of around 486 million euros. Of these, to date, around 920 were dedicated to the preparation of integrated energy-efficient neighbourhood concepts, and just under 130 to the establishment of a rehabilitation management scheme. More than 310 investment projects for neighbourhood supply systems were also supported.

The funding programme, now entering its sixth year, owes its success to the fact that it was needed, and is tailored to the needs of its users. This was also explicitly recognised at the BMUB Congress "from individual building to neighbourhood – the KfW energy efficient urban redevelopment programme is five years old" in June 2016 by virtually all delegates from politics, associations and industry, along with guests from other countries.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.6 to 1.2
Contribution according to experts' recent estimates (The 2014 estimate is based on an evaluation of the years 2007 to 2010. Now that the evaluation is available for the period 2011 to 2012, CO_2 effectiveness was significantly reduced in the current estimate.)	0.08

5.6.6.2 Climate action in local authorities – the National Authority Guideline

Since 2008, the BMUB has been funding a wide range of climate projects in local authorities under its "guideline on promoting climate action projects in social, cultural and public organisations under the National Climate Initiative" (National Authority Guideline). Since the guideline entered into force, some 3,500 local authorities have received support in implementing more than 10,000 climate projects.

Based on the decision under the Climate Action Programme 2020 to top up the funding available for the National Authority Guideline, numerous improvements to promote climate action at local authority level were introduced in 2015. In particular, funding for investment-based projects has been extended.

In 2016, the guideline was revised again. Now sports clubs may also submit applications for climate-related investments. Local authority companies with at least 50.1 percent local authority ownership may likewise apply for investment funding. Measures to boost the energy and resource efficiency of data centres were likewise incorporated into funding.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.3 to 2
Contribution according to experts' recent estimates	0.4

5.6.6.3 Funding the refurbishment of local authority facilities for sports, youth and culture

To supplement the predominantly broad-based funding of projects via energy-efficient urban redevelopment (see section 5.6.6.1) and the Local Authorities Guideline (see section 5.6.6.2), the German government is also committed to providing dedicated support for sports, youth and culture facilities. A new federal programme created in 2015 was designed in recognition of the importance of such facilities for social and societal integration.

Funding will concentrate in particular on larger social infrastructure projects that resonate nationwide and which serve the dual purpose of social integration and climate change mitigation.

Since the programme's publication, some 56 applications have been selected for funding. The German government anticipates that the structural reviews needed for final approval can be completed during 2016 and specific grants approved, allowing the individual projects to be implemented by 2018.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Not reported separately
Contribution according to experts' recent estimates	0.04

5.6.7 Climate-friendly heat generation

5.6.7.1 Micro-CHP

The German government advocates highly efficient combined heat and power generation as a tried-and-trusted way to significantly boost the share of climate-friendly heat. It supports CHP installations, firstly via regulatory provisions such as the Act for the Preservation, Modernisation and Expansion of Cogeneration (see section 5.4.3) and secondly by selectively funding small CHP plants for local heat supply.

The key mechanism for promoting small and micro-CHP plants is the Micro-CHP Guideline, funding of which was increased under the Climate Action Programme 2020.

In early 2015, an amendment to the Micro-CHP Guideline was published, introducing bonus support for heat efficiency and electricity efficiency.

Overall, between 2014 and 2015, just under 3,400 plants with a total installed electrical output of more than 20 megawatts were supported under this scheme.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.2
Contribution according to experts' recent estimates (reduced number of funding cases compared with the original estimate)	Negligible

5.6.7.2 Eliminating tax obstacles for housing companies

Despite balanced, targeted support of measures and technologies to boost energy efficiency and climate action, other obstacles may be hindering the more widespread use of climate-friendly technologies.

For example, housing associations and other real estate companies may lose their tax relief (exemption from corporation and/or trade tax) if they operate photovoltaic (PV) or other combined heat and power generation plants. In this connection, the German government wishes to highlight the ruling issued by the Düsseldorf regional tax office of 9 September 2013 (G 1425-2013/0015) offering potential solutions to this problem. This suggests that suitable options already exist for avoiding potential tax relief losses. The German government will therefore continue to monitor the situation. However, the measures instigated by housing associations and companies must still allow tenants a free choice of electricity provider, and electricity generated on the building roof must not incur additional costs for the tenant.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.23
Contribution according to experts' recent estimates (Overlap effects are expected to increase compared with the 2014 estimate, particularly with the EEG and KWK-G.)	0.05

5.6.8 Competition for ideas: Making climate-friendly building an attractive option

The German government believes that public identification with and acceptance of its climate change mitigation and energy transition policy is pivotal to its success. (Residential) buildings play a key role here. If we can manage to establish climate-friendly, energy-saving building as a "lifestyle product", this will help to drive the energy transition in buildings forward. With this in mind, the Climate Action Programme 2020 included a competition for ideas with the aim of finding new communicative approaches to make climate-friendly, energy-saving building and housing aspirational.

The cornerstones of this competition are:

- Devising a concept for implementing the competition
- Running the competition with awards for the best ideas
- Translating the results into practice
- Instigating a think tank on climate-friendly building.

The concept behind the competition to find new communicative approaches with input from experts in various different disciplines (advertising, psychology, construction et cetera) is now complete. An external service-provider has been appointed to carry out the competition, due to launch in early 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.7 Climate change mitigation in the transport sector

With 164 million tonnes of CO_2 equivalents (estimate for 2015), transport is responsible for around 18 percent of Germany's greenhouse gas emissions. Developments in recent years (see section 4.4) have shown that, particularly in the area of mobility, considerable efforts are still needed to achieve a sustainable and appropriate contribution to reducing greenhouse gas emissions and meeting our climate targets.

The package of transport-related measures adopted by the German government under its Climate Action Programme 2020 hopes to reduce emissions by between seven and ten million tonnes of CO_2 equivalents by 2020.

Measures were adopted in the following areas:

- Climate-friendly design of passenger and freight transport (see sections 5.7.1 and 5.7.2)
- Increased use of electric drives in vehicles (see section 5.7.3)
- Cross-cutting measures in the transport sector (see section 5.7.4)
- Climate change mitigation measures in aviation (see section 5.7.5)
- Supporting climate change mitigation in international maritime transport (see section 5.7.6)
- Other measures in the transport sector (see section 5.7.7).

In addition to the measures already set out in the Climate Action Programme 2020, the German government has also adopted other measures to boost electric mobility in 2016. As these also contribute to the target of reducing greenhouse gases in Germany, they are likewise included in this Climate Action Report. Essentially, the package of measures adopted on 18 May 2016 includes:

- Tax relief for electric mobility (see section 5.7.3.1)
- A premium for buyers of electric vehicles, including fuel cell and plug-in hybrid vehicles (see section 5.7.3.5) and

- Promoting the ongoing expansion of the charging infrastructure (see section 5.7.3.2).

Because the prompt development of a powerful filling and charging infrastructure for alternative fuels is pivotal to the more widespread use of vehicles with alternative drive systems, on 9 November 2016 the Federal Cabinet adopted the National Strategic Framework for Expanding Infrastructure for Alternative Fuels, which sets out the objectives and measures for expanding the infrastructure in respect of a charging infrastructure for electric vehicles, natural gas supply (condensed and liquefied gas) and hydrogen supply for fuel cell vehicles.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	7 to 10
Contribution according to experts' recent estimates	1.15 to 1.6

5.7.1 Making freight transport climate-friendly

5.7.1.1 Further developing the heavy goods vehicles (HGV) toll and basing it on energy efficiency classes

The German government's decision to further develop the HGV toll is to be implemented with a raft of measures.

Back in 2015, the toll system was extended to an additional 1,100 kilometres of trunk road that are of a similar standard to motorways, and since 1 October it has also applied to vehicles with a maximum laden weight of between 7.5 and twelve tonnes (not previously included in the toll). The HGV toll is due to be extended to all trunk roads in 2018. The draft Fourth Act Amending the German Highway Tolls Act was adopted by the Federal Cabinet in the first half of 2016 and is currently being debated by the Bundestag (Bundestag Printed Paper 18/9440). The incorporation of vehicles with a maximum laden weight of between 3.5 and 7.5 tonnes and long-distance buses is to be reviewed by the end of 2017, together with the option of passing on noise costs.

The HGV toll already levies the maximum admissible surcharges for air pollution under European law (Directive 1999/62/EC). Accordingly, the surcharges for pollutants cannot be further increased without a corresponding amendment to European law.

The proposed measure in the Climate Action Programme 2020 to stagger HGV charges based on energy consumption, with a revenue-neutral effect, would necessitate changes to European and national law. In the light of this, energy consumption is unlikely to be incorporated into the HGV toll in Germany before 2020, meaning a smaller reduction contribution for 2020 than originally anticipated. Given the medium-term potential of this measure to reduce greenhouse gases from HGV traffic, the German government will continue to forge ahead with the necessary processes.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution of extending the HGV toll to trunk roads and reducing the weight limit to 7.5 tonnes under the action programme as at December 2014	0.3 to 0.7
Contribution of extending the HGV toll to trunk roads and reducing the weight limit to 7.5 tonnes according to current expert projections. A higher reduction contribution is anticipated after 2020.	0.27
Contribution of staggered charges based on energy consumption under the action programme as at December 2014	1.5 to 2.3
Contribution of staggered charges based on energy consumption according to current expert projections (measure not yet implemented; not expected to take effect before 2020)	No effect before 2020

5.7.1.2 Market launch of energy-efficient commercial vehicles

Under the Climate Action Programme 2020, the German government has promised to support the market launch of energy-efficient commercial vehicles with a fixed-term incentive scheme.

A funding guideline to boost energy efficiency and reduce greenhouse gas emissions is expected to enter into force in mid-2017, with an initial allotted term of up to four years. The scheme helps with the additional cost of investments to reduce energy consumption and greenhouse gas emissions in toll-paying vehicles. The basis for the funding programme under European law will be the General Block Exemption Regulation (GBER) to determine the compatibility of certain categories of state aid with the Single Market. Levels of support are derived from Article 36 (5) of the GBER. Funding for noise- and energy-efficient commercial rail vehicles also offers additional CO_2 reduction potential.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	1.0 to 1.5
Contribution according to experts' recent estimates (measure under preparation)	0.02

5.7.1.3 Strengthening rail freight transport

The ongoing upgrades to the rail infrastructure to relocate freight traffic onto the railways is the second pillar of the German government's strategy to utilise carbon reduction potential in freight transport. The budget has been significantly increased for the next few years to enable implementation of the relevant demand planning measures. It is particularly important to eliminate bottlenecks if traffic is to be successfully relocated onto the railways.

The budget has been significantly increased for the next few years to enable implementation of the corresponding demand planning measures.

Port links with the existing rail network are currently undergoing an improvement programme until 2020. Overall financing for the planned electrification of the Ulm–Lindau and Munich–Lindau lines has been secured, with electrification measures expected to begin in 2017 (Munich–Lindau) and 2018 (Ulm–Lindau).

It should be noted that the estimated reductions are based on a combined estimate for the measures "strengthening rail freight transport" and "promoting multimodal transport by non-nationalised companies and private rail connections", at 1.5 to 1.8 million tonnes of CO_2 equivalents.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (combined with road freight traffic measures)	(1.5 to 1.8)
Contribution according to experts' recent estimates (Contrary to the assumptions made when estimating reductions under the action programme, it is assumed that the measure will only take full effect after 2020, depending on the investment volume.)	0.05

5.7.1.4 Promoting multimodal traffic by non-nationalised companies and private rail connections

As part of its efforts to restructure freight traffic in a more climate-friendly manner, the German government is committed to the stable expansion of handling facilities for multimodal transport. The German government feels it is particularly important to maintain high levels of funding for handling facilities by non-nationalised companies in this sector. By providing financial support for the construction and expansion of multimodal handling facilities, it hopes to encourage a modal shift to the eco-friendlier railways and waterways. Handling facilities belonging to Deutsche Bahn AG are financed under the Federal Rail Expansion Act and also contribute to moving road freight to rail. However, data on this modal shift is not available.

Since the funding of multimodal transport for non-nationalised facilities began in 1998, funding of around euro 829 million had triggered total investments of approximately euro 1.3 billion by March 2015. In the base year alone, according to the last evaluation in 2013, the programme had helped move around 28.4 billion tonne kilometres from the roads onto the railways and waterways.

The corresponding BMVI funding guideline has been revised, and the updated version is due to enter into force on 1 January 2017. The BMVI also funds the construction, expansion and reactivation of private rail connections under a financing guideline, an updated version of which is likewise due to enter into force on 1 January 2017.

It should be noted that the estimated reductions in the table below were jointly estimated for the measures "strengthening rail freight transport" and "promoting multimodal transport by non-nationalised companies and private rail connections", at 1.5 to 1.8 million tonnes of CO_2 equivalents.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014, including strengthening rail freight transport (see section 5.7.1.3)	(1.5 to 1.8)
Contribution according to experts' recent estimates	Flanking measure

5.7.1.5 Strengthening inland waterway transport

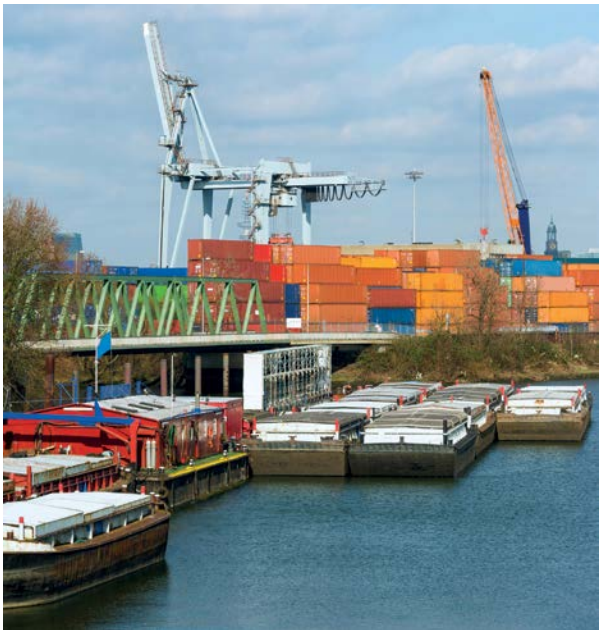
The Climate Action Programme 2020 also provides incentives to relocate freight transport onto inland waterways, with due regard for nature conservation aspects. This also includes providing financial support for multimodal transport handling facilities (see section 5.7.1.4).

Reducing pollutant emissions from ships' engines is a key requirement to raise acceptance of a significant increase in inland shipping. To this end, last year the German government revised the funding guideline for lower-emission engines in inland shipping, and replaced it with the "guideline on grants for inland shipping enterprises for the sustainable modernisation of inland vessels (programme to fund the sustainable modernisation of inland vessels)". The programme, which is scheduled to run until the end of 2018 initially, will encourage the more widespread use of environmentally friendly engines. In total, some 250 projects have been funded under this scheme since 2015, with an emphasis on lower-emission diesel engines.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	The effect of the measure has not been quantified in isolation because it complements other measures in the road and rail freight transport sectors.
Contribution according to experts' recent estimates	Flanking measure

5.7.1.6 Strengthening regional economies

In addition to the measures in freight traffic already mentioned, the German government also plans to strengthen the regionalisation of economies and organise the ever-increasing volumes of delivery traffic in a more environmentally friendly way. Among other things, this relies on incorporating traffic-avoiding and traffic-minimising structures into regional development plans, drawing up appropriate, spatial development and land use plans and establishing overarching public concepts for business and transport development.



These aspects are currently being addressed as part of the "regionally consolidated commercial site development" (RekonGent) research project and embedded into a suitable environmental framework using empirically backed guidance documents and action options for local authorities, shippers and carriers. Proposals are also being drawn up for an assisted-area corridor as part of this project, which aims to reduce the number of journeys and transport distances, protect sensitive areas and reduce land use by consolidating the management intentions of local authorities. This applies both to regional (delivery) traffic and to trans-regional freight transport.

Fundamental analyses are currently underway to serve as a basis for preparing the aforementioned guide. The results are anticipated in the second half of 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.5 to 1.1
Contribution according to experts' recent estimates (Contrary to the assumptions made when estimating the reduction effect in the action programme, the measure is not expected to become fully effective until after 2020.)	Effect only after 2020

5.7.2 Making passenger transport climate-friendly

5.7.2.1 Strengthening public transport

Public transport will likewise be made more climate-friendly.

The German government provides the Länder and municipalities with financial support for local public transport.

Regionalisation funds under the Regionalisation Act (Regionalisierungsgesetz, RegG) are used primarily for public rail transport services, but may also be invested in improving the local public transport system.

Section 5 (5) of the RegG required a re-definition of the level of regionalisation funds available to the Länder. In 2015 the Länder received some 7.4 million euros in total. Within the context of revising the act, the regionalisation funds for 2016 were increased to 8.2 billion euros, with a dynamisation rate of 1.8 percent set for subsequent years up to 2031.

The eight billion euros are distributed based on the so-called "Kiel key" following an agreement with the Länder. Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saarland, Saxony, Saxony-Anhalt and Thuringia, which were financially disadvantaged by the "Kiel key" compared with the previous distribution key, will receive 200 million euros in compensation under a separate key.

Alongside the RegG, since 2007 the Länder have received compensation payments from the federal budget totalling some 1.34 billion euros under legislation on unbundling (Entflechtungsgesetz, EntflechtG). Up until 2013, this was made available to the municipalities for improving local public transport and local authority road building. The Länder themselves decided how funding from the EntflechtG was distributed between these two sectors. Since 2014, unbundling funds have only been subject to a general ring-fencing provision on investment.

To compensate for the loss of financing under unbundling legislation from 2020 onwards, the Länder will receive an equivalent increase in their share of sales tax revenues. A further 332 million euros per annum will also be available to the municipalities under the Act on Federal Government Aid to Improve Transport at the Local Authority Level (Gemeindeverkehrsfinanzierungsgesetz [GVFG]) to help fund local rail transport infrastructures.

Following a resolution of 14 October 2016 by the heads of the federal and Länder governments, the GVFG programme is to be continued, with a significantly increased budget over the next few years to cover the relevant demand planning measures in rail transport.

The German government also continues to support the nationwide introduction of the e-ticket, and an improved passenger information system to make public transport more attractive. In spring 2015, the BMVI also launched a dialogue and stakeholder process as an initiative for the digital networking of the public local transport network. An initial milestone in the process to date is a roadmap outlining the required actions, the steps needed and the corresponding responsibilities, which was adopted in June 2016. The BMVI will also contribute financially to implementation of the roadmap. Corresponding projects will receive a total of 16 million euros between 2016 and 2018. A funding guideline on this topic was published in June 2016.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014, including funding of alternative drives in the public local transport network (see section 5.7.2.2)	0.7 to 1.0
Contribution according to experts' recent estimates (Conservative estimate of the effect of increasing regionalisation funds. It is not currently possible to quantify the reduction effect of the nationwide introduction of e-tickets.)	0.1

5.7.2.2 Promoting alternative drive systems in local public transport

Since 2009, the BMVI has channelled some 100 million euros into the improvement and procurement of buses with hybrid, battery and hydrogen/fuel cell drives. To promote the introduction of alternative drive technologies in local public transport, as part of the BMUB's funding guideline of 2012 (covering the period from 2012 to 2014), transport companies received grants to purchase a total of 58 hybrid buses.

The German government has resolved to continue this funding. Under the new funding guideline, the BMUB will support the purchase of additional hybrid buses.

As part of the June 2015 funding guideline on electric mobility, the BMVI is supporting the expansion of electric mobility in cities, municipalities and districts. Vehicles powered solely by battery will also be considered for grants when purchased in a local authority context.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014, including strengthening public local transport (see section 5.7.2.1)	Not quantified separately
Contribution according to experts' recent estimates	0.02

5.7.2.3 Strengthening cycling and walking

Cycling and walking could partially replace motorised individual transport over short and medium distances, contributing significantly towards reducing CO_2 emissions. A more widespread distribution of electric drives could give the bicycle a larger role in longer distance commuting as well.

Within the context of expanding the cycle path network, the German government is committed to supporting cycling in a legislative sense as well. The 2020 National Cycle Paths Plan (NRVP 2020) is a strategic document for promoting cycling in Germany, in which the German government plays a key role in as

moderator, coordinator and source of ideas. Funding of around 3.2 million euros per annum is provided for both the implementation of non-investment innovative model projects and for the action areas of the NRVP. The government is committed to a safe, demand-based cycle transport infrastructure by building cycle paths on trunk roads and upgrading tow paths on federal waterways to accommodate cycle transport. In total, almost 100 million euros were available for this purpose in 2016.

In 2016 alone, twelve new model projects implementing the NRVP were rolled out, focusing on electric mobility and bikes and the space they interact with. These included:

- The 4th National Cycling Congress in Potsdam
- The German Cycle Prize
- The Cycle Monitor
- The Cycle Academy
- An upgrade to the cycling portal.

The forthcoming call for applications will give priority to applications from the areas of "infrastructure" and "getting mobile by bike – safe and for everyone".

The German government is also tasked with creating the normative framework conditions for developing cycling as necessitated by innovations or for safety reasons. For example, in 2016, e-bikes were placed on an equal legal footing with mopeds.

Model-based investment projects in the area of cycle transport are also supported by the "climate action and cycling competition" under the BMUB's National Climate Initiative. In 2016, 51 project outlines were invited to submit applications, and it is hoped that they will be approved by the end of 2016/early 2017.

The 2015 amendment also improved the funding conditions for cycling under the national authority guideline of the BMUB's National Climate Initiative, and eligibility was extended in 2016.

Funds allocated to the construction of cycle paths on trunk roads were also increased by around ten million euros in 2015.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (with ambitious implementation)	0.5 to 0.8
Contribution according to experts' recent estimates	0.1

5.7.2.4 Promoting corporate mobility management

The German government is committed to supporting corporate mobility management, that is making commuter journeys more sustainable. In future, the development of suitable concepts will be supported by the BMUB and BMVI.

There are plans for a two-stage process with a selection competition, and building on this, a funding guideline to support specific projects. The selection competition is scheduled to take place in the first half of 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Comprehensive quantification is not possible; the efficient mobility programme ("effizient mobil") achieved average savings of 250 tonnes of CO_2 per year, per company.
Contribution according to experts' recent estimates	0.04

5.7.2.5 Fuel-saving driving techniques (cars/HGVs)

The actual fuel consumption of cars and HGVs is determined to a significant extent by individual driving practices. Fuel-saving driving techniques reduce fuel consumption, which in turn reduces emissions of greenhouse gases. For this reason, the German government has decided to promote fuel-saving driving techniques, inter alia by offering training courses.

A research project will be launched in early 2017 to define, structure and assess measures to encourage fuel-saving driving techniques. Interim results are anticipated in 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.4 to 0.8
Contribution according to experts' recent estimates (The measure has not yet been fully implemented. Higher reduction contributions are not expected until after 2020.)	0.04

5.7.2.6 Car Sharing Act

Particularly in densely populated areas, car sharing can help to significantly reduce the traffic pollution caused by individual transportation. Among other things, it helps to improve the traffic flow, ease the pressure on parking spaces, and protect the climate by reducing traffic volumes.

The coalition agreement for the 18th legislative period includes the mandate to create possibilities for the preferential treatment of car sharing. These include the designation of special car sharing bays and either exempting car sharing completely from parking charges or making such schemes eligible for reduced charges. A draft act on preferential treatment for car sharing (CsgG) was agreed within the German government and submitted to the Bundesrat and Bundestag and is expected to enter into force in 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.7.3 Increased use of electric drives in vehicles

In adopting the national development plan for electric mobility in 2009 and the Energy Concept in 2010, the German government emphatically underscored its commitment to significantly increasing the share of electrically powered vehicles in road traffic.

The continuing expansion of electric mobility is pivotal to reducing CO_2 emissions from traffic in the medium and long term. The measures adopted both with and after the action programme to boost the use of electric mobility applications includes a broad raft of measures incorporating fiscal aspects, direct funding, and research and development.

The bundle of measures adopted by the German government on 18 May 2016 will be given an extra boost. This goes beyond the Climate Action Programme 2020 and includes a more extensive broadening of the charging infrastructure, direct funding for the purchase of electric cars, and the granting of tax incentives.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (If the target of one million vehicles is met by 2020 – significantly more after 2020. The reduction does not include additional emissions in the electricity sector.)	0.7
Contribution according to experts' recent estimates. The reduction shown here does not include additional emissions in the electricity sector.	0.5 to 0.7

5.7.3.1 Tax incentives for electric mobility

The Climate Action Programme 2020 initially envisaged a special depreciation allowance for commercial electric vehicles. However, the investigation conducted under the national electric mobility platform showed that this measure would only create a relatively small increase in electric vehicles. For this reason, in May 2016 the German government adopted an additional package of measures to further promote electric mobility, including a tax incentive.

This includes tax exemption for benefits granted by the employer for electric charging of an electric or hybrid electric vehicle at the workplace. It also provides tax incentives for supplying employees with charging devices. It is hoped that this will incentivise employers to become more widely involved in expanding the charging infrastructure.

Additionally, the exemption from motor vehicle tax is being extended from five to ten years for all-electric vehicles registered for the first time between 1 January 2016 and 31 December 2020, and extended to include electric conversions. For first-time registrations, the motor vehicle tax exemption will apply retroactively from 1 January 2016, and for conversions, retroactively from 18 May 2016 (the date of the cabinet resolution on the draft act).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Measure based on the German government's resolutions on electric mobility of 18 May 2016	–
Contribution according to experts' recent estimates	Flanking measure

5.7.3.2 Charging stations

The creation of an adequate number of charging facilities is essential for the more widespread use of electric vehicles.

Until now, Germany has developed a publicly accessible quick charging infrastructure by equipping service stations on motorways with quick-charging pillars (measure on quick-charging infrastructure for electric vehicles at federal motorway service stations), both within the context of the funding programmes for the electric mobility, showcases and model regions, as well as under the SLAM research project (rapid charging network for major axes and cities).

The measure includes a scheme to equip some 400 federal motorway service stations with rapid charging pillars under the concession agreements with Autobahn Tank & Rast GmbH, which has been ongoing since autumn 2015. By the end of 2017, nearly all locations are to be equipped with rapid charging pillars. Installation is closely coordinated with the competent road transport administrations of the Länder. Given the dynamic technological developments in electric mobility, the approach has been updated with a view to the next generation of rapid charging pillars with a charging capacity of 150 kilowatt.

The BMWi's SLAM project includes the creation of and scientific support for location and operator models for rapid charging points, the development of a golden test device and the development of a standardised payment and invoicing system.

This project will create up to 600 additional rapid charging points, 400 of them by 2017; around 150 charging points are already up and running.

In order to accelerate the expansion of the charging infrastructure above and beyond the measures already listed, as part of the May 2016 raft of measures on electric mobility, the German government has decided to make an additional 300 million euros available for expanding the electric vehicle charging infrastructure.

The BMVI is currently working on an additional, comprehensive funding programme aimed at initiating a publicly accessible infrastructure network for regular and rapid charging. The funding guideline, with a four-year term, is due to enter into force in early 2017. The charging electricity must originate from renewable energy sources or from regenerative electricity that has been self-produced locally in order to be eligible for support.

The Charging Pillar Ordinance, which entered into force in March 2016, created binding connector standards for the charging infrastructure. It also states that the Federal Network Agency is responsible for compliance with the technical regulations and the registration of all publicly accessible charging points in a reliable register. The first Amendment to the Charging Pillar Ordinance will implement the requirements of EU Directive 2014/94/EU in full, as well as regulating point-based charging without a contract.

The Electricity Market Act also places charging infrastructure operators on an equal footing with end users, creating legal clarity with regard to the operators' obligations.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.7.3.3 Field trial for electric drives in heavy commercial vehicles

To date, one barrier to the more widespread use of electric vehicles has been their limited range resulting from inadequate battery capacity. However, a number of HGV manufacturers have now announced plans to market heavy commercial vehicles with electric battery drives from 2020, although for the reasons mentioned their application spectrum will be limited to regional deliveries.

By combining fast-charging batteries with sections of overhead contact lines to recharge the batteries whilst the vehicle is being driven, the range of uses for electric drives can be significantly extended. A field trial will test this combination of battery-powered HGVs and an overhead contact line section under real-life conditions. Project outlines were invited as part of the funding announcement for the BMUB's "Renewably Mobile" programme, published in October 2015.

Based on the project outlines submitted, two potential locations have been selected for carrying out the field trial. The German government expects the equipment to be complete by late 2018/early 2019, and the field trial could then begin in early 2019.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates (no effect before the year 2020)	

5.7.3.4 Procurement campaign for electric vehicles – Information campaign

Alongside measures to directly fund the purchase or use of electric vehicles (see sections 5.7.3.1 to 5.7.3.3 and 5.7.3.5), the German government is also keen to raise the visibility of electric mobility by using electric vehicles in publicly-owned fleets. The proportion of newly purchased or leased vehicles with emission levels below 50 g (alternatively: a minimum electric range of 40 km) is to be increased to at least 20 percent.

An information pack on buying electric vehicles, put together by the Alliance for Sustainable Procurement, has been available since early 2016.

The package of market incentives for electric mobility adopted in May 2016 also increased the purchase rate of electric vehicles in government department fleets from ten percent to 20 percent from 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.7.3.5 Purchase premium for electric vehicles

As part of an additional raft of measures to promote electric mobility, on 18 May 2016 the German government also adopted a draft guideline to promote the sale of electric vehicles (environmental premium), published in the Federal Gazette (Bundesanzeiger) on 1 July 2016. The German government believes that this will help to boost demand for environmentally friendly electric vehicles by at least 300,000 units.

The purchase premium of euro 4,000 for all-electric vehicles and euro 3,000 for plug-in hybrids, which will run until 2019 at the latest, is funded in equal shares by the German government and the automotive industry. Eligible vehicles must have a net list price for the basic model of less than euro 60,000. Private individuals, companies, foundations, corporate bodies and associations registering a new vehicle are all eligible to apply.

Applications for purchase and lease agreements signed on or after 18 May 2016 may be submitted online to the Federal Office of Economics and Export Control (BAFA) since 2 July 2016.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Measure based on the German government's resolutions on electric mobility of 18 May 2016	–
Contribution according to experts' recent estimates The reduction shown here does not include additional emissions in the electricity sector.	0.5 to 0.7

5.7.4 Cross-cutting measures in the transport sector

5.7.4.1 Mobility and the federal public administration

The German government is also committed to more efficient, environmentally and socially more acceptable – and hence more sustainable – mobility in its own sphere of responsibility. Its mobility management strategy includes measures such as

- Information
- Communication
- Motivation
- Coordination and service
- Financial incentives.

This will also be linked to the development of a standardised, certified procedure for the planning, execution, implementation and evaluation of mobility management measures.

A research project will draw up a guidance document/catalogue of measures for the federal public administration, with an emphasis on encouraging eco-friendly business trips, sustainable fleet management, promoting sustainable mobility among

employees, and planning and executing climate-friendly or climate-neutral events. The first step will be to analyse which measures already exist in the federal public administration. A second step will analyse legal and organisational obstacles to the implementation of measures in these four action areas, and devise solutions. The outcome will be a catalogue of measures designed to facilitate implementation from a legal and organisational perspective. A concrete proposal for a pilot project for a railcard Bahncard 100 will also be developed in the federal public administration.

The German government expects the project to yield its first interim results during 2017.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.15 to 0.3
Contribution according to experts' recent estimates	No effect before 2020

5.7.4.2 Extension of tax concessions for natural gas and liquefied petroleum gas vehicles beyond 2018

Because they have a more favourable carbon-to-hydrogen ratio than other fuels, natural and liquefied petroleum gases can help to reduce CO_2 emissions in drive systems. In adopting the Climate Action Programme 2020, one of the German government's declared objectives was to extend the valid tax concessions for natural (CNG) and liquid petroleum (LPG) gases as transport fuel beyond 2018. A review of the extension was announced back in 2013 as part of the German government's mobility and fuel strategy, and agreed in the coalition agreement.

In 2015 the Federal Ministry of Finance (BMF) presented its concluding report on the research project on developing energy tax revenues in the fuel sector. Based on this, a corresponding draft act was drawn up by the BMF, which is currently being debated within the German government.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.25
Contribution according to experts' recent estimates	0 to 0.25

5.7.5 Climate change mitigation measures in air transport

5.7.5.1 Single European Sky and market-based instruments

The aim of the "Single European Sky" programme, in place since 2004, is to create a uniform, harmonised European air space, in response to the liberalisation of air traffic in the 1990s, and the anticipated increase in passenger numbers. The creation of a harmonised European air space is viewed as an opportunity to improve fuel consumption, and hence climate action

In an initial stage, the required technological modifications, some of which were very ambitious, were analysed in depth, with a view to incorporating them into the development of a new European air traffic management system from 2017, scheduled for adoption by 2024.

Additionally, in October 2016, the International Civil Aviation Organization (ICAO) adopted a (market-based) instrument to limit CO_2 emissions from international aviation, with a view to achieving carbon-neutral growth in aviation from 2020.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Impossible to quantify
Contribution according to experts' recent estimates	Reduction effect only from 2020

5.7.6 Supporting climate change mitigation in international maritime transport

International maritime transport is not currently included in the national targets for reducing emissions of greenhouse gases. However, as it is a significant contributor, the German government has included it in its measures under the Climate Action Programme 2020. However, no estimates are available of the reduction effect of these measures in 2020.

5.7.6.1 Monitoring and reporting

A key prerequisite of any measure to reduce emissions from international maritime transport is the accurate recording of CO_2 emissions.

Mindful of this fact, the German government has supported EU Regulation 2015/757 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport (MRV Regulation), which entered into force in mid-2015. The German government continues to advocate the introduction of a global system for recording carbon dioxide emissions from maritime transport by the International Maritime Organization (IMO). Additionally, within the IMO, the German government is calling for technical and operational measures to be implemented globally by the IMO for market-based reductions.

In June 2016, the EU Commission presented draft Delegated and Implementing Acts to the MRV Regulation which are due to be adopted this year. These will flesh out the methodology and rules for monitoring CO_2 emissions pursuant to Annexes I and II of the MRV Regulation in order to incorporate the relevant European and international standards and regulate the preparation and verification of monitoring concepts and emission reports. The MRV Regulation will also be adapted in line with international regulations adopted by the IMO in October 2016 as a global system for recording CO_2 emissions from maritime transport.

5.7.6.2 Alternative fuels and LNG

The second measure in international maritime transport focuses on alternatives to ships' diesel, with its comparatively high emissions. The idea is to promote more climate-friendly alternative fuels and boost demand for liquefied natural gases and methane (LNG).

The German government will refit its own vessels as role models. The details are currently under analysis, and the budget is in place. In an initial project the multi-purpose ship "Atair" will be fitted with an LNG propulsion system.

Promoting a range of pilot projects will help to consolidate the readiness of LNG propulsion systems and LNG on-board power supplies for the market. (The projects include converting a container feeder, building a ferry with an LNG propulsion system, and LNG PowerPacs for the on-board supply in ports).

The funding guideline to support other projects aimed at converting and equipping vessels with LNG propulsion systems is currently being coordinated within the German government.

5.7.7 Other measures in the transport sector

The Climate Action Programme 2020 also envisages resolute reduction of emissions in the transport sector beyond 2020. Most of the measures in the action programme will continue to reduce greenhouse gas emissions beyond 2020, and some of them will not reach their full effect until after 2020.

However, further measures are required if the transport sector is to make an adequate contribution to the German government's reduction targets for 2030, as adopted with the Climate Action Plan 2050 of 14 November 2016.

5.8 Reducing non-energy-related emissions in industry and in the commerce, trade and services sector

The industry-related measures adopted by the German government with its Climate Action Programme 2020 essentially include the following areas:

- Resource conservation and efficiency, waste prevention and recycling
- Reducing emissions of fluorinated gases.

The package of measures does not include any measures to reduce energy-related emissions in industry or the commerce, trade and services sector. Such measures are addressed in section 5.5 on the National Action Plan on Energy Efficiency (NAPE).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	2.5 to 5.2
Contribution according to experts' recent estimates (up to 1.2 million tonnes of CO_2 equivalents from reduced fertiliser production)	1.2 to 2.5

5.8.1 Strengthening waste avoidance, recycling and reuse

Alongside an efficient, low-carbon energy supply, the careful handling of available resources, their efficient use and optimum recovery are also vital for meeting our short- and long-term climate targets. Waste avoidance and reuse are key strategies in resource conservation, and significant contributors to reducing greenhouse gas emissions.

The German government's draft revision of the Commercial Wastes Ordinance was adopted in November 2016, and is expected to enter into force by mid-2017.

On 10 August 2016 the German government replaced its original plan for a Recyclables Act with a draft Packaging Act, implementing the key principles of an environmentally sound, efficient and user-friendly household recycling scheme. However, it has opted not to extend product responsibility. At the time of writing the draft was being debated within the government.

Additionally, since 2015, a number of dialogues have been held with stakeholders on implementation of selected aspects of the Waste Prevention Programme. For 2017, a communications strategy for sharing information on this topic will be drafted.

The German government will continue, in particular, to promote the sustainable design and use of products. Above and beyond this, one of the approaches it supports is to increase the usage intensity of a range of products. As well as helping to optimise resource use, this also reduces the use of energy and raw materials, which in turn cuts emissions of greenhouse gases.

The measure is addressed in part by the National Programme for Sustainable Consumption. For example, the BMUB is calling for aspects such as life span, ease of repair and recyclability to be incorporated more fully into product design. A key instrument in this regard is the European Ecodesign Directive (see section 5.5.2.3), which sets out the requirements for selected products.

Consumer information at European and national level will also be stepped up, for example with regard to the durability of products, operating instructions and repair information. Social innovations for sustainable consumption likewise offer potential for more reuse and shared use of products. These are supported, inter alia, by research projects by the Federal Environment Agency. The aim is to improve the technical foundations for social innovations for sustainable consumption (such as impact analysis of environmental relief potential). The German Ecodesign Prize, awarded to eco-friendly product designs which look at the entire lifecycle, is likewise supported and is being expanded. The German Resource Efficiency Programme (ProgRess II) addresses a number of individual aspects which help to implement the measure, such as improving and expanding consumer information on resource-efficient products and sustainable lifestyles. The German government wants central resource conservation aspects to be incorporated into existing statutory provisions such as the Ecodesign Directive and the Energy Consumption Directive, including minimum requirements and information about the

life span and recyclability of products. It also wants resource conservation issues to be more widely incorporated into standards. Teaching aids on eco-friendly product design commissioned by the Federal Environment Agency will be distributed as widely as possible among colleges and universities. The aims of ProgRess aims include setting up a series of dialogue and network initiatives to explore the potential of social innovations. Regional networks and specific funding measures will be developed to support the sharing economy. The Waste Prevention Plan of the German government with the involvement of the Länder prioritises reuse. During the course of implementing the Waste Prevention Programme, the BMUB is engaged in a dialogue process with the Länder, municipalities and other stakeholders. In relation to reuse, aspects considered include cooperation with stakeholders, action aids and quality assurance, as well as how to effectively support repair networks. The development of an umbrella quality brand for reuse and repair centres in Germany is also supported.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	1.85
Contribution according to experts' recent estimates	0.94

5.8.2 Reducing F-gas emissions

As fluorinated gases are classed as greenhouse gases, and have a significantly higher specific global warming potential than CO_2, the German government's Climate Action Programme 2020 includes a number of measures to reduce these climate-damaging gases.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.6
Contribution according to experts' recent estimates	0.3

5.8.2.1 Implementation of the EU F-gas Regulation and preparatory/flanking measures

The legal standards for reducing fluorinated gases are set by the European framework, the EU F-gas Regulation (No 517/2014). However, this legislation will not take effect until after 2020, beyond the scope of the Climate Action Programme 2020. The German government's goal, therefore, is to achieve positive effects ahead of 2020 by adopting preparatory and flanking measures that will ensure the effective and early implementation of the EU F-gas Regulation. In particular, it is committed to strengthening technological developments and planning to avoid lock-in effects, which might endanger medium and long-term climate mitigation targets. The main focus here is on

- Preparing technical resources for the areas in which natural refrigerants can be used
- Appropriate strengthening of technical advice for planners, investors and operators provided by specialist firms
- Training and CPD for technical personnel.

Key technical resources were already developed in 2015, for example on application areas for flammable refrigerants.

Free training courses for the skilled crafts sector, as well as invitations for tender on the funding announcement "forward-thinking cooling systems and centre of excellence and advice on natural refrigerants" (Internet portal) are scheduled for 2016. Between now and 2020, there are plans to update the relevant standards, initiate a number of flagship projects and publish a guidance document on the use of hydrocarbons in heat pumps.

Please note that the estimated reductions in the following table were calculated jointly for the action programme measures on implementation of the EU F-gas Regulation and preparatory/flanking measures and on continuation and adaptation of the funding programme for commercial refrigeration and air conditioning units. Together, their estimated reduction is 0.6 million tonnes of CO_2 equivalents.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014, including funding programme for commercial refrigeration and air conditioning units (see 5.8.2.2).	(0.6)
Contribution according to experts' recent estimates	0.2

Continuation and adaptation of the funding programme for commercial refrigeration and air conditioning units

Refrigeration and air conditioning units can emit greenhouse gases. Even before it adopted the Climate Action Programme 2020, the German government was committed to funding refrigeration and air conditioning units which do not use greenhouse gases or which are converted to alternative gases.

The action programme will continue the existing guideline under the National Climate Initiative and investigate topping up the available funding, possibly integrating a consulting component, and extending funding to include mobile applications as well.

Work on revising and extending the funding programme for refrigeration and air conditioning units began in 2015. The revised programme substantially extends the target group.

The comprehensive revisions are now largely complete and the amended funding guideline will enter into force in early 2017 as the Refrigeration and Air-Conditioning Guideline. In order to avoid duplication of (energy) consulting programmes at federal level, however, it will not include an advisory component as originally envisaged in the government decision. The BMWi offers energy advice for SMEs (see section 5.5.2.7) and for local authorities (see section 5.6.2.5). In order to ensure a continuing high level of transparency for the funding guideline, funding for mobile equipment will not be integrated into the Refrigeration and Air-Conditioning Guideline for stationary installations for the time being. A separate approach is being investigated instead.

The Refrigeration and Air-Conditioning Guideline, which enters into force in early 2017, is expected to include the following elements:

- Conversion from proportionate funding to fixed-amount funding (for example depending on the installed electrical or cooling power)
- Retaining higher support rates (and/or fixed amounts) for installations with halogen-free refrigerants
- Introduction of funding for energy-efficient small compression cooling systems (2 to 5 Kilowatt-electric)
- Increasing (and in some cases doubling) the upper capacity limits for installations eligible for funding
- Introduction of a partial (energy) refurbishment of up to three principal components in refrigeration units (even without replacement of the refrigerant)
- Stipulation of minimum technical requirements with regard to energy consumption and plant component efficiency in order to achieve energy savings (moving away from the current efficiency points system)
- A lowering of the admissible GWP levels[4] for the use of halogenated refrigerants in funding-eligible facilities
- Introduction of a bonus for the use of halogenated refrigerants with low(er) GWP levels than required to be eligible for basic funding
- Extending bonus funding to chillers and heat accumulators, heat pumps and free coolers to boost overall system efficiency (and retain bonuses for heat exchangers), and
- Raising the maximum support limit to euro 200,000 (in line with the de minimis limit; applies to the total of basic support and bonuses).

4 GWP: Greenhouse Warming Potential – Measures the climate impacts of climate-damaging gases in CO_2-equivalents.

In this way, as well as reducing direct greenhouse gas emissions (that is F-gas emissions), the funding also aims to reduce greenhouse gases by reducing the plant's electricity consumption.

Please note that the reductions in the table below are estimated jointly for the measures on implementing the EU F-gas Regulation and preparatory/supporting measures and on the continuation and adaptation of the funding programme for commercial refrigeration and air conditioning units. Together their estimated reduction is 0.6 million tonnes of CO_2 equivalents.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014, including implementation of the EU F-gases Regulation (see section 5.8.2.1).	(0.6)
Contribution according to experts' recent estimates	0.09

5.8.3 Increasing resource efficiency

Significant volumes of greenhouse gases are released during the extraction, transportation, processing, production, use in goods, and during disposal/recycling of raw materials. This includes the energy used in the aforementioned processing stages, but also the greenhouse gases released directly during the conversion or refinement of raw materials. Added to this is the fact that due to demand, raw materials increasingly have to be mined from deposits with a low concentration of materials, tricky mineralogy or complex geological formations. This may necessitate particularly energy-intensive (and hence greenhouse gas-intensive), climate-unfriendly mining practices, which boosting resource efficiency can mitigate. The careful handling of resources is therefore an essential element in the fight against climate change.

Like energy efficiency, resource efficiency relies on the provision and exchange of knowledge. An in-depth knowledge of resource-efficient techniques, technologies and consumption patterns is essential for establishing and contributing to climate action and environmental protection in general.

In order to strengthen the sharing and availability of information about resource efficiency and climate technologies among small and medium-sized companies, since 2009 the VDI Centre for Resource Efficiency (VDI ZRE), a national centre of excellence, has been tasked with expanding resource efficiency consulting services for companies under the auspices of the BMUB's National Climate Initiative. It is also hoped that this will facilitate the expansion and continuation of resource efficiency networks and research programmes.

A measure to update resource efficiency networks will be implemented in mid-2017. We will also be exploring how greater consideration could be given to resource efficiency issues in future by energy efficiency consulting and networks. There are plans to further expand existing research programmes.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.9 Waste management, circular economy and other emissions

Compared with 1990, waste management has already achieved significant successes in reducing emissions of greenhouse gases. Overall, emissions in this area have fallen by more than two-thirds in the last 25 years currently accounting for around one percent of total emissions in Germany. Nevertheless, this industry can – and indeed given the German government's short- and long-term targets, must – continue to consistently exploit the available reduction opportunities, particularly with a view to further significantly reducing emissions of methane from existing landfill sites.

5.9.1 Aeration of landfills to reduce methane emissions

In the anaerobic conditions that prevail in household waste landfill sites, the biogenic carbon contained in waste is converted into methane, which in turn is released into the atmosphere as a highly climate-damaging (compared with carbon dioxide) gas. However, if suitable measures are taken to adequately aerate landfills, the formation of methane is prevented, and biogenic, greenhouse gas-neutral carbon dioxide is released instead.

Given the positive results achieved with this government-funded measure prior to adoption of the action programme, the local authority guideline was revised last year under the National Climate Initiative (see section 5.6.6.2) to promote climate action in local authorities. In 2016, 15 applications for funding were submitted.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.5 to 2.5
Contribution according to experts' recent estimates (Current estimates anticipate a reduced reduction effect in 2020 due to delayed implementation.)	0.05

5.10 Agriculture

One of the goals of the German government's sustainability strategy is to reduce nitrogen surplus in agriculture in the overall balance to 80 kilogram/hectare from 2010 onwards. The measures adopted under the Climate Action Programme 2020 are intended to help meet this target and in particular reduce overall non-CO_2 emissions from agriculture (N_2O). This may also help reduce both N_2O and CO_2 emissions in industry, since the source principle of greenhouse gas reporting requires the energy used in the production of fertilisers and the associated CO_2 emissions (and diffuse N_2O emissions) to be reported by industry, not by agriculture.

Regarding the representation of greenhouse gas reductions in agriculture, It should be noted that the CO_2 equivalent reductions used as a basis in December 2014 were calculated using the N_2O emission factors valid at that time for international reporting. These have since been amended, creating significant differences. The table below therefore includes reduction contributions based on the December 2014 estimates using the current calculation system as well.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents		
	Old method	New method, IPCC 2006
Contribution under the action programme as at December 2014	3.6	2.2
Contribution according to the experts' recent estimates using the IPCC 2006 method	0.6 to 2.1	

5.10.1 Amendment to the Fertiliser Application Ordinance

N_2O emissions occur, inter alia, as a consequence of using nitrogen in fertilisers. Nitrogen-based fertilisers in agriculture cause both direct and indirect N_2O emissions. Direct N_2O emissions are released from fertilised soils, while indirect N_2O emissions are released as a consequence of applying reactive nitrogen compounds (gaseous ammonia losses and nitrate leaching into water bodies) from agricultural sources. What is more, the production of fertilisers is energy-intensive, and manufacture of the basic material, nitric acid, releases nitrous oxide.

The ongoing amendment to fertiliser law therefore aims to further reinforce need-based fertiliser application and resource-efficient use of nitrogen. The amended Fertiliser Application Ordinance contains new and more stringent requirements on fertiliser application, such as

- Further specification of the calculation of fertiliser requirements
- An updated nutrient comparison
- The inclusion of organic plant-based fertilisers into the application limit of 170 kilogram total nitrogen per hectare, per annum (which means that fermentation residues from biogas installations will be included in future)
- More stringent guidelines on application, including with regard to low-emission techniques
- Longer block periods and extended storage capacities.

The amended Fertiliser Act also introduces a new definition of good agricultural practice for the handling of nutrients on farms. The regulations are not only aimed at demand-based fertiliser application, but also address all principal nutrient flows on farms. The amended Fertiliser Act also includes a mandatory power to introduce a binding on-farm materials flow analysis, to be regulated in a separate ordinance in addition to the Fertiliser Application Ordinance. The statutory ordinance concerning the materials analysis will initially apply to larger farms with high livestock levels and enter into force in early 2018.

The German government expects the amendments to the Fertiliser Act and the Fertiliser Application Ordinance to enter into force during the current legislative period.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents

	Old method	New method, IPCC 2006
Contribution under the action programme as at December 2014	3.3	2.0
Contribution according to the experts' recent estimates using the IPCC 2006 method, depending on the specific formulation and enforcement of the Fertiliser Application Ordinance	0.5 to 2.0	

5.10.2 Increasing the percentage of organically farmed land

Increasing the percentage of organically farmed land likewise significantly reduces emissions of greenhouse gases, primarily due to the reduced application of mineral nitrogen fertilisers, which are not used in organic farming, coupled with the reduced use of agricultural pesticides and bought-in animal feeds. The German government's National Sustainability Strategy states that 20 percent of agricultural land should be organically farmed in future.

Under the Climate Action Programme 2020, the German government decided to maintain this as a funding priority when promoting organic farming. At Länder level, this will be implemented within the context of the outline plan for the Joint Task for the Improvement of Agricultural Structures and Coastal Protection (GAK) and the Federal Scheme for Organic Farming and Other Forms of Sustainable Agriculture (BÖLN).

Based on 2013 premium levels, therefore, in 2014 the Planning Committee for Agricultural Structures and Coastal Protection (PLANAK) decided to increase payments for land farmed in accordance with the standards of the EU Regulation on Organic Farming by 24 percent.

The BÖLN scheme will also support sustainable agriculture with the following priorities:

- Identification of research requirements and initiation and support of research projects
- Processing of knowledge for specific target groups
- Strengthening supply and demand for organic and sustainably produced products, particularly training and information schemes and competitions
- Providing support in the form of information services and trade fair stands to promote organic farming and other forms of sustainable agriculture.

In order to lend additional growth impetus to organic farming in Germany and meet the German government's sustainability target of 20 percent organic farming the government is currently drawing up a new strategy Organic Farming – Looking Forwards. In collaboration with representatives of the organic food industry and with the involvement of the Länder, the scientific community and associations, the Federal Ministry for Food and Agriculture, is developing concepts and recommendations for the core action areas. The German government expects ideas to be presented in the spring of 2017, with implementation commencing during the current legislative period.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents		
	Old method	New method, IPCC 2006
Contribution under the action programme as at December 2014	0.3	0.2
Contribution according to the experts' recent estimates using the IPCC 2006 method	0.09	

5.11 Land use, land use change and forestry

Although CO_2 emissions from agricultural land and CO_2 sinks are not currently included in national greenhouse gas emissions and therefore cannot be considered when assessing progress towards climate targets, this sector offers significant potential to reduce the amount of greenhouse gases released from land use and land use changes.

In December 2014, this prompted the European Council to include emissions from this sector in future climate targets. To this end, on 20 July 2016 the European Commission proposed incorporating land use, land use changes and forestry (LULUCF) into the EU framework for greenhouse gas reductions (LULUCF Regulation) in a separate legal text.

It should be noted that the greenhouse gas reductions as CO_2 equivalents for land use, land use changes and forestry sector in December 2014 were calculated with the emission factors for N_2O valid at that time for international reporting. These have since been amended, producing some significant differences in greenhouse gas reduction figures. The table below gives the respective reduction contributions for the December 2014 estimates based on the current calculation system as well.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents		
	Old method	New method, IPCC 2006
Contribution under the action programme as at December 2014	2.5 to 5.4	2.5 to 4.4
Contribution according to the experts' recent estimates using the IPCC 2006 method	1	

5.11.1 Conserving permanent grassland

Ploughing up permanent grassland leads to the loss of organic soil matter, which is released as CO_2. Furthermore, increased mineralisation of the organic soil matter causes the release of nitrogen, and linked to this, N_2O emissions. Another aspect to consider is that ploughing up permanent grassland releases far greater quantities of greenhouse gases more rapidly than the newly created grassland can sequester.

The German government has therefore decided to work with the Länder to conserve permanent grassland by implementing the decisions taken under the reform of the Common Agricultural Policy of 2013, and by prioritising it in the formulation of agri-environmental measures and climate action at Land level.

Since 2015, the conservation of permanent grassland has been regulated under greening legislation (Regulation [EU] No. 1307/2013) as part of the EU reform of the common agricultural policy. EU Member States are required to ensure that the ratio of permanent grassland does not fall by more than five percent. In Germany, legislation on direct payments created the legal requirements for implementation of the EU Regulation. As of 1 January 2015, permanent grassland located within Habitat Directive sites cannot be converted or ploughed up. Permanent grassland created prior to that date which is located outside of Habitat Directive sites may only be converted provided this does not infringe on other legal provisions and on condition that replacement permanent grassland is sown. Overall, permanent grassland, at around 4.7 million hectare, accounts for a comparatively stable proportion of total agricultural land in Germany of approximately 28 percent. Since 2014, land use has stabilised, and area loss observed prior to that date, primarily attributable to the conversion of arable land, is no longer in evidence. Above and beyond regulatory provisions, farmers may also participate in voluntary agri-environmental measures which make a general contribution to the conservation of permanent grassland. Agreements may be signed throughout the EU funding period of 2014 to 2020. The decision by the Planning Committee for Agricultural Structures and Coastal Protection (PLANAK) of August 2014 therefore provides for higher payments for particularly sustainable practices on permanent grassland, with the following priority areas:

- Extensive use of permanent grassland
- Extensive management of permanent grassland
- Extensive management to conserve grassland vegetation containing valuable plant genetic resources.

The Länder are responsible for issuing permits and carrying out checks on grassland conservation and the implementation of agri-environmental and climate change mitigation measures.

The government's aim is to ensure the prompt formulation and implementation of a grassland strategy.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents		
	Old method	New method, IPCC 2006
Contribution under the action programme as at December 2014	1 to 2	1
Contribution according to the experts' recent estimates using the IPCC 2006 method	1	

5.11.2 Peatland conservation

Rewetting peatlands or increasing their water levels produces a number of beneficial effects. Firstly, reinstating the carbon storage function of peatlands significantly reduces emissions of greenhouse gases, such as those produced in drained peatlands; and secondly, it creates additional positive effects for the water balance and biodiversity.

With this in mind, the German government, in collaboration with the Länder, is committed to reaching a suitable agreement based on a 2012 position paper by the Federal Government/Länder Working Group on Nature Conservation, Landscape Management and Recreation (LANA).

It should be stressed that responsibility for implementing the peatland conservation programmes essentially rests with the Länder. However, measures that are implemented under the Community Task for the Improvement of Agricultural Structures and Coastal Protection (GAK) in accordance with its outline plans and which simultaneously support peatland conservation are co-financed by the Federal Government and the Länder.

In order to reduce emissions from the use of organic soils, and hence from peatlands, in early 2015 support for converting arable land into permanent grassland (see section 5.11.1) was significantly increased to a maximum of 1,690 euros per hectare. If particularly eco-friendly and site-appropriate seed mixes are used in conversion and re-sowing, a further increase of up to 2,210 euros per hectare is possible.

Above and beyond this, particularly sustainable practices can contribute to extensive, peatland-friendly use, such as

- Zero tillage and zero usage of mineral nitrogen fertilisers
- Low livestock density
- Delaying putting livestock out to graze in spring by two weeks
- Deferring cultivation measures by four weeks.

The latter two in particular help to ensure a higher groundwater level in the spring months.

Additionally, model projects on the protection, conservation and renaturation of peatland in forests are funded via the Forest Climate Fund (Waldklimafonds). Consulting and dialogue projects on peatland conservation issues are also funded by the BMUB's National Climate Initiative.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (Assumption: 5 percent of total peatland for rewetting)	1.5 to 3.4
Contribution according to experts' recent estimates (Conservative estimate given uncertain data situation)	Impossible to quantify at present

5.12 The government's role in demonstrating best practice

Climate action must be reflected in administrative processes as well. The Federation is committed to its role model function in the implementation of measures. In particular, this concerns

- The sustainable procurement of products and services (see section 5.12.1)
- The German government's programme of sustainability measures (see section 5.12.2)
- Investigating the reduction of climate-damaging subsidies (see section 5.12.3).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 Of which attributable to the measure on the creation of energy refurbishment timetables for the public sector, which is reported under Climate-Friendly Building and Housing (see section 5.6).	0.3 to 2.0 0.1 to 1.7
Contribution according to experts' recent estimates	No contribution before 2020

5.12.1 Public procurement: Strengthening the Competence Centre for Sustainable Procurement and the Alliance for Sustainable Procurement

Since 2010, the German government and Länder have collaborated in the Alliance for Sustainable Procurement, with the aim of exchanging experiences.

This committee, which is chaired by the Federation, aims to increase the proportion of sustainable products and services purchased by the public sector.

In 2012 the Competence Centre for Sustainable Procurement (KNB) was set up to provide information and guidance on sustainable procurement issues for procurement departments within the Federation, Länder and local authorities. A catalogue of measures prepared immediately after the KNB's creation has already been implemented. Examples include:

- The development and operation of a Web-based information platform
- Providing information and advice to procurement departments
- Providing information in the form of guidance documents et cetera
- Involvement in a wide range of bodies and projects
- Preparing and implementing training courses
- Incorporating the former into career training for employees in the non-technical administrative public sector
- Playing a key role in the German government's action programme on sustainability, and much more besides.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.2 to 0.3
Contribution according to experts' recent estimates (Based on existing overlap effects, contrary to the assessment in 2014, this measure is now considered a flanking measure.)	Flanking measure

5.12.2 The German government's programme of sustainability measures

The German government's programme of sustainability measures aims to make the federal public administration more sustainable. It applies to all agencies and institutions that are directly part of the federal public administration.

When the programme of sustainability measures was updated in March 2015, the State Secretaries' Committee on Sustainable Development incorporated more climate-relevant aspects and agreed that the German government should actively contribute to climate change mitigation, primarily with measures relating to federal properties, the introduction of energy and environmental management systems and measures concerned with sustainable procurement and mobility, en route to becoming a carbon-neutral federal public administration[5].

The first monitoring report on the programme of measures was published on 30 May 2016, and describes the implementation status of measures as at 31 December 2015. Among other things, work has begun on recording energy-related data for the Federal Government's properties and for the mobility segment.

Figures on energy consumption and CO_2 emissions are available for military properties, while for civil properties, the collation, review and evaluation of energy data is currently being improved. In the public procurement sector, all authorities and institutions that are directly part of the federal public administration have appointed a contact person to the Competence Centre for Sustainable Procurement (KNB), tasked with the planning, organisation and execution of procurement processes at their particular institution. These contacts will function as multipliers within the authorities and act as links between the KNB and consumers in their authority.

In the mobility sector, the average CO_2 emissions from standard commercial fleet cars were initially calculated, along with business travel-related CO_2 emissions for supreme and higher federal authorities. A comprehensive survey of business flights and business travel for all authorities and institutions that are directly part of the federal public administration is currently being prepared, with the aim of calculating the total CO_2 emissions incurred by the federal public administration.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Impossible to estimate
Contribution according to experts' recent estimates	

5.12.3 Climate-damaging subsidies

Climate-damaging subsidies can act as disincentives and prevent the reduction of greenhouse gases. By eliminating possible disincentives arising from climate-damaging subsidies, it is possible to harness reduction potential and at the same time create financial flexibility.

The Kyoto Protocol calls for the elimination of all subsidies that hinder the reduction of greenhouse gas emissions. The heads of government of the world's top twenty industrialised and newly industrialising countries (G20) have undertaken to gradually phase out inefficient subsidies of fossil fuels.

Ahead of drafting the 25th Subsidy Report in 2015, the German government incorporated a commitment into its subsidy policy guidelines to review sustainability and evaluate subsidies more extensively. The associated sustainability audit is also geared to the objectives of the national sustainability strategy and incorporates a review of long-term ecological, economic and social aspects, including an explicit review of the potential climate change impacts of subsidies.

The German government's next subsidy report will be published in 2017. Following the findings of the 2015

5 www.bundesregierung.de/Content/DE/_Anlagen/Nachhaltigkeit-wiederhergestellt/2017-06-20-nachhaltigkeit-neuauflage-engl.pdf?__blob=publicationFile&v=2 , p 41

subsidy report, it will also devote particular attention to sustainability issues, as decided by the German government under the Climate Action Programme 2020.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Impossible to estimate
Contribution according to experts' recent estimates	

5.12.4 Drawing up energy-efficient refurbishment timetables for the public sector

The public sector acts as a role model in the execution of climate measures, particularly its buildings. As well as sending out a signal to the private buildings sector, it also significantly increases the acceptance and prevalence of refurbishment measures in non-residential buildings.

Against this background, the Climate Action Programme 2020 called for greater efforts in the energy-efficient refurbishment of public properties.

All public properties at a federal, Land and local authority level have a role model function. The first step is to draft an energy-efficient refurbishment timetable for Federation properties, the results of which, in a second step, will be used to create refurbishment timetables for properties belonging to the Länder and local authorities.

The German government is currently working on its energy-efficient refurbishment plan for Federal Government properties. Initially, energy concepts will be drawn up for all Federal Government civil properties identified in the preliminary stages as having potential for energy-efficient refurbishment. On this basis, specific energy-efficient refurbishment measures will then be investigated.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 to the Climate-Friendly Building and Housing Strategy (see section 5.6)	0.1 to 1.7
Contribution according to experts' recent estimates (Based on the current implementation status, no additional reduction effects are currently anticipated from this measure before 2020.)	No contribution anticipated by 2020

5.12.5 Implementation of sustainability assessment systems at Länder, local authority and federal level

The decision to introduce sustainability assessment systems at federal and Land government level is designed to achieve a more comprehensive evaluation of buildings throughout their entire lifecycle, with due regard for climate-related factors.

Since 2015, the Länder have had requirements in place for building certification under the Assessment System for Sustainable Building (BNB) and have set up compliance authorities.

The Federation and Länder hold regular meetings with the compliance authorities to ensure uniform nationwide implementation of the Guideline for Sustainable Building. Furthermore, the Länder and local authorities participate in the implementation processes via regular round tables on sustainable building.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 to the Climate-Friendly Building and Housing Strategy	Flanking measure
Contribution according to experts' recent estimates	

5.13 Research and development

The German government remains committed to scientific research and innovations that produce fresh ideas and approaches for a greenhouse gas-neutral economy and society.

As well as focusing on the technical issues and challenges of the energy transition (see section 5.13.1) and the urban planning and construction sector (see section 5.13.4), it is also particularly important for research to look at ways of preventing climate change (see section 5.13.2) and addressing socio-economic issues (see section 5.13.3).

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.13.1 Research for the energy transition

Energy research is a key pillar of any forward-looking energy policy. The German government's energy research policy is based on the 6th Energy Research Programme, with a budget of 3.4 billion euros from 2013 to 2016. In 2015, the German government spent 863 million euros on researching, developing and demonstrating modern energy technologies. Three-quarters of the research budget was devoted to renewable energies and energy efficiency.

By promoting a variety of research priorities at every stage of the energy chain (generation-transport-use), and funding institutional research and projects, the German government covers long-term basic research as well as practical, application-focused research. Detailed information on funding measures, budgets and structures are published in the annual Energy Research Report.

The German government addresses particular challenges in selected areas that are highly relevant to the energy transition with a comprehensive range of interdepartmental research initiatives. These include the improvement of network infrastructures and storage elements for the future energy system (funding initiatives Future-Proof Power Grids and Energy Storage Systems). The new interdepartmental research initiative "solar building/energy-efficient city", published in spring 2016 as part of the umbrella funding announcement for a flagship initiative: City of the Future, focuses on the energy and heating transition in buildings and neighbourhoods. The BMWi and BMBF have set aside some 150 million euros for this initiative, with the first selected research projects expected to launch in 2017.

The Kopernikus projects are a new format for translating basic research into industrial-scale applications in a far more targeted way, with the involvement of all social groups.

The Carbon2Chem project launched in 2016 is also considered a milestone in cross-sectoral collaboration between companies and academia to reduce CO_2 emissions from the steel, chemicals and energy industries. Work on the first sub-projects began in early 2016.

The BMEL also supports energy and research with a range of funding measures for agriculture and forestry. Particular highlights include the "renewable raw materials" programme to promote research, development and demonstration projects in the material and energy use of renewable raw materials.

5.13.2 Research into preventing climate change

In 2015, research into preventing climate change was anchored in the BMBF's new programme Research for Sustainable Development (FONA[3]). With three priority action areas (national climate modelling initiative, regionalisation of climate knowledge, and integrated evaluation of climate policy and innovation), the aim is to gradually close any gaps in our knowledge of climate change, build new expertise, and from this, create the innovation dynamics needed to drive sustainable development forward.

In each of these three priority areas, the BMBF has devised and initiated funding measures and other activities, setting in motion a raft of processes for implementing the measures resolved under the Climate Action Programme 2020.

For example, the BMBF's initiative for SMEs supports world-class research and development work by small and medium-sized enterprises (SMEs) in the areas of energy efficiency, climate change mitigation and (since 2015) adaptation, as well as the technology sector.

The BMBF also supports international climate policy processes and addresses issues associated with implementation of the Paris Agreement. A funding announcement was therefore published in August 2016 to build our knowledge base for the special IPCC report on limiting global warming to 1.5 degrees. The selected projects are due to commence in early 2017 and will run for a maximum of two years.

The BMBF has been supporting research into and dialogue on the economics of climate change since 2011. It analyses economic instruments and policies relating to climate issues, identifies the costs and opportunities of adjustment, and sheds light on international negotiation processes. In October 2016, a second funding phase announcement was published. A joint project with European partners invites tenders to promote the supply and usability of practical knowledge about climate change via climate services. The projects are due to start next year. The research initiative on paleoclimate modelling was launched in 2015 to improve our knowledge base of climate change and, in particular, improve our understanding and forecasting of past, current and future climate changes. Germany's contribution under the international CMIP6 (Coupled Model Intercomparison Project Phase 6) has been in place since 2016.

The funding measure Urban Climate in Transition has been in place since early 2015, focusing on urban spaces. This is supplemented by the funding area climate resilience through action in cities and regions, which is part of the FONA[3] flagship initiative on the City of the Future (launched in the second quarter 2016). It was derived from the strategy for climate action in cities and regions.

5.13.3 Socio-environmental research

The German government believes that adapting to and limiting climate change means changing the way we as a society live together. Achieving something approximating broad greenhouse gas neutrality by the middle of the century means that our economy must be up to the challenge, but change processes must also take place at a macro-societal level.

As such, socio-environmental research is concerned primarily with social change processes under the model of sustainable development. The BMBF established this as a funding priority back in 2001, in the hope that in future, topics such as

- Energy transition
- Sustainable urban and rural development
- Climate action and adapting to climate change
- Sustainable production

will be able to draw on more in-depth knowledge.

Fostering young talent is also important and there are groups of young researchers working on a number of these topics. To date, around 150 million euros from more than 14 funding measures has been awarded to some 170 socio-environmental research projects.

The following current funding measures are among those contributing to the climate change mitigation:

- **Transformation of the energy system:** 33 collaborative projects between the scientific community and practitioners to develop options for the energy system, (governance) measures for sustainably transforming the energy system and proposals for involving the general public in the transformation process. The outcome of these projects was presented in autumn 2016 at a closing conference.
- **Sustainable production:** 30 projects – presentation of interim results at a status conference in autumn 2016. Climate-relevant aspects such as energy efficiency also play a role.
- **Collaborative projects on climate change at European level:** six projects.
- Two of the seven **groups of young researchers** are more closely involved in climate aspects; they began their research work in mid-2016.
- The funding measure **sustainable transformation of urban spaces:** eight of the 23 projects selected for funding are dedicated to climate change mitigation. They will begin their research work during the course of 2016.

Socio-environmental research features in another funding announcement of April 2016 to implement the FONA[3] flagship initiative City of the Future, focusing on climate-friendly mobility. A funding announcement was also published in July 2016 to examine rebound effects and their socio-environmental impacts in greater detail.

5.13.4 Strengthening applied research in the urban design and buildings sector

The building research sector promotes the development and optimisation of innovative products among small and medium-sized enterprises.

Taking direct and indirect emissions together, the buildings sector accounts for around 30 percent of all greenhouse gas emissions released in Germany. Given the target of a virtually climate-neutral building stock by 2050, it is important not to focus solely on tried-and-trusted methods and techniques, but also to advance and facilitate innovative solutions.

For this reason, we need to focus on research into strategies and concepts for sustainable building, including the Zukunft Bau research initiative, which covers the construction value chain and also includes specific projects, such as the “Efficiency House Plus” standard.

In order to identify and use synergies and delimit these projects from other research projects and funding in the construction sector, these are regularly agreed among participants in the “Energy in Buildings and Neighbourhoods” research network.

As already outlined in the 2015 Climate Action Report, the relevant funding guideline entered into force in the first half of 2015. The first funded projects were selected in 2016 by a panel of experts.

5.14 Advice, public education and initiatives on climate action

5.14.1 Climate change mitigation in business

The Paris Agreement and the G7 summit in Elmau last year made it clear that not only must a society as a whole adopt climate-neutral practices, so too must our business activities.

The economy plays a decisive role in this regard, and also offers enormous opportunities, for example in the development of new, climate-friendly technologies. Alongside the measures already outlined in previous chapters, the innovative strength of business should also be further reinforced with measures in this segment, and should focus on a carbon-neutral future.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (reduction effect in relation to the climate check-up for micro-businesses – see section 5.14.1.2)	0.75
Contribution according to experts' recent estimates	0.23 to 1.8

5.14.1.1 Dialogue process: Business takes action on climate change

For climate change mitigation to be broadly effective in business, companies must recognise for themselves the benefits of a consistent strategy on energy efficiency and climate action. The German government's Climate Action Programme 2020 wants to enter into dialogue with business to encourage companies to identify and eliminate any obstacles, that is to overcome the entry hurdles.

The project to devise this dialogue process has now been awarded, and a draft concept drawn up for implementation. Tenders for implementing the dialogue are now being invited under the National Climate Initiative.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.14.1.2 National Climate Initiative (NKI) – Climate check-up for micro-businesses

Small and medium-sized companies often lack the capacity to review and resolutely implement energy efficiency and climate measures. In this particular sector, therefore, smaller-scale measures not only offer an opportunity for companies to actively contribute to climate change mitigation, but also to save hard cash through energy and resource conservation.

In order to convince these smaller companies of the opportunities offered by climate change mitigation and sensitise them to the issue, the Climate Action Programme prompted the BMUB to pilot a funding guideline for selected trades and services.

The pilot project "Climate Expert for SMEs" will create an information and advice concept and trial it among selected trades and service-providers such as bakers, butchers, chemists, car repair businesses and hairdressers. The aim of the pilot phase is to gather information that can be used to flesh out a funding guideline incorporating more trades.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.75
Contribution according to experts' recent estimates (Based on significant overlap effects with other measures, particularly the NAPE, the reduction effect of this measure is assessed as ‚flanking' in the current estimate.)	Flanking measure

5.14.1.3 Environmental Innovation Programme

The BMUB's Environmental Innovation Programme EIP supports companies wishing to bring pioneering, progressive technologies to the market. The EIP funds demonstration projects, making environmentally-friendly, innovative technologies accessible to a broad user group. Under the Climate Action Programme, up to 2018 more funding will be allocated to projects focusing on climate change mitigation. Funding commitments have already been given to twelve project applications.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	0.14 to 1.7

5.14.2 Consumer action on climate change (prioritising electricity saving)

Of the aforementioned initiatives, funding schemes, advice programmes and regulatory measures, those that have already been adopted, implemented and initiated with a view to meeting Germany's 2020 climate target tend to focus on the supply, conversion and efficiency of energy use in areas which, with the exception of the building and housing sector (see section 5.6), do not directly target final energy consumers themselves. Yet this area in particular offers substantial potential for boosting energy and climate efficiency. The German government is therefore determined to motivate consumers directly, and in particular, to enable low-income households to contribute to climate change mitigation in their own interests and at their own initiative.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014 (reduction effect in relation to the Electricity Savings Check)	0.04
Contribution according to experts' recent estimates	0.09

5.14.2.1 Electricity savings check

It is often the case that enormous energy and financial savings can be achieved with comparatively small investments. However, even such small investments are often beyond the reach of low-income households. As a consequence, many of these "low-hanging fruits" remain untapped, even though the affected households could make significant savings with their running costs, while at the same time delivering cost-effective ways of combating climate change.

The BMUB-funded project "Electricity Savings Check", put in place under the National Climate Initiative before the Climate Action Programme was adopted, aims to overcome this hurdle. The project is carried out by the charity *Caritasverband* and the *Bundesverband der Energie- und Klimaschutzagenturen Deutschlands* (German Association of Energy and Climate Protection Agencies). The BMUB is currently funding the follow-on project "Electricity Savings Check" – at local level. The scheme offers low-income households an individual electricity consultation by long-term unemployed who have completed a special training course as an energy savings assistant. Participating households are supplied with simple, environmentally friendly energy-saving items to help them reduce their electricity consumption, plus a 150 euro voucher towards replacing their refrigerator.

The project "Electricity Savings Check" – at local level will continue this scheme and integrate it into the climate activities of local authorities. The project will build local networks and steering committees, and develop new financing models.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	0.04
Contribution according to experts' recent estimates	0.09

5.14.2.2 Electricity saving campaign

The electricity saving campaign aims to motivate as many private households in Germany as possible to maximise their energy-saving potential and cut their electricity use, which in turn will lower their energy bills in the long term.

The campaign provides a comprehensive comparison table to help consumers save electricity and protect the environment. The "electricity tables for Germany 2016" help consumers to gauge their own consumption and reduce it where applicable. The data collection is published by the BMUB in collaboration with partners from the research, industry and consumer protection sectors. By comparing their own electricity bill with the nationwide data tables published each spring, households can rate their own consumption, for example, as "low", "average" or "very high". The electricity tables make allowance for different situations by incorporating factors such as the size of the household, type of building and water heater type to enable a differentiated assessment. Private households can also take advantage of a range of offers, from specific tips on saving electricity, to on-site consultations, through to an electricity savings check.

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

5.14.3 Climate action in schools and educational establishments

The BMUB has been funding educational projects under the National Climate Initiative since 2008 with its programme for innovative climate projects with a nationwide impact.

The aim is to educate students about climate change and sensitize them to climate issues, as well as initiating and implementing some specific emission-reducing measures. The measures include projects, action days and campaigns, educational materials for the classroom, interactive courses and competitions. As of November 2016, the following educational projects are being supported until 2018/2019.

- StartGreen@School,
- Klimaschutz-Bildung selber machen,
- KlimaTrax,
- Passivhausschulen werden aktiv,
- Klasse-Klima – heißkalt erwischt,
- Green Hack,
- vhs goes green,
- Klimaaktionskinos,
- Carrotmob macht Schule

Reduction of greenhouse gas emissions in 2020, in million tonnes of CO_2 equivalents	
Contribution under the action programme as at December 2014	Flanking measure
Contribution according to experts' recent estimates	

6 Activities undertaken by the Länder, local authorities and social stakeholders

6.1 Climate action by the Länder and local authority associations

Alongside the Federation, the Länder and local authority associations are key public stakeholders with their own climate action activities. With this in mind and also with a view to recognising these substantial efforts, when drawing up its Climate Action Programme 2020 the German government invited the Länder to submit an overview of the climate activities they had initiated since 2012.

An updated list of the Länder activities is published on the BMUB website.

6.2 Social innovation and climate action

Bottom-up initiatives, launched by members of the general public or civil society, can make a huge contribution to the success of the energy transition and to achieving Germany's climate targets. The main emphasis with these types of innovative initiatives is on the social dimension and the ideal of social participation. Ultimately, this also strengthens long-term acceptance, which is essential for completing the energy transition. This was also reflected in the high level of interest in the participatory process to draft the German government's Climate Action Plan 2050 (see section 10).

The BMUB's National Climate Initiative promotes neighbourhood projects to improve quality of life and climate action locally under its *Kurze Wege für den Klimaschutz* (shortcuts to climate action) programme. Initiatives, associations, foundations and local authorities can apply for funding for project ideas that will help local citizens to lead climate-friendly, resource-conserving lives.

The German government firmly believes that active participation, initiative and social commitment are the driving forces behind an intergenerational project like the energy transition in Germany. It therefore continuously supports projects aligned with this concept, be it in the areas of transport (car sharing), energy-efficient, multi-generational community living, or energy communities.

7 Monitoring implementation of the Climate Action Programme – Examining the institutional capacity available for continuous reporting and reviewing

The Federal Environment Agency performs a number of tasks required for continuous reporting on emissions, projections, policies and measures (see section 3 and others). The primary reason for this work is to comply with the German government's international and European reporting obligations. To ensure continuous, scientifically sound reporting, which also forms the basis for its Climate Action Reports, the German government is considering whether and how it can guarantee the necessary institutional capacity.

8 The economic impact of the measures set out in the Climate Action Programme 2020

As well as contributing to climate change mitigation, the measures in the **Climate Action Programme 2020** and the National Action Plan on Energy Efficiency (NAPE) are also expected to produce economic benefits.

For example, more efficient use of fossil fuels will significantly reduce our dependency on imports, encouraging the development of new technologies, and creating lasting added value. Not least, this will also protect jobs and help tap into new employment opportunities. The distribution effects when introducing and improving instruments are a key decision-making criterion.

The BMUB has commissioned a research project to elucidate the economic impacts, particularly the costs and benefits, of the measures resolved under the action programme and the NAPE. In particular, it compared the costs incurred until 2020 with the benefits, many of which extend well beyond the year 2020 (for example, with the energy savings achieved).

Provided its assumptions are accurate, the study suggests that the energy costs saved (over their service life) from implementing the measures in the Action Programme and the National Action Plan on Energy Efficiency could exceed the required investments by just

under 150 billion euros net, of which around 28 percent applies to the period up to 2020. In particular, households will see net savings of 26 billion euros in total. The study also suggests significant positive net effects for the federal budget, thanks to direct and indirect cost savings and revenues. Net savings for the industry and commerce/trade/services sectors will be of a similar magnitude. Only the energy industry will see a slight net burden of around ten billion euros, due to the more widespread use of more expensive primary energy carriers such as natural gas. The energy conversion sector in particular does not benefit financially to the same extent from efficiency measures in the demand sector, as demand will fall while capital costs remain the same. However, from an economic viewpoint, the reduction in fuel imports will lead to significantly reduced import costs (and dependence) of 3.5 billion euros, primarily in the field of imported oil.

The labour market is also expected to benefit. The study suggests that the growing demand for goods in particular, for example in the construction sector, could create additional employment of around two million person-years between 2015 and 2020, which equates to almost 430,000 additional employees in 2020.

Overall, these measures would increase gross domestic product by an additional one percent (approximately).

Overall, the study concludes that for the measures adopted under the Climate Action Programme, the economic benefits would significantly outweigh the costs, particularly if we consider the effects beyond 2020. The measures will incentivise investments many times this amount, creating added value and employment.

9 Climate Action Alliance

When adopting the Climate Action Programme, the German government also set up a **Climate Action Alliance** with the BMUB as lead agency, whose aim is to support implementation of the adopted measures, make it easier to tap into unquantifiable potential, and identify further options for action. The Action Alliance will help to ensure that the target of reducing greenhouse gas emissions in Germany by at least 40 percent by 2020 is met. In particular, members of the Climate Action Alliance are mandated with monitoring implementation of the action programme and developing their own initiatives to tap into additional potential to reach the 2020 climate goals. The Climate Action Alliance comprises representatives from the Länder and municipalities as well as civil society and associations in all industries, sectors and action areas, facilitating the development of cross-cutting ideas and approaches spanning all interests, and discussing them with representatives from the Ministries as well.

In order to keep the discussion and work process tightly focused, the Vienna format commonly used in international negotiations was applied, with a total of 16 tables set up for participants to select. The Action Alliance meets every six months, in spring and autumn. Sessions to date have discussed climate action in the transport sector, local authorities, agriculture, SMEs, and trade and industry. The discussions are based around briefing papers prepared by the table

participants with the involvement of interested representatives from other tables. These briefing papers focus on appraising and proposing measures under the Climate Action Programme 2020 and their formulation.

For example, the contributions and proposals submitted by local authority representatives at the second meeting (autumn 2015) range from a stringent reform of emissions trading at European level, to comments on selectively improving the electricity market (see the action programme measure in sections 5.3.3, 5.4.1, 5.4.2, 5.4.3). The local authorities voiced particular concerns about municipalities subject to emergency budgets or budgetary consolidation plans, expressing the wish for continued, consistent support for climate action at local authority level.

The Local Authorities Guideline under the National Climate Initiative is pivotal for implementing climate action at local authority level. Improving this guideline also forms part of the catalogue of measures for the Climate Action Programme (see section 5.6.6.2). Since 2008, more than 9,000 local authority climate projects have been implemented under the Local Authorities Guideline, which was updated last year with a particular focus on municipalities subject to emergency budgets or budget consolidation plans. Above and beyond this, the Service and Competence Centre for Municipal Climate Protection also supports specialist events in the field of PR work and the involvement of community stakeholders.

At the autumn 2015 meeting, the "transport table" outlined the current status of and concrete proposals for reducing CO_2 in long-distance passenger transport, reducing CO_2 emissions from passenger cars, strengthening rail traffic and the environment alliance, and the use of alternative fuels. Together with representatives from other tables, it reached a consensus for its appraisals and proposals in this field. Where dissent did arise over controversial issues, the table was able to prepare these topics for debate by the whole Action Alliance. The German government has praised the commitment of participants.

Many of the issues raised in this briefing paper are already being discussed at Federal Government level. Some of the aspects addressed, such as extending the tax concessions for natural gas and LPG-powered vehicles, have already been covered by the Climate Action Programme 2020 (see section 5.7.4.2). The same applies to calls for a further expansion of electric mobility (see section 5.7.3), where the German government has already sent a clear signal to the market with its raft of measures adopted on 18 May 2016, including stepping up the expansion of the charging infrastructure, direct support for the purchase of electric vehicles and the granting of tax concessions.

Some of the proposals also look beyond the 2020 horizon, and have been incorporated into discussions surrounding a programme of measures for the Climate Action Plan 2050.

The same applies to the briefing paper submitted by the agriculture and forestry table and representatives from other tables at the third meeting in spring 2016, which addressed a broad spectrum of topics: The use of biofuels in agriculture and forestry, the use of residual materials in biogas facilities, reducing N_2O emissions (revision to the Fertiliser Ordinance, Fertiliser Act), organic farming, developing and stabilising the humus content in agricultural mineral soils, peatland conservation, grassland conservation, food, forestry and the use of wood as a building material.

Some of the topics listed and discussed are taken up, not only by the Climate Action Programme 2020, but also by the Climate Action Plan 2050. For this reason, the specific proposals were also addressed in the discussions surrounding a programme of measures for the Climate Action Plan 2050.

Climate change mitigation in SMEs, trade, buildings and industry was debated at the fourth Action Alliance meeting (autumn 2016) and will be addressed in the Climate Action Report 2017.

As well as debating selected topics agreed between the various associations, at the autumn meeting, Action Alliance members also gave their opinions on the BMUB's draft of this Climate Action Report, which were subsequently taken into account by the German government.

The tables' comments on the current Climate Action Report 2016, the briefing papers and further information on the Climate Action Alliance can be found on the BMUB website.

These opinions and briefing papers are incorporated into the German government's deliberations on implementing the measures in the Action Programme. Some extend well beyond the time horizon of the action programme, and are/have been taken into account in the preparation of programmes of measures for the Climate Action Plan.

The German government finds the format of the Climate Action Alliance expedient for accompanying the implementation of measures, and when adopting the Climate Action Plan 2050 on 14 November 2016 (see section 10), it therefore resolved to continue the Climate Action Alliance beyond 2020. The Action Alliance will accompany the preparation, revision and implementation of the programmes of measures.

10 Climate Action Plan 2050

The Climate Action Plan 2050 adopted by the German government on 14 November 2016 is designed to flesh out **Germany's existing climate targets** for 2050 and the agreed interim target in the light of the Paris Agreement, and to reinforce them with measures. The Climate Action Plan is a modernisation strategy which acts on three levels:

- It develops guiding principles for the individual areas of action for 2050, leaving space for innovations, and aspires to a high level of sustainability.
- It outlines robust transformation pathways, highlights critical path dependencies, and represents interdependencies for all areas of action.
- In particular, it reinforces the interim GHG target for 2030 with specific milestones and strategically designed measures, with due regard for impact and cost analyses.

The Climate Action Plan 2050 provides a roadmap for implementing Germany's long-term climate strategy, offering essential guidance for all stakeholders in industry, science and society.

The superordinate goal of the Climate Action Plan 2050 is to make Germany largely greenhouse gas-neutral by 2050. Within the context of the set targets, the Climate Action Plan 2050 is characterised by its technological neutrality and openness to innovations. It offers guidance for future investments, particularly for the period

until 2030. Specific legislative measures are adopted by the Bundestag.

Specifically, the Climate Action Plan 2050 outlines the following areas of action: energy industry, buildings, transport, industry, agriculture, land use and forestry, together with overarching targets and measures.

The interim target for 2030 already adopted by the German government requires a reduction in total greenhouse gas emissions in Germany of at least 55 percent compared with 1990 levels by no later than 2030. This reduction is to be incorporated into the areas of action with agreed sectoral targets (reduction corridors). As some of these sectoral targets could have far-reaching implications for economic and social development in Germany, a comprehensive impact assessment is undertaken. The outcome of the impact assessment is discussed with the social stakeholders, allowing for an adjustment of sectoral targets in 2018.

The German government's Climate Action Plan 2050 sets a learning process in motion. The plan is not a rigid instrument, but a rough outline of the path to a GHG-neutral economy. It is reviewed and amended at regular intervals in response to technical, societal, political, social and economic developments and changes. This process is backed by a scientific platform and a social discourse process. Following an evaluation of the broad-based dialogue on proposed measures agreed in the 2013 coalition agreement, which took place in 2015/16, the latter will be fleshed out.

Regularly updating the Climate Action Plan 2050 also implements the mechanism agreed in the Paris Agreement to regularly raise the level of ambition. The first update will occur when the parties to the Paris Agreement submit new NDCs, no later than late 2019/early 2020.

In 2018, the Climate Action Plan 2050 will be backed up with a programme of measures with quantified reduction effects, to ensure that the 2030 targets are met. Impact assessments will be carried out to analyse the ecological, social and economic effects of the programme. Once the Climate Action Plan is updated, the applicable programme of measures will also be revised, reinforcing the next reduction steps and milestones with specific measures and, ideally, quantified reductions. The programmes of measures are drawn up in collaboration with the Bundestag (Lower House of Parliament).

To ensure that implementation and target achievement are regularly reviewed (monitoring), the German government will continue to prepare annual Climate Action Reports beyond 2020, so that corrective action can be taken where necessary. As before, implementation and drafting/revision of the programmes of measures will be accompanied by broad-based participation, and the Action Alliance will continue.

Further information on the dialogue process and the scientific foundations for the Climate Action Plan adopted by the German government on 14 November can be found on the BMUB website at (German): www.bmub.bund.de/P3915 and (English): www.bmub.bund.de/fileadmin/Daten_BMU/Download_PDF/Klimaschutz/klimaschutzplan_2050_kurzf_en_bf.pdf

Abbreviations

ÄnderungsG	Amending Act
BAFA	Federal Office for Economic Affairs and Export Control
BBSR	Federal Institute for Research on Building, Urban Affairs and Spatial Development
BFStrMG	Federal Trunk Road Toll Act
BLE	Federal Office for Agriculture and Food
BMBF	Federal Ministry of Education and Research
BMEL	Federal Ministry of Food and Agriculture
BMF	Federal Ministry of Finance
BMJV	Federal Ministry of Justice and Consumer Protection
BMUB	Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety
BMVI	Federal Ministry of Transport and Digital Infrastructure
BMWi	Federal Ministry for Economic Affairs and Energy
BNB	Federal Assessment System for Sustainable Building
BÖLN	Federal Scheme for Organic Farming and Other Forms of Sustainable Agriculture
BRKG	German Travel Expenses Act
BSH	Federal Maritime and Hydrographic Agency
BVWP	Federal Traffic Routes Plan
CH_4	Methane gas
CHP	Combined heat and power generation
CNG	Compressed natural gas
CO_2	Carbon dioxide
CO_2-eq.	Carbon dioxide equivalents
COM	European Commission
COP 22	Conference of the Parties to the Framework Convention on Climate Change
CsgG	Treatment for car sharing (Carsharinggesetz)
CTS	Commerce/trade/services sector
D	Germany
DEHOGA	German Association of Hotels and Restaurants
DIHK	Association of German Chambers of Commerce and Industry
EED	EU Energy Efficiency Directive
EEG	Renewable Energy Sources Act
EIP	Environmental Innovation Programme
EnEV	Energy Conservation Ordinance
EnVKG	Energy Consumption Labelling Act
ESB	Energy modernisation roadmap for government property
ESF	European Social Fund
ESG	Energy efficiency strategy for buildings
ESR	Effort Sharing Regulation
ETS	Emissions Trading System
EU	European Union
F-gases	Fluorinated greenhouse gases
GAK	Improvement of Agricultural Structures and Coastal Protection
GBER	General Block Exemption Regulation
GHG	Greenhouse gas
GVFG	Community Transport Financing Act
HGV	Heavy goods vehicle
ICAO	International Civil Aviation Organization

ICT	Information and communications technology
IMO	International Maritime Organization
INDC	Intended nationally determined contribution
IPCC	Intergovernmental Panel on Climate Change
ISO	Information Security Officer
KfW	Kreditanstalt für Wiederaufbau (Reconstruction Loan Corporation)
kg	Kilogram
KNB	Competence Centre for Sustainable Procurement
kW_{el}	Kilowatt-electric
HFC	hydrofluorocarbon
HGV	Heavy goods vehicle
LANA	Federal Government/Länder Working Group on Nature Conservation, Landscape Management and Recreation
LED	Light emitting diode
LNG	Liquefied natural gas
LPG	Liquid petroleum
LULUCF	Land use, land use changes and forestry
m	Million
MBT	Mechanical-biological treatment
MIP	Market incentive programme for renewable energies
MRV	Monitoring, Reporting, Verification
MSR	Market Stability Reserve
NAPE	National Action Plan on Energy Efficiency
NDC	Nationally determined contribution
NF_3	Nitrogen trifluoride
N_2O	Nitrous oxide (laughing gas)
NIR	National Inventory Report to the UNFCCC
NKI	National Climate Initiative
NRVP	National Cycle Paths Plan
NTRI	National Top-Runner Initiative
PFC	Perfluorocarbon
PLANAK	Planning Committee for Agricultural Structures and Coastal Protection
PV	Photovoltaic
RegG	Regionalisation Act (Regionalisierungsgesetz)
RekonGent	Regionally consolidated commercial site development
SF_6	Sulfur hexafluoride
SGB	Sozialgesetzbuch (Germany's Social Code)
SME	Small and medium-sized enterprise
SpaEfV	Tax Cap and Efficiency System Ordinance
StVO	German Road Traffic Act
t	Tonnes
TWh	Terrawatt hours
UNFCCC	United Nations Framework Convention on Climate Change
WAMS	With-additional-measures scenario
WMS	With-measures scenario
ZDH	German Confederation of Skilled Crafts

Illustrations

Tables

Picture credits

Front page: tai111/Fotolia.com
Page 6: Kletr/Fotolia.com
Page 8: tburger/Fotolia.com
Page 10: wellphoto/Fotolia.com
Page 11: Grecaud Paul/Fotolia.com
Page 12: djama/Fotolia.com
Page 15: Cybrain/Fotolia.com
Page 18: rcfotostock/Fotolia.com
Page 20: Florian Gaertner/photothek.net
Page 23: Industrieblick/Fotolia.com
Page 26: Christian Müller/Fotolia.com
Page 31: Thomas Raupach
Page 32: Michael Leonhard/Hi-FlyFoto
Page 34: Daniel Schoenen/VISUM
Page 36: Qyzz/Fotolia.com
Page 38: nmann77/Fotolia.com
Page 40: Thomas Langreder/VISUM
Page 43: momius/Fotolia.com
Page 47: vario images
Page 49: www.WolfgangHuppertz.de
Page 53: RIEGER Bertrand/hemis.fr/FOTOFINDER.COM
Page 55: AA+W/Fotolia.com
Page 56: Rainer Weisflog
Page 60: Rainer Weisflog
Page 63: plainpicture/Bias
Page 66: blickwinkel/euroluftbild.de/Hans Blossey
Page 69: contrastwerkstatt/Fotolia.com
Page 70: Petair/Fotolia.com
Page 73: TELCOM-PHOTOGRAPHY/Fotolia.com
Page 75: Kzenon/Fotolia.com
Page 76: Thomas Trutschel/photothek.net
Page 78: jörn buchheim/Fotolia.com
Page 83: pure-life-pictures/Fotolia.com
Page 84: industrieblick/Fotolia.com
Page 89: Countrypixel/Fotolia.com
Page 90: fulltimegipsy/Fotolia.com
Page 93: Christian Müller/Fotolia.com
Page 97: Kzenon/Fotolia.com
Page 100: Caro/Ruffer
Page 102: Karsten Thielker
Page 103: farbkombinat/Fotolia.com
Page 104: Brian Jackson/Fotolia.com
Page 105: niemannfrank/Fotolia.com
Page 107: Ralf Geithe/Fotolia.com
Page 109: vario images
Page 110: Björn Wylezichnt/Fotolia.com

www.bmub.bund.de/english