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Climate Action Report 2017

on the German Government's Climate Action Programme 2020



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Edited by

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Climate Action Report

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Climate Action Programme 2020

2017

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1

Executive summary

Germany has set itself the target

of cutting its greenhouse gas emissions by at least 40 percent by 2020 compared with 1990 levels. This equates to a total reduction of around 500 million tonnes of CO₂ equivalent, taking emissions down to 750 million tonnes of CO₂ equivalent. Germany succeeded in reducing its greenhouse gas emissions to 909 million tonnes of CO₂ equivalent by 2016, which is 27 percent lower than 1990 levels. The latest estimates by the Federal Environment Agency indicate a slight fall in 2017 to 905 million tonnes of CO₂ equivalent, which is a 28 percent reduction.

In order to achieve the target set and close the gap of between five and eight percentage points that the German Government's 2013 Projections Report identified would exist in 2020, the Government adopted the Climate Action Programme 2020 in December 2014. It also adopted the National Action Plan on Energy Efficiency (NAPE),

which makes a significant contribution to implementing this programme. A decision was also taken to monitor implementation of the measures listed in the Climate Action Programme 2020 in a continual process and publish an annual Climate Action Report detailing the progress of implementation, the latest emission trends and anticipated reductions. The German Government is fulfilling its commitment for the third time in publishing this 2017 Climate Action Report.

A recent study by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) indicates that the measures implemented so far are expected to achieve a 32 percent reduction in greenhouse gas emissions by 2020 compared with 1990. This would be about eight percent short of the target. The reasons for this are the unexpectedly dynamic economic trend and stronger than expected population growth in recent years.

The Climate Action Programme 2020 is meant to contribute to a reduction of between 62 and 78 million tonnes of CO₂ equivalent to close this gap and meet the 40 percent target. This total is made up of contributions from over 110 individual measures. The updated estimates of the reduction effects of the individual measures, which are published in this 2017 Climate Action Report, were made by a consortium of experts commissioned by the BMU – as was done in the previous year. The current quantification suggests that the measures in the Climate Action Programme are having an effect and can be expected to make a considerable contribution to closing the gap. Nevertheless, the current estimate also indicates that the total reduction effect from all the individual measures is expected to be 40 to 52 million tonnes of CO₂ equivalent for 2020, which is less than in 2014. However, there are uncertainties connected with this estimate, with regard to both the assumptions and the effects. Especially in the case of new measures that have only recently been put in place, there is often no empirical basis for the quantification. The German Government therefore does not fully endorse the estimates of the contributions made by the individual measures.

There are also other studies – some ongoing, some planned – which will be taken into account in future estimates. The Government will continue to monitor implementation of the measures and assess their reduction effects. Nevertheless, it is already possible to estimate that the measures are not likely to be able to deliver the reduction hoped for by 2020.

With this in mind, the German Government is stressing the need for rigorous implementation of the adopted measures in order to actually achieve the reductions envisaged under the Climate Action Programme 2020. The coalition agreement also provides for supplementary action to be taken to close the gap to achieving the 2020 climate target as quickly as possible. The Government is also developing a programme of measures for 2030 to implement the Climate Action Plan 2050.

Measures under the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency are expected to have a positive impact on the economy above and beyond the intended positive effects on

climate change mitigation. For example, more efficient use of fuels will significantly reduce the country's dependency on imports, encourage the development of new technologies and create lasting added value. Not least, this will also protect jobs in many sectors and create new employment opportunities.

The findings of a study commissioned by BMU also identify the opportunities ambitious climate action can create for the German economy and our society. Acting as quickly as possible to close the gap in achieving the 40 percent target and meeting the 55 percent target for 2030 must therefore be seen as stages on the way to making the country virtually greenhouse gas neutral by 2050. The Climate Action Plan 2050 provides important guidance for the period after 2020 and sets specific targets for the individual sectors to meet by 2030. Both the Climate Action Programme 2020 and the Climate Action Plan 2050 are based on the idea of climate action as a strategy for modernising society and the economy in a way that is efficient, scientifically sound and open to all types of technology.

Tackling climate change is, and will remain, a crucial factor in preserving the natural resources that sustain human life on Earth. Limiting anthropogenic climate change and adapting to those changes that cannot be prevented are top priority challenges for society as a whole. The German Government is committed to confronting this challenge and intends to continue along its chosen path.

Combating climate change is something that needs to be tackled by the whole of society, with knowledge about interrelationships and public acceptance of the need for ambitious climate action playing a key role. The sense of shared responsibility that is crucial here can be decisively enhanced by participation and ownership. The Climate Action Alliance (Aktionsbündnis Klimaschutz) was important in exploiting this potential during the search for and development of measures to mitigate climate change.

2

Introduction

Anthropogenic climate change calls for enormous efforts on the part of the entire international community if the resources that sustain human life on this Earth are to be conserved. All over the world, a vast range of different actors are carrying out a host of different initiatives, measures, activities and policies with this aim in mind.

The concentration of greenhouse gases in the atmosphere has increased significantly since industrialisation began. The global warming resulting from that and its impact on ecosystems, society and economies are already being felt across the world. The changes associated with climate change are threatening entire regions with droughts, floods, storms and heat waves, which are likely to become some of the principal causes of mass displacement in the future.

The findings of the extensive research into the causes of climate change and its likely impacts show clearly that it is time we took action.

The stated aim of the international community to make every effort to limit climate change and its effects was made explicit in the Paris Agreement. In this Agreement, virtually all the countries of the world committed to keeping global warming well below 2 degrees Celsius above pre-industrial levels and endeavouring to limit it to 1.5 degrees Celsius. It is essential to work towards greenhouse gas neutrality over the course of the century in all areas of human activity.

The German Government is aware of the country's role and responsibility. In its Climate Action Plan 2050, it pursues the goal of making the country largely

greenhouse gas neutral by the middle of this century and develops specific guiding principles for the individual areas of action for 2050. The Climate Action Plan also outlines robust transformation pathways for all areas of action, and underpins goals, in particular the target for 2030 of achieving at least a 55 percent reduction compared to 1990, with specific emissions targets for different sectors, specific milestones and strategic measures.

The Government is aiming to adopt legislation to ensure compliance with the 2030 climate targets. It will make implementation a statutory requirement in 2019.

It has set an interim target, which aims to cut the country's greenhouse gas emissions across the board by at least 40 percent by 2020 compared with 1990. To achieve the national cuts in emissions required, the German Government adopted the Climate Action Programme 2020 in December 2014. At the same time, it adopted the National Action Plan on Energy Efficiency, which makes a substantial contribution to implementing this programme and to meeting the country's climate targets. Germany's 2017 Projections Report reaffirmed that there is still a need for action. The coalition agreement outlines the necessity of systematically implementing the measures adopted in the Climate Action Programme 2020 and also makes provisions for additional action to be taken to close the gap to achieving the 2020 climate target as quickly as possible.

The Government continuously monitors implementation of the measures set out in the Climate Action Programme and publishes an annual Climate Action Report. The Climate Action Report outlines the latest emissions trends in the various fields of action and progress in implementing the measures set out in the Climate Action Programme 2020, and forecasts the reduction effects that can be expected to result from the individual measures by 2020.

The Government's first Climate Action Report was published in November 2015. The 2016 Climate Action Report introduced for the first time an estimate of the reduction effects that can be expected to result from the individual measures; this 2017 report also includes such an estimate.

Although the 2017 Climate Action Report is being published later in the year than previous reports, it nevertheless addresses the latest measures up to autumn 2017. However, in some cases the wording refers to developments that are foreseeable following the formation of a new Government.

To support implementation of the measures adopted and to identify further fields of action, the German Government, with the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) holding lead responsibility, has launched the National Climate Action Alliance, comprising representatives from all groups of society. The Climate Action Alliance is meant to support the federal Government in achieving its goal of cutting greenhouse gas emissions in Germany by 40 percent. It will once more have the opportunity to comment on the Government's Climate Action Report 2017 and the implementation progress outlined in it. The German Government incorporates the comments submitted by the Climate Action Alliance into its deliberations on implementing its Climate Action Programme.

Statements on the impacts of climate change in Germany and on measures to adapt to them are not the subject of the annual Climate Action Reports. The German Government addresses this in its progress reports on the German Strategy for Adaptation to Climate Change. The federal cabinet adopted the first progress report on the German Strategy for Adaptation to Climate Change on 16 December 2015. Further information is available on the BMU website: www.BMU.bund.de/P216/

3

Cross-cutting climate action reporting

The Federal Republic of Germany regularly reports on past emissions trends

and publishes a projection of future emission trends as part of its reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and the European Monitoring Mechanism Regulation.

In this way, progress towards achieving the country's greenhouse gas reduction targets is subject to continuous and transparent review.

Since the 2015 report on greenhouse gas emissions in 2013, comprehensive changes in the way greenhouse gas emissions are calculated and reported have been implemented in compliance with the resolutions of the Conferences of the Parties to the UNFCCC. Primarily, the changes result from the obligation to use the 2006

IPCC Guidelines on Greenhouse Gas Inventories, which consist not only of a revision of the methods that must be used to calculate emissions but also include greenhouse gases and additional source groups that were not previously part of the inventory, so that a wider spectrum of emissions now has to be reported. This produces changes in the emissions reported for the years from 1990 to 2012. It applies, for example, to the calculation of the global warming potential for nitrous oxide and to a lesser extent for methane.

The German Government already took these changes into account in its first Climate Action Report in 2015. This means that a direct comparison of current information – such as that presented in the first two Climate Action Reports – with that in older reports or presentations is possible to only a limited extent.

3.1 Climate action reporting – description of the reporting obligations

Progress towards cutting greenhouse gas emissions cannot be assessed without a comprehensive and continuous national reporting process. The Parties to the United Nations Framework Convention on Climate Change and the Kyoto Protocol are obliged to set up national systems to report on greenhouse gas emissions. They are the basis for establishing reduction commitments and enable a reliable comparison of the efforts being made by the different Parties. In addition to greenhouse gas inventories, reports on climate targets and strategies, climate change mitigation and adaptation measures, education and research and financial and technical cooperation are also important elements of international reporting.

There are a number of key reports at international and European level:

- The National Inventory Report for the German Greenhouse Gas Inventory 1990 until the present complies with the obligation to prepare and publish national greenhouse gas inventories under the United Nations Framework Convention on Climate Change and the Kyoto Protocol (annual).
 - The Projections Report maps in different scenarios the possible emission-reducing effect of mitigation measures over the next 20 years; it is a reporting obligation for member states of the European Union (biennial).
 - The National Communication to the United Nations Framework Convention on Climate Change provides comprehensive reporting on national circumstances, greenhouse gas emissions, mitigation measures and projections, adaptation to climate change, research, and financial and technical cooperation (every four years).
 - The Biennial Report updates (every two years) the main information in the National Communication, focusing on documenting progress towards achieving climate targets and climate finance.
- Reporting obligations have been steadily developed over the last 20 years – both at 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). This ensures that greenhouse gas emissions are always calculated based on the latest scientific knowledge.
- In addition to European and international reporting obligations, there are additional obligations at national level to monitor the measures put in place under climate and energy strategies in the context of national objectives:
- The annual monitoring reports on the energy transition review progress towards meeting the targets set and the implementation status of corresponding measures with a view to achieving a reliable, affordable and environmentally sound energy supply in order for corrective action to be taken if needed.
 - To assist implementation of the German Government's Climate Action Programme 2020, the Climate Action Report informs on emission trends in the various fields of action and on the reduction effects that can be expected by 2020 (annually).
 - The German Government will continue preparing Climate Action Reports every year beyond 2020 to regularly review implementation and progress towards achieving its greenhouse gas reduction target, in order for corrective action to be taken where necessary. In line with the existing format, the Climate Action Reports present the implementation status of current programmes of measures under the Climate Action Plan 2050, current emissions trends in the various fields of action and an estimate of the reductions expected from upcoming steps.

3.2 Emission trends – National Inventory Report for the German Greenhouse Gas Inventory

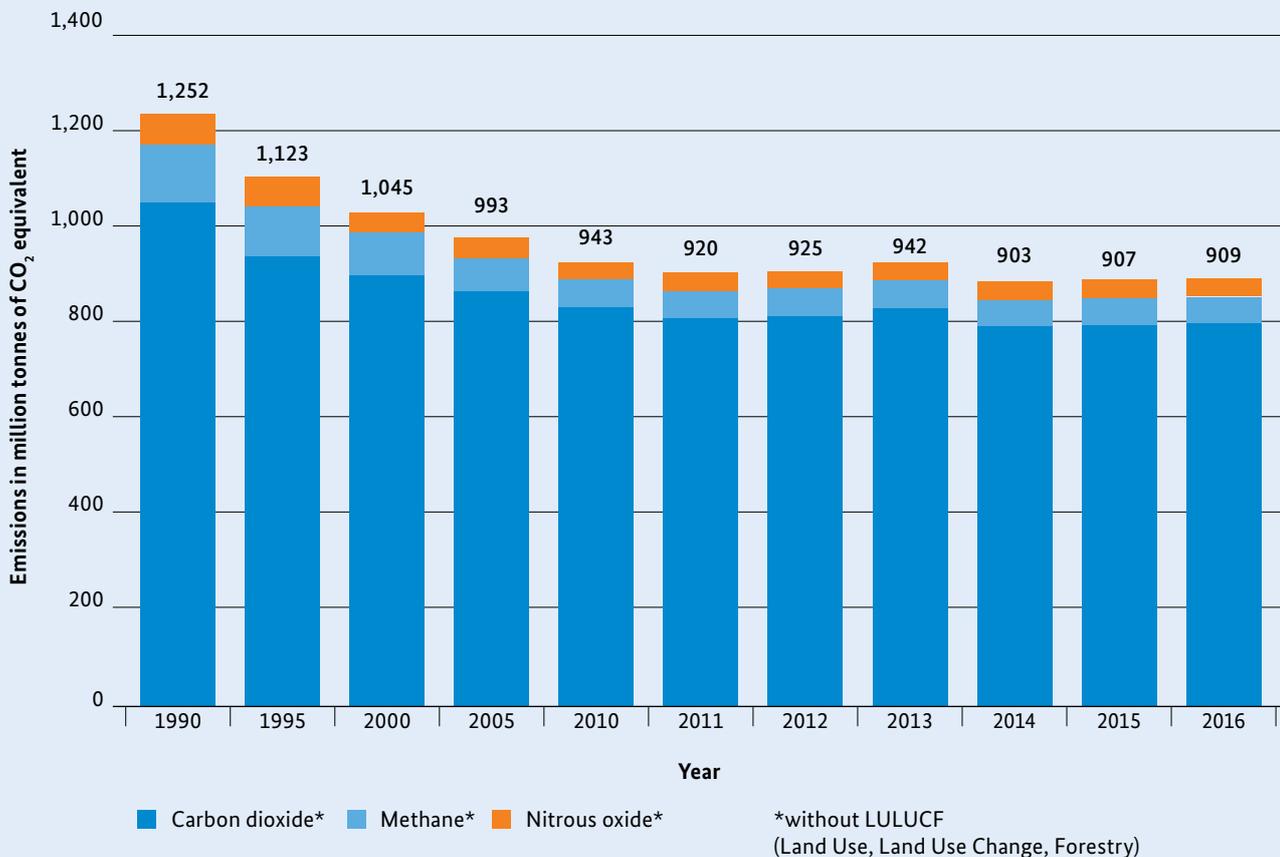
Between 1990 and 2016, Germany’s total greenhouse gas emissions fell by 27.4 percent, which equates to 343 million tonnes of CO₂ equivalent (CO₂ e). A total of 909 million tonnes of greenhouse gases were emitted, which is about 2.7 million tonnes more than in 2015.

Emissions from the energy industry decreased by comparison with the previous year, whereas emissions from the transport sector and private households were considerably higher. The fact that transport emissions rose by 4 million tonnes of CO₂ equivalent (+2.5 percent) is primarily due to increased road transport, especially freight haulage. In addition to colder weather conditions, the leap year day was also a factor in this rise. The temperature trends and correspondingly higher heating energy demand also led to a 3.6-million-tonne

rise in emissions from households and other small consumers, which is a 4.1 percent increase. Greenhouse gas emissions from the energy industry decreased by 1.4 percent and industry’s energy-related emissions also decreased slightly by 0.3 percent whereas its process-related emissions rose by 1.4 percent as a result of the economic situation.

The Federal Environment Agency’s estimates for 2017 assume a slight decline in total emissions in Germany. The energy sector sets the tone for this trend with a decline of 15 million tonnes of CO₂ equivalent, which corresponds to approximately four percent; emissions in the transport and industry sectors, by contrast, rise by five million tonnes of CO₂ equivalent each. In three sectors – agriculture, the trade, commerce and services sector, and private households – emissions stagnate at 72.39 and 91 million tonnes of CO₂ equivalent. Emissions in the waste and wastewater sector fall by 4.3 percent from 10.48 million tonnes to 10.03 million tonnes of CO₂ equivalent.

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



Source: Federal Environment Agency, National Greenhouse Gas Inventory 2018

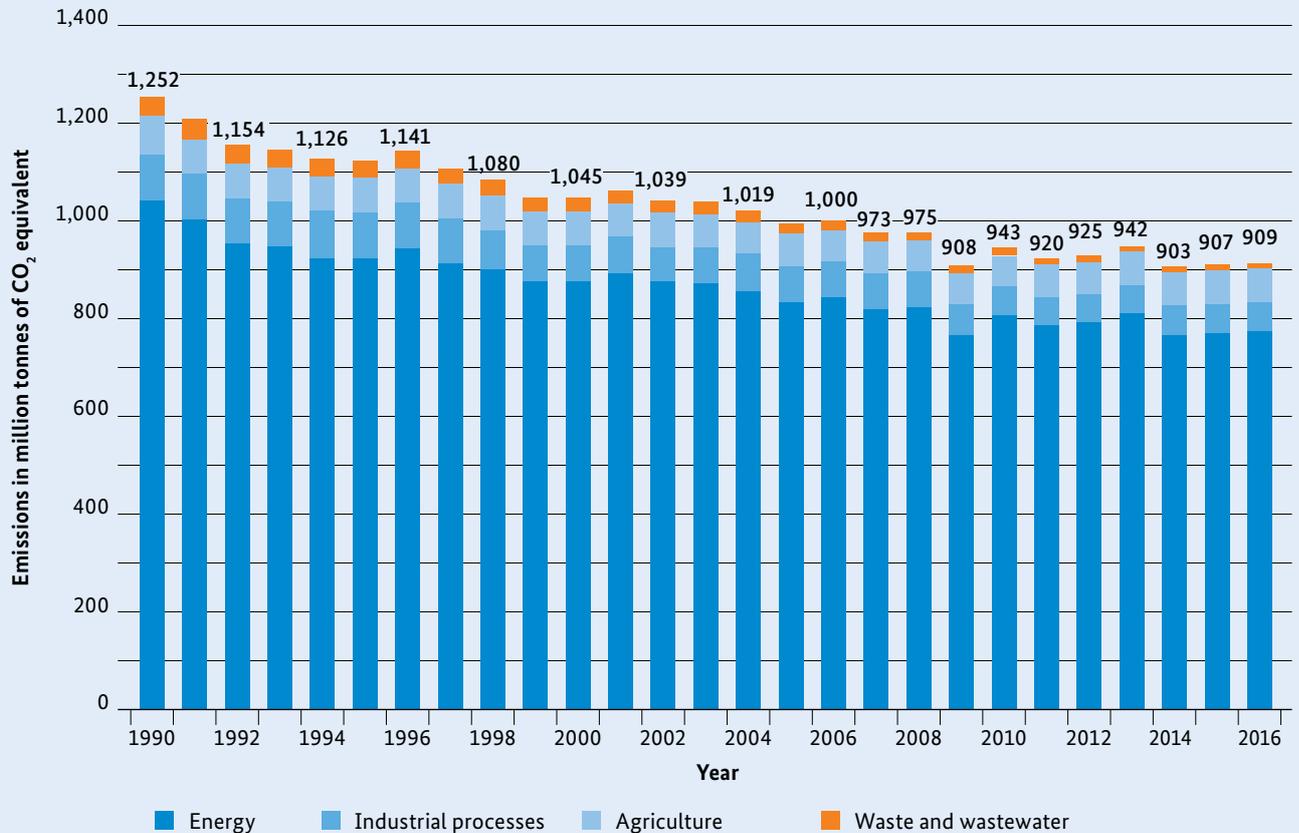
A comparison of the individual greenhouse gases shows that emissions of the gases that dominate in terms of quantity, most strikingly methane, decreased considerably. The main reasons for the trends since 1990 are:

- The switch to lower-emission liquid and gaseous fuels,
- the increasing replacement of fossil fuels by renewable energy sources,
- greater efficiency of plants and facilities,
- changes in livestock raising conditions and reduction in livestock populations, and
- compliance with statutory provisions in waste management.

The influence of cyclical fluctuations in certain sectors on total emissions is particularly striking in the years from 2008 to 2013. For example, the global economic crisis, which began to have an impact on the economy in 2008, was reflected in Germany's emissions.

A comparison of the individual greenhouse gases shows that CO₂ was the predominant gas, largely resulting from combustion processes. Due to the above-average decrease in emissions of the other greenhouse gases, the share of CO₂ in overall greenhouse gas emissions has risen by about four percentage points since 1990 to 88.2 percent. The share of methane emissions (CH₄) was 6 percent and 4 percent for nitrous oxide (N₂O). Fluorinated greenhouse gases accounted for approximately 1.7 percent. This distribution spectrum of greenhouse gas emissions is typical for a highly industrialised country.

Figure 2: Emission trends in Germany since 1990, by category



Source: Federal Environment Agency, June 2018

A closer look at the individual gases reaffirms this trend in its varying degrees. Changes in emissions in 2016 since the base year (1995 for F-gases, otherwise 1990) totalled minus 23.9 percent for carbon dioxide (CO₂), minus 54.4 percent for methane (CH₄) and minus 41.1 percent for nitrous oxide (N₂O). Fluorinated gases (F-gases) as a whole fell by 10.3 percent compared with the 1995 base year, but there were differences in the trends for the individual gases in that category. As a result of the introduction of new technologies and the use of these substances as substitutes, emissions of sulphur hexafluoride (SF₆) have fallen by about 40 percent since 1995 and of perfluorocarbons (PFCs) by almost 90 percent, whereas emissions of hydrofluorocarbons (HFCs) rose by over a third. The rising trend in nitrogen trifluoride (NF₃) is negligible due to the low volume of emissions. Even the contribution of all F-gases to total emissions is low at just 1.7 percent.

A comparison of the individual groups of sources and sinks listed in the greenhouse gas inventory shows that energy-related emissions dominate very clearly. Over time, these emissions have steadily decreased in absolute terms. The majority of deviations from the trend are weather-related. For example, differences in ambient temperature patterns, especially in winter, influence people's heating behaviour and therefore the amount of energy used to supply space heating. That, in turn, has an impact on annual trends in energy-related emissions.

3.3 Projected emission trends

3.3.1 Introduction

Germany produces a Projections Report every two years, giving an estimate of how greenhouse gas emissions are likely to develop in the medium term. The latest Projections Report was officially published in April 2017.¹ The German Government does not fully endorse the findings of the Projections Report but takes them into account in its climate policy considerations.

The scenarios considered in the Projections Report currently extend to 2035. This Climate Action Report concentrates on outlining the findings for 2020. As a rule, the Projections Report presents two scenarios.

The model calculations in the with-measures scenario (WMS) take into account all the measures in the various sectors that were adopted by policy makers, implemented or initiated by a certain date, in case of the 2017 Projections Report by 31 July 2016. The with-additional-measures scenario (WAMS) looks at the effects of additional climate measures that have already been approved or are planned, primarily those outlined in the interministerial Climate Action Programme 2020 and the National Action Plan on Energy Efficiency, but have not been implemented by the set cut-off date.

These projections of emissions trends – even for short periods of time – are fraught with serious uncertainties. Economic trends, energy prices and other underlying conditions can have a strong influence on actual trends. The model calculations depend on the assumptions made and underlying data used. The results must therefore be evaluated in light of the assumptions made about the underlying data as described in the Projections Report. In addition, sensitivity analyses are performed to establish how differences in economic growth, for example, in population trends or in fuel prices could impact on trends in greenhouse gas emissions. Sensitivity analyses carried out for the two scenarios show the potential order of magnitude of the uncertainties.

To evaluate the reduction in emissions resulting from the various measures, the trend resulting from these measures is compared against a (hypothetical) trend that would have occurred had these measures not been put in place and had existing policies and measures not been amended.

The trends in total greenhouse gas emissions are calculated from energy-related greenhouse gas emissions and those from industrial processes and product use. In line with international agreements on greenhouse gas reporting, emissions from international aviation and maritime transport were not used in the calculations; they are, however, included in the report for information purposes. Emissions from land use, land use changes and forestry (LULUCF) are also included for information purposes only, although the most recent Projections Report did do calculations for this sector.

1 http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwqc4_g/170426_PB_2017_-_final.pdf

3.3.2 The current estimate for 2020

The calculations for the Projections Report on the greenhouse gas emissions to be expected in 2020, which were finalised at the beginning of 2017, were based on certain assumptions about trends in Germany. Trends in population numbers and economic growth are of major importance. The economic growth assumed for the projection calculations was surpassed by actual developments in the years 2015 to 2017.² The latest estimate of 2.2 percent economic growth for 2018³ is also significantly higher than the assumptions of approximately 1.3 to 1.6 percent made for those calculations.

Similarly, the actual increase in population in Germany also surpassed the assumptions. By 2020, the population will – depending on the scenario – be between 1 and 1.8 million inhabitants higher than was assumed for the 2017 Projections Report.

The trends for the two factors economic growth and population are likely to increase greenhouse gas emissions and therefore widen the gap between actual emissions and the 40-percent target, which must also be kept in mind. According to a recent study by BMU, it can be assumed that greenhouse gas emissions will be reduced by only roughly 32 percent compared to 1990 levels unless additional climate action measures are put in place.

For total greenhouse gas emissions (not counting land use, land-use change and forestry), the 2017 Projections Report assumed that a reduction of 34.7 percent would be achieved by 2020 under the with-measures scenario and of 35.6 percent under the with-additional-measures scenario – in each case compared with 1990 levels.

However, it must also be pointed out that, in accordance with UNFCCC rules, the emissions trends described do not include developments in international aviation, in the LULUCF sector and to a lesser extent in deep-sea shipping. Under the Kyoto Protocol these sectors are not included in national climate targets. In particular, the very dynamic trend in international aviation causes the relevant greenhouse gas emissions in both scenarios to rise by more than 4 million

tonnes of CO₂ equivalent between 2005 and 2020, which equates to an increase of roughly 14 percent. The LULUCF sector is likely to change from being a sink to being a source of greenhouse gases in the coming years.

3.3.3 A more detailed look at the results

The results described below refer to the with-measures and with-additional-measures scenarios (WMS and WAMS) calculated in the 2017 Projections Report, which are based on assumptions made when work began on the report (summer 2016). The sensitivity analyses were carried out for total emissions only. The sectoral results outlined here are based on assumptions concerning developments in the socio-economic environment. In light of current emission trends, the predictions have to be seen as somewhat optimistic in terms of climate change mitigation. As described above, a number of current trends – especially the considerably more dynamic developments in the economy and higher population numbers – mean that emissions are likely to be higher than expected in 2020.

It remains to be seen to what extent the current unexpectedly sharp rise in the price of emissions allowances might have the opposite effect.

In both scenarios examined, the energy industry accounted for by far the largest share of total emission reductions achieved between 1990 and 2020 (absolute reduction of 174 million tonnes of CO₂ equivalent between 1990 and 2020 in the WMS and 180 million tonnes of CO₂ equivalent in the WAMS, which equates to a reduction of over 37 percent and almost 39 percent respectively).

According to the model calculations, the second largest contribution to the estimated reduction in emissions is made by industry. Here, the annual energy- and process-related emissions could – depending on the scenario – decline by just under 110 million tonnes of CO₂ equivalent (WMS) or over 122 million tonnes of CO₂ equivalent (WAMS), which equates to almost 39 and 40 percent respectively compared with 1990 levels.

The third largest reduction contribution is made by private households, which in both scenarios could

2 www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/VGR/Inlandsprodukt/Tabellen/Gesamtwirtschaft.html
3 www.sachverstaendigenrat-wirtschaft.de/presse-jahresgutachten-2017-18.html

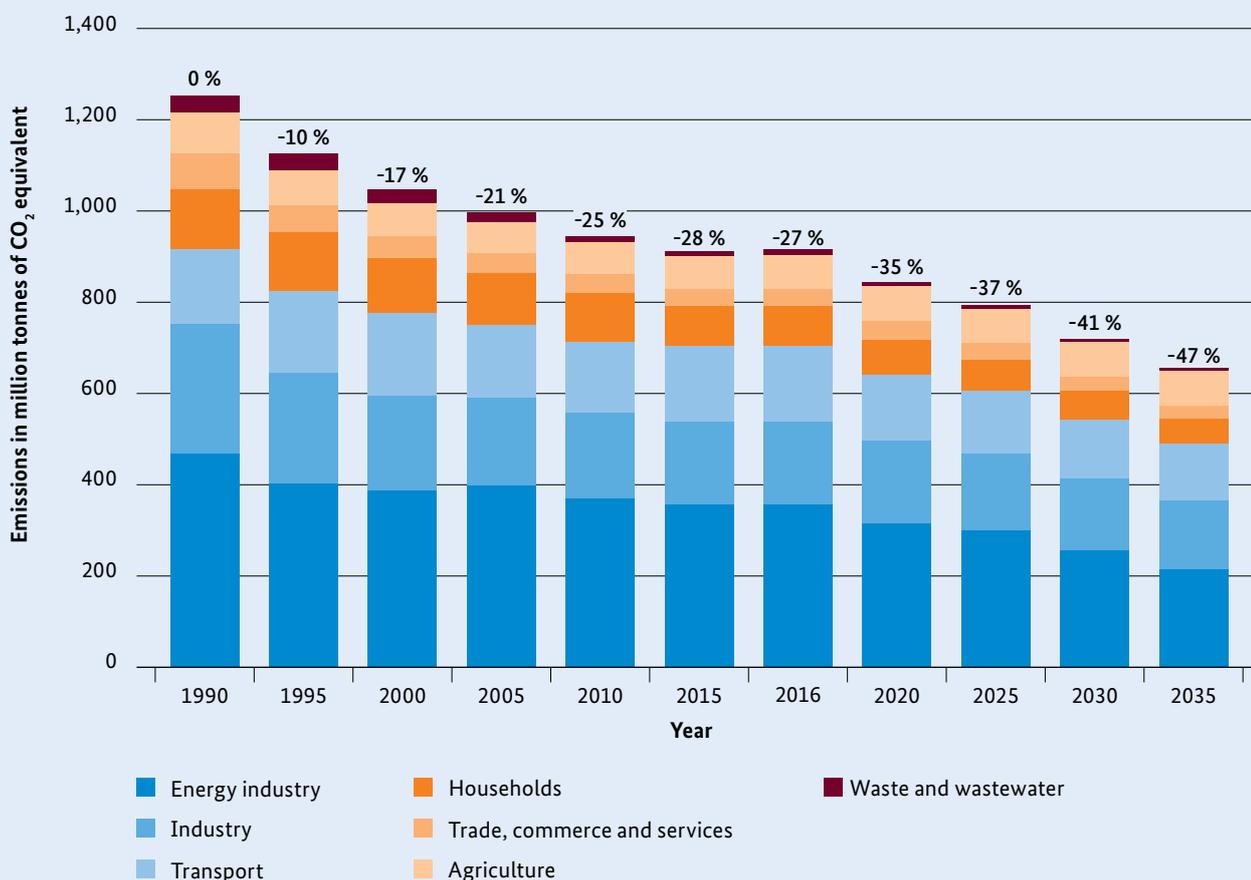
reduce their emissions by about 42 percent or 56 million tonnes of CO₂ equivalent annually by 2012 compared with 1990 levels.

In the trade, commerce and services sector, emission reductions of over 40 million tonnes of CO₂ equivalent could be achieved between 1990 and 2020 in both scenarios, which is a reduction of almost 52 percent.

According to the Projections Report, only minor emissions reductions are achieved in the transport

sector. Based on measures implemented so far, there is a reduction of approximately 5 to 6 million tonnes of CO₂ equivalent in both scenarios, in other words between three and four percent compared with 1990 levels. This estimate is based on assumptions on trends in driving performance and further increases in car efficiency. However, it is becoming clear that the increase in driving performance is greater and the improvements in car efficiency lower than was assumed for the Projections Report. In fact, emissions from the transport sector have risen in recent years

Figure 3: Trends in total greenhouse gas emissions between 1990 and 2035 by source category in the with-measures scenario



Source: Federal Environment Agency, National Inventory Reports for the German Greenhouse Gas Inventory 1990 to 2016 (as at: 03/2018), 2017 Projections Report for Germany pursuant to Regulation (EU) No 525/2013 (online: http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwqc4_g/170426_PB_2017_-_final.pdf).

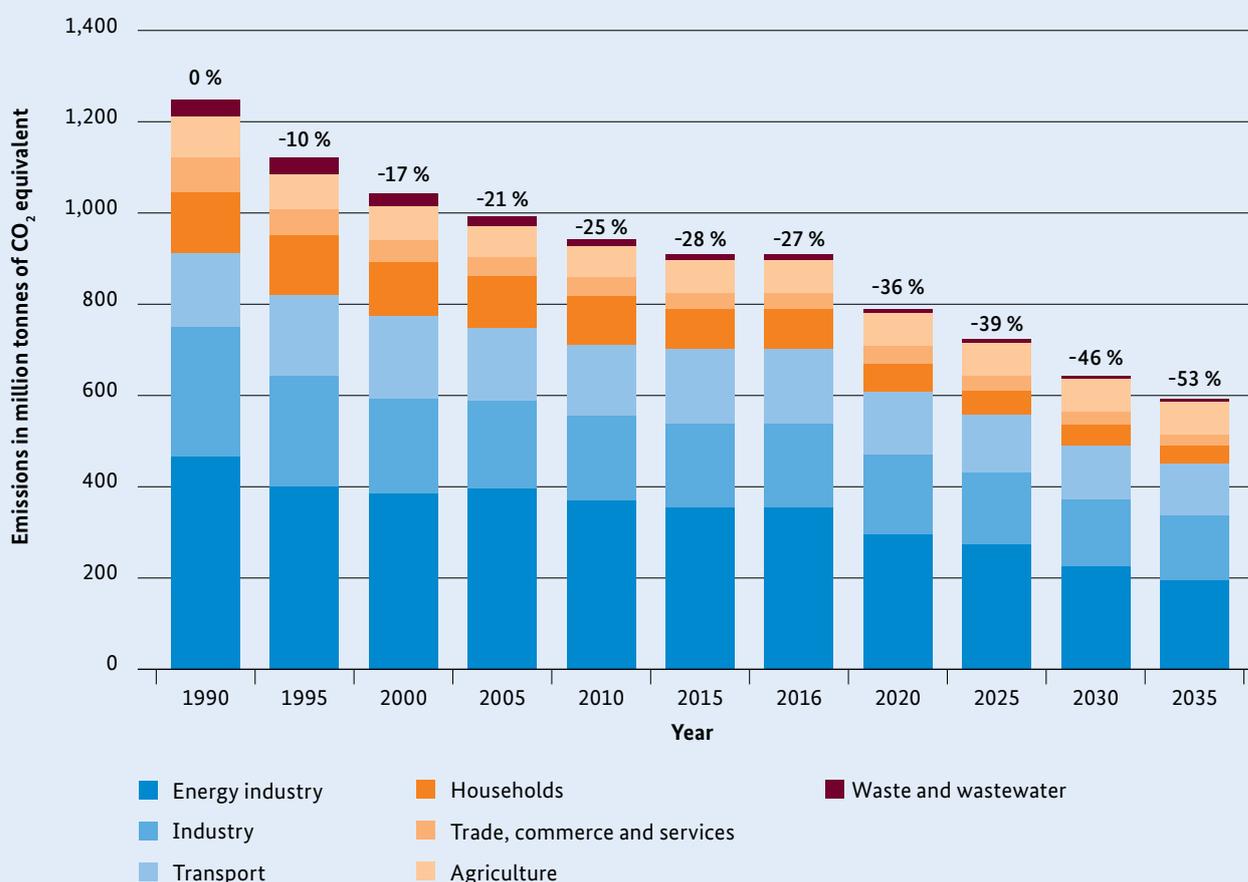
Notes: Under the Convention, total emissions do not include land use, land-use change and forestry or indirect emissions. 1990 to 2016: actual emissions. From 2020: projections under the with-measures scenario

as a result of this (see also Section 4.5). The latest estimate also indicates that the contributions expected from measures set out in the Climate Action Programme 2020 (see Section 5.2) are likely to result in only a slight fall in emissions from the transport sector. Since emissions in other sectors are falling more sharply, the transport sector's share in total emissions is rising. Whereas in 1990, the share of transport in total emissions was just over 13 percent, by 2015 it had risen to almost 18 percent and is likely to be over 19 percent in 2020. It should also be noted that, due

to the expansion of electric mobility, some of the emissions from the transport sector are attributed to the energy industry because that is where public electricity generation is accounted for.

Annual emissions from agriculture fell by 17 million tonnes of CO₂ equivalent between 1990 and 2015 and will fall by a further 2 (WMS) to 4 (WAMS) million tonnes of CO₂ equivalent by 2020, which is 21 and 23 percent respectively compared with 1990 levels.

Figure 4: Trends in total greenhouse gas emissions between 1990 and 2035 by source category in the with-additional-measures scenario



Source: Federal Environment Agency, National Inventory Reports for the German Greenhouse Gas Inventory 1990 to 2016 (as at: 03/2018), 2017 Projections Report for Germany pursuant to Regulation (EU) No 525/2013 (online: http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwqc4_g/170426_PB_2017_-_final.pdf).

Notes: Under the Convention, total emissions do not include land use, land-use change and forestry or indirect emissions. 1990 to 2016: actual emissions. From 2020: projections under the with-additional-measures scenario

Thus, agriculture contributes over seven percent to total emissions. If there were a further reduction in energy-related emissions in all sectors, this share would increase.

Waste management is the sector with the highest emissions reductions in relative terms in the past,

experiencing a decline of over 70 percent between 1990 and 2015. Nevertheless, emissions from the waste management sector can be reduced by almost three million tonnes more CO₂ equivalent, or 23 percent, between 2015 and 2020. This would correspond to a decrease in emissions of up to 78 percent compared to 1990.

Table 1: Trends in total greenhouse gas emissions between 1990 and 2035 by source category: actual emissions up to 2016 and projected emissions in the with-measures scenario

	1990	2015	2016	2020	2025	2030	2035
	in million tonnes of CO ₂ equivalent						
Energy industry	466	349	343	292	303	276	229
Industry	284	188	188	173	162	148	143
Transport	163	162	166	158	151	149	148
Households	132	88	91	76	65	58	53
Trade, commerce and services	78	37	39	37	33	29	25
Agriculture	90	73	72	71	71	69	68
Waste and wastewater	38	11	10	9	7	6	5
Total	1,252	907	909	816	793	735	669
<i>compared to 1990</i>	–	-28 %	-27 %	-35 %	-37 %	-41 %	-46 %

Source: Federal Environment Agency, National Inventory Reports for the German Greenhouse Gas Inventory 1990 to 2016 (as at: 01/2018), 2017 Projections Report for Germany pursuant to Regulation (EU) No 525/2013 (online: http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwqc4_g/170426_PB_2017_-_final.pdf).

Notes: 1990 to 2016: actual emissions. From 2020: projections under the with-measures scenario. Ongoing methodological improvements and updates in the German Greenhouse Gas Inventory mean that figures for 1990 to 2016 may differ from those given in the Climate Action Plan 2050.

Table 2: Trends in total greenhouse gas emissions between 1990 and 2035 by source category: actual emissions up to 2016 and projected emissions in the with-additional-measures scenario

	1990	2015	2016	2020	2025	2030	2035
	in million tonnes of CO ₂ equivalent						
Energy industry	466	349	343	286	281	241	185
Industry	284	188	188	171	159	147	137
Transport	163	162	166	157	148	138	126
Households	132	88	91	76	64	56	51
Trade, commerce and services	78	37	39	38	33	28	23
Agriculture	90	73	72	69	69	67	66
Waste and wastewater	38	11	10	8	7	5	5
Total	1,252	907	909	806	760	682	592
<i>compared to 1990</i>	–	–28 %	–27 %	–36 %	–39 %	–46 %	–53 %

Source: Federal Environment Agency, National Inventory Reports for the German Greenhouse Gas Inventory 1990 to 2016 (as at: 03/2018), 2017 Projections Report for Germany pursuant to Regulation (EU) No 525/2013 (online: http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwqc4_g/170426_PB_2017_-_final.pdf).

Notes: 1990 to 2016: actual emissions. From 2020: projections under the with-additional-measures scenario. Ongoing methodological improvements and updates in the German Greenhouse Gas Inventory mean that figures for 1990 to 2016 may differ from those given in the Climate Action Plan 2050.

4

Fields of action and emission trends – sectoral analysis

The fields of action in the Climate Action Programme 2020

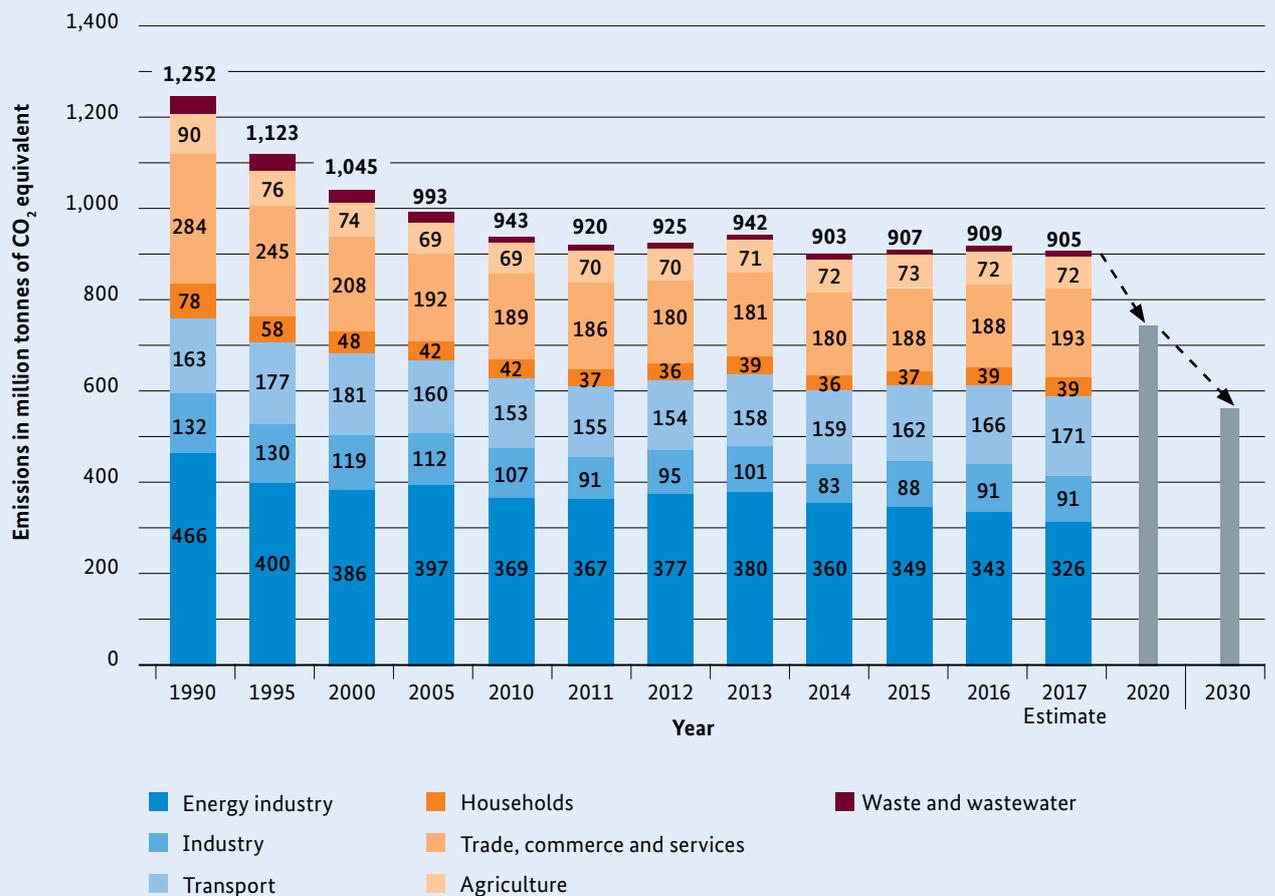
are defined on the basis of the source principle, in other words the origin of the emissions. For example, most emissions resulting from electricity consumption in private households are caused by fossil fuels being burned in power stations and are therefore allocated to the energy industry. Germany's greenhouse gas emissions rose from almost 907 to over 909 million tonnes of CO₂ equivalent between 2015 and 2016, which is an increase of 0.3 percent. The breakdown by sector for

2016 shows that the energy industry was the highest emitter of greenhouse gases, accounting for almost 38 percent of total emissions. In second place was industry at just under 21 percent, followed by the transport sector at over 18 percent, households (direct emissions from residential buildings) at around ten percent, agriculture at eight percent and the trade, commerce and services sector at around four percent. The remaining emissions (one percent) come mainly from the waste management sector.

Initial estimates indicate that just under 905 million tonnes of greenhouse gases were emitted in Germany in 2017, about 0.5 percent less than 2016. This means that greenhouse gas emissions fell by about four million tonnes in 2017. Emissions of carbon dioxide, the most significant gas for the emissions trend, and methane were lower than in 2016. In contrast, emissions of nitrous oxide rose slightly.

The near-term estimate for 2017 has been included in the report, since it is already available and completes the picture. The exact figures for 2017 will not be available until the beginning of 2019. In past years, the near-term estimate was used until it was replaced by the exact figures.

Figure 5: Trends in greenhouse gas emissions in Germany 1990 – 2016 and an estimate for 2017 by sector as defined in the Climate Action Programme 2020 and Germany’s targets for 2020 and 2030



Source: Federal Environment Agency, National Inventory Reports for the German Greenhouse Gas Inventory 1990 to 2016 (as at: 03/2018)

Table 3: A comparison of trends in total greenhouse gas emissions in Germany (figures for absolute emission volumes are in million tonnes of CO₂ equivalents) and near-time estimate for 2017

Sector	Emissions 1990		Emissions 2016		Emissions 2017 (estimate)		Change from 1990 to 2017		With-measures projection for 2020. Absolute and change since 1990		With-additional-measures projection for 2020. Absolute and change from 1990	
	Absolute	[%]	Absolute	[%]	Absolute	[%]	[%]	[%]	Absolute	[%]	Absolute	[%]
Energy industry	466	38 %	343	38 %	328	36 %	-30 %	-4.3 %	292	-37 %	286	-39 %
Industry	284	21 %	188	21 %	193	21 %	-32 %	+2.5 %	173	-39 %	171	-40 %
Transport	163	18 %	166	18 %	171	19 %	+4 %	+3.1 %	158	-3 %	157	-4 %
Households	132	10 %	91	10 %	91	10 %	-31 %	±0.0 %	76	-43 %	76	-42 %
Trade, commerce and services	78	4 %	39	4 %	39	5 %	-50 %	+1.7 %	37	-52 %	38	-52 %
Agriculture	90	8 %	72	8 %	72	8 %	-20 %	+0.3 %	71	-21 %	69	-23 %
Waste and wastewater	38	1 %	10	1 %	10	1 %	-74 %	-4.3 %	9	-77 %	8	-78 %
Total	1,252	100 %	909	100 %	905	100 %	-28 %	-0.5 %	816	-35 %	806	-36 %

Source: Federal Environment Agency, National Inventory Report for the German Greenhouse Gas Inventory 1990 to 2016 (as at: 03/2018), 2017 Projections Report for Germany pursuant to Regulation (EU) No 525/2013, (online: http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwqc4_g/170426_PB_2017_-_final.pdf).

Note: Ongoing methodological improvements and updates in the German Greenhouse Gas Inventory mean that figures for 1990 to 2016 may differ from those given in the Climate Action Plan 2050. The percentage changes are based on calculated values that may give rise to differences from the absolute values, which have been rounded off.

4.1 Energy industry

The energy industry includes all the emissions produced by burning fossil resources in power stations to supply electricity and heat to the public grids along with its fugitive emissions. As already mentioned, it also comprises emissions arising from electricity consumption by private households and by the transport sector, industry (except self-generated energy) and the trade, commerce and services sector.

At 343 million tonnes of CO₂ equivalent and therefore 38 percent of total emissions, the energy industry was the highest emitter of greenhouse gases in 2016. This percentage is slightly lower than in previous years. CO₂ emissions stagnated, continuing to account for about

98 percent of total greenhouse gas emissions in the energy industry.

The key mitigation measures in the energy industry are emissions trading, expansion of renewable energy and combined heat and power generation, and the gradual reduction of lignite-fired power station capacities on the supply side, combined with all the measures that have been put in place to reduce the demand for electricity, heat and cooling from power stations in the public energy supply system (increasing energy efficiency).

Under the with-additional-measures scenario (WAMS), which takes into account measures set out in the Climate Action Programme 2020 and the National Action

Plan on Energy Efficiency (NAPE), the current 2017 Projections Report calculates that reduced energy consumption could result in emissions from the energy industry falling to about 286 million tonnes of CO₂ equivalent by 2020, which is an additional reduction of roughly 6 million tonnes compared to the with-measures scenario (WMS).

4.2 Industry

The industrial sector includes emissions from combustion processes and from the manufacturing industry generating its own power, as well as emissions (including fluorinated gases, known as F-gases) from commercial and industrial processes and product use. Based on the source principle, emissions caused by electricity purchased from external suppliers are included in the energy industry – as are any related measures.

As in previous years, industry was the second-highest emitter after the energy sector. Emissions in 2016 remained virtually unchanged from 2015 levels at roughly 188 million tonnes of CO₂ equivalent and approximately 21 percent of total emissions.

Industry was able to make most progress towards reducing emissions in the 1990s. By comparison with 1990, annual greenhouse gas emissions have fallen by around 96 million tonnes of CO₂ equivalent or approximately 34 percent.

The European Emissions Trading Scheme (EU ETS) is the principal instrument for the industrial sector. Following the reforms to the EU ETS adopted at the end of 2017 for Phase 4, which runs from 2021 to 2030, significant price increases have been seen since the beginning of 2018. Alongside emissions trading, the other most important mitigation measures in this sector are incentives to increase energy productivity, stepping up the use of renewable energy and schemes to reduce emissions of fluorinated greenhouse gases (F-gases). Industry plays a prominent role in the ambitious implementation of the National Action Plan on Energy Efficiency and the EU Energy Efficiency Directive.

Under the with-additional-measures scenario (WAMS), which includes measures set out in the National Action Plan on Energy Efficiency (NAPE) and the Climate Action Programme 2020, the current Projections Report calculates that emissions from the energy industry

could be cut to about 171 million tonnes of CO₂ equivalent by 2020, which is an additional reduction of roughly 2.5 million tonnes compared to the with-measures scenario (WMS). The current reforms of the EU ETS are not yet shown here.

4.3 Trade, commerce and services

This sector includes all emissions from combustion processes in the trade, commerce and services sector (also referred to as small-scale consumption), most of which are used to supply heat (fuel for space heating, cooking and hot water). For that reason, emission trends for the sector are subject to weather-related fluctuations.

At 39 million tonnes of CO₂ equivalent in 2016, the sector accounted for a very small share of Germany's total emissions – roughly four percent. From 2015 to 2016, there was a slight – largely weather-related – increase of just under two million tonnes of CO₂ equivalent. Nevertheless, the sector has seen a far above-average reduction in emissions when 2016 levels are compared with those in 1990 – 50 percent in fact. To date, significant emissions reductions have been achieved, primarily as a result of imposing energy-efficiency requirements on buildings, processes and products.

The Projections Report indicates that, given ambitious implementation of the measures set out in the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE), greenhouse gas emissions in the trade, commerce and services sector could be around 38 million tonnes of CO₂ equivalent in 2020. Exploiting the considerable technical and economic potential in the non-residential building stock is a key factor in achieving this. In addition to improving energy efficiency in heat and electricity consumption, using renewable energy could also bring about further emissions cuts.

4.4 Households

In the private households sector, too, direct emissions (not counting those from the electricity and district heating supply) are caused almost exclusively by the provision of space heating and hot water in buildings. This means that emissions trends in this sector are also subject to very significant weather-related fluctuations.

From 1990 to 2016, direct emissions fell by almost 31 percent to 91 million tonnes of CO₂ equivalent. As a result of weather conditions, emissions were 3.6 million tonnes of CO₂ equivalent up compared to 2015. The overall positive trend is mainly due to improvements in existing buildings and changes to heating systems.

There are a number of particularly important factors in reducing emissions in the private households sector: effective incentives to carry out building refurbishment schemes that include a high-standard energy saving component, continuing to increase the use of renewable energy generated in close proximity to buildings and harnessing potential in the medium and long term by implementing neighbourhood strategies in energy-efficient redevelopment programmes and in the public utilities sector (for example heat generation from grey water). Electricity-saving measures can also help to reduce emissions in the energy industry.

Key instruments include the Energy Conservation Act (Energieeinsparungsgesetz), the Energy Conservation Ordinance (Energieeinsparverordnung), the Heating Costs Ordinance (Heizkostenverordnung), the Renewable Energies Heat Act (Erneuerbare-Energien-Wärme-Gesetz) and the Ordinance on small and medium-sized firing installations (Kleinf Feuerungsanlagenverordnung, 1. BImSchV), the EU Ecodesign and Energy Labelling Directives, taxation of energy products for heating purposes and funding programmes such as the CO₂ building refurbishment programme and the market incentive programme for renewable energies in the heating market (MAP).

Germany's latest Projections Report forecasts considerable emission reductions in the households sector under the with-additional-measures scenario, with levels falling to 76 million tonnes of CO₂ equivalent in 2020. This is contingent on ambitious implementation of the climate action measures planned under the National Action Plan on Energy Efficiency (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, domestic aviation and maritime transport. They do not include fuel used in agriculture, forestry and the fishing industry (which is accounted for in the agriculture sector) or greenhouse gas emissions from international aviation and maritime transport. Continuing growth is forecast in these areas. In accordance with the source principle, emissions caused by electricity generation for electric road and rail transport are not included, either. The main factors influencing greenhouse gas emissions in this sector are transport volume, energy use and the type of fuels used (fossil carbon content).

At 163 million tonnes of CO₂ equivalent, the share of domestic transport in Germany's greenhouse gases emissions was 13.0 percent in the 1990 base year. It rose to 17.7 percent or 185 million tonnes of CO₂ equivalent in 1999, falling again up to 2009. Since 2010, emissions have again risen continuously and reached 166 million tonnes of CO₂ equivalent in 2016, thus once more slightly exceeding the 1990 level. The sector's share in total emissions has increased to 18.2 percent.

The latest Projections Report considers a reduction in emissions in the transport sector (not counting emissions from international transport) under the WAMS to around 157 million tonnes of CO₂ equivalent in 2020 to be possible. However, the actual increase in emissions in recent years and the more up-to-date estimate of the reduction effect of the measures set out in the Climate Action Programme 2020 suggest that this projection should be viewed with caution.

Electric mobility based on renewable energy holds considerable potential for climate change mitigation in the medium term, as do alternative fuels (including

sustainably produced biofuels), a modal shift from private motor transport to public transport, cycling or walking or – in the case of freight transport – a shift from road to rail.

The German Government's coalition agreement also envisages creating an appropriate regulatory framework to drive forward sector coupling. Not only electric mobility but also green hydrogen will benefit from this as sector coupling options.

A rise to over 34 million tonnes of CO₂ equivalent in 2020 is forecast for international aviation and maritime transport.

4.6 Agriculture

The Climate Action Programme 2020 counts methane and nitrous oxide emissions from livestock husbandry and fertiliser management and carbon dioxide emissions from use of fuel in agriculture⁴ as emissions from the agricultural sector.

Greenhouse gas emissions from the sector fell from 90 to 72 million tonnes of CO₂ equivalent between 1990 and 2016, which equates to a 20 percent decrease. Their share in total emissions thus remains virtually unchanged at just over 7 percent.

The reductions achieved thus far in agriculture are primarily due to the decline in livestock farming in eastern Germany after 1990, the environmental standards included in the EU Common Agricultural Policy, better fertiliser management and a greater link between livestock density and land use. Improving efficiency in the use of nitrogen fertiliser and the expansion of organic farming offer additional reduction options.

The latest Projections Report estimates approximately 69 million tonnes of CO₂ equivalent in 2020 under the with-additional-measures scenario, which takes into account measures set out in the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE), which is only a slight reduction compared to 2016, whereas under the with-measures scenario emissions stagnate.

4.7 Land use, land use change and forestry

Emissions from agricultural soils (caused by ploughing up grassland, for example) and carbon release and sequestration in forestry are not included in assessments of whether climate targets have been met.⁵ Nevertheless, the potential for additional climate action in this sector should be explored in the medium term. Reduction potential is likely to be found in preserving and improving the sink performance of forests and bogs, in sustainable forest management and, closely associated to this, the use of wood. The German Government will review the current structure of incentives for using wood as an energy source to determine whether they are effective with regard to climate and sustainability targets.

The latest Projections Report forecasts that the entire LULUCF sector is likely to change from being a sink to being a source of greenhouse gases between 2015 and 2020. This results from the fact that greenhouse gas emissions from arable land and grassland are forecast to remain at the same high level, with the sink performance of forests decreasing at the same time. The latter is essentially due to the fact that land was afforested within a short space of time in the post-war years and that those trees are now mature enough to be utilised.

4 Germany's Inventory Report accounts for emissions from use of fuel in agriculture under energy-related emissions.

5 Based on the source principle, emissions that are avoided by producing energy from wood and other biomass are not accounted for in agriculture and forestry. Instead, the reduced emissions are reflected in the energy industry, construction and housing, transport and industry and business sectors as source categories.

It makes sense to use these forests both from an economic point of view and as a climate change adaptation measure, since many of them are exclusively coniferous forests and should gradually be converted to stable, climate-resilient mixed forests. As a result of changes in uses of wood and a shift in the distribution of age classes of trees, the sink performance of forests is likely to decrease from approximately 75 million tonnes of CO₂ equivalent in 1990 to a low of just under 12 million tonnes of CO₂ equivalent in 2020, after which it increases again. Major fluctuations of this kind are familiar from historical data on forest trends.

There is further potential in the use of wood, which can help store carbon over the long term and replace materials with more detrimental greenhouse gas or environmental footprints, as well as fossil fuels. Based on the assumption that there will be no more relevant conversion of grassland to arable land from 2015 onwards, emissions from arable land decrease slightly up to 2020 and considerably up to 2035. There are only minor changes in emissions from other land-use sectors.

4.8 Other emissions

This sector primarily records methane and nitrous oxide emissions from the waste management and water sector. In this sector, 80 percent of emissions come from gas released by waste landfills, 10 percent from wastewater treatment and another 10 percent from composting and mechanical biological waste treatment.

Since 1990, emissions in this sector fell by almost 73 percent from 38 million tonnes of CO₂ equivalent to 10 million tonnes of CO₂ equivalent in 2016. At roughly 1 percent of total emissions, they currently make only a minor contribution to climate-relevant emissions in Germany. These reductions, which are way above average, result primarily from making it illegal to landfill biodegradable municipal waste and from stepping up recycling rates. Other consumer-side measures designed to improve resource efficiency have an effect in other sectors such as households, industry and the energy sector.

According to the latest Projections Report, emissions in this sector could be cut to about 8 million tonnes of CO₂ equivalent in 2020 under the with-additional-measures scenario. This is the estimated effect of funding landfill aeration under the local authority guideline of the National Climate Initiative, which was agreed in the Climate Action Programme 2020.

There is still potential for wastewater treatment plants to cut their emissions by increasing energy efficiency, generating their own electricity and heat from renewable energy sources (especially sewage gas) and, as in the private households sector, in the medium- and long-term by heat recovery from grey water. Energy efficiency measures in the water sector can also help to reduce emissions from the energy industry.

5

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

This section describes the implementation status for all measures set out in the Climate Action Programme 2020 (including those in the National Action Plan on Energy Efficiency) at the time the information was requested from the relevant ministries in summer 2017. We have also included information on the reduction effects. For various reasons, a lengthy period of time elapsed between asking for the information and publishing this report in spring 2018, which may raise the question

of whether the information on some measures is still up-to-date. We plan to make this period much shorter when preparing the next report. The order in which the measures are described largely follows the Climate Action Programme.

In cases where measures adopted under the Climate Action Programme 2020 or the National Action Plan on Energy Efficiency have been replaced by alternative measures, or where supplementary measures have been adopted, these measures have also been outlined.

The Federal Environment Ministry commissioned a consortium of experts to produce a scientific estimate of the reduction effect of the individual measures. They based their work on a number of data sources and methodologies, including an ex-ante assessment of the impact of the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency (NAPE), the calculations done for the 2015 Projections Report and the quantification carried out for the economic assessment of the Climate Action Programme 2020 that was also commissioned by the Federal Environment Ministry. The experts' quantification of the reduction effect takes into account the planning status and – if available – the implementation status of the individual measures. There are uncertainties connected with this estimate, with regard to both the assumptions and the effects. There are also other studies – some ongoing, some planned – which will be taken into account in future estimates. This estimate is not a substitute for a detailed and empirically based ex-post evaluation of the individual measures; it is merely intended to be a rough estimate of effects looking forward to the target year of 2020 (ex-ante). The German Government believes that more extensive studies and estimates are needed to fully gauge individual contributions. The report on this scientific work, including a description of the key methods on which the quantification is based, can be found on the BMU website.

Appropriate financing is essential for the successful implementation of these 110-plus measures, especially for the funding measures adopted under the Climate Action Programme and the National Action Plan on Energy Efficiency. The financing arrangements for the measures are therefore described separately in the next 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 Climate Action Programme 2020: regulatory law, economic incentives, funding programmes, advice and information.

The additional financial resources the German Government made available in 2015 are financing a considerable percentage of the measures connected with funding programmes. For example, starting in 2016, the

funds of the National Climate Initiative were topped up with 150 million euros to finance measures under the Climate Action Programme 2020.

Over 12 billion euros are available up to 2020 for new measures under the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency. Of this sum, approximately five billion euros are earmarked for the Government's climate-friendly building and housing strategy (including building-related measures within the National Action Plan on Energy Efficiency), over 1.7 billion euros for measures in the transport sector and over 135 million euros for reducing non-energy-related emissions from industry and the trade, commerce and services sector. The Federal Organic Farming Scheme is allocating 88 million euros to agriculture.

Up to 2020, over 1.2 billion euros will be also be channelled into mainly long-term research on energy, preventive research on climate change, socio-ecological research and research in the field of construction. The National Action Plan on Energy Efficiency (NAPE) will be supplemented by a package of measures to boost energy efficiency in the buildings sector, in local authorities, industry and rail transport, with the aim of cutting emissions by 5.5 million tonnes of CO₂ equivalent in these areas and especially in the electricity sector (see section 5.4.2). The Federal Ministry of Economic Affairs and Energy has around 17 billion euros available for all ongoing and new efficiency measures (as at: November 2016). Of this sum, around 2.5 billion euros are available between 2016 and 2020 to implement measures under NAPE.

By making such significant funds available to implement measures under the Climate Action Programme and NAPE, the German Government sent out an unequivocal message that it intends to step up climate action and continues to underline the importance it has for Germany in terms of sustainable growth, investments and jobs (see section 8).

Overall, the measures are being implemented within the budget and financial plans of each ministry (including all regular and civil-servant posts) with the proviso that the necessary funds are available in the budget.

The German Government has incorporated the resources needed to fund the measures under the Climate Action Programme and the NAPE until 2020 into the federal budget for 2017 and the 2017 financial plan for the Special Energy and Climate Fund.

5.2 Measures within the Climate Action Programme 2020

Table 4 shows the estimated reduction contributions made by the key policy measures under the Climate Action Programme as established by the scientific quantification carried out by the consortium of experts. The contributions are listed by current state of implementation and planning. They are compared with the reduction contributions outlined in the Climate Action Programme in December 2014. They indicate the respective reduction contribution compared with the emission levels projected for 2020 without taking

into account the measures of the Climate Action Programme. Unfortunately, the greenhouse gas reduction to be expected in 2020 as a result of the package of measures decreased further and is now only between 40 and 52 million tonnes of CO₂ equivalent.

The reduction effects of the individual measures were quantified in the fourth quarter of 2017. In the case of some measures, important information was added after completion of the quantification, which relates to the 2017 reporting year and is therefore mentioned in the descriptions. It was not possible to include this information in the quantification of the reduction contributions.

Table 4: Greenhouse gas reduction effect of the key policy measures under the Climate Action Programme 2020 – as estimated by the Action Programme (as at: December 2014) and as currently estimated by the consortium of experts. The comparisons relate to the projected emissions for 2020 without the measures of the Climate Action Programme.

Key policy measures	Contribution to reducing greenhouse gas emissions in 2020 in million tonnes of CO ₂ equivalent	
	Contribution as originally estimated as at December 2014	Contribution as currently estimated by experts (figures are rounded off)
National Action Plan on Energy Efficiency – NAPE – (without measures in the transport sector)	Approx. 25 to 30 (including energy efficiency in buildings)	19 to 26 (including energy efficiency in buildings)
Climate-friendly building and housing strategy and energy-efficient refurbishment roadmap at federal, Länder and local level	Total of approx. 5.7 to 10 (of which 1.5 to 4.7 in addition to NAPE)	Total 3.2 to 3.8 (of which 0.8 in addition to NAPE)
Measures in the transport sector	Approx. 7 to 10	1.1 to 2
Reduction in non-energy-related emissions in:		
Industry, trade, commerce and services	2.5 to 5.2	1.3 to 1.8
Waste management	0.5 to 2.5	0.16
Agriculture⁶	3.6	0.6 to 2.2
Reform of the emissions trading scheme	The effects of the latest reforms are not yet shown here.	
Further measures, especially in the electricity sector	22	16.4 to 18.4
Advice, public awareness and initiatives at all levels to step up climate action		0.48
Total	62 to 78	40 to 52

⁶ The reduction contributions estimated in December 2014 are based on the emission factors for nitrous oxide applicable at that time for international reporting. They have since been adjusted and form the basis for the estimate for the 2016 climate action report.

5.3 Emissions trading and European and international climate policy

Germany's climate policy is embedded in European and international agreements and obligations. Germany acknowledges its special responsibility as one of the leading industrialised countries and as an economically strong EU member state. It is therefore working to achieve an effective, efficient and credible European and international climate policy.

5.3.1 International cooperation

The 21st session of the Conference of the Parties to the UNFCCC (COP21) adopted the text of a new climate agreement in Paris on 12 December 2015. In doing so, the international community took a historic step towards stepping up climate action and strengthening sustainable development. The Paris Agreement entered into force on 4 November 2016. Germany and the EU ratified it on 5 October 2016. It was a turning point for international climate action. It is the first climate agreement to place obligations on all countries. A total of 169 countries have already submitted their Nationally Determined Contributions (NDCs) to the United Nations. With the entry into force of the Paris Agreement and ratification by individual countries, the international community has made a binding commitment to the goal of keeping global warming well below 2 degrees Celsius above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 degrees Celsius. The Paris Agreement also enshrines for the first time the goal, now binding under international law, of strengthening resilience against the consequences of climate change and making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resistant development.

Countries all over the world have also set themselves the goal of achieving greenhouse gas neutrality in the second half of the century, which means that only as much greenhouse gas will be emitted as can be removed by sinks. The IPCC reports illustrate various paths to achieving the temperature targets. Some of them focus on the decarbonisation of energy systems all over the world by mid-century. However, more is involved, because the stated goal includes all greenhouse gas emissions even if some, such as those from certain

industrial processes or agriculture, cannot be reduced to zero using currently available technology.

For the first time, all contributions to stabilising the global climate that relate to forests have been acknowledged in an agreement to which all the countries in the world have committed. The agreement comprises the forest-related elements of REDD+, sustainable forest management and the possibility of recognising wood and wood-based products as additional options for storing carbon.⁷ The Agreement calls upon the Parties to conserve and expand this positive effect on the climate that forests have, in other words acting as carbon sinks and reservoirs.

The Agreement gives all Parties the clear task of systematically implementing the necessary climate measures. It breaks with the previous rigid division into industrialised countries, on the one hand, and developing countries and emerging economies, on the other, while still emphasising the leadership role of the industrialised countries.

The Agreement contains a five-year review and ambition mechanism to regularly verify whether the Parties' NDCs are sufficient. It also applies to the European Union (EU), which will mean resubmitting or updating NDCs by 2020 and, as of 2025, making NDCs for the post-2030 period progressively more ambitious. A robust transparency system for reporting emissions, progress in implementing NDCs, and climate financing that is equally applicable to all countries is aiming to supplement the mechanism to ensure that the goal of greenhouse gas neutrality can be achieved.

The Agreement ensures particular support for vulnerable countries in the areas of climate change mitigation and adaptation – in the form of financing, technology transfer and capacity building.

With this in mind, the commitment the industrialised countries made in 2009 – to join forces in providing 100 billion USD from public and private sources for climate change mitigation and adaptation in developing countries from 2020 onwards – was reaffirmed. Chancellor Angela Merkel announced in May 2015 that the German contribution would be doubled in 2020 from its 2014 level to four billion USD from budget funds. Since then, German climate finance has increased, most recently to 3.4 billion euros from budget funds in 2016.

7 The methods and crediting rules needed to implement the Agreement are currently the subject of the negotiations.

About 80 – 90 percent of these funds each year come from the budget of the Federal Ministry for Economic Cooperation and Development (BMZ). They are divided roughly equally between climate change mitigation and adaptation. Germany contributes a further 5.2 billion euros in climate finance from funds raised on the capital market in the form of development loans, equity participation and other forms of finance. Private sector investments attributable to German finance totalled over one billion euros.

The Paris Agreement sends an important signal to society and the global economy, and therefore to all private and public-sector stakeholders. Under the Agreement, Germany is obliged to work towards its implementation both nationally and at EU level.

Building on the huge success of Paris and the fact that the Agreement entered into force sooner than expected, efforts since the 22nd session of the Conference of the Parties to the UNFCCC, held in Marrakech (Morocco) in November 2016, have concentrated on its implementation. To this end, a programme of work up to the end of 2018 was adopted, specifying the negotiating issues and steps on mitigation, adaptation, financing, transparency, capacity building, technology development and transfer and markets, and designing the ratchet mechanism provided for in the Agreement. Another important outcome of the summit was the NDC Partnership, which was initiated by Germany and Morocco and gives particular support in implementing the Agreement to developing countries and emerging economies. A total of 84 countries and multilateral organisations have joined the Partnership (55 developing countries and emerging economies, 16 industrialised countries, including the European Commission; as at March 2018). Work at national level within the NDC Partnership has now got off the ground in over 22 member countries and 3 regional initiatives. Germany has to date supported the Partnership with 121 million euros.

The 23rd session of the Conference of the Parties to the UNFCCC (COP23) was held in Bonn in November 2017, at the headquarters of the UNFCCC Secretariat. Fiji held the presidency of the Conference of the Parties, a first for a small island state that is particularly at risk from climate change. Germany carried out its role as technical host extremely successfully – partly thanks to an innovative conference concept. Hosting the conference also strengthened Bonn as a United Nations location.

Germany also joined forces with the Fijian COP23 presidency, Ethiopia as current V20 president, the World Bank and the United Kingdom in advocating for the establishment of the InsuResilience Global Partnership. This Partnership strengthens the resilience of the V20 and G20 countries, especially the poor and vulnerable sections of the population, to the impacts of climate change. Its aim is to shift focus to planning, preparation and protection and to offer solutions in the form of risk transfer instruments for risks that cannot be mitigated.

This global partnership now has over 40 members. They include countries, international and civil society organisations, representatives from the private sector and science, implementing organisations and other initiatives. The Federal Ministry for Economic Cooperation and Development (BMZ) supports the partnership with 110 million euros. The Global Partnership is based on InsuResilience, an initiative set up by the G7 in Elmau in 2015, and its stated aim is to insure 400 million additional poor and vulnerable people against climate risks by 2020.

Important progress was achieved in Bonn in fleshing out the details of the Paris Agreement provisions. The aim was for these provisions to be adopted at the 24th session of the Conference of the Parties in Poland in December 2018.

The framework for the Talanoa Dialogue (also referred to as facilitative dialogue – talanoa is a Fijian participatory decision-making concept) was also established in Bonn. The Talanoa Dialogue has been established as a process for 2018. It aims to review whether the international community's ambition level can be ratcheted up, since the sum total of all the NDCs submitted is not sufficient to achieve the goal of keeping the global temperature increase below 2 degrees Celsius. The plan is that there will be a technical phase during the year and a political phase during the 24th session of the Conference of the Parties, during which it will be established how far the international community has progressed with its emission reductions, how big the ambition gap is, and what can be done to close it. In this way, it is meant to support the countries in preparing their updates or resubmissions of their Nationally Determined Contributions in 2020. Thus, it is an initial trial run for the far broader global inventory, which is scheduled to be carried out every five years starting in 2023 in preparation for ratcheting up

the ambition of all countries in the fields of mitigation, adaptation and financing.

The NDCs submitted by the countries to date do, in fact, differ greatly in terms of level of ambition and therefore in terms of CO₂ avoidance costs. The German Government is therefore continuing to work within the framework of implementation of the Paris Agreement towards the creation of globally uniform competitive conditions. Germany is also part of the World Bank's Carbon Pricing Leadership Coalition, which works to enlist support for CO₂-pricing instruments worldwide.

5.3.2 Cooperation within the EU

Climate action is one of the European Union's (EU) key policy areas. The EU is well on the way to surpassing its binding target of reducing greenhouse gas emissions by 20 percent by 2020 compared with 1990 levels: the EU-wide reduction already totalled 23 percent in 2016. In October 2014, the European Council adopted a new target to succeed the 2020 target, aiming to cut greenhouse gas emissions in the EU by at least 40 percent by 2020 compared with 1990 levels. This target is based on a cost-efficient reduction path to limit the increase in global mean temperature to 2 degrees Celsius, which is set out in the European Commission's "A Roadmap for moving to a competitive low-carbon economy in 2050." Similarly to the 2020 target, the climate target for 2030 is to be jointly achieved using two instruments: the EU Emissions Trading Scheme (EU ETS), which covers large areas of the energy sector and industry, and the Effort-Sharing Regulation, which obliges the member states to comply with binding national targets for the sectors outside emissions trading – especially transport, buildings and agriculture. The emission budgets established on the basis of a linear reduction path make it possible to bank reductions and transfer them to another member state.

In addition to the climate target, energy targets are also planned for 2030; they are currently being negotiated between the European Council and the European Parliament. For example, the European Council proposed

further targets for the expansion of renewable energy, suggesting that the share of renewables in final primary energy consumption should be at least 27 percent, along with an increase in energy efficiency with primary energy consumption being at least 30 percent lower than in the reference forecast. The European Parliament, on the other hand, is calling for more ambitious targets in both areas. The outcome of the negotiations is expected in summer 2018.

The EU adopted its 2030 climate target as its nationally determined contribution (NDC) to the Paris Agreement and submitted it to the UNFCCC secretariat. After the European Commission submitted a legislative proposal to adapt the EU ETS to the new 2030 climate target (see section 5.3.3) in July 2015, the proposal for the EU Effort Sharing Regulation (ESR) was published on 20 July 2016. This proposal also sets national climate targets beyond the EU ETS. In line with the decision of the European Council of 2014, the proposal distributes the reduction targets, ranging from zero to minus 40 percent compared with 2005, across the member states, basing the distribution on the criterion of per-capita GDP. For Germany, the proposal envisages a reduction of at least 38 percent in 2030 compared to 2005. An agreement was reached between the member states and the EU parliament, enabling the legislative process to be concluded. The essential elements remained unchanged.

The greenhouse gas balance of forest and soils (land use, land use change and forestry – LULUCF) will be included through a separate legal text for the first time in the EU climate and energy policy framework (LULUCF Regulation). The proposal, which was approved by the member states and the European Parliament in December 2017, contains a climate target for the LULUCF sector and crediting and accounting regulations for determining emissions and removals in the member states. The ESR includes a flexibility mechanism, which allows credits from the LULUCF Regulation to be used to a limited extent in the ESR in cases where the LULUCF target has been surpassed.

5.3.3 Emissions trading scheme

The European Emissions Trading Scheme (EU ETS) is a key instrument in European climate policy. It covers the majority of emissions from industry and the energy sector and was extended to include aviation within Europe in 2012. That means it applies to about 45 percent of greenhouse gas emissions in Europe. Roughly 1,900 installations in Germany are subject to the EU ETS.

Emissions trading works on the cap & trade principle. An upper limit, or cap, specifies the total volume of greenhouse gases that installations covered by the Emissions Trading Scheme are allowed to emit. The member states issue a corresponding number of emission allowances to the installations, some of them free of charge, others auctioned. The emission allowances can be traded freely on the market. This puts a price on emitting greenhouse gases.

In this way, the instrument creates a European market for emission allowances and ensures that Europe reaches its target by capping greenhouse gas emissions. At the same time, it creates the necessary conditions for leveraging reduction potential where it is most cost-effective. The Emissions Trading System is not designed to achieve targeted emissions reductions in individual countries and sectors and thus ensure national climate targets are met. However, it is an instrument that uses the price of emissions allowances to create a key incentive to cut emissions.

The economic and financial crisis at the end of the 2000s, combined with the inflow of international project credits, produced huge surpluses of emissions allowances in the past, resulting in very low prices for the allowances.

This severely weakened the ability of the Emissions Trading System to create incentives to invest in low-emission technologies. For that reason, even before the Climate Action Programme 2020 was passed, the EU adopted a backloading proposal, which took 900 million emissions allowances off the market before 2016. In order to make the EU ETS systematically more flexible and able to cope with greater demand fluctuations and therefore price fluctuations, the introduction of a market stability reserve (MSR) was also agreed in 2015. It will be activated in 2019.

However, these two measures were only the first step towards a structural reform of the EU ETS. In 2015, the European Commission therefore presented a proposal

for a comprehensive reform for Phase 4 (2021 to 2030), which implements the decisions of the European Council of October 2014. After intense negotiations, the Council of the European Union and the EU parliament agreed on a reform package in November 2017. One of the elements of the agreement is that considerably more emission allowances will be withdrawn from the market than in the past. This means that a scarcity of allowances on the market is to be expected in the early 2020s, which will further increase the incentives to invest in mitigation measures.

During the reform process the German Government pursued two main objectives: firstly, to make the European Emissions Trading Scheme considerably stronger thus enabling it to once more fulfil its function as one of the EU's key climate policy instruments and secondly, to ensure energy-intensive industries maintain their ability to compete with those in countries that have less stringent climate policies. With the agreement reached between the Council and the European Parliament on the reform of the EU ETS, the German Government achieved both objectives.

The total number of allowances available in a single year will be reduced more quickly than before as a result of the reform: in the past, 1.74 percent of the allowances were shaved off each year; from 2021 that figure will be 2.2 percent. Furthermore, the reform will also lead to a significant acceleration of this surplus reduction in that up to 2023 twice as many of the allowances in circulation will be transferred into the MSR than previously planned (24 percent instead of 12 percent). The Commission will review how the MSR operates up to 2022. Another element that is important for strengthening emissions trading in the long term is the newly adopted limitation of the total size of the MSR: from 2023, the reserve will be limited to a volume that corresponds to the amount of allowances auctioned in the EU ETS the previous year. The number of allowances in the reserve over and above that amount will be cancelled (in all likelihood about 2 billion).

Thanks to the MSR mechanism that was improved as part of the reform, allowance surpluses caused by the closure of an installation will be better absorbed than before. In addition to the existing possibility of owners voluntarily cancelling allowances, Article 12 (4) of the ETS Directive now clarifies that member states can also cancel allowances from the contingent they have available for auction in cases where electricity generation capacity is shutdown as a result of national climate measures.

Taken together, these measures make it possible to stabilise the reduction path in the EU ETS and send out an effective CO₂ price signal.

Maintaining the competitiveness of energy and emission-intensive industry was another of the German Government's concerns in the reform process. The Paris Agreement has not yet created internationally comparable competitive conditions in terms of CO₂ costs. This means that there is still a danger of industrial production and its emissions being relocated to countries with laxer climate legislation. Avoiding the use of a cross-sectoral reduction factor in the next phase of trading was of key importance here. A limited share of the allowances for auction will therefore be released for free allocation to the extent necessary to avoid the need for a correction factor. Furthermore, all sectors at risk of carbon leakage will continue to receive a free allocation. The number of allowances freely allocated is established on the basis of the 10 percent most efficient installations and reduced using real data (by at least 0.2 percent and at most 1.6 percent annually). Furthermore, after the reform, it will also be possible – unlike under current arrangements – to adapt the allocation in the case of significant and permanent changes in production volume. To ensure

energy-intensive industries are adequately protected against carbon leakage, the German Government also joined forces with other member states and was able to secure agreement that electricity price compensation would be continued, since it does just that.

Research and development in the field of low-emission technologies and their demonstration in practice are crucial for the transition to a more climate-friendly economy. To improve the investment climate in this respect, the German Government has been making the case for funding opportunities for innovative climate technologies to be expanded in the wake of the reforms. The Innovation Fund can be used to support innovative projects in all member states. Innovations in the fields of prevention and reduction of greenhouse gas emissions, especially from industrial production, along with capture, use and storage of CO₂, the use of renewable energy and energy storage solutions are covered by these funds.

Furthermore, the Modernisation Fund was set up. Only lower-income member states can access its resources in order to modernise their energy supply systems and thus make them more climate-friendly.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014

Contribution according to the latest estimate of experts

The effects of the latest reforms are not yet incorporated.

5.4 Reducing the impact of electricity generation on the climate

The German Government continues to regard the energy transition as one of the key components of a successful climate policy. It involves both supplying climate-friendly final energy and ensuring it is used efficiently.

The energy industry carries significant responsibility in this area due, in particular, to its role as supplier of electricity. For that reason, the German Government's Climate Action Programme includes further measures in this sector beyond emissions trading, which are

designed to bring about additional cuts in greenhouse gas emissions by 2020. Concurrently, measures under the National Action Plan on Energy Efficiency (NAPE) also aim to reduce electricity consumption (see section 5.5).

5.4.1 Renewable energy

In 2016, the supply of electricity from renewable energy sources rather than fossil fuels led to an emissions reduction of around 120 CO₂ equivalent. Wind energy, biomass and photovoltaics made the main contributions to mitigating climate change. The 2017 Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz) introduced competition-based auctioning, an instrument which makes it possible to steer volumes, thus facilitating better planning for the expansion of renewable energy. Plants below 750 Kilowatt continue to receive fixed tariffs. The aim was to adhere to the targeted expansion corridor of 40 to 45 percent of renewable energy in the electricity supply by 2025 and 55 to 60 percent in 2035, and to reach these targets as cost-effectively as possible. In this way, it was possible to significantly increase the share of electricity from renewable sources in gross electricity consumption to just under 32 percent or roughly 190 Terawatt hour (TWh) in 2016 and to over 36 percent or 218 TWh in 2017.

The provisions on offshore wind turbines were transferred from the EEG to the Offshore Wind Energy Act (Gesetz zur Entwicklung und Förderung der Windenergie auf See), which entered into force on 1 January 2017 and was designed in such a way as to facilitate planning and steering. A competition-based auctioning system was introduced for this area, too.

Overall, consumer electricity prices remained largely stable compared with previous years, despite the continued expansion of renewable energy.

As mentioned above, the new system of competition-based auctioning that was introduced with the 2017 Renewable Energy Sources Act served to ensure a continued cost-effective expansion of renewable energy and was also intended to ensure that the specified development corridor for renewable energy would be adhered to. Special arrangements for citizens' energy companies in the field of onshore wind energy aimed at safeguarding stakeholder diversity. In the three auction rounds for onshore wind power in 2017, the vast

majority of bids that were awarded funding came from citizens' energy companies that had been granted more flexible conditions, with the result that the majority of projects that won the bid do not have a license under the Federal Immission Control Act. The coalition agreement added the provision that in future only those projects in possession of such a license will be allowed to take part in the auctions. This will have to be taken into account in any arrangements made to safeguard diversity of stakeholders.

In the case of solar systems with a capacity above 750 Kilowatt (kw), the average award value weighted by quantity has steadily decreased over the course of the auction rounds. In the auction in December 2016, this was 6.9 euro cents per Kilowatt hour (kWh), in February it was 6.58 euro cents/kWh, and in the June round it was 5.66 euro cents/kWh. In the last round of auctioning in October 2017, the award value weighted by quantity fell to 4.91 euro cents/kWh. The Bundesnetzagentur's (Federal Network Agency) auction for photovoltaics in June and October 2017 was open to bids on arable land and grassland in disadvantaged areas of two Länder, which then exercised a new option provided for in the 2017 Renewable Energy Sources Act. Using this option, Länder can adopt ordinances allowing for ground-mounted photovoltaic systems to be set up on farmland and grassland in disadvantaged areas in line with the European definition of less-favoured areas (Directive 86/465/EEC). Over half the successful bids were for installations on land of this kind. The BMU is reviewing this development in the context of nature conservation monitoring.

In the **onshore wind** category, the average bid value in the first round in May 2017 was 5.71 euro cents/kWh; in the third and last round in November 2017, it was 3.82 euro cents/kWh. This sharp drop in costs is due to the special situation of the citizens' energy companies and does not reflect the competitive situation of non-privileged wind turbines. This was reaffirmed by the outcome of the auction of 1 February 2018, in which only projects with a license under the Federal Immission Control Act were eligible to participate. Here the average bid value was 4.73 euro cents/kWh.

In the case of **offshore wind**, the lowest bid value in the April 2017 auction was zero (0.0 euro cents/kWh); the highest bid to have been awarded funding was 6.00 euro cents/kWh. Potential for cost reduction is clearly evident here, although it remains to be seen whether

these low award values are repeated in the next auction in April 2018. It should be noted that, in line with the specifications of the Offshore Wind Energy Act, at the next auction will cover awards for at least 500 Megawatt (MW) in the Baltic.

The Offshore Wind Energy Act interlinks site development, spatial planning, approval, funding and grid connection for offshore wind turbines. In a transition model, auctions on 1 April 2017 and 1 April 2018 will invite bids from specific areas that have reached an advanced stage of development before, starting in 2018, preliminary investigations of sites will be carried out according to a site development plan, which will also steer the expansion of offshore windfarms.

The determination of funding volumes by means of auctions also applies to all biomass plants between

150 kW and 20 megawatts that have taken up operation from 1 January 2017. Existing biomass plants may participate in the auction irrespective of the installed capacity in order to receive follow-up funding. Funding is available for the use of biomass as defined in the Biomass Ordinance (Biomasseverordnung); this does not include waste wood, for example. Approximately 122 MW were auctioned in the first round starting on 1 September 2017. With a bid volume of roughly 41 MW, this round of bidding was clearly undersubscribed. Of the 24 eligible bids, four were for new installations and 20 for existing ones. The average bid value (weighted by quantity) was 14.30 euro cents/kWh. The next call date is 1 September 2018.

Background papers on all auctions with the results are publicised on the website of the Bundesnetzagentur.

Below is an overview of the dates and volumes for auctioning in 2017:

1 February 2017	Solar installations: 200 MW
1 April 2017	Offshore wind energy installations: 1,550 MW
1 May 2017	Onshore wind energy installations: 800 MW
1 June 2017	Solar installations: 200 MW
1 August 2017	Onshore wind energy installations: 1,000 MW
1 September 2017	Biomass installations: 150 MW (minus the capacity installed the previous year pursuant to Section 28 (3a) Renewable Energy Sources Act).
1 October 2017	Solar installations: 200 MW
1 November 2017	Onshore wind energy installations: 1,000 MW

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Foreseeable trend corresponds to the projection without the Climate Action Programme
Contribution according to the latest estimate of experts	

The 2017 Renewable Energy Sources Act implemented the European Commission state aid provisions for the auctions' form:

In a pilot phase of three years (2018 – 2020), auctions will cover both onshore wind energy installations and solar installations in joint procedures. One of the aims here is use for a distribution system component to facilitate local steering of the expansion. The auction

volume is limited to 400 MW of the annual auction quantity. Subsequently, an evaluation will be carried out to determine whether this joint auctioning will be continued beyond 2020. From 1 April 2018, the Bundesnetzagentur will carry out joint auctioning to determine the level of financial support for solar installations and onshore wind energy installations, in addition to technology-specific auctions.

In order to strengthen European integration of the energy transition, the 2017 Renewable Energy Sources Act provides for 5 percent of the capacity to be installed each year to be open to participants from other member states. In summer 2017, the ordinance on opening up auctioning procedures, which previously applied to PV installations only, was revised to include transboundary auctioning for onshore wind energy installations.

The coalition agreement includes a decision to continue the determined, efficient, grid-synchronised and increasingly market-oriented expansion of renewable energy, which is crucial for a successful energy transition and for climate policy. Under these conditions, every effort will be made to achieve a 65 percent share for renewables by 2030; the necessary adjustments will be made. The expansion of renewable energy must be stepped up considerably if the additional electricity needed to achieve the climate targets in the transport sector, in buildings and in industry are to be met. The challenge is to better synchronise renewable energy and grid capacities.

For that reason, the coalition agreement also announced an ambitious action plan to optimise existing grids and accelerate the expansion of the power grids. Special auctions for wind and solar power are also designed to contribute to achieving the 2020 climate target.

5.4.2 Other measures, especially in the electricity sector

In addition to emissions trading and the expansion of renewable energy, further measures in the electricity sector aim to cut greenhouse gas emissions by a further 22 million tonnes of CO₂ equivalent by 2020.

To this end, the German Government launched a package of measures on 1 July 2015 for the generation sector (security standby, combined heat and power) along with other energy efficiency measures above and beyond those set out in the National Action Plan on Energy Efficiency (buildings, industry, municipalities, rail transport).

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	22.0
Contribution according to the latest estimate of experts Including CHP contribution (see Section 5.4.3)	16.4 to 18.4

5.4.2.1 Security standby

With an additional cut in emissions of 22 million tonnes of CO₂ equivalent, other measures, especially in the electricity sector, put in place in line with the National Action Plan on Energy Efficiency, are set to make the second largest contribution to achieving the 2020 targets. On 1 July 2015, the governing coalition published a paper outlining the key parameters for successful implementation of Germany's energy transition with corresponding proposals for a package of measures.

Security standby accounts for over 50 percent of the mitigation effect achieved by this package of measures.

Lignite-fired power plants with an electrical capacity of 2.7 gigawatts will be gradually and provisionally shut down and will be on standby for four years. During this period, they will be the option of last resort to guarantee the power supply. They will then be permanently decommissioned. The operators will receive compensation.

This arrangement is part of the Electricity Market Act (see Section 13g of the Electricity Market Act/Strommarktgesetz), which was adopted by the Bundestag on 24 June 2016. Security standby applies to the following power-generation plants, which account for 13 percent of Germany's total lignite-fired power plant capacity.

Table 5: Overview of the lignite-fired power plants being put on standby under Article 13g of the Electricity Market Act

Deadline:	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 the review, that must also be carried out by 30 June 2018 pursuant to Section 13g of the Electricity Market Act, indicates that this measure alone does not achieve the desired emissions reduction of 12.5 million tonnes of CO₂ equivalent, power plant operators will be obligated to make additional cuts totalling up to 1.5 million tonnes of CO₂ equivalent per year, starting in 2019.

These plans were notified to the European Commission, who found that they were in line with EU state

aid rules and issued a decision to this effect on 24 May 2016. The first power plant (Buschhaus, operated by Mibra) was put on standby on 1 October 2016 and temporarily mothballed; Blocks P and Q at the Frimmersdorf power plant followed in October 2017.

Section 5.4.3 has more details on other measures in the generation sector, including additional support for combined heat and power generation plants.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Planned contribution envisaged under the Electricity Market Act	12.5
Contribution according to the latest estimate of experts (This figure is based on assumptions concerning trends in electricity demand, the amount of electricity from CHP plants and the number of coal-fired power plants in operation.)	Up to 12.5

5.4.2.2 Energy efficiency in buildings

Another component of the governing coalition's decision of 1 July 2015 to cut emissions by a further 22 million tonnes of CO₂ equivalent focuses on additional energy efficiency measures in buildings. It does therefore belong in this sector but goes beyond the efficiency measures for the buildings sector described in Section 5.6.2.

A heating optimisation programme supporting high-efficiency pumps and hydraulic balancing was launched in August 2016. It aims to promote the replacement of up to 2 million inefficient pumps in buildings by 2020. Furthermore, up to 200,000 heating

systems are being optimised through hydraulic balancing and other low-investment measures (for example replacement of thermostatic valves). A combination of pump replacement and heating optimisation is possible. Current plans connected with these measures envisage cutting about 1.8 million tonnes of CO₂ equivalent by 2020. A reduction of another 0.7 million tonnes of CO₂ equivalent from the quota originally planned for the buildings sector is to be achieved through measures in industry (see Section 5.4.2.5).

By the end of 2017, about 110,000 heating and hot water circulation pumps and about 55,000 hydraulic balance systems had been funded under the heating

optimisation programme. The number of applications for funding was lower than expected.

The programme is part of the energy efficiency campaign launched by the Federal Ministry of Economic Affairs and Energy.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the coalition Government's decision of 1 July 2015	1.8
Contribution according to the latest estimate of experts	0.20 to 0.92

5.4.2.3 Energy efficiency in municipalities

Promotion of energy efficiency and climate action in municipalities is an additional component of a package agreed on 1 July 2015 and published in a paper outlining the key parameters for successful implementation of Germany's energy transition. It aims to cut emissions by a further one million tonnes of CO₂ equivalent. The aim is to provide targeted Government funding to create incentives to harness the potential for increasing energy efficiency and reducing greenhouse gas emissions.

The first seven projects (2016 selection) were approved on 1 April 2017 as part of a call for applications for funding for municipal model investment projects in the field of climate action; approval for 23 of the 29 selected projects has just been granted. Another 20 projects were selected in a second round (at a meeting in June 2017) and invited to apply for funding.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the coalition Government's decision of 1 July 2015	1.0
Contribution according to the latest estimate of experts (Quantification depends on how the approved projects take more precise shape; this is therefore a conservative estimate.)	0.19 to 0.34

5.4.2.4 Energy efficiency in rail transport

With an additional cut in emissions of 22 million tonnes of CO₂ equivalent, other measures put in place in line with the National Action Plan on Energy Efficiency – especially in the electricity sector – are set to make the second largest contribution to achieving the 2020 targets. On 1 July 2015, the governing coalition published a paper outlining the key parameters for successful implementation of Germany's energy transition with corresponding proposals for a package of

measures. The proposed measure to increase the energy efficiency of the German railways aims to cut emissions by a further one million tonnes of CO₂ equivalent.

Since the interministerial consultation on the funding guideline on the energy efficiency of electric rail transport has been delayed, the guideline is now expected to enter into force in the first half of 2018 with the first applications expected in 2019.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the coalition Government's decision of 1 July 2015	1.0
Contribution according to the latest estimate of experts (Since no applications for funding have been received, the estimate is fraught with a high degree of uncertainty. This is therefore a conservative estimate.)	0,05 bis 0,08

5.4.2.5 Funding programme for high-efficiency cross-cutting technologies in industry

The funding programme for high-efficiency cross-cutting technologies came into force in an amended form in May 2016. A total of 4,387 applications for funding were received in 2017 and 27 million euros of funding were approved. Many companies are familiar with the programme since it has been running for many years. Trade and industry associations also actively support

it in their external communications. This programme aims to contribute 0.9 million tonnes of CO₂ equivalent per year, starting in 2020.

To implement this package of measures, a programme to minimise and use waste heat entered into force in May 2016 as part of the waste heat campaign. Further information can be found in Section 5.5.1.4.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the coalition Government's decision of 1 July 2015	Not established
Not established	0.5

5.4.3 Combined heat and power generation

Co-generating electricity and heat in highly efficient and low-emission combined heat and power plants (CHP), which are flexible enough to respond to market signals, is an important element of a future-oriented energy supply that is designed to use fuel efficiently and therefore be climate-friendly. The German Government's stated aim is therefore to create the enabling environment needed to promote a high proportion of CHP in the energy mix. Not least as a result of the systematic development of the Combined Heat and Power Act (Kraft-Wärme-Kopplungsgesetz), the amount of co-generated electricity has risen in recent years, reaching and indeed surpassing the 2020 target four years ahead of schedule. There is a high likelihood that the 2025 target will also be met. The aim to expand CHP has therefore been successfully achieved. However, changes in the electricity and heat markets mean that the legal framework has to be constantly adapted in order to guarantee CHP contributes to cutting CO₂ and ensuring energy efficiency in the future and meeting the climate targets set for 2020. CHP now needs to be

developed in a way that makes it an even lower carbon option and more flexible, thus guaranteeing it a future in the energy transition.

The Act Amending the Combined Heat and Power Act (Änderungsgesetz zum Kraft-Wärme-Kopplungsgesetz) entered into force on 1 January 2017. Among other things, it includes the possibility of introducing tendering processes for medium-sized CHP plants and for innovative CHP systems. Innovative CHP systems consist of a highly flexible CHP plant, installations to generate heat from renewable energy and an electrical heat generator. These innovative CHP systems respond flexibly in two senses: both in terms of heat generation from renewable energy and to electricity market price signals. In this way, they support the decarbonisation of heat systems and the flexibility of the supply and demand side in the electricity market. The CHP auction ordinance (KWK Ausschreibungsverordnung) came into force in 2017. The first auctioning process for CHP plants was carried out in December 2017. Bids for around 81 MW were awarded and the average bid price was roughly four euro cents/kWh. The first auction for innovative CHP systems will follow in June 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme 2020	Not quantifiable
Contribution envisaged under the coalition Government's decision of 1 July 2015 (see Section 5.4.2)	4.0
Contribution according to the latest estimate of experts	3 to 4

5.4.4 LED lead market initiative

Light-emitting diodes (LED) are a cost-effective and energy-efficient type of lighting. Use of LEDs has continued to become more widespread in recent years, not least because their price has fallen constantly. Private households in particular are increasingly opting for this form of lighting.

However, in the public sector, a lack of information in many local authorities means that the savings potential of LEDs remains unused, both in exterior and interior lighting. BMU launched the LED lead market initiative to remove these non-financial obstacles.

Workshops on specific topics were held, the outcomes of which are fed into further work. A scientific conference on LEDs as an example of the role of innovation in climate action was also held on 16 February 2017. Over 130 specialists from the fields of policy-making, industry and local authorities discussed questions concerning the future of LEDs. The project's findings are continuously fed into the National Climate Initiative.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution under to the Climate Action Programme as at December 2014	0.01
Contribution according to the latest estimate of experts	0.01

5.5 National Action Plan on Energy Efficiency

Increasing efficiency, in other words cutting the amount of final energy used and therefore ultimately reducing the amount of primary energy used, makes a key contribution to reducing greenhouse gas emissions. In addition to the energy efficiency measures already mentioned in Section 5.4.2 as "Other measures", especially in the electricity sector, the measures adopted under the National Action Plan on Energy Efficiency (NAPE) with a reduction target of 25 to 30 million tonnes of CO₂ equivalent by 2020 make the greatest contribution to achieving the climate targets set by the Climate Action Programme. Whereas the effects of NAPE on lowering energy consumption are the subject of a separate monitoring process, the

Climate Action Report concentrates on the extent to which individual measures under NAPE reduce greenhouse gas emissions. This is not a substitute for a detailed ex-post evaluation of the individual measures.

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 the buildings sector (see Section 5.6.2)

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 including additional immediate actions, measures from October 2012 onwards and an estimated figure for the effects of more extensive work processes	25 to 30
Contribution according to the latest estimate of experts	19 to 26

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

5.5.1.1 Introducing a competitive tendering system for energy efficiency

Two rounds of tendering are held each year during the pilot phase (2016 to the end of 2018). The second round was concluded at the end of January 2017, the third at the end of May of the same year. The experience of the first two rounds indicates that the competitive tendering model for energy efficiency measures basically works. The funding applications received cover a broad technological spectrum from a wide range of industries and sectors and vary in terms of cost/benefit, with bids ranging from 4 to 35 euro cents/MWh of funding. However, the level of state aid was across the board close to the 30 percent ceiling stipulated under the General Block Exemption Regulation.

The number of applications received in the first three rounds is still low. Based on feedback from the working group on competitive tenders, the main reasons for this are the newness of the funding procedure, the relatively high specifications combined with only moderate levels of funding, and the fact that companies do not yet have widespread knowledge of the programme.

Since the third round, there have been positive developments in terms of awareness of the programme and interest among relevant stakeholders. This was largely the result of the executing agency stepping up public relations work, directly targeting sectors and multipliers, and improving its advisory services.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	1.5 to 3.1
Contribution according to the latest estimate of experts	0.09

5.5.1.2 Contracting funding – default guarantees by guarantor banks for contracting finance/funding programme for energy conservation contracting

As a result of the National Action Plan on Energy Efficiency (NAPE), the Länder-owned guarantor banks have been financing energy conservation contracting projects with a guarantee of up to two million euros. The increase was recorded in addenda to the counter-guarantees made by the Federation to the individual Länder-owned guarantor banks. The counter-guarantee had a limited term until the end of 2017.

The offer of a higher guarantee limit has been taken up only once since the beginning of 2016. Initial enquiries about contracting projects are concerned with volumes that can be covered by the usual maximum amount of 1.25 million euros. In particular, there was no uptake for the more extensive and long-term projects by small trades businesses, which had been hoped for. That is no doubt due to the fact that these businesses are not short of work at present. The Federation, in conjunction with the Länder-owned guarantor banks, continued to support contracting projects until the end of 2017. The higher upper limit for guarantees was not extended into the new counter-guarantee period (from 2018 onwards).

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under NAPE as at December 2014	0.3 to 0.5
Contribution according to the latest estimate of experts	Cannot currently be estimated

5.5.1.3 Developing KfW's energy efficiency programmes

The Kreditanstalt für Wiederaufbau's (KfW) energy efficiency programmes award low-interest loans as an incentive to invest in making production facilities and processes more energy efficient.

Since the programme has been revised and improved funding conditions took effect back in July 2015, the amount of funding is now based on the level of energy savings achieved (entry and premium standard). The

latest guidance notes on this funding guideline are published on the KfW website. Over 1.19 million euros were awarded to 268 applications in 2015; 466 applications were granted in 2016, with funding exceeding 2.03 million euros.

For information on funding for energy-efficient refurbishment and energy-efficient construction of new commercial buildings, please refer to the further development of the CO₂ building refurbishment programme (see Section 5.6.2.3).

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under NAPE as at December 2014	2.0
Contribution according to the latest estimate of experts	4.8 to 7.3

5.5.1.4 Campaign to use waste heat

About two thirds of the energy used in industry is for process heat, which in turn produces a significant amount of waste heat. The considerable and often cost-effective potential for making savings by preventing or using waste heat is roughly 125 TWh and should be exploited more systematically. To this end, the Federal Ministry of Economic Affairs and Technology implemented the decisions of the coalition committee of 1 July 2015 and established the campaign to use waste heat. At the heart of this campaign is a programme to minimise and use waste heat in commercial enterprises, which was launched in May 2016. The goal is to save an additional one million tonnes of CO₂ equivalent per year up to 2020.

The programme is now widely known. Feedback from business also testifies to the programme being easy to understand and user-friendly. The current evaluation assumes that the programme's goals (especially regarding CO₂ equivalent savings) will be reached.

KfW had approved total of 217 projects by the end of 2017. This attracted about 250 million euros in investment, producing CO₂ savings of 160,000 tonnes.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts (Savings achieved under the industry package of 1 July 2015 are not included; see section 5.4.2.5)	1.0

5.5.1.5 Pilot programme for energy-savings meters

The Federal Office for Economic Affairs and Export Control (Bundesamt für Wirtschaft und Ausfuhrkontrolle – BAFA) received 14 project applications between the start of the project at the end of May 2016 and January 2017. Three applications with a volume of 2.2 million euros have been granted so far; the remaining applications are currently being considered. Activities in 2016 focused on creating the conditions needed for BAFA, the grant approval agency, to run the scheme. Furthermore, events were organised in conjunction with business associations to provide information about the programme to interested companies and to guarantee the high quality of the digital metering systems from the beginning by presenting examples of best practice, for instance.

The funding volume was increased from 30 to 55 million euros at the beginning of 2017 due to the high demand. This made it possible to secure the budget funds needed to deal with the unexpectedly high number of applications and prevent a moratorium on approvals in the second half of 2017.

The pilot programme is being evaluated concurrently to understand its effects. To date, most applicants aim to achieve energy consumption savings for their end customers of between 10 and 30 percent but in individual cases of between 70 and 80 percent. Most of the applications received so far target electricity and gas consumption savings. The readings taken at end consumers' meters will be decisive in assessing the actual savings. They are likely to be available from 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts	0.21

5.5.1.6 Improving the conditions for energy services

Energy services offer numerous opportunities for promoting investment in energy efficiency and energy-saving technologies. Although these technologies are often financially worthwhile within a reasonable period of time, there are clearly still barriers to investment. With its National Action Plan on Energy Efficiency (NAPE), the German Government set itself the goal of eliminating these barriers.

The idea here is to work with the stakeholders concerned with a view to improving the conditions needed for the energy services to be effective.

As provided for under NAPE, the dialogue on performance contracting between the Federation and the

Länder has been strengthened so that the parties can learn from each other and work together to develop suggestions for improvement. The most important areas where action is needed were identified during previous events and possible solutions developed. In 2017, work concentrated mainly on issues that had emerged during various dialogue events and meetings during the 2016 project year. The focus was on acting on the insights gained at the events and meetings in 2016 in order to establish competence centres in the Länder. A number of Länder have already expressed interest in setting up competence centres in designated pilot regions with the support of the German Energy Agency (dena). Two workshops on model contracts and approval practice of local authorities are also being run.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.1.7 New financing concepts

The working group on innovative financing instruments, which is part of the energy efficiency platform at the Federal Ministry for Economic Affairs and Energy, continued its work in 2017. It focused on looking at approaches to reducing the transaction costs of investments in energy efficiency. Two key approaches identified were standardisation of due diligence procedures in external financing for efficiency projects and bundling individual projects into larger portfolios. This resulted in the ACE project (energy efficiency asset class), which is funded through a grant from the

Federal Ministry for Economic Affairs and Energy. The project aims to develop possible ways of making energy efficiency measures more attractive for external financiers (banks, energy service providers, institutional investors). In addition to standardising due diligence procedures and bundling projects, it will also make recommendations for the Federation's funding programmes. It has a term of 18 months (September 2017 to February 2019). The working group also drafted recommendations on facilitating off-balance-sheet financing for efficiency investments.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.1.8 Strengthening research to improve energy efficiency

The German Government funds research into new technologies in the field of energy efficiency – especially in buildings and neighbourhoods, industry and the trade, commerce and services sector – under its Sixth Energy Research Programme. The Federal Ministry for Economic Affairs and Energy continued to expand energy research networks with a view to increasing transparency and networking. As at October 2017, the seven energy research networks established comprised approximately 2,800 registered members. The

networks provide valuable input on relevant research topics from the point of view of science and research, and provide a platform to network actors in the fields of research, business and policymaking. In addition to enhancing participation and transparency, the research networks are also intended to improve and accelerate the transfer of findings to practitioners in the energy industry. Furthermore, the research networks also presented expert recommendations at a meeting of the energy transition's research and innovation platform on 28 November 2017 within the consultation process on the Seventh Energy Research Programme.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.1.9 Reviewing the efficiency requirement of the Federal Immission Control Act, including with regard to optimising its enforcement

It is the duty of the responsible Government agency to verify compliance with the requirement that operators of installations subject to licensing use energy sparingly and efficiently as stipulated in Section 5 (1) (4) of the Federal Immission Control Act (Bundes-Immissionsschutzgesetz).

The complexity of the installations and technical differences in their structure mean that it is not always easy for the responsible agency to evaluate the licensing application. Furthermore, the requirements based on current standards are not sufficiently detailed. More extensive work on legal and technical aspects is needed to further operationalise Article 5 (1) (4) of the Act.

A research project aims to flesh out operators' energy-efficiency obligations under this legislation, outline them in more precise legal terms and also clarify the

legal framework within which the requirements can be made more specific.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.1.10 Continuing the programme to promote energy-efficient and climate-friendly production processes

The funding guideline for energy-efficient production was extended from 13 December 2013 to 31 December 2017. After that, a reorientation of the programme content is planned within the framework of the funding strategy that starts in 2018.

The programme is being continuously evaluated. The first overall evaluation was carried out for the period between 2013 and 2016. It indicates that 2.01 Petajoule (PJ) of primary energy and 180,000 tonnes of CO₂ had been saved as a result of just under 60 funded

projects. The evaluation testifies to a high degree of success in meeting targets, particularly with regard to the level of innovation of the funded projects and the efficiency of the funding. The programme's special feature of funding complex measures that are not targeted at any specific technology and the fact that it now enjoys a high degree of acceptance by industry has resulted in an increase in the quality and quantity of applications currently being received. The businesses receiving funding are delivering an average saving of 226 kilogram of CO₂ per year per 100 euros in additional investment, as compared to the funding requirement of 100 kilogram of CO₂ per year.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Not shown separately
Contribution according to the latest estimate of experts	0.85

5.5.1.11 An energy efficiency act

The German Government has announced that, in the interest of effective implementation of the National Action Plan on Energy Efficiency (NAPE), it will review the option of drawing up an energy efficiency act. In particular, it will look at the extent to which an energy efficiency act could serve to consolidate

existing legislation and implement the intended objectives, including evaluation. The subject of the expert report comprises options for setting targets, a general energy efficiency review and the possibility of removing barriers in energy law. The study will run until the end of 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.2 Individual responsibility for increasing energy efficiency

5.5.2.1 Energy Efficiency Networks Initiative

By the end of 2016, 102 energy efficiency networks had been set up within this initiative. Whereas 29 new networks were established in 2015, the initiative gathered pace in 2016 with 73 new networks being set up. This was probably due to the fact that in the first year many stakeholders had to focus on laying the groundwork, such as endeavours to provide industry-specific information.

Monitoring is carried out annually to record the effects of the initiative. Its aim is to record measures that were implemented as a result of the networks and map the total effects of the initiative in quantitative terms. This

will be done for the first time in the third quarter of 2017.

The networks have to set their targets at the latest a year after they were established. The initiative's head office was therefore able to analyse 38 network targets on the basis of absolute values for savings and use them to make initial statements about the effects in 2015/2016. The networks' average target for primary energy savings was found to be 40 Gigawatt hour (GWh). For 100 networks this would produce primary energy savings of 15 PJ up to 2020. The analysis showed that the savings of 75 PJ up to 2020 forecast by the German Government is achievable, provided 500 energy efficiency networks all set themselves targets that are comparable with those of these 38 networks and put appropriate measures in place to meet them.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	5.0
Contribution according to the latest estimate of experts (Since small businesses are also eligible to participate, the savings per company could be lower than the estimate of December 2014.)	1.70 to 2.86

5.5.2.2 Advice on local energy efficiency networks

The German Government's aim in supporting this programme is to establish local energy-efficiency networks and thus establish a targeted exchange of experience in the field of energy and resource efficiency among municipal decision-makers. The funding programme itself aims to support and monitor the establishment and operation of the networks.

The Federal Environment Ministry (BMU) and the Federal Ministry for Economic Affairs and Energy (BMWi) agreed that the former would take over funding in the following areas from the latter's funding guideline on energy advice and energy efficiency networks for municipalities and non-profit organisations of 16 December 2015:

- Energy efficiency networks in municipalities (module 1 of the funding guideline mentioned above), and
- Energy analyses for public wastewater treatment plants (module 3 of the funding guideline mentioned above).

With its funding guideline for local authority networks, the BMU is continuing the BMWi's above-mentioned measures from the National Action Plan for Energy Efficiency but adding the topic of resource efficiency.

This measure has been merged with the measure on energy advice for municipalities. Its reduction contribution is recorded there.

5.5.2.3 EU energy labelling and ecodesign

At EU level, improving the energy efficiency of products and thus their contribution to saving CO₂ is regulated by energy consumption labelling and ecodesign (the Energy Labelling Regulation and the Ecodesign Directive).

The aim of the framework regulation on energy labelling, which was amended in 2017, is to reassess the energy efficiency classes – especially for the product groups in which the best efficiency classes are already occupied – and rescale them. The amended framework regulation entered into force on 1 August 2017. It specifies different time frames within which the individual pieces of delegated legislation for the product

groups must be adapted to the new label. As a result, the Commission is obliged to revise the delegated label regulations for five product groups by November 2018 (household washing machines, dishwashers, refrigerating appliances, televisions and lighting). The requirements will then enter into force 12 months later. Most of the other product groups will then follow by 2023.

The revision of ecodesign regulations for energy-related products also gathered pace in 2017, partly due to the European Commission's 2016 – 2019 work programme. It is expected that revised ecodesign requirements will be adopted in autumn 2018 for at least the five product groups in parallel to energy consumption labelling.

When considering the estimated reduction effect, it is important to note that the reduction contribution envisaged under NAPE applied to EU energy labelling and ecodesign and the national top-runner initiative jointly. The estimated figure was 5.1 million tonnes of CO₂ equivalent in 2020. The updated estimate for both measures is given in section 5.5.2.4.

5.5.2.4 National top-runner initiative

According to the German Government's decision on NAPE, the national top-runner initiative (NTRI) is meant to be developed as an energy efficiency tool, providing information, promoting dialogue and injecting new ideas.

The aim is to drive forward the penetration of the market with high-quality goods and services along the entire value chain and thus reduce energy consumption.

The NTRI is currently being implemented. The conceptual measures have been completed. Consumer information campaigns for six product groups are

planned, along with various activities with retailers and manufacturers. Action has been taken in response to most of the pointers that emerged from the concurrent evaluation.

The Federal Ministry of Economic Affairs and Energy has a project to support market surveillance with product tests. Roughly a year into the project, about 50 percent of the ring tests and ten percent of the individual tests planned for the entire term had been conducted. So far, there has been participation in individual standardisation bodies and an active exchange of measured results with the market surveillance authorities of the Länder. National and European market surveillance bodies are also informed of the project's results at regular intervals.

To date, indications of shortcomings in the declaration of the energy efficiency of individual products have been identified. Energy savings can be deduced indirectly from the future correction of the declarations. A longer-term effect is expected from improvements to the conditions for market surveillance resulting from the establishment of more efficient test methods. This would decrease the incentive for manufacturers to make false declarations about their products since the risk of detection would rise.

When considering the estimated reduction effect in the table below, it is important to note that the reduction contribution envisaged under NAPE applied to EU energy labelling and ecodesign and the national top-runner initiative jointly. The estimated figure was 5.1 million tonnes of CO₂ equivalent. The lower greenhouse gas reduction mainly results from the latest figures evaluating the NTRI.

The work to strengthen market surveillance is a separate measure under the energy efficiency fund, and its effect has not been included here.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under 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 the latest estimate of experts	2.5 to 3.0

5.5.2.5 Mandatory energy audits for enterprises that are not SMEs (Small and medium-sized enterprises) (implementation of Article 8 of the Energy Efficiency Directive)

Large companies often have a high energy demand. This, in combination with the availability of in-house capacities, means that they can leverage considerable potential for efficiency and consequently greenhouse gas reduction.

As a result of the amendment to the Energy Services Act (Energiedienstleistungsgesetz / EDL-G), these companies are obliged to carry out their first energy audit by 5 December 2015 or alternatively to introduce a certified environmental or energy management system. The Federal Office for Economic Affairs and Export Control (BAFA) carries out random checks at regular intervals on about 500 companies a year to monitor compliance with their obligations.

The Federal Ministry for Economic Affairs and Energy and BAFA have commissioned an evaluation of the first energy audit commitment period, the final results of which are expected shortly.

The preliminary results indicate that, of a total of 900 companies surveyed, 462 decided in favour of an energy audit and 403 opted for an energy management system. It was mainly energy-intensive companies that decided to put an energy management system in place, whereas businesses in the services sector carried out an energy audit. The primary energy savings achieved per year starting in 2016 was 4.12 PJ, the final energy savings were 3.02 PJ per year and the CO₂ reduction totalled approximately 264,110 tonnes per year. It is not yet possible to quantify the longer-term effect of mandatory audits since the legislation has not been in force very long.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	3.4
Contribution according to the latest estimate of experts	1.3 to 2.4

5.5.2.6 Taking forward the SME Initiative for Energy Reforms and Climate Change Mitigation

The SME initiative is a collaborative project involving the Federal Ministry for Economic Affairs and Energy (BMWi), the Federal Ministry for the Environment, Nature Conservation, and Nuclear Safety (BMU), the Association of German Chambers of Commerce and Industry (DIHK) and the German Confederation of Skilled Crafts (ZdH). The first funding period ended on 31 December 2015. The second phase began on 1 January

2016, thus connecting seamlessly to the predecessor project. Seven environment centres in the skilled crafts sector, which oversee regional development workshops in their districts, were involved. Nationwide contacts to around 10,000 businesses were set up to raise awareness for energy efficiency, and 375 companies were visited directly.

Over 1,000 trainees from more than 300 companies gained qualifications as energy scouts during the first phase of the project.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts	0.08 to 0.1

5.5.2.7 Taking forward the programme to provide energy advice to SMEs

The programme to provide energy advice to SMEs was adapted to existing EU requirements with effect from 1 January 2015, and funding levels were increased. Since 1 January 2016, the requirements on the qualifications of energy consultants have become more stringent. The quality has continuously risen as a result of two factors: technical checks by the Federal Office for Economic Affairs and Export Control (BAFA) and the opportunity to improve the advisory reports by the energy consultants.

In 2017, the eligibility criteria for energy consultants were extended to include qualified professionals from all industries, including craftspeople and specialised plant and process engineering consultants who were thus allowed to provide energy advice to SMEs. Consumers and SMEs alike will benefit from this larger pool of qualified consultants. The advice will have to maintain the same level of objectivity and high quality.

BAFA received around 5,100 applications for funding in 2016 and 2017.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts	2.6 to 4.4

5.5.2.8 National efficiency label for old heating systems

Since 1 January 2016, energy efficiency advisors and other actors have been able to issue an efficiency label on a voluntary basis. District heating inspectors have been obliged to attach the label to the old heating system after completing their inspection since 1 January 2017. Thus, implementation of the measure is going to plan.

In 2016, agents authorised to issue labels accessed a total of 1,183 basic packages and 928 large packages of labels. Precise details of the number of labels that were attached to boilers during this period are not currently available but they are part of the concurrent evaluation and monitoring of the measure. It is assumed that approximately ten percent of the efficiency class C and D labels dispatched in 2016 were attached to old heating systems. That amounts to approximately 13,400 labels.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	0.7
Contribution according to the latest estimate of experts	1.06

5.5.2.9 Energy efficiency in the wastewater treatment sector

Studies have shown that significant efficiency potential could be harnessed in the wastewater treatment sector, which means there is also potential for cutting greenhouse gas emissions. This has prompted the German Government to fund energy checks and analyses in municipal facilities. The aim is also to review whether checks of this kind should be made mandatory for municipal wastewater treatment facilities in future.

The measure focuses first of all on funding energy checks and analyses and in three years' time will introduce them as a mandatory requirement.

The Federal Environment Ministry (BMU) and the Federal Ministry for Economic Affairs and Energy (BMWi) agreed that the former would take over funding in the following areas from the latter's funding guideline on energy advice and energy efficiency networks for

municipalities and non-profit organisations of 16 December 2015:

- Energy efficiency networks in municipalities (module 1 of the funding guideline mentioned above) and
- Energy analyses for public wastewater treatment plants (module 3 of the funding guideline mentioned above).

With its funding guideline for municipal networks, the BMU is continuing BMWi's above-mentioned measures from the National Action Plan for Energy Efficiency but adding the topic of resource efficiency.

An estimate of the reduction contribution is made in the measure on energy advice for local authorities described under 5.6.2.5.

5.5.2.10 Advice: consolidation and quality assurance

As numerous measures under the National Action Plan on Energy Efficiency (NAPE) and the Climate Action Programme clearly demonstrate, the German Government directly provides significant funds for investments to implement energy efficiency and mitigation measures.

However, exploiting this indisputable and diverse efficiency potential depends not only on a wide range of information that has also been improved as a result of the Climate Action Programme and NAPE but also on a reliable and high-calibre advisory service (see section 5.6.2.1) both in advance of and during implementation of efficiency and mitigation measures. In order to emphasise this and at the same time improve the effectiveness of the measures, the German Government set itself the goal of reviewing existing advisory services to determine whether they are easily comprehensible and effective and fulfil potentially necessary additional requirements and, wherever possible, to consolidate them. To that end, the following Government advisory services

- Energy advice for residential buildings (on-site advice, individual refurbishment roadmap)
- Energy advice for small and medium-sized enterprises, and

- Energy advice for non-residential buildings belonging to municipalities and non-profit organisations

were further developed, tailored to their specific target groups and better coordinated. Special attention will continue to be paid to the quality of the advice.

Consumer advice centres will also continue to provide energy advice. In order to tailor independent energy advice and checks more closely to the private consumers who are their target group, a project being conducted with the Federation of German Consumer Organisations (vzbv) and the consumer organisations at Länder level has part-financed regional managers since summer 2016. Work is being done in conjunction with municipalities, energy agencies and other organisations to bring the advisory services closer to the consumer and thus make them more widely known.

The idea is to illustrate the benefits of energy-efficient refurbishment to end users (private consumers, municipalities, non-profit organisations and SMEs), identify the need for it, present refurbishment options that make economic sense and encourage uptake of the scheme by providing information about funding instruments. In this way, access to high-quality energy audits is guaranteed for all end consumers as required by the European Energy Efficiency Directive and in compliance with its specifications.

When the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency were adopted, energy efficiency experts (such as advisors and funding specialists) were already registered on a list used in federal funding programmes. The list of approved experts is a way of assuring quality and qualification levels, since the energy advisors are required to show evidence of continuing professional development.

Furthermore, an expert report was commissioned, which is designed to trigger the development of a uniform qualification test for energy advisors that takes existing tests into account. This is an important step towards a uniform nationwide quality benchmark for energy advisory services and towards more transparency for the consumer. On the other hand, it is not possible to make energy advisor a protected job title for reasons connected with heterogeneity of scope, the legalities involved in creating a new official designation for a profession (for which the Länder are responsible) and because of the pressure to liberalise this field at European level.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.2.11 Developing key performance indicators and benchmarks in the commercial sector

The German Government's aim is to use appropriate research projects to drive forward the development and communication of high-quality comparative key performance indicators and recognised standards and benchmarks in the trade, commerce and services sector and industry. To this end, a number of projects are currently being implemented.

An important finding of one of the research projects is that ultimately five energy policy instruments could

be used to ascertain sector-specific energy efficiency benchmarks. However, it also emerged during the project work that the data base that can be ascertained in this way is not sufficient to create informative energy performance indicators. This would require further development of the reporting obligations. However, the findings indicate that this would entail considerable effort for benefits that are not yet clear. For that reason, an alternative to setting up a sector-specific energy efficiency benchmarking system, which would work along the lines of the ENERGY STAR approach developed in the United States, is being considered.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.2.12 Energy efficiency in information and communications technology

The huge progress in information and communications technology (ICT) has, on the one hand, led to a significant increase in available computing power but it has also created considerable efficiency potential (reduction in specific energy consumption). On the other hand, the steady increase in ICT use and the rising number of appliances are resulting in a growing electricity and cooling demand in this field. A study commissioned by the Federal Ministry for Economic Affairs and Energy on the development of ICT-related electricity demand in Germany (2015) forecasts a sharp rise in electricity demand up to 2025, particularly for data centres and telecommunication networks. The German Government believes appropriate measures must be put in place to counteract this trend.

Implementation will take place in several stages. A process of dialogue with relevant stakeholders from science and industry was launched, in order to identify

appropriate measures and instruments to increase the efficiency of data centres. This included carrying out workshops on potential efficiency measures in data centres in June and October 2016.

The Federal Environment Agency will support the Federal Ministry for Economic Affairs and Energy in refining and implementing measures to achieve significant potential for efficiency in data centres.

To this end, the first results of the dialogue process were analysed and a project was outlined that will be commissioned soon and supervised by the Federal Environment Agency.

One of its aims is to develop key performance indicators for electricity consumption and efficiency in data centres and to test them in suitable reference and demonstration projects. The idea is to develop best practices on this basis and acquire insights for the design of further appropriate measures.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts	Cannot yet be estimated

5.5.2.13 Energy advice for agricultural businesses

Knowledge of the opportunities for energy efficiency among interested parties, in other words operators, owners and users of facilities, buildings and services, is crucial to harnessing the potential for energy saving that is actually available. Here again it is extremely important that the knowledge is translated into competent advice and tailored to the specific industry. To drive forward the exploitation of efficiency potential in this sector, the German Government decided to step up energy advice for agriculture and roll out a funding programme for it.

By the end of June 2017, a total of 220 applications to fund advisory services had been received for 2017, with a funding volume of around one million euros.

There is a close connection to the measure described under 5.5.2.14 on energy efficiency in agriculture and horticulture, so that the reduction contributions expected have been quantified in that section.

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

The advisory process usually results in the implementation of energy efficiency measures that are deemed useful. The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) and the Federal Ministry of Food and Agriculture (BMEL) jointly operated a funding programme between 2009 and 2012 with the specific aim of implementing these measures.

Under NAPE, the German Government decided to reinstate the funding programme, initially for 2016 to 2018.

The advisory services provided (see 5.5.2.13) triggered numerous investment measures. By the end of June 2017, a total of 388 applications for investment funding for 2017 had been received with a funding volume of around 14 million euros.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts	0.11

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

An approach that works in terms of neighbourhoods, in other words buildings and properties that are in a spatial relationship with each other, is very important for achieving the climate and energy transition targets. This is true not only of residential neighbourhoods, in which approaches that are not limited to a single building will in future be tested, funded and implemented: a neighbourhood can also comprise a mix of trade, commerce and services, industry and residential buildings or they can be business and industrial parks.

In this context, energy efficiency managers, a job that has not yet been established but which will in future involve identifying potential for energy efficiency both in individual companies and industry-wide, will play an important role, similar to that of climate action or rehabilitation managers in residential neighbourhoods. Their responsibilities will include analysing relevant data in the participating companies, identifying and advising on funding programmes, providing information about possible approaches to efficiency and supporting the implementation of specific measures.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.5.2.16 Sector-specific efficiency campaigns

Many of the climate action and energy efficiency instruments mentioned are not directed at individual sectors or industries. Sector-specific measures, however, can help to harness potential available in a particular area for making energy savings and cutting emissions – not only because they can be geared to the specific technology in question but also because they directly address the relevant stakeholders.

The aim of the German Government's decision to conduct efficiency campaigns, with the backing of the respective industries and their associations, is:

- Providing information,
- Stepping up advice on industry-typical energy efficiency measures,
- Identifying cost drivers,

- Exploring funding possibilities,
- Establishing networks and in this way ultimately
- Stepping up implementation of efficiency measures.

The National Climate Initiative has been funding a climate action project for the retail sector since April 2017 ("Der Einzelhandel packt's an – die HDE Effizienz- und Klimaschutzoffensive"). The project is being carried out by the German Retail Federation (HDE) in conjunction with adelphi research gemeinnützige GmbH. The project will run for three years. This broad-based campaign aims to provide information, raise awareness and provide practical implementation aids to reduce the barriers to implementing efficiency and climate action measures in the retail trade, especially in SMEs. The aim is to reduce greenhouse gas emissions in the retail sector and to motivate end consumers to make climate-friendly purchase decisions.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	Quantification not currently possible

5.5.2.17 Pilot project on using a new method to establish key energy efficiency parameters in companies and promote dissemination

This pilot project launched by the German Government is intended to be implemented in the industrial and commercial sector and in households as part of the work to develop key performance indicators and benchmarks.

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) awarded a service contract to establish and use energy

performance indicators as a way of helping to increase energy efficiency and climate action in companies. BMU has already commissioned the development of a method to establish energy performance indicators and this project ("EnPI-Connect: Energiekennzahlen für Monitoring und Benchmarking") aims to work with energy managers to use the method in at least three companies and achieve direct energy efficiency increases. In the process, the experience gained in the companies – including commercial ones – will be evaluated. Recommendations for action can then be developed on the basis of this experience.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.6 Climate-friendly building and housing strategy

The Climate Action Programme 2020 includes the task of developing an efficiency strategy for buildings (see Section 4.5.2) and a climate-friendly building and housing strategy, which combines energy efficiency concerns with more far-reaching climate action. Both assignments have been carried out: the efficiency strategy for buildings was adopted by the cabinet as a stand-alone document in 2015, and the climate-friendly building and housing strategy is included in the Climate Action Plan 2050 as a separate section entitled “Climate action in the buildings sector.” It builds on the efficiency strategy for buildings and on the findings of the Alliance for Affordable Housing and Building (Bündnis für bezahlbares Wohnen und Bauen) and combines climate-friendly building and housing with other housing, neighbourhood and urban development, and sustainable building issues. Important elements of it are high-specification standards for new

builds, long-term strategies for refurbishing existing buildings and a gradual switch to heating systems based on renewable energy.

In addition to that, sustainability, affordability of housing for tenants and owner-occupiers, and the cost-effectiveness of measures used in existing buildings must be ensured.

Both strategies focus on the long-term goal formulated for 2050 of achieving a virtually climate-neutral building stock and on the question of how the interaction between energy efficiency and use of renewable energy can achieve this. In light of the longevity of buildings, the German Government believes that identifying target-oriented approaches systematically and as quickly as possible – and thus avoiding stranded investments – is crucially important in this sector.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014 of which 1.5 to 4.7 million tonnes of CO ₂ equivalent over and above NAPE and energy-efficient refurbishment roadmaps at federal, Länder and local level (see Section 5.12.4)	5.7 to 10.0
Contribution according to the latest estimate of experts (of which 0.8 over and above NAPE) and energy-efficient refurbishment roadmaps at federal, Länder and local level	3.2 to 3.8 0.7 to 0.8 No contribution is expected to be made before 2020

5.6.1 Long-term goal: climate-neutral building stock

A reliable and valid overview of the fundamental data corpus on buildings is essential to defining climate action that is specifically tailored to the sector.

Knowledge of the energy performance and structural condition of existing buildings – especially

non-residential buildings – is limited. Work to acquire the representative primary data needed to make a statistically valid recording and evaluation of the structure and energy quality of the non-residential building stock in Germany began in December 2015 and will continue until May 2019. The random sample design developed has been tried and tested repeatedly. Plans to record data on around 100,000 buildings are currently being implemented.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.6.2 Energy efficiency in the buildings sector

The lower the demand for final energy as a result of efficient use, the lower the demand for (fossil-based) primary energy. This, in turn, results in greater reductions in greenhouse gas emissions. The extent of the reduction depends on the fuel used. This also applies to buildings.

The measures adopted by the German Government in the area of energy efficiency in buildings as part of the National Action Plan on Energy Efficiency (NAPE) are listed below, along with their current implementation status.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	4.2 to 5.3
Contribution according to the latest estimate of experts	2.5 to 3.0

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

Higher energy efficiency specifications necessitate higher quality design and execution of efficiency measures. In fact, whether the users of buildings accept the efficiency measures hinges on the quality and care with which they are executed, particularly in the case of refurbishment work on existing buildings. For this reason, it is essential that the individual stages involved in making a refurbishment decision are closely linked, as is the case with the energy advice scheme and the CO₂ building refurbishment programme (KfW funding programme). This ensures that all stages of investment – starting with an initial consultation (an energy advice session at a consumer advice centre, for example), followed by energy advice specifically for residential buildings (on-site advice, individual refurbishment roadmap – see Section 5.5.2.10) through to supervision of the refurbishment work – are funded and that a high quality can be maintained throughout.

The grants available for energy advice for residential buildings were increased in March 2015. Funding is also provided for energy advisors to participate in meetings of homeowners' associations so that they can present their advisory reports.

To improve the quality of the energy advice, a new advisory instrument was launched in 2017: individual refurbishment roadmaps for private residential buildings. These roadmaps give the recipients of the advisory service an individually coordinated step-by-step refurbishment plan. They identify in a more comprehensible overview the investment needed for each stage, along with suitable funding options. This makes it possible to carry out the refurbishment in a systematic way, even if it is done in stages. The individual refurbishment roadmap scheme was integrated into the energy advice for residential buildings programme (on-site advice, individual refurbishment roadmap) and supported with a grant of 60 percent.

However, significantly more high-quality energy advice sessions will need to be carried out to achieve the goals of the heating transition. In 2017, the eligibility criteria for energy consultants were therefore extended to allow access to qualified professional from all industries, including craftspeople and heating inspectors, who will be able to provide energy advice for residential buildings. This means that consumers will be able to benefit from a larger pool of qualified consultants. The advice will have to maintain the same level of objectivity and high quality.

The Federal Office for Economic Affairs and Export Control (BAFA) received around 25,000 applications for funding between March 2015 and the end of 2017.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.2
Contribution according to the latest estimate of experts (High level of uncertainty, since the number of funding cases completed is not yet known)	0.06

5.6.2.2 Energy Efficiency Incentive Programme (APEE)

This programme, which was launched on 1 January 2016, usefully complements and strengthens the existing funding landscape and has been integrated into the CO₂ building refurbishment programme and the market incentive programme (MAP). Innovative fuel cell heating for new and existing buildings came onto the market in August 2016.

In 2017, funding was approved for around 53,000 applications under the APEE, of which almost 40,000 were in the APEE programme components within the CO₂ building refurbishment programme, about 430 were in KfW's renewable energy programme, MAP premium, and around 12,700 measures were investment grants under the MAP programme component (BAFA part of MAP).

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014 The figure given includes the estimate of the reduction effect of the tax incentives for building refurbishment adopted under NAPE.	2.1
Contribution according to the latest estimate of experts	0.23

5.6.2.3 Continuing, refining and providing additional funding for the CO₂ building refurbishment programme up to 2018

One of the German Government's principal goals is for the country's building stock to be virtually climate-neutral by 2050. The KfW funding programmes for energy-efficient new build and refurbishment, which are financed by the CO₂ refurbishment programme, make an important contribution to this.

The programmes have been improved and extended in various ways in recent years in order to exploit the efficiency potential in the buildings sector. They are basically open to all owner groups for energy-efficient refurbishment and for constructing new residential buildings, buildings that are part of municipal and social infrastructure, and commercial buildings.

By the end of 2017, the funding had already supported the energy-efficient refurbishment or construction of almost 5 million homes. The investment volume funded totalled around 318 billion euros. Since 2007, energy-saving measures in over 3,000 buildings that are part of social or municipal infrastructure have been funded. The record of funding for commercial buildings adopted under NAPE is also positive. Over 3,500 applications for funding for refurbishment of existing commercial buildings or for new builds were approved between July 2015 and December 2017. The investment volume since the programme was launched totals about 9.7 billion euros.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.7
Contribution according to the latest estimate of experts	0.8

5.6.2.4 Heating check-ups

The German Government's decision intends voluntary heating check-ups to focus on heat generation units as a whole, particularly from the point of view of increasing energy efficiency, to identify weaknesses and provide suggestions for how to remedy them.

By last year, it had already become clear that it did not make sense to carry out the heating check-ups developed by industry under DIN EN 15378 in addition to the measures for increasing energy efficiency in buildings that already existed. In particular, the implementation costs and fragmented nature of the programme speak against funding it, which is why the programme was terminated.

5.6.2.5 Energy advice for municipalities

Public buildings can and must play an outstanding role in implementing the goals of the energy transition. Municipalities and their properties and buildings belonging to non-profit organisations play a key role here. The German Government's belief that huge energy efficiency potential can be exploited here, thus making massive contributions to climate change mitigation and energy efficiency, is not the only reason. Added to this is the opportunity for the public sector to lead by example and demonstrate the benefits of appropriate and cost-effective efficiency measures for private residential and non-residential buildings. Energy-efficient refurbishment of existing non-residential buildings is

extremely important. It is crucial here to ensure that the specific requirements posed by municipal properties are taken into account because often these buildings and their systems are highly complex and heterogeneous.

For that reason, the German Government decided to launch a funding programme under its National Action Plan on Energy Efficiency, which is specially tailored to the needs of municipalities, municipal premises and non-profit organisations.

The programme on funding for energy advice for non-residential buildings belonging to municipalities or non-profit organisations ("Energieberatung für Nichtwohngebäude von Kommunen und gemeinnützigen Organisationen") has provided funds since 1 January 2016 under an amendment entering into force on 1 March 2017. Services eligible for funding are advice on:

- energy-efficient concepts for refurbishing non-residential buildings (including coordinated individual measures and comprehensive refurbishment), and
- constructing non-residential new builds in line with the requirements of the EU Buildings Directive.

BAFA received around 1,250 applications for funding in 2016 and 2017.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Not established
Contribution according to the latest estimate of experts	0.04

5.6.2.6 Further development of energy-saving legislation

In addition to the measures mentioned above to promote energy-efficient and climate-friendly building as set out in the climate-friendly building and housing strategy, the provisions of the Energy Conservation Act (Energieeinsparungsgesetz), the Energy Conservation Ordinance (Energieeinsparverordnung) and the Renewable Energies Heat Act (Erneuerbare-Energien-Wärmegesetz) are also essential to achieving the goal of a virtually climate-neutral building stock.

An overhaul of energy legislation for buildings (Gebäudeenergiegesetz) will be tackled in this legislative period. It will centre on creating an act on energy in buildings, combining the Energy Conservation Act, Energy Conservation Ordinance and Renewable Energies Heat Act. The German Government has had expert studies carried out on this (looking especially at the possibility of updating the existing cost-efficiency analysis and flexibility options, and reviewing the specifications system and the legal regulations on primary energy factors).

This consolidation of legislation is intended to create a uniform system of legal provisions, in which energy efficiency and the use of renewable energy in the building sector are integrated. Standardisation will make it easier to apply and enforce the legislation. A neighbourhood approach and better opportunities for using renewable energy in buildings will also be introduced. The

amended legislation will transpose the requirements of EU law. The coalition agreement stipulates that the current energy specifications will continue to apply. Similarly, the principles of economic viability, a technology-neutral approach and simplification will continue to apply.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Not established
Contribution according to the latest estimate of experts	No effect before 2020

5.6.2.7 A comparison between the Energy Conservation Regulation and the Renewable Energies Heat Act

An expert report thoroughly investigated how to better integrate requirements relating to energy efficiency and renewables, and the options for better implementation and simplification.

The comparison was part of the preparatory work for the revision of energy conservation legislation during the last legislative period and has been concluded.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
As estimated under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

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

The German Government believes that well-founded, direct information on heating energy consumption (including for hot water) can make consumers more motivated to step up their efforts to save energy.

For that reason, it decided under the National Action Plan on Energy Efficiency to review the key regulatory law instrument for this – the Heating Costs Regulation – to establish whether further developments in the field of billing and consumption information could make a useful contribution to achieving further energy savings, while complying with the cost-efficiency requirement.

The German Government's review was supported by a research project on informative and transparent billing

for heating costs as a contribution to climate action. It looked at the question of whether, and to what extent, heating bills could be developed into a more informative and transparent instrument to help further reduce energy consumption for heating and hot water and therefore cut CO₂ emissions from residential buildings. Since a field trial on the effects of interim information on consumption is currently running, there are no plans at present to make this a mandatory stipulation of the Heating Costs Ordinance. Furthermore, developing heating billing requirements to increase transparency for the consumer is being reviewed and also discussed within the Alliance for Affordable Housing and Building. A more far-reaching process has been agreed with representatives of the companies that read heat meters, the housing industry and the German Tenants' Association (Deutscher Mieterbund) to develop a more transparent and uniform system for heating bills.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts	0.51 to 1.03

5.6.2.9 Tenancy law

The German Government is aiming to achieve a virtually climate-neutral building stock by 2050. Energy-efficient building refurbishment plays a key role in this. However, landlords are only willing to do this work if they can finance the investment in the building and if it is economically viable. The option of increasing the rent following modernisation work is therefore an important factor. Tenants also benefit from modernisation work to increase energy-efficiency if their overall housing costs – rent, heating and service charges – fall or at least remain the same. If the modernisation work is so extensive that the rent increase is significantly greater than the cost savings achieved as a result of lower energy demand,

tenants may struggle financially. In addition to upgrading the energy efficiency of the building stock, ensuring affordable housing is another of the German Government's important goals.

With this in mind, the coalition agreement for the 19th legislative period includes limits on rent increases that landlords may impose following modernisation work. It also includes the option to select a simplified rent increase procedure for small-scale modernisation measures up to 10,000 euros. The Federal Ministry of Justice and Consumer Protection plans to develop corresponding legislative proposals.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.6.2.10 Individual refurbishment roadmaps for residential and non-residential buildings

Refurbishing residential buildings to make them more energy-efficient involves reconciling increasing demands regarding how buildings are used, higher levels of technology and complex building work. These parameters also have to be coordinated with other considerations, such as the financial possibilities available to a building owner wishing to carry out this work, and incorporated into a refurbishment roadmap that is divided into different phases. In light of its aim to make the country's building stock virtually climate-neutral

by 2050, the German Government decided to develop a standardised framework for refurbishment work, which would give building owners the option to identify technically and financially optimum solutions for their building.

The methodology of the individual refurbishment roadmap for residential buildings was integrated into the energy advice for residential buildings programme (on-site advice) on 1 July 2017. The first software trials were successful. Four manufacturers passed the software tests and their products are now available on the market.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.6.2.11 Taking forward the market incentive programme (MAP) for renewable energies

One of the aims of the market incentive programme is to expand the use of renewable energy in the heating and cooling market, especially with a view to meeting the statutory target set by the Renewable Energies Heat Act that renewables should account for 14 percent of final energy consumption in the heating and cooling sector by 2020. That figure is currently 12.9 percent (2017, as at February 2018). The programme promotes investment in/systems for using renewable energy, predominantly in existing buildings.

In the investment grant part of MAP (known as the BAFA component, BAFA being the abbreviation for the Federal Office of Economics and Export Control), 1.76 million solar thermal plants, biomass boilers and heat pumps have been funded with grants of around 2.69 billion euros since the year 2000. This triggered an investment volume of nearly 19.11 billion euros (as at 31 December 2017).

Within this part of the programme, a total of roughly 61,400 systems were funded with about 196.7 million euros, predominantly solar thermal plants, biomass boilers and heat pumps in existing detached and semi-detached houses. Biomass heating systems take first place here, with approximately 24,450 being funded. They are followed by approximately 18,420 heat pumps and roughly 17,880 solar collector systems, plus other measures.

In another of MAP's programme components funded by KfW (premium renewable energy programme), approximately 23,475 larger scale systems were funded with over 3.3 billion euros. Repayment grants amounting to 831 million euros were approved. The major part of the measures funded consisted of about 12,570 heating networks, followed in second place by around 5,918 biomass heating plants, plus other measures (as at 31 December 2017).

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under NAPE as at December 2014	Not established
Contribution according to the latest estimate of experts	0.81

5.6.2.12 Setting new standards promptly – developing system components

This is one of the measures of the National Action Plan on Energy Efficiency (NAPE). It aims to introduce new technical standards more quickly. This was triggered by the realisation that a great deal of time can elapse between the development of a product and its market

launch, especially in the building industry. This means that potential for simplification and efficiency remains unused. Using standardised system components would offer the possibility of constructing and operating buildings not just with greater cost efficiency but also with consistent technical quality.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.6.2.13 Research network on energy in buildings and neighbourhoods – research network on building for the energy transition

New ideas, concepts and technologies are one of the driving forces in the German economy. The German Government promotes innovative energy technologies for buildings and neighbourhoods in its Energy

Research Programme and has set itself the goal of making research findings available to practitioners as quickly as possible in order to accelerate the energy transition in this sector. To this end, the research network on energy in buildings and neighbourhoods ("Forschungsnetzwerk Energie in Gebäuden und

Quartieren”) was established in 2014. In November 2017 it was renamed the research network on building for the energy transition (“Forschungsnetzwerk Energiewendebauen”). The aim is to intensify the two-way flow of information between researchers and practitioners so that not only research findings

are transferred into practice quickly, researchers also actually get feedback from practitioners about current challenges. In addition, the network makes it possible for the research landscape to be directly involved in strategic processes of energy research policy.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Cannot be quantified
Contribution according to the latest estimate of experts	

5.6.2.14 The efficiency strategy for buildings

The efficiency strategy for buildings is the German Government’s strategy paper for the energy transition in the buildings sector. It tackles not only technical and energy aspects but also outlines some initial economic approaches and explores possible interactions with other sectors.

The Climate Action Plan 2050 contains a section on the buildings sector. Its climate-friendly building and housing strategy is based on the findings of the efficiency strategy for buildings. The efficiency strategy for buildings outlines two possible development scenarios: the efficiency scenario and the renewables scenario. A target corridor is created between these two scenarios, within which the target of making the country’s building stock virtually climate-neutral by 2050 can be achieved in different ways. Whereas the efficiency scenario focuses on the (greatest possible) effort in the area of efficiency, the renewables scenario is based on increasing the use of renewable energy up to the predicted limit of their potential.

Furthermore, other specific measures, some of which were adopted under the National Action Plan on Energy Efficiency, were consolidated and fleshed out in the efficiency strategy for buildings. Since the strategy was adopted, a number of measures have been launched: an initiative entitled “EnEff.Gebäude 2050” funding innovative projects for a virtually climate-neutral building stock by 2050 (see Section 5.6.2.15), a funding programme concerned with heating optimisation (replacing pumps in buildings and ensuring hydraulic balance), which was launched between April and August 2016, see Section 5.4.2.2) and the advisory instrument developing refurbishment roadmaps for individual buildings (see Section 5.6.2.10).

The efficiency strategy for buildings is not designed to be a rigid instrument; instead, the aim is to continue developing it with a view to achieving the target of making the building stock virtually climate-neutral by 2050.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under NAPE as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

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

To accompany the efficiency strategy for buildings, “EnEff.Gebäude 2050” funds projects that aim to develop innovative and exemplary ways of achieving a virtually climate-neutral building stock by 2050. The funding initiative supports the transfer of energy

research results to make them available for broad-based use. Innovation and transformation projects are intended to demonstrate how technologies and concepts that are available but not yet established on the market can lower primary energy demand and achieve virtually climate-neutral buildings and neighbourhoods on a wide scale. The projects explore

the latest research findings and test new approaches and ambitious concepts for increasing energy efficiency and using renewable energy in buildings and neighbourhoods. The aim is to use these projects to show what is already technically feasible, economically viable, legally possible and capable of stimulating

a broad-based, socially acceptable use of virtually climate-neutral buildings.

The call for projects under this measure was published in 2016. As at April 2018, 33 projects in 10 collaborative networks had been launched.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under NAPE as at December 2014	None, since this is a new measure under the efficiency strategy for buildings.
Contribution according to the latest estimate of experts	0.02

5.6.2.16 Package of measures for air conditioning and ventilation equipment

In the area of building services, not only heating technology but also air conditioning and ventilation systems usually have great potential for energy efficiency. However, there are a number of barriers to exploiting that potential, such as:

- insufficient knowledge on the part of building owners,
- the high level of complexity of the technology,
- a lack of clarity in the funding landscape and
- the regulatory requirements and inadequate enforcement of these regulations.

The German Government has set itself the goal of overcoming these barriers, in addition to implementing the measures already adopted under the National Action Plan on Energy Efficiency

To make the standard on conducting inspections under DIN SPEC 15240 more conclusive, a number of proposals were submitted to DIN and are expected to be taken into consideration in the updated DIN SPEC 15240 in the middle of 2018. They include taking oversizing into account and incorporating demand-oriented control of operating times and volume flow. Based on the extended inspections, BAFA commissioned the development of suitable web-based software for inspectors. Furthermore, the Federal Ministry of Economic Affairs and Energy is set to commission the development of a software tool for operators and general energy advisors to be used for initial consultations.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	None, since this is a new measure under the efficiency strategy for buildings.
Contribution according to the latest estimate of experts	It is expected that quantification will be possible from 2018

5.6.3 Training initiative in building efficiency

5.6.3.1 BUILD UP SKILLS

The German Government believes that it is only possible to build residential and non-residential buildings to high energy specifications if they are designed and executed properly. Good training is crucial to ensuring the high quality of both these aspects, in other words the design and execution. The introduction of new

technologies, innovations in fixed building services and also the changing needs of the people who use buildings also require a constant flow of information. It is also essential that all parties involved participate in continuing professional development on a regular basis.

The project was concluded on 30 September 2016. Project reports and findings are available on: www.bauinitiative.de

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.6.3.2 European Social Fund programme (ESF)

In addition to the Build Up Skills project, which focuses on specific associations, the German Government also decided to fund cross-trade training for apprentices and trainers. The courses provided are informal and extra-curricular with a practical focus.

All the projects are running very successfully and as at August 2017, it is anticipated that the targets set for participant numbers will be reached. Two networking meetings take place each year. The projects benefit greatly from these meetings in terms of public relations, professional expertise and also joint activities. The guideline for the second round of funding was published in December 2017 and envisages new projects starting at the beginning of 2019.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.6.4 Climate-friendly housing for low-income households

Another of the German Government's stated aims is to ensure as many people as possible are able to live in climate-friendly housing. However, low-income households often cannot afford to rent an apartment that has undergone energy-efficient refurbishment. For that

reason, the Government decided to consider the possibility of adding:

- a climate component to housing benefit, and
- a corresponding amendment (gross rent including utilities) regarding basic income support of book II (SGB II) and book XII (SGB XII) of the Social Code.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 (The reduction effect of the climate component in housing benefit (see Section 5.6.4.1) and amendment to books II and XII (SGB II and SGB XII) of the Social Code have been estimated together.)	0.4
Contribution according to the latest estimate of experts	0.02
from the climate component in housing benefit (see Section 5.6.4.1)	0.01
from the amendment to books II and XII of the Social Code (see Section 5.6.4.2)	0.01

5.6.4.1 Climate component in housing benefit

The rents (not including heating costs) of many homes where energy-efficient refurbishment has been carried out are higher than the maximum rent allowances for people receiving income-support benefits, which

means that they often cannot afford to live in homes with a high energy performance standard.

In order to create social equality in cases like that and make it possible for housing benefit recipients to live

in homes that have undergone energy-efficient refurbishment, the German Government decided under the Climate Action Programme 2020 to review the introduction of an additional climate component in cooperation with the Länder.

The recommended option for formally integrating a climate component into housing benefit that is practicable and fit for purpose is to raise the maximum rent

that can be considered, with the proviso that it would only apply to homes that had a certain energy efficiency standard. The question of how to furnish proof of the energy standard remains to be clarified. Another research project therefore aims to develop a legally robust, practicable and simple to run procedure, which would record the energy standard of a home and not place excessive demands on tenants, landlords, owners or the housing benefit agencies.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 (Not shown separately; the reduction effect was jointly estimated with the amendment to books II and XII (SGB II and SGB XII) of the Social Code. (see Section 5.6.4.2))	-
Contribution according to the latest estimate of experts	0.01

5.6.4.2 Amending books II and XII (SGB II and SGB XII) of the Social Code

Currently, the appropriate level of payments for housing within the basic income support for jobseekers and within social security benefits is mainly based on rent excluding utilities. This often results in people receiving income-support benefits not being able to rent homes where energy-efficient refurbishment has been carried out because the rent (not including utilities) is higher, whereas the heating costs are lower. This could in the long term lead to a situation in which there is a concentration of these households living in housing that has not undergone energy-efficient refurbishment. The German Government therefore announced in its Climate Action Programme that, as part of the planned simplification of the law, it would also review adding provisions to address this to books II and XII of the Social Code (SGB II and XII). The idea would be to use a single concept (gross rent including utilities) to determine the appropriate level of accommodation costs within the basic income support for jobseekers under book II (SGB II) and within social security benefits under book XII (SGB XII) of the Social Code.

The report has been published and is available (in German) on the Federal Ministry of Labour and Social

Affairs website under Publikationen, Forschungsberichte. The study looks at ways of determining the appropriate level of payments for accommodation and heating pursuant to book II (SGB II) and book XII (SGB XII) of the Social Code. One focus of the study was to review current implementation practice on the basis of a nationwide survey of municipalities, 12 case studies and 20 discussions with experts. The different procedures used by benefit agencies were analysed taking into account housing market conditions, and key implementation challenges and problems were discussed. The other focus of the study was to develop various procedures for calculating maximum allowable rents. The study differentiates between three basic assessment approaches, which it links to different data sets and calculation steps. A comparative calculation was done for 12 case studies and 878 German middle-order centres. Different ways of developing the legal framework are being discussed.

On 1 August 2016, Article 22 (10) of book II of the Social Code (SGB II) introduced a new concept for determining appropriate payment levels: an overall limit for appropriate benefit payments that takes into account both appropriate accommodation costs and appropriate heating costs.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 (Not shown separately; the reduction effect was jointly estimated with the climate component in housing benefit (see Section 5.6.4.1).)	-
Contribution according to the latest estimate of experts	0.01

5.6.5 Rents maps

The German Government believes that the regulations for drawing up (professional) rents maps need to be made more specific, in particular to ensure legal certainty. Based on decisions under the Climate Action Programme, the possibility of including energy-saving equipment and features in rent maps will be reviewed, since differences in energy performance have to date not always been reflected in the market.

It was not possible to reach an agreement on the proposals for changes to tenancy law made by the Federal Ministry of Justice and Consumer Protection in the 18th legislative period. The coalition agreement for the 19th legislative period put the topic of rent maps on the agenda again.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	Savings are not likely until after 2020 therefore no estimate is reported here.

5.6.6 Energy-efficient urban rehabilitation and climate action in municipalities

Beyond the measures mentioned above relating to individual buildings, the German Government believes it is important to also support climate-friendly projects focusing on energy efficiency in neighbourhoods, in urban planning and in municipalities. With this in mind, the

→ energy efficient urban rehabilitation (see Section 5.6.6.1),

→ local authority guideline (see Section 5.6.6.2) and

→ refurbishment of facilities for sports, youth and culture (see Section 5.6.6.3)

programmes will fund a wide range of projects and also, in the case of refurbishing sports, youth and cultural facilities, it will provide a great deal of support for model projects.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.9 to 3.2
Contribution according to the latest estimate of experts	0.69 to 0.79
from the energy-efficient urban rehabilitation programme (see Section 5.6.6.1)	0.06 to 0.12
from the local authority guideline (see Section 5.6.6.2)	0.6
from the federal programme for the refurbishment of facilities for sports, youth and culture (see Section 5.6.6.3)	0.03 to 0.07

5.6.6.1 Energy-efficient urban rehabilitation

Since the end of 2011, the German Government has supported integrated neighbourhood strategies and rehabilitation managers with grants and energy-efficient supply systems for neighbourhoods (especially heat supply) with loans. This has triggered comprehensive measures to improve energy efficiency in buildings and municipal infrastructure.

One of the German Government's decisions taken under the Climate Action Programme 2020 was to continue developing the successful energy-efficient urban rehabilitation programme up to 2020 and to increase funding for it if necessary.

From the programme's launch on 15 November 2011 until 31 December 2017, funding was approved for

1,376 projects with a volume of around 743 million euros (776 concepts; 205 rehabilitation management projects and 395 neighbourhood supply projects).

A highly regarded conference with around 200 participants from local Government, the public sector, the housing and energy industry, and other professionals was held at the end of the first four-year phase of research that accompanied the KfW programme. It focused on how the practice that has developed in municipalities in recent years can be used to create a new understanding of energy-efficient neighbourhood rehabilitation and how to take it forward. Key issues in presentations and panels were how to link energy

saving and generation with neighbourhood rehabilitation and how to sustain collaboration among stakeholders.

The further development of energy-efficient urban rehabilitation includes increasing the repayment grants for all purposes in the energy-efficient neighbourhood rehabilitation programme, adapting the eligible purposes such as using and avoiding waste heat, increasingly using renewables for heat supply and exploiting the energy-saving potential in water supply and wastewater treatment. A new invitation to tender for the accompanying research was issued and the research will continue from May 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.6 to 1.2
Contribution according to the latest estimate of experts (The evaluation for 2011 to 2014 resulted in a reduction effect that was significantly lower than the previous estimate. However, an evaluation for 2012 to 2016 that was published in 2018 shows a marked improvement in the effect on CO ₂ emissions. The findings will be taken into account in the 2018 Climate Action Report.)	0.06 to 0.12

5.6.6.2 Climate action in municipalities – local authority guideline

Since 2008, a diverse range of projects in municipalities have been supported under the guidelines on promoting action in social, cultural and public establishments, or Local Authorities Guideline, under the National Climate Initiative. Around 12,500 projects in over 3,000 municipalities were funded with about 560 million euros up to the end of 2017. Additional investment totalling 908 million euros was also triggered.

Work to revise the guideline started again in 2017. The aim is to publish the new Local Authorities Guideline on 1 January 2019. Work on developing new activities eligible for funding and updating existing ones was concluded at the end of the first quarter of 2018. The internal and interdepartmental coordination work and discussions in the Bundestag's environment committee will take place by autumn 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.3 to 2
Contribution according to the latest estimate of experts	0.6

5.6.6.3 Funding the refurbishment of facilities for sports, youth and culture (federal programme)

In addition to the neighbourhood approaches and broad-based support for local climate action, a special focus is placed on funding sports, youth and cultural facilities. These facilities play a key role in social and societal integration. The German Government made

funding totalling 240 million euros available for the period between 2015 and 2020.

The federal programme began in 2015. An initial selection of projects took place in 2016; further projects were selected for funding in 2017 by the German Bundestag's budget committee. A total of 102 projects have been funded.

They have all received the funding. In line with the commitment appropriations earmarked, the building work will be carried out by the end of the funding period in question – either 2018 or 2020.

This measure provides targeted support to local community projects in the field of sports, youth and culture, which the communities would not be able to

finance themselves. The overall effect of the measure is limited, but it does support long-term transformation goals at local level.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Not shown separately
Contribution according to the latest estimate of experts	0.03 to 0.07

5.6.7 Climate-friendly heat generation

5.6.7.1 Micro-CHP

Highly efficient and flexible combined heat and power plants lower CO₂ equivalent emissions, in particular in cases where they are used instead of fossil-fired plants that are not based on cogeneration. Micro-CHP units are funded, on the one hand, under the Combined Heat and Power Act and, on the other hand, under the micro-CHP guideline, which received approval for an increase in funding under the Climate Action Programme 2020.

Funding of micro-CHP units was continued at the beginning of 2015 on the basis of the amended guideline. In total, approximately 4,900 units with an installed capacity of 28 megawatts were funded in 2014, 2015 and 2016. A further 700 units with an installed capacity of around 3.6 megawatts were also funded in the first half of 2017. Bonus support for heat efficiency was granted to about 63 and 67 percent of cases in 2016 and 2017 respectively; roughly, every sixth unit received bonus support for electricity efficiency in 2016 and every fifth in 2017.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.2
Contribution according to the latest estimate of experts	0.01

5.6.7.2 Eliminating tax obstacles for housing companies

Despite balanced and targeted funding of measures and technologies to increase energy efficiency and mitigate climate change, other barriers can prevent climate-friendly technologies from becoming more widely known and used.

For example, housing companies that operate photovoltaic or combined heat and power plants may lose

some of their tax relief (housing associations are currently exempt from business and corporation tax; other types of housing companies can apply for additional relief on business tax). The order of 9 September 2013 (G 1425-2013/0015) issued by North-Rhine Westphalia's Regional Finance Office addressed this problem and proposed a number of solutions that are possible under the current legal situation.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.23
Contribution according to the latest estimate of experts (More overlap effects than in the 2014 estimate, in particular with the Renewable Energy Sources Act and Combined Heat and Power Act)	0.02

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

The German Government sees the public's identification with – and thus acceptance of – its climate action policy and the country's energy transition as key factors in their success. The (residential) buildings sector plays an important role here because if climate-friendly and energy-saving buildings can be established as a lifestyle product, they can become key drivers of the energy transition in the sector. For that reason, the Climate Action Programme 2020 included the decision to hold a competition for ideas with the aim of finding new communication approaches to make climate-friendly, energy-saving building and housing attractive.

The German Government has identified the following key elements for the competition:

- Drawing up a concept for running the competition
- Running the competition with awards for the best ideas
- Translating the results into practice
- Setting up a think tank on climate-friendly building

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.7 Climate change mitigation in the transport sector

At 166 million tonnes of CO₂ equivalent, the transport sector accounted for about 18 percent of greenhouse gas emissions in Germany in 2016. The trends of recent years (see Section 4.5) show that efforts made so far in the sector are nowhere near sufficient to deliver the contribution to cutting greenhouse gas emissions needed to achieve the 2030 target for the sector and other climate targets. We still have a long way to go.

The package of transport-related measures adopted by the German Government under its Climate Action Programme 2020 was designed to achieve reductions of 7 to 10 million tonnes of CO₂ equivalent in the sector by 2020.

The package included:

- Making passenger and freight transport climate-friendly (see Sections 5.7.1 and 5.7.2),
- Increasing the use of electric drives (see Section 5.7.3),
- Introducing cross-cutting measures in the transport sector (see Section 5.7.4),
- Putting mitigation measures in place in air transport (see Section 5.7.5)
- Supporting climate action in international maritime traffic (see Section 5.7.6) and

→ Introducing other measures in the transport sector (see Section 5.7.7)

In addition to the measures under the Climate Action Programme, the German Government also put in place other measures in 2016 to boost electric mobility. Since they also help to achieve the goal of reducing Germany's greenhouse gas emissions, they are also described in this and the last Climate Action Report. The package of measures adopted on 18 May 2016 consists of:

→ Tax incentives for electric mobility (see Section 5.7.3.1),

→ A purchase bonus for electric vehicles – including fuel cell and plug-in hybrid vehicles (see Section 5.7.3.5) and

→ Funding for the further expansion of charging infrastructure (see Section 5.7.3.2).

The 2030 programme of measures will contain further measures to get the transport sector on the right path to reach its target. Innovative cross-sectoral solutions must be a priority.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	7 to 10
Contribution according to the latest estimate of experts	1.1 to 2

5.7.1 Making freight transport climate-friendly

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

The German Government's decision to develop the HGV toll will be implemented by a package of staggered measures.

Back in 2015, the toll scheme was extended to an additional 1,100 kilometres of trunk road that are of a similar standard to motorways, and since 1 October 2015, it has applied to vehicles with a maximum total laden weight of between 7.5 and 12 tonnes, which were not previously subject to tolls. The HGV toll was expanded to all trunk roads on 1 July 2018. The Fourth Act Amending the Federal Trunk Road Toll Act (Viertes Gesetz zur Änderung des Bundesfernstraßenmautgesetzes) of 27 March 2017 (Federal Law Gazette I, page 564) entered into force on 31 March 2017.

The HGV toll already imposes the maximum charges for air pollution permitted under European law (Directive 1999/62/EC). It would therefore only be possible

to allocate the costs actually incurred if the European legislation were changed accordingly. A corresponding proposal to revise Directive 1999/62/EC was presented by the European Commission on 31 May 2017 as part of the mobility package that is currently being negotiated between the EU and the member states.

To accelerate the market penetration of measures to increase the efficiency of commercial vehicles, the German Government is aiming to tie the HGV toll to the vehicles' CO₂ emissions in a way that is revenue-neutral. This measure cannot be implemented until the necessary legislative changes have been made at national and European level. The first proposals were presented by the European Commission on 31 May 2017 as part of the mobility package and others are scheduled to follow in the next few months. The discussion of the proposals with the member states will then begin.

Furthermore, there are plans to include noise pollution costs when determining the toll charges. This is part of the draft of the Fifth Act Amending the Federal Trunk Road Toll Act (Fünftes Gesetz zur Änderung des Bundesfernstraßenmautgesetzes), which is currently going through the legislative process.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution made by extending the toll to federal trunk roads and lowering the maximum laden weight to 7.5 tonnes as envisaged under the Climate Action Programme as at December 2014.	0.3 to 0.7
Contribution made by extending the toll to federal trunk roads and lowering the maximum laden weight to 7.5 tonnes according to the latest estimate of experts; a higher reduction contribution is expected after 2020.	0.3 to 0.7
Contribution made by tying the HGV toll to vehicles' CO ₂ emissions as envisaged under the Climate Action Programme as at December 2014.	1.5 to 2.3
Contribution made by tying the HGV toll to vehicles' CO ₂ emissions according to the latest estimate of experts (The measure has not yet been implemented so it must therefore be assumed that it will not have an effect before 2020.).	No effect before 2020

5.7.1.2 Market launch of energy-efficient commercial vehicles

In line with the German Government's decision under the Climate Action Programme, the market launch of energy-efficient commercial vehicles will be supported by a fixed-term funding programme. A funding guideline that focuses both on increasing energy efficiency and on cutting greenhouse gas emissions is currently undergoing interministerial coordination. The funding programme is scheduled to run until 31 December

2020. The scheme helps with the additional costs of investments to reduce the energy consumption and greenhouse gas emissions of vehicles subject to tolls. The funding programme will be based on Commission Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market (General Block Exemption Regulation). The level of investment aid is based on Article 36 (5) of the General Block Exemption Regulation.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	1.0 to 1.5
Contribution according to the latest estimate of experts (measure in preparation)	0.03

5.7.1.3 Strengthening rail freight transport

In addition to road freight transport measures, the systematic upgrade of rail infrastructure to shift freight transport to the railways is the second pillar of the German Government's strategy to exploit the carbon reduction potential in the freight transport sector.

Measures under the immediate action programme on inland traffic to and from seaports, which are scheduled to continue until 2020, are currently improving capacities of seaports and their connection to the rail network. The total funding needed for the planned

electrification of the Ulm to Lindau and Munich to Lindau lines has been guaranteed.

The Federal Ministry of Transport and Digital Infrastructure (BMVI) adopted the Rail Freight Masterplan in 2017, which will also boost rail freight transport. Key measures include lowering track access charges, upgrading the rail network to accommodate the use of 740-metre freight trains, electrification of additional routes, and digitalisation and automation to increase the productivity and quality of rail freight transport.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 (The measure works in combination with measures in the road freight transport sector.)	1.5 to 1.8
Contribution according to the latest estimate of experts (Contrary to the assumptions made in the Climate Action Programme about the estimated reduction effect, it can be assumed that for the most part the measure will not be effective until after 2020, depending on the investment volume.)	0.05

5.7.1.4 Funding combined transport for non-state-owned companies and for private sidings

As part of the measures to make freight transport climate-friendly, the German Government is focusing on the steady expansion of transshipment facilities for combined transport. A funding guideline on building new private transshipment facilities and upgrading existing ones provides financial support for projects that shift freight transport to the railways and waterways. The German Government believes it is particularly important to maintain high levels of funding for non-state-owned companies in this sector. Transshipment facilities belonging to Deutsche Bahn AG are funded through an act on upgrading federal railway infrastructure (Bundesschienenwegeausbaugesetz).

Between the start of combined transport funding for non-state-owned facilities in 1998 and March 2015, 829

million euros in funding triggered total investments of about 1.3 billion euros. As a result of this funding, a total of 28.4 billion tonne kilometres were transported by rail and waterways instead of by road in 2013, which was the base year of the last evaluation. This means that 2.04 million tonnes of CO₂ were saved in the freight transport sector compared with the 2013 base year.

Updated versions of the funding guidelines on financial support for private transshipment facilities for combined transport and for private sidings entered into force in January 2017. In the case of funding for combined transport, the updates are mainly concerned with making it easier to provide securities for a potential repayment of funding to the federal Government. In the case of private sidings, a new funding formula was integrated to make it possible to fund what are known as light goods in the future.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate 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 the latest estimate of experts	Flanking measure

5.7.1.5 Strengthening inland waterway transport

Under the Climate Action Programme, the decision was taken to strengthen inland waterway transport. Modal shifts of freight to waterways are funded, provided nature conservation concerns are taken into account. This includes funding combined transport (see Section 5.7.1.4).

Public acceptance for a marked increase in inland shipping depends to a great degree on reducing pollutant

emissions from ships' engines. The German Government therefore revised the funding guideline for lower emission engines in inland shipping in 2015 and replaced it with a guideline on grants for inland shipping enterprises for sustainable modernisation of inland vessels. The programme, which will initially run until the end of 2018, will promote the use of more environmentally friendly engines. A total of about 250 projects have been funded since 2015, with the focus on lower emission diesel engines.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	This measure has not been quantified separately because it acts to complement road and rail freight transport measures.
Contribution according to the latest estimate of experts	Flanking measure

5.7.1.6 Strengthening regional economic cycles

In addition to the above-mentioned measures in the freight transport sector, the German Government also plans to reinforce the regionalisation of economic cycles. The main aim here is to make the growing volume of delivery traffic more environmentally sound and climate friendly. This depends, among other things, on regional development plans incorporating structures that generate less traffic, designing regional structure and spatial development plans accordingly and establishing overarching municipal strategies for developing commercial areas and transport.

These aspects are currently being explored within a research project on regionally consolidated development of commercial areas (RekonGent) and will be embedded in an environmentally appropriate framework that includes empirically based guidance documents and options for action for municipalities, shipping agents and haulage contractors. Proposals for designating assisted areas will also be developed in this context. The project's aim is to consolidate the management plans across municipalities when developing commercial areas to reduce the number of trips and transport distances, protect sensitive areas and reduce land take. This applies to both local (delivery) traffic and long-distance freight transport.

The stock taking needed to study the transport efficiency of regionally consolidated commercial areas has largely been completed. The findings are currently being calibrated with the outcome of the case studies. A

study of the opportunities and barriers in two regions has been completed. The results for individual measures are being discussed and developed with a view to implementing cooperation across municipalities to develop a guidance document for local actors.

In addition to this project, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety launched a national Sustainable Urban Logistics competition (NULog). Its specific objective is to survey and award prizes to innovative environmental measures that make a measurable contribution to reducing environmental pollution, are transferable to other towns and cities, and are economically viable. The competition focuses on three fields of innovation in urban logistics: smart addresses (measures connected with the place and type of delivery, such as theft-proof packing boxes that are not confined to being used by a single company), smart routes (optimisation of transport routes in the city, for example using new types of vehicle and new transport concepts) and smart scheduling (optimising transport processes, for example night-time deliveries).

The competition primarily addresses municipalities, businesses, research groups and industry and regional associations. The key criterion is to help the environment and climate, especially by reducing CO₂ emissions. Entries will be assessed by a jury of experts.

The project is currently in the design and preparation phase.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.5 to 1.1
Contribution according to the latest estimate of experts (Contrary to the assumptions made in the Climate Action Programme in connection with the estimated reduction effect, it can be assumed that the measure will not be effective until after 2020.)	No effect until after 2020

5.7.2 Making passenger transport climate-friendly

5.7.2.1 Strengthening public transport

The Federation continues to provide the Länder and municipalities with financial support for public transport. The Länder receive regionalisation funds through the Local Public Transport (Regionalisation) Act (Regionalisierungsgesetz) to finance local rail transport. However, they may also use them to invest in improving the overall public transport system.

Pursuant to Article 5 (5) of the Act, the regionalisation funding for the Länder had to be revised. The Länder received approximately 7.4 billion euros in 2015. As a result of the amendment, the regionalisation funds for 2016 were increased to 8.2 billion euros. A 1.8 percent increase was stipulated for future years up to 2031.

The 8 billion euros are distributed among all the Länder using what is known as the “Kiel Scale.” This distribution ratio puts a number of Länder at a financial disadvantage compared with the previous system: Berlin, Brandenburg, Mecklenburg-Western Pomerania, Saarland, Saxony, Saxony-Anhalt and Thuringia. A total of 200 million euros will be distributed using a different scale to compensate for this.

The legislative process was concluded with publication of the Fourth Act Amending the Local Public Transport (Regionalisation) Act (Viertes Gesetz zur Änderung des Regionalisierungsgesetzes) on 6 December 2016.

In addition to funds under this Act, the Länder have also since 2007 received compensation payments from the federal budget of roughly 1.34 billion euros under the act on separating joint tasks and funding

(Entflechtungsgesetz). They received these funds up to 2013 to enable them to improve transport in the local communities (public transport and road building). The Länder themselves were responsible for deciding on the exact distribution of the funds between these two areas. Since 2014, funds from the act have been ring-fenced only in the sense that they must be used for investment purposes. The reorganisation of financial arrangements between the Federation and the Länder stipulates that from 2020 the Länder will receive a higher share of the revenue from value added tax instead of funds from the act. Furthermore, the municipalities are eligible for 332 million euros in funding from the Local Authority Transport Infrastructure Financing Act (Gemeindeverkehrsfinanzierungsgesetz / GVFG) to part fund local rail infrastructure. This GVFG-programme will continue “until revoked”. The coalition agreement contains a provision for these funds to be raised to one billion euros by 2021. To realise this, both Article 125c of the Basic Law and the GVFG will need to be amended. The legislative process to amend the Basic Law has been initiated.

The German Government also continues to support the nationwide introduction of e-tickets and an improved passenger information system to make public transport more attractive. The Federal Ministry of Transport and Digital Infrastructure (BMVI) also launched a dialogue and stakeholder process in spring 2015 to promote digital networking of public transport. One of the milestones of the process to date is a road map, which was adopted in June 2016 and outlines the necessary steps and corresponding responsibilities. The BMVI also participates financially in the implementation of the road map. A total of 16 million euros is being provided to fund projects between 2016 and 2018. Currently 14 transport network projects are being funded; their term ends on 30 September 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 including the promotion of alternative drives in public transport (see Section .7.2.2)	0.7 to 1.0
Contribution according to the latest estimate of experts (Conservative estimate of the effect of the increase in 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 Promotion of alternative drives systems in local public transport

The Federal Ministry of Transport and Digital Infrastructure (BMVI) has provided 100 million euros since 2009 to promote the further development and procurement of buses with electric, hybrid and fuel cell drives. To support the introduction of alternative drive technology in local public transport, transport companies received assistance to purchase hybrid buses on the basis of the 2012 funding guideline of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) (which ran from 2012 to 2014).

Under the Climate Action Programme 2020, the German Government decided to continue this funding until the end of 2017. The purchase of 91 hybrid buses was funded on the basis of BMU's two funding guidelines.

The Federal Environment Ministry also has a new guideline under which funding for up to 80 percent of the additional investment costs of purchasing battery-electric buses and plug-in hybrid buses is available. It has been approved by the European Commission.

The BMVI also continues to fund battery and fuel cell buses based on the corresponding funding guidelines.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 including strengthening public passenger transport (see Section 5.7.2.1)	Not shown separately
Contribution according to the latest estimate of experts	0.01 to 0.02

5.7.2.3 Strengthening cycling and walking

Over short and medium distances, cycling and walking can partially replace private motor transport and make a considerable contribution to reducing CO₂ emissions. If electric drives become more widely deployed, cycling could also take on greater importance even over longer distances, including in commuter transport, for example. The German Government's remit in further expanding the cycle path network includes creating a legal framework to support cycling.

The National Cycling Plan 2020 (NRVP 2020) is the strategic document for promoting cycling in Germany. The Federation plays an important role as moderator, coordinator and source of new ideas and provides 4.2 million euros each year to implement innovative non-investment model projects in the fields of action covered by the NRVP. The funds are used to carry out research projects, studies (for example Cycle Monitor) and conferences. An increase to 5 million euros a year to implement the NRVP is provided for from the 2018 budget year.

On the other hand, the Federation is also committed to creating a safe, appropriate cycling infrastructure by building cycle paths on trunk roads and upgrading tow paths along federal waterways to make them suitable for cycling. Over the past three years, 220 million euros were invested in building 730 kilometres of cycle paths along federal trunk roads. About 17,150 kilometres of cycle paths along federal trunk roads are available for cyclists in Germany. The Federal Ministry of Transport and Digital Infrastructure provides 25 million euros annually to fund the construction of bicycle highways by the Länder and municipalities.

It is also the Federation's responsibility to create the normative framework for the further development of cycling, as necessitated by innovation or aspects of transport legislation.

Model investment projects in the field of cycling are also funded under the climate action through cycling competition, which is part of the National Climate Initiative and was launched by the Federal Environment Ministry. A total of 55 projects were approved by the end of 2017, with funding totalling about 77.5 million euros.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 (given ambitious implementation)	0.5 to 0.8
Contribution according to the latest estimate of experts	0.1

5.7.2.4 Promoting corporate mobility management

The German Government has decided to promote corporate mobility management, in other words making business-related travel more sustainable (commuting, vehicle fleets, business trips). In future, BMU and BMVI will support the development and implementation of strategies for this.

The kick-off event for the “mobil gewinnt” competition was held in Berlin on 15 May 2017. The closing date for entries was 15 October 2017. The prize-winners received their awards at a ceremony in Berlin on 13 December 2017. The 25 award-winning applications were recommended to BMVI with a view to funding their implementation. A BMVI funding guideline is the essential basis for this. It is currently being developed and coordinated.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Comprehensive quantification is not possible; average savings of 250 tonnes of CO ₂ per company per year were achieved under the "effizient mobil" programme.
Contribution according to the latest estimate of experts	0.04

5.7.2.5 Fuel-saving driving techniques (cars/HGVs)

The actual fuel consumption of cars and HGVs is decisively influenced by individual driving styles. A fuel-efficient driving technique reduces fuel consumption, which in turn reduces emissions of greenhouse gases. The German Government therefore decided to promote fuel-efficient driving. Courses on fuel-saving are one way of achieving this.

A research project was launched at the beginning of 2017 to design and evaluate specific measures to promote fuel-efficient driving. The first interim findings are expected in 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	0.4 to 0.8
Contribution according to the latest estimate of experts	No effect until after 2020

5.7.2.6 Car Sharing Act

Car sharing can help to reduce environmental pollution caused by private motor transport, especially in major centres of population.

The coalition agreement for the 18th legislative period includes the mandate to create possibilities for giving preferential treatment to car sharing. This involves creating the legal basis for designating special parking areas for car-sharing schemes and reducing or waiving parking charges for them.

To this end, the German Government drew up the Car-Sharing Act (Carsharinggesetz), which entered into force on 1 September 2017. It creates the conditions for municipalities to put in place appropriate preferential arrangements. This also necessitates a change to road traffic regulations. A draft ordinance to this effect is currently being discussed within the German Government.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.7.3 Increased use of electric drives in vehicles

In adopting the National Development Plan for Electric Mobility in 2009, the Energy Concept for an Environmentally Sound, Reliable and Affordable Energy Supply in 2010 and the Government Programme for Electric Mobility in 2011, the German Government underlined its plans to significantly expand the share of vehicles with electric drives in the road transport sector.

This is a crucial element in reducing CO₂ emissions in the transport sector in the medium and long term. The measures adopted under, and also subsequent to, the action programme to help electric mobility scale

up in the market include a broad package of measures to improve the enabling environment, address fiscal aspects and assure extensive promotion of research and development.

The Market Incentive Programme, adopted on 18 May 2016 and going beyond the decisions adopted in the Climate Action Programme 2020, provides an additional boost to electric mobility. Measures include, for example, the expansion of charging infrastructure through public funding totalling 300 million euros, direct support for purchases of battery-electric vehicles, hydrogen/fuel cell vehicles and plug-in hybrids (known as an environmental bonus), greater efforts in public procurement and grant tax advantages.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 (by achieving the target of one million vehicles in 2020 – significantly more after 2020. The reduction does not take additional emissions in the electricity sector into account.)	0.7
Contribution according to the latest estimate of experts The reduction given follows the convention of not including additional emissions in the electricity sector.	0.5 to 0.7

5.7.3.1 Tax incentives to promote electric mobility

Under the Climate Action Programme, the decision was taken to review the possibility of a special depreciation allowance for commercial electric vehicles. However, the review, which was carried out within the National Platform for Electric Mobility, showed that at this point in time the measure would result in only a relatively small increase in electric vehicles. In light of this, the Market Incentive Programme, which was adopted in 2016, contains changes to motor vehicle tax and income tax, in addition to a direct premium for purchasing electric vehicles.

The measures were implemented by the act on tax incentives to promote electric mobility in road transport (Gesetz zur steuerlichen Förderung von Elektromobilität im Straßenverkehr), which entered into force on 17 November 2016.

Pure electric vehicles that are registered for the first time from 1 January 2016 until 31 December 2020 are exempt from motor vehicle tax for five years. This tax exemption has now been retrospectively extended to 10 years starting on 1 January 2016. The 10-year tax exemption was also extended to vehicles that have undergone technically appropriate retrofitting to

convert them into pure electric vehicles, provided this has been carried out with a legal permit.

Under the Income Tax Act (Einkommensteuergesetz), benefits granted by an employer for charging a pure electric or hybrid electric vehicle on the premises of the employer or an associated company using a company-owned charging facility that is temporarily put to private use are exempt from tax (Article 3 (46) of the Income Tax Act). Employers also have the option of an income tax flat rate of 25 % on the benefits of monetary value from the transfer of a charging facility free of charge or at a reduced price and for grants for an employee's expenditure on purchasing and using a charging facility (Article 40 (2), 1st sentence, point 6 of the Income Tax Act). The new regulations are applicable from 1 January 2017 until 31 December 2020. They create an incentive for employers to become more involved in expanding charging infrastructure.

Under the Electricity Duty Act (Stromsteuergesetz), tax relief on electric-drive vehicles used in public transport entered into force on 1 January 2018. This is designed to promote electrification in public transport and therefore enhance air quality in towns and cities.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Measure based on the German Government's decisions on electric mobility of 18 May 2016.

-

Contribution according to the latest estimate of experts

Flanking measure

5.7.3.2 Charging stations

Increasing the use of electric vehicles depends on creating a sufficient number of charging facilities. Public funds to set up an appropriate charging infrastructure are being provided both at federal level and by the individual Länder.

The Federation supports a programme to install rapid charging infrastructure for electric vehicles with fast charging points at all motorway service areas – roughly 400. This will be done in the framework of existing agreements with the concessionaire (Autobahn Tank & Rast GmbH). By the end of 2017, some 300 service areas had been equipped with fast charging points. This was done in close collaboration with the Länder highways authorities. In response to the dynamic technological developments in electric mobility, the strategy was updated to accommodate a generation of fast charging

points with a charging capacity of 150 kW, which, since the middle of 2016, are being installed in service areas.

Electric mobility is also being promoted through a number of federal funding programmes, such as the showcasing electromobility programme (Schaufenster Elektromobilität), which has already ended, a model regions for electric mobility programme and the SLAM – Fast-charging network for axes and metropolises – research project, under which over 210 fast charging points have already been installed.

In the context of the package of measures for electric mobility from May 2016, the German Government decided to make additional funds of 300 million euros available to accelerate the expansion of the charging infrastructure on top of the other measures mentioned

above. The funding guideline on charging infrastructure for electric vehicles aims to advance the creation of a nationwide appropriate charging infrastructure for battery electric vehicles in Germany. The Federal Ministry of Transport and Digital Infrastructure will use this to fund the installation of at least 15,000 charging stations. The funds will break down into 100 million euros for normal charging facilities up to 22 kW and 200 million euros for fast charging facilities with a capacity of 22 kW and over.

The Charging Station Ordinance (Ladesäulenverordnung), which entered into force on 17 March 2016, creates binding standards for plugs for the charging infrastructure used for electric mobility. It also stipulates that the Bundesnetzagentur is responsible for compliance with the technical specifications and for registering all publicly accessible charging points in a reliable register. The first amendment to this ordinance will fully implement all other requirements set out in EU Directive 2014/94/EU, including ensuring that electric vehicle users can recharge on an ad-hoc basis

without a contract with the electricity supplier. The aim is to ensure that there are no technical or legal obstacles to charging electric vehicles throughout the EU. The EU directive stipulates that operators of charging points accessible to the public must ensure that electric vehicle users can recharge on an ad hoc basis without having a long-term contract with the electricity supplier or being obliged to enter into one in the future. The Charging Station Ordinance thus regulates access details and also the authentication procedures needed for cashless payment.

Operators of charging infrastructure and final consumers are treated equally under the Electricity Market Act (Strommarktgesetz). This creates legal clarity with regard to operators' energy-related obligations. Furthermore, a provision will be created in electricity tax legislation, according to which anyone who exclusively supplies electricity for which tax has been paid to electric vehicles will not be treated as a supplier as defined in electricity tax legislation and therefore is not subject to the obligations of a supplier.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.7.3.3 Field trial on electric drives in heavy commercial vehicles

So far, one of the obstacles to more widespread use of electric heavy commercial vehicles has always been their limited battery capacity, which reduces the vehicles' range. However, a number of HGV manufacturers have announced their plans to launch heavy commercial vehicles with battery-electric drive on the market over the next few years. The obstacles mentioned above mean that their use will be restricted to local delivery services.

Combining fast-charging batteries with overhead contact line sections to recharge the batteries when the vehicle is being driven will considerably expand the range of uses for electric drives. A field trial will test this combination of battery-powered HGVs and an overhead contact line section under realistic conditions over several years.

The field trial will take place at the following three locations: the A1 motorway in Schleswig-Holstein (Hamburg – Lübeck), the A5 motorway in Hesse (Frankfurt/Main – Darmstadt) and trunk road B 462 in Baden-Württemberg (Kuppenheim – Gernsbach). Funds to install the necessary infrastructure have now been approved for all three locations. The aim is to equip a 10-kilometre stretch of road at each location with an overhead contact line. The German Government expects construction of the installations to be completed by the end of 2018 in Hessen, by mid-2019 in Schleswig-Holstein and by the end of 2019 in Baden-Württemberg, and that the field trial at all three locations will be able to start immediately afterwards. The field trial will include logistics companies using the infrastructure in their daily operations and documenting their experience with it.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.7.3.4 Procurement campaign for electric vehicles – information campaign

In addition to measures that directly promote the purchase or use of electric vehicles (see Sections 5.7.3.1 to 5.7.3.3 and 5.7.3.5), there are also plans to increase the visibility of electric mobility by using electric vehicles in the public sector's vehicle fleet. The aim is that at least 20 percent of the Federation's vehicle fleet will have electric drives (electric vehicles) in future.

An information pack on procurement of electric vehicles put together by the Alliance for Sustainable Procurement has been available since the beginning of 2016. The German Government also organises information events to support the responsible organisational units within public agencies.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.7.3.5 Purchase premium for electric vehicles

Along with its decision to introduce an additional market incentive programme to promote electric mobility, the German Government also adopted a draft guideline to promote sales of electric vehicles (environmental bonus) in May 2016. This was published in the Federal Gazette (Bundesanzeiger) on 1 July 2016. The environmental bonus will help to accelerate the market penetration of electric vehicles.

A premium of 4,000 euros for fully electric vehicles and 3,000 euros for plug-in hybrids is paid, half of which is

financed by the automotive industry and half by the German Government. To be eligible for funding, the vehicle's net list price (for the basic model) must not exceed 60,000 euros. Private individuals, businesses, foundations, corporations and associations are eligible to apply for the premium when registering a new vehicle. Funding applications can be made for purchase and leasing agreements dated 18 May 2016 or later. From 2 July 2016, they may be submitted online to the Federal Office for Economic Affairs and Export Control (BAFA).

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Measure based on the German Government's decisions on electric mobility of 18 May 2016.	-
Contribution according to the latest estimate of experts The reduction does not take additional emissions in the electricity sector into account.	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 has also set itself the goal of contributing to more efficient, environmentally sound, socially acceptable and therefore generally more sustainable mobility in its own sphere of responsibility. The main features of its mobility management strategy are measures such as:

- Information,
- Communication
- Motivation,

- Coordination and service, and
- Financial incentives.

This will also include the development of a standardised and certified procedure for planning, implementing and evaluating mobility management measures.

A project carried out by the German Institute of Urban Affairs (Difu) to provide technical support for implementation of the Climate Action Programme 2020 and Climate Action Plan 2050 in the transport sector began in early 2017. In 2018, it will develop a guidance document on sustainable mobility in the federal public administration based on an online survey of federal agencies, carefully targeted interviews with experts from different federal agencies and three practical workshops.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	0.15 to 0.3
Contribution according to the latest estimate of experts	No effect before 2020

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

By comparison with other fuels, natural gas and liquefied gases have a better carbon to hydrogen ratio, which means that they can cut emissions of CO₂ from vehicles. For that reason, the tax concessions for both types of gaseous fuel have been extended beyond 2018 under the Second Act Amending the Energy Tax Act and Electricity Duty Act (Gesetz zur Änderung des Energiesteuer- und des Stromsteuergesetzes sowie zur

Änderung des Luftverkehrsteuergesetz). The tax concession for liquefied gas expires in 2022, that for natural gas in 2026. The concessions will be gradually reduced each year starting in 2019 for liquefied gas and in 2024 for natural gas.

The Bundestag and Bundesrat (lower and upper house of parliament) adopted the draft of the Second Act Amending the Energy Tax Act and Electricity Duty Act. It entered into force on 1 January 2018.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	0.25
Contribution according to the latest estimate of experts	0 to 0.25

5.7.5 Mitigation measures in air transport

5.7.5.1 Single European Sky (SES)

The aim of the Single European Sky programme, which has been running since 2004, is to create a uniform and above all harmonised European airspace. This was triggered by the liberalisation of aviation in the 1990s and the rising passenger numbers which were foreseeable then. The creation of a harmonised airspace in Europe is also seen as an opportunity to bring about improvements in fuel consumption and thus ultimately help to mitigate climate change.

5.7.5.2 CO₂ standard for aircraft

The ICAO's CO₂ emissions standard for aircraft is scheduled to enter into force for new aircraft type designs in 2020 and for aircraft type designs in production in 2028. Certain transitional rules will apply from 2023.

5.7.5.3 Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)

CORSIA is a global market-based scheme, adopted by ICAO in 2016, which aims to bring about carbon neutral growth in international air traffic from 2020 onwards.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	Not quantifiable
Contribution according to the latest estimate of experts	No reduction effect until after 2020

5.7.6 Supporting climate change mitigation in international maritime transport

Currently, international maritime transport does not count towards meeting national reduction targets for greenhouse gas emissions. However, since it contributes to global greenhouse gas emissions, the German Government's Climate Action Programme 2020 also includes measures in this sector. However, no estimates are available of the reduction effect of these measures in 2020.

5.7.6.1 Monitoring and reporting

A key element of this measure is implementation of Regulation (EU) 2015/757 on the monitoring, reporting and verification of carbon dioxide emissions from maritime transport (MRV Regulation) from 2018, and support for the introduction of a system to monitor CO₂ emissions from shipping from 2019 by the International Maritime Organization (IMO). A proposal by the European Commission to revise the MRV Regulation in light of the Data Collection System adopted by the IMO is expected in 2018.

Furthermore, the German Government is strongly advocating within the IMO to ensure that its (IMO's) sector-specific strategy to reduce greenhouse gas emissions from international shipping is geared towards the targets of the Paris Agreement and that maritime transport makes an appropriate contribution to reducing global greenhouse gas emissions.

5.7.6.2 Alternative fuels and LNG

The second measure in international maritime shipping focuses on alternative fuels to replace the relatively emissions-intensive use of oil-based fuels. The aim here is to promote climate-friendly alternative fuels. The first step is to support the demand for liquefied natural gases (LNG) and methane. The Federation will lead by example in equipping its own ships. The first project is to equip Atair II, a new vessel under construction for the Federal Maritime and Hydrographic Agency, with an LNG dual-fuel propulsion system. The ship carries out research, surveys and wreck search operations. The keel laying ceremony took place on 15 December 2017.

The customs authority is planning to build a new LNG-powered ship. The invitation to tender for this was issued in the second half of 2017. The invitation to tender for the preparation of the technical tender documents for the construction of the vessel, the review of drawings and supervision of construction has already been published.

The funding guideline for equipping and retrofitting maritime vessels with LNG propulsion systems and the first call for funding applications were published at the end of 2017.

The long-term aim is to bring about a shift in energy supply for shipping, making it greenhouse gas neutral and based on renewable energy sources.

5.7.7 Other measures in the transport sector

With the Climate Action Programme 2020, the decision was taken to continue endeavours to reduce emissions in the transport sector on an ambitious scale. Most of the measures under this programme will continue to contribute to reducing greenhouse gas emissions beyond 2020, some will begin to have a greater effect after 2020.

However, further measures will be needed if the transport sector is to make an appropriate contribution to achieving the German Government's reduction targets

for 2030. Decisions on these measures were taken when the Climate Action Plan 2050 was adopted on 14 November 2016.

The imminent programme of measures for 2030 will deliver further contributions.

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

The measures in the industry field of action, which were adopted by the German Government in its Climate Action Programme 2020, cover principally the following areas:

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

The package of measures in this field of action does not include any designed to reduce energy-related emissions in industry or the trade, commerce and services sector. Any measures of this kind that were adopted by the German Government under the Climate Action Programme 2020 or the National Action Plan on Energy Efficiency will be discussed in Section 5.5.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	2.5 to 5.2
Contribution according to the latest estimate of experts (Up to 1.2 million tonnes of CO ₂ equivalent as a result of lower fertiliser production)	1.3 to 1.8

5.8.1 Strengthening waste avoidance, recycling and reuse

Achieving short- and long-term climate targets depends not only on an efficient and low-carbon supply of energy but also on the sound management of available resources, their efficient use and optimum recycling. Waste avoidance and recycling are therefore key strategies in resource conservation, while also making a significant contribution to reducing greenhouse gas emissions.

The Commercial Waste Ordinance (Gewerbeabfallverordnung) has now been amended. Its most important elements entered into force on 1 August 2017, and it will enter fully into force on 1 January 2019. The Packaging Act (Verpackungsgesetz) of 5 July 2017 will also enter into force on 1 January 2019, replacing the current Packaging Ordinance (Verpackungsverordnung). Dialogue processes and research projects are currently being carried out to implement the Waste Prevention Programme of the German Government and the Länder with a view to revising it in 2019.

Special attention will also be paid to promoting the sustainable design and use of products. The German Government is working to achieve this at European level within the framework of the Ecodesign Directive for energy-related product groups. Another possible, more far-reaching approach supported by the German Government is to increase the intensity of use of a wide range of products. Although the main aim of this is to help optimise resource consumption, it also reduces the use of energy and natural resources, which in turn cuts greenhouse gas emissions.

Consumer information at European and national level will also be enhanced, for example with regard to the shelf life of products, operating instructions and information about repairs. Social innovations for sustainable consumption also offer potential for increasing re-use and shared use of products.

A competence centre set up by the German Government at the Federal Environment Agency (UBA) in March 2017 coordinates the National Programme for Sustainable Consumption with the involvement of all federal ministries and their subordinate authorities. It is structured in a way that is designed to drive forward sustainable consumption as a joint activity in which the entire federal Government participates and to create an institutional basis to enable this. The overarching objective is to make sustainable consumption a permanent issue in public awareness, to support a professional exchange between all stakeholders in society and to promote synergies in the implementation of the National Programme for Sustainable Consumption. The National Sustainable Consumption Network was set up in January 2017 as a societal platform. The Sustainable Consumption Competence Centre is the central contact point for the national network and supports its activities. The network's key tasks include intensifying

the cross-cutting and practice-oriented dialogue on the national programme and the approaches and proposed measures set out in it, strengthening the involvement and cooperation of relevant societal stakeholders in the implementation process, mobilising commitment, resources and capacities of stakeholders to implement the programme, and identifying funding opportunities. The second network meeting with over 120 stakeholders took place in December 2017. UBA has now developed teaching materials and information pages on its website to help implement the programme:

→ www.umweltbundesamt.de/umwelttipps-fuer-den-alltag

→ www.umweltbundesamt.de/themen/wirtschaftskonsum/umweltfreundliche-beschaffung

Other websites with information include:

→ www.ecodesignkit.de/home-willkommen

→ www.siegelklarheit.de/home#textilien

Networks and platforms address the topic of sustainable products in the context of ProgRes (German resource efficiency programme) and thus in terms of resource conservation. An example of this is the National Resource Efficiency Platform (NaRes) the last meeting on 21 September 2017 also dealt with sustainable consumption.

On 3 April 2017, the second ProgRes implementation workshop took place. It looked at ways of improving resource efficiency in consumption with the particular aim of making sustainable consumption an integral part of resource policy. Follow-up activities on this workshop are being considered.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	1.85
Contribution according to the latest estimate of experts	0.99 to 1.5

Under the EMAS Regulation (Eco-Management and Audit Scheme) European Commission was tasked with producing sectoral reference documents that contain guidance and examples of best practice for reducing non-energy-related emissions from the manufacturing and service industries and the public sector. The experience of German companies and industry associations was fed into the stakeholder processes that were carried out to develop the reference documents. To date, reference documents have been published for the retail trade, tourism and the food and beverage manufacturing industry. Others have been completed for agriculture, the construction industry and public administration. Internal improvement processes within a company that are part of an environmental

management system can achieve considerable greenhouse gas savings. All available environmental declarations made by German companies could be used to quantify savings achievements. The possibility of carrying out studies/surveys to this end is being reviewed.

5.8.2 Reducing F-gas emissions

Since fluorinated gases are also greenhouse gases and have a far higher greenhouse gas potential than carbon dioxide, the German Government also adopted decisions under its Climate Action Programme 2020 that focus on reducing these climate-damaging gases.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	0.6
Contribution according to the latest estimate of experts	0.29

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

The legal benchmarks for reducing fluorinated gases are set by EU legislation – the F-Gas Regulation (No 517/2014). However, the provisions of the F-Gas Regulation will not produce their full effect until after 2020, which is outside the time frame of the Climate Action Programme 2020. German Government's decision in connection with the Climate Action Programme was therefore aimed at taking appropriate action in order to achieve a positive effect before 2020. They essentially include preparatory and flanking measures to ensure effective implementation of the EU F-Gas Regulation ahead of schedule. In particular, technological developments and planning decisions are to be strengthened in order to avoid lock-in effects that would in turn jeopardise medium- and long-term climate targets. The focus here is primarily on:

- Preparing the technical bases for the areas of application for natural refrigerants
- Enhancing the technical advice provided by specialist companies to planners, investors and operators, and

- Providing training and continuing professional development opportunities for technical staff.

A project to develop an internet portal on climate-friendly refrigeration was commissioned in mid-2017. The portal went live at the beginning of 2018. It gives operators of refrigeration systems the opportunity to access impartial information about alternatives to fluorinated refrigerants.

The eco-label UZ 59b Omnibusse, which was adopted in December 2017, calls for air-conditioning systems with natural refrigerants starting on 1 January 2020.

The National Climate Initiative's project to promote natural refrigerants in the food retail trade and in heat pumps aims to provide impetus for updating technical standards (adaptation of maximum permissible charge size for flammable refrigerants to real-life scenarios) and for making more widespread use of flammable refrigerants.

Another project plans to address the increased and safer use of hydrocarbons refrigerants in household heat pumps, to work towards publishing by 2020 guidelines

for the use of hydrocarbons in heat pumps and to drive forward the adaptation of the relevant technical standards. This project aims not only at reducing F-Gas

emissions in compliance with the F-Gas Regulation; it is also extremely important for achieving climate targets in the building sector (energy and heat transition).

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 incl. the funding programme on commercial refrigeration and air conditioning systems (see Section 5.8.2.2)	(0.6)
Contribution according to the latest estimate of experts	0.2

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

Refrigeration and air-conditioning equipment can emit F-gases that have an impact on the climate. It is therefore the stated aim of the funding programme for refrigeration and air conditioning systems, which existed before the German Government adopted the Climate Action Programme 2020, to promote systems which either do not use climate-damaging F-gases or those which switch to F-gases that do not damage the climate.

With the Climate Action Programme 2020, the decision was taken to continue the funding guideline under the National Climate Initiative and to review the possibility of increasing available funding, of integrating an advisory component into the funding guideline and

of expanding its scope from stationary systems only to include mobile applications.

Since 1 January 2017, funding has been based on the amended refrigeration and air conditioning guideline of 1 December 2016.

Initial experience with the amended guideline indicates that some modifications to the eligibility criteria and funding coefficients are required. The underlying process was started in June 2017 and should be completed by the beginning of 2018 with a new (minor) amendment to the guideline. This will include, for example, the possibility of funding for evaporative cooling systems. Funding for mobile cooling systems – for buses and trams, for example, or for refrigerated transport applications – is also being reviewed in this context.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 Including implementation of the EU F-Gas Regulation (see Section 5.8.2.1)	(0.6)
Contribution according to the latest estimate of experts	0.09

5.8.3 Increasing resource efficiency

Considerable amounts of greenhouse gases are released during the extraction, transport, processing, the use in production and goods and the recycling of raw materials. This is, on the one hand, due to the energy used in the stages mentioned above and, on the other, to the fact that greenhouse gases are directly released during the processing of raw materials. Added to this is the fact that, due to high demand, some raw materials are increasingly being extracted from complex deposit sites with low concentrations of raw materials

and mineralogical characteristics that pose technological challenges. This may necessitate extraction practices that are particularly energy and greenhouse gas intensive. This could, however, be mitigated by increasing resource efficiency. Thus, the sound management of resources (for example sustainable supply chains, material savings in production or closed material cycles) plays an important role in climate change mitigation.

Since 2009, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has

commissioned the work of a resource efficiency competence centre. The contract was awarded to the VDI Centre for Resource Efficiency in 2009, 2012 and 2015. The competence centre produces studies and information material on resource efficiency and advises SMEs. The idea is to promote the idea in German industry and make a contribution to climate change mitigation. The advisory services for SMEs are to be expanded.

The synergies between resource efficiency and climate action will also be further explored in research projects. This will make it possible to illustrate more clearly how resource efficiency contributes to climate change mitigation and to identify and exploit additional potential.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.9 Waste management and circular economy measures; other emissions

Under the anaerobic conditions usually found in landfills, the biogenic carbon in waste is converted into methane, which is released into the atmosphere. Methane is a greenhouse gas that has a far higher global warming potential (GWP) than carbon dioxide. The formation of methane can be prevented by taking appropriate measures to adequately aerate the landfill, so that carbon dioxide that is biogenic in origin and therefore greenhouse-gas-neutral is emitted instead.

As part of the above-mentioned revision of the Local Authorities Guideline in connection with the Climate Action Programme 2020, funding was expanded, and the deadlines for applications were initially extended until 2018. Eight applications for funding were submitted in 2017.

5.9.1 Aeration of landfills to reduce methane emissions

Given the positive results of the measure to aerate landfills that was funded before the German Government adopted the Climate Action Programme, the Local Authorities Guideline, which is part of the National Climate Initiative (see Section 5.6.6.2) and funds climate action in municipalities, was revised in 2015. A total of 19 applications for funding were submitted in 2015 and 2016, and another eight were received in 2017. The original target of aerating about 120, for the most part larger, landfills, does not now seem achievable.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.5 to 2.5
Contribution according to the latest estimate of experts (It is currently estimated that, due to delayed implementation, a reduction effect is not expected until 2020.)	0.16

5.10 Agriculture

One of the aims of the German Government's sustainable development strategy is to reduce the nitrogen surplus on agricultural land in the total balance to 70 kilogram nitrogen (N) per hectare (ha) per annum. The measures adopted under the Climate Action Programme 2020 serve to achieve this goal and thus reduce non-CO₂-emissions in agriculture (nitrous oxide – N₂O). This will actually help to reduce N₂O and CO₂ emissions in industry since, based on the source principle used in greenhouse gas reporting, the energy used to produce fertiliser and the CO₂ emissions and diffuse N₂O emissions associated with that are accounted for in industry not in the agricultural sector

The corresponding transport emissions would also be avoided.

In terms of the calculations of greenhouse gas reductions in the agriculture sector, it is important to note that they are based on reductions in CO₂ equivalent as at December 2014, which were determined using the emission factors for nitrous oxide valid for international reporting at the time. Since they have now been adjusted, resulting in sometimes considerable differences in reduction figures, the estimates as at December 2014 are shown twice, one figure based on the old calculation system, the other on the new method.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent		
	Old method	New method: IPCC 2006
Contribution envisaged under the Climate Action Programme as at December 2014	3.6	2.2
Contribution based on the latest estimate of experts using the IPCC method from 2006	0.6 to 2.2	

5.10.1 Amendment to the Fertiliser Application Ordinance

The use of nitrogen-containing fertilisers is the main source of nitrous oxide emissions (N₂O). These fertilisers cause both direct and indirect emissions. Nitrous oxide is released directly from fertilised soil and indirectly as a result of reactive nitrogen compounds (gaseous ammonia losses and nitrate leaching in water bodies) from agricultural sources. The production of

mineral fertilisers is also energy intensive and causes high levels of greenhouse gases emissions.

The fertiliser legislation, which was amended in 2017, aims to reinforce appropriate use of fertiliser and resource-efficient use of nitrogen. The amended Fertiliser Application Ordinance (Düngeverordnung) was adopted by the Bundesrat (upper house) on 30 March 2017 and entered into force on 2 June 2017.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent		
	Old method	New method: IPCC 2006
Contribution envisaged under the Climate Action Programme as at December 2014	3.3	2.0
Contribution based on the latest estimate of experts using the IPCC method from 2006 Depends on the specifics of how the Fertiliser Application Regulation is implemented.	0.5 to 2.0	

5.10.2 Increasing the percentage of land used for organic farming

Expanding the amount of land that is organically farmed also reduces greenhouse gas emissions, especially since organic farming does not use mineral nitrogen fertilisers or chemical pesticides and buys in less animal feed than conventional farming. The German Government's sustainable development strategy states that 20 percent of agricultural land should be organically farmed in future.

With its Climate Action Programme 2020, the German Government decided to continue to focus on the details of how to promote organic farming. This

is to be implemented at Länder level within the strategic plan of the Joint Task for the Improvement of Agricultural Structures and Coastal Protection (GAK) and the Federal Organic Farming Scheme and other Forms of Sustainable Agriculture (BÖLN).

The Federal Ministry of Food and Agriculture introduced a strategy for the future of organic farming in 2017 with the aim of further strengthening organic farming in Germany and helping to increase the amount of organically farmed land.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent		
	Old method	New method: IPCC 2006
Contribution envisaged under the Climate Action Programme as at December 2014	0.3	0.2
Contribution based on the latest estimate of experts using the IPCC method from 2006	0.12 to 0.24	

5.11 Land use, land use change and forestry

Although CO₂ emissions from agricultural land and CO₂ sinks are not counted in national greenhouse gas emissions and are therefore not included in the evaluation of progress towards achieving the targets set in the Climate Action Plan 2050, this sector nevertheless offers considerable potential for reducing the amount of greenhouse gases released as a result of land use and land-use changes.

For this reason, the European Council adopted a decision in December 2014 that emissions in this sector will in future be included in climate targets. To this end, the European Commission proposed on 20 July 2016 to create a separate legal text to include the land use, land use change and forestry sector (LULUCF) in the EU greenhouse gas reduction framework (LULUCF

Regulation). This regulation defines accounting rules, which take into consideration the natural fluctuations that occur in this sector and introduces uniform reference levels to be used by all EU member states in determining greenhouse gas emissions and removals. Each EU member state compares the actual removal of CO₂ by forests and soils with the reference levels set out in the Regulation. A reduction in the amount of CO₂ removed by comparison with the reference levels results in debits, an increase in credits. The member states have to ensure that their account balance does not show more debits than credits. A surplus of debits has to be offset by additional climate action within the land-use sector or in other sectors that are not part of the emissions trading system.

In terms of the figures for greenhouse gas reductions in the land use, land use change and forestry sector, it is important to note that they are based on reductions in CO₂ equivalent as at December 2014, which were determined

using the emission factors valid for international reporting at the time. Since they have now been adjusted, resulting in sometimes considerable differences in

reduction figures, the estimates as at December 2014 are shown twice, one figure based on the old calculation system, the other on the new method.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent		
	Old method	New method: IPCC 2006
Contribution envisaged under the Climate Action Programme as at December 2014	2.5 to 5.4	2.5 to 4.4
Contribution based on the latest estimate of experts using the IPCC method from 2006	1	

5.11.1 Conserving permanent grassland

When permanent grassland is ploughed up, soil organic matter is lost along with the carbon held in it, which is released as CO₂. Furthermore, the increased mineralisation of the soil organic matter causes nitrogen to be released, which in turn causes nitrous oxide emissions. Another aspect is important here: ploughing up permanent grassland releases far greater quantities of greenhouse gases far more rapidly than newly created grassland can remove them.

The German Government and the Länder advocated conserving permanent grassland in the implementation of the decisions taken under the Common Agricultural Policy in 2013 and made it a priority in fleshing out the details of agro-environmental measures and climate action at Länder level.

Within the current negotiations on the future and further development of the Common Agricultural Policy (CAP) after 2020, the German Government is also supporting the European Commission in working towards strengthening CAP's contribution to climate and environmental targets. Germany is advocating for CAP's contribution to climate change mitigation, nature conservation and environmental protection to become more ambitious. It is likewise important to ensure that the contributions of the agricultural sector to climate change mitigation, environmental protection and conservation of biodiversity and natural resources receive greater recognition. Conserving permanent grassland will play a decisive role in this.

The recently observed trend towards a stabilisation of permanent grassland in absolute terms is reaffirmed by currently still provisional data for the year of application 2017.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent		
	Old method	New method: IPCC 2006
Contribution envisaged under the Climate Action Programme as at December 2014	1 to 2	1
Contribution based on the latest estimate of experts using the IPCC method from 2006	1	

5.11.2 Protection of peatlands

Raising the water level in peatlands, usually by rewetting, has a number of positive effects. For example, reinstating their carbon storage function significantly reduces the greenhouse gas emissions that occur when peatlands are drained, while also having additional

positive effects on the water balance, nature conservation and biodiversity.

Rewetting farmed land usually requires a change in use. On the one hand, the land becomes less trafficable and the commercially usable species change (reeds and water buffalo instead of cereals and dairy cattle) but, on

the other hand, the long-term prospect of CO₂ being stored in the soil improves as there is less loss of organic soil matter. The impact on productivity and on the CO₂-balance, including that of products, must be reviewed on a case-by-case basis.

The German Government is therefore working with the Länder on the common goal of reaching an agreement to this effect based on a position paper of November 2012 by the Federal/Länder Working Group on Nature Conservation, Landscape Management and Recreation (LANA).

It must be stressed that implementation of peatland conservation programmes is the responsibility of the Länder. However, measures that are implemented under the Joint Task for the Improvement of Agricultural Structures and Coastal Protection (GAK) in line with its strategic plan and can contribute to peatland conservation are jointly financed by the Federation and the Länder.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014 (Assumption: 5% of the total surface area of peatlands to be rewetted)	1.5 to 3.4
Contribution according to the latest estimate of experts (Conservative estimate because the data situation is uncertain)	Cannot currently be quantified

5.12 Leading by example

Climate action must also be reflected in the activities of the public sector. Thus, the Federation has set itself the goal of leading by example in implementing measures. This applies in particular to:

→ The sustainable procurement of products and services (see Section 5.12.1),

→ The German Government's programme of sustainable development measures (see Section 5.12.2) and

→ Exploring the possibility of abolishing climate-damaging subsidies (see Section 5.12.3).

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014 The measure concerned with drawing up energy-efficient refurbishment roadmaps the public sector accounts for. This is counted towards climate-friendly building and housing (see Section 5.6).	0.3 to 2.0 0.1 to 1.7
Contribution according to the latest estimate of experts	No contribution is expected to be made before 2020

5.12.1 Public procurement: strengthening the Centre of Excellence for Sustainable Procurement and the Alliance for Sustainable Procurement

The possibility of taking sustainable development criteria into account was strengthened as part of the reform of public procurement legislation. The new regulations applied above the EU thresholds from 2016 and

below them from 2017. Qualitative, environmental and innovative aspects can be taken into account in each phase of a contract award procedure – from the tender specification, criteria for selecting and awarding the contract through to contract performance conditions. Furthermore, the Ordinance on the Award of Public Contracts (Vergabeverordnung) contains special provisions on the procurement of road vehicles and energy consumption-related deliveries and services.

The Centre of Excellence for Sustainable Procurement was created within the Procurement Office of the Federal Ministry of the Interior in 2012. It acts as a central advisory and information centre on all matters relating to sustainable procurement for all contracting authorities (i.e. procurement practitioners) at federal, Länder and local authority level.

It continues to record a high number of visits to its internet platform, and a commissioned development of the website will improve information on environmental matters and other aspects relevant to sustainable development.

Sustainable development criteria gained a higher profile within contracting authorities after the criteria were strengthened during the reform of public procurement legislation in 2016. This was reflected in the high demand for the training courses organised by the Centre of Excellence, which received excellent feedback from public bodies and procurement officers. However, the Centre does not have the personnel capacity to

deliver the training on the wide scale needed. Additional human resources are required here.

By strongly promoting the inclusion of sustainable development aspects in procurement in civil service training curricula (Hochschule des Bundes für öffentliche Verwaltung), the Centre aims to consolidate the principle of sustainable development in public administration. To a certain extent, this is also being done at Länder level.

The German Government is also developing a phased plan for sustainable textile procurement, which will be published in 2018. The Federal Environment Agency's website has a wide range of information and guidance documents on specific products and product groups to support public contracting officers in purchasing environmentally sound products.

The German Government's programme of sustainability measures sets out the requirements for federal procurement (see 5.12.2).

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	0.2 to 0.3
Contribution according to the latest estimate of experts (Contrary to the 2014 estimate, this measure is regarded as a flanking measure due to overlap effects.)	Flanking measure

5.12.2 The German Government's sustainability measures programme

With its sustainability measures programme, the German Government is seeking to make the activities of its own administration more sustainable. The programme applies to all Government bodies and agencies that are directly part of the federal public administration. It includes climate action measures as a way of helping the federal public administration to become climate neutral.

The 2016 monitoring report on the programme of sustainability measures was published on 24 April 2017 (implementation status of the measures as at 31 December 2016). It identifies progress on individual measures but also flags up urgent need for action, especially with regard to collecting energy data for all civilian federal properties, preparing energy-efficient

refurbishment roadmaps for federal properties, introducing LUMASPlus and EMAS (environmental management systems) in other federal properties and implementing targets for sustainable procurement, especially regarding the energy efficiency of the vehicle fleet.

In 2016, the CO₂ emissions from federal buildings totalled 0.47 million tonnes according to existing energy data. For those belonging to the Federal Ministry of Defence, the total was 1.08 million tonnes, which already meets the target for 2020.

The process of collecting, reviewing and analysing energy data for the Government's civil buildings has not yet been completed and is currently being developed further. In the area of mobility, the recording of CO₂ emissions from business trips (air, road and rail) has been extended to cover almost all Government bodies

and agencies that are directly part of the federal public administration. Emissions in 2016⁸ totalled 265,415 tonnes of CO₂ equivalent. Portions of business trips taken in taxis or private cars were not included. Emissions from military vehicles were not taken into account, in contrast to enforcement trips, for example by the customs authorities.

Flights, including those of the Special Air Mission Wing, accounted for over 80 percent of emissions of CO₂ equivalent. Emissions from air travel were 2.9 percent up on the previous year. The reason for this was the higher proportion of inter-continental air traffic.

As a result of the improved and more extensive data set that was achieved for the reporting period, it is not yet possible to draw any conclusions about trends in emissions from operating the car fleets.

The processes for collecting data on offsetting emissions as stipulated under the Climate Action Programme 2020 and the programme of sustainability measures have been synchronised to reduce the work involved.

Acquisition and withdrawal of offsetting certificates for emissions in 2016 have been completed in 2017. Emissions in 2017 will be offset in 2018.

The Federal Ministry of Transport and Digital Infrastructure is currently testing the introduction of a mobility management scheme in the federal public administration, for whom it is also preparing a guidance document.

The aim that over ten percent of newly purchased or leased motor vehicles should have a maximum emission value of 50 Gram CO₂ per kilometre was not achieved in 2017. The available data indicated that around four percent achieved that target. Overall, about 40 Government authorities have not yet achieved the 10-percent target.

Although IT services continue to rise, the energy consumption by IT operations in federal Government departments fell considerably once more. Consumption was 353 GWh in 2016 and 344 GWh in 2017.

In its 2017 environmental declaration, the Federal Environment Agency was the first federal authority in Germany to announce its plan to become greenhouse gas neutral. This will involve the following fields of action: buildings, mobility, procurement, and contracting and events.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014

Contribution according to the latest estimate of experts

Flanking measure

5.12.3 Climate-damaging subsidies

Climate-damaging subsidies can create undesired incentives that are an obstacle to reducing greenhouse gases. Abolishing this kind of misdirected subsidy can harness reduction potential while also creating financial flexibility.

The Kyoto Protocol calls for the abolition of any subsidies that hinder the reduction of greenhouse gas emissions. The heads of Government of the Group of 20 leading industrialised countries and emerging economies (G20) therefore committed to gradually phasing out inefficient subsidies for fossil fuels.

The federal cabinet adopted the Government's 26th subsidy report on 23 August 2017. Under the guidelines on subsidy policy, all subsidies are subject to a sustainability assessment. This is based on the German Sustainable Development Strategy, revised 2016 version, which was adopted by the federal cabinet on 11 January 2017. The Sustainable Development Strategy was adapted, making it more international in orientation and in particular geared to the UN's 2030 Agenda and its Sustainable Development Goals (SDGs). The sustainability assessment under the subsidy report concentrates on reviewing the long-term economic, environmental and social impacts of subsidies. On the one hand, the long-term effects of a subsidy are considered

⁸ The figures for 2017 are not yet available and are expected during the 2nd quarter of 2018.

in terms of climate change mitigation and resource conservation, for example, and, on the other hand, the potential threat to Germany's ability to compete internationally and its value as an attractive business

location are considered and possible conflicts of interest identified. The German Government's next subsidy report will be published in 2019.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014	It is not possible to make an estimate.
Contribution according to the latest estimate of experts	

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

The public sector must lead by example in taking climate action, especially with regard to the buildings it uses. It sends out a signal regarding the use of residential buildings and increases the acceptance for refurbishment activities in the non-residential building sector, which in turn encourages a more widespread implementation.

In light of this, greater efforts will be undertaken to tackle energy efficient refurbishment of public buildings in line with the decisions taken under the Climate Action Programme 2020.

In principle, all public property, whether at federal, Länder or local level, should set an example in this way. The first step in this direction is to draft an energy-efficient refurbishment roadmap for properties owned

or used by the federal public administration. The second step would involve using the results to do the same for properties owned or used by the Länder or local authorities.

The German Government is currently working on the roadmap for federal properties. On the basis of the draft, the first specific energy concepts for properties are being drawn up and evaluated. They will form the basis for planning the refurbishment work, which will be carried out once cost-effectiveness is proven. The buildings that have already been assessed under this scheme have a better energy performance than was assumed when estimating potential savings in 2013/2015. In light of this, it is becoming apparent that the targets set by the German Government will not be achieved. Further efforts are being made to continue driving forward the operational implementation of cost-effective energy-efficient refurbishment measures.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 To Climate-friendly building and housing strategy (see Section 5.6)	0.1 to 1.7
Contribution according to the latest estimate of experts (The current implementation status indicates that the measure cannot be expected to have any additional reduction effects before 2020.)	No contribution before 2020

5.12.5 Implementation of sustainability assessment systems also at Länder and local level

The aim of introducing sustainability assessment systems is establishing a more comprehensive evaluation of buildings over their entire life cycle and also considering climate-relevant factors at both federal and Länder level.

In 2017, a number of consultations with representatives from the building authorities of different Länder

(for example Berlin, Baden-Württemberg, Schleswig-Holstein) were carried out. The aim was to provide support in setting up both structures for carrying out sustainability assessments of any construction projects at Länder level and bodies for checking compliance. Cooperation within a pilot project on sustainably building schools in Berlin, in which three schools participated, also took place in 2017. An exchange of experience at the sustainable building round table was also further consolidated with a meeting in May and December 2017.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014 To Climate-friendly building and housing strategy	Flanking measure
Contribution according to the latest estimate of experts	

5.13 Research and development

The German Government will continue to endorse the strategy that scientific research and its findings lead to new ideas, innovations and ways of working towards a society and economy that are greenhouse gas neutral – both now and in the future.

It is of particular importance that research addresses not only the technical issues and challenges of the energy transition (see Section 5.13.1) and the urban development and buildings sector (see Section 5.13.4), but also explores socio-ecological issues (see Section 5.13.3) and ways of mitigating climate change and adapting to its consequences (see Section 5.13.2).

Furthermore, the findings of ministry-funded research, such as those of the Federal Environment Agency, which is a scientific agency and federal institution with

a research and development remit, provide important foundations for the German Government to base its decisions on in the field of climate change mitigation and adaptation.

Overall, research on the climate system, climate change mitigation and adaptation in Germany is supported by a diverse, highly structured institutional research system, consisting of federal authorities and research institutes, universities, cooperative institutions and research companies. They collect climate data, observe climate trends, model the climate and make projections and forecasts concerning impacts of climate change. Assessments and analyses of how the climate is developing, and also of societal processes and climate policy, create the basis for advisory services for knowledge users and for specific technological and social solutions for climate change mitigation and adaptation.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

5.13.1 Research for the energy transition

Energy research is one of the central pillars of 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 for 2013 to 2016. In 2016, the Government spent 876 million euros on research, development and demonstration of modern energy technologies. Three quarters of the budget went into research on renewable energy and energy efficiency.

The emphasis here is on funding for technologies used to generate electricity with wind and photovoltaic systems, increasing the share of renewables in the heating sector, energy-optimised buildings and neighbourhoods and energy efficiency in industry. It particularly focuses on systemic solutions for the integration of new energy technologies, new grid technologies, energy storage and sector coupling.

Funding a range of different research priorities using appropriate instruments – some targeting research projects, others targeting institutional research – ensures that both long-term basic research and practice- and application-oriented research are always covered. The German Government publishes detailed information on funding measures, budgets and structures in its annual report on energy research. This report is based on the **EnArgus information system**, a project that is part of the German Government's sixth Energy Research Programme.

The following research is currently being funded under the Energy Research Programme:

- Research initiative on the **energy transition in the transport sector**: sector coupling through the use of electricity-based fuels is funded by the Federal Ministry of Economic Affairs and Energy to specifically link research, development and demonstration of innovative energy and transport topics. The projects started in mid-2018.
- Within the cross-ministerial call for proposals on **Solar Building Design/Energy-Efficient Cities**, six beacon projects in Kaiserslautern, Heide (Holstein), Oldenburg, Esslingen, Zwickau and Stuttgart/Überlingen were selected and funding has begun.
- Cross-ministerial funding initiatives on **future grids and energy storage systems**, funded by the Federal Ministry of Economic Affairs and Energy and the Federal Ministry of Education and Research, are working on developing the grid infrastructure and storage elements within the energy system (ongoing).
- The **Energy Transition Research Alliance**, which is jointly implemented with cooperative industrial research under the Energy Research Programme, pays particular attention to the interests of small and medium-sized enterprises.

In autumn 2016, the four Copernicus projects began work and set the direction of travel in the areas of new grid structures, power-to-X, industrial processes and system integration. Over the next 10 years, the projects will work with industry, the scientific community and society to help put solutions in these crucial areas of the energy transition into practice.

Under the Carbon2Chem project, the use of gases from steel production is very close to becoming reality. The aim is to recover valuable chemical raw materials from these gases and lower the CO₂ emissions of the steel, chemical and energy industries. This involves setting up a pilot plant in 2018, which will house industrial-scale electrolysers.

To **accelerate transfer of the results** into practice, the networking activities within the research landscape will be expanded through measures such as the following:

- The **energy research networks** launched by the Federal Ministry of Economic Affairs and Energy (BMWi) represent the broad-based research landscape in Germany on issues of bioenergy, buildings and neighbourhoods, energy efficiency in industry and trade, energy systems analysis, renewable energy, flexible energy conversion and electricity grids. In addition to promoting participation and transparency, the research networks also aim to boost the rapid transfer of research results into practice in the energy industry.
- The **energy transition research and innovation platform** is an advisory body for the BMWi and

aims to foster a dialogue on the strategic direction of energy research with national stakeholders in the field of policymaking, industry and science. The aim is to network Germany's diverse research activities more closely and use them more effectively in order to prepare the way for new energy technologies and innovative processes and get them to market quickly.

- At **European and international level**, the BMWi research partnerships include working in the EU's Strategic Energy Technology Plan (SET Plan), the International Energy Agency's Technology Collaboration Programme and the Mission Innovation.

As the competent ministry, the BMWi is currently preparing a new Energy Research Programme, for which a broad participation process was launched in autumn 2016 with stakeholders from industry, the scientific community and the Länder. Sector coupling and digitalisation as new trends, and real-life experimental facilities as a new funding pillar for systemic demonstration and market preparation for innovative energy technologies and improving access to research funding for start-ups will occupy an important place in the 7th Energy Research Programme, which is scheduled to be presented to the federal cabinet in 2018.

5.13.2 Research into climate change mitigation and adaptation

Research into climate change mitigation and adaptation was firmly established as a component of Research for Sustainable Development programme (FONA3) drawn up by the Federal Ministry of Education and Research (BMBF). With three priority fields of action (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.

The Federal Ministry of Education and Research carries out funding measures and other activities in all three fields of action, thus launching numerous processes to implement the measures adopted under the Climate Action Programme 2020.

The BMBF supports international climate processes and addresses the issues arising from the implementation of the Paris Agreement. A number of research

projects to strengthen the knowledge base for the IPCC's special report on limiting global warming to 1.5 degrees Celsius were launched in 2017. The BMBF also collaborates with European partners to fund climate services that deliver practice-oriented, usable knowledge about climate change.

A number of activities are designed to further improve the knowledge base on climate change and the ability to model it and hence improve predictions. They include a research initiative on paleoclimate modelling (PalMod), which has been running since 2015, and Germany's contribution to the Coupled Model Inter-comparison Project Phase 6 (CMIP6), which started in 2016. Projects under a funding measure looking at cloud and precipitation processes began in 2016.

The BMBF has been financing research on the economics of climate change since 2011 and a dialogue on the subject since 2014. This involves analysing instruments and policies in the field of climate economics, identifying costs and adaptation options, exploring international negotiating processes and questions about transformation processes connected with decarbonisation. Projects in the second funding phase will begin at the end of 2017 and in mid-2018.

The BMBF's SME Innovative funding initiative is designed to provide long-term support for small and medium-sized enterprises (SMEs) to carry out cutting-edge research. Research and development is funded under this initiative in areas such as energy efficiency and climate change mitigation and adaptation, along with other fields of technology.

The BMBF's Urban Climate Under Change [UC]2 funding measure has been developing a new, innovative urban climate model since 2016. In future, it will be possible to use this model to conduct interdisciplinary analyses and plan measures to improve the urban climate and air quality. This gives towns and cities a practicable set of instruments for addressing the problems associated with climatic conditions and air pollution now and in the future. The funding measure began in mid-2016 and comprises 30 projects working on developing models, evaluation and user friendliness. The BMBF's funding measure on climate resilience through action in cities and regions also focuses on urban areas. It is part of City of the Future, a flagship initiative, through which the BMBF funds research into CO₂-neutral, climate-adapted and socially and environmentally equitable cities. The first projects on climate resilience began in 2017.

5.13.3 Socio-ecological research

The German Government believes that adaptation to climate change and the action taken to curb climate change need to be accompanied by changes in how we live together in society. Achieving virtual climate neutrality by the middle of the century presupposes that not only our economic system addresses this challenge but that processes of change also take place in society as a whole.

Socio-ecological research is therefore concerned primarily with exploring the processes of change in society under the guiding principle of sustainable development. The BMBF established this as a funding priority back in 2001. The aim of the funding is to be able in future to draw on more in-depth knowledge on topics such as:

- Transformation of energy systems,
- Sustainable urban and rural development,
- Climate action and adaptation,
- Sustainable economic activities, and
- Rebound effects.

Fostering young talent also makes an important contribution here, and groups of young researchers are working on several of the topics mentioned above. To date, a sum of approximately 220 million euros has been awarded to around 200 socio-ecological research projects in 20 funding measures.

The following ongoing funding measures contribute to climate change mitigation:

- Sustainable economic activities. Potential outcome/synthesis products were discussed at the networking conference in spring 2017. Climate-relevant aspects, such as energy efficiency, also play a role in the projects.
- Societal Transformation in the Face of Climate Change: German partners are involved in three of the six project networks researching climate issues under the European Joint Programming Initiative JPI Climate. Two of these projects have been successfully completed, the third ends in 2018.

- The young researcher groups presented their projects at a kick-off event in May 2017. Three other groups of young researchers looking at climate-relevant topics began work in July and September 2017; the areas they are working on include the sharing economy and the energy transition.
- Funding measure on sustainable transformation of urban space – eight of the 23 projects funded are concerned with climate change mitigation. They began their research in 2016. They presented their projects at a networking conference in December 2017 and discussed their approaches with other projects as part of the City of the Future flagship initiative.
- A funding measure to implement the City of the Future flagship initiative comprises three socio-ecological research projects working on climate-friendly mobility.
- Funding measure on rebound effects from a socio-ecological perspective: nine research networks dealing with avoiding or curbing rebound effects were selected for funding. The first project began in November 2017; the others will start in 2018. The findings will play a key role in planning climate action because rebound effects have a negative impact on the effectiveness of energy efficiency measures.

5.13.4 Strengthening applied research in the urban design and buildings sector

Taking all direct and indirect emissions into account, the buildings sector is currently responsible for about 30 percent of Germany's greenhouse gas emissions. In view of the target set for 2050 that the building stock should be virtually climate neutral, this makes it all the more important to not rely solely on traditional methods and techniques but to drive forward and facilitate innovative solutions.

For that reason, the aim is to continue to advance research on strategies and concepts for sustainable construction and to further develop the Zukunft Bau research initiative. Funding here targets the entire construction value chain and also includes specific projects such as those concerned with the Efficiency House Plus standard. Building research focuses on developing and optimising innovative products in small and medium-sized companies.

The projects are distinct from other research projects and funding schemes in the buildings sector, especially from research for energy-optimised buildings and neighbourhoods funded by the Federal Ministry of Economic Affairs and Energy under its ENERGIE-WENDEBAUEN research initiative.

With its Zukunft Bau and Efficiency House Plus research projects, the federation also supports the prompt transfer of knowledge from practical, applied building research and thus helps to get innovations onto market quickly. Since the end of 2017, the Federal Building Ministry has pooled this transfer of information in its own information and competence centre for sustainable building in Berlin (Bundesinformations- und Kompetenzzentrum für zukunftsgerechtes Bauen) in the former Efficiency House Plus beacon project. It provides a broad range of information on current building research and conducts an objective discourse on the future of building involving all sections of society (www.bauen-der-zukunft.de).

Scientific forecasts are expecting efficiency houses plus to account for 15 percent of new builds and existing buildings in Germany, saving 14 million tonnes of CO₂ per year from 2050 onwards. Extending the KfW programme to include funding for more broad-based activities using the efficiency house plus approach in multi-storey housing, period buildings and measures at neighbourhood level would bring about further CO₂ savings.

Since it can be assumed that not all buildings will become climate neutral, efficiency houses plus can help compensate for this deficit. The aim must be to permanently establish and expand funding for this climate-neutral efficiency house plus standard so that the above-mentioned savings can be achieved.

5.14 Advice, awareness raising and private initiative to step up climate action

5.14.1 Mitigation measures in industry

The decisions taken at the Paris Climate Change Conference underline the importance of gearing not only our society and its behaviour to climate neutrality but most particularly our economic activities.

Industry plays a crucial role here, one that also brings great opportunities created by the development of new climate-friendly technologies, for example. In addition to putting in place the measures described in the sections above, the Government also intends to further enhance industry's innovative strength with the measures adopted here and to gear it towards a climate-neutral future.

Reduction in greenhouse gases in 2020 in million tonnes of CO₂ equivalent

Contribution envisaged under the Climate Action Programme as at December 2014 (Reduction effect based on climate check-ups for micro businesses – see Section 5.14.1.2)	0.75
Contribution according to the latest estimate of experts	0.09

5.14.1.1 Dialogue process: business mitigates climate change

If climate action is to have a broad impact, including in the business sector, it is extremely important for companies to recognise the positive effects that systematic energy efficiency measures and climate action can have on their business. In order to establish a willingness on the part of companies to identify and eliminate any obstacles, in other words to overcome the first hurdle, the German Government decided under the Climate Action Programme to engage in a process of dialogue with the private sector.

The contract to implement this process was awarded at the end of 2016. The kick-off event for the dialogue forum entitled Business mitigates climate change took place in June 2017 with the heads of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). A steering committee with representatives from business, politics and the scientific community was set up and meets on a regular basis. The dialogue forum participated as partner at an event, organised by Deutsche Post, Econsense and EY, on Implementing the Paris Agreement – What Business Can Do to Meet the <2°C Target. This event took place

in November 2017 in parallel to COP23. The working group phase of the dialogue forum is scheduled to

begin with an event in March 2018, which will be attended by the Federal Environment Minister.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

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

Small and medium-sized enterprises often do not have the capacity to consider energy efficiency measures and climate action nor, ultimately, to put them in place. And yet smaller-scale measures offer businesses not only the opportunity to engage proactively in climate action but also to save money by conserving energy and resources.

The Klimaprofi für den Mittelstand (climate expert for SMEs) project developed an information and advice scheme for small and medium-sized businesses that is now being tested across selected trades, such as bakers, butchers, pharmacies, 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 that will be addressed to more trades.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.75
Contribution according to the latest estimate of experts (Due to significant overlap effects with other measures, in particular measures under NAPE, the reduction effect of the measure is evaluated in the current estimate as a flanking measure.)	Flanking measure

5.14.1.3 Environmental Innovation Programme

With its Environmental Innovation Programme, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety helps companies to establish pioneering and progressive technologies on the market. The programme funds demonstration projects and thus makes innovative, environmentally friendly technologies accessible to a broad user group.

In particular, up to 2020 funding will concentrate more on demonstration projects that focus on climate action in order to make innovative, environmentally friendly technologies accessible to a broad user group. Thirteen projects were approved by 28 July 2017. Budget funds totalling 15 million euros per year were allocated for this measure for the 2016 to 2020 period.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	0.4

5.14.2 Consumer action on climate change (prioritising electricity saving)

The German Government is endeavouring to motivate consumers and to enable low-income households in particular to take the initiative and play a part in climate action, which is also in their own interest.

The initiatives, funding and advisory programmes and regulatory provisions, which have been mentioned in

the past, adopted, implemented and tackled and that aim to meet the 2020 climate target, focus on supply or conversion of energy and the most efficient use of energy in areas that – with the exception of the buildings and housing sector (see Section 5.6) – do not directly address the economical use of final energy by consumers. And yet the final energy sector offers considerable potential for increasing energy and climate efficiency – provided consumers are properly informed and motivated.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014 (Reduction effect based on electricity savings check)	0.04
Contribution according to the latest estimate of experts	0.08

5.14.2.1 Electricity savings check

Measures requiring only a minimum level of investment can often bring about great energy and financial savings. However, for low-income households even that kind of measure is often beyond their budget. As a consequence, many low-hanging fruits go unharvested, although they would ease the financial situation of the households concerned (significantly lowering their running costs) and at the same time deliver cost-effective ways of combating climate change.

Even before the Climate Action Programme was adopted, overcoming this hurdle was the stated aim of the electricity savings check, which is funded by the Federal Ministry for the Environment, Nature

Conservation and Nuclear Safety under the National Climate Initiative and implemented by the German Caritas Association. (Deutscher Caritasverband) and the German Association of Energy and Climate Action Agencies (Bundesverband der Energie- und Klimaschutzagenturen Deutschlands).

The project was expanded on 1 May 2017 with the aim of testing and using new ways of reaching out to groups of people who are particularly affected by poverty (neighbourhood approach). A particular focus is on getting senior citizens and single parents on board. The expansion aims to carry out 4,000 additional consultations.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	0.04
Contribution according to the latest estimate of experts	0.08

5.14.2.2 Electricity saving campaign

The aim of the electricity saving campaign is to motivate as many private households in Germany as possible to exploit their energy-saving potential and save

electricity, which will lower their energy costs in the long term.

The project has been completed.

5.14.3 Climate action in schools and educational establishments

With its call for funding applications for innovative climate action projects that make an impact nationwide, the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety has been funding education projects under its National Climate Initiative.

The projects are meant to raise climate awareness among students, encourage them to get involved in climate action and contribute to reducing CO₂ emissions. This takes place through practice-based projects, action days and campaigns and is backed up by interactive learning opportunities and competitions.

As at December 2017, 10 projects with terms running to 2019/2020 are being funded:

- Passivhausschulen werden aktiv (operation of passive house schools), total funding: 806,000 euros, ends 12/2017.
- Escape Climate Change (an interactive escape game for schools), total funding: 560,000 euros.
- Klasse Klima – heißkalt erwischt (broad based climate action for young people), total funding: 811,000 euros.
- Klimaaktionskinos (young people make short films, which are shown in venues such as youth hostels. The electricity for the projectors is produced by bicycle power), total funding: 638,000 euros.
- Carrotmob macht Schule (flash mobs gather in shops to raise funds for climate action), total funding: 521,000 euros.
- Bildung Klima plus (setting up climate education centres), total funding: 544,000 euros.
- Schule-Klima-Wandel (school students are trained to be climate ambassadors and pass on their knowledge to their peers), total funding: 831,000 euros.
- StartGreen@School (integrating climate action and sustainability into entrepreneurship lessons), total funding: 940,000 euros.
- Klima-Kita-Netzwerk (a network supporting climate action and resource conservation in pre-school facilities), total funding: 581,000 euros.
- Netzwerk grüne Arbeitswelt (green economy network for young people), total funding: 645,000 euros.

Reduction in greenhouse gases in 2020 in million tonnes of CO ₂ equivalent	
Contribution envisaged under the Climate Action Programme as at December 2014	Flanking measure
Contribution according to the latest estimate of experts	

6

Activities undertaken by the Länder, municipalities and social actors

6.1 Climate action undertaken by the Länder and local authority associations

In addition to the Federation, the Länder and local authority associations are key actors in the public sector, carrying out their own mitigation measures. When the German Government drew up its Climate Action Programme 2020, it recognised the substantial efforts by Länder und municipalities and invited the Länder to submit an overview of the climate activities they had

initiated since 2012. This invitation still stands and will be re-issued when the Länder are contacted in preparation for the 2018 Climate Action Report.

An updated list of the Länder activities will be posted on the BMU website when the 2018 Climate Action Report is published..

6.2 Social innovation and climate action

The German Government firmly believes that active participation, initiative and social commitment are essential for an intergenerational project such as the energy transition in Germany. It therefore provides ongoing support to projects that put this concept into practice in a number of different areas: transport (car sharing), energy-efficient multi-generational community housing and energy communities.

The main emphasis is on the social dimension and the idea of social participation. In the long term, this also strengthens public 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 BMU's National Climate Initiative promotes neighbourhood projects under its Kurze Wege für den Klimaschutz (keep it local for the climate) programme. Associations, clubs, foundations and municipalities receive funding for their neighbourhood projects – which they carry out alone or in conjunction with others – designed to help local residents go about their day-to-day lives in a way that is climate-friendly and conserves resources.

7

Assisting 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 needed for continuous reporting on emissions, projections, policies and measures (see Section 3, for example). The primary reason for this work is to comply with the German Government's international and European reporting obligations. To ensure continuous and scientifically sound reporting, which also forms the basis for its Climate Action Reports, the German Government constantly reviews how it can guarantee the necessary institutional capacity.

8

The economic impact of the measures under the Climate Action Programme 2020

Measures under the Climate Action Programme 2020

and the National Action Plan on Energy Efficiency are expected to have a positive economic impact above and beyond the desired positive effects on climate change mitigation.

For example, more efficient use of fossil fuels will significantly reduce our dependency on imports. It will also encourage the development of new technologies and create lasting added value. Not least, this will also protect jobs in many sectors and create new employment opportunities. When introducing and further developing instruments, their distributive effect is an important decision criterion.

When introducing and further developing instruments, their distributive effect is an important factor. In some cases, positive economic effects can be identified.

The Federal Ministry for the Environment, Nature Conservation and Nuclear Safety commissioned a research project in 2016 to explore the economic effects, particularly the costs and benefits, of measures approved under the Climate Action Programme and the National Action Plan on Energy Efficiency (NAPE).⁹ In particular, it compared the costs incurred up to 2020 with the benefits (such as those resulting from energy savings), many of which extend well beyond 2020.

⁹ www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Aktionsprogramm_Klimaschutz/aktionsprogramm_klimaschutz_2020_abschlussbericht_bf.pdf

The study presupposes that the assumptions made in 2016 with regard to the implementation and effects of the measures, for example, actually hold true to the extent described. The conclusions of the study must be understood in light of this; they indicate that, in net terms based on cash values, the energy costs saved by implementing the measures (over their lifetime) under the Climate Action Programme and the National Action Plan on Energy Efficiency could exceed the investments necessary to implement them by almost 150 billion euros.

Twenty-eight percent of those savings will be made during the period up to 2020. The study believes that households, in particular, 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. Industry and the trade, commerce and services sector will also enjoy comparable savings. The generation sector is the only part of the energy industry that must anticipate net additional expense of about ten billion euros. This is attributable to increased use of expensive primary fuels 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 it will see 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.

Positive effects on the labour market in Germany are also anticipated. 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.

The sum of all of the approved measures could lead to GDP growth of about one percent.

The study comes to the overall conclusion that the economic benefits associated with the approved measures in the Climate Action Programme clearly exceed the costs. This is particularly the case when the effect after 2020 is also taken into consideration. The measures will incentivise investments many times this amount, creating added value and employment.

Other studies have explored the economic impacts of energy and climate policy measures and the associated macroeconomic issues as well. They establish quantitative effects of varying degrees depending on the underlying assumptions, but they all arrive at similar conclusions regarding the big picture.

Climate Action Alliance

When adopting the Climate Action Programme, the German Government also set up a Climate Action Alliance with the BMU holding lead responsibility. The main task of the Alliance is to support implementation of the programme measures adopted, make it easier to activate potential that is currently rated as not yet quantifiable and identify further options for action. In particular, members of the Climate Action Alliance are called upon to develop activities of their own that help to exploit additional potential to reach the German Government's climate targets. The government has found the format of the Climate Action Alliance to be valuable in supporting the implementation of measures. When adopting the Climate Action Plan 2050 on 14 November 2016 (see Section 10), it therefore resolved to continue the Alliance beyond 2020. The Climate Action Alliance will support the preparation, revision and implementation of the programmes of measures.

The Climate Action Alliance comprises representatives from the Länder and municipalities as well as civil society and associations in all industries, sectors and fields of action, facilitating the development of cross-cutting ideas and approaches spanning all interests, and discussing them – including with representatives from the ministries.

In order to keep the discussion and work process tightly focused, the Vienna format established at international negotiations was used. To date, 16 tables have been set up, and participants can choose which to join. The Climate Action Alliance meets every six months, in spring and autumn.

The long period of time involved in forming a Government following elections in Germany meant that the spring meeting of 2018 was postponed until summer. Sessions to date have discussed climate action in the

transport sector, municipalities, agriculture, small and medium-sized enterprises, trade and industry. The discussions are based around briefing papers prepared by the participants of the respective table 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.

The fourth meeting of the Climate Action Alliance in November 2016 focused on climate change mitigation in SMEs and the skilled trades. The SME table presented a briefing paper outlining its key demands: maintaining competitiveness and ensuring that the energy transition is business friendly and SME friendly, being open to all types of technology and promoting innovation. The table reported on various projects in the skilled trades sectors, some completed and some ongoing, which contribute to climate change mitigation through energy efficiency, networking and advisory services. It stressed that the sector sees itself as a competent stakeholder but one that must nevertheless not be overburdened. The 2016 Climate Action Report was also discussed at the meeting.

At the Climate Action Alliance's fifth meeting in April 2017, climate action in industry, the buildings sector and commercial buildings was discussed. The industry table presented a briefing paper containing a number of climate action projects demonstrating best practice in various companies. Since it was not possible to reach a consensus on all points in the paper, it must be seen as an idea collection.

In its presentations, the buildings table stressed the specific features of its sector, especially how diverse and different owners and users of buildings are. In the case of residential buildings, the associations believe that the potential for carrying out modernisation work in a

cost effective way is low. A database is currently being created to make an inventory of the existing stock of non-residential buildings. It is assumed that the need for refurbishment is high in the case of sports facilities. However, the data situation here needs to be improved. Comments on the Climate Action Programme and 10 joint proposals were also presented. These were supplemented by individual points made by the different associations.

DENEFF (German Industry Initiative for Energy Efficiency) presented the findings of a project on financing investments in energy efficiency in residential and non-residential buildings, which is funded by the BMU. The project is part of the Finanzforum Energieeffizienz (energy efficiency financing forum). Another item on the meeting's agenda was the Climate Action Alliance's enhanced role as a result of the Climate Action Plan 2050.

Germany's general elections (for the Bundestag) and the delay in forming a new Government meant that the meeting scheduled for autumn 2017 was postponed to spring/early summer 2018.

The briefing papers and presentations by the different tables, along with further information on the Climate Action Alliance, can be found on the website of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

These opinions and briefing papers are incorporated into the German Government's deliberations on implementing the measures in the Climate Action Programme. Some extend well beyond the time horizon of the programme, and can be taken into account when preparing programmes of measures for the Climate Action Plan 2050.

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 target for 2050 and the agreed interim targets in light of the Paris Agreement, and to reinforce them with measures. The Climate Action Plan is a modernisation strategy that performs on three levels:

- It develops specific guiding principles for the individual fields of action for 2050, creates space for innovation and strives to maximise sustainable development.
- It outlines robust transformation pathways for all fields of action, examines critical path dependencies and describes interdependencies.
- It underpins goals, in particular the interim GHG target for 2030, with sectoral targets, specific mile-

stones and strategic measures, and includes 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, the scientific community and society.

The overarching goal of the Climate Action Plan 2050 is to make Germany largely greenhouse gas-neutral by 2050. The goals set by the Climate Action Plan 2050 are characterised by a technology-neutral and innovation-friendly approach. It provides guidance for upcoming investments, especially for the period up to 2030. The Bundestag (Germany's lower house of parliament) will put specific legislative measures in place and the Plan's implementation will become legally binding in 2019.

The Climate Action Plan 2050 outlines the fields of action concerned with the energy industry, buildings,

transport, industry, agriculture, land use and forestry. It also sets out 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 achieved in the various fields of action in line with the 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 will be undertaken. The outcome of the impact assessment will be discussed with the social stakeholders, allowing appropriate paths to achieve the sectoral targets in 2018 to be identified.

The German Government is using the Climate Action Plan 2050 to set a learning process in motion. The Plan is not a rigid instrument; it is a rough outline of the path towards a greenhouse-gas-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.

Regularly updating the Climate Action Plan 2050 also implements the mechanism agreed in the Paris Agreement to regularly raise the level of ambition of national climate policies. The first update will take place when the Parties to the Paris Agreement must submit updated NDCs – by late 2019 or early 2020 at the latest.

To ensure that the 2030 targets are achieved, the Climate Action Plan 2050 will be backed up with a programme of measures with quantified reduction effects. The environmental, social and economic impacts of each programme of measures will be assessed. This means that the update of the Climate Action Plan will be followed by a revision of each applicable programme of measures. It will underpin each upcoming reduction step and milestone with specific measures that, where possible, have a quantified effect on achieving reductions. The programmes of measures will be developed in consultation with the Bundestag.

The German Government prepares Climate Action Reports every year so that it can regularly review implementation and target achievement (monitoring), and it will continue to do this after 2020 so that corrective action can be taken where necessary. The implementation and revision of the programmes of measures will continue to include broad-based participation. To this end, the Climate Action Alliance will be continued.

Further information on the dialogue process and the scientific foundations for the Climate Action Plan adopted by the German Government on 14 November 2016 is available on the BMU website (in German) at: www.bmub.bund.de/P3915 and (English): www.BMU.bund.de/P3915/

Abbreviations

BAFA	Federal Office for Economic Affairs and Export Control
BBSR	Federal Institute for Research on Building, Urban Affairs and Spatial Development
BMBF	Federal Ministry of Education and Research
BMEL	Federal Ministry of Food and Agriculture
BMU	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BMVI	Federal Ministry of Transport and Digital Infrastructure
BMWi	Federal Ministry for Economic Affairs and Energy
BMZ	Federal Ministry for Economic Cooperation and Development
BNB	Assessment System for Sustainable Building
BÖLN	Federal Organic Farming Scheme and other Forms of Sustainable Agriculture
BSH	Federal Maritime and Hydrographic Agency
C	Celsius
CAP	EU Common Agricultural Policy
CH₄	Methane
CHP	Combined heat and power generation
CMIP6	Coupled Model Intercomparison Project Phase 6
CO₂	Carbon dioxide
CO₂e	Carbon dioxide equivalent
COM	European Commission
COP23	Conference of the Parties to the UNFCCC
D	Germany
DIHK	German Chambers of Commerce and Industry (Deutsche Industrie und Handelskammern)
EDL-G	Energy Services Act (Energiedienstleistungsgesetz)
EMAS	Eco-management and audit scheme
ESF	European Social Fund
ESR	EU Effort Sharing Regulation
ETS	Emissions Trading System
EU	European Union
F-gases	Fluorinated greenhouse gases
FONA3	Research for Sustainable Development programme
GAK	Joint Task for the Improvement of Agricultural Structures and Coastal Protection (Gemeinschaftsaufgabe Agrarstruktur und Küstenschutz)
GHG	Greenhouse gases
GVFG	Local Authority Transport Infrastructure Financing Act (Gemeindeverkehrsfinanzierungsgesetz)
GWh	Gigawatt hour
GWP	Global warming potential
Ha	Hectare
HFCs	Hydrofluorocarbons
HGV	Heavy goods vehicles
ICAO	International Civil Aviation Organisation
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
KfW	Kreditanstalt für Wiederaufbau
kg	Kilogram
kW	Kilowatt
kWh	Kilowatt hour
LED	Light-emitting diode

LNG	Liquefied natural gas
LULUCF	Land use, land use change and forestry
MAP	Market Incentive Programme
MBT	Mechanical biological treatment
MRV	Monitoring, reporting, verification
MSR	Market Stability Reserve (EU Emissions Trading System)
MW	Megawatt
N	Nitrogen
N₂O	Nitrous oxide (laughing gas)
NAPE	National Action Plan on Energy Efficiency
NDC	Nationally determined contribution
NF₃	Nitrogen trifluoride
NIR	National Inventory Report
NRVP	National Cycling Plan (Nationaler Radverkehrsplan)
NTRI	National top-runner initiative
NULog	National Sustainable Urban Logistics competition
PFCs	Perfluorocarbons
PJ	Petajoule
SET Plan	Strategic Energy Technology Plan
SF₆	Sulphur hexafluoride
SME	Small and medium-sized enterprises
t	Ton
TWh	Terawatt hour
UC	Urban Climate Under Change
UNFCCC	United Nations Framework Convention on Climate Change
vzbv	Federation of German Consumer Organizations (Verbraucherzentrale Bundesverband)
WAMS	With-additional-measures scenario in the Projections Report
WMS	With-measures scenario in the Projections Report
ZdH	German Confederation of Skilled Crafts (Zentralverband des Deutschen Handwerks)

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