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under the United Nations Framework Convention on Climate Change
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The emissions situation in 2015

By 2015, Germany had succeeded in cutting its emissions by 27.9% from 1990 levels. The release of carbon dioxide is still the main contributor to greenhouse gas emissions, accounting for 87.8 %. The relative share of CO_2 emissions in total greenhouse gas emissions has actually risen slightly since the base year, due to the disproportionate reduction in emissions of other greenhouse gases. Methane emissions' (CH_4) share in total emissions was 6.2%, nitrous oxide's (N_2O) share was 4.3% and that of fluorinated greenhouse gases (known as F-gases) was approximately 1.7%. Nitrogen trifluoride (NF_3), a greenhouse gas which has only recently been included in the reporting, contributes a negligible share of 0.001 %. The distribution of greenhouse gas emissions in Germany is typical of a highly developed, industrialised country. When considered by category, reductions are seen in all sectors - with the exception of transport, where emissions are at the same level as in the 1990 base year - with the most marked reductions being in the waste management sector.

Reduction targets

In its Climate Action Plan 2050, the German government also confirmed and further defined its ambitious national climate targets: Germany intends to be largely greenhouse gas neutral by 2050. The German government also affirms the intermediate targets of reducing its greenhouse gas emissions by at least 55 % by 2030 and 70 % by 2040 compared with base year 1990. In addition, the Climate Action Plan 2050 spells out the government's 2030 climate target for the individual sectors, describes the development pathways needed in those sectors, lists initial implementation measures and sets up a process for monitoring and refining the policies and measures. This is the means by which Germany will play its part in achieving the Paris Agreement's overall aim to limit global warming to well below 2 degrees Celsius and to pursue efforts to limit the temperature increase to 1.5 degrees Celsius.

The German government adopted the Climate Action Programme 2020 in December 2014. It did so in response to the 2013 Projections Report, which stated that the national emission reduction target of minus 40 % by 2020 would probably not be achieved with the measures that had been put in place at that time. In order to reach the 40 % target, therefore, additional efforts needed to be made. The German government did this with the most comprehensive action programme up to that time, which contained measures in all sectors.

Emission trends

Overall, climate action measures and the energy transition have resulted in considerable progress in achieving the target for 2020. However, current projections indicate that they are not sufficient to achieve Germany's ambitious climate action target for 2020. According to the latest estimates (2017 Projections Report), which the German government does not fully endorse but which it will take into account in its future considerations, measures that have

been approved so far – including those in the Climate Action Programme 2020 – will be able to reduce greenhouse gases by between 35 % and 38 % by 2020.[1]

The question of whether further measures should be taken – and if so which ones – in order to achieve the target of reducing greenhouse gas emissions by at least 40 % by 2020 is being considered. The German government can, if necessary, use the first programme of measures for the Climate Action Plan 2050 in 2018 to make appropriate additions to the existing package of measures.

Overall the fact remains that Germany has made significant progress in climate change mitigation since the beginning of the 1990s. Examples of this include the fact that it has decoupled economic growth from greenhouse gas emissions and surpassed the reduction targets it committed to under the first commitment period of the Kyoto Protocol (2008-2012). Germany is also making good progress with regard to the target for the second commitment period of the Kyoto Protocol (2013-2020) in terms of the overall budget. In particular, the expansion of renewable energy has led to increasing reductions in energy-related greenhouse gas emissions. Renewable energy's share in gross electricity consumption rose to 31.7 % in 2016, with its share in gross final energy consumption that year rising to 12.0 %. Its share in total heat and cooling consumption in 2016 was 13.4 % and in the transport sector it was 5.1 %.[2]In 2016, a total of 158 million tonnes of CO_2 equivalents were avoided as a result of renewable energy.[3] Germany's restructuring of its energy supply is an ongoing stimulus for growth, investment and employment.

Climate finance

The German government contributes its fair share to international climate finance and is one of the world’s largest donors. Since 2005, it has increased its climate finance from public budget funds almost sevenfold to around EUR 3.362 billion in 2016. In 2015, the international climate finance from public budget funds totalled EUR 2.684 billion. The Government is aiming to double its international climate finance from the 2014 target value of EUR two billion to EUR four billion by 2020 (from budgetary sources and grant elements of development loans), thus fulfilling the commitment Chancellor Merkel made in 2015. In addition to the public climate finance from budget funds, Germany has also since 2013 reported mobilised public climate finance, i.e. climate-related credit financing provided by KfW Entwicklungsbank and the Deutsche Investitions- und Entwicklungsgesellschaft mbH (DEG), which uses market funds. Since 2015, this reporting has been project-specific. In addition to the deployed budgetary funds, an additional EUR 5.172 billion (USD 5.721 billion) were pledged by KfW and DEG from capital market funds in 2016. This means that Germany has increased its contribution to climate finance fivefold since 2005. The aim of the German government is to be even-handed in providing climate finance for emission reduction and climate change adaptation. Of the budgetary funds provided from the federal budget, 55 % was used for bilateral mitigation measures and 45 % for bilateral adaptation measures in

[1] Projections report 2017. German version available online at http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/envwqc4_g/170426_PB_2017_-_final.pdf; English version will be available in due course at http://acm.eionet.europa.eu/.

[2] AG Erneuerbare Energien Statistik (2017): Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland, as at: 02/2017.

[3] Federal Environment Agency, AG Erneuerbare Energien-Statistik (2017), http://www.umweltbundesamt.de/indikator-vermiedene-thg-emissionen-durch

2016. The German government uses a broad range of instruments and institutions for its international cooperation activities in the field of climate and development.

Background

As a Party to the United Nations Framework Convention on Climate Change (UNFCCC), Germany is obliged to submit regular reports. In addition to the annual National Inventory Report and the National Communication to be submitted every four years, Biennial Reports have also been a requirement since 2014.[4] In this Third Biennial Report, Germany reports - in compliance with the biennial reporting guidelines[5] - on trends in greenhouse gas emissions, its national reduction target, measures taken to achieve the target and progress made, projections of future emissions trends and provision of financial, technological and capacity-building support to developing countries. This report will be submitted as an annex to the Seventh National Communication. Comprehensive information is given in the common tabular format in tables[6] in the annex to this report.

1. Information on greenhouse gas emissions and trends, Greenhouse Gas Inventories including information on the National System of Emissions Inventories

The descriptions in this chapter are based on the 2017 National Inventory Report (NIR 2017). In accordance with decision 3/CP.5, Germany submitted its Report on 15 April 2017 along with the Greenhouse Gas Inventories covering the period from 1990 to 2015. The Report describes the methods and data sources on which the calculations of German greenhouse gas emissions are based.

Please refer to NIR 2017 for a detailed description of methodology and for information on the determination and calculation of emission inventories.[7] The data used in this report correspond to the emission data in NIR 2017.[8] Detailed information on annual emissions can be found in the inventories published annually in the common reporting format (CRF).

1.1 Summary of information from the Greenhouse Gas Inventories

Since 1994, the countries listed in Annex I of the UN Framework Convention on Climate Change - including Germany - have been obliged to submit a Greenhouse Gas Inventory to the UNFCCC Secretariat by 15 April each year. The revised UNFCCC Reporting Guidelines, which were adopted by the 19th session of the Conference of the Parties,[9] require details of emissions and removals by sinks in the base year (1990 for CO_2, N_2O, CH_4; 1995 for HFCs, PFCs, SF_6, NF_3) and for each year up to two years before the report year to be provided.

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4 UNFCCC Decision 1/CP.16.

5 UNFCCC biennial reporting guidelines for developed country Parties. Annex I to UNFCCC Decision 2/CP.17.

6 Common tabular format for UNFCCC biennial reporting guidelines for developed country Parties UNFCCC Decision 19/CP.18.

7 https://www.umweltbundesamt.de/themen/klima-energie/treibhausgas-emissionen

8 http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/zip/deu-2017-crf-11apr17.zip

9 Revised UNFCCC Reporting Guidelines: http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2

Under the Kyoto Protocol, reduction targets for aggregate emissions of a basket of six greenhouse gases - carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) - were agreed for two commitment periods (2008 to 2012 and 2013 to 2020). In the second commitment period, further greenhouse gases were added to the original six: nitrogen trifluoride (NF_3), six hydrofluorocarbons (HFC-152, HFC-161, HFC 236cb, HFC 236ea, HFC-245fa, HFC-365mfc) and two perfluorocarbons (C-C_3F_6, $C_{10}F_{18}$).

1.2 Greenhouse gas emissions and trends

Overall emissions of greenhouse gases were 27.9 % below 1990 levels.[10] A closer look at the individual components reaffirms this trend in its varying degrees for the different gases. The changes in emissions of the principal greenhouse gases in terms of quantity amounted to minus -24.7 % for carbon dioxide (CO_2), minus -53.4 % for methane (CH_4) and minus -39.3 % for nitrous oxide (N_2O). By contrast, the trend for F-gases, which account for about 1.6 % of greenhouse gas emissions, is not quite so uniform. As a result of the introduction of new technologies and the use of these substances as substitutes, emissions of SF_6 fell by 19.6 % and of PFCs by 91.7 % compared with 1990, whereas emissions of HFCs rose by 92.8 %. Emissions of NF_3, a greenhouse gas which is included in the report for the first time, have risen very markedly since 1990 – by 72.8 % – but their contribution to overall emissions, at approximately 0.001 %, is extremely small.

[10] The above figures do not take account of emissions from the land use, land-use change and forestry (LULUCF) category

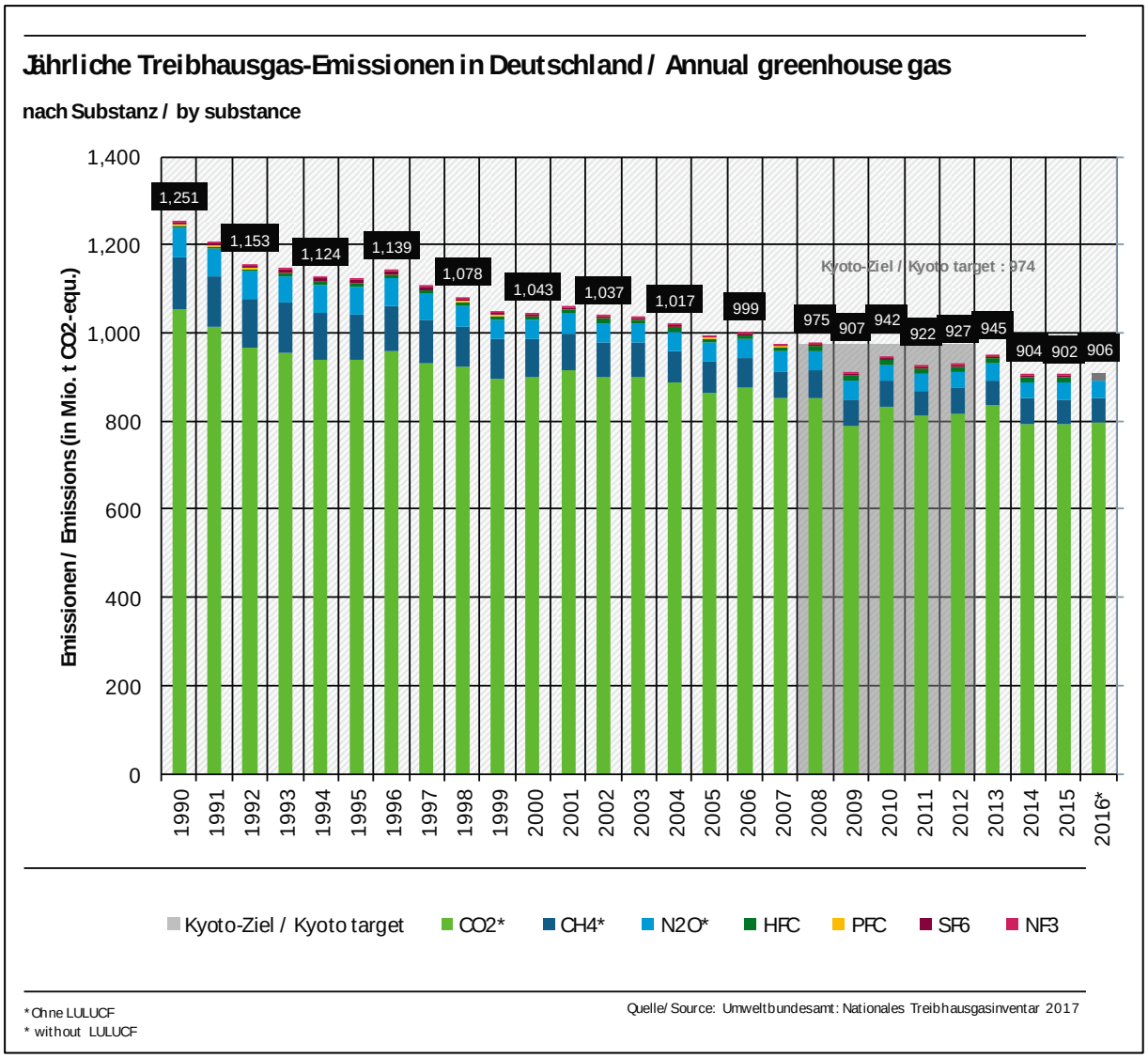

Figure 1: Emission trends in Germany since 1990 by greenhouse gas[11]

The distribution of greenhouse gas emissions in Germany is typical of a highly developed, industrialised country. In 2015, release of carbon dioxide was once again the main contributor to greenhouse gas emissions, accounting for 87.8 %. Most of them came from stationary and mobile combustion of fossil fuels. The relative share of CO_2 emissions in total greenhouse gas emissions has risen by about 3.5 % since the base year, due to the disproportionate reduction in emissions of other greenhouse gases. Methane (CH_4) emissions, most of which are caused by livestock raising, fuel distribution and landfills, accounted for a 6.2 % share. Most emissions of nitrous oxide (N_2O) came from agriculture, industrial processes and the combustion of fossil fuels, contributing 4.3 % to greenhouse gas emissions. Fluorinated greenhouse gases (known as F-gases) contributed about 1.7 % to total emissions.

[11] Federal Environment Agency: National Inventory Report 2017.

1.2.1 Trends for aggregate greenhouse gas emissions 1990-2015

There was a marked 27.9 % reduction in greenhouse gas emissions between 1990 and 2015. The individual greenhouse gases contributed to this change to varying degrees (see Figure 2).

Emissions of the direct greenhouse gases that dominate in terms of quantity, primarily methane, were reduced considerably. The main reasons for this are as follows:

- Change from the use of solid fuels to lower-emission liquid and gaseous fuels since 1990
- Increased use of renewable energy sources and the associated substitution for fossil fuels
- More efficient plants and facilities
- Changes in livestock raising conditions and reduction in livestock populations
- Compliance with statutory provisions on waste management

Figure 2 shows the contribution of the individual groups of sources and sinks to total greenhouse gas emissions. It clearly illustrates the absolute dominance of energy-related emissions and the fact that the relative contributions of the individual groups of sources and sinks remain largely constant. Over time, energy-related emissions have steadily decreased. The majority of deviations from the trend are temperature-related. Differences in temperature trends - especially in winter - influence heating behaviour and thus the energy consumed to produce space heating. This has a major impact on the annual trend in energy-related CO_2 emissions.

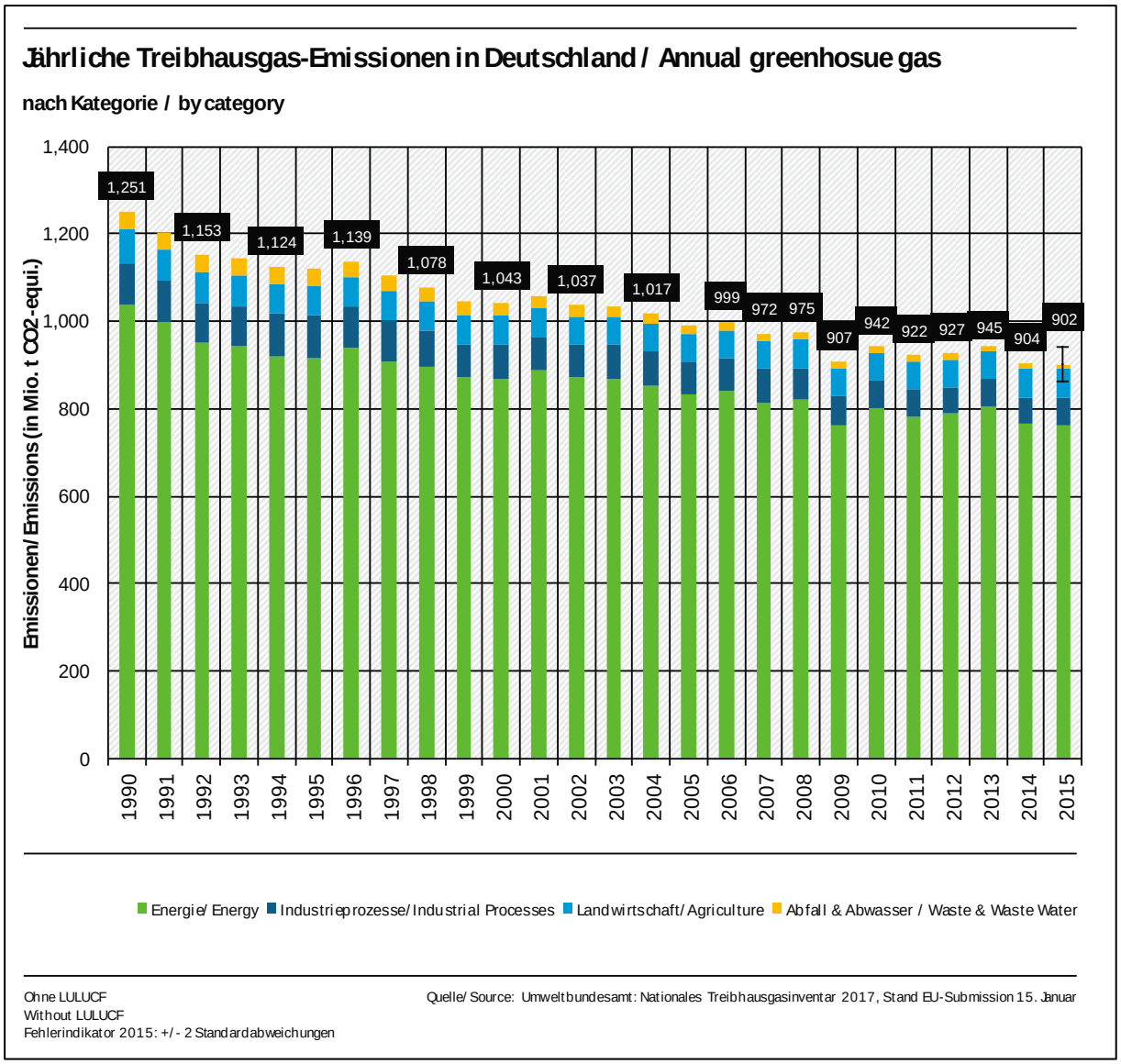

Figure 2: Emission trends in Germany since 1990 by category[12]

[12] Federal Environment Agency: National Inventory Report 2017; The above figures do not take account of emissions from the land use, land-use change and forestry (LULUCF) category

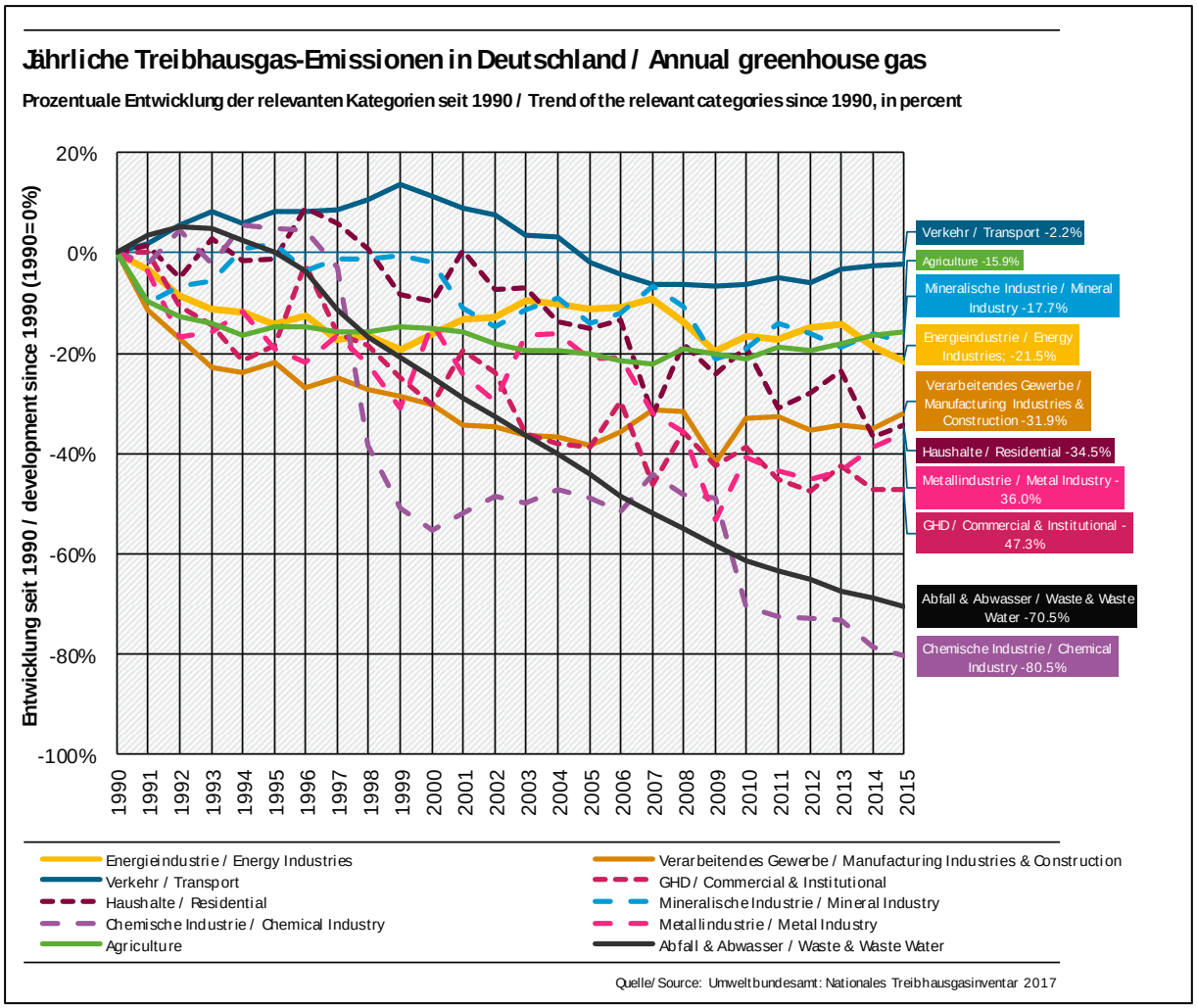

Figure 3: Relative trends in greenhouse gas emissions since 1990 by category[13]

Figure 3 shows the relative trends in greenhouse gas emissions for the different categories since 1990. The most marked reduction here was in emissions in the waste management sector, where regulations introduced to increase recycling of reusable materials (packaging legislation) and composting (legislation on organic waste) have resulted in a steep decline in the amount of waste being landfilled and therefore in a steady reduction in landfill emissions. As far as emissions from industrial processes are concerned, emission-reduction measures - especially in the area of adipic acid production from 1997 to 2009 - had a major impact. Emissions from solvent and product use fell significantly as a result of N_2O being used less frequently as an anaesthetic. Trends in emissions from agriculture essentially reflect the trends in livestock populations.

1.2.2 Emissions trends by greenhouse gas

The individual greenhouse gases contributed to the trends in greenhouse gas emissions to differing degrees. The reasons for that will be explained in greater detail in the discussion of trends below. The global economic crisis, which began to impact on Germany at the end of

[13] Federal Environment Agency: National Inventory Report 2017.

2008, had a major influence on emissions; some of the annual variations between 2008-2015 were caused by economic fluctuations in specific sectors.

The release of carbon dioxide - the vast majority of which was caused by stationary and mobile combustion processes - dominates the overall picture regarding aggregate greenhouse gas emissions. Due to the above-average decrease in emissions of the other greenhouse gases, CO_2's share in overall greenhouse gas emissions has risen since 1990. All other greenhouse gases together are responsible for only about one tenth of total greenhouse gas emissions.

Carbon dioxide (CO_2)

The reduction in CO_2 emissions is closely linked to trends in the energy sector. The sharp emissions reduction in this area seen in the early 1990s was primarily the result of restructuring in the former East Germany following reunification, including switching to cleaner fuels and decommissioning obsolete facilities. The changes in the fuel mix have continued, to a somewhat lesser degree, up to the current report year.

Use of gases, primarily natural gas, as substitutes for solid and liquid fuels is also reflected in emissions trends for stationary combustion systems. While CO_2 emissions from liquid fuels decreased by about 23 % from their 1990 levels, and emissions from solid fuels by as much as about 40 %, emissions from gaseous fuels increased by roughly 25 %.

When these emissions trends are viewed at the level of individual categories, a highly consistent picture emerges. In comparison to 1990 levels, CO_2 emissions in all sub-categories of energy-related emissions decreased by a total of nearly 244 million tonnes.

Trends in the transport sector, which is dominated by road transport, are somewhat different: CO_2 emissions increased significantly between 1991 and 2000, before declining in the period up to 2009. The decline in emissions from road transport is partly due to improvements in efficiency, the use of diesel fuel as a substitute for petrol and the blending of biodiesel. As a result of rising traffic volumes and a decrease in the use of biofuels, a steady rise in CO_2 emissions was observed again from 2012. At around 159 million tonnes, CO_2 emissions from the transport sector were reduced only slightly compared with their starting level in 1990 (roughly 162 million tonnes).

CO_2 emissions were slightly lower than the previous year with reductions in the energy industry being partially offset by slight increases in emissions from the manufacturing industry and slightly higher heating demand in the household sector.

Nitrous oxide (N_2O)

Since 1990, N_2O emissions have decreased by about 40 %. The main emissions sources are nitrogen-containing fertilisers in agriculture, the use of fossil fuels and livestock raising. Smaller amounts of emissions are caused by wastewater treatment, the chemical industry and the use of N_2O in products (for example as an anaesthetic). Industry has had the greatest influence on emissions reductions, especially in the area of adipic acid production as a consequence of abatement systems being fitted in 1997 and 2009. As a result of technological reduction measures, emissions from the chemical industry have been reduced by about 96 % with respect to 1990. Since 1999, emissions trends have been strongly influenced by economic trends in the chemical industry.

Total emissions were slightly up on the previous year, mainly due to the fact that emissions from agriculture continue to rise.

Methane (CH_4)

Methane emissions are caused mainly by livestock husbandry, landfilling waste and the distribution of liquid and gaseous fuels. On the other hand, energy-related and process-related emissions and emissions from wastewater treatment are almost negligible. Methane emissions have been reduced by over 53 % since 1990. This trend has been primarily the result of environmental policy measures (waste separation with intensified recycling and increasing energy recovery from waste), which have decreased the amount of organic waste sent to landfill. A second important factor is that energy recovery from coal mine gas has increased, while overall production of such gas has decreased (due to the closure of coal mines). Emissions in this area have decreased by nearly 76 % since 1990. Yet another reason for the emissions reductions is that livestock populations in the former East Germany have been reduced, with reductions occurring especially in the first half of the 1990s. Repairs and modernisation of outdated gas distribution networks in that part of Germany, along with improvements in fuel distribution, have brought about further reductions in total emissions.

Emissions were once more slightly down on the previous year. Lower emissions from landfills and agriculture were to some extent cancelled out by a rise in in energy-related emissions.

Fluorinated gases

Emissions of HFCs rose, primarily as a result of their increased use as refrigerants in refrigeration and air-conditioning systems and of increasing disposal of those systems. This rise was only partly offset by emissions reductions resulting from their reduced use in PUR installation foams. The emissions reductions for PFCs were achieved primarily through efforts of primary aluminium producers and semiconductor manufacturers. The SF_6 emissions reduction up to 2003 is due primarily to use of the gas in automobile tyres being phased out since the mid-1990s. The EU-wide ban in force since 2007 and efforts to increase environmental awareness have been successful here, resulting in emissions reductions of over 100 tonnes and greenhouse gas reductions of 2.5 million tonnes of CO_2e. Similar success has been achieved with soundproof windows, for which production use of SF_6 has been reduced since 1990 and is now zero. The majority of current and future emissions of this substance will result from open disposal of old windows. Emissions from electricity transmission facilities have also decreased considerably. Important new emissions sources include welding, production of solar cells and production of glass fibre optics.

Since 2015, the only use of NF_3 has been in the production of semiconductors. NF_3 emissions accounted for 0.0013 % of total greenhouse gas emissions in 2015. Since their relevance to overall greenhouse gas emissions is so minor, no separate trend analysis is provided here.

1.3 Description of the National System of Emissions Inventories

Germany's National System of Emissions Inventories under Article 5.1 of the Kyoto Protocol fulfils all UN and EU requirements.[14] All reviews to date have reaffirmed this.

1.3.1 Institutional, legal and procedural aspects of the National System

The National System was essentially institutionalised on three levels in Germany:

it has been established at ministerial level with the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) as lead agency, based on an agreement between the undersecretaries of the participating ministries in 2007. The system now incorporates the Federal Ministry of Food and Agriculture (BMEL), Federal Ministry for Economic Affairs and Energy (BMWi), Federal Ministry of Transport and Digital Infrastructure (BMVI), Federal Ministry of the Interior (BMI), Federal Ministry of Finance (BMF) and Federal Ministry of Defence (BMVg), so that all of the key institutions that are in a position to make high-quality specialised contributions are now involved.

Similarly in 2007, the tasks involved in serving as the Single National Entity for Germany were assigned to the Federal Environment Agency. The Single National Entity integrates other specialised units at the level of the Federal Environment Agency into the National System and coordinates the input of all the other institutions and organizations involved in emissions reporting.

The Figure below provides an overview of the structure of the three levels of the National System of Emissions in Germany.

[14] Guidelines for National Systems under Article 5, paragraph 1, of the Kyoto Protocol. UNFCCC Decision 19/CMP.1. Online at: http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14 and Decision 24/CP.19: http://unfccc.int/resource/docs/2013/cop19/eng/10a03.pdf#page=2 and Decision 280/2004/EC.

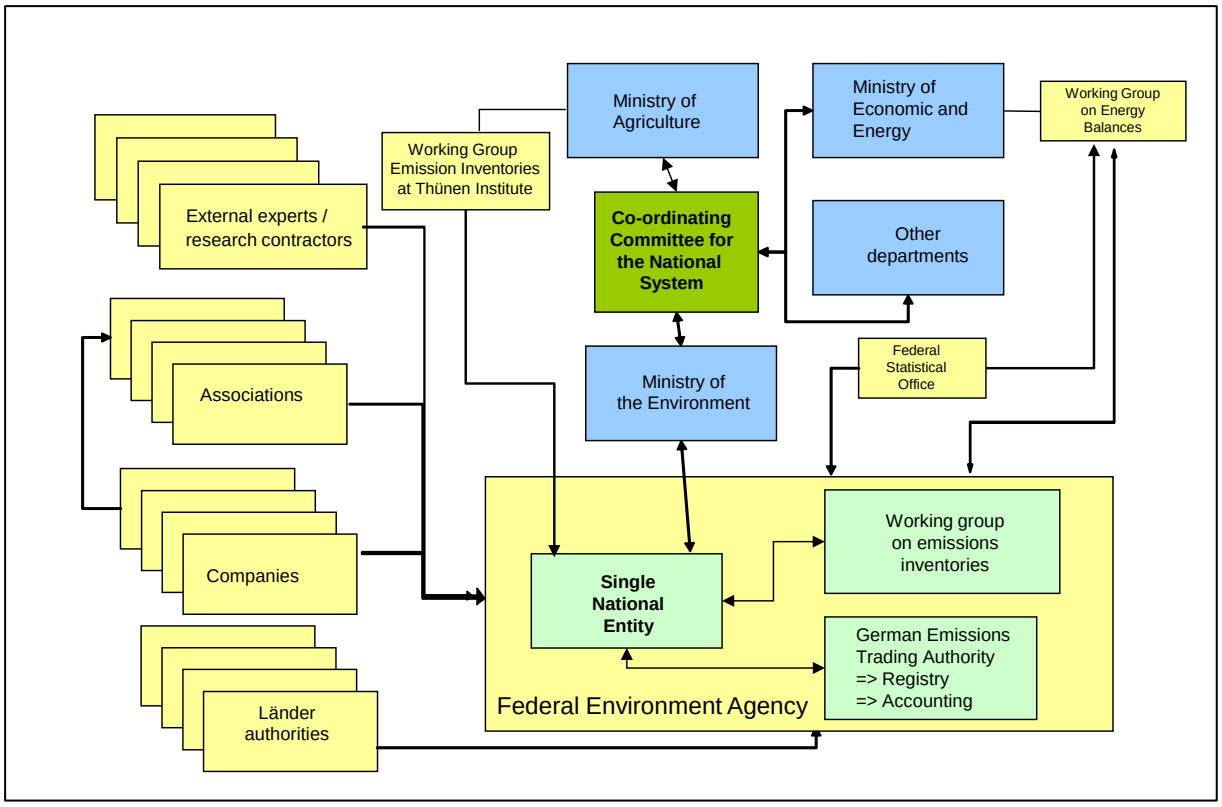

Figure 4: Information on changes to the National System[15]

In this reporting period, the focus was on the further institutional consolidation of the National System to meet the requirements for the second Commitment Period of the Kyoto Protocol. The modified concept for producing emissions and carbon inventories for source categories 3 and 4, including the quality assurance concept for KP-LULUCF (land use, land-use change and forestry), was implemented in the inventory, especially regarding any additional activities elected under Article 3.4 of the Kyoto Protocol (KP). Furthermore, the existing institutionalisation was continually reviewed to check that it is fit for purpose for the second commitment period.

1.3.2 Information on quality management

The National System in Germany serves to ensure that preparation of the inventories conforms to the principles of transparency, consistency, comparability, completeness and accuracy. This is achieved through ongoing quality management and continuous inventory improvement, for example.

A Quality System for Emissions (QSE) creates the necessary conditions for complying with good inventory practice and carrying out routine quality assurance both within and beyond the Federal Environment Agency. It was set up in the Federal Environment Agency in 2005 on the basis of an in-house directive and covers all the processes necessary for ongoing improvements to the quality of the Greenhouse Gas Inventories. This includes defining responsibilities and quality targets relating to choice of method, data collection, calculation of emissions, determining uncertainties and recording the quality tests carried out and their results (confirming that targets have been achieved and, if they were not achieved, listing

[15] Own illustration, Federal Environment Agency

proposed measures for remedying that in the future). A database ensures ongoing quality improvement within the Quality System for Emissions (QSE). It contains all the tabular documents on national quality control (QC)/quality assurance (QA) (QC/QA plan, checklists, lists detailing responsibilities etc.).

Since 2008, further government agencies, institutions and inventory experts have been incorporated into the quality management system and minimum requirements of data documentation, quality control/quality assurance and archiving have been specified so that the Quality System for Emissions has been extended to cover the entire National System. The procedure makes it possible for other organisations to develop their own quality assurance systems that are tailored to their specific needs and build on their existing structures.

2. Description of the quantified economy-wide emissions target for greenhouse gases

2.1 National targets

Germany is pursuing ambitious climate change mitigation goals.

The German government has set itself the target of reducing the country's greenhouse gas emissions by at least 40 % by 2020 in relation to 1990. This target goes well beyond Germany's target to cut its emissions by 14 % as its contribution to the EU target of a 20 % reduction for 2020 under the Effort Sharing Decision, which applies to emissions that are not covered by the EU Emissions Trading Scheme. .

The 2020 target is a decisive step towards achieving the government's other interim targets – a reduction of at least 55 % by 2030 and at least 70 % by 2040 – and its long-term target of lowering emissions by between 80 % and 95 % by 2050 compared with 1990. The German government also established its goal of becoming largely greenhouse gas neutral by 2050 in its Climate Action Plan 2050. The Plan breaks down the emissions reduction target for 2030 into specific sector targets for the energy industry, buildings, transport, industry and agriculture.

The official National Inventory data is used to measure progress towards achieving the national greenhouse gas (GHG) reduction targets. The national targets thus comprise emissions of all the greenhouse gases covered by the Kyoto Protocol. They apply to domestic emissions in all sectors and do not take into consideration credits from land use, land-use change and forestry (LULUCF) or credits from what are known as flexible mechanisms such as the Clean Development Mechanism (CDM) and Joint Implementation (JI).

2.2 European target

In 2010, the European Union made the commitment to reduce its greenhouse gas emissions by 20 % from 1990 levels by 2020.

Parameter	Description
Base year	1990
Target year	2020

Emissions reduction target	-20 %
Target includes these greenhouse gases	CO_2, CH_4, N_2O, HFCs, SF_6
GWP (global warming potential)	AR4
Sectors	All sources and sectors according to IPCC (Intergovernmental Panel on Climate Change); international aviation partially included.
LULUCF	Not included
Counting flexible mechanisms	Possible under certain conditions under the ESD and in the ETS (Emissions Trading Scheme)

Table 1: Description of the European Union's quantified emission reduction target

The 28 EU Member States agreed to this target as a common goal under the UN Framework Convention on Climate Change.

With the adoption of the 2020 climate and energy package in April 2009,[16] the EU approved a series of projects to implement the target agreement under the UN Framework Convention on Climate Change. The Renewable Energy Directive, new agreements on EU emissions trading, and the Effort Sharing Decision are intended to ensure that the agreed reduction target is met. The overall target of a 20 % reduction from 1990 levels corresponds to a 14 % reduction from 2005 levels. Two-thirds of the 14 % reduction applies to the sector covered by the Emissions Trading System and one-third to the sector not covered by the system.[17]

All EU Member States and the non-Member States Norway, Iceland and Liechtenstein, which also participate in the EU Emission Trading System, agreed to a common emissions cap under the amended Emissions Trading Directive.[18] This means there are no longer any specific national caps. The annual caps specified for allocations for the 2013-2020 period are being reduced by 1.74 % annually, based on the average level of allocations by the Member States over the previous second phase (2008-2012). The annual emission caps can be viewed as intermediate targets. The EU's Biennial Report contains additional information on the EU Emissions Trading Scheme (ETS).

Emissions outside of the ETS are governed by the Effort Sharing Decision.[19] Emissions from international maritime traffic, national and international aviation (covered by emissions trading since 1 January 2012) and land use, land-use change and forestry (LULUCF) are exempt. Many smaller emissions sources in different sectors are covered: transport (cars and heavy goods vehicles), buildings (particularly heating), services, small industrial installations, fugitive emissions in the energy sector, F-gas emissions from appliances and other sources, agriculture and waste. These emissions account for some 60 % of total greenhouse gas emissions in the EU.

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16 Including Decision 406/2009/EC, Decision 2009/29/EC and Decision 406/2009/EC.

17 Directive 2009/29/EC.

18 Directive 2009/29/EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community.

19 Decision No 406/2009/EC.

While the EU emissions trading target is to be jointly fulfilled, the reduction target for areas not covered by the ETS is divided into national targets for each Member State. The Effort Sharing Decision initially specified a percentage reduction target for the 2005-2020 period. That reduction target was then translated into binding annual emission budgets[20] for the 2013-2020 period.[21] Accordingly, Germany must reduce its emissions in the areas not covered by the ETS by 14 % from 2005 levels by 2020 pursuant to the Effort Sharing Decision. The annual emission budgets are 472 Mt CO_2e for 2013 and will be reduced to 425 Mt by 2020.

A uniform monitoring and review process for those agreements is specified for all EU Member States in the Monitoring Mechanism Regulation.[22]

The ETS and ESD allow for the use of flexible mechanisms. Article 11a (8) of the amended Emissions Trading Directive 2009/29/EC specifies that credits may not exceed 50 % of the Community-wide reduction below 2005 levels. That value is further restricted by limits for individual installations specified in Commission Regulation No 1123/2013 on international credit entitlements.[23]

Under certain circumstances, credits from project-based mechanisms can also be used for emissions not covered by the ETS, as specified in Article 5 of the ESD. The annual cap for each Member State is 3 % of emissions in 2005. Unused credits may be banked forward or transferred to other Member States up to 2020.

3. Progress towards meeting the national emissions reduction target

3.1 Reduction measures and their effect

The most important strategies and measures under German climate policy include the Climate Action Programme 2020, which was adopted in December 2014, and the Climate Action Plan 2050, which was approved in 2016.[24] Both the Climate Action Programme and the Climate Action Plan are described at length in the Seventh National Communication.

In the section below, we present selected measures (including revisions) that made a particularly substantial contribution to reducing greenhouse gases during the 2016-2017

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[20] Annual emission allocations (AEAs).

[21] Commission decision of 26 March 2013 on determining Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council (2013/162/EU) and Commission Implementing Decision of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/ EC of the European Parliament and of the Council (2013/634/EU).

[22] Monitoring Mechanism Regulation (MMR): Regulation (EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC.

[23] Commission Regulation (EU), RICE, Commission Regulation on International Credit Entitlements: No 1123/2013 of 8 November 2013 on determining international credit entitlements pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

[24] English version available online at: http://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/klimaschutzplan_2050_en_bf.pdf

reporting period. The Seventh National Communication and Common Tabular Format (CTF) Table 3 contain detailed information on the measures. The listed measures are an integral part of the with-measures scenario in the Projections Report,[25] in which the reported effects of measures on greenhouse gases are also determined. A programme of measures to implement the Climate Action Plan 2050 and ensure that the targets for 2030 are reached will be developed in 2018.

3.1.1 Cross-sectoral strategies and measures

EU Emissions Trading Scheme

Emissions trading has been the main multi-sectoral measure for reducing CO_2 emissions in Germany since 2005. Emissions trading requires operators of power generation plants, energy-intensive industries, aviation and aluminium and adipic acid manufacturers to surrender CO_2 allowances for their CO_2 emissions during the previous year. The third phase of EU emissions trading began in early 2013 and runs until 2020. The emissions trading scheme is constantly being refined. When the third phase began, the national emission budgets and register were replaced by a centralised European emission budget and register, auctioning of certificates became the norm, and aviation along with other industrial sectors were also placed under the scope of the ETS. A market stability reserve will be used to stabilise carbon allowance prices starting in 2019. According to calculations in the Projections Report, emissions trading in 2020 will reduce greenhouse gas emissions by 9 Mt CO_2e more than under a without-measures scenario without emissions trading (see policy and measure 1 (PaM 1) in CTF Table 3).

3.1.2 Sectoral strategies and measures

Energy industry

Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz, EEG)

Since the decisions were taken on the energy transition, the Act has undergone constant development and been adapted to the new requirements and framework for the expansion of renewable energy sources. The amendment of the EEG in 2016 defines expansion paths for the most important renewable energy sources. Most of them are to be achieved by tendering procedures for funding that are being introduced for biomass systems (with installed capacity above 150 kW), onshore wind turbines and solar systems (with capacity above 750 kW) and offshore wind turbines. The tendering procedure will replace a guaranteed feed-in tariff. The tendering will be carried out by the Bundesnetzagentur (Federal Network Agency), a federal agency that reports to the Ministry for Economic Affairs and Energy.

A detailed study of the expansion of renewable energy sources is contained in the renewable energy progress report[26] and the annual national monitoring report on the energy transition.[27]

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[25] Projections report 2017. German version available online at http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/ ; English version will be available in due course at http://acm.eionet.europa.eu/ .

[26] The EU Commission publishes an online English version of the progress reports of each EU Member State: http://ec.europa.eu/energy/en/topics/renewable-energy/progress-reports.

Overall, renewables' share in electricity consumption is set to rise from 32 % at present to between 40 and 45 % in 2025 and to between 55 and 60 % in 2035. The German government's 2015 Projections Report showed that the EEG had reduced greenhouse gases by 147 Mt CO_2e (the current 2017 Projections Report did not recalculate that effect) (see CTF Table 3, PaM 4).

Lignite-fired power plants on standby for reserve capacity only

On 4 November 2015 the federal cabinet decided to put several lignite-fired power plants on standby for reserve capacity only. The shut-down of the relevant power plant units was grounded in Article 13g of the Energy Industry Act (Energiewirtschaftsgesetz – EnWG).

The simulation in the power plant model of the system used to model the policy scenarios shows that placing lignite-fired power plants on standby for reserve capacity only considerably reduces their emissions. However, the electricity production thus lost must be replaced by other power plants, and at the same time exports fall. In the model, the production that is lost is primarily replaced by coal-fired power plants.

The early mothballing of lignite-fired power plants reduces CO_2 emissions by 10 Mt CO2e in 2020 (see CTF Table 3, PaM 6).

Energy: Electricity consumption in private households

EU Ecodesign Directive

The Ecodesign Directive 2009/125/EC (formerly Directive 2005/32/EC) is the legal framework that specifies minimum efficiency standards for energy-related products in the European internal market. Directive 2009/125/EC was transposed into German law by the 25 November 2011 version of the Energy-Related Products Act (Energieverbrauchsrelevante-Produkte-Gesetz – EVPG). For further details, please refer to the description of the Ecodesign Directive in the Sixth National Communication. Minimum energy efficiency standards for air heating products were introduced in 2016 in Commission Regulation (EU) 2016/2281. Regulations for other product groups are currently being prepared or reviewed.

The 2017 Projections Report attributes electricity savings totalling 30.6 TWh in 2020 to the Ecodesign Directive. Of this, 14.9 TWh is from private households, 4.5 TWh from industry and 11.2 TWh from the trade, commerce and services sector. Emissions reductions resulting from savings in the use of fuel amount to 0.05 Mt CO_2e (see CTF Table 3, PaM 7a). The GHG reduction resulting from lower electricity consumption is considered for this measure in a package with other electricity saving models (see CTF Table 3, PaM 7b, GHG reduction contained in PaM 3).

Advice for low-income households on conserving energy

The new electricity check for local authorities project was launched as part of the National Climate Initiative (NKI) on 1 April 2016. The project builds on the earlier advice scheme for low-income households. It seeks to get electricity checks established at the local authority

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[27] Federal Ministry for Economic Affairs and Energy (2017): Fifth Monitoring Report on Energy of the Future, http://www.bmwi.de/Redaktion/DE/Publikationen/Energie/fuenfter-monitoring-bericht-energie-der-zukunft.pdf?__blob=publicationFile&v=38.

level over the long term. The following budget funding has been made available for this project: 2016: EUR 7.8 million, 2017/18: EUR 9.8 million each year, 2019: EUR 2.5 million. According to calculations in the 2017 policy scenarios, private households will save 0.15 TWh of electricity in 2020 as a result of this measure. The effect on greenhouse gases was determined in a package containing multiple electricity saving measures using a simulation in the power plant model (see CTF Table 3, PaM 12, greenhouse gas reduction contained in PaM 3).

Energy: Consumption in industry and the trade, commerce and services sector – electricity and process heat/steam

In addition to the measures outlined below, the EU Ecodesign Directive, with its minimum efficiency standards for various product groups, makes a substantial contribution to improving energy efficiency and hence to the avoidance of greenhouse gas emissions in industry and trade.[28]

Funding guideline for promoting the prevention and utilisation of waste heat (PaM 18)

This guideline, which is an element of the Waste Heat Prevention Campaign, entered into force in 2016. It includes financial support for measures to avoid producing industrial waste heat or to ensure that it is utilised. Funding is in the form of a repayment grant for up to 50 % of the eligible costs under a KfW loan. The programme will fund capital investments in different kinds of technology to encourage modernisation or expansion of existing plants and building new plants if that avoids the production of waste heat or makes it possible to utilise previously unused waste heat more efficiently. This includes internal and external capital investments as well as measures to use waste heat to generate electricity. A total funding volume of EUR 300 million is available up to 2020.

Reduction effect

As a result of fuel savings, this measure avoids 0.1 Mt CO_2e in 2020 in the commerce, trade and services sector and 0.5 Mt CO_2e in industry. In addition, 0.1 TWh of electricity is saved in industry.

Promoting energy efficiency networks

Companies wanting to set energy efficiency and CO_2 reduction goals and learn from one another can join energy efficiency networks. There have previously been some 110 of these networks in Germany, although there is potential for up to 700 (Fraunhofer ISI et al. 2008, p. 180). Funding for 40 more energy efficiency networks was approved under the National Climate Initiative (NKI) in August 2014. The German government decided in the National Action Plan on Energy Efficiency (NAPE) to establish some 500 networks on a voluntary basis up to 2020. The networks must fulfil uniform minimum requirements, including conducting an energy audit at company level, setting a conservation target at the network level based on individual company targets and taking advantage of the potential for savings that has been identified according to the network target. The networks will have the support of a trained energy advisor. Measures that are implemented will be subject to annual monitoring and will be an integral part of the interim reports required under the funding rules.

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[28] It is expected that the Ecodesign Directive will lead to electricity savings of 4.5 TWh in industry and 11.2 TWh in the trade, commerce and services sector; see above.

In the commerce, trade and services sector the energy efficiency networks can reduce electricity consumption by 0.1 TWh and reduce direct GHG emissions from fuel inputs by 0.1 Mt CO_2e in 2020. In industry, savings amount to 1.1 TWh of electricity and an additional 0.7 Mt CO_2e reduction in greenhouse gas emissions as a result of avoided fuel inputs (see CTF Table 3, PaM 17).

Industrial processes and use of products (fluorinated greenhouse gases)

Transposition of EU Regulation 517/2014 on fluorinated greenhouse gases

EU Regulation 517/2014 is a key instrument for reducing F-gas emissions from industrial processes. It limits the total amount of HFCs that can be sold in the EU and phases them down over time to 21 % of sales during the 2009-2012 period. This leads to price increases and shortages on the market. The Regulation also includes the following individual measures:

- Bans on placing on the market certain products and equipment that contain fluorinated greenhouse gases, such as fire protection equipment (HFC-23), certain refrigeration and air-conditioning equipment, foams (HFCs) and technical aerosols (HFCs)
- Ban on the use of SF_6 in all magnesium foundries
- Maintenance obligation/leak checks for equipment containing fluorinated greenhouse gases in quantities of 5 tonnes CO_2e or more

The policy scenarios indicate that this package of measures will reduce greenhouse gases by a total of 1.2 Mt CO_2e in 2020 (see CTF Table 3, PaM 33 and 34).

Transport

In addition to the measures set out below, the German government uses budget funds to promote public transport, rail infrastructure and electric mobility. The funding programmes are described in greater detail in the Seventh National Communication.

HGV toll

A toll has been charged for heavy goods vehicles with a maximum permissible gross laden weight greater than 12 tonnes using the Autobahn motorway system since 2005. As of 1 July 2018, the HGV toll will also apply to all 40,000 km of roads built and maintained by the federal government. The tolls are based on pollutant class.

The external costs of air pollution have been incorporated since 1 January 2015 in line with Directive 1999/62/EC. The allocation of noise costs will be examined by the end of 2017.

The 2017 Projections Report calculated the direct emission reductions in 2020 as being 0.1 Mt CO_2e (see CTF Table 3, PaM 28).

Promotion of electric mobility (PaM 29)

The German government and industry came together in the National Platform for Electric Mobility (NPE) to define the goal of developing Germany into a lead market for and lead supplier of electric mobility. The goal is to have one million electric vehicles in use by 2020, rising to six million by 2030. The government provides financial support for the expansion of charging infrastructure, the further development and testing of electric drives in commercial vehicles, and a subsidy for purchases of electric cars.

Reduction effect

The 2017 Projections Report calculated a GHG reduction of 0.5 Mt CO_2e in 2020 for various measures promoting electric mobility. If indirect emissions are taken into account (for example as a result of emissions being transferred to the electricity sector when electricity is used as a fuel), the GHG reduction is 0.2 Mt CO_2e.

Agriculture

Fertiliser Application Regulation

The amendment to the Fertiliser Application Regulation (Düngeverordnung) entered into force at the end of May 2017, thus putting key provisions of the EU Nitrates Directive into effect in Germany. Many aspects of the Fertiliser Application Regulation influence the management of nutrients, particularly farm manure. The new regulations now also include manure of plant origin (digestion residues from biogas plants) in the permitted field application limit for organic fertilisers of 170 kg N/ha, and mandatory fertiliser planning according to specific instructions has been introduced. In addition, for the first time provisions have also been included to reduce atmospheric nitrogen losses (obligation to incorporate manures and urea on uncultivated arable land within four hours), and from 2020 the permissible gross nitrogen balance surplus is reduced from previously 60 to 50 kg N/ha on a three-year average. In order to target regional pollution situations more specifically, the Länder now have the option of introducing further measures such as shorter incorporation times, longer closed periods for applying fertiliser and lower permissible nutrient surpluses in areas with high nitrate inputs and high phosphorus loads in surface waters.

This measure is projected to reduce GHG emissions by 2.2 Mt CO_2e in 2020 (see CTF Table 3, PaM 42).

NEC Directive and National Air Pollution Control Programme

A 29 % reduction in ammonia emissions by 2030 compared with 2005 levels is specified in the new National Emissions Ceilings (NEC) Directive (2016/2284/EU), which entered into force on 31 December 2016 replacing earlier legislation (Directive 2001/81/EC). Reducing ammonia as an atmospheric pollutant has an indirect effect on reducing greenhouse gases. Some measures in the above-mentioned amendment to the Fertiliser Application Regulation contribute to this reduction (provisions on prompt incorporation of manure on uncultivated arable land, low-emission ground-level application of slurry and the use of urease inhibitors in mineral urea-based fertilisers). Under the NEC Directive, Germany is required to submit a National Air Pollution Control Programme to the Commission by 1 April 2019 describing measures suited to achieving the reduction targets. The measures to reduce the atmospheric pollutant ammonia have the indirect effect of reducing CO_2 and N_2O.

Calculations indicate that the NEC Directive results in GHG emissions being 0.4 Mt CO_2e lower in 2020 (see CTF Table 3, PaM 43).

Land use and land-use changes

Conservation of permanent grassland

The Climate Action Programme 2020 includes conservation of permanent grassland. Implementation of the greening requirements introduced during the CAP reform is being pursued with particular zeal in Germany. According to the provision that applies up to 2020, farms that receive direct payments and are subject to greening requirements may not plough

or convert permanent grassland that existed as of 1 January 2015 in Special Areas of Conservation (environmentally sensitive permanent grassland). Other permanent grassland that is not classified as environmentally sensitive may generally be converted only if an official permit has been granted, subject to documentation of a replacement area of equal size on which new permanent grassland must be established. The conservation of permanent grassland is also supported by provisions in several Länder.

If the areas of permanent grassland are maintained at the level of 2014, greenhouse gas emissions will be 0.8 Mt CO_2e lower in 2020 (see CTF Table 3, PaM 45).

Conservation and sustainable management of forests

The German government decided in its 2050 Climate Action Plan to provide federal funding for forest conversion under the Joint Task for the Improvement of Agricultural Structures and Coastal Protection (GAK), thereby supporting the adaptation of forests to climate change. The German government's Forest Climate Fund is also promoting measures to maintain and expand the potential of forests and wood to reduce CO_2 and to help German forests adapt to climate change.

Other measures under the Climate Action Plan include the Charter for Wood 2.0, increasing the amount of forested land, greater consideration of climate change mitigation in the area of forests in the GAK, and reinforcing Germany's international cooperation in the areas of conserving, restoring and sustainably managing forests; supporting the widespread use of certification as an instrument for providing proof that wood products are the result of legal, sustainable forestry practices; and reducing atmospheric inputs of nitrogen and acids into forest soils.

Based on the trend for forest carbon stocks projected by the WEHAM model (forest development and timber resource modelling), forests' function as a sink will decline considerably between 2014 and 2020, from 57.8 Mt CO_2e to just over 11 Mt CO_2e, after which the quantity of carbon dioxide bound by forests each year subsequently rises again (see CTF Table 3, PaM 46). Further information on this trend is provided in section 3.1.13 of the 2017 Projections Report.

The waste management sector

Strengthening recycling through the Packaging Act and the Commercial Waste Regulation

The provisions of the 2017 Packaging Act (Verpackungsgesetz) and the 2017 Commercial Waste Regulation (Gewerbeabfallverordnung) will lead to an increasing rate of recovery of secondary raw materials from waste, with preference being given to recycling or otherwise using them to generate energy. As a result of the substitution of primary raw materials, this leads to the avoidance of greenhouse gas emissions compared with the extraction and use of primary raw materials. However, it is not possible to account for the avoidance in the waste sector because the effects arising from the legal provisions are not yet quantifiable and, statistically, the reductions are attributed to the National Greenhouse Gas Inventories of the industrial sectors that make use of the recycled materials (see CTF Table 3, PaM 38).

Amendment to the Technical Instructions on Air Quality Control (TA Luft), emission reduction measures in anaerobic digestion plants

According to this planned regulation, which has not yet been formally adopted, the aerobic treatment of digestion residues, and especially their removal from the digestion tank and aeration, must take place in an enclosed space. Any exhaust gases must be scrubbed. In

future, improved process management and monitoring will have the particular purpose of reducing the amount of methane generated in the plants and thus lead to a reduction in emissions. Furthermore, the use of biogas generated in the digestion process to produce energy serves as a substitute for fossil fuels, thus avoiding greenhouse gas emissions. Therefore despite the increase in volumes of separately collected biowaste, emissions of greenhouse gases from composting and anaerobic digestion at biogas plants will decrease.

According to the Projections Report, the reduction in emissions resulting from lower methane emissions will be approximately 121 kt CO_2 per year in 2020 (see CTF Table 3, PaM 36).

Buildings

CO_2 building refurbishment programme

KfW programmes for energy-efficient construction and refurbishment of residential and non-residential buildings are financed by funds from the CO_2 building refurbishment programme. The funding programme is addressed to various target groups and promotes both energy-efficient new buildings and refurbishment of existing buildings. A total of EUR 2 billion is available in 2017 for new funding measures for the Energy-Efficient Refurbishment and Energy-Efficient Construction (private consumers), Energy-Efficient Construction and Refurbishment (commercial buildings) and Energy-Efficient Construction and Refurbishment (municipal and social infrastructure) sub-programmes.

The 2017 Projections Report determined that direct emission reductions as a result of fuel savings in the buildings sector will be 2.9 Mt CO_2e in 2020 (see CTF Table 3, PaM 19). There is also a reduction in electricity consumption of 2 TWh.

Market Incentive Programme for renewable energy (MAP)

The MAP promotes equipment for the use of renewable energy sources for heating and cooling and certain heat storage facilities and local heating networks for both residential and non-residential buildings. Eligibility is primarily limited to equipment in existing buildings, with equipment in new construction being funded only in exceptional cases. The details of MAP funding are given in the guidelines on promoting the use of renewable energy technology in the heat market (Richtlinien zur Förderung von Maßnahmen zur Nutzung erneuerbarer Energien im Wärmemarkt) published on 11 March 2015. Budget funds of some EUR 222 million and an additional EUR 87 million from the Special Energy and Climate Fund are available for the Market Incentive Programme in 2017.

The emissions reductions in the policy scenarios were determined by comparison with a without-measures scenario as described in section 4.3.5.2 of the National Communication. The model calculates direct GHG reductions from fuel savings amounting to 3.9 Mt CO_2e and 0.5 TWh of electricity savings in 2020 (see CTF Table 3, PaM 21).

Energy Conservation Regulation (Energieeinsparverordnung) 2014

The most recent amendment of the regulation, under which stricter requirements for the primary energy demand for new builds were imposed with effect from 2016, entered into force on 1 May 2014. The maximum admissible primary energy requirement was reduced by 25 % compared with the 2009 Energy Conservation Regulation, and the requirements for the energy performance of the building envelope were increased by 20 % on average. This ruling applies to boilers that were installed before 1 January 1985. Boilers installed after this date are subject to the regulation after 30 years of operation.

The emissions reductions in the Projections Report were determined by comparison with a without-measures scenario. The model shows a direct emission reduction of 3.1 Mt CO_2e in 2020 as a result of fuel savings (see CTF Table 3, PaM 22), and 0.9 TWh of electricity is saved.

3.1.3 Information on changes to institutional climate change mitigation arrangements

Regulations in the European context

The regulations in the European context are part of the EU biennial report.

Regulations in the national context

Interministerial Working Group on CO_2 Reduction

The German government set up the Interministerial Working Group on CO_2 Reduction in 1990, with the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) as the lead agency. The working group's remit is to draft guidelines for climate action, identify areas where action is needed, identify potential for reducing greenhouse gases and propose comprehensive packages of measures to reduce greenhouse gas emissions in Germany and submit them to the federal cabinet. The Interministerial Working Group on CO_2 Reduction will provide any necessary support for further development and implementation of the 2050 Climate Action Plan.

Other institutional arrangements

The Second Biennial Report described other institutions that participate in implementing agreements under the Kyoto Protocol. There have been no changes in the institutions concerned or in their portfolio of activities since 2016.

Monitoring and evaluation of climate change mitigation activities

The monitoring and evaluation of EU targets are described in the European Union's biennial report.

Important developments and indicators related to national climate targets are regularly discussed in the German government's climate action report[29] (published annually since 2015), the annual monitoring report[30] and the progress report entitled Energy of the Future,[31] which is published every four years. The reports are available online. Progress in implementation of the 2050 Climate Action Plan will also be reported on a regular basis starting in 2020.

[29] The 2016 climate action report is available here: http://www.bmub.bund.de/fileadmin/Daten_BMU/Pools/Broschueren/klimaschutzbericht_2016_bf.pdf

[30] https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/DatenaustauschUndMonitoring/Monitoring/Monitoringbericht2016.pdf?__blob=publicationFile&v=2

[31] https://www.bundesnetzagentur.de/SharedDocs/Downloads/DE/Sachgebiete/Energie/Unternehmen_Institutionen/MonitoringEnergiederZukunft/fortschrittsberichtlang.pdf?__blob=publicationFile&v=3

3.1.4 Evaluating the effects of reduction measures

To date there has been selective ex-post evaluation of the effect on the climate and the economy of climate change mitigation measures in Germany. For example, the Fifth Monitoring Report on the Energy Transition included a detailed analysis of the contribution of expanding the use of renewable energy sources. A study was done to determine the economic impacts of the Climate Action Programme 2020 for the German government's 2016 climate action report. The next two chapters make reference to these publications.

Effects of policies and measures on trends in greenhouse gas emissions

Trends in emissions avoided by using renewable energy

Replacing fossil fuels with renewable energy sources makes an important contribution to meeting climate targets. Emissions totalling almost 160 Mt CO_2e were avoided in 2016, compared with a reference system under which renewable energy sources were not used and energy demand remained the same as in 2016. The electricity sector accounted for almost 120 Mt of the amount avoided. Emissions were 36 Mt CO_2e lower in the heating sector and 4 Mt CO_2e lower in the transport sector. Across all sectors, biomass contributed around 64 % to the total GHG reduction, followed by wind energy at 33 % and photovoltaics with a share of almost 15 % (see Figure 5).

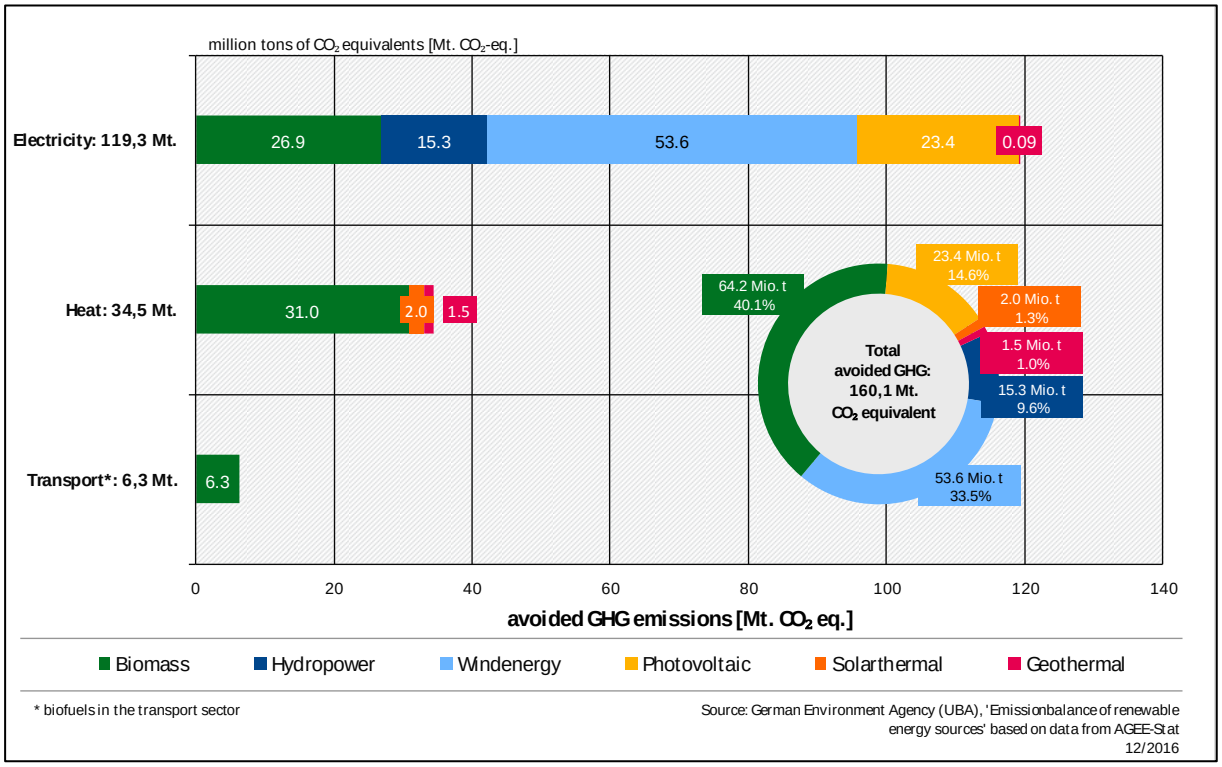

Figure 5: Net balance of greenhouse gas emissions avoided due to the use of renewable energy sources in 2016[32]

[32] Federal Environment Agency, AG Erneuerbare Energien-Statistik (2017), http://www.umweltbundesamt.de/indikator-vermiedene-thg-emissionen-durch

The avoidance of emissions as a result of using renewable energy sources is calculated on a net basis. The emissions caused by the provision of final energy from renewables are offset against the gross emissions avoided by substituting fossil fuels and/or nuclear energy. This takes into account all upstream process chains involved in extracting and supplying energy sources and manufacturing and operating plant and equipment (not including dismantling); it thus differs from the internationally binding rules used to determine GHG emissions in the GHG inventories.

Socio-economic effects of reduction measures

Measures under the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency are expected to have positive economic effects in Germany going beyond the intended positive effects on climate change mitigation. For example, greater efficiency in the use of fossil energy sources can help to reduce fuel imports. The measures also promote the development of new technologies. Domestic value creation is maintained, and employment in many sectors can be safeguarded or jobs created in new sectors.

The Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety commissioned a research project to elucidate 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). The costs to be incurred up to 2020 were compared with the benefits (such as those resulting from energy conservation), which frequently extend beyond 2020. The conclusions of the study indicate that, in net terms based on cash values, the energy costs saved by implementing the measures under the Action Programme and NAPE could exceed the investments necessary to implement the measures by almost EUR 150 billion. This is subject to the proviso that the assumptions used actually apply to the extent presented. Twenty-eight percent of those savings will be made during the period up to 2020. According to the study, households will experience the greatest benefit, with net savings totalling EUR 26 billion. The study also finds that there will be considerable direct and indirect cost savings for the national budget. 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 a net additional expense of about EUR 10 billion. This is attributable to increased use of expensive primary fuels such as natural gas. Capital costs remain constant as demand decreases, so the conversion sector does not profit from efficiency measures in the demand sector to the same extent. From the economic viewpoint, lower fuel imports with assumed marked increases in fuel prices lead to much lower import costs of EUR 3.5 billion. This primarily applies to the area of imported petroleum.

Positive impulses for the labour market in Germany are also anticipated. According to the study, rising demand for goods (for example in the buildings sector) could increase employment by about two million person-years between 2015 and 2020. Almost 430,000 more people are expected to be employed by 2020 as a result, according to the study. A combination of all of the approved measures could lead to GDP growth of about 1 %.

The aforementioned study[33] concludes that the economic benefits associated with the approved measures in the Climate Action Programme clearly exceed the costs. This is

[33] PwC (2016): Wirtschaftliche Bewertung des Aktionsprogramm Klimaschutz 2020.

particularly the case when the effect after 2020 is considered. The measures stimulate and multiply investments, promoting value creation and employment.[34]

Other studies have explored the economic impacts of energy and climate policy measures and the associated macroeconomic issues. They derive quantitative effects of varying degrees depending on the underlying assumptions, but in the overall perspective they arrive at similar conclusions.

Information on minimisation of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol

Most measures in Germany are not expected to have direct effects on developing countries; in other cases the expected effects, such as those resulting from the development of technical and administrative structures for climate change mitigation, are considered to be very positive.

The potential indirect effects are almost all consistently positive, particularly as a result of beneficial effects on the energy supply and energy prices in the cooperation countries. NIR 2016 contained a detailed description of the individual measures. They related to areas including promotion of biofuels, elimination of coal subsidies, policies and measures at EU level, particularly emissions trading, and supporting developing countries in diversifying their energy supplies. There have been no changes since those measures were reported.

3.1.5 Use of credits from market mechanisms to achieve national reduction targets

Germany does not plan to use credits from market mechanisms to achieve its climate change targets.

3.2 Evaluation of emissions reduction, recognising market-based instruments and LULUCF

3.2.1 National targets

In its Climate Action Plan 2050 of November 2016,[35] the German government confirmed and further defined its ambitious national climate targets: Germany is abiding by the existing national target of a 40 % reduction in its greenhouse gas emissions by 2020. The German government also affirms in the Climate Action Plan 2050 the targets of reducing its greenhouse gas emissions by at least 55 % by 2030, 70 % by 2040, and 80 to 95 % by 2050 compared with base year 1990. The Climate Action Plan clearly states that Germany intends to be largely greenhouse gas neutral by 2050.

In addition, the Climate Action Plan spelled out the government's 2030 climate target for the individual sectors, described the necessary development pathways, agreed initial implementation measures and set up a process for monitoring and refining the policies and measures. This is the means by which Germany will play its part in achieving the Paris Agreement’s aim to limit global warming to well below 2 degrees Celsius and to pursue efforts to limit the temperature increase to 1.5 degrees Celsius.

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[34] BMUB (2016): 2016 Climate Action Report to the German government's Action Programme 2020.

[35] Climate Action Plan in German and English at http://unfccc.int/focus/long-term_strategies/items/9971.php and http://www.bmub.bund.de/themen/klima-energie/klimaschutz/klima-klimaschutz-download/artikel/klimaschutzplan-2050-1/?tx_ttnews%5BbackPid%5D=3915.

The German government adopted the Climate Action Programme 2020 in December 2014. It did so in response to Germany's 2013 Projections Report, which stated that the national emission reduction target of minus 40 % by 2020 would probably not be achieved with the measures that had been put in place at that time. In order to reach the 40 % target, therefore, additional efforts needed to be made. The German government did this with the most comprehensive action programme up to that time, which contained measures in all sectors.

The national GHG reduction target for 2020 is underpinned by a series of sub-targets in the area of energy efficiency and renewable energy, some of which apply to specific sectors and which are also specified in the government's 2050 Energy Concept and in some cases also in legislation such as the Renewable Energy Sources Act (Gesetz zum Ausbau der erneuerbaren Energien, EEG).

Germany has made significant progress in climate change mitigation since the beginning of the 1990s. Examples of this include the fact that it has decoupled economic growth from greenhouse gas emissions and surpassed the reduction targets it set itself under the first commitment period of the Kyoto Protocol. To achieve the German government's ambitious national target of cutting the country's greenhouse gas emissions by at least 40 % by 2020 compared with 1990, emissions need to be cut from the 1990 level of about 1,250 Mt CO_2e to a maximum of 750 Mt CO_2e in 2020.

According to the 2017 National Inventory Report, some 902 million tonnes of greenhouse gases were emitted in Germany in 2015. That equates to a 28.1 % reduction in comparison to 1990. According to the latest estimates by the Federal Environment Agency, 906 million tonnes of greenhouse gases were emitted in 2016, a reduction of about 27.6 % since 1990.[36] The 2017 Projections Report concludes that, as a result of the measures that have already been adopted and implemented, a reduction in greenhouse gases of 34.7 % can be achieved by 2020. When uncertainties regarding population trends, economic trends and energy prices are taken into account, a range of about 34.5 to 38.4 % results. The German government does not fully endorse the scenarios of the 2017 Projections Report for the period 2005 to 2035, but it will ensure that the research findings are taken into account in its future deliberations.

3.2.2 Germany's contribution to the EU reduction targets

The EU has made a joint commitment under the UNFCCC for all its Member States, undertaking to cut greenhouse gas emissions by 20 % compared with 1990 levels by 2020.[37] The EU contribution is ascertained by adding together the emissions of all 28 Member States. Emissions from land use, land-use change and forestry (LULUCF) do not count towards the EU target and are therefore not included in CTF Tables 4 and 4a.

A portion of the total emissions is regulated under the EU-wide Emissions Trading Scheme. Installations and processes that fall under the Emissions Trading Scheme in all 28 EU Member States are allocated allowances from an EU emissions budget (cap). Norway, Iceland and Liechtenstein, which are not members of the EU but do participate in the ETS,

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[36] Press release 09/2017 of the Federal Environment Agency, "Klimabilanz 2016: Verkehr und kühle Witterung lassen Emissionen steigen" of 20 March 2017 https://www.destatis.de/DE/ZahlenFakten/Wirtschaftsbereiche/Energie/Erzeugung/Tabellen/AbgabeKlaergas.html, accessed 2 August 2017.

[37] FCCC/SB/2011/INF.1/Rev.1.

also receive allowances in this way. The aim is cut these emissions by 21 % compared with 2005 levels by 2020. According to the European Environment Agency, emissions from stationary installations that are covered by the Emissions Trading Scheme (not including aviation), decreased by 24 % between 2005 and 2015.[38]

Table 2 shows the trends in emissions from stationary installations in Germany covered by the Emissions Trading Scheme and trends shown in the Projections Report up to 2035. Between 2005 and 2014 there was an actual decrease of 11 %. In principle, this downward trend continues in the projections for the 2020 to 2035 period. Credits obtained from flexible mechanisms under the Kyoto Protocol can to a certain extent be used in the ETS, provided the mitigation projects meet certain quality criteria.[39]

[38] EEA Report 24/2016: Trends and projections in the EU ETS in 2016. The EU Emissions Trading System in numbers.

[39] Directive 2009/29/EC of the European Parliament and of the Council of 23 April 2009 amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading scheme of the Community

	2005	2010	2014	2020	2025	2030	2035
	Mt CO_2e						
Emissions from stationary installations within the ETS[a]	518.9	478.9	461.3	387.7	393.6	360.5	311.3
Emissions covered by the ESD[b]	470.4	459.5	438.3	426.5	397.3	371.9	355.9
Total emissions covered by the ESD and from stationary installations within the ETS[c]	989.3	938.4	899.5	814.2	790.9	732.4	667.2
Trends in emissions from stationary installations within the ETS compared with 2005	0.0 %	-7.7 %	-11.1 %	-25.3 %	-24.1 %	-30.5 %	-40.0 %
Trends in emissions covered by the ESD compared with 2005	0.0 %	-2.3 %	-6.8 %	-9.3 %	-15.5 %	-20.9 %	-24.3 %
NF3 (outside the scope of the ESD and ETS)[c]	0.0	0.1	0.0	0.0	0.0	0.0	0.0

Table 2: Trends in emissions trading for stationary installations and in emissions in the ESD sectors under the WMS of the 2017 Projections Report.[40]

Note on Table 2:

[a] Emissions covered by the ETS in line with the 2013 definition.

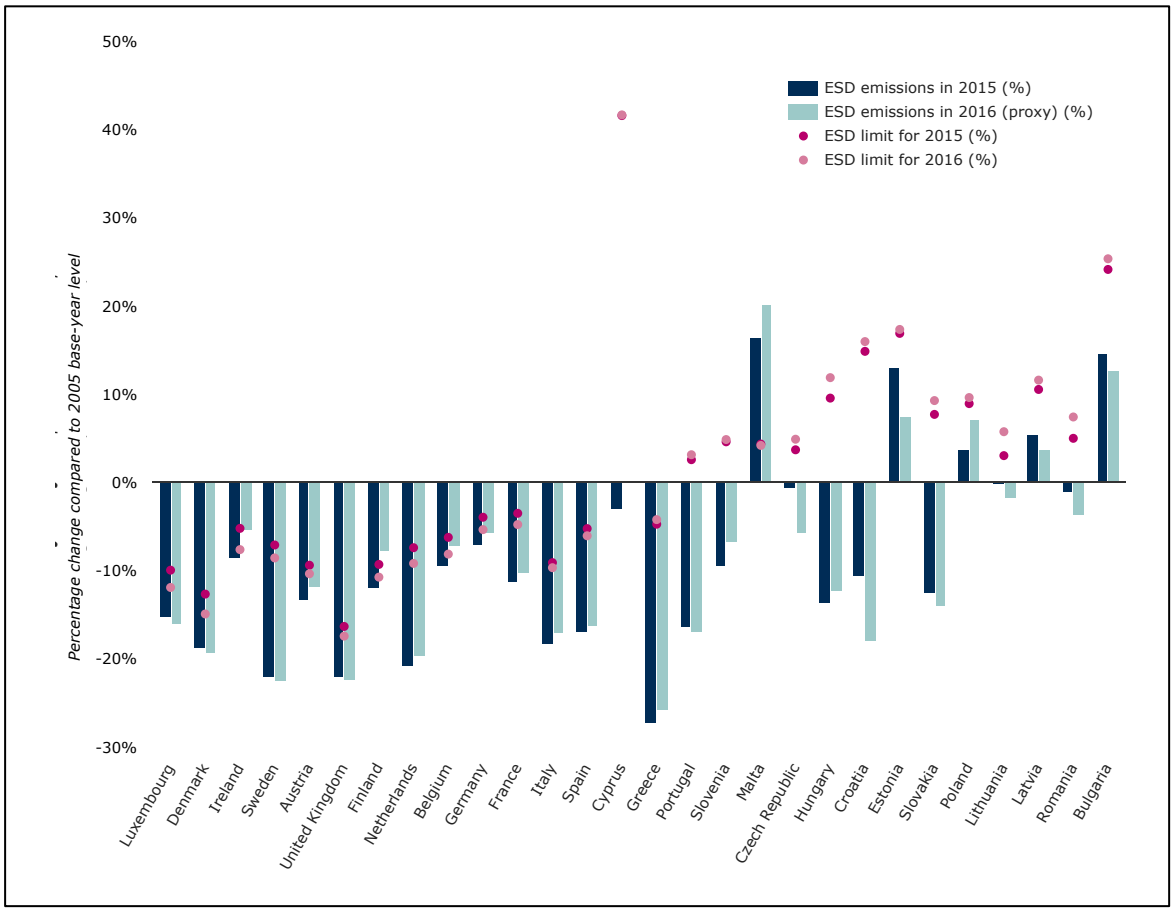
[b] For reasons of consistency (i.e. to permit comparison with data for 2020-2035), emissions covered by the ETS have been calculated using CRF categories; in line with the 2013 definition. This does *not* correspond to the base value for the reduction target under the Effort Sharing Decision.

[c] This sum is lower than the total national emissions because CO_2 emissions from domestic aviation and all NF_3 emissions are not covered by the ETS or the ESD.

[40] Source: Federal Environment Agency: 2016 National Inventory Report, Central System for Emissions, European Environment Agency EU ETS Data Viewer, calculations by Öko-Institut.

The EU Member States have agreed national reduction targets for the greenhouse gas emissions that are not regulated by the Emissions Trading Scheme. Under this agreement Germany has committed to reducing emissions by 14 % from 2005 levels by 2020.[41] This percentage reduction target was translated into an annual emissions budget for each Member State. In 2013 the emission budgets were adapted to ensure compliance with IPCC requirements.[42] Furthermore, in 2017 a decision was taken to distribute the additional reductions required across the emissions budgets for 2017 to 2020 only.[43] This means that Germany has to comply with considerably tighter emission limits during this period.

The latest estimates indicate that Germany is complying with its emissions budgets: emissions under the ESD totalled 448.7 Mt CO_2e in 2015. The budget for 2015 was 459.1 Mt CO_2e and for 2014 it was 465.83 Mt CO_2e; actual emissions were 436.79 Mt CO_2e. Similarly, the budget of 472.5 Mt was complied with in 2013, with actual emissions totalling 460.2 Mt.[44]



41 Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020

42 2013/634/EU: Commission Implementing Decision of 31 October 2013 on the adjustments to Member States' annual emission allocations for the period from 2013 to 2020 pursuant to Decision No 406/2009/EC of the European Parliament and of the Council

43 Commission Decision (EU) 2017/1471 of 10 August 2017 amending Decision 2013/162/EU to revise Member States' annual emission allocations for the period from 2017 to 2020

44 European Environment Agency, Greenhouse Gas Emissions covered under the Effort Sharing Decision, https://www.eea.europa.eu/data-and-maps/data/esd/esd.xlsx/ghg_exd.xlsx.

Figure 6: Targets and emissions under the EU Effort Sharing Decision, 2015-2016[45]

According to current evaluations by the European Environment Agency, Germany achieved the overall target of cutting greenhouse gas emissions by 14% within the accounting period.

It is also possible to use flexible Kyoto mechanisms under the Effort Sharing Decision. Despite the fact that it is foreseeable that the new emission limits will be exceeded, Germany is not planning to use credits from Kyoto Mechanisms to achieve its targets. Instead these flexible mechanisms will, if necessary, be used within the ESD. Consequently, details of the use of flexible mechanisms have not been reported in CTF Table 4b.

4. Projections

The projections described here are based on calculations from 2016 and have already been used in the 2017 Projections Report.

For Germany's 2017 Projection Report, a research consortium developed a "with-measures" scenario (WMS) for the trends in greenhouse gas emissions in Germany for the 2005 to 2035 period. It comprises all new climate and energy measures launched by 31 July 2016 and existing ones that had been substantially modified by the same date. Secondly, it modelled a “with-additional-measures” scenario (WAMS), which includes primarily the policy measures that are set out in the interministerial Climate Action Programme 2020 and the National Action Plan on Energy Efficiency but have not yet been implemented.

The German government does not fully endorse the results of the scenarios for the trend in greenhouse gas emissions in Germany for the 2005 to 2035 period. Any scenario that looks as far ahead as 2035 is bound to be fraught with major uncertainties. Different trends have been estimated, depending on the assumptions made and methodology used. For example, studies and forecasts that the German government commissioned for the Climate Action Programme 2020 and the National Action Plan on Energy Efficiency come to diverging conclusions on individual points.

4.1 Description of the methodology used

An energy system model and an emissions calculation model were used to develop the scenarios by consolidating the results of detailed sectoral analyses, some based on models, into consistent and exhaustive figures for energy demand and greenhouse gas emissions. They are fully compatible with Germany’s Greenhouse Gas Inventories in the first commitment period (as of the date of the 2016 Inventory Report). Most of the calculations for the scenarios contained in this report are based on the National Greenhouse Gas Inventory. The most recent Greenhouse Gas Inventory available at the time this scenario was calculated is from the 2016 reporting year and was prepared in accordance with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories using global warming potentials (GWP) from the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC). Specific studies were done for space heating and hot water, electrical appliances, industry, the trade, commerce and services sector, transport, electricity

[45] EEA Report 17/2017: Trends and Projections in EU GHG Emissions.

generation from renewable energies and fossil electricity generation, as well as for fugitive emissions in the energy sectors and process-related CO_2, CH_4 and N_2O emissions. The results of other studies were used or adapted for other source categories (HFCs, PFCs and SF_6 emissions and agriculture, land use, land-use change and forestry (LULUCF)).

The 2017 Projections Report, which contains a more detailed description of the methodology and a fact sheet for the models used, can be found on the EEA data server.[46]

4.2 Projection results

4.2.1 Cross-cutting trends

The trends in total greenhouse gas emissions are calculated from energy-related greenhouse gas emissions and those from industrial processes, product use, agriculture, waste management, and land use, land-use change and forestry (LULUCF). This kind of estimate of emissions trends - even for short periods of time - is fraught with serious uncertainties. Economic trends, energy prices and other underlying conditions can have a strong influence on actual trends. The results must therefore be evaluated in the light of the assumptions made about the underlying data as described in the Projections Report. Sensitivity analyses carried out for the two scenarios within the 2017 Projections Report show the potential order of magnitude of the uncertainties.

Figure 7 summarises the main projection results for trends in total greenhouse gas emissions. It shows the raw inventory data for the historical reference years 1990 to 2014. The projections under the WMS and WAMS from 2020 onwards are shown next to each other to illustrate the additional effects expected from measures that are included in the WAMS but not in the WMS.

[46] Projections report 2017. German version available online at http://cdr.eionet.europa.eu/de/eu/mmr/art04-13-14_lcds_pams_projections/projections/; English version will be available in due course at http://acm.eionet.europa.eu/.

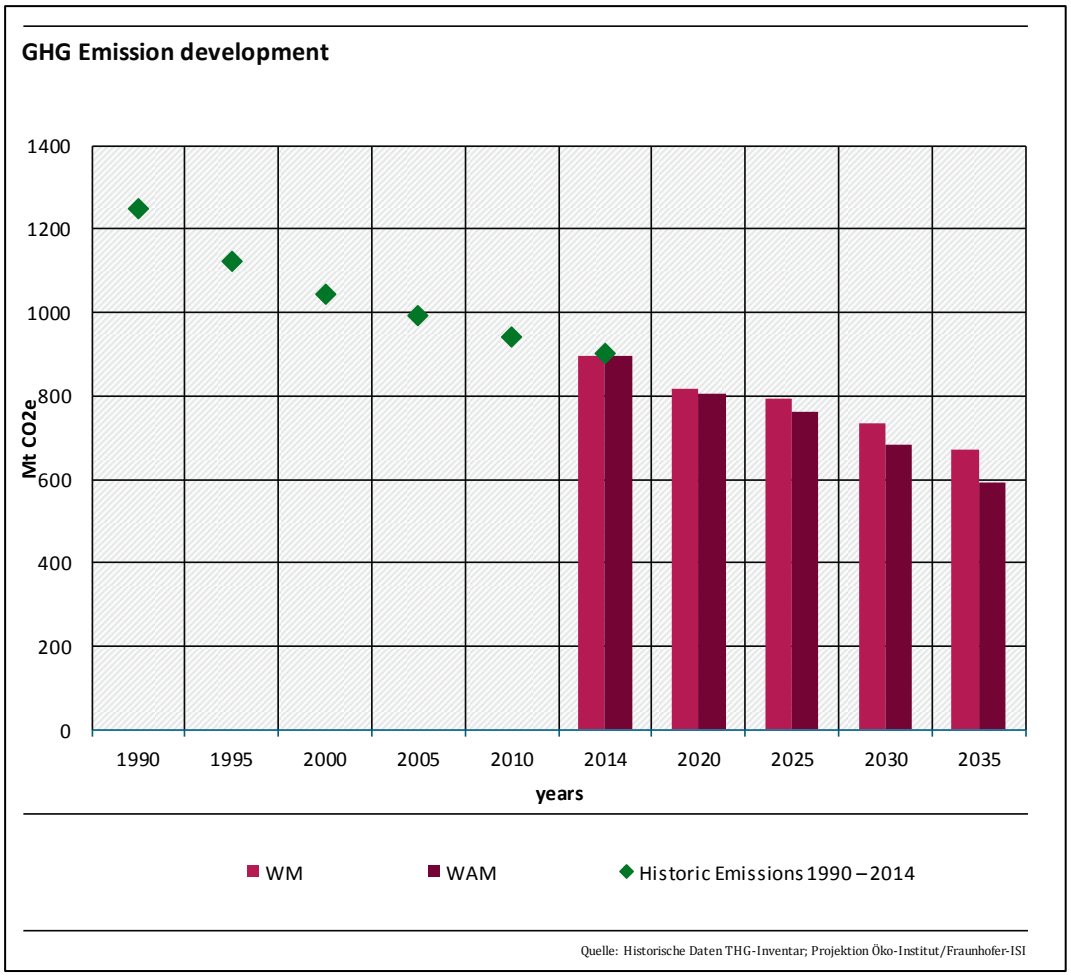


Figure 7: Trends in total greenhouse gases under the WMS and WAMS (1990-2035)[47]

For *total greenhouse gas emissions* (excluding land use, land-use change and forestry and international aviation and maritime transport), the WMS shows a reduction of 175 Mt CO_2e or 18 % for the 2005 to 2020 period. By 2030, the reduction from 2005 levels is about 257 Mt CO_2e or 26 % and by 2035 it is 323 Mt CO_2e or 33 %. Compared with 1990, this equates to a reduction of 34.7 % by 2020, 41 % by 2030, and over 46 % by 2035. If the sensitivities analysed in the report are taken into consideration, the possible corridor for emissions reduction in 2020 is between 33.7 % (stronger economic growth) and 37.5 % (lower electricity export balance) of the 1990 level.

Under the WAMS there is a reduction in *total greenhouse gas emissions* (excluding land use, land-use change and forestry and international aviation and maritime transport) of 186 Mt CO_2e or almost 19 % for the 2005 to 2020 period. By 2030, the reduction compared with 2005 is about 310 Mt CO_2e or over 31 % and by 2035 it is 400 Mt CO_2e or over 40 %. This corresponds to a 35.5 % reduction from 1990 levels by 2020. By 2030 there is a reduction of over 45 % and by 2035 of almost 53% compared with 1990. If the sensitivities analysed in the report are taken into consideration, the possible corridor for emissions reduction in 2020 is between 34.5 % (stronger economic growth) and 38.4 % (lower electricity export balance) of the 1990 level.

[47] Öko-Institut.

However, it must also be pointed out that the emissions trends described do not include developments in *international aviation* (and to a lesser extent deep-sea shipping). In particular, the very dynamic trend in international aviation causes the relevant greenhouse gas emissions to increase by more than 4 Mt CO_2e between 2005 and 2020, which equates to a 14 % increase. Since no additional measures are assumed for international transport under the WAMS, this statement applies equally to both scenarios.

4.2.2 Electricity generation

Under the WMS electricity consumption falls by approximately 10 % during the scenario horizon. However, as a result of the sometimes extremely strong electricity exports (between 34 and 51 TWh), net electricity generation remains at around 600 TWh until 2020 and then falls to 574 TWh in 2030 and to 554 TWh in 2035. It would fall considerably more if it were not for a marked rise in electricity consumption in the road transport sector caused by electric vehicles.

Electricity generation from renewable energy sources increases considerably under the WMS (from roughly 160 TWh in 2014 to about 286 TWh in 2030). This trend is primarily driven by a considerable increase in capacity of both onshore and offshore wind energy. Generation from photovoltaics also rises (increasing by about 25 % by 2035), although in this case a level of saturation is reached over time. Whereas electricity generation from nuclear energy, lignite, coal, and mineral oil decreases up to 2035, the use of natural gas to generate electricity increases.

Electricity demand decreases considerably during the scenario horizon under the WAMS. However, as a result of the - in some cases extremely significant - electricity exports (between 36 and 58 TWh), net electricity generation remains at the 2014 level until 2020 and then decreases by over 50 TWh by 2035. It would fall considerably more if it were not for a marked rise in electricity consumption in the road transport sector caused by electric vehicles.

Electricity generation from renewable energy sources increases markedly under the WAMS (from 160 TWh in 2014 to about 299 TWh in 2030). In comparison with the WMS, PV electricity generation increases by a total of 22 TWh in 2035. Electricity generation from biomass and wind energy is unchanged until 2030 in comparison with the WMS. In 2035, electricity generation from onshore wind energy increases by 7 TWh compared with the WAMS. There is a greater decrease in the use of lignite and coal than under the WMS, but a greater increase in coal-fired electricity generation.

Emission trends

In the with-measures scenario, greenhouse gas emissions in the electricity sector (including emissions from CHP plants generating electricity and heat) fall from 364 Mt CO_2e in 2014 to 286 Mt CO_2e in 2030, with approximately 60 Mt CO_2e of the reduction occurring in the period up to 2020, while the reduction in the period 2020 to 2030 is only a further 15 Mt CO_2e.

In the with-additional-measures scenario, greenhouse gas emissions in the electricity sector (including emissions from CHP plants generating electricity and heat) fall from about 364 Mt CO_2e in 2014 to 200 Mt CO_2e in 2035, with approximately 70 Mt CO_2e of the reduction occurring during the period up to 2020 and a further 93 Mt CO2e during the period up to 2035.

4.2.3 Other energy conversion sectors

Other sectors of the energy industry include district heating plants, oil and other refineries, other installations in the conversion sector (lignite mines, coal mines, briquette factories, coking plants, other conversion and processing installations, and the energy consumption of biogas plants) and natural gas compressor stations in pipeline networks.

Greenhouse gas emissions from other sectors of the energy industry decreased by about 21 % between 1990 and 2014, but in both scenarios they are higher in 2020 than they were in 2014 (largely due to weather conditions). Due to the steep increase in the use of natural gas in public heating plants up to 2035, emissions in 2035 under the WMS are only about 9 % lower than in 1990. By contrast, the use of natural gas in public heating plants does not rise as steeply under the WAMS, and use of other kinds of energy is also lower than under the WMS. For that reason, under the WAMS emissions fall from their 2014 level and in 2035 are about 28 % lower than in 1990 and about 20 % lower than in 2005. CO_2 emissions dominate the total emissions from the remaining sectors of the energy industry, accounting for 99 % of all emissions.

4.2.4 Fugitive emissions from fuels

The differences between the two scenarios studied are negligible.

Fugitive emissions from coal mining and the oil and gas industries decrease by about 61 % from 2005 to 2035 under the with-measures scenario. Similarly under the with-additional-measures scenario this figure is 61 %. This trend is primarily the result of coal mining being phased out in Germany. The total reduction in energy-related greenhouse gas emissions (combustion-related emissions, including international transport and fugitive emissions from fuels) in the with-measures scenario is 268 Mt CO_2e or 31 % in the period from 2005 to 2035.

4.2.5 Transport

Compared with 2005, final energy consumption for domestic transport rises by about 1.2 % by 2020 under the WMS.[48] The reason the decrease is small is the higher transport volume, which is not fully offset by the increase in efficiency. A 2.4 % decrease in final energy consumption for the domestic transport sector by comparison with 2005 is achieved by 2035.

Final energy consumption from international transport also continues to rise up to 2020 under the WMS, with the final energy consumption of transport as a whole rising by 3.2 % by 2020 compared with 2005 and then declining slightly, so that final energy consumption by 2035 is only 2.5 % higher than 2005.

Under the WAMS, there are virtually no changes in total final energy consumption by domestic transport up to 2020 as compared with 2005. In the area of fuel, the most dynamic change is the decline in petrol (and bioethanol) and an increase in diesel (and biodiesel). There is no change in the final energy consumption of the international transport sector compared with the with-measures scenario. The higher percentage of electric vehicles compared with the with-measures scenario results in the transport sector consuming a total

[48] In the energy balance, which is the basis for the figures given for final energy demand up to 2012, the electricity consumption of the transport sector is corrected downwards from 2012 onwards. The figure for 2005 reported in the energy balance for electricity consumption is probably an overestimation. This correction to the energy balance must be taken into consideration in time series analyses and in the comparison with 2005, because it results in the increase in final energy demand being reduced by nearly one percentage point.

of 124 petajoules (PJ) of electricity in 2025. Rail transport accounts for 39.8 PJ of that and battery electric transport for 84.6 PJ. Thus, there is a 49 % increase in electricity demand compared with the with-measures scenario.

Emission trends

Up to 2035, overall GHG emissions under the WMS decline to about 188 Mt CO_2e; under the WAMS they decline by over 21 Mt CO_2e more to approximately 167 Mt CO_2e. This equates under the WMS to an increase of almost 3 % compared with 1990 and under the WAMS to a reduction of almost 9 %. In both scenarios, the emissions level for 2014 is surpassed in 2020; in both scenarios emissions decrease after 2020 - only slightly under the WMS, but considerably under the WAMS. Emissions in 2020 are between 193 and 194 Mt CO_2e, an increase of almost 6 % compared with 1990.

If the individual gases are considered, it can be seen that relatively speaking the emission reduction measures have the greatest impact on methane emissions. There is a reduction in these emissions of over 90 % between 1990 and 2035. In the case of CO_2, emissions are higher in 2035 than in 1990 under the WMS; under the WAMS they are 9 % lower. Nitrous oxide emissions increase in both scenarios; CO_2 remains by far the most predominant gas, accounting for 99 % of total emissions from the transport sector in both 1990 and 2035.

4.2.6 Private households - heating and cooling, appliances

Up to 2035, emissions from heating, cooling and appliances in private households decline to about 53 Mt CO_2e under the WMS; under the WAMS they decline by about 2 Mt CO_2e more to approximately 51 Mt CO_2e. This equates to a reduction of almost 60 % compared with 1990 under the WMS and around 61 % under the WAMS. It is a reduction of between 53 and 55 % compared with 2005. Since none of the measures under the WAMS that are not also included in the WMS result in additional fossil fuel savings before 2025, the emissions in both scenarios in 2020 are about 76 Mt CO_2e, a 42 % decrease compared with 1990. The decline in heating oil demand is the driver behind the emission reduction under the WMS and WAMS.

If the individual gases are considered, it will be seen that the emission reduction measures impact mainly on CO_2 and N_2O emissions. Compared with 1990, the reduction in N_2O emissions under both scenarios is the highest at 74 %, followed by the reduction in CO_2 emissions, which fall by 60 % under the WMS and by 61 % under the WAMS. CH_4 emissions are cut by 49 % between 1990 and 2035 under both scenarios. CO_2 remains by far the most predominant gas, accounting for 98 % of the total emissions from the household sector both in 1990 and in 2035.

4.2.7 Private households – electricity consumption

Private households experience a continual decrease in electricity consumption under the WMS - from just under 111 TWh in 2010 to about 95 TWh in 2035. Under the WAMS, electricity consumption in 2035 is 6 % lower overall at roughly 82 TWh, with the greatest savings by comparison with the WMS being in lighting (approximately 49 %) and white goods (approximately 8 %).

The other electricity demand, for example for small electrical appliances and new ICT equipment, becomes the most important component in 2035, reaching a share of over 30 %. However, the forecast here is fraught with great uncertainty because it is not possible to

estimate accurately what the specific consumption of the new technologies will be and how widespread they will be.

4.2.8 Trade, commerce and services - heating and cooling, appliances and processes

Under the WMS, emissions from heating, cooling, appliances and processes in the trade, commerce and services sector decline to about 28 Mt CO_2e by 2035; under the WAMS they decline by about 1.3 Mt CO_2e more to approximately 27 Mt CO_2e. This equates to a reduction of about 68 % compared with 1990 under the WMS and of just less than 70 % under the WAMS. Emissions in 2020 under both scenarios are about 43 Mt CO_2, a decrease of roughly 52 % compared with 1990.

If the individual gases are considered, it can be seen that the emission reduction measures impact on CO_2, CH_4 and N_2O emissions. Compared with 1990, almost complete emission neutrality is achieved for methane emissions (99 % decrease under both scenarios). The reduction in CO_2 and N_2O emissions during the same period, from 1990 to 2035, is approximately 70 %. With a 97 % share, CO_2 was by far the most predominant gas in the total emissions from the trade, commerce and services sector in 1990; its share in total emissions rises to 100 % in 2035.

4.2.9 Industry

Under the WMS, emissions of CO_2, CH_4 and N_2O in industry (excluding industrial power plants but including construction transport) decline to about 46 Mt CO_2e by 2035; under the WAMS they decline by about 4 Mt CO_2e more to approximately 42 Mt CO_2e. This equates to a reduction of almost 61 % compared with 1990 under the WMS and almost 65 % under the WAMS. Emissions in 2020 under both scenarios are about 63 Mt CO_2e, a decrease of between 46 % and 47 % compared with 1990.

If the individual gases are considered, it can be seen that emissions of all three of the relevant greenhouse gases (CO_2, CH_4 and N_2O) are responsible for the emission reductions. In 2015 compared with 1990, the reduction in emissions under both scenarios is the highest for N_2O at 67 % (WMS) and 69 % (WAMS), followed by CO_2 emissions, which fall by 61 % under the WMS and 65 % under the WAMS. CH_4 emissions are cut by 52 % between 1990 and 2035 under the WMS and by 54 % under the WAMS. CO_2 remains by far the most predominant gas, accounting for 99 % of total emissions by industry in both 1990 and 2035.

4.2.10 Industrial processes and use of products (CO_2, CH_4 and N_2O emissions)

CO_2, CH_4 and N_2O emissions in the industrial processes and product use sector fall to about 40 Mt CO_2e under the WMS and WAMS. This equates to a reduction of almost 52 % compared to 1990. Emissions in this sector had already fallen by 44 % in the past, from 83.2 Mt CO_2e in 1990 to 46.4 Mt CO_2e in 2014.

If the individual gases are considered, it can be seen that emission reduction measures from 2014 onwards impact mainly on CO_2 emissions. There is a 14 % reduction in CO_2 between 2014 and 2035 and a 35 % decrease between 1990 and 2035 under both scenarios. Nitrous oxide emissions were very high in 1990, so the reduction up to 2035 is 95 % under both scenarios. CO_2 is by far the dominant gas in 2035, accounting for 96 % of total emissions in the industrial processes and product use sector (not counting fluorinated greenhouse gases). Emissions of N_2O and CH_4 remain at a low level between 2014 and 2035.

4.2.11 Industrial processes and use of products (fluorinated greenhouse gases)

Emissions of fluorinated greenhouse gases from industrial processes and product use fall to about 5 Mt CO_2e by 2035 under the WMS and WAMS. This corresponds to a reduction of almost 72 % compared to 1995, which is the base year for German F-gas emissions under the Kyoto Protocol. It is a reduction of about 66 % compared with 2005. Emissions in 2020 under the WMS and WAMS are about 14 Mt CO_2, a decrease of between 17 % and 18 % compared with 1995.

If the individual gases are considered, it will be seen that the reductions in emissions between 1995 and 2014 are limited to PFCs, SF_6 and the unspecified mix only. The increased use of HFCs up to 2014 resulted in steep rises in HFC emissions, which decrease again by 2035. These emissions decrease by almost 70 % between 2014 and 2035 under both scenarios. From 2014, PFC emissions remain at a nearly constant level, as do emissions of the non-specified mix. Similarly, there are only slight variations for NF_3 emissions in the time series since 1995. HFC emissions account for the largest share of total emissions since 2005; in 2035 their share is expected to be over 70 %.

4.2.12 Agriculture

Emissions from agriculture were reduced by over 16 % by 2014 compared with 1990, but they were 5 % higher than in 2005. By 2020 emissions fall by almost 17 % compared to 1990 to over 66 Mt CO_2e under the WMS and by almost 20 % to just over 64 Mt CO_2e under the WAMS. Emissions are expected to fall by 19 % by 2035 compared to 1990 to 64.5 Mt CO_2e under the WMS and by 22 % to 62.5 Mt CO_2e under the WAMS. The changes in emissions apply relatively evenly to all greenhouse gases so that there are only slight shifts in the percentage shares in emissions from agriculture accounted for by CO_2, CH_4 and N_2O.

4.2.13 LULUCF

Since no measures were investigated in the LULUCF (land use, land-use change and forestry) sector under the WAMS over and above those contained in the WMS, the results are identical under both scenarios.

Under the assumed scenario, a shift in the distribution of age classes of trees, the resulting reduction in tree growth and changes in the use of wood cause the forests' sink effect to be reduced, falling from its original level of about 75 Mt CO_2e. The model calculations show an increase once more from 2020 onwards. In 2035, the forests' sink effect is over 21 Mt CO_2e.

Overall, the LULUCF sector changes from being a sink to being a source of greenhouse gases in the period between 2014 (-15 Mt CO_2e) and 2020 (+29 Mt CO_2e). 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 considerably up to 2035. There are only minor changes in emissions from other land-use sectors. The changes in greenhouse gas emissions resulting from the expected changes in forest carbon stocks surpass all changes connected to measures in other sectors under the scenario examined. In 2035, the cumulative greenhouse gas emissions forecast for the LULUCF sector are also positive at approximately 19 Mt CO_2e.

When accounting for forestry's contribution to climate change mitigation, it must be kept in mind that emissions that are avoided by producing materials and energy from wood that is directly related to the raw material supplied by the forestry sector are not classified under that

source category. Instead, the reduced emissions are reflected in the energy industry, construction and housing, transport and industry business sectors or source categories.

4.2.14 Waste management

Methane emissions from landfills are the predominant component of greenhouse gas emissions from the waste management and wastewater sector. Because landfilling untreated waste was phased out in 2005 - a measure that was publicised a long time in advance - these emissions have been steadily decreasing since 1990. Since 2005, the volumes of waste that are still sent to landfill are for the most part pre-treated (incineration, biological-mechanical treatment) household waste, commercial waste similar to household waste, and waste from industry, consisting predominantly of the inert fractions. The methane and nitrous oxide emissions from other sources, especially composting, biological-mechanical waste treatment and municipal wastewater differ from these emissions only marginally.

By 2014, emissions from the waste management sector had already fallen by almost 70 % compared to 1990 (38 Mt CO_2e) to 11.6 Mt CO_2e. By 2020, emissions fall by between 77 % and 78 % compared with 1990 to about 8.5 Mt CO_2e. By 2035, reductions of 87 % to 88 % compared with 1990 are achieved, with emissions falling to approximately 4 Mt CO_2e. Future reductions are primarily in methane emissions, which are approximately 3 Mt CO_2e lower in 2020 than in 2014. By 2035, methane emissions are reduced by approximately 6.5 Mt CO_2e compared with 2014 under the WMS and by a further 0.4 Mt CO_2e under the WAMS.

4.3 Estimate of the aggregate impact of strategies and measures

Impact of the individual measures in the with-measures scenario

Table 3 shows the reduction effects of the quantified instruments in the with-measures scenario. It should be noted that some of the instruments in the demand sectors do not lead to a reduction in direct emissions – at least not exclusively – but also reduce electricity consumption. The overall impact of this reduction is quantified in the energy industry sector (electricity savings resulting from measures in other sectors).

Direct emissions reductions by all measures under the WMS in each sector	2020	2025	2030	2035
	Mt CO_2e			
Energy industry	17.0	2.0	9.0	10.0
Industry	6.1	10.1	12.2	12.6
Trade, commerce and services	0.0	0.0	0.0	0.0
Households	4.7	9.3	15.7	16.4
Transport	0.8	0.8	0.6	0.5
Fugitive emissions from fuels	0.0	0.0	0.0	0.0
Industrial processes	4.7	9.3	15.7	16.4
Agriculture	0.0	0.6	0.6	0.7
Waste management	0.2	0.1	-0.2	-0.2
Total	33.5	32.2	53.6	56.4

LULUCF	1.3	2.5	3.7	4.9
Total with LULUCF	34.8	34.7	57.3	61.3

Table 3: Direct emissions reduction achieved through climate policy instruments under the WMS, summarised by sector

Table 4 shows the reduction effects of the additional quantified instruments under the with-additional-measures scenario as compared to the with-measures scenario.

Table 5 contains the complete reduction effects under the WAMS resulting from all measures under the WMS and the WAMS taken together.

Direct emissions reductions resulting from all additional measures under the WAMS in each sector	2020	2025	2030	2035
	Mt CO_2e			
Energy industry	9.0	23.0	32.0	41.0
Industry	2.5	4.0	5.4	6.9
Trade, commerce and services	0.0	0.0	0.0	0.0
Households	0.2	2.0	0.0	0.0
Transport	0.6	3.3	11.0	21.1
Fugitive emissions from fuels	0.0	0.0	0.0	0.0
Industrial processes	0.2	2.0	0.0	0.0
Agriculture	2.6	2.7	3.0	2.9
Waste management	0.2	0.6	0.8	0.5
Total	15.3	37.6	52.2	69.5
LULUCF	0.0	0.0	0.0	0.0
Total with LULUCF	15.3	37.6	52.2	69.5

Table 4: Direct additional emissions reduction achieved through climate policy instruments under the WAMS, summarised by sector

Direct emissions reductions resulting from all measures under the WAMS for each sector	2020	2025	2030	2035
	Mt CO_2e			
Energy industry	26.0	25.0	41.0	51.0
Industry	8.6	14.1	17.6	19.6
Trade, commerce and services	0.0	0.0	0.0	0.0
Households	4.9	11.3	15.7	16.4
Transport	1.4	4.1	11.6	21.6
Fugitive emissions from fuels	0.0	0.0	0.0	0.0
Industrial processes	4.9	11.3	15.7	16.4

Agriculture	2.6	3.3	3.6	3.6
Waste management	0.4	0.7	0.6	0.4
Total	48.8	69.8	105.8	125.4
LULUCF	1.3	2.5	3.7	4.9
Total with LULUCF	50.1	72.3	109.5	130.3

Table 5: Direct emissions reduction achieved through climate policy instruments under the WAMS, summarised by sector

4.4 Trends in total greenhouse gas emissions and their components

Trends in greenhouse gas emissions under the with-measures and with-additional-measures projection scenarios are aggregated below in two different ways. On the one hand, the contributions made by the different greenhouse gases are depicted and, on the other, the contributions made by the individual source categories. Each of these depictions shows the total greenhouse gas emissions defined in two different ways: with and without emissions from deep-sea shipping and international aviation, and with and without release or sequestration of greenhouse gases in the land use, land-use change and forestry sector (LULUCF). The two types of international transport are included in the national Greenhouse Gas Inventories, but only as “memo items” for information. As a rule, emissions from international fuel bunkers (deep-sea shipping and international aviation) and LULUCF do not count towards meeting climate targets in Germany; this report follows this convention.

Figure 7 (Chapter 4.2.1) summarises the main projection results for trends in total greenhouse gas emissions. It shows the raw inventory data for the historical reference years 1990 to 2014. The projections under the WMS and WAMS from 2020 onwards are shown next to each other to illustrate the additional effects expected from measures that are included in the WAMS but not in the WMS.

4.4.1 Results of the projection under the with-measures scenario

4.4.1.1 Trends in greenhouse gas emissions by type of gas

CTF Table 6(a) shows a summary of trends in emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). This summary does not include greenhouse gas emissions from international fuel bunkers (deep-sea shipping and international aviation) and LULUCF.

By 2014, domestic greenhouse gas emissions were already just less than 28 % down on 1990 and over 9 % down on 2005 in the national balance. Compared with the 1990 reference year, total greenhouse gas emissions fall by just under 35 % (-18 % compared with 2005) from 1,250 to 816 Mt CO_2e up to 2020 and by almost 41 % (-26 % compared with 2005) to 734 Mt CO_2e up to 2030. The German government's goal to reduce greenhouse gas emissions by 40 % by 2020 and 55 % by 2030 compared with 1990 is thus not achieved under the with-measures scenario.

Between 1990 and 2014, annual emissions of carbon dioxide[49] were cut by almost 25 %. CO_2 emissions are 44 % lower in 2035 than in 1990. Both historically and in the projection, CO_2 is the gas with the largest share in Germany's total greenhouse gas emissions.

The greatest reductions in methane emissions have already been achieved in the past: CH_4 was the most important greenhouse gas in 1990, with a share in total emissions of almost 10 %. However, since a 54 % cut in CH_4 emissions had been achieved by 2014, their share in total emissions fell to only slightly more than 6 %. By 2035, CH_4 emissions are a good 62 % down on 1990. However, since the emissions reductions here are disproportionately low, especially from 2020, their percentage rises again slightly to just below 7 % up to 2035.

Nitrous oxide's share in total greenhouse gas emissions was over 5 % in 1990. Here too an almost 41 % cut was achieved by 2014, so that its share in total emissions fell from 5 % to 4 %. However, by contrast with methane, there have been no further reductions in emissions for nitrous oxide. In 2035, N_2O emissions are only slightly lower than in 2014. Their percentage share therefore rises once more to over 5 % in 2035.

In 1990, fluorinated gases accounted for 1.1 % of total greenhouse gas emissions; by 2014, this figure had risen to 1.6 %. By 2020, it increases slightly to 1.7 %, after which it falls to 0.7 % by 2035.[50]

The reductions compared with Kyoto Protocol base year emissions (for which emissions in 1990 were used for CO_2, CH_4 and N_2O and emissions in 1995 for fluorinated gases) are in each case slighter higher than emissions reductions from 1990 levels.

4.4.1.2 Trends in greenhouse gas emissions by category

CTF table 6a, table 6 and figure 8 provide an overview of emission trends under the with-measures scenario, broken down by category. Considering domestic emissions but not including international aviation, maritime transport and LULUCF, greenhouse gas emissions fell by almost 28 % up to 2014 compared with 1990 and by over 9 % compared with 2005. Up to 2020, emissions fall by just under 35 % compared with 1990 (18 % down on 2005) and up to 2035 they fall by over 46 % compared with 1990 (33 % down on 2005) to 669 Mt CO_2e.

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[49] CO_2 emissions from combustion of biomass are not included here or in any of the CO_2 emissions discussed in this report.

[50] Hydrofluorocarbons (HFCs) were the major group within the fluorinated greenhouse gases in 2014. HFC emissions more than quadrupled between 1995 (the reference year for fluorinated greenhouse gases) and 2014. However, since HFC emissions will fall again considerably in the future, emissions of 68 % below 2014 levels will be achieved in 2035, which is nevertheless 31 % higher than 1995 levels. Since emissions of perfluorocarbons (PFCs) had already been cut by 89 % by 2014 compared with 1995 levels, only slight reductions are expected in the future. By 2014, sulphur hexafluoride (SF_6) emissions had been cut by over 47 % from their 1995 level. However, since an initial increase in SF_6 emissions is projected, their 2020 level will be only 33 % below their 1995 level. On the other hand, a very marked decline is expected from 2020, so that by 2035 SF_6 emissions may be 85 % lower than in 1995. By 2014, there had already been a reduction of over 97 % compared to 1995 in the unspecified mix of HFCs and PFCs. These emissions will remain at roughly this level. Emissions of nitrogen trifluoride (NF_3) reached their highest level in 2010, but in 2014 they were still several times higher than in 1995. However, NF_3 will continue to be of negligible importance in the future.

Source category	1990	2005	2010	2014	2020	2025	2030	2035
	Mt CO_2e							
Energy industry	427.4	378.8	356.2	346.3	283.0	294.9	267.9	221.4
Industry	186.7	115.2	125.2	119.7	113.1	108.1	101.3	97.5
Trade, commerce and services	88.4	47.9	47.6	39.5	42.5	37.5	32.7	27.9
Households	130.8	111.9	106.9	85.2	75.7	65.0	57.8	52.5
Transport	164.4	161.4	154.2	161.1	159.1	152.7	150.0	148.9
Fugitive emissions from fuels	38.0	16.4	11.3	10.5	7.6	7.2	6.8	6.5
Industrial processes	96.4	75.3	62.0	61.0	60.3	54.4	47.0	45.1
Agriculture	79.8	63.6	63.0	66.9	66.3	66.3	65.1	64.5
Waste management	38.0	21.2	14.6	11.6	8.6	7.0	5.9	5.0
Total	1,249.8	991.8	941.0	901.8	816.4	793.1	734.5	669.3
Compared with 2005	26.0 %	22.5 %	0.0 %	-5.2 %	-9.1 %	-20.0 %	-25.9 %	-25.9 %
Compared with 1990	22.5 %	0.0 %	-20.6 %	-24.7 %	-34.7 %	-34.7 %	-41.2 %	-41.2 %
Compared with base year[a]	-0.3 %	-20.9 %	-24.9 %	-28.1 %	-34.9 %	-32.7 %	-41.4 %	-46.6 %
Memo items:								
LULUCF	-31.3	-12.1	-16.3	-15.0	29.1	11.2	19.2	18.7
International aviation and maritime transport	18.6	30.1	32.5	31.3	34.4	36.8	38.8	39.2
Total, incl. memo items	1,237.1	1,009.9	957.2	918.1	879.9	841.0	792.5	727.2
Compared with 2005	22.5 %	22.5 %	0.0 %	-5.2 %	-9.1 %	-12.9 %	-16.7 %	-21.5 %

Source category	1990	2005	2010	2014	2020	2025	2030	2035
	Mt CO_2e							
Compared with 1990	22.5 %	0.0 %	-18.4 %	-22.6 %	-25.8 %	-28.9 %	-32.0 %	-41.2 %
Compared with base year[a]	-0.3 %	-18.6 %	-22.9 %	-26.0 %	-29.1 %	-32.2 %	-36.1 %	-41.4 %

Table 6: Trends in total greenhouse gas emissions by source category under the WMS, 1990-2035[51]

[51] 2017 Projections Report for Germany in accordance with 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/manage_document; English version will be available in due course at http://acm.eionet.europa.eu/

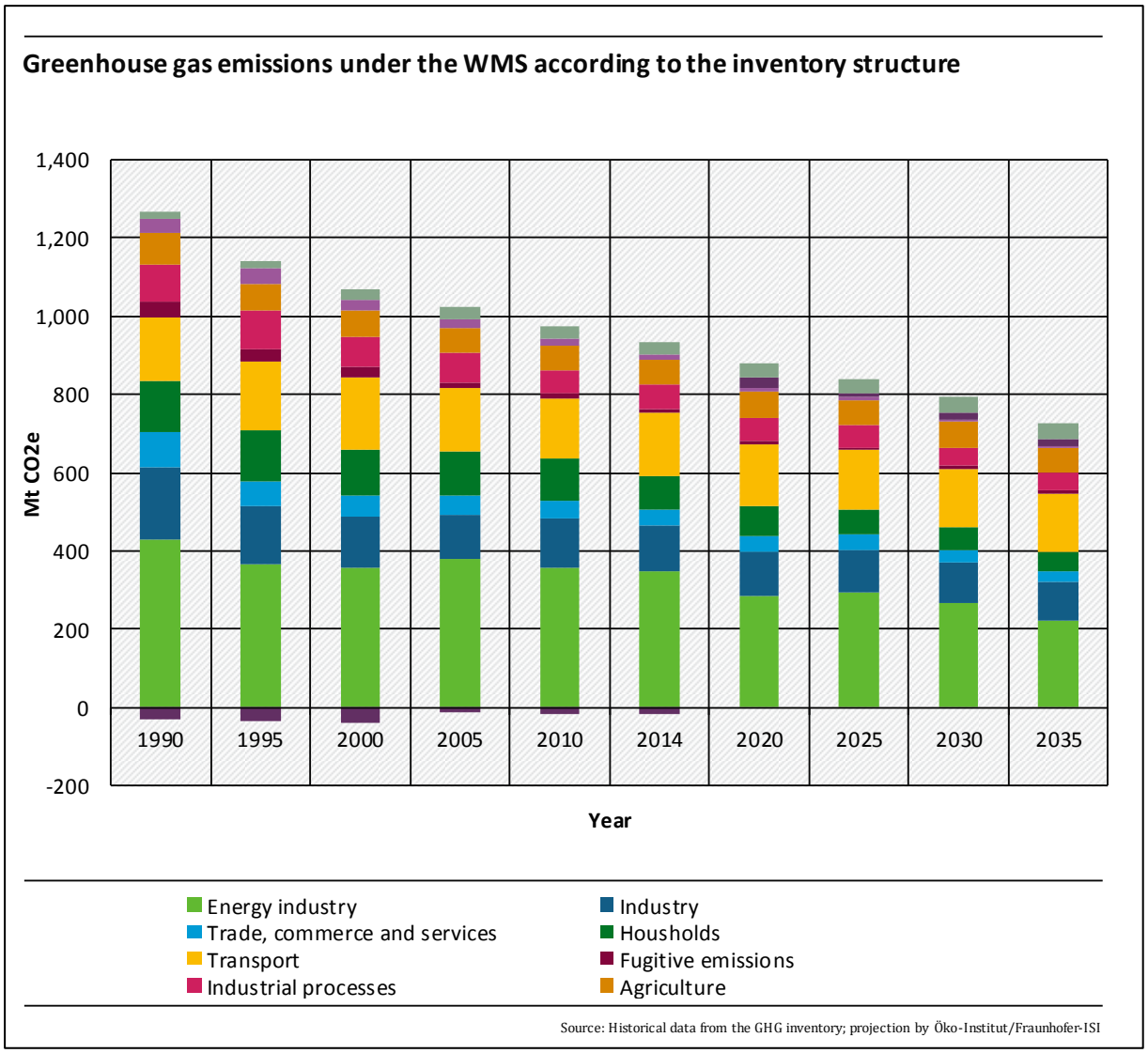

Figure 8: Trends in total greenhouse gas emissions by source category under the WMS (1990-2035)[52]

Over half the emissions reductions from 2014 to 2035 are achieved by the energy industry. In this sector, emissions fall in absolute terms by 63 Mt CO_2e up to 2020 compared with 2014 and by 125 Mt CO_2e up to 2035. That equates to an 18 % reduction in 2020 compared with 2014 (-34 % compared with 1990) and represents a 36 % reduction in 2035 (-48 % compared with in 1990). Whereas the energy industry's share in total emissions (not counting international transport and LULUCF) rose from over 34 % in 1990 to over 38 % in 2014, it falls to about 33 % by 2035.

Energy-related industrial emissions fall by just under 7 Mt CO_2e or 6 % by 2020 (39 % below their 1990 level), and then fall by just under 19 Mt CO_2e or 19 % by 2035 from their 2014

[52] 2017 Projections Report for Germany in accordance with 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/manage_document; English version will be available in due course at http://acm.eionet.europa.eu/

level (48 % down on 1990). Overall, industrial emissions' share rises from over 13 % in 2014 to almost 15 % in 2035.

Greenhouse gas emissions from the trade, commerce and services sector rise by a good 3 Mt CO_2e or 8 % up to 2020 compared with 2014 (-52 % compared with 1990) and then decline by 12 Mt CO_2e or 29 % up to 2035 compared with 2014 (-68 % compared with 1990). The trade, commerce and services sector's share in total emissions remains at about 4 %.

The second largest contribution to the projected reduction in emissions comes from private households: they reduce their emissions by 11 % or 9 Mt CO_2e between 2014 and 2020 (42 % down on 1990) and by 39 % or 33 Mt CO_2e up to 2035 (60 % below 1990 levels). Furthermore, private households' share falls from 9 % in 2014 to less than 8 % in 2035.

Only minor emissions reductions are achieved in the transport sector. They fall by 2 Mt CO_2e or 1 % from 2014 levels (-3 % compared with 1990) in 2020 and by 12 Mt CO_2e or 8 % in 2035 compared with 2014 (-9 % compared with 1990). Nevertheless, the historically rising trend in transport emissions' percentage share continues: whereas in 1990 transport's share in total emissions was still a little over 13 %, it rose to almost 18 % in 2014 and exceeds 22 % by 2035. It must also be noted that, due to the expansion of electric mobility, some of the emissions from the transport sector are shifted to the energy industry, because public electricity generation is accounted for in the latter.

In absolute terms, reductions in fugitive emissions from the energy sector are low but they are high in relative terms: emissions reductions of 3 Mt CO_2e between 2014 and 2020 and of 4 Mt CO_2e up to 2035 equate to decreases from 2014 levels of 28 % in 2020 (80 % down on 1990) and 38 % in 2035 (79 % down on 1990). The relative percentage remains the same at around 1 %.

Emissions from industrial processes were the most important of all the non-energy-related emissions in 1990, accounting for almost 8 % of total emissions; in 2014 their share had fallen to just under 7 %. There is little change in this percentage up to 2035. Nevertheless, emissions from industrial processes fall by almost 1 Mt CO_2e or 1 % between 2014 and 2020 (37 % down on 1990) and by 16 Mt CO_2e or 26 % by 2035 (53 % down on 1990).

Although emissions from agriculture decreased between 1990 and 2014, it has nevertheless become the most important source of greenhouse gases apart from the energy sector. Furthermore, agriculture is the sector with the lowest projected emissions reduction: just less than 1 Mt CO_2e or 1 % by 2020 compared with 2014 (-17 % compared with 1990) and just over 2 Mt CO_2e or 4 % by 2035 compared with 2014 (-19 % compared with 1990). This also means that agriculture's share in total emissions rose from over 6 % in 1990 to 7 % in 2014 and reaches almost 10 % in 2035.

Waste management is the sector with the historically highest emissions reductions in relative terms, experiencing an almost 70 % decline in emissions between 1990 and 2014. Nevertheless, emissions from the waste management sector are reduced by a further 3 Mt CO_2e or 25 % between 2014 and 2020 and by almost 7 Mt CO_2e or 57 % up to 2035. This means that waste management continues to be the sector with the greatest emissions reductions in relative terms – 77 % in 2020 and 87 % in 2035 (compared with 1990 levels).

The rise in agricultural emissions and only slight decrease in emissions from the waste management sector explain the below-average decrease in methane and nitrous oxide emissions described in section 4.2.12.

Whereas in the past the LULUCF sector was an overall sink, in the projection it is a source of emissions. For more information on this please refer to section 4.2.13 .

Emissions from the proportion of international aviation and maritime transport that is attributable to Germany rose by over 68 % between 1990 and 2014. These emissions rise by a further 3 Mt CO_2 or 10 % up to 2020 and by 7 Mt CO_2e or 25 % up to 2035 compared with 2014. This means that emissions from international aviation and maritime transport are 85 % higher in 2020 than in 1990 and in 2035 they are actually more than twice as high as in 1990.

Taking international maritime transport and aviation into account, emissions in 2014 were just under 26 % and just over 9 % lower than in 1990 and 2005 respectively and fall by 29 % compared with 1990 (-13 % compared with 2005) by 2020 and by 44 % by 2035 (-32 % compared with 2005).

4.4.2 Results of the projection under the with-additional-measures scenario

4.4.2.1 Trends in greenhouse gas emissions by gas

CTF Table 6(c) shows a summary of trends in emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride (SF_6) and nitrogen trifluoride (NF_3). This summary does not include greenhouse gas emissions from international fuel bunkers (deep-sea shipping and international aviation) and LULUCF.

By 2014, domestic greenhouse gas emissions were already just less than 28 % down on 1990 and almost 9 % down on 2005 in the national balance. By comparison with the 1990 reference year, total greenhouse gas emissions fall by almost 36 % (19 % compared with 2005) to almost 806 Mt CO_2e by 2020 and by 45 % (31 % compared with 2005) to 682 Mt CO_2e by 2030. The German government's goal to reduce greenhouse gas emissions by 40 % by 2020 and 55 % by 2030 compared with 1990 is thus not achieved under the with-additional-measures scenario either.

It is evident that the measures analysed in the with-additional-measures scenario do not begin to have an impact until after 2025. In 2020, the additional emissions reduction brought about by the WAMS scenario compared with the WMS totalled only 11 Mt CO_2e; that figure rises to 33 Mt CO_2e in 2025 and to 53 Mt CO_2e in 2030.

Between 1990 and 2014, annual emissions of carbon dioxide[53] were cut by almost 25 %. CO_2 emissions in 2035 are almost 52 % lower than in 1990. Both historically and in the projection, CO_2 is the gas with the largest share in Germany's total greenhouse gas emissions. In 1990, it accounted for over 84 % and in 2014 for almost 88 % of total greenhouse gas emissions. By 2035, this share falls to about 86 %. CO_2 emissions from the combustion of biomass, which are not included in the total and are therefore reported for information only, soared between 1990 and 2014 and peak around 2020 before declining again.

The greatest reductions in methane emissions have already been achieved in the past: CH_4 was the most important greenhouse gas in 1990, with a share in total emissions of almost

[53] CO_2 emissions from combustion of biomass are not included here or in any of the CO_2 emissions discussed in this report.

10 %. However, since a 54 % cut in CH_4 emissions had been achieved by 2014, their share in total emissions fell to only slightly more than 6 %. By 2035, CH_4 emissions are at least 63 % down on 1990. However, since the emissions reductions here are disproportionately low, especially from 2020, their percentage rises again slightly to over 7 % by 2035.

Nitrous oxide's share in total greenhouse gas emissions was over 5 % in 1990. Here too an almost 40 % cut was achieved by 2014, so that its share in total emissions fell from 5 % to 4 %. The decrease in N_2O emissions up to 2035 is disproportionately low. This explains why nitrous oxide emissions also account for almost 6 % in 2035 under the WAMS.

In 1990, fluorinated gases accounted for 1.1 % of total greenhouse gas emissions; by 2014, this figure had risen to 1.6 %. By 2020, it increases slightly to 1.7 %, after which it falls to 0.8 % by 2035.

4.4.2.2 Trends in greenhouse gas emissions by category

CTF Tables 6(a) and 7 and Figure 9 provide an overview of emission trends under the with-additional-measures scenario, broken down by category. Considering domestic emissions but not including international aviation and maritime transport and LULUCF, greenhouse gas emissions fell by almost 28 % up to 2014 compared with 1990 and by over 9 % compared with 2005. By 2020, emissions fall to just under 36 % compared with 1990 (19 % down on 2005) and by 2035 they fall by almost 53 % compared with 1990 (40 % down on 2005) to 592 Mt CO_2e.

Over half the emissions reductions from 2014 to 2035 are achieved by the energy industry. In this sector, emissions fall in absolute terms by 69 Mt CO_2e up to 2020 compared with 2014 and by 169 Mt CO_2e up to 2035. That equates to an 18 % reduction in 2020 compared with 2014 (-34 % compared with 1990) and represents a 36 % reduction in 2035 (-48 % compared with 1990). The additional emissions reduction by the energy industry under the WAMS as compared to the WMS totals almost 45 Mt CO_2e in 2035. Whereas the energy industry's share in total emissions (not counting international transport and LULUCF) rose from just over 34 % in 1990 to almost 38 % in 2014, it falls to under 30 % by 2035.

Energy-related industrial emissions fall by almost 9 Mt CO_2e up to 2020 or 7 % from their 2014 level (41 % down on 1990) and then fall by just under 28 Mt CO_2e up to 2035 or 23 % from their 2014 level (51 % down on 1990). The additional reduction in energy-related emissions from industry under the WAMS as compared to the WMS is over 5 Mt CO_2e in 2035. Overall, industrial emissions' share rises from 13 % in 2014 to almost 16 % in 2035.

Greenhouse gas emissions from the trade, commerce and services sector – as under the WMS – rise by more than 3 Mt CO_2e or 7 % up to 2020 compared with 2014 (-52 % compared with 1990) and then decline by 13 Mt CO_2e or 33 % up to 2035 compared with 2014 (-70 % compared with 1990). The additional emissions reduction by the trade, commerce and services sector under the WAMS as compared to the WMS totals almost 1 Mt CO_2e in 2035. The trade, commerce and services sector's share in total emissions – as under the WMS – remains the same at about 4 %.

Under the WAMS, the second largest contribution to the projected reduction in emissions also comes from private households: they reduce their emissions by 11 % or 9 Mt CO_2e between 2014 and 2020 (42 % down on 1990) and by 41 % or 35 Mt CO_2e up to 2035 (61 % below 1990 levels). The additional emissions reduction by households under the WAMS as compared to the WMS totals almost 2 Mt CO_2e in 2035. The trade, commerce and services sector's share in total emissions remains the same at about 9 %.

After the energy industry and private households, the domestic transport sector achieves the greatest long-term emissions reductions in absolute terms. In 2020 the reduction is only 3 Mt CO_2e or 2 % compared with 2014 (-4 % compared with 1990). By 2035, the emissions reduction from domestic transport increases to 33 Mt CO_2e, which is 21 % up on 2014 (down 22 % on 1990). The additional emissions reduction by transport under the WAMS as compared to the WMS totals almost 21 Mt CO_2e in 2035. Nevertheless, the historically rising trend in transport emissions' percentage share also continues under the WAMS: whereas in 1990 transport's share in total emissions was still a little over 13 %, it rose to almost 18 % in 2014 and exceeds 22 % in 2035 under the WAMS.

In absolute terms, reductions in fugitive emissions from the energy sector are low, but they are high in relative terms. The additional emissions reductions under the WAMS are minimal. The relative percentage also remains the same at around 1 %.

Emissions from industrial processes were the most important of all the non-energy-related emissions in 1990, accounting for almost 8 % of total emissions; there is little change in this percentage under the WAMS. Emissions from industrial processes up to 2035 are only minimally lower under the WAMS than under the WMS. By 2035, emission levels are 54 % lower than in 1990.

Although emissions from agriculture decreased between 1990 and 2014, it has nevertheless become the most important source of greenhouse gases apart from the energy sector. Furthermore, agriculture is the only important sector where only very low emissions reductions are projected: just less than 3 Mt CO_2e or 4 % between 2014 and 2020 (-20 % compared with 1990) and over 4 Mt CO_2e or almost 7 % up to 2035 (-22 % compared with 1990). This also means that agriculture's share in total emissions rises from 7 % in 2014 to almost 11 %. The additional emissions reduction achieved by agriculture under the WAMS as compared to the WMS totals about 2 Mt CO_2e in 2035.

Waste management is the sector with the highest historical emissions reductions in relative terms (-70 % in 2014 compared with 1990). Emissions under the WAMS decrease further up to 2035. The additional emissions reduction under the WAMS as compared to the WMS totals 0.4 Mt CO_2e in 2035. Waste management thus continues to be the sector with the greatest emissions reductions in relative terms – 88 % in 2035 (compared with 1990 levels).

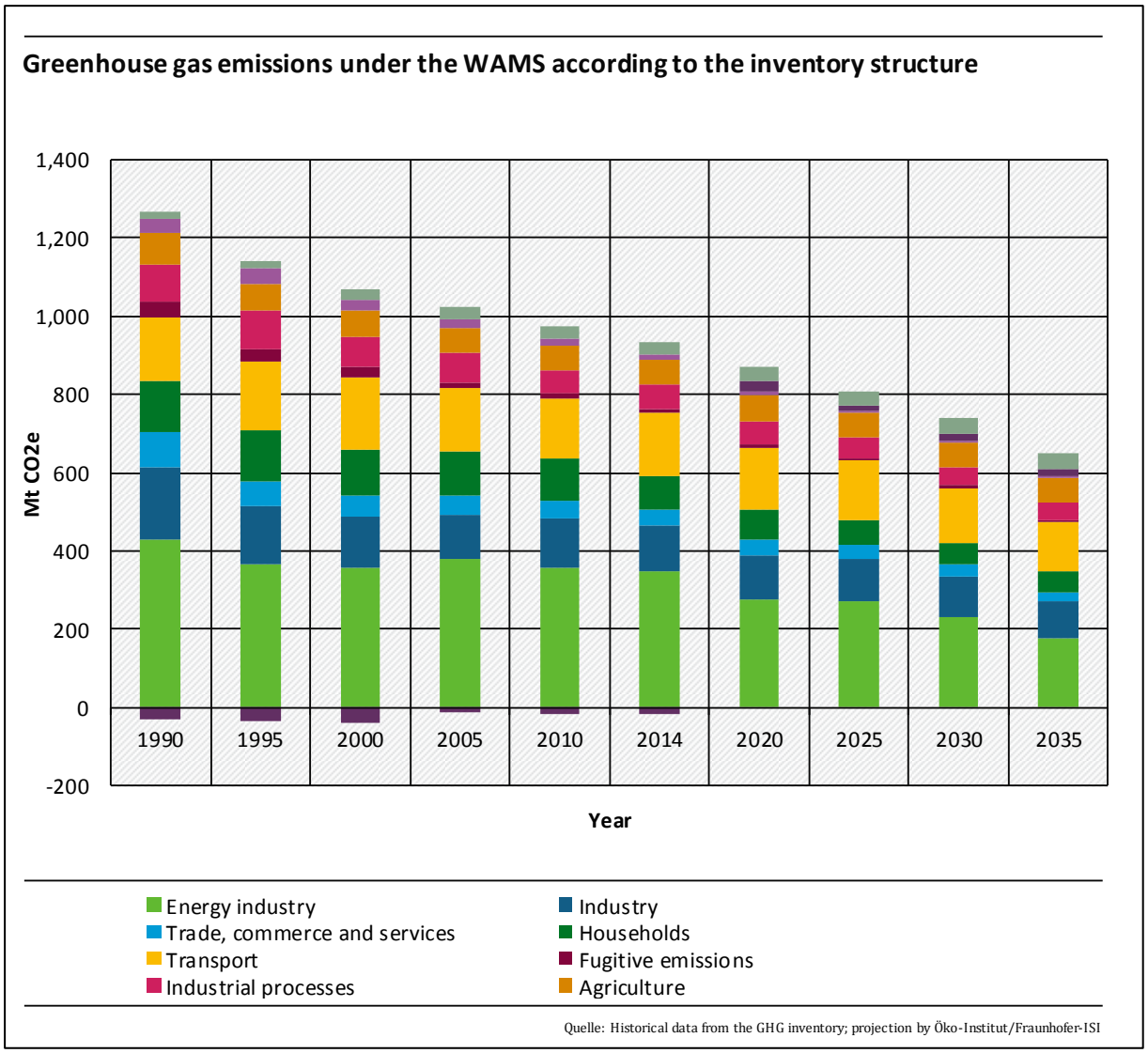

Figure 9: Trends in total greenhouse gases by source category under the WAMS (1990-2035)[54]

Source category	1990	2005	2010	2014	2020	2025	2030	2035
	Mt CO_2e							
Energy industry	427.4	378.8	356.2	346.3	277.4	272.4	232.6	176.9
Industry	186.7	115.2	125.2	119.7	110.8	106.3	100.2	92.1
Trade, commerce and services	88.4	47.9	47.6	39.5	42.5	37.0	31.7	26.6
Households	130.8	111.9	106.9	85.2	76.0	64.2	56.3	50.7
Transport	164.4	161.4	154.2	161.1	158.4	149.7	139.0	127.7

[54] 2017 Projections Report for Germany in accordance with 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/manage_document; English version will be available in due course at http://acm.eionet.europa.eu/

Source category	1990	2005	2010	2014	2020	2025	2030	2035
Fugitive emissions from fuels	38.0	16.4	11.3	10.5	7.6	7.2	6.8	6.4
Industrial processes	96.4	75.3	62.0	61.0	60.1	52.4	46.9	44.8
Agriculture	79.8	63.6	63.0	66.9	64.2	64.3	63.1	62.5
Waste management	38.0	21.2	14.6	11.6	8.5	6.6	5.5	4.6
Total	1,249.8	991.8	941.0	901.8	805.6	760.2	682.0	592.3
Compared with 2005	26.0 %	22.5 %	0.0 %	-5.2 %	-9.1 %	-18.8 %	-23.4 %	-31.2 %
Compared with 1990	22.5 %	0.0 %	-20.6 %	-24.7 %	-27.8 %	-35.5 %	-39.2 %	-45.4 %
Compared with base year[a]	-0.3 %	-20.9 %	-24.9 %	-28.1 %	-35.7 %	-39.4 %	-45.6 %	-52.8 %
Memo items:								
LULUCF	-31.3	-12.1	-16.3	-15.0	29.1	11.2	19.2	18.7
International aviation and maritime transport	18.6	30.1	32.5	31.3	34.4	36.8	38.8	39.2
Total, incl. memo items	1,237.1	1,009.9	957.2	918.1	869.1	808.1	740.0	650.2
Compared with 2005	22.5 %	22.5 %	0.0 %	-5.2 %	-9.1 %	-20.0 %	-20.0 %	-26.7 %
Compared with 1990	22.5 %	0.0 %	-18.4 %	-22.6 %	-25.8 %	-34.7 %	-34.7 %	-40.2 %
Compared with base year[a]	-0.3 %	-18.6 %	-22.9 %	-26.0 %	-30.0 %	-34.9 %	-40.4 %	-47.6 %

Table 7: Trends in total greenhouse gases by source category under the WAMS, 1990-2035[55]

[55] 2017 Projections Report for Germany in accordance with 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/manage_document; English version will be available in due course at http://acm.eionet.europa.eu/

5. Financial and technical support and capacity-building in developing countries

5.1 Climate finance

5.1.1 General principles and assumptions

Engagement in climate action is an integral part of Germany's development policy and vice versa. The impacts of increasing climate change are directly affecting the living conditions and development opportunities of all people. Growth and development strategies must include greenhouse gas neutrality and decarbonisation of the economy as an imperative. With regard to supporting developing countries in climate change adaptation and mitigation, Germany considers the implementation of the Paris Agreement and Agenda 2030 to be closely linked.

5.1.2 Overview of climate finance 2015-2016

The German government stands to its financial obligation and further increased its finance up to 2016 to support developing countries, emerging economies and countries in transition in their efforts to reduce greenhouse gas emissions (GHGs), adapt to the impacts of climate change and protect forests and biodiversity, including REDD+ (Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries). The Government is aiming to double its international climate finance from the 2014 target value of EUR two billion to EUR four billion by 2020 (from budgetary sources and grant elements of development loans), thus fulfilling the commitment Chancellor Merkel made in 2015.

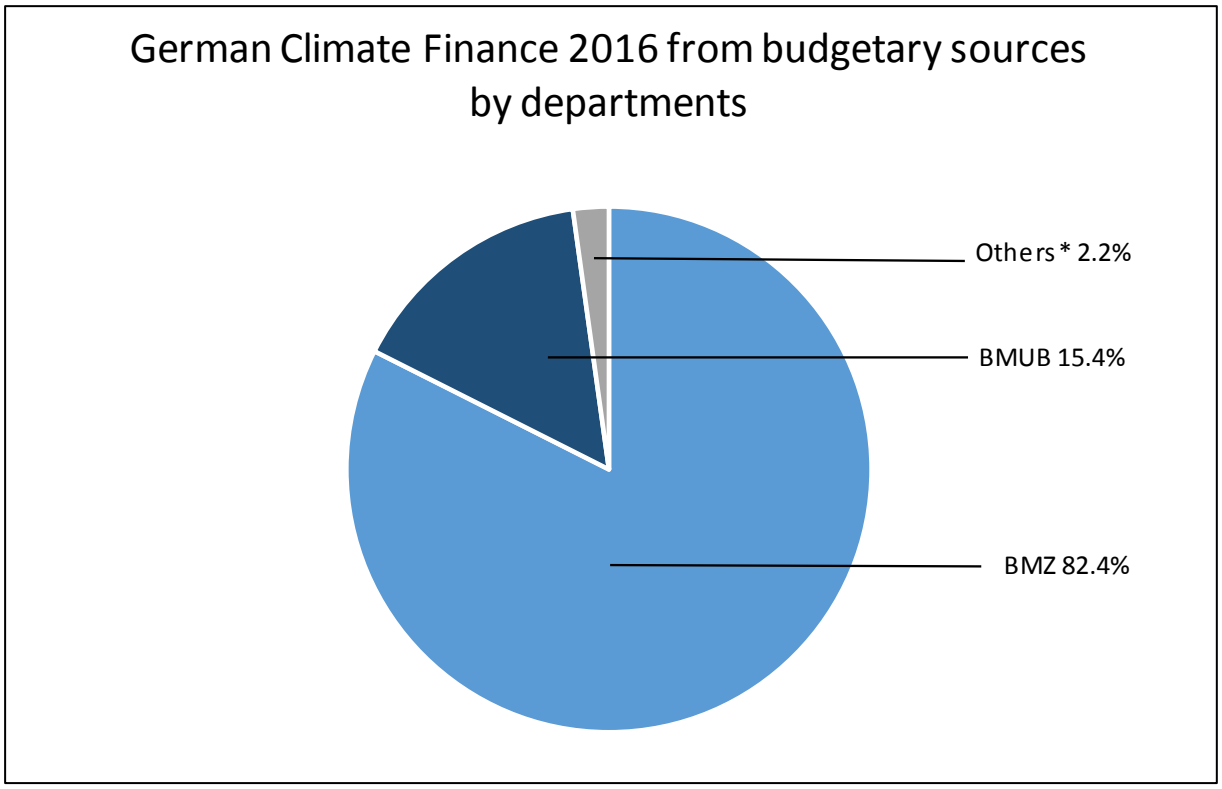

Figure 10: German climate finance for 2016 from budgetary sources, showing the percentages contributed by each ministry (*BMBF, BMWi, Federal Foreign Office)[56]

In 2016 Germany provided budgetary resources amounting to EUR 3.362 billion (USD 3.719 billion) for international climate finance. This represents an increase of 25.3 % compared with the previous year (2015: EUR 2.684/USD 2.977 billion). In addition, it pledged EUR 5.172 billion (USD 5.721 billion) in mobilised public finance from capital resources (c.f. definitions on page 62) through KfW Development Bank and Deutsche Investitions- und Entwicklungsgesellschaft mbH (DEG). In total, public climate finance ran to around EUR 8.546 billion or USD 9.44 billion (2015: EUR 7.406 billion/USD 8.192 billion).

In addition, steady growth can be observed when extending the observation period to include 2013 with EUR 1.950 billion (USD 2.652 billion) and 2014 with EUR 2.344 billion (USD 3.110 billion). Germany has increased its contribution to climate finance seven-fold since 2005. The increase in Germany's climate finance also reflects the successful mainstreaming of climate-related issues in its development cooperation efforts.

[56] Own illustration, BMZ

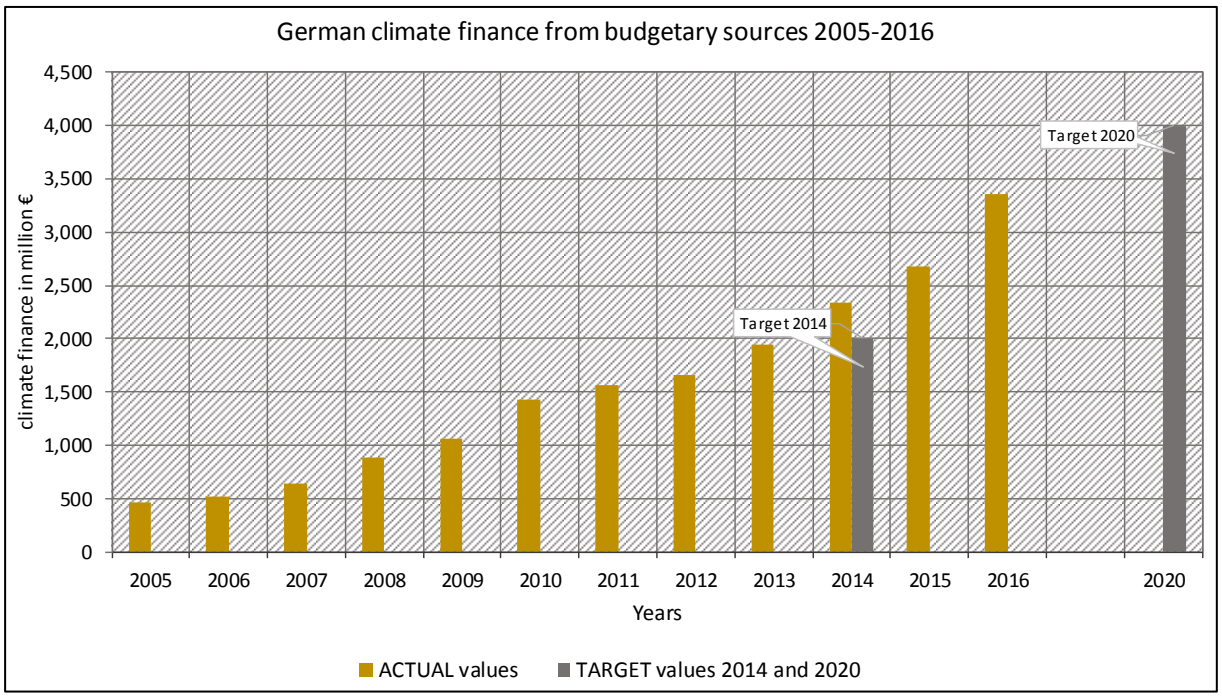

Figure 11: German climate finance from public budgetary sources 2005–2016 (in millions of euros)[57]

5.1.3 German climate finance instruments, institutions and initiatives

The German government uses a broad range of instruments and institutions for its international cooperation activities in the field of climate and development:

- Bilateral financial, technical and academic cooperation: German climate finance focuses on bilateral cooperation. From 2015 to 2016 around 85 % of the budgetary resources allocated to climate finance was spent on bilateral cooperation.
- Multilateral cooperation, such as the Green Climate Fund, the Climate Investment Funds, the Adaptation Fund under the Kyoto Protocol, the Global Environment Facility and the Forest Carbon Partnership Facility as well as cooperation with multilateral development banks and United Nations organisations.

During the reporting period for the Biennial Report, Germany set important priorities by instigating and/or providing comprehensive support for international initiatives. These priorities have supported the successful conclusion of the Paris Agreement and should now advance its rapid and ambitious implementation. Noteworthy in these efforts are the NDC Partnership (see section below), the G7 climate risk insurance initiative InsuResilience (see section 5.1.5), the Africa Renewable Energy Initiative (AREI) (see section 6.3.4.5), the NAMA Facility and the AFR100 initiative (see section 5.1.6).

Methodology used to measure German climate finance

Germany attaches great importance to measuring and communicating its climate finance transparently and comprehensively. For this reason, it has reported its bilateral climate finance in Table 7b on a project-specific basis in order to depict the individual projects in as

[57] Own illustration, BMZ

much detail as possible. In addition, supplementary information can be found on the BMZ,[58] BMUB[59] and BMBF[60] websites on the individual projects.

Since 2013 Germany has reported on its total public climate finance, including mobilised climate finance. Since 2015 it presents the mobilised public climate finance on a project-specific basis.

Germany distinguishes between two sub-categories of public climate finance:

a) Climate finance from budgetary sources, including grant equivalents of development loans that include budgetary sources. Climate finance provided from the public budget is recorded in this category. In the 2014 report, the imputed climate-relevant contributions to the funds of the MDBs were recorded for the first time using the methodology developed by the Organisation for Economic Co-operation and Development (OECD) Joint ENVIRONET and WP-STAT Task Team to Improve Rio Markers, Environment and Development Finance Statistics. The grant elements of development loans will be recorded in future as soon as data are available.
b) Mobilised public finance is the climate-related loan finance from KfW Development Bank's market funds and DEG's own resources. It predominantly comprises finance streams that count as official development assistance (ODA), as a rule in the form of concessional loans.

To ensure transparent records of climate finance, Germany has been using OECD climate markers, also known as Rio markers, since the 2011 reporting year.

They are presented with a differentiation between different areas: reduction of greenhouse gases, adaptation to climate change and forest and biodiversity conservation, including REDD+. So far there are no individual international markers for REDD+.

Technology transfer and capacity building are components of virtually all of the German government’s bilateral cooperation projects and cannot be categorised separately.

The statistical data in Tables 7, 7a and 7b in the Annex to this document contain the funds allocated from public budgetary sources for all climate-related bilateral development cooperation projects that were approved in the year in question. Multilateral contributions to climate finance are considered as disbursements.

Germany currently reports on mobilised private climate finance only in those areas in which there are already agreed reporting methods. Using the DAC methodology, mobilised private climate finance amounted to EUR 357 million in 2015 for KfW Development Bank. Data on commitments for 2016 is not collected until autumn 2017. DEG is mandated to work with the private sector. Private climate finance mobilised through DEG loans or equity participation is determined based on the overall investment sums of the projects, from which finance from public actors, primarily public development banks, is subtracted. The private finance comes primarily from DEG customers, that is investors/sponsors or private banks. The details on private climate finance are incomplete to the extent that they do not take many other possible forms of mobilisation into account. The German government is currently working on

[58] www.bmz.de/climatefinance

[59] www.international-climate-initiative.com/en/projects

[60] www.fona.de/en/index.php

internationally agreed criteria for recording the climate finance made possible through government guarantees (Euler Hermes).

Support for Nationally Determined Contributions and the NDC Partnership

Through a range of measures from various ministries, the German government is supporting the implementation of planned national climate pledges in the partner countries (known as Nationally Determined Contributions or NDCs), which were agreed to by the Parties to the Paris Agreement. It has already supported around 40 countries in the development of their Intended Nationally Determined Contributions (INDCs) in the run-up to the Paris Agreement's entry into force.

In order to quickly and effectively commence the implementation of the NDCs and contribute to raising climate ambition, BMZ and BMUB, in conjunction with the Moroccan COP Presidency, other industrialised countries and developing countries, the World Resources Institute (WRI) and various international institutions, launched a global partnership to promote the implementation of NDCs at the beginning of 2016 (the NDC Partnership or NDCP).[61] This is currently being supported by a range of donors and is already working through a secretariat. The aim of the partnership is to support developing countries in bringing together their national climate contributions and development goals (NDCs and SDGs) and to help in deploying the respective bilateral and multilateral donor programmes in a more coordinated way for implementation.

A total of 59 countries and nine international organisations and development banks are currently members of the NDC Partnership.[62] The NDC Partnership is in principle open to all countries and international organisations that support its objectives and principles.[63] Thomas Silberhorn (Parliamentary State Secretary at BMZ) and Nezha El Ouafi (Secretary of State at the Ministry for Energy, Mines and Sustainable Development in Morocco) serve as Co-Chairs of the Partnership.

5.1.4 Channels for delivering German climate finance (allocation channels)

5.1.4.1 Bilateral cooperation

A large proportion of Germany's climate finance contributions come in the form of bilateral cooperation.

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[61] http://www.ndcpartnership.org/

[62] http://www.ndcpartnership.org/partners - as at: 10.08.2017

[63] Such as: support country-driven processes, promote long-term climate action, enhance efficiency and responsiveness, build in-country capacity, improve coordination, enhance integration into national planning, advance adaptation and mitigation, align development and climate change, support multi-stakeholder engagement.

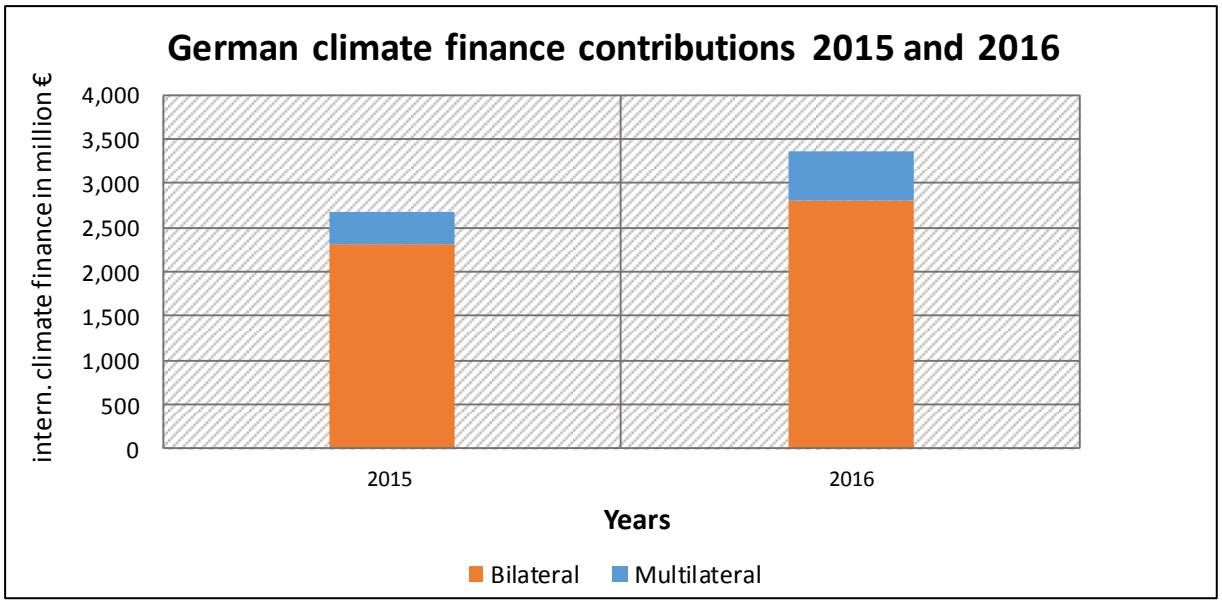

Figure 12: German climate finance contributions from budgetary sources for 2015-2016 divided into bilateral and multilateral (in millions of euros)[64]

The aim of the German government is to be even-handed in providing climate finance for emission reduction and climate change adaptation (Figure 12). Of the budgetary funds provided from the federal budget, 55 % was used for mitigation measures and 45 % for adaptation measures in 2015 and 2016.

[64] Own illustration, BMZ

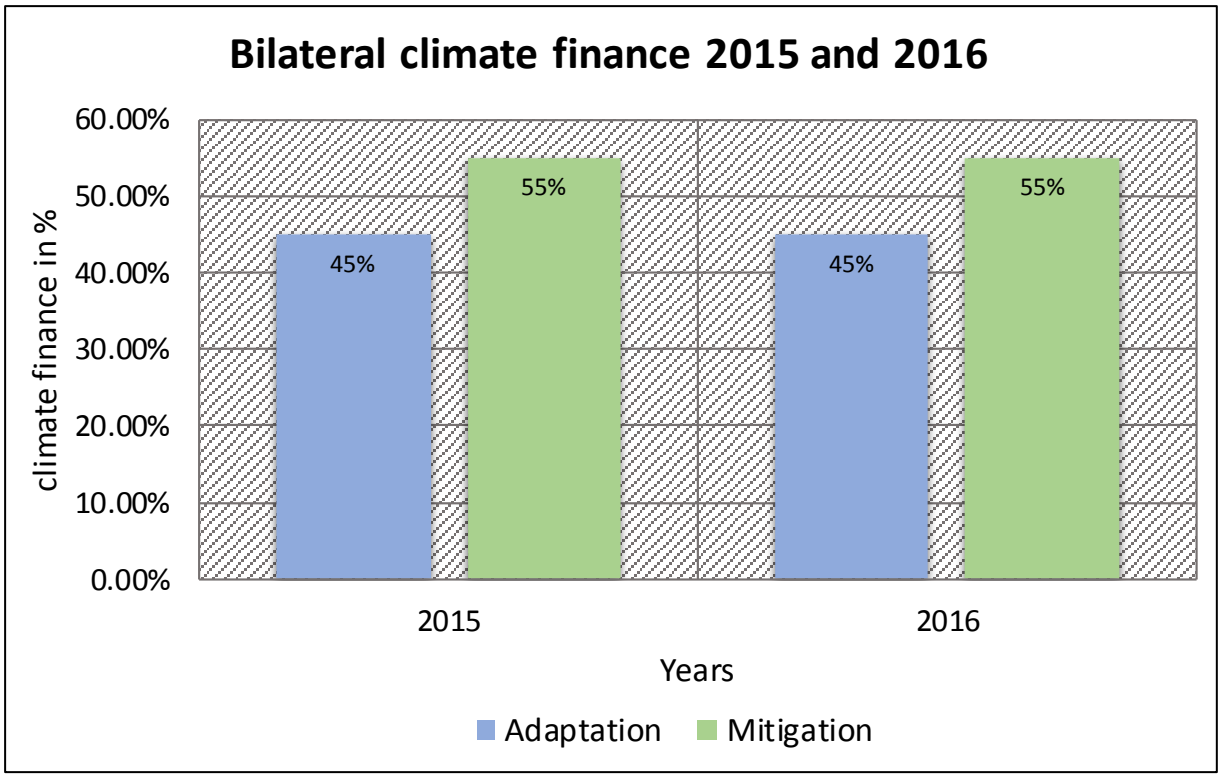

Figure 13: German bilateral climate finance from budgetary sources for 2015–2016, divided into adaptation and mitigation (in percent)[65]

In addition to public climate finance from budgetary sources, Germany has since 2013 also reported on mobilised public climate finance, i.e. climate-related credit financed by KfW Development Bank and Deutsche Investitions- und Entwicklungsgesellschaft mbH (DEG) that uses market funds. Since 2015, this reporting has been carried out on a project-specific basis. In addition to the deployed budgetary funds, an additional EUR 5.172 billion (USD 5.721 billion) were pledged by KfW and DEG from capital market funds in 2016.

[65] Own illustration, BMZ

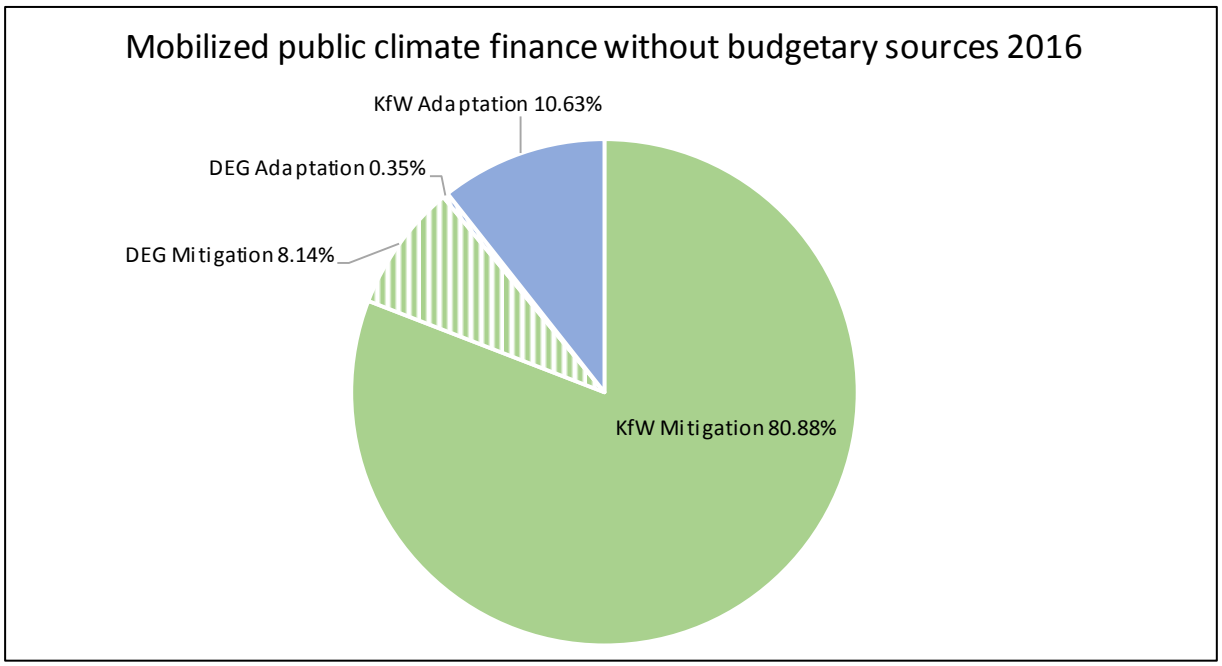

Figure 14: German finance fed by mobilised public market funds for 2016 (in percent)[66]

Regional distribution: in 2016, Germany supported partner governments in Africa with EUR 946 million (USD 1,046.5 million), in the Asian, Middle East and South-East European regions with EUR 886 million (USD 980.1 million), in Latin America and the Caribbean region with EUR 372 million (USD 411.5 million) and through global projects with EUR 614 million (USD 679.2 million) (see Figure 13). In 2015, Germany spent EUR 957 million (USD 1,062 million) for partnerships with African partner governments, EUR 688 million (USD 763.4 million) in the Asian, Middle East and South-East European regions, EUR 348 million (USD 368 million) in Latin America and the Caribbean and EUR 314 million (USD 348 million) in global projects (cf. figure 13).

[66] Own illustration, BMZ

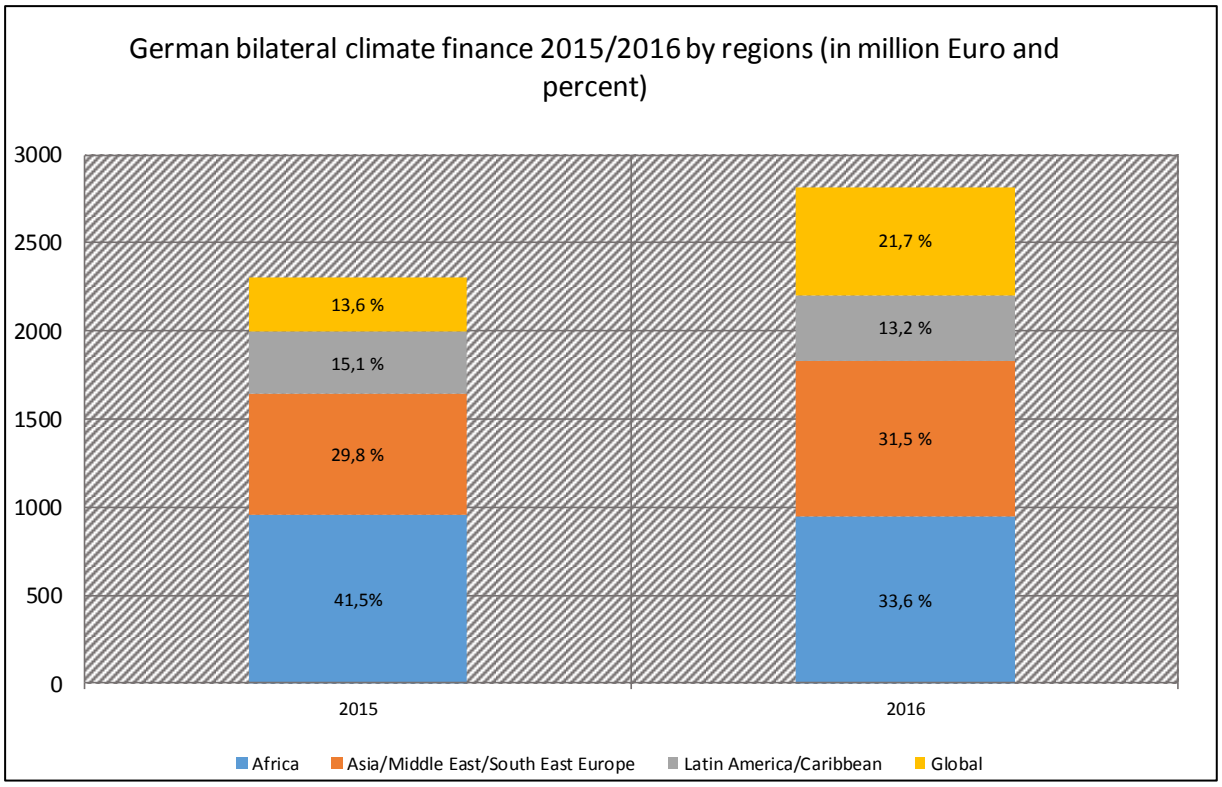

Figure 15: German bilateral climate finance 2015-2016 from budgetary sources by region (in percent)[67]

5.1.4.2 Multilateral cooperation

Germany provides part of its climate financing through multilateral institutions as contributions to international climate funds and multilateral organisations. Germany is involved not only in its role as donor, but also supports funds and multilateral development banks with regard to their strategic orientation and operational implementation in order to optimise their contribution to making the climate finance efficient and effective.

The funds that were directly set up/operate under the United Nations Framework Convention on Climate Change and are supported by Germany include the Green Climate Fund (GCF), the Adaptation Fund (AF); the Global Environment Facility (GEF); the Least Developed Countries Fund (LDCF); and the Special Climate Change Fund (SCCF).

Germany also supports climate funds that exist independently of the Framework Convention on Climate Change: the World Bank's Climate Investment Funds (CIF), including the Pilot Programme for Climate Resilience (PPCR); and the Forest Carbon Partnership Facility (FCPF).

Germany participates in the following funds of multilateral development banks (MDBs) through its regular contributions: the International Development Association (IDA) of the World Bank, the African Development Fund (AfDF), the Asian Development Fund (AsDF) and various funds of the Caribbean Development Bank. These contributions, as well as its contributions to the GEF, are included in German climate finance in accordance with the imputed climate-relevant shares established by these institutions. In addition, Germany

[67] Own illustration, BMZ

supports United Nations programmes in implementing the global climate agenda through annual contributions and special initiatives.

With a pledge of EUR 750 million (USD 1.003 billion), Germany is one of the largest donors to the Green Climate Fund (GCF). As a member of the Board, it participates actively in discussions on the institutional set-up and operational implementation of the Fund.

Germany pledged EUR 350 million (USD 460.3 million) for the Sixth Replenishment (2014–2018) and is thus the third-largest donor to the Global Environment Facility (GEF) after Japan and the USA. Ever since the GEF began publishing its imputed climate relevant share (2015), Germany has used it as a basis for calculating the GEF climate contribution. In addition to the regular replenishment cycle, Germany provided EUR 9.94 million (USD 11 million) in 2016 for the Trust Fund for the Capacity-Building Initiative for Transparency (CBIT). Germany serves as a member of the GEF Council, where it focuses particularly on harnessing synergies between the conventions dealt with in the GEF and the expansion of the effective results monitoring at project and programme level.

The German commitments to the LDCF amount to a total of EUR 215 million (USD 237.8 million) (as at March 2017). In the reporting period, it paid EUR 55 million (USD 61 million) into the Fund. This makes Germany the largest donor to the LDCF. In addition, Germany is providing technical advisory services on LDCF priorities, for example on innovative approaches in climate risk management, and also advising the Fund on designing project proposals. In this work, Germany is able to draw on its experience at country level to contribute to the strategic orientation and further development of the LDCF.

In total, Germany's commitments to the SCCF amount to EUR 90 million (USD 99.6 million) (as at March 2017). In the reporting period, it paid EUR 3 million (USD 3.3 million) into the Fund, which makes it the Fund’s largest donor. Germany concentrates its support on adaptation to climate change and provides advice on designing project proposals.

In 2015 and 2016 Germany paid a total of EUR 100 million (USD 110.6 million) into the Adaptation Fund and thus supports adaptation projects worldwide. In addition, Germany serves as a member of the Board, which is based here. Through its active participation on the Board, Germany supports the strategic orientation as well as the operational implementation of the Fund.

The German contribution to the World Bank’s Climate Investment Funds (CIFs) amounts to a total of EUR 550 million. With a contribution EUR 500 million (approximately USD 615 million) to the Clean Technology Fund (CTF) in the form of a loan, Germany is the Fund's fourth largest donor. Germany also supports the Pilot Program for Climate Resilience (PPCR) with a grant of EUR 50 million (USD 55.3 million). In addition to its financial contributions, BMZ also plays an active part in the work of the CIFs.

Germany is a co-initiator of the Forest Carbon Partnership Facility (FCPF) and is currently the second largest donor, after Norway and ahead of the United Kingdom, with overall commitments of EUR 210.4 million (USD 232.7 million), of which EUR 200.4 million (USD 221.7 million) is from BMZ and EUR 10 million (USD 11 million) is from BMUB). Germany paid in EUR 64.2 million (USD 71 million) for the period 2015-2016.

5.1.4.3 Multilateral financial institutions

Germany cooperates closely with multilateral financial institutions on climate change mitigation and adaptation. It facilitates intensive work by institutions on climate issues

through capital contributions, regular contributions to funds of multilateral financial institutions and climate-specific trust funds. In addition, Germany promotes close cooperation with institutions in multilateral initiatives and partnerships (such as the above-mentioned NDC Partnership). In the executive bodies, Germany actively supports climate-related topics and clearly advocates a climate-oriented agenda.

Germany participates with regular contributions to the funds of various multilateral development banks. These contributions will be included in German climate finance in accordance with the imputed climate relevant shares established by these institutions. In addition to the funds, the development banks themselves support the partner countries with substantial resources, which are refinanced on the international capital market (mobilised public climate finance, similar to KfW climate finance, for example). Reporting on non-concessional climate finance provided by multilateral development banks would need to be reported in a form that has been coordinated with other donors. In 2016 the multilateral development banks jointly mobilised USD 25.5 billion in public climate finance (according to the banks' own calculations in the 2016 Joint Report on Multilateral Development Banks' Climate Finance, published in September 2017). As a major shareholder of the banks, Germany contributed a great deal to this.

Organisation	2015	2016
World Bank (IDA)	109.7/121.7	96.8/107.1
African Development Bank (AfDF)	56.5/62.7	36.9/40.8
Asian Development Bank (AsDF)	7.0/7.8	5.7/6.3

Table 8: Selected imputed climate relevant shares of core contributions in millions of EUR/USD

In addition to capital contributions and funds for regular replenishment cycles of concessional financing, Germany makes additional contributions to climate-specific trust funds in multilateral finance institutions. In 2015 and 2016 its contributions to these funds amounted to EUR 96.275 million (USD 106.499 million). CTF Table 7a lists payments made.

5.1.4.4 Specialised UN organisations

Germany also pays annually into designated United Nations programmes to boost expertise and develop capacities in selected areas. Tables 7a and 7b lists the UN programmes supported.

Germany also provides funding for initiatives, fiduciary funds and knowledge centres. The support amounted to EUR 28.24 million/USD 31.32 million in 2015 and EUR 86.26 million/USD 95.42 million in 2016. Through these initiatives, Germany is strengthening capacity building in developing countries to implement climate change mitigation and adaptation measures, increase climate transparency and drive measures to implement the Montreal Protocol. In addition, it annually supports the activities of the UNFCCC secretariat as well as climate-related knowledge generation in several institutions. From 2015-2016, Germany supported the UNFCCC secretariat with EUR 12.4 million (USD 13.7 million) in compulsory and voluntary contributions.

5.1.5 Approaches to climate change adaptation

Germany attaches great importance to supporting developing countries in adapting to climate change. It sees it as an international responsibility and has made it one of the four integral pillars of the German Strategy for Adaptation to Climate Change (2008).

The German government strives to provide balanced support for mitigation and adaptation. In 2015, 55.22 % of bilateral climate finance was allocated to mitigation (EUR 1.3 billion or USD 1.4 billion) and 44.78 % to adaptation (EUR 1 billion or USD 1.1 billion). In 2016, adaptation's share was 44.96 % (EUR 1.27 billion/USD 1.4 billion); accordingly mitigation's share was 55.03 % (EUR 1.55 billion/USD 1.71 billion). Germany provides targeted support to the most vulnerable countries in the group of least developed countries and small island developing states to strengthen their adaptive capacities and increase the resilience of their agricultural production and infrastructure.

The priority areas of BMZ's support are ecosystem-based adaptation (EbA) and adaptation of agricultural production and food security, water management and adaptation, risk management instruments in connection with climate change impacts, for example through innovative insurance solutions, and the development and implementation of national adaptation strategies in the context of countries' National Adaptation Plans (NAP) and Nationally Determined Contributions (NDCs). In addition to the relevant BMZ projects and programmes, the International Climate Initiative (IKI) also contributes to German climate finance for adaptation. Overall, German climate finance in this area is directed at the needs of particularly vulnerable countries and groups.

Management of climate risks – disaster preparedness

As a signatory to the Sendai Framework for Disaster Risk Reduction**,** Germany supports developing countries in their endeavours to take precautions to protect critical infrastructure such as schools, hospitals and power stations.

Climate risk insurance initiative – InsuResilience

At the impetus of BMZ, the climate risk insurance initiative InsuResilience was launched under the German G7 Presidency in 2015. The aim of the initiative is to create access to direct or indirect insurance against climate risks for up to 400 million additional poor and vulnerable people in developing countries by 2020. So far, BMZ has contributed EUR 190 million (USD 208 million) and has provided a headquarters for the InsuResilience secretariat in Bonn.

Integrating adaptation into national development planning

A key approach in BMZ's support to establish adaptive capacities is promoting the integration of climate aspects into the national development and budget planning of partner countries. Germany supports partner countries in designing their National Adaptation Plan (NAP) processes, for example. In conjunction with other countries, BMZ launched the NAP Global Network in 2014, which contributes to national and global coordination of donors in the field of climate change adaptation and acts as a communication forum for experts and government representatives.

Agriculture

Agriculture is particularly affected by climate change. Without adaptation, it will not be possible to achieve the production increases on the ground that are required to feed a global population that continues to grow rapidly, and simultaneously contribute as much as possible to reducing greenhouse gas (GHG) emissions. Germany therefore strives to adapt agricultural development in partner countries to the challenges posed by climate change. The

promotion of food security in rural areas and agriculture is a great concern of the German government. It provides about EUR 1.5 billion annually for this purpose through its special One World, No Hunger initiative. In addition, the German government supports the Food and Agriculture Organization of the United Nations (FAO), within the framework of its food security programmes, in adapting agriculture to climate change and reducing agriculture's impact on the climate. Scientists working in inter- and transdisciplinary research partnerships set up by BMBF have developed a knowledge base on the interactions between land management, climate change and ecosystem services as part of a funding measure on sustainable land management, which received a total of EUR 75.9 million (USD 84.0 million) in funding between 2009 and 2016. BMZ contributes EUR 20 million (USD 22.12 million) per year towards funding 17 international agricultural research centres.

Water

Water is the medium by which climate change most directly impacts people and ecosystems as well as various industries. This affects poor people in particular, whose adaptive capacity is low due to financial limitations, and can promote conflict. Germany's international cooperation activities are working toward designing adaptation measures in the water sector on the basis of the projected climate change impacts in the partner countries.

Ecosystem-based adaptation (EbA)

The ecosystem-based adaptation (EbA) projects financed by BMZ advise partner countries on integrating the EbA approach into their planning processes and implementing it. Model projects test EbA measures and compile and disseminate the results. The International Climate Initiative (IKI) invested EUR 125 million (USD 138 million) in EbA up to the end of 2016.

5.1.6 Approaches to reducing greenhouse gases

Germany supports partner countries in establishing low-emission economic and supply structures. This includes using renewable energy, increasing energy efficiency, reducing extremely climate-damaging fluorinated GHGs and sustainable urban planning. Other areas of action include developing climate-oriented mobility and waste management strategies and also the conservation of natural carbon sinks.

Energy

Cooperation in the energy field is pursuing a rapid transformation of the energy sector in emerging economies and developing countries. The aim is to achieve sustainable, needs-based, low-emission and climate-proof energy infrastructure at all levels and thus bring together energy security and climate change mitigation.

To this end, the German government is drawing, for example, on the experience it has acquired with achieving an energy transition in Germany, and supports in particular expanding the use of renewable energy and increasing energy efficiency. Innovative solutions to utilising renewable energy sources to improve energy access and reduce energy poverty in developing countries are also taken into account. The transformation of the energy sector is supported through the provision of innovative financing instruments, investment measures, guidance on the transfer of technologies and expertise, development of

institutional capacities and skills, policy advice in the partner countries, and cooperation with regional and multilateral partners.

In addition, Germany is advocating for a gradual phasing out of fossil fuels by 2050, especially for bringing a rapid halt to coal expansion. In order to further strengthen the transformative character of German development cooperation's energy projects, the government, in line with its report on coal finance for the economic committee of the German parliament (Bericht der Bundesregierung zur internationalen Kohlefinanzierung für den Wirtschaftsausschuss des Deutschen Bundestages)[68] from January 2015, is no longer supporting the construction of new coal-fired power stations and retrofitting of decommissioned coal-fired power stations in partner countries. Therefore, in 2015, KfW Development Bank reviewed its financing criteria for coal-fired power stations and made them more stringent. In early 2016 they were taken into account as additional criteria in the newly formulated technological and climate-related criteria in the OECD Sector Understanding on Coal-Fired Electricity Generation Projects.

Transport

German development cooperation policy aims to increase energy efficiency in the transport sector and promote modes of transportation that have less of an impact on the environment and climate. The German government is supporting the establishment and expansion of public transport systems in developing countries and emerging economies, and also introducing regulations and measures to promote environmentally friendly passenger and goods transport, making vehicle fleets more energy efficient and environmentally sound, for example through alternative environmentally-friendly drive technology, and improving transport planning in towns and cities.

Forestry

The German government's international forest policy aims to halt deforestation and further forest degradation, preserve or restore forests as greenhouse gas sinks and tap into the CO_2 mitigation potential of sustainable forestry. It primarily supports concepts that reconcile forest protection and sustainable use. It is one of the biggest donors worldwide in the area of international forest protection. Up to 2016, BMZ made available EUR 2 billion (USD 2.21 billion) for more than 200 forestry initiatives. Currently the support is focused on the sustainable use of forests for climate protection (REDD+) and conservation of biodiversity. Promoting the restoration of forest landscapes and deforestation-free supply chains are also BMZ priorities in international forest policy. BMZ launched the African Forest Landscape Restoration Initiative (AFR100) in conjunction with the New Partnership for Africa's Development (NEPAD) and the World Resources Institute (WRI) at the 2015 Paris Climate Change Conference. The initiative aims to restore around 100 million hectares of forest landscapes in Africa by 2030 and, in doing so, also supports the implementation at regional level of the global target set by the Bonn Challenge.

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[68] Bericht der Bundesregierung zur internationalen Kohlefinanzierung für den Wirtschaftsausschuss des Deutschen Bundestages; online:http://www.bmwi.de/Redaktion/DE/Downloads/B/bericht-der-bundesregierung-zur-internationalen-kohlefinanzierung-fuer-den-wirtschaftsausschuss-des-deutschen-bundestages.pdf?__blob=publicationFile&v=5

An important possibility for leveraging forest conservation lies in cooperation between governments and business and the creation of sustainable enabling environments. The German government therefore promotes private sector initiatives relating to soy, palm oil, coffee and cocoa and will further strengthen its cooperation with the private sector to establish "deforestation-free" supply chains.

Urban development

The German government sees towns and cities as key players in endeavours to achieve a global sustainability agenda. German development cooperation activities promote the drafting and implementation of urban development strategies that incorporate climate change mitigation and resilience to the impacts of climate change in partner countries. In total, Germany has provided more than EUR 10 billion (USD 11 billion) for climate action in towns and cities over the past five years through its development cooperation activities. There is a particular focus on establishing climate-friendly infrastructure that can withstand climate change impacts.

In the International Climate Initiative (IKI), the topic of sustainable urban development cuts across the mitigation, adaptation and biodiversity funding areas. The supported projects assist partner countries in developing strategies for dealing with the impacts of climate change in towns and cities and in making the economic structure more sustainable and low-emission.

Furthermore, Germany provided support through BMBF research projects totalling EUR 6.1 million (approx. USD 6.7 million) to urban growth centres for planning and managing urban infrastructure and services between 2014 and 2016.

Mitigation initiatives

The German government initiated the African Renewable Energy Initiative (AREI) and at the Paris Climate Change Conference pledged a total of EUR 3 billion up to 2020 in support for the AREI. In 2016, BMZ made new commitments for renewable energy, energy efficiency and power transmission and distribution in Africa amounting to more than EUR 1.2 billion (USD 1.3 billion) through bilateral technical and financial cooperation. These commitments contribute fully to the achievement of the AREI targets.

The NAMA Facility was launched in 2012 at the initiative of the German Environment Ministry and the British government. It aims to implement ambitious NAMA projects that contribute to the transformative shift to low-carbon development.

As lead donor, BMZ supports the Energising Development Partnership (EnDev) with the aim of eliminating global energy poverty. Since 2005, EnDev has helped 17.3 million people, 38,600 small and medium-sized enterprises (SMEs) and 19,400 social institutions obtain sustainable access to electricity or modern cooking and heating technologies. In total, BMZ supported EnDev with approx. EUR 19.35 million (USD 21.4 million) from 2015 to 2016.

5.1.7 REDD+ approaches and important initiatives with German involvement

Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+) is a cornerstone of Germany's international cooperation in the forestry sector. Germany (BMZ and BMUB) provided over EUR 1 billion in financing for REDD+ in the

period 2008-2016. The share of the ongoing bilateral and multilateral REDD+ portfolio (EUR 751.1 million (USD 830.9 million)) in the ongoing total portfolio (approx. EUR 1,650.7 million (USD 1.826 million)) is 45.5 %, and has increased by 31 % in comparison to 2015 (EUR 574.5 million (USD 635.5 million)). If the new REDD+ commitments from 2016 are included, REDD+ accounts for nearly 49 % of BMZ's total bilateral and multilateral forestry portfolio. Germany's development cooperation supports relevant forest countries in creating an enabling environment for implementation of REDD+ at national and sub-national level (e.g. good governance, participation of civil society and indigenous associations, monitoring of forests). In addition it provides results-based financing for countries that can already demonstrate avoided deforestation. This occurs through bilateral and multilateral support programmes.

Germany is taking part in a joint initiative with Norway and the United Kingdom (GNU) in order to make further progress in protecting forests. The aim is to promote the REDD+ approach more broadly, implement integrated land-use programmes and strengthen private sector investment in deforestation-free value chains. The German government views this initiative as part of the implementation of the New York Forest Declaration that was signed in September 2014. In December 2015 in Paris, the GNU governments announced that they would provide EUR 5.5 billion (USD 6.1 billion) for the period 2015 to 2020, or EUR 0.904 (USD 1 billion) annually until 2020 for REDD+. BMZ launched the REDD Early Movers (REM) programme back in 2012 in order to support forerunners in forest conservation for climate change mitigation and to test results-based REDD+ finance. BMZ has provided funding amounting to EUR 59.5 million (USD 65.8 million) up to now. The measures financed by the German government aim not only at reducing emissions but also at improving adaptation to the impacts of climate change.

The Bonn Challenge is an essential German development cooperation tool for conserving natural resources. The initiative was founded based on a ministerial conference of the same name that BMUB organised in 2011 in Bonn in conjunction with the International Union for Conservation of Nature (IUCN). It calls for 150 million hectares of forest to be restored by 2020, or the required processes to have at least been initiated. The German government supports implementation through local initiatives and pilot projects as part of its International Climate Initiative (IKI). It is strengthening capacities in the countries and developing the analytical groundwork and maps to identify the potential to rehabilitate forests.

BMZ has been supporting the Amazon Forest Conservation and Climate Fund since 2008, which is the first national REDD+ financial mechanism in Brazil or anywhere in the world, with a total of EUR 21 million in financial cooperation (approximately USD 23 million) and EUR 4.2 million (USD 4.6 million) in technical cooperation. At the Brazilian-German intergovernmental consultations in Brasilia, Chancellor Merkel raised the prospect of providing a further EUR 100 million (USD 111 million) in financial cooperation.

5.1.8 Mobilisation of private investment in climate change mitigation and adaptation measures in developing countries

Strategies and measures that help make financial flows consistent with climate-friendly development as set out in Article 2.1.c of the Paris Agreement ("shifting the trillions") and that contribute to mobilising private investment in climate change mitigation and adaptation are fundamental building blocks of German climate finance.

Achieving this requires clear price signals and a reliable, long-term enabling environment. The aim is to deploy the limited public funds so that they effectively mobilise private funds

(both through financial and technical cooperation) for climate change mitigation and adaptation with the highest possible transformative impacts in non-Annex I countries. This involves not only the direct mobilisation effect; it also involves structural changes in the economy and in the financial sector brought about by taking climate change risks into account and integrating them into decision-making processes. Appropriate measures have been put in place in areas such as those described below.

The German government supports advisory services for policy-makers in establishing guidelines and regulations that facilitate private investment. By providing assistance in project development and preparation of funding proposals, public and private actors are also supported in mobilising investment. The actual and perceived risks relating to investments in climate change mitigation and adaptation can be overcome through advisory services on policy instruments and innovative financial products and by providing data and information.

Providing capital to institutions such as local banks for adaptation and mitigation actions while at the same time building capacities, enables the institutions to develop adapted financial products and build a portfolio over the long term. Green finance activities are currently providing almost EUR 2.1 billion to around 120 projects in 20 different countries and nine multi-country approaches.

Germany also promotes capacity building for various national public and private sector institutions, which is often a fundamental requirement for making private investment possible.

It promotes close cooperation between the private sector and governments in the field of climate risk management in order to provide actors in affected areas with risk management strategies that safeguard their incomes, food security, employment opportunities and access to loans in times of climate change. Example: InsuResilience (see section 5.1.5 above).

Germany is promoting a range of multi-actor dialogues in order to strengthen and replicate the results of successful practices and facilitate the participation of other donors. They facilitate exchange between actors from the public and private sectors in areas such as making governments' climate strategies accessible to private financiers and project developers.

The Deutsche Investitions- und Entwicklungsgesellschaft mbH (DEG) works solely with the private sector. It assumes the risks that commercial banks and investors assume to only a limited extent or do not (or are not able to) assume at all. In this way, DEG facilitates the delivery of a suitable financial package in which private investors and commercial banks can take part.

5.2 Technology development and transfer

5.2.1 General

Technology transfer is a component in virtually all of the German government’s climate-related bilateral cooperation. Environmentally friendly technologies, for example in the field of energy infrastructure, are an essential part of economic development and climate action. It is therefore not possible to separately report climate finance contributions that are solely categorised as technology transfer.

With regard to climate technology, low-carbon energy, climate-smart cities and resilient rural development are areas of particular relevance to German development cooperation.

Germany is involved in technology cooperation through its committed support to the UNFCCC Technology Mechanism and its organisations: the Technology Executive Committee (TEC) and the Climate Technology Centre and Network (CTCN). Germany has been supporting the TEC with voluntary contributions amounting to EUR 550,000 (approx. USD 608,407) and the CTCN with EUR 1,047,019 (USD 1,158,207) since 2013.

Through the German Climate Technology Initiative (DKTI), BMZ is financing modern, climate-friendly and climate-adapted infrastructure measures in emerging economies and developing countries, which reduce GHG emissions and promote adaptation to climate change. By 2016, projects totalling EUR 7.86 billion (USD 8.7 billion) had been approved.

5.2.2 Energy sector

The EU Energy Initiative Partnership Dialogue Facility (EUEI PDF) is a multi-donor facility aiming to promote renewable energy to achieve equitable and climate-friendly development worldwide. Here the focus is on larger-scale renewable energy. In hosting the secretariat of the Africa-EU Energy Partnership (AEEP), the Facility promotes high-level political dialogue between the two continents. Increased attention will be paid to establishing networks between energy and climate actors in order to forge a cross-sectoral alliance for achieving development and climate goals.

The Africa-EU Renewable Energy Cooperation Programme (RECP) supports companies in developing bankable projects and in so doing contributes to closing the gaps between available climate funds and the numerous, but not always convincing, project approaches. The programme currently supports 25 projects with a capacity of 221 megawatts. By providing basic finance of EUR 4.69 million (approx. USD 5.19 million), BMZ leveraged co-financing of approximately EUR 23 million (USD 28 million.).

5.2.3 Transport sector

Germany is known for sustainable solutions and innovative concepts along the entire mobility and logistics chain. The German Partnership for Sustainable Mobility (GPSM) has also acted as a 'pilot' and is the key contact partner for sustainable mobility and logistics solutions from Germany. The professional network involving industry, academia and civil society promotes dialogue on sustainable transport with actors from developing countries and emerging economies and processes Germany's lessons learned, tailoring them for specific target groups.

Technical cooperation advisory services help climate-friendly mobility options to gain a firm foothold in the market and increase the ability of subnational actors to plan and introduce climate-friendly technologies in the transport sector.

5.2.4 Private sector cooperation

Industry plays a key role in designing future-oriented and modern energy supply systems in our partner countries: as a technology supplier and source of finance. Many German development cooperation projects therefore aim to create a better technical and policy framework in the partner countries in order to ultimately recruit the support of the private sector as a key actor in the broad-based marketing of appropriate technologies.

Through its develoPPP.de programme, BMZ supports companies that invest in developing countries and emerging economies. They receive financial support and, if they request it, also technical support. Over 1,500 development partnerships have been initiated since 1999

in all areas ranging from wastewater management to certification. BMZ supported projects with EUR 74 million in 2015 and 2016. Some of these were considered climate-related due to investments in renewable energy, energy efficiency, biodiversity and forestry.

5.3 Capacity building

Capacity building is an integral part and core element of virtually all the German government's bilateral cooperation projects. It is therefore not possible to separately report finance streams used exclusively for capacity building.

The German government is involved in capacity building through bilateral and multilateral cooperation as well as various partnerships with the private sector, academia and civil society. In order to support partner countries in the effective implementation of the United Nations Framework Convention on Climate Change and the Paris Agreement, it provides comprehensive capacity building measures in the areas of greenhouse gas reduction, adaptation to climate change, technology development and transfer, and access to climate finance, as well as other specific sectors and cross-cutting aspects such as reporting (see sections 2, 3, 4, 6, Part B, and CTF Table 9). The support measures for capacity building are designed to be context-specific, results-based and consistent with national priorities. In this work, it uses its range of international cooperation instruments and institutions to build capacities at individual, institutional and systemic level in the area of climate and development. See sections 5.1.4, 5.1.5 and 5.2 and CTF Table 9 in this Biennial Report for an example of capacity-related measures and initiatives in the areas of greenhouse gas reduction and climate change adaptation, and at sector level.

6. Other relevant information

Further developments in German climate policy

In 2018, the German government will present a programme of measures to implement the Climate Action Plan 2050. The measures will be designed to ensure that the GHG reduction targets - overall and for individual sectors - are met by 2030. A National Climate Action Alliance made up of representatives from all social groups and a scientific platform will support this process. Furthermore, progress towards implementation of the Climate Action Plan 2050 will be monitored. This will be linked to the process monitoring the Climate Action Programme 2020.

In 2015 the government also began to produce an annual report on the Climate Action Programme 2020, containing information on the latest emissions trends in the various areas for action, implementation progress and a forecast of the reduction effects that can be expected by 2020.

7. List of German legislation cited

Primary legislation (federal)

Energy Industry Act	Energiewirtschaftsgesetz
Energy-Related Products Act	Energieverbrauchsrelevante-Produkte-

	Gesetz
Packaging Act	Verpackungsgesetz
Renewable Energy Sources Act	Gesetz zum Ausbau der erneuerbaren Energien (Erneuerbare-Energien-Gesetz, EEG)

Secondary legislation (federal)

Commercial Waste Regulation	Gewerbeabfallverordnung
Energy Conservation Regulation	Energieeinsparverordnung
Fertiliser Application Regulation	Düngeverordnung

Translators' note: The English translations of German legislation cited should be seen as descriptive, rather than official. In particular, there may be discrepancies from previous texts published by German government agencies in which *Verordnung* has been translated as Ordinance. We believe that *Verordnung* corresponds more closely to secondary legislation commonly known in the English-speaking world as a Regulation or Regulations.

8. Annex 1: Reporting tables (CTF)