Summary
of
Germany's
National Air Pollution Control Programme

9 July 2019

Link to the website on which the programme is available for download	https://www.umweltbundesamt.de/nlrp2019
Link to the website on the consultation relating to the programme	https://www.bmu.de/meldung/beteiligung-der-oeffentlichkeit-im-rahmen-der-erstellung-des-nationalen-luftreinhalteprogramms/

Contents

Index of figures

Index of tables

Abbreviations

EURAD	Chemical transport model of the Rhenish Institute for Environmental Research (Rheinisches Institut für Umweltforschung, RIU)
MCP	Medium Combustion Plant
MWMS	Mit-Weiteren-Maßnahmen-Szenario (With Additional Measures Scenario – a climate change mitigation scenario in the German government's 2017 projection report)
NEC	National Emission Ceilings
NECD	old: Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on national emission ceilings for certain atmospheric pollutants new: Directive (EU) 2016/2284 of the European Parliament and of the Council of 14 December 2016 on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC
NECP	National Energy and Climate Plan
SO_2	sulphur dioxide; in relation to emissions, SO_2 in the national air pollution control programme pursuant to the 43rd BImSchV covers not only sulphur dioxide but also all sulphur compounds, including sulphur trioxide (SO_3), sulphuric acid (H_2SO_4) and reduced sulphur compounds such as hydrogen sulphide (H_2S), mercaptans and dimethyl sulphides, expressed as sulphur dioxide
WM	With Measures
WAM	With Additional Measures (NEC compliance scenario)

Summary

1 The national air pollution control programme in the political context

Directive (EU) 2016/2284 on the reduction of national emissions of certain atmospheric pollutants (also known as the new National Emission Ceilings (NEC) Directive) introduces mandatory reductions in national emissions, thereby contributing to the EU's aim of achieving further significant reductions in air pollution, especially with regard to fine particulate matter, in the Member States and hence Europe-wide. The NEC Directive was transposed into national legislation via the 43rd Ordinance on the Implementation of the Federal Immission Control Act (43rd BImSchV).

Germany's national air pollution control programme serves to meet reporting obligations vis-à-vis the European Commission pursuant to Articles 6 and 10 of the NEC Directive and Sections 4 and 16 of the 43rd BImSchV. Following a resolution by the Federal Cabinet, the first report to the European Commission was submitted on 22 May 2019. It describes the development of national emissions to 2030 and the planned measures for meeting emission reduction commitments on the basis of the current state of knowledge.

2 The trend of national emissions in the period 2005-2016

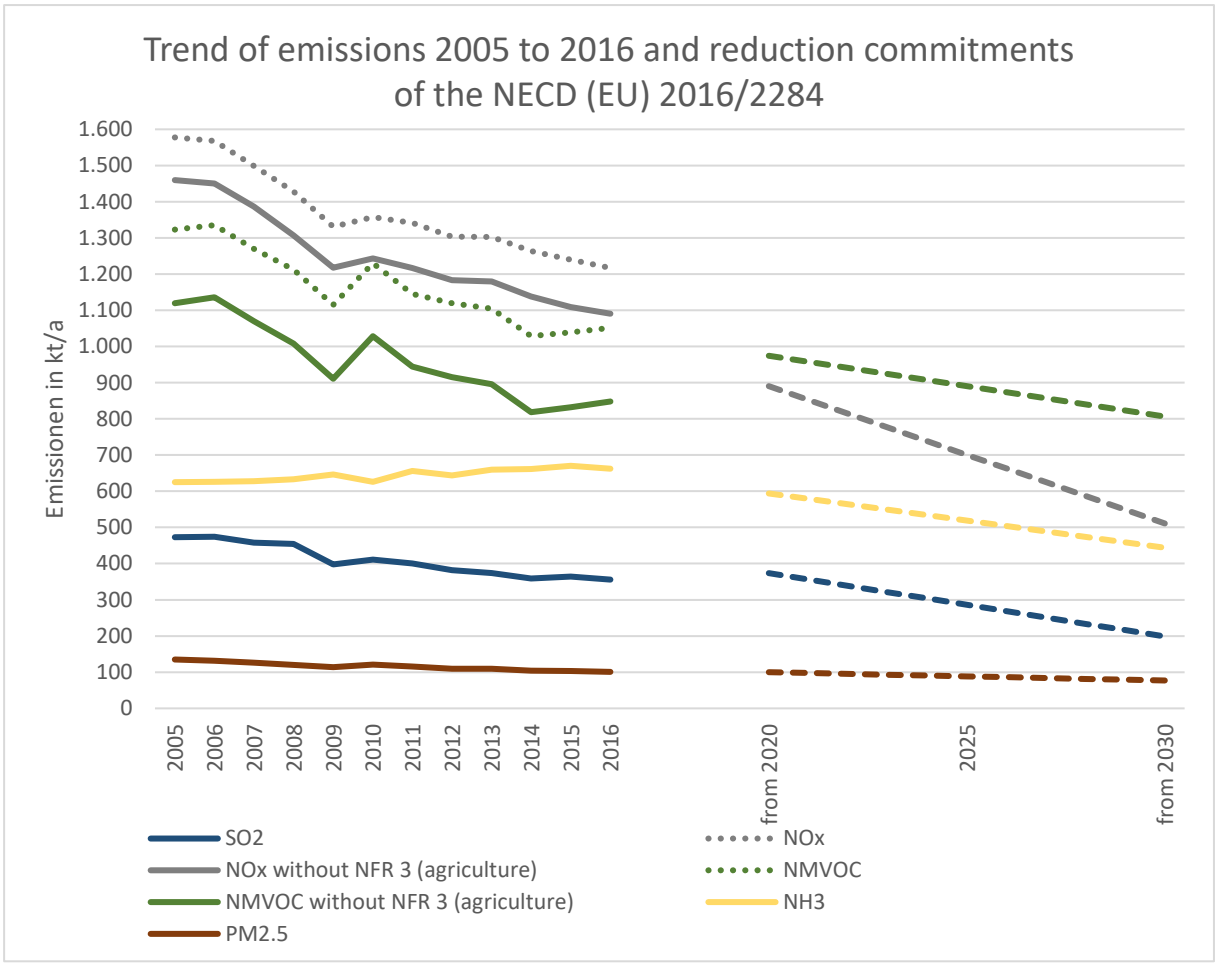
With the exception of NH_3 emissions, anthropogenic emissions of the atmospheric pollutants covered by the NEC Directive (EU) 2016/2284 have fallen in recent years (see Figure 1). However, negative impacts on and risks to human health and the environment are still significant (NEC Directive, recital 1). The trend of emissions over the past ten to 15 years shows that high technical mitigation potentials have already been implemented in many source groups and that in Germany, given constant or growing activity rates, it is becoming increasingly more challenging and expensive to realise emissions reductions by means of process- or system-integrated mitigation measures.

Between 2005 and 2016, total SO_2 emissions in Germany fell by just under 25%. The significant reduction in SO_2 emissions since 2008 is largely due to the increased use of heating oil with a low sulphur content in stationary small combustion. Emissions from the energy sector, manufacturing and industrial processes have also decreased.

Total German NO_X emissions fell by almost 23% between 2005 and 2016. The biggest emissions reductions have occurred in the road transport sector. Despite increases in the total mileage of heavy and light duty vehicles and private cars, nitrogen oxide emissions have been cut sharply – with the exception of NO_x emissions from diesel cars – as a result of the tightening of emissions limits and the steady fleet renewal that has accompanied this. Slight emissions reductions have been recorded in industrial processes, in manufacturing and in small combustion; in the energy sector and in agriculture, though, emissions rose slightly.

Total German ammonia emissions increased by roughly 6% between 2005 and 2016. This increase is mainly attributable to the land spreading of residues from the fermentation of energy crops in biogas plants. In connection with the use of mineral fertilisers, the increasing part played by urea, which has relatively high emission factors, is responsible for rising emissions. In the transport sector, reductions in NH_3 emissions have resulted from technical improvements to catalytic converters in petrol cars.

Figure 1: Trend of SO_2, NO_X, NMVOC, NH_3 and $PM_{2.5}$ emissions from 2005 to 2016 and linear reduction path under Directive (EU) 2016/2284
Source: Emissions report 2018, Federal Environment Agency, FG V 1.6



Between 2005 and 2016 total German NMVOC emissions were reduced by a good 20%. NMVOC emissions from industrial processes, predominantly solvent and product use, fell significantly during this period. This fall is attributable to the implementation of various European directives (the Solvent Emissions Directive 1999/13/EC (also known as the VOC Directive), which was replaced in 2010 by the Industrial Emissions Directive (IED) 2010/75/EU, and the Decopaint Directive 2004/42/EC) and national transposition of these (31st BImSchV, 2nd BImSchV, the Technical Instructions on Air Quality Control (TA-Luft) and the ordinance on solvent-based paints and varnishes ChemVOCFarbV). Significant reductions in road transport emissions have also been achieved, partly through improvements to catalytic converters in petrol cars. NMVOC emissions from fuel evaporation and small combustion plants were also reduced. By contrast, NMVOC emissions from agriculture rose slightly.

Total direct $PM_{2.5}$ emissions in Germany fell by about 25% between 2005 and 2016. Reductions in the transport sector were particularly significant. $PM_{2.5}$ exhaust emissions fell significantly as a result of the progressive tightening of emissions limits (Euro norms) for cars and light and heavy commercial vehicles and the resulting fleet modernisation. However, emissions from abrasion of tyres and brake wear and from road wear rose on account of increasing vehicle mileage. $PM_{2.5}$ emissions have also fallen in recent years in the source groups of industrial processes,

manufacturing, the energy sector and residential and commercial small combustion. Although the use of wood fuel for heating purposes has increased sharply in recent years, implementation of the strict emissions limits for small combustion plants laid down in the 1st BImSchV have enabled a reduction in overall particulate emissions to be achieved. On the other hand, emissions from agriculture have increased slightly.

3 The trend of air quality in the period 2005-2016

Between 2005 and 2016 there was also a general decline in measured levels of atmospheric pollutants such as nitrogen dioxide (NO_2) and fine particulate matter (PM_{10} and $PM_{2.5}$)

The mean annual limit value for NO_2 of 40 µg/m^3 is rarely exceeded except at traffic oriented measuring sites. The hourly limit value for NO_2 (200 µg/m^3 no more than 18 times in a calendar year) has been exceeded only occasionally in recent years. There has been a noticeable fall in nitrogen dioxide concentrations at traffic sites since 2005.

Levels of fine particulate matter are determined not only by direct emissions of fine particulate matter but also by emissions of precursors that form fine particles in the atmosphere. As a result of both regional and local reductions in direct PM_{10} emissions and precursor gases, there has also been a noticeable fall in measured PM_{10} concentrations since 2005, albeit with significant inter-annual fluctuations in the trend. Pollution not only depends on the strength of the emission sources but is also significantly influenced by meteorological conditions. The number of measuring sites at which the daily limit value for PM_{10} (50 µg/m^3 no more than 35 times in a calendar year) has been exceeded has fallen significantly since the introduction of the limit value in 2005. Since that date, too, the mean annual limit value for PM_{10} of 40 µg/m^3 has been exceeded only rarely, mainly at traffic oriented measuring sites. No readings above the mean annual limit value for PM_{10} have been recorded since 2012.

The fall in PM_{10} concentrations has been accompanied by a corresponding decline in annual mean concentrations of the $PM_{2.5}$ fraction. Compliance with the limit value (annual mean of 25 µg/m^3) is not at risk in Germany. Since the introduction of the mean annual limit value in 2010, the limit has been exceeded only once, at a traffic oriented station.

Peak ozone concentrations in Germany have been falling for many years. However, there has been little change in mean ozone concentrations since 2005. The ozone target value for the protection of health has been in place since 2010. It is considered to be exceeded if the daily maximum eight-hour average concentration is above 120 µg/m^3 on more than 25 days per year, averaged over three years. This occurs mainly at rural background stations; it also occurs, although to a lesser extent, at urban background stations. As a result of the high-ozone summer of 2015, more exceedances were recorded in the reporting years of 2015 (3-year mean 2013-2015) and 2016 (3-year mean 2014-2016) than in the preceding years. Throughout Germany, readings do not currently meet the long-term target of an eight-hour average of no more than 120 µg/m^3 that is due to be achieved by 2020.

Because of Germany's central location in Europe, transboundary transport of atmospheric pollutants is a major issue, with pollutants being transported both from Germany into neighbouring states and from neighbouring states into Germany. The transport and concentration of atmospheric pollutants are of course also affected by naturally occurring emissions and the weather. It cannot therefore be automatically concluded that a fall in national emissions leads to a fall in levels of atmospheric pollutants.

4 Emissions projections to 2030 in the With Measures (WM) scenario and the With Additional Measures (WAM) scenario

For the national air pollution control programme, emissions projections to 2030 have been produced on the basis of two scenarios.

- The **With Measures (WM) scenario** comprises measures that have already been adopted – in the climate change mitigation sector by 31 July 2016, in the road transport sector by 1 January 2017, in the agricultural sector by 31 May 2017 and in the air pollution control sector by 1 September 2017.
- In addition, on account of the anticipated partial failure to meet the reduction commitments in the WM scenario, Germany is also required to submit a **With Additional Measures (WAM) scenario**. The WAM scenario contains further measures that had not been formally and legally adopted by the relevant deadline and strategies that the German government has agreed to implement in order to comply with the reduction commitments of the NEC Directive.

Figures 2 to 6 show the predicted trend of SO_2, NO_X, NMVOC, NH_3 and $PM_{2.5}$ emissions in the WM and WAM scenarios between 2005 and 2030 and the emissions reduction commitments of the NEC Directive (EU) 2016/2284 for each pollutant.

In the with-measures (WM) scenario, the reduction commitments for 2020 can be met for all pollutants. In 2030, by contrast, the reduction commitment is met only for NMVOC in this scenario. The WAM scenario continues to meet the reduction commitments for all pollutants post-2020.

Figure 2: SO_2 emissions and emissions projections in the WM and WAM scenarios

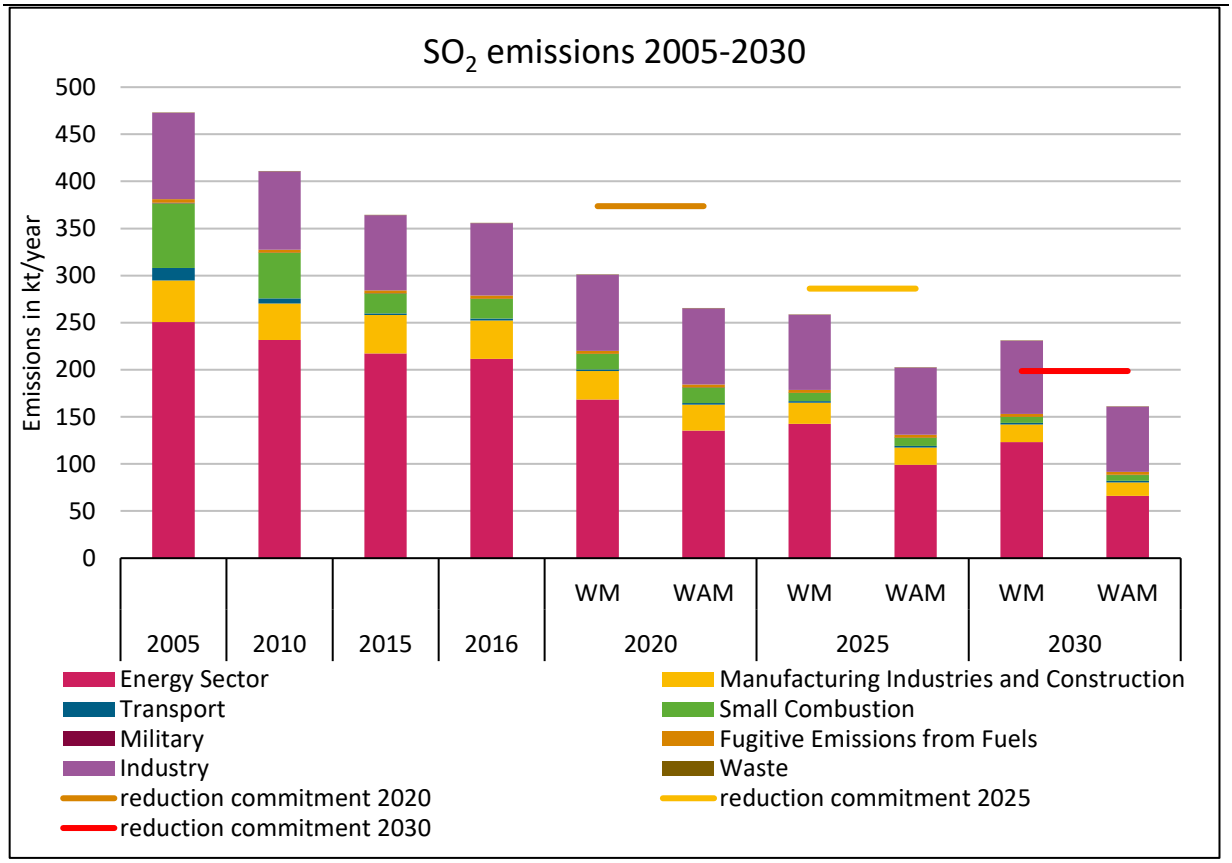


Figure 3: NO_x emissions and emissions projections in the WM and WAM scenarios

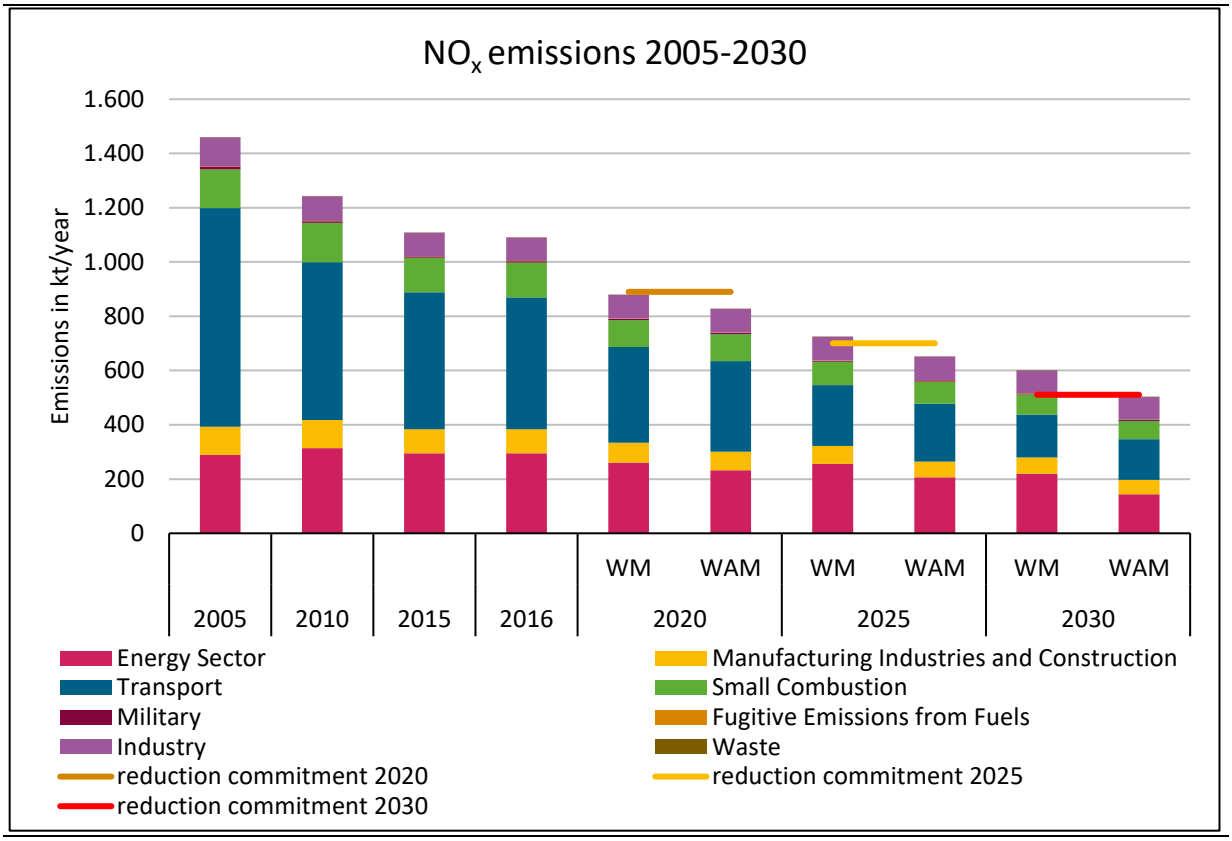


Figure 4: NMVOC emissions and emissions projections in the WM and WAM scenarios

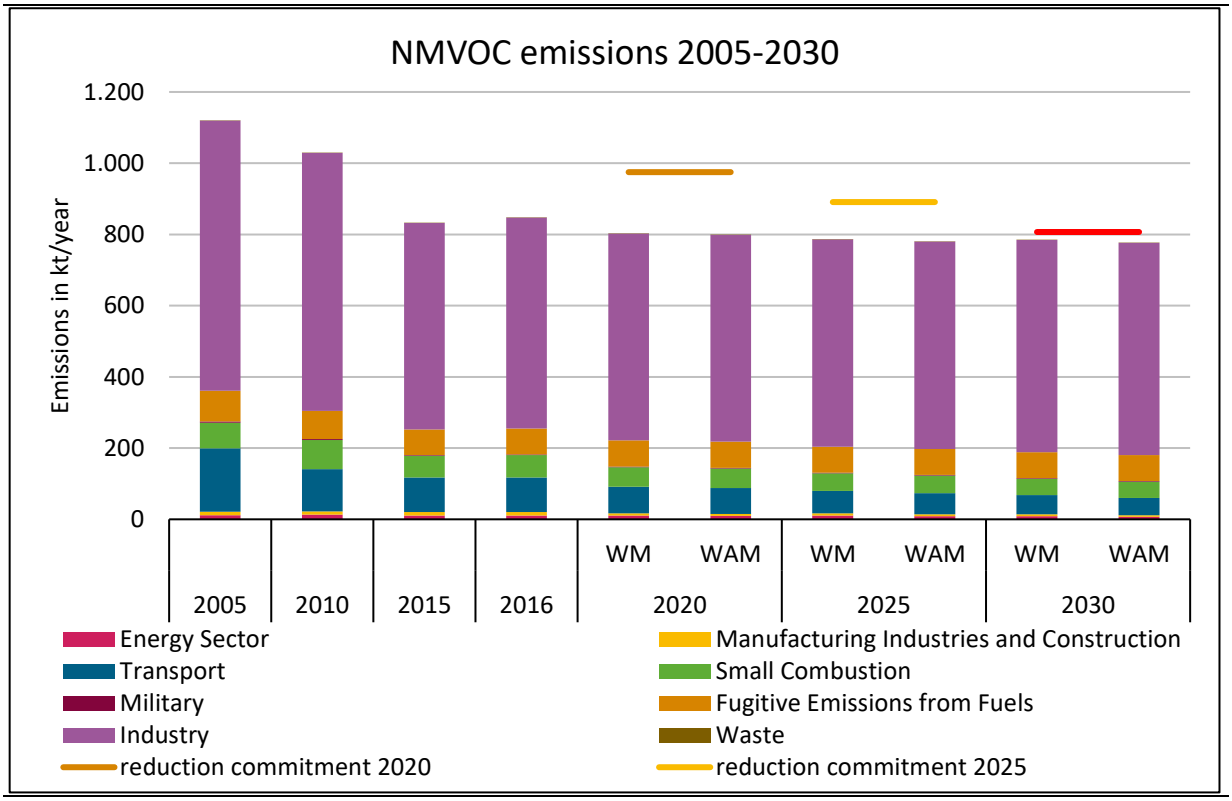


Figure 5: $PM_{2.5}$ emissions and emissions projections in the WM and WAM scenarios

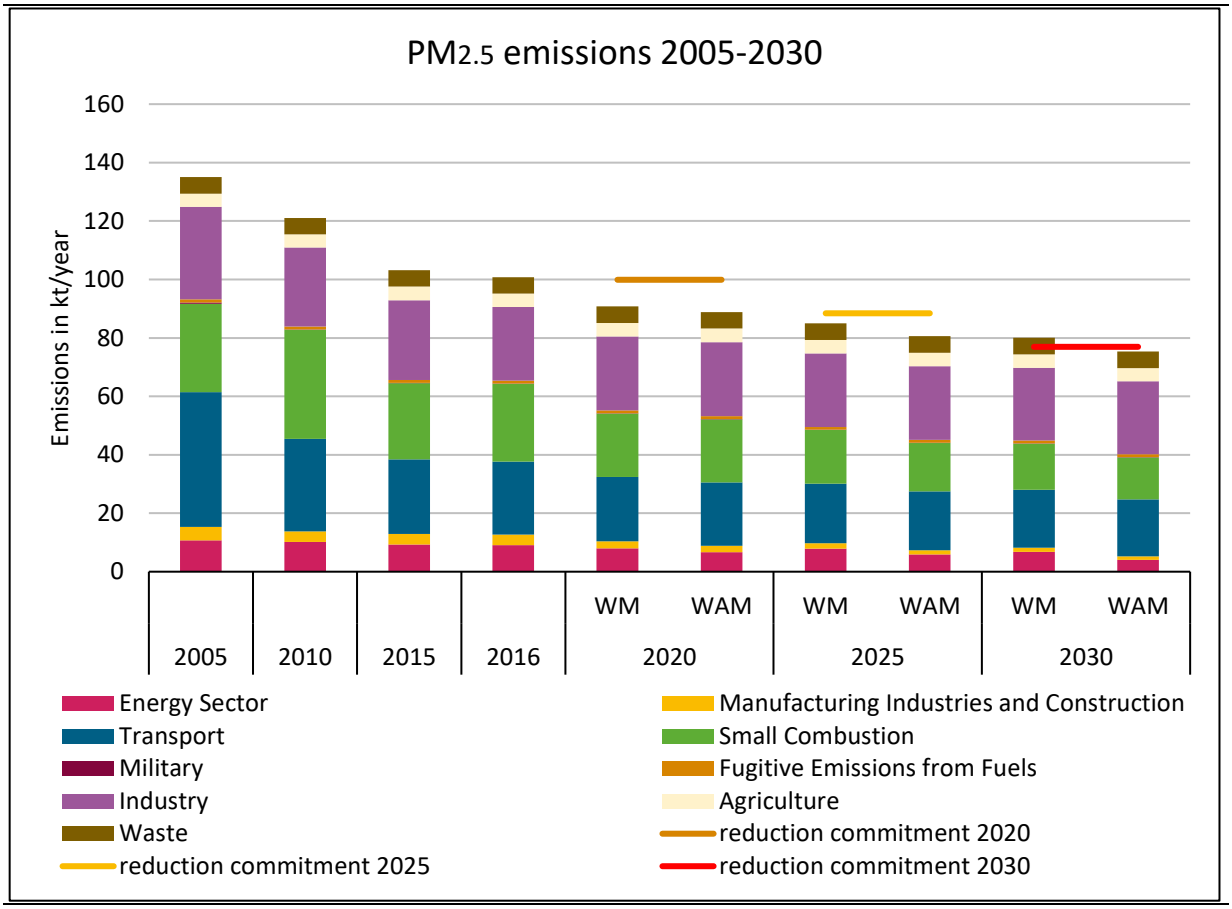
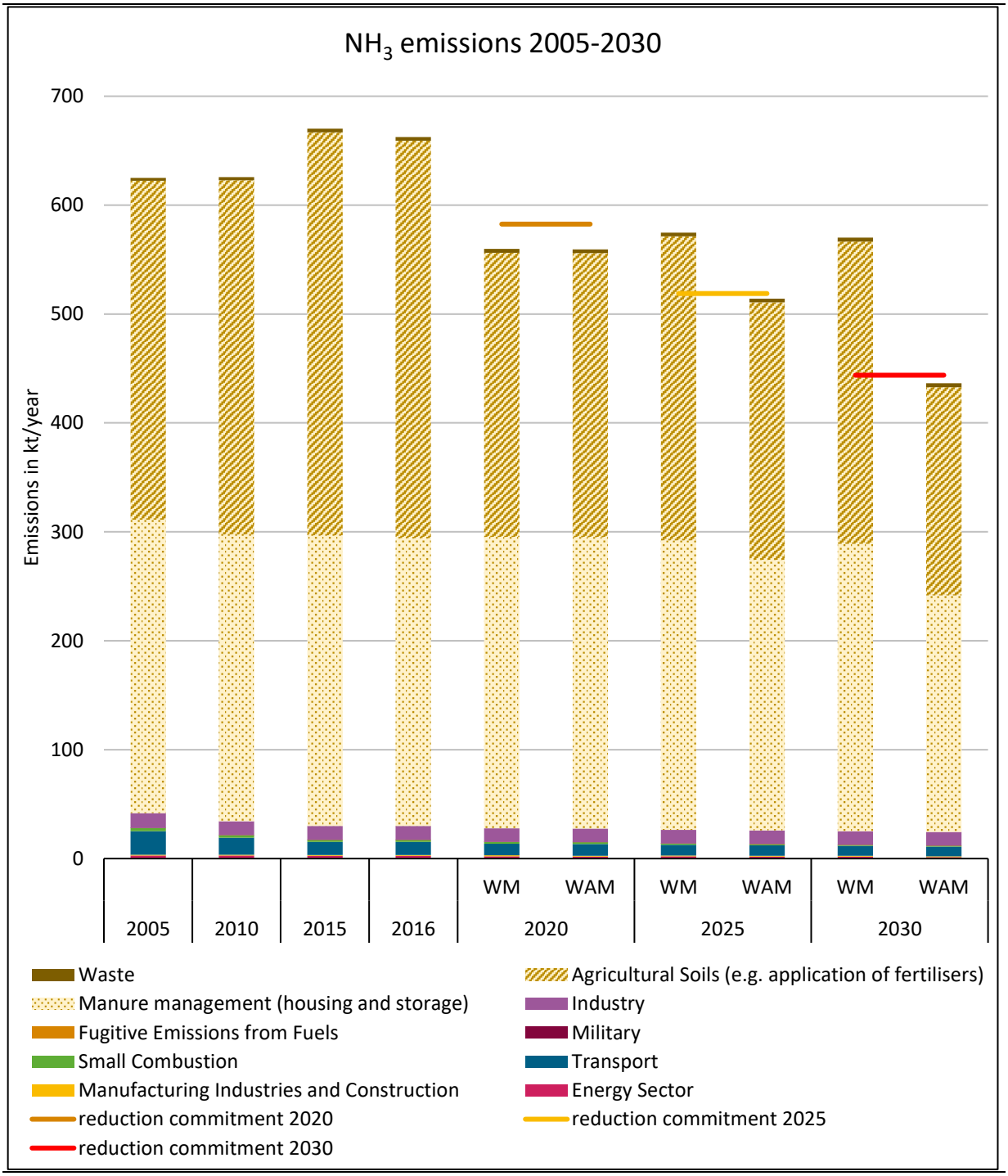


Figure 6: NH_3 emissions and emissions projections in the WM and WAM scenarios



5 Policy Options considered to comply with the emission reduction commitments

The WAM scenario contains the following measures and packages of measures; in some cases, they have now been adopted, are in the process of being implemented or the German government has agreed on future implementation of them in the national air pollution control programme.

- **Climate change mitigation**

  a) Climate change mitigation measures in the 'with additional measures scenario' (MWMS) in the German government's projection report 2017

  b) Phasing out the generation of electricity from coal and lignite in accordance with the recommendations of the Commission on Growth, Structural Change and Employment

- **Air pollution control**

  Combustion plants

  c) National implementation of the MCP Directive (EU) 2015/2193 in accordance with the German government's resolution of 18 March 2019, expected to be in force from July 2019

  d) Retention of the rules on solid fuel boilers in the 1st BImSchV

  Transport

  e) Package of road transport measures – environmental premium and software update for cars; hardware retrofitting for buses; promotion of public transport, cycling and walking; continued tightening of the CO_2 limits for cars

  Agriculture

  f) Package of agricultural measures – optimised feeding; emissions reduction measures in animal housing; low-emission storage of manure; low-emission application of manure and mineral fertilisers; reduced use of mineral fertilisers due to lower gaseous losses

  Further options for measures in relation to combustion plants

  g) Possible promotion of a shift in the fuels used in industrial production in favour of lower-sulphur fuels or more efficient technology for exhaust gas cleaning

  h) Only if essential for achievement of the NO_X reduction target for 2030: amendment of the 13th BImSchV for selected fuels except coal

Table 1 shows the assessment of the additional reduction potentials of the measures and packages of measures by comparison with the WM scenario for the years 2025 and 2030.

Table 1: Projected emissions development in the WAM scenario, quantification of the contributions of individual measures and packages of measures

NECD reduction commitments (from 2005 baseline)			2025					2030				
			NO_X	SO_2	NMVOC	NH_3	$PM_{2.5}$	NO_X	SO_2	NMVOC	NH_3	$PM_{2.5}$
			52%	39.5%	20.5%	17%	34.5%	65%	58%	28%	29%	43%
WM scenario		%	50%	45%	30%	8%	37%	59%	51%	30%	9%	41%
		kt	726	259	787	575	85	603	231	785	570	80
Reduction potentials of other strategies and measures												
Climate change mitigation	a)	kt	-17.2	-17.8	-1.5		-1.1	-24.6	-26.6	-2.0		-1.6
	b)	kt	-24.7	-29.6	-0.7	-0.4	-1.3	-32.3	-34.8	-0.9	-0.5	-1.5
Air pollution control	Combustion plants											
	c)	kt	-17.8	-0.2				-31.2	-0.2			-0.1
	d)	kt					-1.7					-1.3
	Transport											
	e)	kt	-11.3		-3.9	-0.1	-0.3	-7.2		-5.5	-0.2	-0.3
	Agriculture											
	f)	kt				-60.1					-133.0	
	Combustion plants - optional											
	g)	kt		-8.6					-8.2			
	h)	kt	-2,0					-2.1				
WAM scenario		%	55%	57%	30%	18%	40%	65%	66%	31%	30%	44%
		kt	653	202	781	514	81	506	161	776	436	75

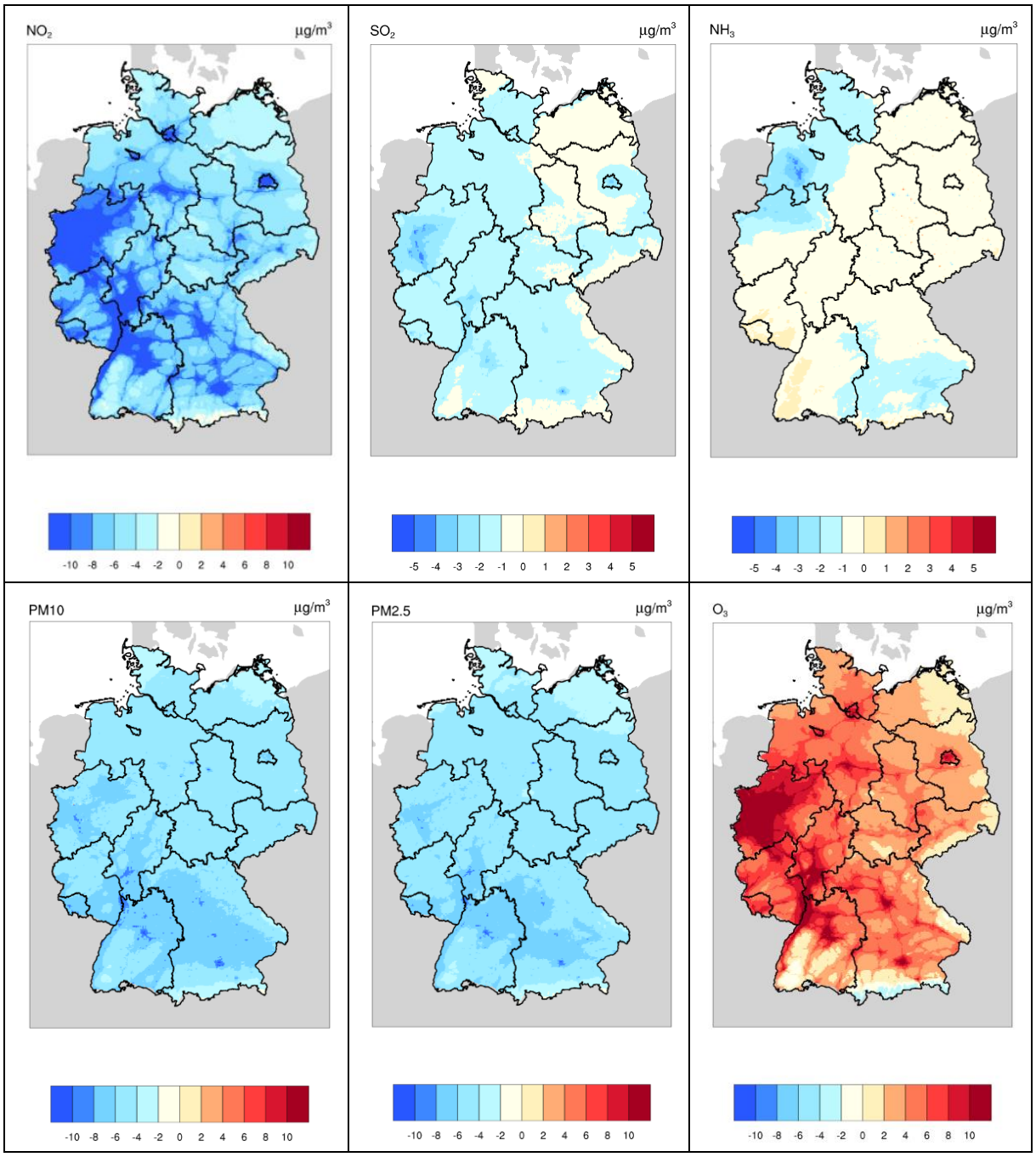
6 Characterisation of the likely improvement in air quality in the WAM-scenario

For both emissions scenarios the future development of background concentrations was modelled under the meteorological conditions of 2005 and compared with the air pollution levels of that year.

Figure 7 shows difference maps of the modelled absolute annual mean values of the background concentrations in a horizontal resolution of 2x2 km^2 for the pollutants NO_2, SO_2, NH_3, PM_{10}, $PM_{2.5}$ and O_3 in 2005 and 2030 in the WAM scenario.

Between 2005 and 2030 there is a noticeable fall in NO_2 pollution. The modelled background concentration falls by up to 10 µg/m^3, especially in highly polluted, congested areas; this is due to the significant reduction in NO_X emissions from road transport by 2030. An even greater reduction in annual mean values measured at traffic sites can be expected throughout Germany. However, this statement needs to be tested by small-scale hotspot modelling that takes additional assumptions into account.

Figure 7: Difference of the EURAD model runs WAM 2030-2005 for NO_2, SO_2, NH_3, PM_{10}, $PM_{2.5}$ and O_3 in µg/m³ under the same meteorological conditions



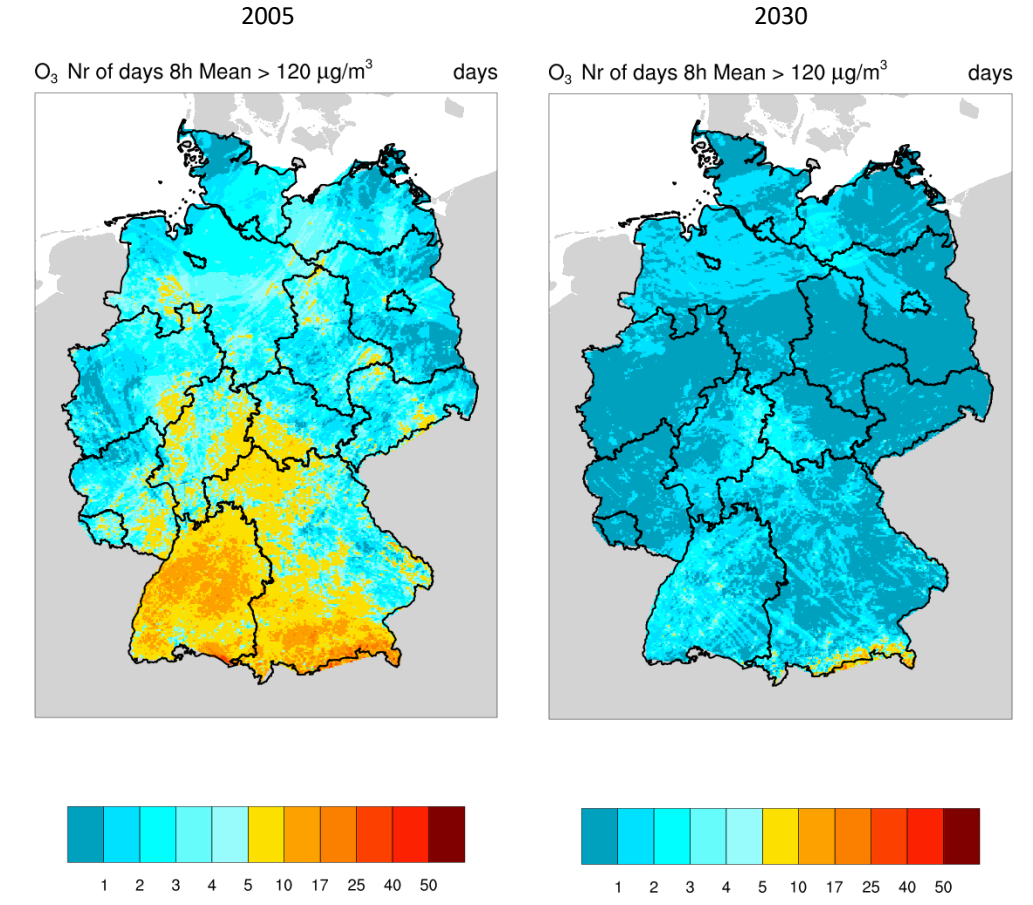
As a result of the fall in SO_X emissions from large combustion plants larger than 50 MW and from combustion plants smaller than 1 MW, the annual mean values for SO_2 also fall in the period 2005-2030 in the WAM scenario. Close to sources the reductions are of the order of 4 µg/m³; on average, reductions of 1-2 µg/m³ are achieved.

Figure 7 also shows a significant fall in annual mean values for NH_3 in the period 2005-2030 in the WAM scenario. The package of agricultural measures achieves significant reductions in NH_3 levels, especially in intensively farmed areas.

The annual mean values of PM_{10} and $PM_{2.5}$ fall by 2-8 µg/m³ in the period 2005-2030. Because of the considerable secondary formation of fine particulate matter from precursor emissions, no conclusions can be drawn about the reduction of primary fine particulate sources. The fall in the modelled background concentrations is particularly large in densely populated areas.

The modelled ozone annual mean values increase significantly in the period 2005-2030. In conurbations and congested areas there is a rise of up to 10 µg/m³; this is probably attributable to a fall in NO emissions in urban areas. However, the number of days with high peak concentrations (Figure 8Figure 8) falls further. The modelled decrease in peak concentrations is the result of a nationwide reduction in emissions of ozone precursors.

Figure 8: Results of the EURAD model runs 2005 and WAM 2030 for the number of days on which O_3 levels exceed target values under the same meteorological conditions



7 Coherence with plans and programmes in other policy areas

The strategies and measures selected in the national air pollution control programme for achievement of the reduction commitments of Directive (EU) 2016/2284 have some significant synergies with other policy areas.

They are particularly consistent with climate change mitigation policy, since in many cases emissions of atmospheric pollutants correlate with emissions of greenhouse gases. In the field of climate change mitigation the German government is currently preparing the first programme of measures to implement the Climate Action Plan 2050. In both the programme of measures relating to the Climate Action Plan and in the national air pollution control programme, a progressive reduction in electricity generation from coal will contribute to the respective targets and reduction commitments.

The quantifications in the present programme are largely based on the projections in the German government's 2017 projection report. This is the most recent official greenhouse gas (GHG) projection published by the German government. The reference trends of GHG emissions in the draft of the integrated National Energy and Climate Plan (NECP) are currently provisional. A corresponding draft of the NECP has been submitted to the European Commission. The final version of the NECP is to be submitted by the end of 2019. It can be assumed that an energy scenario that takes account of the recommendations of the Commission on Growth, Structural Change and Employment or of a decision that the German government may have taken on the implementation of these recommendations will be produced for the final version of the NECP. The existing report already quantifies the effect on air pollutant emissions of an energy scenario that involves an earlier phasing out of electricity generation from coal than was assumed in the 'with additional measures scenario' (MWMS) in the German government's projection report 2017. Should the energy scenario in the final NECP or a decision by the German government on the phase-out of coal differ significantly from the calculations already performed in the national air pollution control programme, the quantifications will be updated.

Agricultural plans and programmes also have a significant influence on the development of emissions, especially on ammonia emissions. Further development of the EU's Common Agricultural Policy and implementation of the policy in Germany thus set the framework for the emissions themselves and for the eligibility of emissions reductions measures for funding.

The measures in the national air pollution control programme give rise to further synergies, especially with plans and programmes in the fields of health, biodiversity, water, nitrogen and sustainability. Examples are

- the national action programme for the protection of waters from pollution by nitrates,
- the insect protection action programme (in preparation),
- the livestock strategy,
- the arable farming strategy (in preparation),
- the action programme for integrated nitrogen reduction (in preparation) and
- the German sustainability strategy.