

SRU



German Advisory Council
on the Environment

Biodiversity and human health need ambitious reduction commitments

**A German perspective on
the new draft NEC Directive
with regards to ammonia
and nitrogen oxides**

May 2015

**Partial translation of the Special Report
„Nitrogen: Strategies for resolving an urgent environmental problem“**

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1. Introduction

Despite the progress that has been made towards improving air quality, concentrations and depositions of air pollutants are still too high with negative impacts on human health and the environment. The most important air pollutants include the nitrogen oxides (nitrogen dioxide and nitric oxide) and ammonia. Nitrogen dioxide is directly harmful for human health via the airways and it represents the number one atmospheric pollutant in Germany and also in Europe (UBA 2015). Nitrogen oxides and ammonia in ambient air form hazardous particulate matter and nitrogen oxides lead to the formation of ground level ozone. Nitrogen-induced eutrophication and acidification contribute to biodiversity loss.

The excessive deposition of nitrogen compounds in the environment is the topic of the special report "Nitrogen: Strategies for resolving an urgent environmental problem" published by the German Advisory Council on the Environment (SRU) in January 2015. The report analyses the impacts of nitrogen pollution in Germany and the causes of the problems. Possible solutions are formulated and more than forty recommendations are made.

One of the most important recent steps has been the proposal for a new NEC Directive (NECD = National Emission Ceilings Directive; European Commission 2013d) presented by the European Commission in December 2013. The proposal, which includes updated emission ceilings for ammonia and nitrogen oxides, among others, has been assessed by the SRU in the above-mentioned special report. In the following, excerpts from the special report are given, beginning with a brief description for Germany of emissions, polluters, and impacts relating to ammonia and nitrogen oxides and followed by an assessment of the European Commission proposal for a new NEC Directive.

2. Emissions, polluters and impacts in Germany

2.1 Emissions of reactive nitrogen into the atmosphere

About half of all reactive nitrogen emitted into the atmosphere in Germany is in the form of nitrogen oxides (NO_x), ammonia (NH₃) and nitrous oxide (N₂O) (SRU 2015, Fig. 3-2 and No. 82). Expressed in terms of the nitrogen content, this is equivalent to a total of 958 kt in 2012. The most important source of emissions of reactive nitrogen into the atmosphere in Germany is the agricultural sector, which accounts for 550 kt nitrogen (57 %). This is followed by stationary combustion installations, which emit 181 kt nitrogen (19 %) and transport (173 kt nitrogen (18 %) (Table 1).

Table 1

**Sources of emissions of NO_x, NH₃ and N₂O
in Germany for 2012 (in kt)**

Source of emissions	NO _x	NO _x -N	NH ₃	NH ₃ -N	N ₂ O	N ₂ O-N	Combined N	% of total N
Stationary combustion installations	549	167	6	5	14	9	181	18.9 %
Transport	521	159	14	11	5	3	173	18.1 %
Industrial processes	87	27	12	10	10	6	43	4.5 %
Agriculture	107	33	512	427	141	90	550	57.4 %
Waste and wastewater treatment	0.4	0.1	0	0	9	6	6	0.6 %
Others*	5.5	1.7	1.8	1.5	3	2	5	0.5 %
Total	1269		545		182			
Total N		386		454		116	958	100 %
* Sum of emissions from: "Military and other small sources", "Diffuse emissions from fuels", "Solvent and other product uses" and "Land use, land use change, forestry"								
SRU/SG 2015/Tab. 3-4; Data source: UBA 2013g; 2013k								
In order to be able to compare the amounts of nitrogen compounds, figures are additionally expressed in terms of the nitrogen content. On the basis of molar masses, the conversion factor for ammonia (NH ₃) is 0.8235, for nitrogen dioxide (NO ₂) 0.3044, and for nitrous oxide (N ₂ O) 0.6364. This means that 100 kt ammonia is expressed as 82.4 kt nitrogen, 100 kt nitrogen dioxide as 30 kt nitrogen, and 100 kt nitrous oxide as 64 kt nitrogen.								

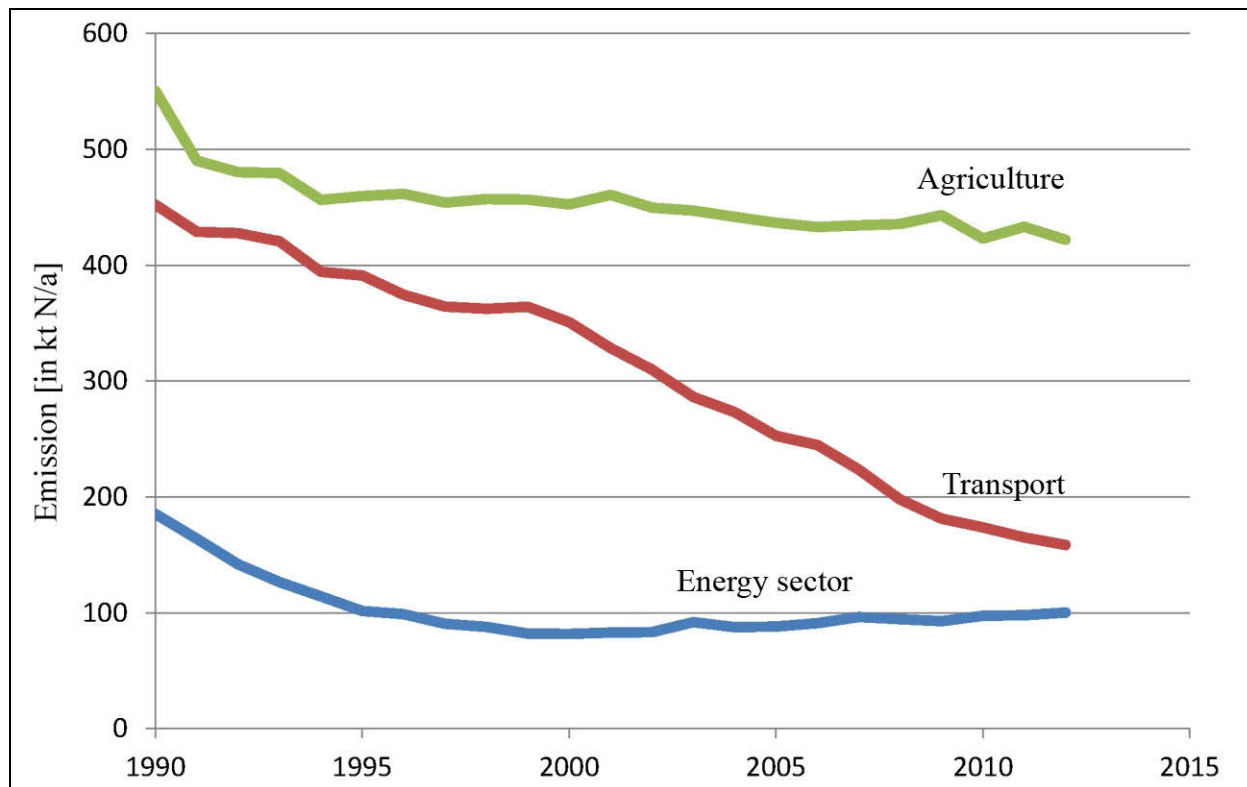
Differentiating in terms of nitrogen compounds, 94 % of the ammonia emissions are from the agricultural sector. The two main sources of nitrogen oxides are stationary combustion installations (43 %) and transport (41 %). The emissions from international air traffic and shipping are not included in the figures for emissions of nitrogen oxides from transport. The most important source of emissions of nitrous oxide is agriculture (77 %), with 94 % of these emissions originating from soils used for agricultural purposes.

The emissions of gaseous nitrogen compounds in Germany were reduced by some 41 % overall between 1990 and 2012 (UBA 2013g; 2013k). The emissions of nitrous oxide have been reduced by 34 % since 1990 (SRU 2015, Fig. 3-28), although more recently there has only been a slight downward trend. A comparison of the developments of emissions of nitrogen oxides from both the stationary combustion installations in the energy sector and

from the transport sector, and of ammonia emissions from agriculture for this period show that the largest reductions were achieved in the transport sector (Figure 1). The emissions from the energy sector initially declined, but over the second half of the period showed a slight upward trend. The reductions in emissions of ammonia from the agricultural sector until about 1995 were mainly due to the reduction in livestock levels (OSTERBURG and RÖSEMANN 2012).

Figure 1

**Changes in NO_x emissions from the energy and transport sectors
and of NH₃ emissions from the agricultural sector (in kt N/a)**



Source: UBA 2014f

In future, fermentation residues from biogas production should be taken into consideration as a new source of ammonia emissions (see SRU 2015, No. 428 and section 6.5.1.4).

2.2 Depositions

Nitrogen compounds emitted into the atmosphere impact in part on the area near the source of the emissions, but some emissions may be transported over considerable distances before being deposited and having harmful effects. In Germany it can be assumed that ammonia itself leads to increased ammonia concentrations and depositions within a few kilometres of the source. In contrast, emissions of nitrogen oxides are transported over longer distances and depositions close to the source of the emissions are less frequent

(HERTEL et al. 2011). Both ammonia and nitrogen oxides can react with other atmospheric components, forming or attaching to aerosols. These tiny aerosol particles have a very low rate of deposition and can therefore be transported for thousands of kilometres before they are removed from the atmosphere in the process known as wet deposition, i.e. mainly by precipitation (HERTEL et al. 2011; cf. SRU 2015, Fig. 3-4). For example, ammonia reacts with acids in the atmosphere to form ammonium salts, which in Central Europe accounts for a considerable proportion of atmospheric particulate matter (DÄMMGEN et al. 2013).

Since the nitrogen compounds in the atmosphere have no potential for forming elemental nitrogen, almost all atmospheric emissions of reactive nitrogen – with the exception of nitrous oxide – are deposited on the earth's surface within hours or days, where they impact on ecosystems (GALLOWAY et al. 2003). Nitrous oxide, which is an important greenhouse gas, has a tropospheric residence time of approximately 100 years (GALLOWAY et al. 2003).

Models provide data for the overall deposition of nitrogen from the atmosphere over Germany. The mean value for Germany from the MAPESI dataset (Modelling of Air Pollutants and Ecosystem Impact) for 2007 is 22 kg nitrogen per hectare, with mean depositions in forest ecosystems of 24 kg nitrogen per hectare. The values for the grid squares range from 5 to 62 kg nitrogen per hectare (SRU 2015, Fig. 3-5). The maximum levels of atmospheric reactive nitrogen deposition of up to 62 kg nitrogen per hectare per annum are found in north-western Germany (western Lower Saxony, north-west North Rhine-Westphalia) and in south-eastern Germany (eastern Baden-Württemberg, west and south-east Bavaria) (BUILTJES et al. 2011). In particular, high livestock levels in these regions result in the highest levels of ammonia emissions. These are deposited to a large extent near to the sources of the emissions (LAI 2012; cf. SRU 2015, Fig. 3-5; No. 89).

Depositions from the atmosphere are less relevant for aquatic ecosystems, although 20 to 25 % of nitrogen depositions reach the North Sea and Baltic Sea via atmospheric pathways (SRU 2015, No. 115).

2.3 Impacts

While nitrogen depositions in Germany have been reduced in many sectors, they still remain much too high overall, and concentrations of reactive nitrogen in waters, soils and the atmosphere can lead to considerable impacts. In 2009, some 48 % of Germany's natural and semi-natural terrestrial ecosystems were affected by eutrophication (SRU 2015, Fig. 3-18), 8 % were affected by acidification. The North Sea and Baltic Sea also show considerable levels of eutrophication. Some 26 % of all groundwater bodies have a poor chemical status due to high nitrate contents. This also impairs the preparation of drinking water. In some regions, compliance with limit values for nitrates in drinking water is only possible by means of cost-intensive treatment measures. In agglomerations, human health is harmed by the

inhalation of nitrogen oxides and particulate matter. Currently, there is a marked failure to comply with existing targets for clean air, water conservation and nature conservation (which in some cases are legally binding).

3. The European Commission's proposal for a new NEC Directive

3.1 The importance of national emission ceilings

The long-term objective of the EU is to reduce levels of air pollution so that these do not exceed the air quality criteria of the World Health Organisation for human health and also do not exceed the critical loads and the critical levels for ecosystems (European Commission 2013c; p. 6; cf. also 7th Environmental Action Programme of the EU: European Commission 2014a). The aim of the European Union biodiversity strategy and also of the German biodiversity strategy is to provide sensitive ecosystems with sustainable protection against eutrophication by 2020 (BMU 2007). With regard to climate change, the German government has set itself the target of reducing greenhouse gas emissions by 80 to 95 % relative to 1990 levels by 2050 (Federal Statistical Office 2014).

The SRU expressly supports these objectives. However, it is obvious that there remains a long way to go before they are reached. The European Commission has produced models for the Member States showing how the area of ecosystems where critical loads for eutrophication are exceeded could be reduced by emission reduction measures (AMANN et al. 2014). For Germany, halving the proportion of such areas (– 55 %) would require a reduction in the emissions of ammonia by 50 % and of nitrogen oxides by 73 % relative to 2005 levels. The health threats posed by particulate matter and by ground-level ozone would also only be approximately halved by these reductions in emissions (ibid).

The main sources of anthropogenous emissions of ammonia and nitrogen oxides are agriculture, stationary combustion installations, and transport (Tab. 1). Nitrogen compounds emitted into the atmosphere can have impacts in the vicinity of the source, or may be transported considerable distances before being deposited. The amount of these air pollutants in a specific area therefore always consist of a background level and local effects (if any).

In order to reduce the impacts on ecosystems and human health, it is therefore important to adopt national clean air strategies which reduce long-range transported emissions (and thus reduce background deposition levels) as well as reducing local emissions by specifically targeted measures. The reduction of background pollution levels also contributes to the protection of sensitive areas.

The necessary actions (SRU 2015, No. 315) can in principle be implemented in clean air law by three strategic measures (FROMMER et al. 2012):

- Specifying national emission ceilings (see below),
- Establishing standards for regional air quality (see SRU 2015, section 6.1.2),
 - Specifying installation-related emission limit values (cf. SRU 2015, 6.4.3. on livestock facilities; 6.8 on combustion installations; and 6.2.2 on FFH impact assessments).

3.2 Gothenburg Protocol and NEC Directive

Under the Convention on Long-Range Transboundary Air Pollution (CLRTAP), national emission ceilings for air pollutants were set out in 1999 in the Gothenburg Protocol to abate acidification, eutrophication and ground-level ozone (UNECE 2014).

In the EU, the Gothenburg Protocol is implemented through the NEC Directive. This contains national emission ceilings for all European Union Member States for nitrogen oxides and ammonia (in addition to sulphur dioxide (SO₂) and non-methane volatile organic compounds (NMVOC)). The aim of these emission ceilings, as in the Gothenburg Protocol, is to reduce the eutrophication and acidification of ecosystems and the health impacts of ozone. The calculation of the emission ceilings and the optimisation of measures in terms of costs and the specific regional impacts are also in line with the procedures in the Gothenburg Protocol (SPRANGER 2014). The NEC Directive requires the Member States to collect emission data, to carry out an analysis of the main sources, and draw up programmes with the aim of complying at least with the national emission ceilings (cf. SRU 2008, No. 310f.). The Member States can themselves determine which measures to adopt in order to comply with the ceilings, so that in principle they can choose the measures which they feel are most efficient.

In Germany, the NEC Directive was transposed as the 39th Ordinance on Air-quality standards and emission ceilings (39 BImSchV). A national programme was published on the reduction of ozone concentrations and compliance with the emission ceilings (UBA 2007). This programme lists the measures that must be adopted in order to comply with the objectives of the NEC Directive. In accordance with Article 34 of 39 BImSchV this is only a “policy programme of the German Federal Government”, so that the national emission ceilings have primarily a political influence but do not exert a direct controlling influence.

Germany only just met the emission ceiling of the NEC Directive for ammonia in 2010, exceeded the ceiling in 2011, and in 2012 was again just below the ceiling. For nitrogen oxides it was well above the ceiling for 2010, 2011 and 2012 (Figure 2). Nevertheless, over the period from 1980 to 2010 there was a steady increase in the proportion of areas in Germany below the critical loads for acidification and eutrophication (UBA 2014 f, p. 40).

Within the EU, six other Member States also failed to meet their emission ceilings for nitrogen oxides in 2011, and two other Member States also failed to comply in the case of ammonia (EEA 2013). The 2010 target of a 30 % reduction in the eutrophication risk was

only achieved for 22.8 % of the EU-15 area and 22.5 % of the EU-27 area (HETTELINGH et al. 2013).

However, compliance with the emission ceilings of the NEC Directive will not be sufficient to adequately reduce impacts, in particular on terrestrial ecosystems by ammonia and nitrogen oxides, or to reduce harm to human health in agglomerations caused by particulate matter, ozone, and nitrogen dioxide (AMANN et al. 2014). A further lowering of the emissions ceilings is necessary. Until a solution is implemented at the EU level, steps can also be taken at the national level in the form of introducing more stringent protective measures, in accordance with Article 193 of the Treaty on the Functioning of the European Union (TFEU).

3.3 New reduction commitments

Following the update of the reduction commitments under the Gothenburg Protocol in 2012 (the new targets apply for 2020 (UNECE 2012; SPRANGER 2014)), the European Commission in December 2013 announced a new clean air policy (“Environment: New policy package to clean up Europe's air”, Press release of the European Commission, 18 December 2013). The policy package contains a proposal for a new NEC Directive (European Commission 2013d), in addition to a new “Clean Air Programme for Europe” (European Commission 2013c), and a proposal for a new Directive to reduce pollution from medium-sized combustion installations (European Commission 2013e).

As in the Gothenburg Protocol, reduction commitments are included in the European Commission's proposal for the new NEC Directive (National Emission Reduction Commitments), however these are now for six air pollutants and for the target year of 2030. Methane (CH₄) and particulate matter (PM_{2.5}) have been added to the pollutants already contained in the old NEC Directive (nitrogen oxides, ammonia, non-methane volatile organic compounds (NMVOCs), and sulphur dioxide). With regard to nitrogenous air pollutants, the proposals specify a reduction commitment for Germany of 39 % for ammonia and 69 % for nitrogen oxides relative to levels in 2005 (Annex II of the draft directive). For 2020 the reduction commitments of the Gothenburg Protocol are incorporated. For 2025 there are no specific reduction commitments, but the Member States are required to limit their annual emissions of pollutants in 2025 to the values derived from a linear reduction trajectory between the commitments for 2020 and 2030. However, this only applies for necessary measures which do not entail disproportionate costs (Art. 4.2 of the Proposal).

Scenarios for the reduction commitments

The reduction commitments are based on the results of extensive modelling and scenario calculations (cf. the impact assessment for the above-mentioned European Commission proposal (European Commission 2013b)). The calculations are based on forecasts for the

economic developments in the Member States, future energy consumption, the technological potential for reducing emissions and the costs entailed, and the data about the atmospheric dispersion of atmospheric pollutants and their impacts on the environment and health (cf. SRU 2008, No. 287). The scenarios that were considered include the CLE baseline scenario (current legislation scenario), which takes into account all national regulations of relevance for emission reduction, including the national implementation of EU-wide regulations. It assumes no new EU regulatory action (European Commission 2013b, p. 38). Other scenarios are also simulated, including the MTFR scenario (Maximum Technically Feasible Reduction), which shows the results of applying all technically available abatement measures. In the impact assessment, the costs and benefits of pollution reductions are compared. An optimum scenario was identified which represents a 75 %-gap-closure, i.e. the gap between baseline scenario and the MTFR scenario is closed by 75 %. However, this target was changed in the course of the negotiations within the European Commission to a 70 % gap closure, resulting in the reduction commitments contained in the European Commission proposal. In addition, the target year was shifted from 2025 to 2030 – once again a less ambitious target. The calculations of the impact assessment were up-dated in early 2014 and adapted in accordance with the targets of the European Commission proposal (AMANN et al. 2014).

In January 2015, the European Commission published a report with an updated emissions scenario (AMANN et al. 2015a; 2015b). At the same time, once again a less ambitious gap-closure of 67% was chosen instead of 70%. For Germany, slightly lower reduction targets were calculated on the basis of the new data with regard to ammonia (-38%) and nitrogen oxides (-64%).

According to the estimates of the European Commission, by implementing the reduction commitments of the proposed new NEC Directive health impacts in the EU due to particulate matter could be reduced by 52 % by 2030, and the ecosystem areas on which the critical loads for eutrophication are exceeded could be reduced by 35 %. For Germany, the corresponding reductions in impacts are estimated to be 49 % and 46 %, respectively (AMANN et al. 2014). These reduction commitments are therefore only an intermediate step on the way to the long-term objective of reaching air quality levels that do not have significant impacts on human health and the environment. The monetarised benefits are estimated to be 12- to 40-times greater than the costs. However, in the comparison of the costs and benefits of the reduction measures, only some of the healthcare savings are monetarised, while environmental savings were not considered. This means that the actual benefits would be considerably higher. The European Commission therefore regards the cost considerations of the Impact Assessment as conservative (“Questions and answers on the EU Clean Air Policy Package”, Press release of the European Commission, 18 December 2013).

Figure 2 shows the emissions of ammonia and nitrogen oxides in Germany for the reference year 2005 and for 2010 (UBA 2014b), with a prediction of these emissions for 2030 on the basis of the baseline scenario of the Impact Assessment (see Text Box). The bar chart also shows the reduction commitments of the NEC Directive, the revised Gothenburg Protocol and the EC proposal for a new NEC Directive.

The emissions data show that emissions of nitrogen oxides were reduced markedly between 2005 and 2010, while ammonia emissions hardly changed over the same period (cf. Figure 1). The predictions for 2030 show a further reduction in emissions of nitrogen oxides, but no appreciable change in emissions of ammonia. These predictions highlight the fact that it will not be possible for Germany to comply with the reduction commitments of the proposed new NEC Directive unless further reduction measures are adopted. In order to meet the proposed targets, ammonia emissions must be additionally reduced by approximately 200 kt/a, while for the emissions of nitrogen oxides there is a gap of some 100 kt/a according to the predictions of the baseline scenario.

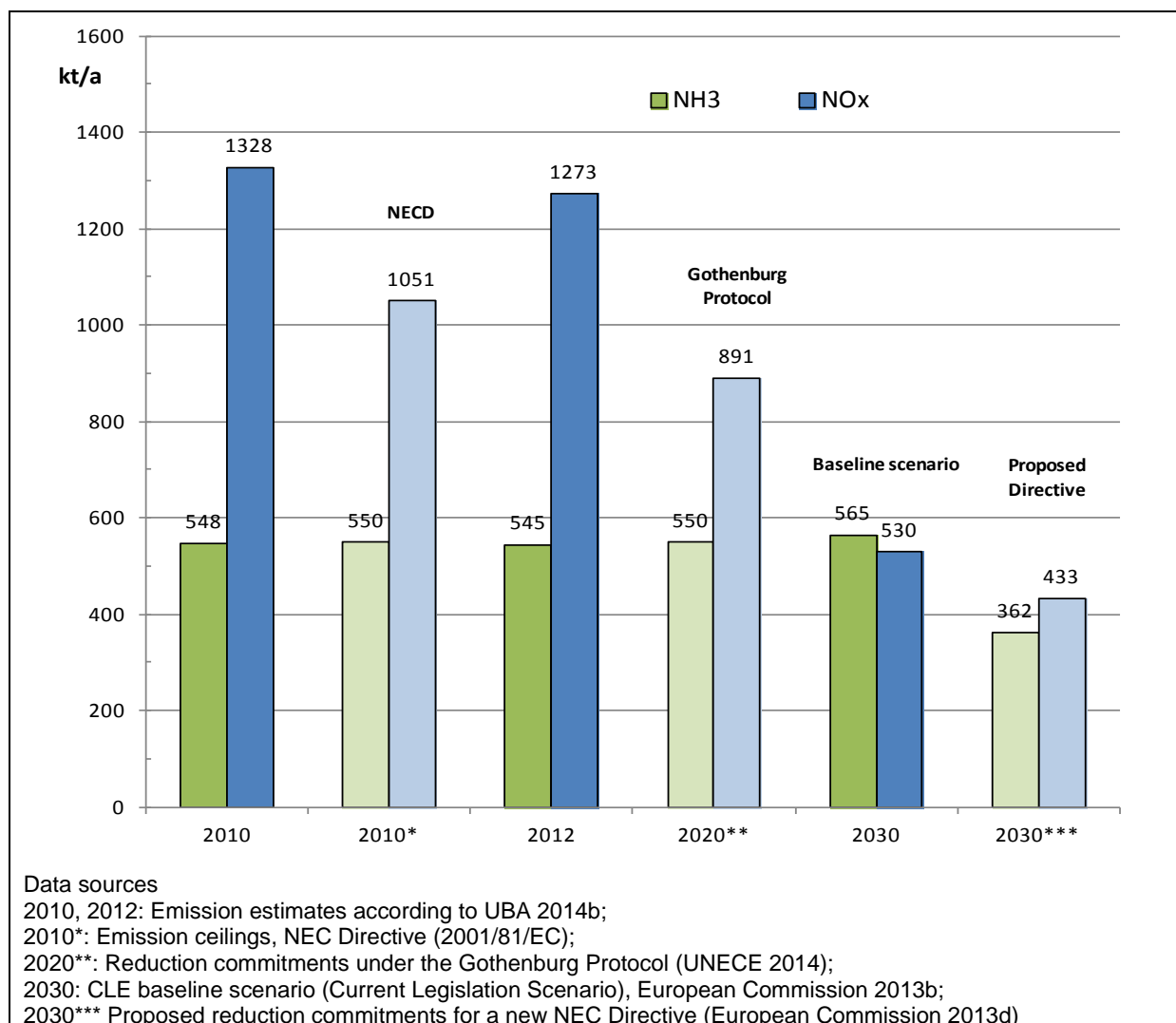
In order to achieve the emission commitments, the Member States are each to draw up a “National Air Pollution Control Programme”, (Art. 6 of the draft). This is already required under the current NEC Directive, but the new feature in the European Commission proposal is that the possible contents of the programme are described in some detail in Annex III. In Part 1 of this annex, reduction measures are listed for the sectors which may be included in a clean air programme. The proposed measures relate exclusively to agriculture and consist mainly of measures for the control of ammonia emissions (Part A). Included are limitations on applications and low-emission approaches for the application of mineral fertilisers, for the spreading of manure, the storage of manure from livestock farming, and low protein feeding strategies. It should be noted that specific reduction quotas are given in some cases; these relate to a reference method from the UNECE Ammonia Guidance Document (2012). However, as in the current NEC, Member States can themselves decide which instruments and measures they use in order to ensure compliance with the reduction commitments.

The measures for the application of manure correspond largely to the recommendations put forward by the SRU (cf. SRU et al. 2013; No. 416 f.). However the language used in the title of the Annex (“Measures which may be included”) is very weak; furthermore, most measures are to be introduced by 2022, although the relevant technologies already represent the state of the art.

The measures proposed in the EC draft for nitrogen management are to be welcomed. Nitrogen management is to be introduced which takes the entire nitrogen cycle into account. Member States are also called on to establish a national nitrogen budget (Annex III, Part 1, A2; on the German nitrogen budget see also SRU 2015, section 3.2.1 and No. 618f.).

Figure 2

Emissions and predictions for emissions of nitrogen oxides and ammonia in Germany compared with international reduction commitments or proposals (emissions in kt/a)



SRU/SG 2015/Fig. 6-1

A new element of the proposed directive is the inclusion of monitoring of the impacts of air pollution (Art. 8). This provides the opportunity, when presenting emission reduction measures in the national clean air programme, to take into consideration not only the effects on the overall emissions, but also the spatial distribution of the pollution and its impacts.

3.4 Emission reduction potential in Germany

A research project for the German Federal Environment Agency (UBA) investigated the reductions in emissions of various atmospheric pollutants that can be achieved by means of

the reduction scenarios (JÖRSS et al. 2014). For nitrogen oxides, a maximum scenario is calculated to lead to a reduction of 58 % in emissions from 2005 to 2030 (Scenario “EWS+”). This takes into account the three most relevant sources of emissions of nitrogen oxides (combustion installations, manufacturing, and transport). The emission reductions from stationary combustion installations, based above all on the assumption that climate change mitigation measures are implemented, amount to 43 % (cf. SRU 2015, 6.8). The reductions in the manufacturing sector (30 %) are based on assumptions regarding the lowering of emission limit values. The 80 % reductions in emissions in the transport sector are based mainly on the implementation of tighter limit values for road vehicle emissions that have already been decided on. However, it must be borne in mind that these emission reductions in the transport sector are not sufficient in order to comply with the local air quality values for nitrogen dioxide (cf. SRU 2015, No. 120f. and Section 6.7). Further emission reductions are necessary and relevant reduction potentials are available (SRU 2015, 6.7). With regard to combustion installations, further reduction potentials can be exploited in particular for existing plants and installations (SRU 2015, 6.8).

The results of the research project for Germany show that under the current legislation scenario (taking into account all measures passed by 8 July 2011 and which first came into force in the original or amended form after 1 January 2005), no further emission reductions will be achieved for ammonia by 2030 (see Figure 2). This means that it will not be possible to comply with certainty with the emissions ceilings of the current NEC Directive (550 kt/a). Germany would fail to meet the targets of the European Commission proposal for 2030 by an appreciable margin.

For the most important source of ammonia emissions, the agricultural sector (see SRU 2015, 6.4), emissions for 2030 are estimated at 550 kt/a (see Figure 2). In a scenario which takes supplementary farming measures into account (Scenario LaWi-APS+NH₃, JÖRSS et al. 2014), an additional reduction potential of approximately 76 kt/a ammonia was calculated. The measures include low-emission manure spreading, covering of liquid manure storage containers, low-nitrogen fodder, and treatment of exhaust air from pig housing (Table 2). Important legal instruments for realising this potential in Germany are the Fertiliser Ordinance (cf. SRU 2015, section 6.4.2), and the certification of livestock housing (cf. SRU 2015, section 6.4.3), which would both have to be made much tighter than the current regulations. In addition, measures in biogas production could reduce ammonia emissions by a further 26 kt/a (Scenario LaWi-APS+NH₃+KS, JÖRSS et al. 2014). The above-mentioned measures have a combined reduction potential of approx. 100 kt/a: they represent the state of art, and are for the most part relatively cost-efficient.

Table 2

Measures to reduce NH₃ emissions

NH ₃ reduction measures	In kt NH ₃ /a	
From JÖRSS et al. (2014), Scenario LaWi-APS+NH ₃	(values rounded)	
Work poultry manure into ground within 4 hours after application; Liquid manure application with a dragged hose on established arable land; Liquid application with a dragged shoe on grassland; Work in solid manure within 4 hours (not including poultry manure and dry manure)	60.8	Total 76
Covering liquid pig manure storage containers with a floating foil	4.3	
Nitrogen-reduced fodder for pig and breeding sows (50 % of all pig stocks)	3.7	
Exhaust air treatment for 20 % of all pig stocks	7.7	
Measures for biogas production (e.g. gas-tight storage of digestates, higher proportion of liquid manure instead of plant fermentation substrates)	26	
Further reduction measures on the basis of DÖHLER et al. (2011)		
Application of manure on open ground only with the drag-shoe method; on grassland and arable land with the trench method and additionally working in of the manure within 1 h	Estimated total 50-100 kt	
Extension of exhaust air treatment to include smaller pig housing and poultry installations		
Reduced use of urea-based fertiliser, or requirements for low-emission working in and for the use of urease inhibitors		
SRU/SG 2015/Tab. 6-1; sources: JÖRSS et al. 2014; DÖHLER et al. 2011		

In total there is therefore a theoretical reduction potential from technical measures of some 150 to 200 kt/a ammonia. In principle there is also a considerable reduction potential by voluntary changes in people's nutritional habits (cf. SRU 2015, 4.1.5 and 6.6.2), provided that livestock levels in Germany could be reduced in parallel with a decline in consumer demand. According to an estimate by WESTHOEK et al. (2014), halving the consumption of products from livestock farming could lead to a reduction of ammonia emissions by some 40 %, provided there was a parallel reduction in the production of meat, eggs and milk and that the high-protein animal products were replaced by grains and not by fruit and vegetables, and further assuming that the overall calorie intake remained constant. Even if the assumption postulated in the model calculation of a complete substitution of animal products by grain products may not prove fully realistic in practice, not least because it may come into conflict with health policy targets, the model calculation indicates the considerable potential for reductions offered by voluntary changes in habits with regard to nutrition.

In a report for the European Commission, produced as a contribution to the Impact Assessment, the maximum scenarios of the EU Member States (see Box) were compared. The comparison shows that Germany has the highest reduction potential for ammonia (51 %) – taking into account the costs of the reduction measures. One of the reasons for the high reduction potential is that there are large livestock farms in Germany in which investments in more effective reduction technology are viable. However, it should also be noted that cost-

efficient reduction measures have not been implemented as fully as they could have been (OENEMA et al. 2012, p. 33 f.).

3.5 Assessment of the European Commission proposal and recommendations

The SRU welcomes the fact that the European Commission has put forward a proposal for the further development of the NEC Directive. The lowering of the emission ceilings for nitrogen oxides and ammonia is important in order to further reduce reactive nitrogen pollution. However, these reduction targets are not ambitious enough in terms of their effects on impacts. With the proposed reduction commitments, which only have to be achieved by 2030, critical loads for eutrophication will still be exceeded in some 40 % of natural and near-natural ecosystem areas in Germany. Impacts on human health by particulate matter and by ground-level ozone can only be expected to be reduced by 49 % and 33 % respectively in comparison with 2005 levels. Although the reduction targets were based on an extensive cost-benefit analysis, in the end it was not the optimum scenario that was chosen, but a less ambitious reduction in emissions (see box). The SRU views very critically the fact that the reduction commitments only apply from 2030 and that no binding commitments are specified for 2025.

However, since the reduction commitments would in part require considerable efforts by the emitting sectors and that in general it must be expected that negotiations at the EU level will prove difficult and are likely to lead to a weakening of the European Commission proposal, the German government should support the reduction commitments of the Commission proposal as a matter of urgency. Furthermore, in order to pursue the goals formulated in the 7th Environmental Action Programme (EAP) for clean air in the EU and the goals of the national and European biodiversity strategies, the German government should also work to strengthen the reduction targets for 2030 by means of also establishing legally binding reduction targets for 2025. Only then can the Commission be certain that the Member States will already adopt measures now to reduce their emissions, so that the compliance with the final targets is not endangered. The reduction targets for 2025 should be specified in such a way that approximately half the emission reductions required by 2030 will have been achieved. By specifying national reduction commitments in the EU it will also be possible to reduce the impacts of long-range air pollution.

The SRU also welcomes the fact that the proposal for a new NEC Directive recommends drawing up national nitrogen budgets. This instrument is very important for a comprehensive approach to tackling the problems of reactive nitrogen.

4. Conclusions

The national emission ceilings for nitrogen oxides and ammonia urgently need to be lowered. The reduction objectives for 2030 recommended by the European Commission in connection with the revised NEC Directive (39 % reduction for ammonia and 69 % reduction for nitrogen oxides) are a step in the right direction, but are insufficient in terms of reducing environmental impacts. Even if the European Commission's reduction objectives were met, around 40 % of Germany's natural and semi-natural terrestrial ecosystems would still exceed eutrophication limits in 2030, while in the same year the health hazards due to particulate matter and ground-level ozone would only have been reduced by 49 % and 33 %, respectively.

Nevertheless, the German Federal Government should support the European Commission's proposals, and should make sure that these reduction objectives are under no circumstances weakened in what are likely to be tough negotiations. The German government should also proactively support additional legally binding interim standards for 2025, so as to ensure that the EU Member States begin taking action now.

An agreement within the EU for national reduction targets is important for all Member States because atmospheric pollutants are transported for long distances and across borders. Only by working together will it be possible to reduce long-range transboundary air pollution and thus to reduce background pollution levels.

5. Literature

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A detailed list of references is provided in the special report, which can be downloaded at <http://www.umweltrat.de>.

Members

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