Projections have not yet been updated for the 2023 submission. The content below is outdated.

Calculation Documentation

For its national emission projections, Germany takes into account climate projection activity data and category-specific reports on air pollution emission factor development in the future. For all sectors, emission scenarios were developed in the greatest possible consistency with the latest available energy and greenhouse gas emission scenario of Germany's National Energy and Climate Plan (NECP), assuming all measures of the Climate Protection Programme 2030 will be fully implemented.

Deviating from this comprehensive projection of activity data, the transport emissions are calculated with the aid of the TREMOD model ("Transport Emission Model"), version 6.03 (Allekotte et al. 2020[1)]). For estimating the future development of transport-related energy consumption and emissions a TREMOD trend scenario to 2050 has been developed, which is regularly updated each year. The trend scenario builds on recent traffic performance projections and considers all relevant political regulations that came into force by mid-2018. The TREMOD trend scenario was used as the basis for the WM scenario for every time series related to transport.

The activity rates and the emission factors for the emission projections of the sector NFR 3 "Agriculture" in both scenarios are calculated and provided by the Thünen-Institute (TI). These data are transferred directly to the database and used for the projections.

The NMVOC emissions from NFR sector 2.D.3, containing emissions from solvent and solvent-containing product use and their manufacturing, are not calculated from activity rates and emission factors within the emission inventory database. For their calculation a separate model run by the Institute for Environmental Strategies (Ökopol GmbH) is used (see Zimmermann and Jepsen, 2018[2)]) and resulting emissions are imported into the inventory database. This model also contains an emission projection based on economic projections for specific branches of industry. These economic projections were updated using Prognos (2018) "Deutschland Report 2025 | 2035 | 2045 ". The resulting NMVOC emission projections are taken directly into the database.

Starting from these activity data set as a basis, future emission factors for air pollutants were modelled for each of the policies and measures individually. For each measure, the relevant emissions factors were identified and the existing historic time series in the database was extended to 2020, 2025, 2030 and partially to 2035. Then, the future activity data for those years were multiplied with the modelled emission factors to derive projected emissions. This approach allows detailed calculations of mitigations attributable to each measure. The following documentation shows the calculation of emission projections in two scenarios in detail. Measures that have already been implemented or measures whose implementation has been decided are assigned to the WM scenario (with measures). Additional measures that have not yet been implemented are assigned to the WAM scenario (with additional measures).

Data basis of the emission projections calculation is the inventory of the submission 2020 with the processing of the emission data. The calculations of the emission values are based on the NEC directive EU 2016/2284 as well as the German regulations for the implementation of the Federal Immission Control Act (BImSchV), which define plant-specific limit values.

Because the limit values in the BImSchVs and in the BAT conclusions are usually given in mg / Nm^3, a conversion into kg / TJ is necessary. Table 1 shows the conversion factors (Rentz et al., 2002[3)]) which are used to convert mg / Nm^3 into kg / TJ for the reduction measures under consideration. For each relevant pollutant, a fuel-specific conversion factor is given, taking into account the reference oxygen content in percent.

Table 1: Fuel-specific conversion factors for air pollutants according to Rentz et al. (2002)

Pollutant	Fuel	Reference oxygen content 3 %	Reference oxygen content 6 %	Reference oxygen content 15 %

Pollutant	Fuel	Reference oxygen content 3 %	Reference oxygen content 6 %	Reference oxygen content 15 %
NO_X	Hard coal		2.75	
	Lignite	2.88	2.40	
	Heavy fuel oil	3.39		
	Light heating oil	3.49		
	Natural gas	3.57		
	Natural gas (gas turbines)	3.45		1.15
	Heavy fuel oil (gas turbines)	3.53		1.18
SO_2	Hard coal		2.74	
	Lignite	2.87	2.39	
	Heavy fuel oil	3.39		
	Light heating oil	3.49		
	Natural gas	4.00		
	Natural gas (gas turbines)	3.60		1.20
	Heavy fuel oil (gas turbines)	3.53		1.18
TSP	Hard coal		2.86	
	Lignite	2.97	2.48	
	Heavy fuel oil	3.39		
	Light heating oil	3.38		
	Natural gas	3.24		
	Natural gas (gas turbines)	3.75		1.25
	Heavy fuel oil (gas turbines)	3.50		1.17

Furthermore, the calculations of the emission factors for particulate matter ($PM_{2.5}$ and PM_{10}) always result from the TSP emission factors. In most cases the same ratio between TSP and $PM_{2.5}$ or PM_{10} is assumed as in the reference year from the 2020 submission and is adopted for the years 2020 to 2030.

[1)]
https://www.umweltbundesamt.de/en/publikationen/aktualisierung-tremod-2019

[2)]
Zimmermann, T. and Jepsen, D. (2018): Consistency check of German emission inventories for NMVOC from solvents, on behalf of the German Environment Agency (UBA), Project-Nr. 72117.

[3)]
Rentz, O., Karl, U., Peter. H. (2002): Determination and evaluation of emission factors for combustion installations in Germany for the years 1995, 2000 and 2010, on behalf of the German Environment Agency (UBA), Project-Nr.299 43 142.