03

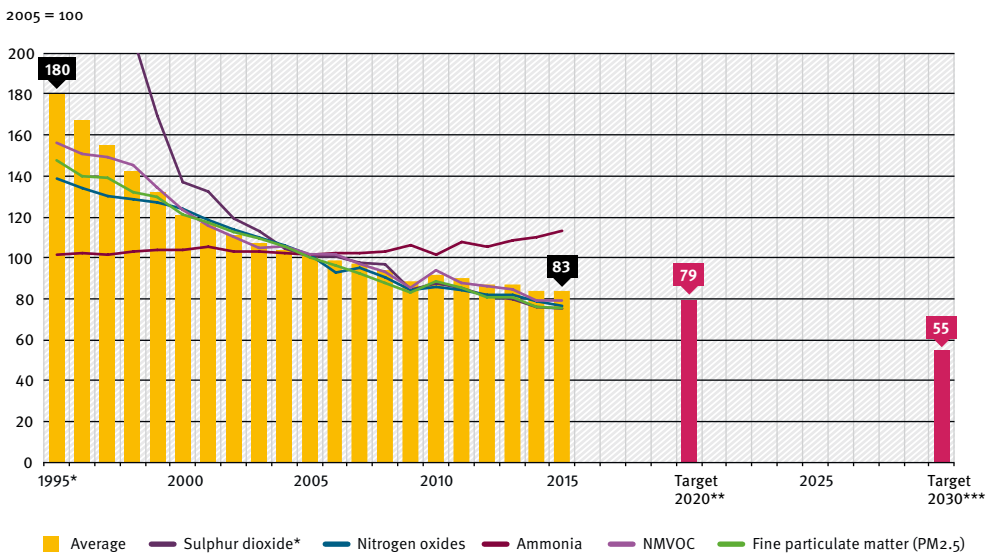
AIR

Emission of air pollutants

Air quality in agglomerations

Emission of air pollutants

Air pollutant index of emissions
Mean percentage trend of different air pollutant emissions compared with 2005



* Sulphur dioxide value in 1995: 360
** 2020 target based on the Gothenburg Protocol reduction commitments
*** 2030 target based on the future EU 'national emission reduction commitments' and the target of the Federal Governments' Strategy for Sustainable Development

Source: German Environment Agency, National trend tables for German reporting on atmospheric emissions since 1990, Emissions from 1990 to 2015 (as of 02/2017)

At a glance

- Annual emissions of five air pollutants decreased on average by almost 4 % between 1995 and 2015.
- The commitments of the Gothenburg Protocol for 2020 are expected to be reached.
- Reaching the commitments of the European NERC (national emission reduction commitments) Directive for 2030, is a major challenge for the German environmental policy. Ammonia emissions in particular, as well as – as agreed – coal-fired power generation must be reduced to achieve this.

Environmental importance

The indicator is based on the trend for five different pollutants (index) from different sources. Ammonia (NH_3) mainly comes from agriculture through livestock farming and fertilisation. Nitrogen oxides (NOx) and sulphur dioxide (SO_2) are mainly produced by combustion processes in power stations and engines. Non-methane volatile organic compounds (NMVOCs) mainly arise from the use of solvents in industrial processes. Fine particulate matter with a particle size of less than 2.5 micrometres (PM2.5) is derived from combustion processes in households, road transport and agriculture.

Their impacts on the environment are equally varied. Sulphur dioxide causes acidification of ecosystems by 'acid rain'. Ammonia and nitrogen oxides lead to excessive nutrient enrichment (eutrophication). NMVOCs contribute to the formation of harmful ozone pollution. PM2.5 causes respiratory diseases in humans.

Assessing the development

The value of the index has fallen sharply since 1995: From 180 in 1995 to 83 in 2015. However, the progress made with the different pollutants varies significantly. Emissions of sulphur dioxide have declined by almost 80 % since 1995. Emissions of ammonia, on the other hand, have risen by 12 % since then.

Germany has committed to reducing emissions of the five main air pollutants in accordance with the 2012 amendment to the Gothenburg Protocol of the Geneva Convention on Long-Range Transboundary Air (UNECE n.d.).

Germany must reduce emissions by an average of 21 % compared to 2005 by 2020. It is possible to achieve this target. Additional new targets were set for future 'national emission reduction commitments' for the five main air pollutants at the end of June 2016. Accordingly, Germany must reduce emissions of the five air pollutants by an average of 45 % between 2005 and 2030. The Federal Government has included this reduction target in the German Sustainable Development Strategy (Federal Government 2016).

Achieving these targets is a major challenge for German environmental policy. Additional measures are needed, especially to reduce ammonia emissions from agriculture. Coal-fired power generation must also be reduced. To do this, it will be necessary at least to implement the adapted climate policy scenarios ('With additional measures') on which the Federal Government's 'Projection Report 2015' is based (Federal Government 2015).

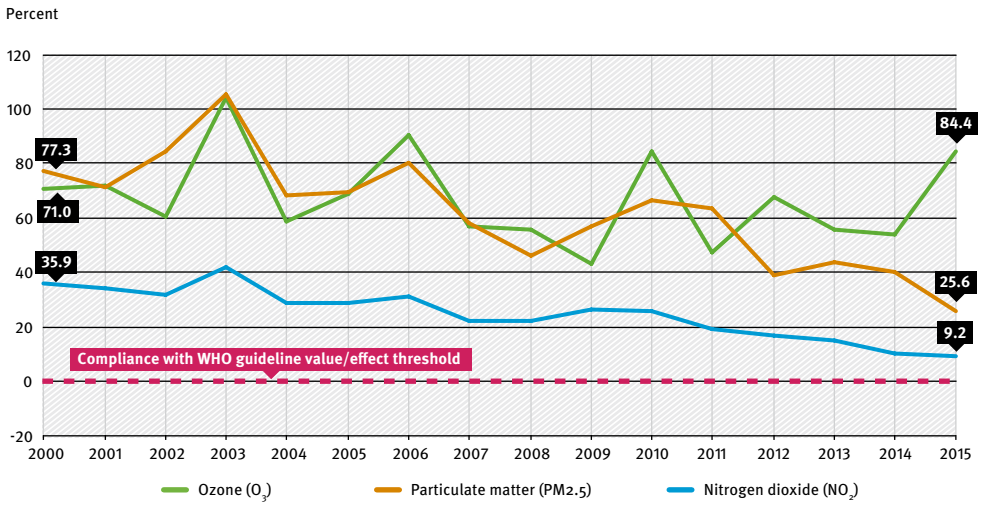
Methodology

The indicator is based on the relative trend in the emissions of five pollutants since 2005. Emissions of this year were set at 100 (indexed). The indicator is calculated from the annual average for the five pollutants. The calculation is based on data from the respective air pollutant inventories calculated by the German Environment Agency (UBA). These calculations are described in detail in the UBA's 'German Informative Inventory Report' (UBA 2017a).

- Indicator online (latest data, data download): www.uba.de/en/57122
- Detailed information: www.uba.de/15709 (in German only)
- Last update: 02/2017

Air quality in agglomerations

Discrepancy between average pollutant concentrations and WHO recommendations or prescribed effect thresholds in urban background locations in German agglomarations*



* WHO guideline values: O_3: 100 µg/m³ as max. daily 8-hour mean; PM2.5: 10 µg/m³ in annual mean (WHO Air quality guidelines - global update 2005); effect threshold for NO_2: 20 µg/m³ in annual mean (HRAPIE Project, WHO 2013)

Quelle: German Environment Agency 2016

At a glance

- The background levels of three main air pollutants in German agglomerations exceed World Health Organisation (WHO) guide line values and effect thresholds.
- Close to sources, pollutant levels can even be significantly higher.
- The situation regarding nitrogen dioxide and particulate matter has greatly improved since 2000.
- Ozone and particulate matter pollution is very dependent on the weather. Levels thus fluctuate significantly.

- Indicator online (latest data, data download): www.uba.de/en/57123
- Detailed information: www.uba.de/11137 (in German only)
- Last update: 07/2016

Environmental importance

Nitrogen dioxide (NO_2), particulate matter (PM2.5) and ozone (O_3) are of particular concern to human health. All three pollutants affect the respiratory organs. Many premature deaths are also attributed to particulates (cf. 'Health risks due to particulate matter' indicator). Ecosystems are also damaged by ozone.

The World Health Organisation WHO has defined air quality guideline values for particulates and ozone (WHO 2006). A new threshold for NO_2 has been proposed in a research paper (WHO 2013). Above these levels, health risks increase significantly. These values are stricter than the limits defined in the EU Air Quality Directive.

Air quality is particularly precarious in agglomerations, where one third of the German population lives. Here, industry, traffic and residential areas exist in close proximity. The indicator incorporates data from monitoring stations which measure background urban pollution levels. At busy locations in cities pollution levels may be significantly higher. The indicator represents the average discrepancy of all monitoring stations of urban background from WHO guideline values and an effect threshold, respectively. Even with negative indicator values, individual monitoring stations can still be above the target value.

Assessing the development

Levels of nitrogen dioxide and particulate matter have fallen considerably. If this trend continues, concentrations of both pollutants may fall below the WHO recommendations in the foreseeable future.

However, ozone concentrations fluctuate widely. This is largely due to the influence of the weather. In hot summers such as 2003 or 2015, ozone concentrations rise sharply. Thus it is impossible to make a meaningful statement about the trend in recent years.

In 2008 the EU set out its air quality objectives in the Air Quality Directive (EU Directive – 2008/50/EC). The German Environment Agency believes that, in the long term, the limit values defined in the directive should be reduced to the WHO recommendations. Even then, large parts of Germany would still fail to meet the less ambitious targets of the EU directive (UBA 2016c). There is still a long way to go until the air in agglomerations is sufficiently 'clean'.

Methodology

The indicator is based on measurement data from the network of German air quality monitoring stations. All monitoring sites within an agglomeration were included in the measurement of urban and suburban background pollution levels. Measurements of these monitoring sites are used to calculate the extent to which the three pollutants NO_2, PM2.5 and O_3 exceed or fall short of WHO recommendations. The average discrepancy between the values recorded at all monitoring stations and the WHO recommendation is calculated for each agglomeration. The average discrepancies are then averaged across all agglomerations and expressed in a standardised form with the WHO recommendation.