3 | Emissions of acidifying substances

Key question

Have we succeeded in reducing air pollution with acidifying substances that adversely affect human health and ecosystems?

Key messages

Emissions of acidifying substances (SO_2, NO_x and NH_3) in the air have been decreasing steadily since 1990. Since 1990 the total emissions of acidifying substances decreased by 85.4%, since 2000 by 37.2% and then in the last year-to-year comparison of 2014–2015 by 2.2%.
Of the total aggregate emissions of acidifying substances in 2015 emissions of NH_3 participated by 35.4%, SO_2 by 33.4% and NO_x emissions by 31.2%.
Total emissions of acidifying substances get closer to the limit values of national emissions for 2020.

Overall assessment of the trend

Change since 1990

Change since 2000

Last year-to-year change

References to current conceptual, strategic and legislative documents

Directive 2001/81/EC of the European Parliament and of the Council on national emission ceilings for certain atmospheric pollutants (NECD)
- establishment of national emission ceilings for SO_2: 265 kt.year^{-1}, i.e. 8.28 kt.year^{-1} in the equivalent of acidification[9]
- establishment of national emission ceilings for NO_x: 286 kt.year^{-1}, i.e. 6.22 kt.year^{-1} in the equivalent of acidification
- establishment of national emission ceilings for NH_3: 80 kt.year^{-1}, i.e. 4.71 kt.year^{-1} weighed by the acidifying equivalent

Directive of the European Parliament and of the Council of 2015/2193 of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants
- establishment of rules for the reduction of emissions of SO_2, NO_x and dust into the air from medium-sized combustion plants with the objective to reduce the amount of emissions into the air and reduce the possible risks arising from these emissions to human health and the environment

Convention on Long-Range Transboundary Air Pollution (CLRTAP)
- prevention of the spread of transboundary air pollution on long distances

Protocol to Abate Acidification, Eutrophication and Ground-level Ozone of CLRTAP (The Gothenburg Protocol)
- reduction of areas with an excessive degree of acidification in Europe
- establishment of new emission ceilings for the year 2020 set as a percentage reduction in emissions compared to the state in 2005: for SO_2 the emission reduction is set to 45%, for NO_x it is 35% and for NH_3 it is 7%

[9] *All the data on emissions, presented both in the texts and charts are based on the values expressed using the so-called acidifying equivalent (acidification). The acidifying equivalent factors are as follows for the below substances: for NO_x = 0.02174; for SO_2 = 0.03125 and for NH_3 = 0.05882. The total emissions equal the sum of total annual emissions of the individual substances expressed in tonnes and multiplied by their respective acidifying equivalent factors.*

The European Commission's package of 18th December 2013 with the title "A Clean Air Programme for Europe"
- a significant reduction in emissions by 2030 from sources of pollution and thus achieving a decrease in the values of the background concentrations towards values recommended by the WHO

State Environmental Policy of the Czech Republic 2012–2020
- meeting the national emission ceilings valid since 2010 and the reduction of the total emissions of SO_2, NO_x, NH_3 by 2020 in line with the commitments of the Czech Republic

Medium-term strategy (by 2020) to improve air quality in the Czech Republic
- from 2020 no exceedance of the values of the national emission ceilings laid down on the basis of the New National Scenario with additional measures
- the progressive creation of conditions to meet future national commitments to reduce emissions by 2025 and 2030

National Emission Reduction Programme of the Czech Republic
- meeting the specified non-excess values of national emissions for SO_2 (92 kt.year^{-1}, i.e. 2.88 kt.year^{-1} in the equivalent of acidification), NO_x (143 kt.year^{-1}, i.e. 3.11 kt.year^{-1} in the equivalent of acidification), NH_3 (64 kt.year^{-1}, i.e. 3.76 kt.year^{-1}, i.e. in the equivalent of acidification)
- reduction of the negative impact on ecosystems and vegetation and on the materials by way of compliance with the national emission reduction obligations and compliance with applicable pollution limits

Operational Programme Environment 2014–2020
- reduce emissions from residential heating of households involved in the exposure of the population concentrations of pollutants (supports Exchange of non organic heat sources, the so-called pot subsidies)
- reduce emissions from stationary sources contributing to the population's exposure to excessive concentrations of pollutants

Impacts on human health and ecosystems

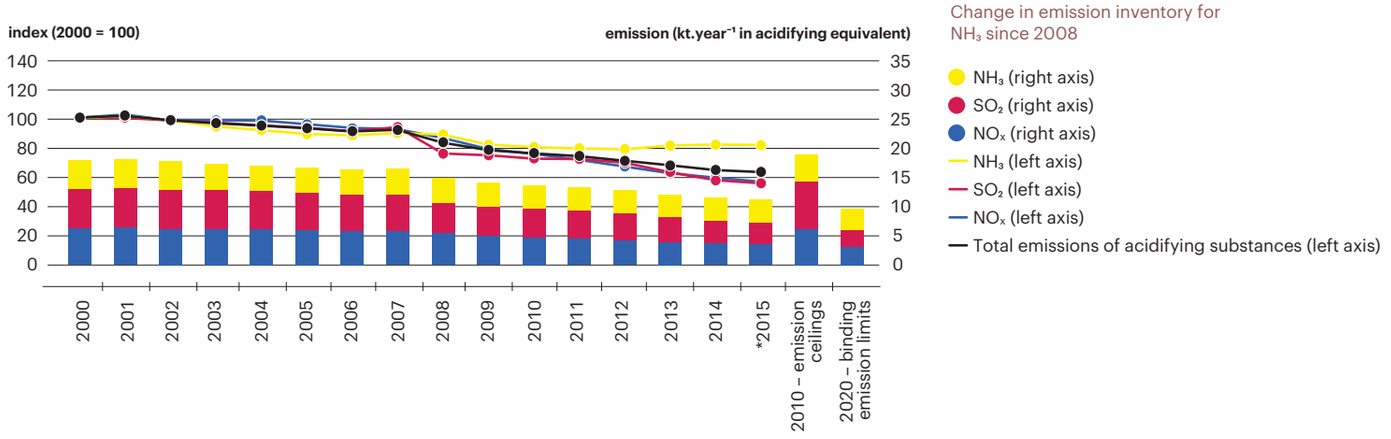
Acidifying substances produce long- and short-term health problems. Even a short-term exposure to acidifying substances causes irritation of the respiratory system which may limit its functions and also reduce the organism's resistance to infectious diseases in long-term. Short-term and long-term exposure to acidifying substances also aggravates the problem of asthmatics and allergy, while the highest risk presents from the point of view of human health NO_x (NO_2), the long-term exposure to which exacerbates the illness of the respiratory system especially for sensitive population groups, such as children, the elderly and the sick.

Emissions of acidifying substances increase the hydrogen ion concentration in all elements of environment, which leads to the reduction of pH and the subsequent leaching of toxic metals (Al, Cd, Pb and Cu). There is also the deterioration of the flows of nutrients, which may lead to the violation of the root system and a distorted outlet mode. As a result of the increased acidity of the environment there is a decreased biodiversity and unstable individual ecosystems.

Indicator assessment

Chart 1

Development of total emissions of acidifying substances in the Czech Republic and the level of national emission ceilings for 2010 and the binding emissions limits from 2020 [index, 2000 = 100]; [kt.year^{-1} in acidifying equivalent], 2000–2015

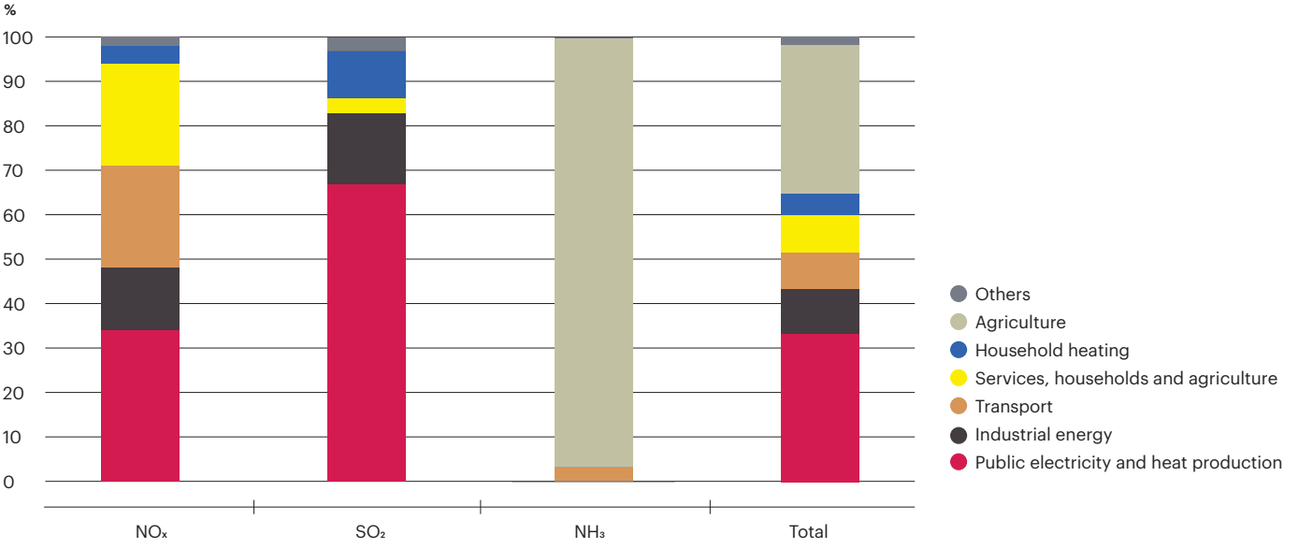


**Preliminary data.*
Emissions from the use of nitrogen fertilisers have been included in the NH_3 emission balance since 2008.
The correction of emission inventories was carried out for the presented period 2000–2015 due to the adjustments of emission factors.

Source: Czech Hydrometeorological Institute

Chart 2

Sources of emissions of acidifying substances in the Czech Republic [%], 2014



Emissions of NH_3 from agriculture come from livestock breeding and the use of mineral nitrogen fertilisers.
Emissions in the sector of services, households and agriculture come from mobile and stationary combustion sources (excluding residential heating).
The correction of emission inventories was carried out for the presented period due to the adjustments of emission factors.
Data for the year 2015 are not, due to the methodology of their reporting, available at the time of publication.

Source: Czech Hydrometeorological Institute

Emissions of acidifying substances (SO_2, NO_x and NH_3) have been declining in the long-term; between the years **1990–2015** they experienced an overall decrease by 85.4%, i.e. from 79.0 to 11.5 kt.year^{-1} in acidifying equivalent. In this period emissions of SO_2 dropped by 93.4% (from 57.8 to 3.8 kt.year^{-1}), NO_x emissions by 70.1% (from 12.0 to 3.6 kt.year^{-1}) and NH_3 emissions by 55.6% (from 9.2 to 4.1 kt.year^{-1}) in the acidification equivalent. The most significant decrease in all emissions of acidifying substances was recorded in the 1990s particularly at the beginning, as a result of structural changes in the national economy.

Between **2000–2015** the trend of reducing acidifying substances continued, and in this period there was a decline by 37.2%. The most important decreases occurred between 2007 and 2008 (by 10.1%), and also between 2008 and 2009 (by 5.8%), due to the decline of the national economy caused by the economic crisis. In the period 2000–2015 SO_2 emissions decreased by 45.1%, NO_x emissions by 43.4% and emissions of NH_3 by 18.4%. In the period **2005–2015** SO_2 emissions decreased by 41.0%, NO_x emissions by 40.9% and emissions of NH_3 by 8.0%.

In 2015 the total emissions of acidifying substances also fell, by 2.2%, which is the lowest annual decline since 1990. This decrease was mainly caused by the reduction of SO_2 emissions by 3.5% and NO_x emissions by 3.3%. NH_3 emissions are stagnating.

Emissions of acidifying substances were for the year 2015 for the whole of the Czech Republic **below the national emission ceilings for 2010**. To achieve the binding emission limits **from 2020** it is required to reduce the emissions of SO_2 by 33.5%, NO_x emissions by 15.3% and emissions of NH_3 by 8.3% (Chart 1).

Based on the 2014[10] data, the **main sources of emissions of acidifying substances in the Czech Republic** (Chart 2) were the sector of agriculture (33.5%, i.e. 3.9 kt.year^{-1} in acidifying equivalent), public electricity and heat production (33.3%, i.e. 3.9 kt.year^{-1} in acidifying equivalent) and industrial energy sector (9.9%, i.e. 1.2 kt.year^{-1} in acidifying equivalent).

However, the representation of individual emissions of acidifying substances varies. The main producer of emissions of **SO_2** in 2014 was particularly public electricity and heat production (66.8%, i.e. the 2.7 kt.year^{-1} in the acidification equivalent), and also industrial energy (16.0%) and residential heating (10.7%).

NO_x emissions in 2014 were mostly produced in the sector of public electricity and heat production (34.0%, i.e. 1.3 kt.year^{-1} in the acidification equivalent), an important source is the transport sector in the long term (23.0%) and combustion processes in the sector of service, households and agriculture (without the inclusion of the category of residential heating).

Emissions of **NH_3** in 2014 came mainly from the agricultural sector (96.5%, i.e. 3.9 kt.year^{-1} in the acidification equivalent), and especially from the livestock and from the application of nitrogen mineral fertilisers.

Emissions of **SO_2 and NO_x** are steadily decreasing, in particular as a result of the introduction of technologies and manufacturing processes with the BAT, in the 1990s connected with particularly the desulphurisation of coal fired power plants, the use of fuels with a lower sulphur content and the reduction of the energy demands in economy. A significant role in the present also represents the diversification of electricity production, i.e. the decrease in production of electricity in coal-fired power plants and on the contrary, the increase in electricity

[10] *Data for the year 2015 are not, due to the methodology of their reporting, available at the time of publication.*

generation from nuclear and RES, and also an overall decrease of its production (in 2015, the annual decline by 2.6%) and also the obligation to meet the legislative requirements given by the transposition of Directive of the European Parliament and of the Council 2010/75/EU on industrial emissions into Czech legislation[11]. An important negative factor in the production of SO_2 and NO_x emissions is, however, the long-term pro-export term nature of electricity generation (in 2015 it was on its long-time minimum, indicator 31 – Electricity and heat generation), especially in the case that most of the electricity is produced in steam plants for solid fuels. The quantity of produced emissions of SO_2 and NO_x in the residential heating sector is significantly affected by the metrological conditions in the heating season in individual years and also the prevailing method of residential heating, which, however, does not change in the long term in the Czech Republic.

The long-term reduction of **NO_x** emissions is also associated with a decrease in these emissions from the transport sector, in particular as a result of a gradual, albeit slow modernisation and replacement of the vehicle fleet, and also due to the decline in transportation emissions.

Stagnation or a slight decrease in the emission of **NH_3** is associated in particular with agricultural policy of the Czech Republic and with the implementation of the Common Agricultural Policy. The reduction of emissions of NH_3 in the long term is, however, contributed to by the decline of livestock, especially swine.

Detailed indicator assessment and specifications, data sources

CENIA, key environmental indicators

http://indicators.cenia.cz

[11] *Deviations from the emission ceilings for each substance group of acidifying substances are listed in the Statistical Environmental Yearbook of the Czech Republic for 2015 in the environmental chapter in the thematic chapter 3.2 Air, Section 3.2.1 Air Emission situation.*