

Air pollution statistics - air emissions accounts

Statistics Explained

Data from December 2025

Next update of the article: January 2027

Highlights

Between 2008 and 2023, emissions of acidifying gases (ammonia, nitrogen oxides and sulphur dioxide) in the EU decreased by 43%.

Between 2008 and 2023, emissions of ozone precursors (nitrogen oxides, non-methane volatile organic compounds, carbon monoxide and methane) in the EU decreased by 29%.

This article is about emissions of [acidifying gases](#) and [ozone precursor substances](#) classified by emitting economic activities. Eurostat records and publishes those in annual air emissions accounts (AEA), one of the modules in the European environmental economic accounts (for which the legal basis is [Regulation \(EU\) No 691/2011](#)). AEA are suited for integrated environmental economic analyses such as calculating emission intensities.

In addition, Eurostat disseminates emissions of air pollutants classified by technical processes. These are recorded in emission inventories for air pollutants and form the official data for international policies on transboundary air pollution. Furthermore, Eurostat estimates and disseminates 'footprints' which are emissions of air pollutants classified by final products that are demanded by households or government, or that are invested in or exported.

General overview

The EU emissions of acidifying gases (sulphur dioxide (SO₂), [nitrogen oxides \(NO_x\)](#) and [ammonia \(NH₃\)](#)) have continuously been decreasing over the past years. In 2023, emissions of NH₃ and NO_x contributed 47% and 41%, respectively, while sulphur dioxide contributed 12% to the total acidifying potential.

The EU emissions of ozone precursors (nitrogen oxides (NO_x), methane (CH₄), carbon monoxide (CO) and [non-methane volatile organic compounds \(NMVOC\)](#)) have also been falling over the past years. In 2023, the main contributors to the tropospheric ozone formation potential were NO_x and NMVOC with 54% and 35%, respectively.

Acidifying gases

Several air pollutants contribute to the acidification of the environment. The most important ones are sulphur dioxide (SO₂), nitrogen oxides (NO_x) and ammonia (NH₃). The impact of SO₂, NO_x and NH₃ can be observed in the progressive degradation of soils, water and forests. They also contribute to the formation of fine particles in the air that cause respiratory diseases. The acidifying potential of SO₂, NO_x and NH₃ is commonly measured in SO₂ equivalents (SO₂eq.).

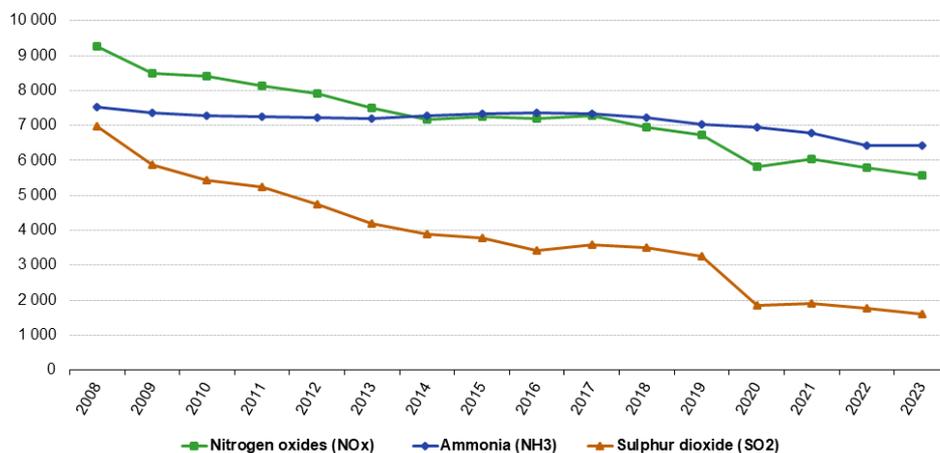
Emissions of acidifying gases have been on a continuous decrease

The acidifying potential associated with EU residents' emissions has continuously been decreasing over the past 15 years (Figure 1). Between 2008 and 2023 emissions of the 3 main acidifying gases decreased by approximately 10

million tonnes of SO₂eq. to reach 14 million tonnes of SO₂eq. (-43%). SO₂emissions decreased by 77% and contributed 12% to the total acidifying potential. NO_xemissions decreased by 40% and contributed 41% to the total acidifying potential. Emissions of ammonia (NH₃), quantitatively the most significant acidifying gas decreased by 15% and contributed 47% to the total acidifying potential.

Acidifying gas emissions by chemical compound, EU, 2008-2023

(thousand tonnes of SO₂ equivalents)



Source: Eurostat (online data code: env_ac_ainah_r2)



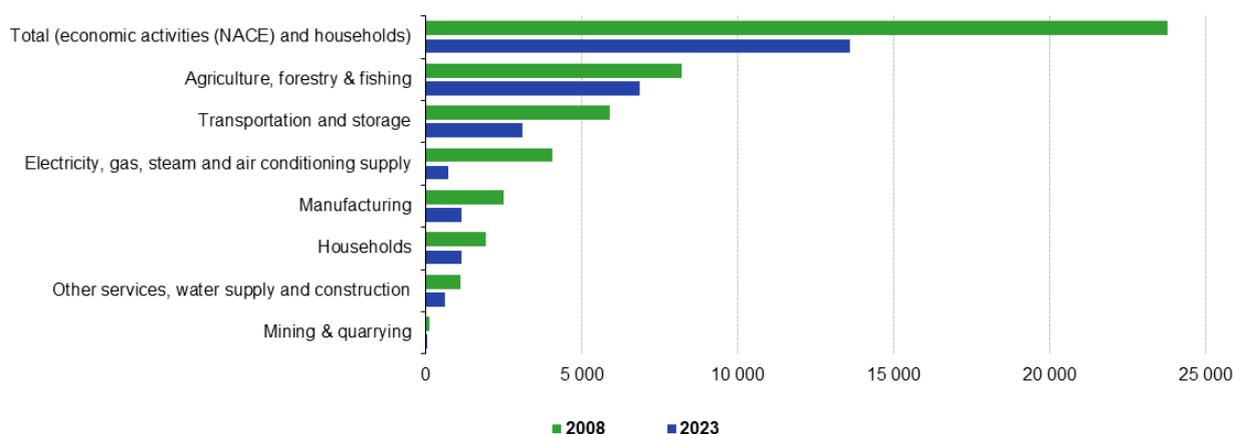
Figure 1: Acidifying gas emissions by chemical compound, EU, 2008-2023 Source: Eurostat (env_ac_ainah_r2)

Acidifying gas emissions by economic activity

Agriculture, forestry and fishing emits the most acidifying gases. In 2023, it contributed 50% of the acidifying gases emitted by EU economic activities and households (Figure 2). Ammonia (NH₃) is the most significant acidifying substance emitted by agriculture, forestry and fishing (Figure 3). In 2023, transportation and storage was the production activity with the second largest share (23%) in total acidifying emissions (Figure 2). In this case, NO_x was the dominant acidifying gas (Figure 3).

Acidifying gas emissions by economic activity, EU, 2008 and 2023

(thousand tonnes of SO₂ equivalents)



Source: Eurostat (online data code: env_ac_ainah_r2)

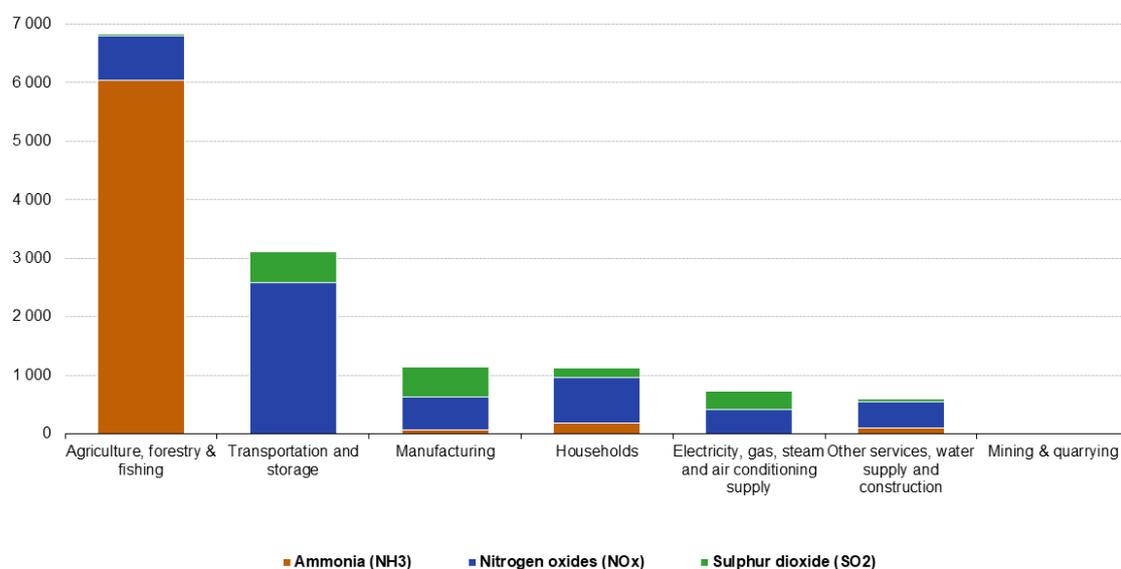
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Figure 2: Acidifying gas emissions by economic activity, EU, 2008 and 2023 Source: Eurostat (env_ac_ainah_r2)

Most activities recorded significant drops in acidifying gas emissions. The largest decrease was observed in electricity, gas, steam and air conditioning supply industry, which dropped from 4.1 million tonnes of SO₂eq. in 2008 to 0.7 million tonnes of SO₂eq. in 2023 (-82%). A more systematic use of end-of-pipe pollution filters and the use of more efficient combustion technologies in electricity and heat production are the main contributors to this development.

Acidifying gas emissions by economic activity and chemical compound, EU, 2023

(thousand tonnes of SO₂ equivalents)



Source: Eurostat (online data code: env_ac_ainah_r2)

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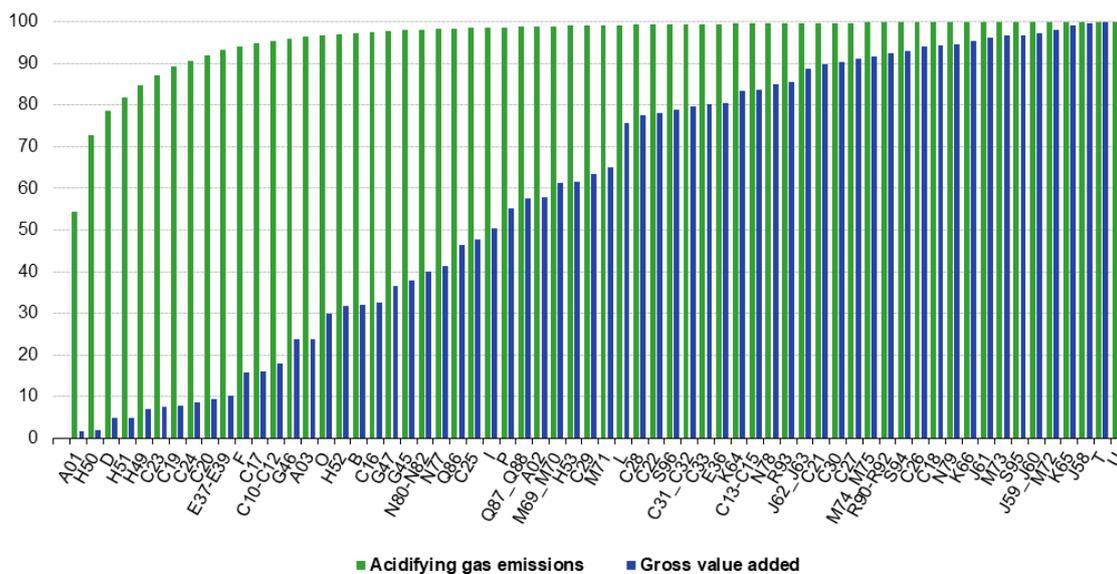
Figure 3: Acidifying gas emissions by economic activity and chemical compound, EU, 2023 Source: Eurostat (env_ac_ainah_r2)

Comparing acidifying gas emissions with gross value added

Figure 4 compares acidifying gas emissions (AGE) with the [gross value added](#) (GVA) of 64 production activities ([NACE classification](#)) in the EU in 2023. This breakdown into 64 production activities is the same that is used in economic statistics (national accounts), therefore enabling integrated analyses. In Figure 4 the production activities are in descending order of their acidifying gas emissions. Both bars (AGE and GVA) of each production activity show the cumulated percentage, in other words, the percentage of all the activities, which are to the left of the activity and the activity itself.

Acidifying gas emissions and gross value added by production activities (NACE), EU, 2023

(cumulated %)



Source: Eurostat (online data code: env_ac_ainah_r2, naio_10_cp1610)



Figure 4: Acidifying gas emissions and gross value added by production activities (NACE), EU, 2023 Source: Eurostat (env_ac_ainah_r2) and (naio_10_cp1610)

Figure 4 shows that the top 5 emitters account for 85% of the total acidifying gas emissions of the 64 production activities, while these 5 production activities only contribute 7% to the [gross domestic product](#) (GDP) of the EU economy. These 5 production activities are crop and animal production, hunting and related service activities (NACE A01), water transport (NACE H50), electricity, gas, steam and air conditioning supply (NACE D), air transport (NACE H51) and land transport and transport via pipelines (NACE H49). The GDP is the sum of gross value added of the 64 production activities plus net taxes on products. In Figure 4 only the NACE codes of the production activities are given due to space restrictions. Their names and descriptions are available in the publication [NACE Rev. 2 - Statistical classification of economic activities](#) .

Ozone precursors

Tropospheric ozone occurs when ozone precursor substances (i.e. [non-methane volatile organic compounds](#) (NMVOC) , [nitrogen oxides](#) (NOx), carbon monoxide (CO) and methane (CH4)) react in the lower atmosphere in the presence of sunlight. High ozone levels occur during the warmer summer months as the sun makes, for example, exhaust fumes from vehicles react in the lower atmosphere. High ozone levels are known to damage human tissue and are a health risk, especially for people with respiratory problems. Through the [National Emissions Ceilings Directive](#) (NECD) and the [Gothenburg Protocol](#) under [UNECE-CLRTAP](#) (United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution), the EU focusses on the emissions of NOx and NMVOC as they are the most relevant of the 4 pollutants.

Emissions of ozone precursors have been on a continuous decrease, NOx is the most significant ozone

precursor

From 2008 to 2023, the tropospheric ozone formation potential associated with EU residents' emissions of ozone precursors continuously decreased by 10.4 million tonnes of NMVOC equivalents (NMVOC eq.), to reach 18 million tonnes of NMVOC eq. (-37%). The most significant ozone precursor NO_x, decreased the most throughout the last 15 years (-6.5 million tonnes). NMVOC emissions decreased by 2.6 million tonnes and CO emissions decreased by 1.3 million tonnes NMVOC eq. (Figure 5).

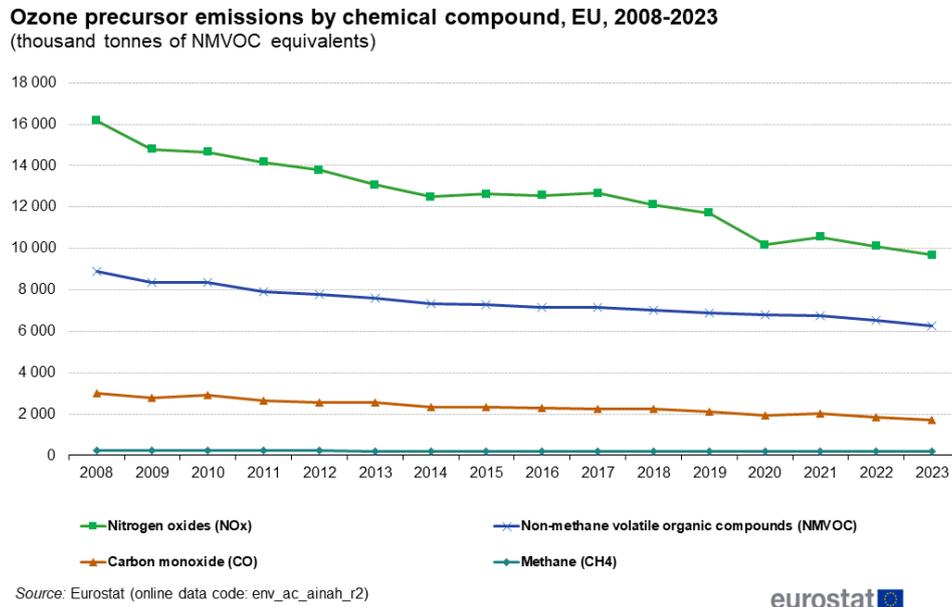


Figure 5: Ozone precursor emissions by chemical compound, EU, 2008-2023 Source: Eurostat (env_ac_ainah_r2)

Ozone precursor emissions by economic activity

With 27%, the transport industry contributed the most to total emissions of ozone precursors in 2023 followed by households with 25%. The agriculture, forestry and fishing industry was the third largest emitter with 19% (Figure 6).

Between 2008 and 2023, the largest absolute drop occurred in households (2.8 million tonnes of NMVOC eq. or -39%). For the same period, the largest relative drop was observed in electricity, gas, steam and air conditioning supply with -60%.

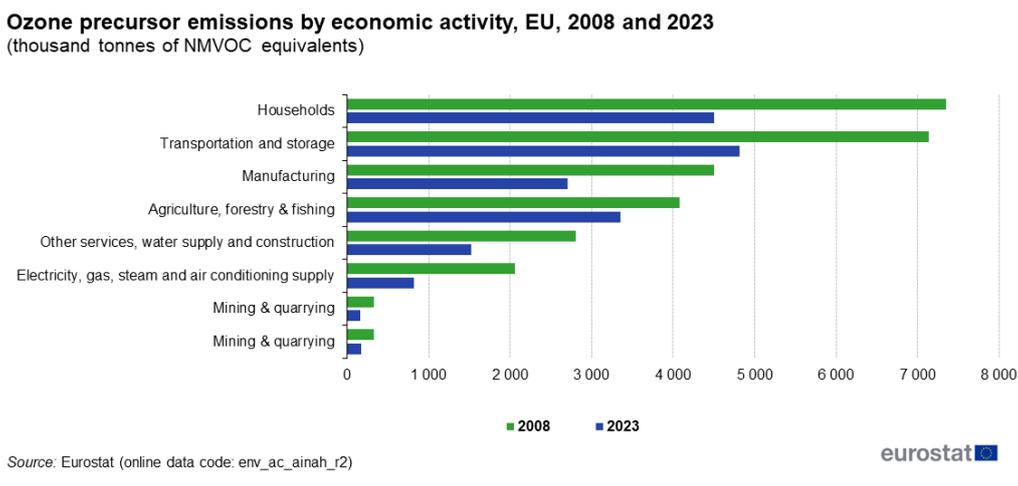


Figure 6: Ozone precursor emissions by economic activity, EU, 2008 and 2023 Source: Eurostat (env_ac_ainah_r2)

In 2023, NMVOC was the most significant ozone precursor emitted by households, manufacturing and agriculture. NOx was the most significant ozone precursor emitted by the transportation industry and the electricity, gas, steam and air conditioning industry (Figure 7).

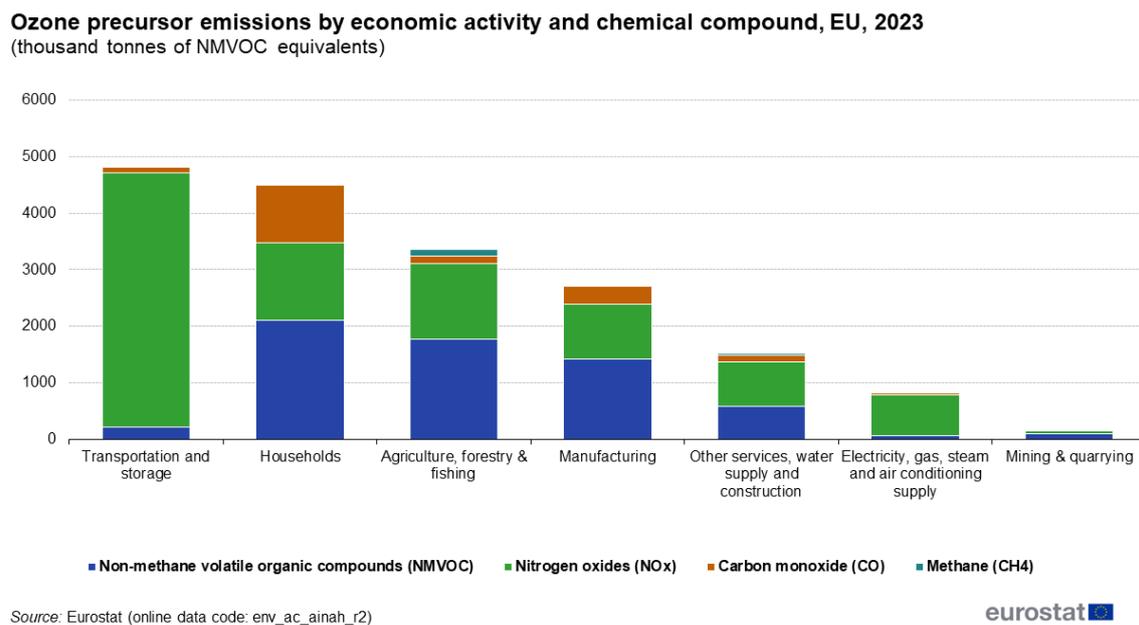
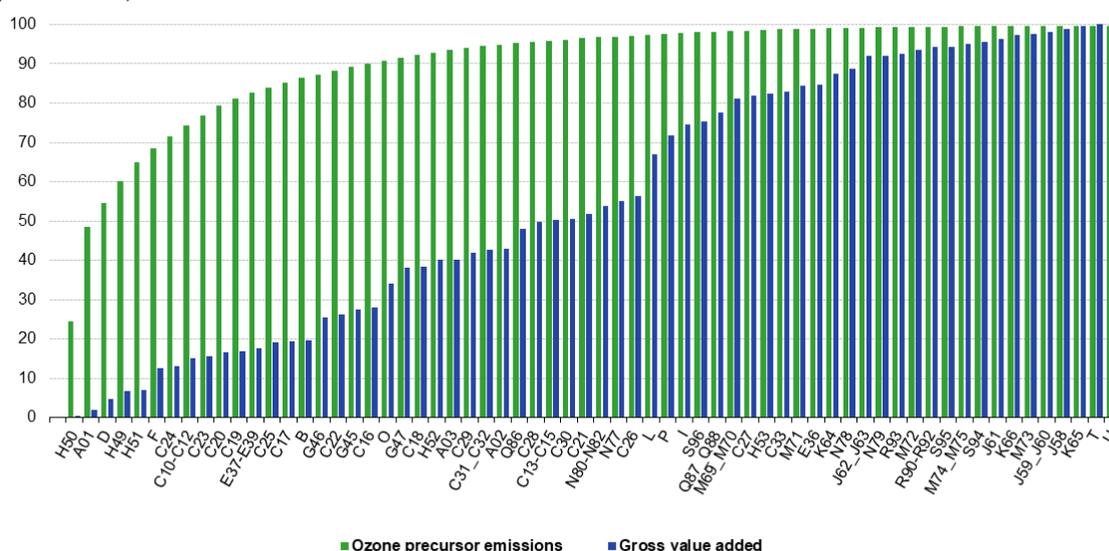


Figure 7: Ozone precursor emissions by economic activity and chemical compound, EU, 2023 Source: Eurostat (env_ac_ainah_r2)

Comparing ozone precursor emissions with gross value added

Figure 8 compares ozone precursor emissions (O3PR) with the gross value added (GVA) for 64 production activities (NACE classification) in the EU in 2023. This breakdown into 64 production activities is used for economic statistics (national accounts), therefore enabling integrated analyses. In Figure 8 the production activities are in descending order of their ozone precursor emissions. Both bars (O3PR and GVA) of each production activity show the cumulated percentage, in other words the percentage of all the activities, which are to the left of the activity and the activity itself.

Ozone precursor emissions and gross value added by production activities (NACE), EU, 2023
(cumulated %)



Source: Eurostat (online data code: env_ac_ainah_r2, naio_10_cp1610)



Figure 8: Ozone precursor emissions and gross value added by production activities (NACE), EU, 2023
Source: Eurostat (env_ac_ainah_r2) and (naio_10_cp1610)

Figure 8 shows that top 5 emitters account for 65% of ozone precursor emissions of the 64 production activities, while these top 5 production activities only contribute to 7% of the [gross domestic product](#) (GDP). These 5 production activities are water transport (NACE H50), crop and animal production, hunting and related service activities (NACE A01), electricity, gas, steam and air conditioning supply (NACE D), land transport and transport via pipelines (NACE H49) and air transport (NACE H51). The GDP is the sum of gross value added of the 64 production activities plus net taxes on products. In Figure 8 only the NACE codes of the production activities are given due to space restrictions. Their names and descriptions are available in the publication [NACE Rev. 2 - Statistical classification of economic activities](#).

Source data for tables and graphs

- [Air pollution statistics - air emissions accounts: tables and figures](#)

Data sources

The basis for Eurostat’s air emissions accounts is [Regulation \(EU\) No 691/2011](#) on European environmental economic accounts.

Annual data are transmitted by the EU Member States, as well as the [European Free Trade Association \(EFTA\)](#) countries and some [candidate countries](#).

Emissions of individual acidifying gases and ozone precursor substances are converted and aggregated to provide information for the environmental pressures ‘acidifying potential’ and ‘tropospheric ozone formation potential’. They use common units (SO₂equivalent and NMVOC equivalent) to allow comparison and combination of the relative effect of different gases. For calculating SO₂equivalents the following conversion factors are used: nitrogen oxides 0.7, sulphur dioxide 1.0 and ammonia 1.9. For calculating NMVOC equivalents the following conversion factors are used: nitrogen oxides 1.22, non-methane volatile organic compounds 1.0, carbon monoxide 0.11 and methane 0.014.

In air emissions accounts, emission data are organised by economic activity, using [NACE](#). This makes it possible

to have an integrated environmental-economic analysis to supplement national accounts. Economic activities encompass production by all businesses resident in a country, including those operating ships, aircraft and other transportation equipment in other countries.

Air emissions accounts also include households as consumers. Their emissions are accounted for whenever household consumption is directly responsible for environmental pressures. For example, emissions from a privately owned car are counted under households, whereas cars owned by transport businesses (such as taxis) are counted under transport services.

The following activity groupings are used in this article:

- agriculture, forestry and fishing — NACE Rev. 2 Section A
- mining and quarrying — NACE Rev. 2 Section B
- manufacturing — NACE Rev. 2 Section C
- electricity, gas, steam and air conditioning supply — NACE Rev. 2 Section D
- transportation and storage — NACE Rev. 2 Section H
- other services, water supply and construction — NACE Rev. 2 Sections E to G and I to U, in other words all remaining economic activities as defined in NACE
- households — households as consumers

Emissions accounts versus emission inventories

The main differences between air emissions accounts (AEA) and emission inventories for air pollutants are:

Note: National and EU totals differ between the 2 approaches, as different boundaries apply. Air pollution

Air emissions accounts – air pollutants (residence principle)	Emission inventories for air pollutants (territory principle)
Emissions are assigned to the country where the economic operator causing the emission is resident.	Emissions are assigned to the country where the emission takes place
Emissions are classified by economic activity, following the NACE classification of the system of national accounts.	Emissions are assigned to processes classified according to their technical nature (e.g. combustion in power plants, solvent use).
Emissions from international navigation and aviation are assigned to the countries where the operator of the ship/aircraft is resident, regardless of where the emission takes place.	Emissions from international navigation and aviation are assigned to the countries where the associated fuel is bunkered, irrespective of the operator's place of residence.

inventories include international aviation and maritime transport (international bunker fuels) as memorandum items, which means that they are excluded from national totals reported. However, they are included in air emissions accounts totals. Therefore total emissions reported in air pollution inventory databases can differ significantly from the total reported in air emissions accounts for countries with a large international aircraft and/or shipping fleet. AEA reconciles totals with emission inventories through 'bridging items'.

Context

The need to supplement information on the economy with environmental indicators has been recognised in a [European Commission](#) Communication titled '[GDP and beyond](#)' (COM(2009) 433). Furthermore, similar recommendations have been made within the [Report by the Commission on the Measurement of Economic Performance and Social Progress](#), the so-called Stiglitz report. The recommendations support the expansion of the statistical understanding of human well-being by supplementing economic indicators such as [GDP](#) with additional information, including physical indicators related to the environment.

Air emissions accounts measure the interplay between the economy and the environment with respect to air emissions, in order to assess whether current production and consumption activities are on a sustainable path of

development. Measuring [sustainable development](#) is a complex undertaking as it has to incorporate economic, social and environmental indicators. The data obtained from air emissions accounts may subsequently feed into political decision-making, underpinning policies that target both continued economic growth and sustainable development, for example, the European Commission's [European Green Deal](#) .

Explore further

Other articles

- [Greenhouse gas emission accounts](#)
- [NACE background](#)
- [National accounts and GDP](#)

Database

- [Environment \(env\)](#)
- [Emissions of greenhouse gases and air pollutants \(detailed datasets\)](#) , see:

Air emissions accounts (env_air_aa)

[env_ac_ainah_r2](#)

[env_ac_aibrid_r2](#)

[env_ac_aeint_r2](#)

Thematic section

- [Environment](#)
- [Emissions of greenhouse gases and air pollutants](#)

Publications

- [Manual for Air Emissions Accounts, 2015 edition](#)
- [Environmental accounts](#) , see publications

Methodology

- [Air emissions accounts by NACE Rev. 2 activity](#)
- [System of Environmental - Economic Accounting 2012 - Central Framework](#)

External links

- [Convention on Long-Range Transboundary Air Pollution](#)
- [United Nations Framework Convention on Climate Change \(UNFCCC\)](#)