INDICATORS: THEMES AND SECTORS

AIR QUALITY AND ATMOSPHERIC EMISSIONS

2.1

Environmental profile of Spain 2012

In Spain, the National Plan of Air Quality and Protection of the Atmosphere (the AIRE Plan) 2013-2016, has been developed as an instrument to allow public administrations to improve the environment and reduce emissions. It contains 39 specific objectives that include 78 horizontal and sectoral measures, and deals with air quality issues at their source; for that reason it proposes measures such as the promotion of the use of less polluting forms of transport, the use of public transport in place of private vehicles and discriminatory measures against less efficient and more polluting vehicles, among others. It also aims to involve citizens, adopting measures to offer real time information on air quality and to incorporate the material as a study subject in secondary education. The plan was finally approved in April 2013 and allows a novel framework to improve the air quality in Spain to be set up.

The Plan can be considered as the instrument that will allow for compliance with Directive 2008/50/CE, of 21 May 2008, on ambient air quality and cleaner air for Europe, as well as, specifically, compliance with the legal specifications the Directive sets out for particulate matter.

In the framework defined by the AIRE Plan, there are diverse initiatives for the improvement of air quality that are worthwhile highlighting. The Plan for the Promotion of the Environment, PIMA Air, has the objective of reducing CO_2 emissions, as well as polluting atmospheric emissions, through the substitution of the small commercial vehicle fleet (up to 3.5 tonnes that are more than seven years old) by models that are more efficient and have less environmental impact. Royal Decree 89/2013, of 8 February, regulates the direct grant of aid under the PIMA Air Plan for the acquisition of commercial vehicles.

Additionally, during 2012 the national emission ceilings of four atmospheric pollutants have been

reviewed within the framework of the Gothenburg Protocol of the Geneva Convention, establishing new commitments for the year 2020. A new emission ceiling has also been added for PM2.5 particulate matter, which is the particulate fraction with the greatest impact on human health. During 2013, declared as the Year of Air in the EU, the Commission plans to review its Thematic Strategy on Air Pollution.

As regards climate change, at the end of 2012 the 18th Conference of the Parties to the United Nations Framework Convention on Climate Change (COP18) took place in Doha, Qatar. In addition to forming the basis of a stronger and more ambitious global action against climate change in the short and medium term, agreements were adopted concerning two main policy themes: the adoption of a new binding international agreement in 2015 (with effect from 2020) and an extension to the second commitment period of the Kyoto Protocol, starting on 1 January 2013.

KEY POINTS

- In 2011 GHG emissions increased 0.5% with respect to the previous year, placing the emissions at 21% over the base year level established in the Kyoto Protocol; Spain was responsible for 7.7% of EU GHG emissions; the emissions per inhabitant and per unit of GDP were below the EU average.
- Although in 2011 the aggregated emissions of acidifying and eutrophying substances increased by 3.1%, since 1990 these have experienced a sharp fall, of up to 46.4%. SO2 emissions have shown the greatest reduction (75.3%) followed by NOx (19.7%), while NH3 emissions have shown a clear rise (14%).
- The emissions of tropospheric ozone precursors have increased by 1.4% in 2011, though during the period 1990-2011 these fell by 25.3%.
- The emissions of particulate matter continued the downward trend seen over recent years; the emission of particulates smaller than 10 μm has decreased by 23.8% from the year 2000, while the emission of particulates smaller than 2.5 μm, the most harmful for health, has decreased by 22.5%. Non-industrial combustion plants and road transport were the sectors that recorded the highest particulate emissions in Spain.
- As regards a representative situation of average air quality, the definitive 2011 data consolidates the trend of previous years, with no breaches in the legal limits (limit for NO_2 and PM10 and target for ozone) in any of the population-weighted average values for the different pollutants. This analysis does not rule out that at certain times and at specific points in urban environments the limits may be exceeded.
- In 2012 the decreases in the annual amount of exceedances of the 120 $\mu g/m^3$ maximum daily eight-hour mean, and the five-year-moving averages of AOT 40 of ozone have continued, in compliance with legal specifications. The average of the sulphur dioxide, nitrogen dioxide and PM10 concentrations of the last years are below the legal limits.

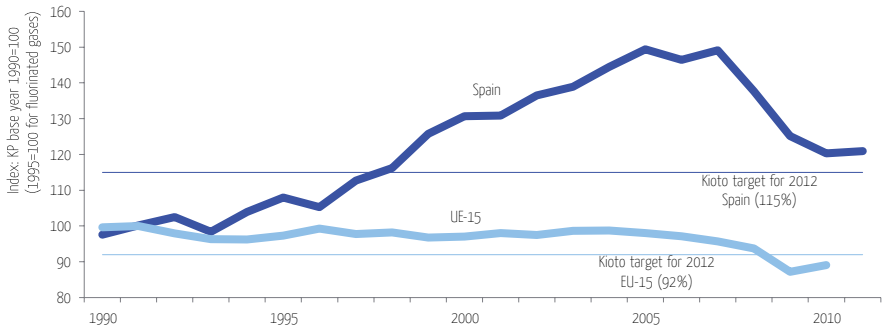
INDICATORS

- Greenhouse Gas Emissions
- Emissions of acidifying and eutrophying gases and tropospheric ozone precursors
- Emissions of particulate matter
- Air quality in urban environments
- Regional background air quality for the protection of health and vegetation

Emissions of greenhouse gases

In 2011, GHG emissions increased slightly, breaking the declining trend seen during the previous three years

Total Greenhouse Gas Emissions (CO_2 equivalent)



Source: EEA and MAGRAMA

In 2011 GHG emissions increased by 0.5%, going from 348,641 kt to 350,484 kt of CO_2-eq. this breaks the decreasing trend of 2008 (-7.7%), 2009 (-3.9%) and 2010 (-3.1%).

The emissions in 2011 are 21% above the base year level. In total, the evolution of the index has been characterized by a sustained increase during the period of 1990-2007, with the exceptions of 1993, 1996 and 2006, which saw sporadic declines in respect to the previous year. The series continues with the three decreases mentioned and the slight upturn in 2011.

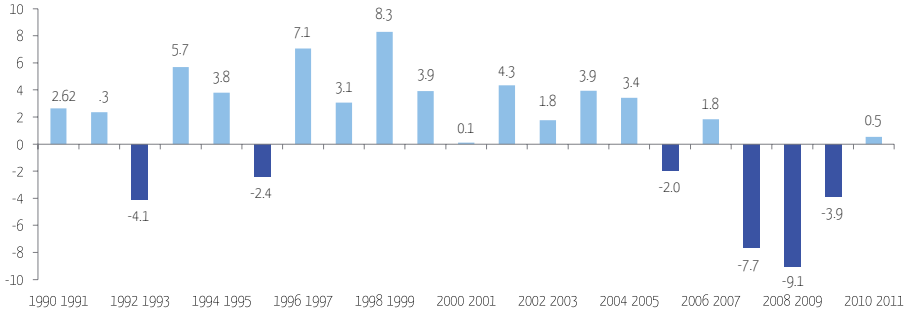
The decrease produced in 2008 and 2009 arose from the combination of two important factors: a change in the distribution of fuels used in the electricity generation industry (with a strong fall in coal consumption) and the effects of the economic recession arising from the economic and financial crisis. The increase in 2011, on the other hand, was a consequence, among other things, of an increase in coal consumption for electricity generation, in spite of there being a decrease in the consumption of fuels for road transport and in the residential and services sectors, together with lower levels of activity in major industrial sectors.

An analysis of the different activity sectors shows a major contribution from the energy sector (which includes, among others, transport emissions), which increased its share from 74.6% in 1990 to 77.5% in 2011, followed, at a considerable distance, by agriculture, with 13.2% in 1990 and 10.6% in 2011. The third group on the list is industry (with an exemption for combustion activities included in the first sector, energy), whose contribution decreased from 9.1% in 1990 to 7.5% in 2011. The waste sector has shown a tendency to increase its share, varying its contribution from 2.6% in 1990 to 4% in 2011.

Finally, the group of solvents used along with other products represent a marginal contribution of between 0.4% and 0.6% of the total.

Carbon dioxide is the main gas emitted, increasing from 80.2% in 1990 to reach 81.1% in 2011, followed by methane and nitrous oxide, which have similar contributions, though methane is slightly higher. Fluorinated gases show a reduced contribution of 2.6% in 2011.

Change in greenhouse gas emissions (%)



Source: MAGRAMA

NOTES

- This indicator presents the total emissions of the six main greenhouse gases (CO_2, CH_4, N_2O, HFC_s, PFCs y SF_6), expressed jointly as CO_2-eq (index 1990=100, and 1995=100 for fluorinated gases).
- Under the Kyoto Protocol of the UN Convention on Climate Change, the EU has undertaken to reduce its greenhouse gas emissions by 8% in relation to 1990 levels within the period 2008-2012. Each EU member state has different obligations and Spain has to stabilise GHG emissions at 15% above 1990 levels.
- The figures are for gross emissions and exclude net sink (capture minus emissions) for 'Land use, changes in land use and forestry'.
- The figures taken as the reference value (base year level) when examining the changes over time in aggregate emissions (without including emissions and absorption attributable to 'Land use, changes in land use and forestry') is the officially approved value used to calculate the quantity allocated to Spain when evaluating its Kyoto commitments.
- Within the context of the EU, Spain contributed 7.7% of total emissions in 2011 and released 7.6 tons of CO_2-eq per inhabitant, lower than the EU average of 9 tons of CO_2-eq per inhabitant. In GDP terms also, Spain was one of the countries with the lowest emissions intensity, releasing 0.33 kg of CO_2-eq in order to generate one unit of GDP in 2011, while in the EU-27 this intensity was 0.36 kg of CO_2-eq.

SOURCES

- Ministry of Agriculture, Food and Environment, 2013. Greenhouse Gas Emissions Inventory of Spain, years 1990-2011. Communication to the Commission. General Directorate for Environmental Quality and Assessment and Natural Environment.
- European Environment Agency, 2012. EEA greenhouse gas data viewer (web).

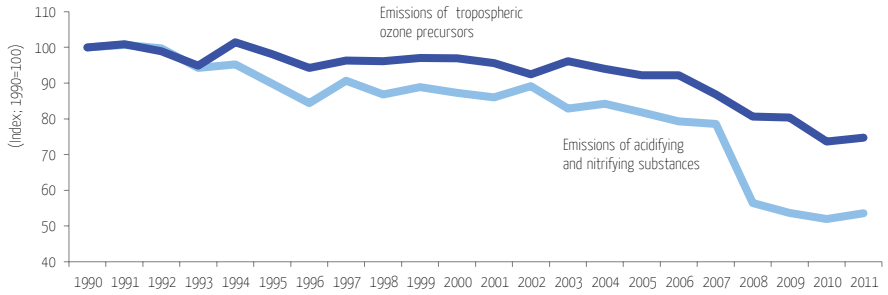
FURTHER INFORMATION

- http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/
- http://www.eea.europa.eu/data-and-maps/data/data-viewers/greenhouse-gases-viewer/

Emissions of acidifying and eutrophying gases, and tropospheric ozone precursors

In 2011 the emissions of acidifying and eutrophying and tropospheric ozone precursors increased slightly

Agregated emissions of acidifying and nitrifying substances and tropospheric ozone precursors



Source: MAGRAMA

The aggregated emissions of acidifying and eutrophying substances have experienced a large reduction during the period 1990-2011, decreasing by 46.4%. Although the overall downward trend is very clear, isolated increases can be observed in some years, and notably the decreases in 2008, 2009 and 2010 were much less pronounced. In 2011 there was a rise of 3.1% that, in principle, may be an isolated exception such as those that have occurred over the series.

Emissions of SO_2 have experienced the most marked reduction (75.3%), followed by NO_x (19.7%), while NH_3 is the only pollutant that has increased, by almost 14%. In relation to SO_2, almost all economic sectors have contributed to this decrease, in particular combustion in energy and transformation industries, industrial combustion plants and road transport. Meanwhile, in relation to NO_x emissions road transport provided the main reduction (42.4%), followed by non-combustion industrial processes that, although they reduced by 40.4%, have a lower effective incidence because of their overall low share of total emissions.

The main reason behind the growth of NH_3 emissions is an increase from manure management, with reference to nitrogen compounds.

Regarding 2011, emissions of SO_2 were responsible for the majority of the acidifying emis-

sions, which increased 10.4% (due mainly to the rise of emissions from the production and transformation of energy). The contribution to NO_x emissions however fell.

As regards overall emissions of tropospheric ozone precursors, these also show a decreasing trend, although this decrease was less marked. During the period 1990-2011, the aggregated emissions of the four gases evaluated (NO_x, NMVOC, CO y CH_4) fell by 25.3%.

Looking at each type of gas, the largest decline in the period mentioned was in CO, which experienced a reduction of 50% (mainly due to a significant decrease of the emissions of this pollutant from road transport). The reduction of NMVOC has been significant, although to a lesser degree (almost a 25%). The only precursor that has suffered an increase is CH_4, with a rise of 23.2%, due to the increase in contributions from agriculture, waste management and industrial combustion plants.

As occurred with acidifying and eutrophying emissions, in 2011 these aggregated emissions increased by 1.4%, halting the uninterrupted decreasing trend from 2004, due to the rise of NO_x emissions (3.64%) and, to a lesser extent, of NMVOC (0.5%). It is necessary to highlight a marked 58.1% increase in 2011 of NO_x emissions from combustion in the production and transformation of energy.

NOTES

- The graph for the indicator shows the changes in aggregate total annual emissions of acidifying and eutrophying substances (SO_2, NO_x y NH_3) and tropospheric ozone precursors (NO_x, NMVOC, CO y CH_4), in relation to the base year 1990. (1990=100).
- SNAP 11 group emissions (other sources and sinks) are not included for NMVOCs, nor are emissions pertaining to subgroups 10.01 and 10.02 (fertilised and unfertilised crops) corresponding to leaf biomass.
- Emissions of acidifying a nd eutrophying gases are presented as acid equivalents (hydrogen ion-generating potential), and are aggregated using the following weighting factors: 31.25 acid equivalent/kg for SO_2 (2/64 acid equivalent/g), 21.74 acid equivalent/kg for NO_x, expressed as NO_2, (1/46 acid equivalent/g) and 58.82 acid equivalent/kg for NH_3 (1/17 acid equivalent/g). Emissions of tropospheric ozone precursors were estimated using the tropospheric ozone depleting potential (expressed as NMVOC equivalent). The following weighting factors were used: 1.22 for NO_x, 1.00 for NMVOC, 0.11 for CO and 0.014 for CH_4.
- The objective of Directive 2001/81/CE, of the European Parliament and of the Council, of 23 October 2001, on national emission ceilings for certain atmospheric pollutants, is to limit emissions of acidifying and eutrophying pollutants and ozone precursors in order to protect human health and the environment.

SOURCES

- Ministry of Agriculture, Food and Environment, 2013. Greenhouse Gas Emissions Inventory of Spain, years 1990-2011. Directorate-General for Environmental Quality and Assessment and Natural Environment.

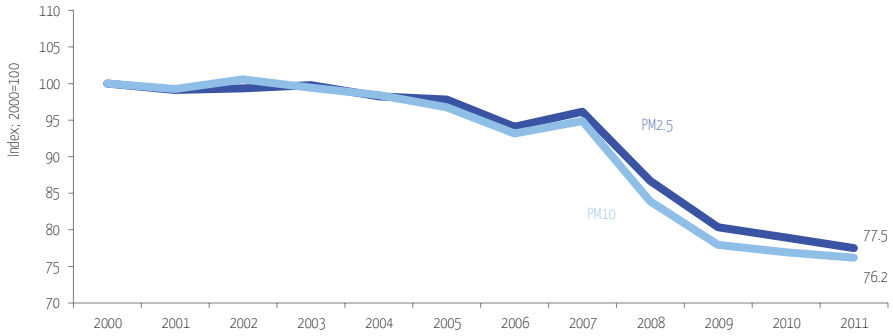
FURTHER INFORMATION

- http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/
- http://www.eea.europa.eu

Emissions of particulate matter

Unlike other pollutants, emissions of particulate matter continued to fall in 2011

Particulate matter emissions: PM2,5 and PM10



Source: MAGRAMA

In Spain emissions of particulate matter continued to follow the downward trend seen in recent years, although in 2011, as in 2010, a slowdown in the rate of decrease was observed.

From 2000 to 2011 emissions of particulates smaller than 10 μm have decreased by 23.8%. Almost all sectors have contributed to this decline, except for agriculture (where PM10 emissions increased by 6.8%, mainly from manure) and other transportation means and mobile machinery (a rise of 5.2%, due mostly to emissions from maritime activities). The sector that has most reduced particulate emissions is combustion in the energy and transformation industries, which has fallen 75.4% (despite the 2011 results) and road transport with a fall of 34.7%.

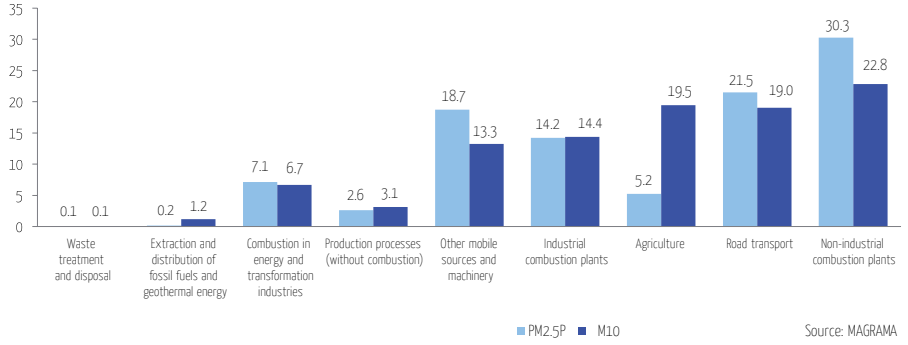
Nevertheless, in 2011 a fall of just 1% was seen; almost all sectors increased their particulate emissions and only falls from road transport and fossil fuel extraction (both slightly above 10%) compensated for the rise in emissions from the rest. The increase in emissions from combustion in energy and transformation industries should be noted (mostly arising from the activity of thermoelectrical power plants), being almost 23% in 2011.

Particulates smaller than 2.5 μm are very harmful to human health due to the breathing and irritation problems they can cause in lung capillaries. During the period 2000-2011 their emissions were reduced by 22.5%. Again, the reductions in the emissions from combustion in energy and transformation industries (64.8% and 9,965 t) and from transport (40.5% and 11,080 t) have most contributed to the total decrease.

However, in 2011 the emissions only fell by 1.8%, with combustion in energy and transformation industries being, again, the sector with the largest increase (17.8%) due to the increase in emissions from thermoelectric power plants.

Regardless of the performance of the different sectors, the distribution of particulate emissions varies relatively little over time, and industrial combustion plants and road transport are the main causes of particulate emissions; with agriculture an important source in the case of emissions of particulates larger than 10 μm, and other means of transport in the case of particles smaller than 2.5 μm.

Breakdown of particulate matter emissions by sector (%). 2011



Source: MAGRAMA

In terms of EEA countries, during the period 1990-2010, the average reduction of total PM10 emissions was 26%, while the reduction for PM2.5 was 28%.

NOTES

- The indicator covers emissions of suspended primary particulate matter with an aerodynamic diameter less than or equal to 10 and 2.5 μm (PM10 and PM2.5).
- The EU has not established specific limits for emission of primary particulate matter, but it did put limits in place in 2010 for their precursors (NO_x, SO_x y NH_3), under the National Emission Ceilings Directive (Directive 2001/81/CE) and the Gothenburg Protocol to the Convention on Long-Range Transboundary Air Pollution (Council Decision 81/462/CEE, of 11 June 1981).

SOURCES

- Ministry of Agriculture, Food and Environment, 2013. Greenhouse Gas Emissions Inventory of Spain, years 1990-2011. Directorate-General for Environmental Quality and Assessment and Natural Environment.

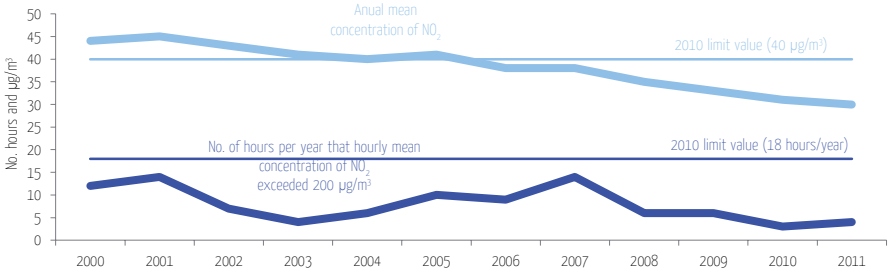
FURTHER INFORMATION

- http://www.magrama.gob.es/es/calidad-y-evaluacion-ambiental/temas/sistema-espanol-de-inventario-sei-/
- http://www.eea.europa.eu/

Air quality in urban environments

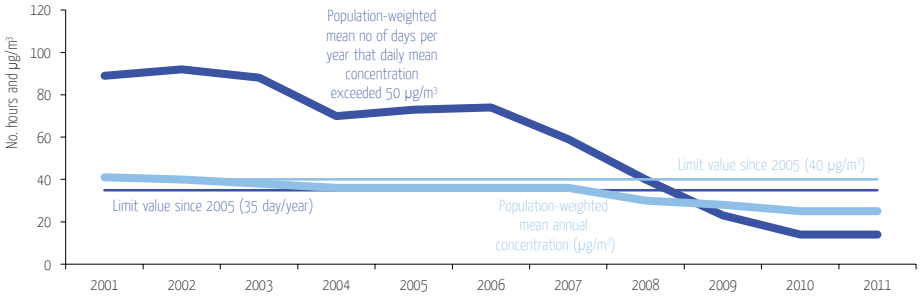
In 2011 average air quality in cities with more than 50,000 inhabitants did not exceed the legal limits and targets.

NO_2: population-weighted mean No. of hours per year that hourly mean concentration exceeded 200 µg/m³ and annual mean concentration (Total for spanish municipalities >50,000 inhabitants)



Source: MAGRAMA

PM10: population-weighted mean No. of days per year that daily mean Concentration exceeded 50 µg/m³ and annual mean concentration (Total for spanish municipalities >50,000 inhabitants)



Source: MAGRAMA

The average air quality in Spanish municipalities with more than 50,000 inhabitants, according to definitive 2011 data, consolidates the trend seen in previous years of not exceeding the legal values (limit for NO_2 and PM10 and for the target for ozone) for any of the average values of the different pollutants.

In relation to nitrogen oxides, the population-weighted average annual concentration of NO_2 has not, since 2006, exceeded 40 μg/m^3, the limit established in 2010. A similar situation can be seen with the total population-weighted annual number of hours where the hourly mean concentration exceeds 200 μg/m^3 , and the limit of 18 hours/year has not been exceeded. In both cases, there is a downward trend, while though it is more marked in the former.

For particulates with a diameter smaller than 10 microns, the variables analysed show a similar behaviour. Firstly, the population-weighted average annual concentration established in 2005 has not been exceeded since 2003, with a marked decrease as of 2007. Secondly, the total population- weighted average number of days per year registering a daily average concentration of 50 μg/m^3 has not exceeded the limit of 35 days per year since 2009.

The target for ozone establishes that the maximum daily eight-hour mobile mean concentration of 120 μg/m^3 must not be exceeded on more than 25 days per year. In the data available this limit was not breached in any year, with highest number of exceedances occurring in 2003, with 16 days over the limit.

The trends of these pollutants allows for the monitoring of the state of air quality in cities with more than 50,000 inhabitants. The analysis generalises the overall situations that may exist and establishes one representative picture of the average air quality the relevance of which diminishes when weighted by population. Nevertheless, the evaluation of air quality at specific points in the cities may show exceedances of the limits and targets. In Spain, additionally, the incursion of African dust particles, which increases, in a natural manner, the concentration of particles, must be taken into account. Likewise, the high levels of solar radiation in certain months of the year increase the ozone concentration.

NOTES

- The indicator monitors the variables used in the Project on European Common Indicators (ECI), and presents their evolution over time, comparing them with the limits and targets established for 2005 and 2010 in the existing legislation (Royal Decree 102/2011). For each pollutant the average value of all the stations, belonging to each of the municipalities with more than 50,000 inhabitants with sufficient valid values, is calculated, and must be multiplied by the population of that municipality. The sum of these values for all the populations, divided by the total population of all those cities, allows us to obtain the weighted average. In the case of ozone, the indicator, according to the legislation, is based on the three-year average.
- Definitive data for 2011 are offered here, having taken into account all stations with sufficient data (85% for the daily and hourly exceedances and 50% for the annual average concentrations). However, it should be emphasised that the average value obtained represents the average situation of the pollutant, and it is possible that there may be differences between this value and the situation at any given moment that could occur at any specific station.
- The evolution of SO_2 and CO concentrations is not considered as there is no issue with these in urban environments. From 2002, no exceedance of the CO limit has taken place (10 mg/m^3 of average CO daily maximum as an eight-hour mobile mean), and from 2009 no exceedance of the SO_2 limit has occurred. The 2011 data are definitive and are the same as those sent to the EU in compliance with current legislation.

SOURCES

- Ministry of Agriculture, Food and Environment, 2013. Greenhouse Gas Emissions Inventory of Spain, years 1990-2011. Directorate-General for Environmental Quality and Assessment and Natural Environment.

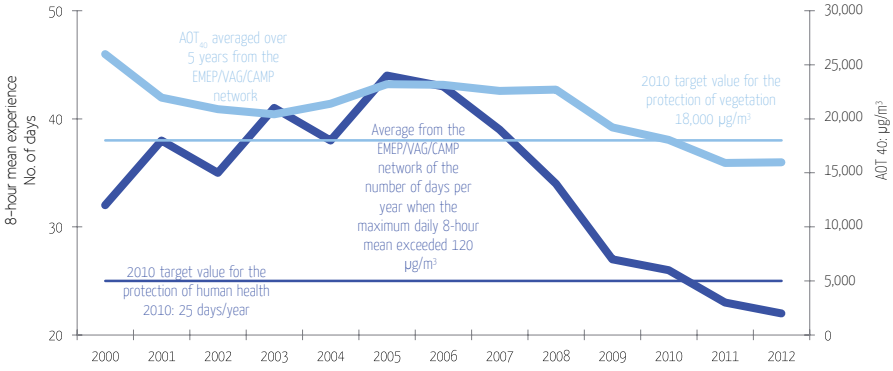
FURTHER INFORMATION

- http://www.eea.europa.es/
- Http://www.magrama.gob.es/es/

Regional background air quality for the protection of health and vegetation

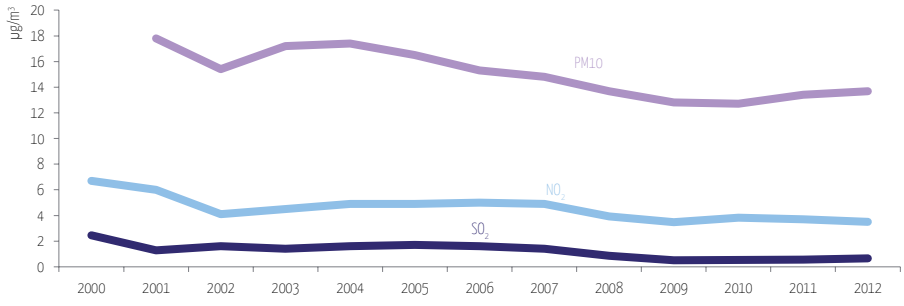
Continuing the downward trend of previous years, the 2012 average values for ozone comply with the legal limits on background contamination in Spain

Background pollution in Spain: Ozone



Source: MAGRAMA

Background pollution in Spain.
Average of annual mean concentrations



Source: MAGRAMA

In order to assess existing background pollution in Spain, an arithmetic average of the mean concentrations of all the stations included in the EMEP/GAW/CAMP Network for the selected pollutants has been used.

In recent years the average mean concentrations of sulphur dioxide, nitrogen dioxide and particles with a diameter smaller than 10 microns, have been lower than the legal limits. Additionally, the linear trend shows a generalised downward evolution, although it appears there is a slight increase in 2012 (provisional data) for PM10 and SO_2. Therefore, and without taking into account possible one-off situations where the legal limits are exceeded, the conclusion can be reached that existing background contamination in Spain of these pollutants is satisfactory, with vegetation protection guaranteed (the case of SO_2 and NO_2) as is the population's health (PM10), given that the established limits have not been exceeded.

The emission of ozone precursors, conditioned by the high levels of sunshine in Spain, causes the tropospheric ozone to be one of the most worrying problems, due to the effects on human health. Nevertheless, the number of days per year recorded by the EMEP/GAW/CAMP Network where the maximum daily eight-hour average exceeded a concentration of 120 μg/m^3 was lower than 25 days, being the objective limit established as of 2010 as a threshold to guarantee protection of vegetation. A similar situation occurs with the mean 5 year-running average for AOT40, which since 2010 has recorded lower values than the objective limit of 18,000 μg/m^3.

NOTES

- The indicator assesses general background pollution in Spain. This is presented for each pollutant and year as the mean concentrations recorded at all of the stations on the EMEP/ GAW/CAMP Network, which supplies approximate information on background air pollution in Spain. It does not provide information on discrete exceedance episodes that may occur in specific stations. Data for 2012 information is provisional.
- The acronym AOT40 stands for 'Amount Over Threshold'; this index is defined as the sum of the difference between the hourly concentrations above 80 μg/m^3 (= 40 parts per billion or ppb) and 80 μg/m^3 over a given period (that, in the case of protection of vegetation, are the months of May, June and July), using only the hourly values measured between 8:00 and 20:00 hours, central European time (CET), each day (Royal Decree 1796/2003, which transposes Directive 2002/3/CE; both respectively substituted by Royal Decree 102/2011 and Directive 2008/50/CE). In order to obtain the AOT 40 figure from the 1-hour ozone concentration at each of the stations covered, figures are taken for all those years in which 90% of more of the available data are valid, corrected to standardise all at 100% of possible data. Averages are calculated over five years (running averages) or, in the absence of a complete consecutive series of annual AOT40 figures, a minimum 3-year average is used (Annex I of Royal Decree 1796/2003, which transposes Directive 2002/3/EC into Spanish law; both substituted by RD 102/2011 and Directive 2008/50/CE).
- The EMEP (European Monitoring Evaluation Programme), established under the framework of the Geneva Convention, measures background air pollution. The Global Atmospheric Watch (GAW) is a project implemented by the World Meteorological Organisation (WMO). The Comprehensive Atmospheric Monitoring Programme (CAMP) is fruit of the OSPAR Convention and is designed to identify atmospheric inputs in the North-East Atlantic region and examine their impacts on the marine environment. The EMEP/GAW/CAMP network, which seeks to meet the aims of the aforementioned programme, monitors tropospheric levels of background air pollution and sedimentation on the Earth's surface in order to protect the environment.
- Royal Decree 102/2011, of 28 January, on improving air quality (which transposes Directive 2008/50/CEE of the European Parliament and the Council, of 21 May 2008), establishes limit values for the protection of health and critical levels for the protection of vegetation against NO_x and SO_2.

SOURCES

- Ministry of Agriculture, Food and Environment, 2013. Air Quality Data Base. Directorate-General for Environmental Quality and Assessment and Natural Environment.

FURTHER INFORMATION

- http://www.magrama.gob.es/es/
- http://www.aemet.es/
- http://www.eea.europa.eu/