Cleaner air for Europe: EU efforts to fight air pollution

- Certain EU air pollutant levels would have been up to 2.3 times higher without EU measures and technological improvements
- Each year, EU legislation and better technology help to avoid 80 000 premature deaths
- The clean air policy package could help reduce premature deaths by 206 000 in 2030

An EU air quality policy for better health, environment and economy

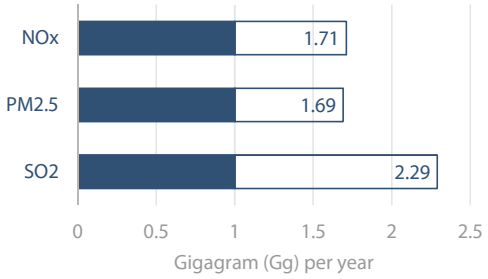
Air pollution knows no borders. Wind can carry pollutants over thousands of kilometres. Poor air quality impacts negatively on human health, ecosystems, crop yields and buildings. It is one of the main environmental causes of premature death, having claimed 5.5 million lives globally and over 430 000 in the EU in 2013. The European Commission estimates the **cost of air pollution** linked to the **degradation of health** in European society to amount to **€330 billion to €940 billion** per year.[1]

Developed since 1970 in the wake of acid rain fall that had been destroying European forests and polluting freshwaters, EU air quality policy, in combination with technological change, has contributed to reducing air pollution substantially.

Core EU legislative measures on air quality have put ceilings on national emissions of pollutants, and have set maximum levels of air pollutant concentrations in the air, and limit values for air pollutant emissions at source, through introducing EU-level standards for certain installations. These measures aim at protecting human health and the environment from the harmful effects of air pollutants. Research by Crippa et al.[2] shows that without the EU abatement measures and technological improvements effected since the 1970s, the level of the main air pollutants in the EU-27 in 2010 would have been 1.69–2.29 times higher (Figure 1). Furthermore, Turnock et al.[3] calculated that **80 000 premature deaths are avoided** each year in the EU thanks to air quality legislation and improved technologies.

Over the years, the **European Parliament** has maintained its ambitious stance on reducing air pollution, calling for higher national ceilings on emissions by 2030. It has repeatedly stressed the importance of timely and correct implementation of EU environmental law and has emphasised that the EU should do all it can to prevent the manipulation of tests for car pollution emissions and fuel consumption. It has also stressed the importance of aligning the EU's long-term air quality objectives with the WHO guidelines for reducing air pollution and limiting its impact on human health, ecosystems and biodiversity.

Figure 1 – 2010 emission levels in EU-27 with and without EU air quality measures and technology change



EU-27 emissions of NO_x, $PM_{2.5}$ and SO_2 in 2010 would have been respectively 1.71, 1.69 and 2.29 times higher than they actually were in 2010, if neither EU air quality policy nor technology had improved since 1970. To better illustrate the avoided increase in air pollution, Figure 1 presents the 2010 emissions of NO_x, $PM_{2.5}$ and SO_2 as equal to 1 Gg.

Data source: Crippa et al., 2016, Global Emissions EDGAR v4.3.1 and EPRS calculations.

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What is polluting the air and what are the impacts?

The **main primary air pollutants** in the EU are sulphur dioxide (SO_2), nitrogen oxides (NO_X – NO and NO_2), non-methane volatile organic compounds (NMVOCs), ammonia (NH_3) and particulate matter ($PM_{2.5}$ and PM_{10}).

- Ground-level ozone (O_3) and PM (which is also a primary pollutant) are **secondary pollutants** formed as results of reactions between other pollutants, mainly SO_2, NO_X, NH_3 and NMVOCs.
- The most problematic air pollutants affecting human health are PM, NO_2 and O_3, which may cause respiratory and cardiovascular diseases, and possibly premature death. In 2013, $PM_{2.5}$ was estimated to have caused 436 000 premature deaths in the EU, NO_2 – 71 000 and O_3 – 17 000.
- Airborne sulphur and nitrogen compounds from SO_2, NO_x and NH_3 may accumulate in water and soil and provoke ecosystem acidification (leading to a depletion of soil nutrients and a release of toxic metals) and eutrophication (leading to oxygen depletion in waters).
- Ground-level ozone is detrimental to forest growth and crop yields.

The main sources of air pollution due to **human activity** are transport (NO_X, PM), energy production and industrial activities (SO_2, PM, NMVOC), households (PM) and agriculture (NH_3).

EU contribution to better air quality

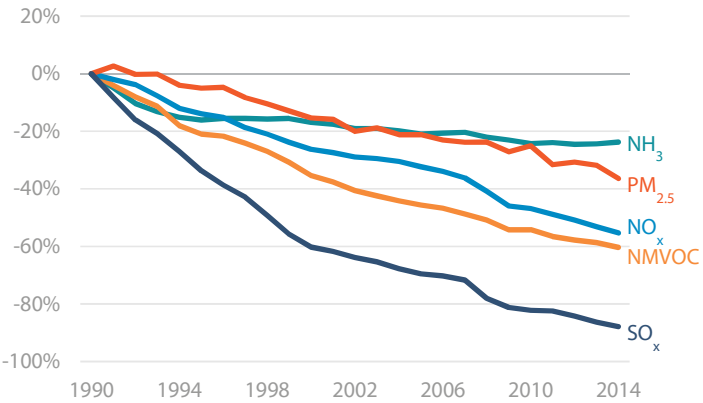
Legal provisions

EU environmental law aims at achieving a high level of protection, and is based on the principles of precaution, preventive action, rectification of damages at source, and on the 'polluter pays' principle. Member States can adopt more ambitious laws but cannot seek competitive advantages by lowering EU environmental standards. As 'guardian of the treaties', the Commission can initiate infringement proceedings against Member States for non-compliance with EU environmental law. The EU has transposed the 1979 UN Convention on Long-range Transboundary Air Pollution – a ground-breaking binding measure to reduce pollution in the northern hemisphere, whose scope has been extended in additional protocols (latterly in 2012, in the revised Gothenburg Protocol) – into EU environmental law.

EU success in fighting air pollution

In the last four decades, the EU has managed to further its economic activity while reducing air pollution levels. One of the best examples of these efforts is the reduction in sulphur dioxide emitted during the combustion of sulphur-containing fuels to avoid acid rain. In 1988, Directive 88/609/EEC set an upper limit for SO_2, NO_x and dust emissions from large combustion plants. Another positive shift took place when the European power sector switched to lower-sulphur-content fuels and installed new clean technologies. Road transport followed suit by introducing catalytic convertors to reduce harmful exhausts. Structural changes in central and eastern European (CEE) economies brought about further positive impacts. Between 1990 and 2014, the EU decreased overall sulphur oxide (SO_x – SO and SO_2) levels by 88 % (Figure 2). Currently, all Member States meet the SO_2 targets set for 2010 in the National Emission Ceilings (NEC) Directive. Reduced SO_2 and NO_x levels in the atmosphere have limited EU ecosystems' exposure to acidification, whose critical loads have dropped from 43 % in 1980 to 7 % in 2010.

Figure 2 – Change in main air pollutant levels, EU-28 (%)



Data source: European Environment Agency, 2016.

Since the 1990s, the EU has set binding 'Euro' standards to limit emissions from road vehicles (similar to the US standards in place since the 1970s). The Crippa et al. research[4] found that the Euro standards cut $PM_{2.5}$ emissions from road transport exhausts by 50 % globally, and that the implementation of Euro standards by EU and Japanese car-makers on global markets lowered $PM_{2.5}$ concentrations and thus **extended life expectancy** by 5 months in Europe and by 3.5 months in Japan.

As a condition for their EU accession, CEE countries had to align their national legislation with EU environmental standards and to reduce their air pollution levels accordingly. Pre-accession funding instruments (such as PHARE) helped them comply with over 200 major EU environmental legal acts. This financial assistance had a positive impact on the environment and helped tackle cross-border air pollution problems, such as that in the 'Black Triangle' region between Germany, Poland and the Czech Republic, mainly the result of burning sulphur-rich brown coal. Economic changes related to the fall of communism and successful cross-border cooperation brought about pollution-control measures, modernisation of combustion processes and closure of some of the most polluting power plants. A total of €13 million in PHARE funds was spent on the Black Triangle project between 1991 and 2001. From 1990 to 2004, the region saw a significant decrease in air pollutants and the progressive rehabilitation of the environment. Since the end of the 1990s, the region's annual average concentrations of SOx, CO, benzene and lead have been below the relevant limit values.

EU-level action brings added value

Recent studies show that without EU air quality policies and technological improvements since the 1970s, air pollution would have been much higher, and damage to the environment and human health would have been greater. The above-mentioned Turnock et al. study revealed that improved air quality resulting from EU measures and technological improvements is responsible for preventing around 38 % of the total number of premature deaths in the EU between 1970 and 2009. The research also estimated that perceived economic costs of poor air quality would have been 33 % higher without EU action and improved technology. The Crippa et al. publication on 40 years of improvements in European air quality estimated that these measures prolonged life expectancy in western and central Europe by 4–5 months.

Challenges ahead

Welfare costs due to premature deaths from air pollution are projected to more than double in European OECD countries by 2060, if no additional policy measures are taken. According to the EEA, progress in the further reduction of pollutants beyond 2030 is likely to be slow, unless additional measures are taken. The EU would thus risk not achieving its long-term air quality goals.

Although the EU has reduced the levels of all main pollutants over recent decades, many Member States exceed their national limits. Moreover, local concentrations of certain pollutants, especially due to road traffic in urban areas, exceed EU and WHO standards, causing health and environmental risks.

Indeed, as many as 23 Member States do not comply with EU air pollution limits. Some 10 countries exceed the 2010 targets set in the NEC Directive for either NO_x, NMVOCs or NH_3. Other breaches relate to excessive concentration values of air pollutants in the air, as defined in the Ambient Air Quality Directive (AAQD). Between 2012 and 2014, 8–16 % of the EU's urban population was exposed to harmful (as per the AAQD norms) PM and O_3 values. If the stricter WHO guidelines were taken as a reference, then harmful exposure would range between 50 % and 96 %. Moreover, if no further air quality measures are implemented, eutrophication might threaten over 50 % of EU ecosystems in 2020. Lack of compliance with EU air quality legislation can be exacerbated by poor coordination between governance levels in Member States as well as a lack of capacity at regional and local level, as highlighted by the Commission and the European Committee of the Regions.

Moreover, reducing nitrogen oxide emissions from cars remains a challenge. Their levels are higher than expected due to a gap between emission results from laboratory testing and real-life driving.

Finally, EU climate change policy is crucial for reducing levels of air pollutants. However, not all measures lead to shared benefits between the two policies, and some result in trade-offs. A coordinated approach based on scientific evidence could help EU policy-makers to strengthen synergies between the two fields.

New measures for air quality and their potential benefits

In response to the above-mentioned challenges, in 2013 the Commission presented a clean air policy package. It included a proposal for a review of the NEC Directive, expected to reduce, by 2030, the level of premature deaths caused by air pollution by half and the damage to ecosystems by one third, compared to 2005 levels. The estimated savings from implementing the package were placed at about €3.3 billion a year in direct costs caused by air pollution, and a further **€40 billion–€140 billion** in indirect costs (for instance, related to improving the health of EU citizens). Implementation costs were assessed at about €2.2 billion yearly by 2030. Furthermore, these measures could result in **206 000** fewer premature deaths in 2030 compared to today. The revised NEC Directive, adopted at the end of 2016, set targets for 2020 and 2030 and broadened its scope to include $PM_{2.5}$ also. The directive ensures EU ratification of the revised Gothenburg Protocol, which aims at further limiting acidification, eutrophication and ground-level ozone by 2020. Additionally, the package includes a new directive which regulates SO_2, NO_x and dust emissions from medium combustion plants. Finally, the Non-Road Mobile Machinery Directive was reviewed with the aim of reducing NO_x and PM emissions from non-road mobile machinery.

A report by the European Environmental Bureau (EEB) criticised the revised NEC Directive for not being more ambitious. Even if this directive is fully implemented, around 250 000 Europeans are still expected to die prematurely in 2030 because of air pollution. Therefore, the EEB called on the Member States to implement the new and existing air quality legislation (beyond the minimum requirements) and on the Commission to enforce it, whilst also proposing new sector-specific legislation.

The Commission is currently pursuing infringement proceedings against a dozen Member States for breaching EU air quality legislation. In addition, in February 2017 the Commission launched a first environmental implementation review with the aim of improving compliance. The review stresses the need for a new approach to mobility, as transport is currently the main source of EU air quality problems.

EU 'type approval' legislation on the pre-sale production, environmental and safety requirements for cars is currently being reviewed. In a first-reading position from April 2017, the European Parliament proposed to make the process more independent and to introduce stricter oversight of cars already in use. Additionally, new ways of measuring emissions during the type approval of vehicles have been adopted. The aim is to bring emissions of air pollutants from cars closer to the standards set in the legislation.

Europeans seem to understand that environmental challenges cross national borders and need European solutions. The 2017 EuroBarometer survey on perceptions and expectations indicated that three quarters of EU citizens support more European-level action in environmental protection.

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[1] These costs come, for instance, from premature mortality and restricted activity days; their size depends on whether low or high possible impact valuations are used. European Commission, Impact Assessment of the clean air policy package, SWD(2013) 531, Part 2/4, p.108.

[2] Crippa, M. et al., *Forty years of improvements in European air quality: regional policy-industry interactions with global impacts*, Atmos. Chem. Phys., 16, 3825-3841, 2016.

[3] Turnock, S. T. et al., *The impact of European legislative and technology measures to reduce air pollutants on air quality, human health and climate*, Environ. Res. Lett. 11 024010, 2016.

[4] Crippa, M. et al., *EU effect: Exporting emission standards for vehicles through the global market economy*, European Commission, Joint Research Centre, Ispra, Italy, 2016.

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