

# Revealing the costs of air pollution from industrial facilities in Europe

[EEA technical report No 15 2011](#)

## Questions and answers

### 1. What are the report's objectives?

The report from the European Environment Agency (EEA), 'Revealing the costs of air pollution from industrial facilities in Europe' presents an estimation of the costs of harm to health and the environment caused by pollutants released from industrial facilities included in the European Pollutant Release and Transfer Register (E-PRTR).

The results provide insights into the hidden costs of air pollution from industrial sources and provide answers to some important questions, including, for example:

- *which countries contribute most to the estimated damage costs of air pollution in Europe?*
- *which industrial sectors contribute most to the costs of air pollution in Europe?*
- *are a few sites responsible for a large share of the costs?*
- *can you give examples of some key individual facilities, which are responsible for the highest estimated damage costs?*

The EEA report also assesses the damage costs associated with different groups of pollutants – the 'traditional' regional air pollutants (e.g. nitrogen oxides, sulphur dioxide, particulate matter, etc.), heavy metals, organic micro-pollutants and the greenhouse gas CO<sub>2</sub>.

Such insights are particularly valuable in the context of Europe's current discussions on how best to move towards a resource-efficient and low-carbon economy by 2050.

Such studies will also inform the review of the EU air quality legislation launched recently by the European Commission and which will be completed by 2013.

### 2. What is the European Pollutant Release and Transfer Register (E-PRTR)?

The E-PRTR was established to improve European access to environmental information. An important objective of the E-PRTR is to encourage improvements in environmental performance by providing public access to information on the releases of pollutants. First published in 2009, the register contains information about the quantity and location of pollutants released to air, water and land, reported by more than 24 000 of the largest industrial facilities throughout Europe. Around 10 000 of these facilities report

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emissions to air. E-PRTR includes annual data for 91 substances and covers 65 detailed economic activities. The activities cover the main sectors

- energy;
- production and processing of metals;
- mineral industry;
- chemical industry;
- waste and waste water management;
- paper and wood production and processing;
- intensive livestock production and aquaculture;
- animal and vegetable products from the food and beverage sectors, etc.

### **3. What does 'damage cost' mean and how is it calculated in this report?**

'Damage costs' reflect the adverse impacts on human health and the environment caused by air pollutants as expressed in a common metric (i.e. a monetary value).

Such monetary values have been developed through cooperation between different scientific and economic disciplines, linking existing knowledge in a way that allows external costs to be monetised.

Damage costs incorporate a degree of uncertainty. These extend from the scientific knowledge concerning the impact of a given pollutant, to the exposure methods applied and the models used. However, when considered alongside other sources of information, they can support decisions, partly by drawing attention to the implicit trade-offs inherent in decision-making.

To assess the damage costs from an individual industrial facility, it is possible to perform a detailed modelling of its pollution impacts. However, such intensive analysis would be extremely resource intensive and costly if the aim were to model simultaneously and in detail the individual emissions and impacts from the approximately 10 000 facilities covered by the E-PRTR. A simplified approach to assessing damage costs was therefore developed, and is described in the EEA report.

Included in the estimation of damage costs of the regional air pollutants in this study is an extensive list of health impacts, ranging from mortality to days with respiratory or other symptoms of ill health. Additional impacts such as crop damage from exposure to ozone, and material damage from SO<sub>2</sub> emissions is also included. For the heavy metals and organic micro-pollutants, the analysis focuses on health effects, particularly cancers but also, for lead and mercury, neuro-toxic effects leading to IQ loss and subsequent loss of earnings potential. Monetisation of greenhouse gas emissions follows a different approach to that adopted for the other pollutants considered, using an estimate of marginal abatement costs.

#### **4. How reliable are the models and data used in the report?**

The report from the EEA builds on existing policy tools and methods, such as those developed under the EU's Clean Air For Europe (CAFE) programme for the main air pollutants. The CAFE methods are regularly applied in cost-benefit analyses to support EU and international policymaking on air pollution. The report employs other existing models and approaches used to inform policymakers about the damage costs of heavy metals, organic micro-pollutants and CO<sub>2</sub>.

There are differences between the selected pollutants in terms of the extent of current knowledge about how to evaluate their impacts. There has been extensive past debate about the methods used to estimate impacts and associated damage costs of the main air pollutants under the CAFE Programme, and some consensus (though not universal) has been reached in this area. There has been less debate, however, about the approach used for the heavy metals, trace organic pollutants and CO<sub>2</sub>, so the methodology for these pollutants may be considered less robust.

The emission data used in the study is from the latest information reported each year by industrial facilities and which are publicly available from the E-PRTR. Information in the E-PRTR is subject to an annual review process, and feedback is provided to countries concerning the quality of the submitted data. Recommendations are also included in the EEA report concerning how the E-PRTR could be improved to benefit future assessments.

#### **5. Does the study suggest that industry in Europe is not doing enough to safeguard health and the environment?**

In using the emissions reported by the facilities themselves available through the E-PRTR, the EEA report does not assess whether the emissions of a given facility are consistent with its legal requirements for operation.

At the European, national and local scales there are a range of legal measures in place that aim to ensure that industrial facilities operate within agreed parameters which do not adversely affect human health and the environment beyond what is considered acceptable by policymakers. An important function of the national and/or local competent authorities is to ensure that the facilities within their jurisdiction operate in accordance with their permitted operating conditions.

#### **6. The study examines damage costs from industrial facilities, but what about benefits?**

Industry provides many important economic and social benefits such as producing the goods and products that society consumes, employment and tax revenues. The report does not assess these. It is important in any consideration of the overall impacts of industry that such benefits are fully recognised.

## **7. Why is the power sector the largest contributor to the total estimate of damage cost?**

The industrial facilities covered by the analysis include large power plants, refineries, manufacturing combustion and industrial processes, waste and certain agricultural activities. The power sector includes some of the largest facilities in Europe which release the greatest amount of pollutants and hence impose the highest damage costs.

It is important to note that the efficiency of a large power plant can be higher than the smaller combustion facilities used in the other sectors.

Furthermore, including certain other sectors excluded from EEA's analysis, such as transport and household combustion will also contribute significantly to overall damage costs, especially as population exposure to pollutants from these sources is often higher than from the industrial sources included in the E-PRTR.

## **8. Why are there large variations between facilities and countries?**

Countries such as Germany, Poland, the United Kingdom, France and Italy, contribute the most to the total damage costs as they contain a high number of large facilities. Large facilities release greater amounts of pollutants and hence impose higher damage costs.

However, when the national damage costs are corrected to reflect the productivity of national economies, the ordering of countries changes significantly. The emissions from a number of eastern European countries (Bulgaria, Romania, Estonia, Poland and the Czech Republic) are then more important in terms of their damage costs.

Similarly, ranking facilities according to their aggregate emission damage costs does not provide information of the efficiency of production at a given facility. The report illustrates the potential differences in facility efficiency by using CO<sub>2</sub> emissions as a proxy for fuel consumption.

## **9. How do these pollutant emissions affect the air quality and environment in Europe?**

The report assesses the damage costs arising from a number of important pollutants that can harm human health and or the environment, including:

- the regional and local air pollutants: ammonia (NH<sub>3</sub>), nitrogen oxides (NO<sub>x</sub>), non-methane volatile organic compounds (NMVOCs), particulate matter (PM<sub>10</sub>) and sulphur oxides (SO<sub>x</sub>);
- heavy metals: arsenic, cadmium, chromium, lead, mercury and nickel;
- organic micro-pollutants: benzene, dioxins and furans, and polycyclic aromatic hydrocarbons (PAHs);
- carbon dioxide (CO<sub>2</sub>).

Each pollutant affects air quality in a different way. The main regional air pollutants, in addition to being important pollutants in their own right, also contribute to the formation of ground-level ozone and particulate matter in the atmosphere, aggravating existing respiratory conditions and causing or

aggravating cardiovascular and lung diseases. Pollutants such as SO<sub>2</sub>, NH<sub>3</sub> and NO<sub>x</sub> cause acidification and/or eutrophication in the environment.

Heavy metals can build-up in soils and sediments, and can bio-accumulate in food chains. They are typically toxic to both terrestrial and aquatic ecosystems. The different organic pollutants cause different harmful effects to human health and to ecosystems, but each is a known or suspected human carcinogen; dioxins and furans and PAHs also bio-accumulate in the environment.

## **10. How can the damage costs from facilities be reduced?**

Increasing the environmental efficiency of industrial facilities is an important way in which environmental impacts can be reduced e.g. by reducing the emissions per unit of production or fuel used. Increasing the share of clean renewable energy sources in Europe is another.

Moving to cleaner burning fuels is one such way in which improved environmental efficiency might be achieved e.g. by shifting from high-sulphur solid (e.g. coal) and liquid (e.g. heavy fuel oil) fuels to low sulphur fuels (such as natural gas). The introduction of modern pollutant abatement techniques more widely across Europe will further help reduce the environmental impacts from industrial facilities. Many European facilities have also made good progress in improving the technical processes and controls within manufacturing which has helped to reduce emission of a number of pollutants including heavy metals and organic pollutants.

### **Further EEA information on air pollution**

The EEA has recently released a number of other publications addressing various aspects of air pollution in Europe. These include:

- The '[Air Quality in Europe – 2011](#)' report summarising Europe's air quality status;
- Updated [indicator factsheets](#) document the emissions from different sectors and the past emission trends of a number of air pollutants;
- The '[Laying the foundations for greener transport – TERM 2011](#)' report that explores the environmental impact of transport;
- '[Air pollution impacts from carbon capture and storage \(CCS\)](#)' assesses the potential impacts on air pollutants from the introduction of CCS in Europe.

In 2012 the EEA also plans to publish an assessment of the potential for large combustion plants in Europe to reduce their emissions of selected air pollutants further. Another EEA report will investigate the extent to which the EU National Emission Ceilings Directive's environmental objectives for 2010 have been attained.