European Environment Agency

# Understanding pollutant emissions from Europe's cities

## Highlights from the EU Air Implementation Pilot project

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Information about the European Union is available on the Internet. It can be accessed through the Europa server (www.europa.eu).

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark
Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99
Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

## The EU Air Implementation Pilot project

In 2012 the European Environment Agency (EEA) and the European Commission's DG Environment established the Air Implementation Pilot project:

http://www.eea.europa.eu/air/pilot

By exchanging experiences among cities and looking in-depth into their air quality activities, the project aims:

- to explore how far the implementation of EU air quality legislation has progressed at regional or urban levels (with a focus on cities);
- to inform the European Union about results and experiences from the local level, and to provide proposals for improved implementation measures and action plans to improve air quality.

The Air Implementation Pilot addresses a number of issues relevant for local air quality management. These include:

- assessing the status of local emission inventories and how well they inform the development of local action plans to improve air quality;
- examining how air quality models take into account different air pollutant sources and how they are linked to air pollutant concentrations at the city level;
- identifying how cities communicate air quality status to the public and sharing innovative ideas in particular those well received by citizens.

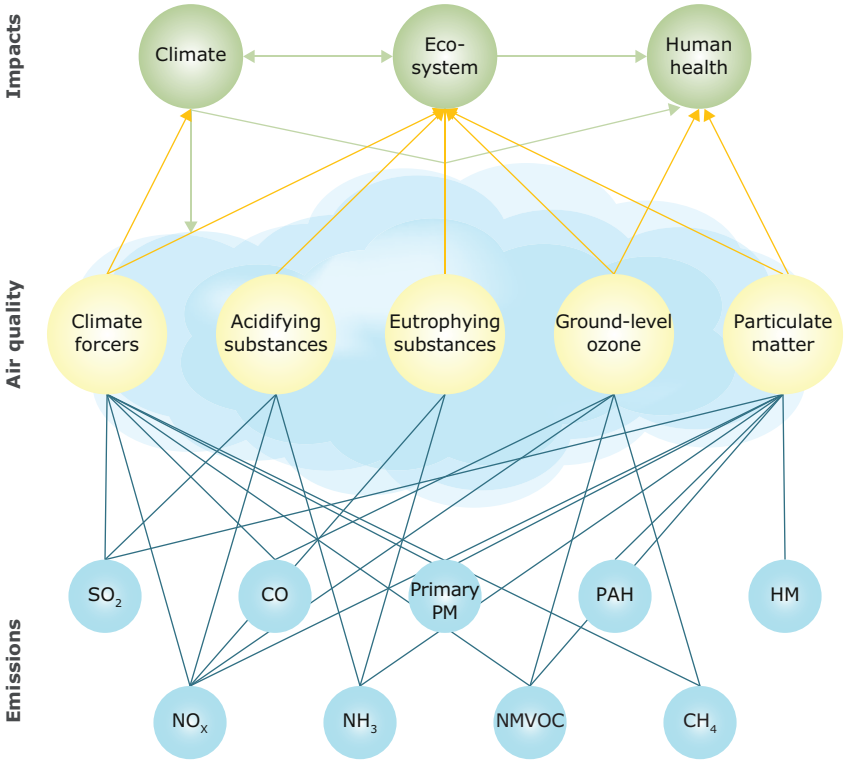
# Introduction

Up to 30 % of Europe's urban citizens are potentially exposed to levels of air pollution that exceed some of the European Union air quality standards set to protect human health.

2013 has been designated the European '**Year of Air**'. Current air policy is being reviewed with a focus on finding ways to improve the quality of the air we breathe. Understanding the types and sources of air pollution in our cities is crucial for developing effective strategies to reduce local sources of air pollution.

Air pollution is a complex problem. Different pollutants from a large variety of sources interact in different ways in the atmosphere, affecting our health, environment and climate. Many air pollutants also act as greenhouse gases in the atmosphere thereby contributing to climate change. Understanding the relationships between measures designed to reduce emissions of air pollutants and greenhouse gases is therefore important.

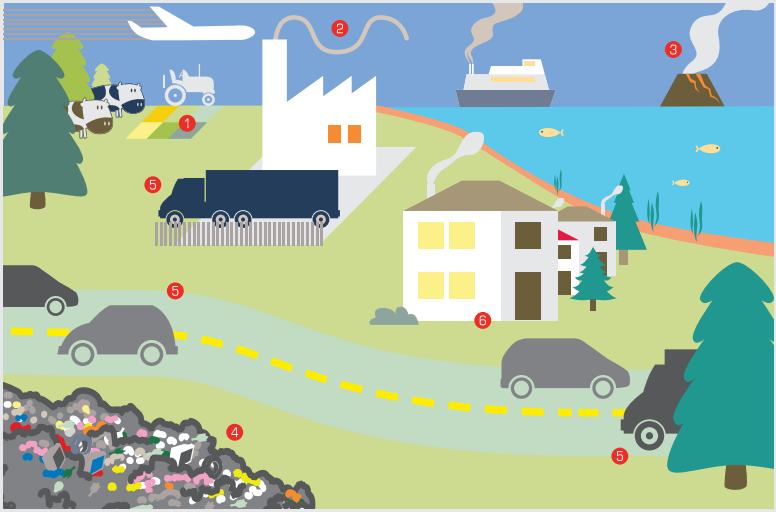
**Interactions among air pollutants and their potential impacts**




**Source:** EEA.

## Sources of air pollution in Europe

Air pollution is not the same everywhere. Different pollutants are released into the atmosphere from a wide range of sources, including industry, transport, agriculture, waste management and households. Certain air pollutants are also released from natural sources.




**1 /** Around 90 % of ammonia emissions and 80 % of methane emissions come from **agricultural activities.**

**2 /** Some 60 % of sulphur oxides come from **energy production and distribution.**

**3 /** Many **natural phenomena,** including volcanic eruptions and sand storms, release air pollutants into the atmosphere.

**4 / Waste (landfills), coal mining and long-distance gas transmission** are sources of methane.

**5 /** More than 40 % of emissions of nitrogen oxides come from **road transport.**

Almost 40 % of primary $PM_{2.5}$ emissions come from transport.

**6 / Fuel combustion** is a key contributor to air pollution – from road transport, households to energy use and production.

**Businesses, public buildings and households** contribute to around half of the $PM_{2.5}$ and carbon monoxide emissions.

**Source:** EEA.

# Knowledge of emissions helps improve air quality

'Emission inventories' are collections of data that show the amounts of air pollutants and/or greenhouse gases released by different activities occurring within a defined geographical area.

For cities, the availability of an emission inventory allows:

- identification of the local sources of pollution and the relative importance of each in terms of the released emissions;
- knowledge on the contribution each source makes to the ambient air quality by using air quality models, and knowledge on the extent to which local air quality problems are caused by sources within or outside the city;
- identification of which sectors or sources it is important to control to improve local air quality;
- following the effectiveness of local measures undertaken to improve air quality by monitoring the calculated change in emissions with time.

At national or international level, emission inventories are key tools for:

- monitoring progress towards emission reduction targets (e.g. the EU National Emission Ceilings Directive for air pollutants, or the UNFCCC's Kyoto Protocol for greenhouse gases);
- monitoring the implementation of sectoral legislation and its effectiveness in reducing or controlling emissions.

# Compiling existing knowledge of local emissions

Studies and compilations of air quality and greenhouse gas emissions data from the twelve European cities, shown in the map below, were reviewed as part of the Air Implementation Pilot.

Findings about emission inventories include:

- Good quality input data is essential (e.g. on traffic statistics, household combustion practices, construction emissions etc.) but can be challenging for local authorities to obtain.

- There are significant differences in the comparability and consistency between the inventories of different cities e.g. with respect to the methods and emission factors used, which sources are included and how these are defined, the timing of updates, the format and storage of data.

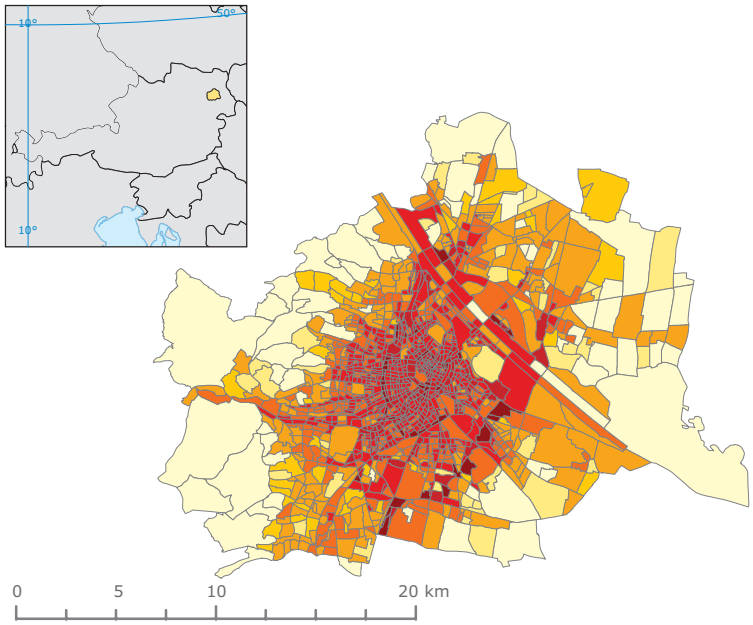
- There is a need for improved guidance for estimating fugitive and diffuse emissions (e.g. particles resuspension from traffic, construction work, etc.), for quality assurance/ quality control and for establishing local scale emission inventories for air pollutants in general. In contrast, more information on compiling greenhouse gas emission estimates at local scale is available.


**Source:** EEA.

- Several cities actively consider and integrate synergies between management of air quality and greenhouse gases when planning local actions and solutions to environmental problems.

- A forum or platform for exchange of information, experiences and application of local action plans and results could be beneficial for local practitioners.

**An example of an emission inventory — spatial distribution of Vienna $NO_x$ emissions in 2006 (g/m²)**




**Source:** Umweltbundesamt.

# Selected examples of urban emission inventory initiatives and guidance documentation

**CiteAir II**
http://www.citeair.eu/

CiteAir II was an EU funded project with the aim of providing up-to-date information on air quality, greenhouse gases (GHG) and emissions in European cities to local and regional authorities.

One of the outputs of the project was a guidebook addressing the integration of greenhouse gases into air pollutant emission inventories at the local scale (covering $CO_2$, $PM_{10}$, $NO_X$, $NO_2$).

**Covenant of Mayors (CoM)**
http://www.eumayors.eu

The CoM is a grouping of more than 4 800 cities that have voluntarily committed to increase energy efficiency and use of renewable energy sources. To support their implementation of sustainable energy action plans (SEAP), each city must compile a GHG emission inventory based on local energy consumption.

A SEAP manual provides specific guidance to produce baseline emission inventories at urban level and includes emission factors for the main emission sources (fuels, electricity etc.), advice for activity data collection, and help to use existing tools.

**EU $CO_2$ 80/50 — METREX**
http://euco2.eu/

This project examined in which ways and in what regions an 80 % reduction target for $CO_2$ emissions could be achieved by 2050.

$CO_2$ emissions and other greenhouse gases and energy data for 18 cities and three regions were compiled in the form of an urban emission inventory and mitigation scenarios were applied with a commercial inventory tool.

**The EMEP/EEA Air Pollutant Emission Inventory Guidebook**
http://www.eea.europa.eu/emep-eea-guidebook

The EMEP/EEA Guidebook provides practical guidance and data for estimating emissions of air pollutants from a range of sources. The methods and emission factors it contains for sources such as household stoves, road transport etc. can be used for estimating city emissions.

**FAIRMODE**
http://fairmode.ew.eea.europa.eu/

The Forum for Air Quality Modelling (FAIRMODE) is a joint initiative of the EEA and the European Commission's Joint Research Centre (JRC). Its aim is to bring together air quality modellers and users in order to promote and support the harmonised use of models by EU Member States, with emphasis on their application to the European Air Quality Directive. A sub-group of FAIRMODE addresses urban emissions and projections.

**Environment Tools**
http://www.environmenttools.co.uk/

This website lists over 500 environmental accounting software tools, and techniques for measuring and monitoring. A Local Air Quality Management Tools listing is available which supports authorities in the Local Air Quality Management process.

**C40 Cities: Climate Leadership Group**
http://www.c40cities.org/

This global campaign offers a platform and information for city representatives focused on greenhouse gas emissions reductions and action plans.

The campaign published the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC) Pilot Version 1.0 which is mainly based on the IPCC approach for estimating emissions.

**CDP — the Carbon Disclosure Project**
https://www.cdproject.net/en-US/Programmes/Pages/CDP-Cities.aspx

The CDP works as a non-profit organisation and offers a voluntary climate change reporting platform for city authorities. By submitting questionnaires to the organisation, cities' emission inventories can be analysed as to how far their emissions can be managed and reduced.

# Where to find additional information for compiling inventories?

Compiling an emission inventory at (sub-)urban scales is challenging. A wealth of information is available but it can be time consuming to bring all the information together. The following table provides some suggested publicly available sources of information for specific topics.

| Topic | Air pollutants | Greenhouse gases |
|---|---|---|
| Source description | 1, 2 (partly), 3 | 2, 6 |
| Emission factors for: | | |
| Energy sector | 1 | 2 |
| Residential sector | 1 | 2 |
| Transport sector | 1, 3, 8 | 1, 2, 3, 8 |
| Agriculture sector | 1 | 2 |
| Waste sector | 1 | 2 |
| Fugitive emissions | 1 | 2 (only VOC) |
| Tools or templates | 3, 4, 5, 6 | 2, 3, 6 |
| Uncertainty | 1, 3, 7 | 2, 3, 7 |
| Guidelines | 1, 5 | 2, 6 |

## Information sources


1) EMEP/EEA Emission Inventory Guidebook, http://www.eea.europa.eu/emep-eea-guidebook

2) 2006 IPCC GHG Guidelines, http://www.ipcc-nggip.iges.or.jp

3) COPERT IV road transport emissions software, http://www.emisia.com/copert/

4) CollectER inventory database system, http://acm.eionet.europa.eu/country_tools/

5) CITEAIR, http://www.citeair.eu/

6) CoM, http://www.eumayors.eu/Library,84.html

7) TREMOVE, http://ec.europa.eu/environment/air/pollutants/models/tremove.htm

8) Handbuch der Emissionsfaktoren, HBEF, http://www.hbefa.net/


## Additional information

For those compiling local emission inventories a range of other guidance material can be available from national or regional sources e.g. from local authority networks, environmental protection agencies etc. The following links provide examples of such guidance material.

http://www.iaqm.co.uk/guidance.html
The Institute of Air Quality Management (IAQM) provides information about action plans and measures as well as air quality management (e.g. guidance of AQ monitoring of demolition and construction sites).

http://www.epa.ie/downloads/advice/air/emissions
The Environmental Protection Agency of Ireland presents a sample of guidance documents about air monitoring of stationary emission sources

and climate change background information (e.g. Monitoring and Reporting for Greenhouse Gas Emissions 2008 — (MRG2) — New guidelines and EPA guidance and template).

http://www.polisnetwork.eu
Under the framework of the network POLIS European cities and regions are working together for developing innovative technologies and policies for local transport. Actual information about meetings and projects in the sector transport is given.

http://www.klimabuendnis.org/co2-monitoring0.html#c2199
In the framework of a research project of the German Federal Agency for Environment and together with 'Climate Alliance' (European network of local authorities committed to the protection of the world's climate) the Institute for Energy and Environmental Research (IFEU Institute) developed in the year 2009 the Climate Cities Benchmark (CCB). Within the scope of establishing a $CO_2$ emission database the Climate Alliance developed a set of rules for monitoring local $CO_2$ emissions which are in line with the IPCC and Covenant of Mayor guidelines. The description is available only in German.

http://www.lanuv.nrw.de/emikat97/startfr2.htm
The German agency 'Landesamt für Natur, Umwelt und Verbraucherschutz' of the region North Rhine-Westphalia offers information about local air quality, emission source definitions and emission monitoring. The description is available only in German.

http://www.inemar.eu/xwiki/bin/view/InemarDatiWeb
Agenzia Regionale per la Protezione dell'Ambiente (ARPA) Lombardia presents on its webpage background information around emission inventories for the region Lombardy which were compiled for the years 2003, 2005, 2007, 2008 and 2010. This is used as an internal guidance document and it is available in Italian.

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**Understanding pollutants emissions from Europe's cities**
Highlights from the EU Air Implementation Pilot project

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This brochure, produced by the EEA, summarises findings on local scale emission inventories from the EU Air Implementation Pilot project. It also highlights sources of information and guidance for those compiling city inventories.

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**Contacts**

Further information concerning the activities of the EU Air Implementation Pilot project and the broader theme of air pollution, can be found on the website of the EEA:

http://www.eea.europa.eu/air/implementation-pilot

http://www.eea.europa.eu/air

For additional information please contact:

eea.enquiries@eea.europa.eu

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European Environment Agency
Kongens Nytorv 6
1050 Copenhagen K
Denmark

Tel.: +45 33 36 71 00
Fax: +45 33 36 71 99

Web: eea.europa.eu
Enquiries: eea.europa.eu/enquiries

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