Analysis of co-benefits of air pollution, noise and climate change policies on a local scale

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Front page picture:
<Source: copyrights by Oeko-Institute, 2012, Mega city projects focus mainly on the residential, transport and industry sectors for reducing CO\textsubscript{2} emissions by implementing action plans on local level.>

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1 Introduction

1.1 Man-made Pollution

Climate change (CC) is one of the top ten topics discussed in global media today. In the light of the projected increase in the global temperature by approx. 2°C by 2050 major problems will increasingly occur all over the world. For a long time there was much controversy about whether the temperature increase results from man-made. But several scientific studies could verify the relationship between temperature increase and man-made activity. An increasing temperature causes reduced water availability by decreasing of rainfall and the increasing intensity of heat waves affect air pollution and above all human health. Alongside the effects of pollution the increase in temperature results in more deaths.

The effect of greenhouse gases (GHG) like carbon dioxide (CO₂), nitrous oxide (N₂O) and methane (CH₄) and furthermore water vapour and ozone on the atmosphere is to absorb and emit radiation within the thermal infrared range. This process is the so-called greenhouse effect. Other GHGs in the atmosphere are entirely man-made such as the halocarbons and other chlorine- and bromine-containing substances.

Air pollutants (AP) like fine particles (particle matter, PM), in particular black carbon, also have impacts on climate change effects and thus on human health. As an example black carbon (BC) is a climate forcing agent; emissions occur due to incomplete combustion of fossil fuels or biofuel from anthropogenic as well as from natural sources. With its global warming potential the Earth atmosphere absorbs heat and reduces the albedo.

Further primary air pollutants are sulphur dioxide (SOₓ), nitrogen oxides (NOₓ) and volatile organic compounds (VOCs). With their chemical reactions in the atmosphere they influence the formation of ground level ozone or causes eutrophication in the aquatic environment. In the industrialised countries, they are mainly produced by the energy and transportation sectors (Slanina and Hanson, 2006).

Both, greenhouse gases and classical air pollutants mostly have the same sources and their emissions interact with the atmosphere. Together, they cause a variety of environmental effects on the local, regional or global levels (IPPC 2007, Fourth Assessment Report, Chapter 11.8.1.), but there are differences on local and temporal levels between air pollution control and climate change effects. Air pollution occurs earlier and closer on ground level while climate impacts affect in long-term and globally. Ways in which noise effects could be
reduced by CC or AP mitigation strategies are not discussed further. But with the implementation of better technologies (e.g. electric vehicles) which goes along with of reducing CC/AP, noise can be reduced as well.

Since the third assessment report (TAR) by the Intergovernmental Panel on Climate Change (IPCC) in 2001 was published, the co-benefits of climate change mitigation policies and air pollution control have been discussed (see chapter 7.2.2.3 Ancillary Benefits and Costs and Co-benefits and Costs, IPCC TAR). Numerous scientific publications and studies have underlined a variety of co-benefits of greenhouse gas mitigation on air pollution for industrialised and developing countries.

**Figure 1-1  Mechanism for the Generation of Ancillary impacts**

The above figure (Figure 1-1) of the IPCC TAR presents the development of ancillary benefits of GHG emission reduction policies. The definition of “ancillary impacts” reflects that in some cases the benefits might be negative and from the perspective of policies the abatement of local air pollution caused by GHG mitigation might be an additional benefit.

As it is mentioned the economic and institutional system within a country influences the reductions in GHGs, changes in other pollutants, and mitigation costs. Changes in GHG emissions in turn lead to changes in air and water pollution, which ultimately extend throughout the environment and feed back into the economy. In many cases, when measured using standard economic techniques, the health and environmental benefits add up to substantial fractions of the direct mitigation costs. For an example decarbonisation strategies could lead to significant direct cost savings because of reduced air pollution costs.
Another polluter is noise, defined as human, animal, or machine-created environmental noise, that harms and stresses the activity or balance of human or animal life. The definition is pursuant to the Directive 2002/49/EC article 10.1. This directive should give a common approach for avoiding, preventing or reducing the harmful effects of environmental noise. The main target is integrated noise management. In the first step the competent authorities in the European member states had to produce strategic noise maps for major roads, railways, airports and agglomerations. The second step is to inform and consult the public. The third step is to produce local action plans to reduce noise. In general, noise is not considered together with climate change or air pollution.

1.2 Impact from Cities

The increase of population living in urban areas continues, especially in the developing world. Close to half of the world's population now lives in urban areas (TAR, 2001) and most cities with more than 1 million inhabitants are in the developing world where cities will reach a size around 10 million inhabitants. As it is mentioned in the TAR the future world might be less dominated by "megacities" (cities with a population of over 10 million population) than previously predicted. Nevertheless, this dramatic trend contributes to local air pollution and to GHG emissions. Trends toward urbanisation mean that the impacts of climate change on human settlements in most countries, if they occur, will increasingly affect urban populations, not rural or traditional settlements (TAR, 2001, chapter 7.2.1, http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg2/308.htm).

Taking into account that two thirds of the world’s energy is consumed in cities and that this share has been forecasted to increase further to 73% by 2030 (IEA/OECD 2008, p. 179) the responsibility of cities to enforce mitigating climate change policy is unavoidable. Accordingly, cities have a major role to play in monitoring and reducing GHG emissions and mitigating climate change. If Europe wants to succeed in reducing its GHG emissions by 20% up to 2020 it will require close monitoring of the policies and measures at the Member State (MS) level, in particular in the non-ETS sectors under the Effort Sharing Decision (Decision 406/2009/EC) and cities have to adopt their policies on that goal.

Meanwhile, the challenge to implement these strategies is for many cities courteous and therefore, they take part on megacity projects for offering their inhabitants sustainability and green life style. The adoption of the Leipzig Charter on Sustainable European Cities (2007) and the launch of the Covenant of Mayors (2009) showed that many cities are well prepared in terms of climate policy.

1.3 City Projects

Since the early 1990’s major cities have joined forces to build international networks. ‘Eurocities’1 is one of them and supports the exchange of best technologies between advanced cities and cities that do not yet have a complete strategy as mentioned in the Commission’s white paper on climate adaptation in 2001. From 2005 onwards with the

---

1 http://www.eurocities.eu/eurocities/home
‘declaration on climate change’ local authorities assumed responsibility of implementing sustainable systems. The ‘Green Digital Charter’ was launched at the end of 2009 and should encourage cities to reduce the carbon footprint of their information and communication technologies (ICT) which lead to more energy efficiency in areas such as buildings, transport and energy. The charter carries more than 20 signatories and is supported and promoted by the EUROCITIES-led Networking intelligent Cities for Energy Efficiency (NiCE) project, which began in September 2011.

Five key challenges are always in the foreground of all the initiatives:

Energy efficiency by

- incentive renovation and insulation of private buildings where possible;
- improving public transport and overall urban transport management;
- investing in more energy efficient heating and cooling, such as through district heating and cooling, and seasonal thermal storage;
- increasing energy efficiency of public lighting, for instance through the installation of LED lighting.

Green growth by

- a shift toward a development where environmental protection and economic growth complement each other.

Innovation by

- the cities and their partners are also leaders of ‘public’ and ‘social’ innovation, themselves significant drivers of Europe’s global competitiveness and city success.

Mobility by

- implementing a fully integrated approach linking transport, environment and economic development.

Smart cities by

- utilisation of networked infrastructure to improve economic and political efficiency and enable social, cultural and urban development. Smart cities can be identified (and ranked) along six main axes or dimensions. These axes are: a smart economy, smart mobility, a smart environment, smart people, smart living, and, finally, smart governance.

City initiatives or projects are presented in this study in detail and are analysed in terms of their objects, action plans and methodology. To get a good overview of the emission sources and their respective reduction potentials cities need appropriate tools to establish a GHG emissions inventory. As a result, action plans to reduce GHG emissions at local level can be prepared and better conducted (Bader and Bleischwitz, 2009). This paper takes into account
that international city networks as well as national initiatives have developed such tools at local level.

1.4 EU Directives

The important directive is surely the ‘Effort Sharing’ Decision No 406/2009/EC on the effort of Member States to reduce their greenhouse gas emissions (see here Article 28 and 29, so that “in addition to individual Member States, central governments and local and regional organisations and authorities, market actors — together with households and individual consumers — should be involved in contributing to the implementation of the Community’s reduction commitment, irrespective of the level of greenhouse gas emissions which can be attributed to them.”). The implementation of clean air, water and ambient policies in cities were supported by several EU directives (e.g. National emissions ceiling\(^2\), NEC, Directive or Directive 2008/50/EC, Clean air for Europe, CAFE) which will be broken down on local level. Most of them are characterised by new measurement campaigns, technology standards and best available techniques (BAT) (see air and water quality and waste water handling, noise). Other directives regulate the energy consumption among end users and energy suppliers (e.g. energy efficiency, ecodesign, F-gas regulation). All of these directives or regulations focus on abatements strategies for establishing healthy and better environmental conditions in cities. The following directives are the main pillars for the implementation of the European Union (EU) energy and climate program:

- Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from Large Combustion Plants;
- Directive 2002/49/EC article 10.1.: Issue action plans aiming at improving the noise situation;

\(^2\) NEC objective is: to limit emissions of acidifying and eutrophying pollutants and ozone precursors in order to improve the protection in the Community of the environment and human health against risks of adverse effects from acidification, soil eutrophication and ground-level ozone. (see here http://rod.eionet.europa.eu/instruments/522)


1.5 Methodology

This research project examines the international city networks and national initiatives that have developed emission inventories or sustainable instruments at local level, many of which are comprehensive and display a great variety of different functions. The growing amount of material available on how to construct and implement mitigation and adaptation policies lead to a need for comparative analysis and assessment. Thus, the main aim of the project is to obtain a good understanding and overview of the results of studies that have already been performed in this area. Another aim of this study is to examine whether local GHG inventories are comparable, and if not, how greater comparability could be achieved. These methodological challenges provide a basis for the identification of the main points from which differences between inventories could stem.

The first section of the project compiles existing initiatives and projects which have been assessed regarding local initiatives in the CC/AP mitigation field and provides an overview of the way the project was managed, the project’s objectives and what the outcome of the campaign was. Secondly, if an emission inventory on local level has been compiled, it is examined which pollutants and sectors were analysed and what kind of methodology or guidance was applied. And thirdly, if information on policies and measures was considered and co-benefits between AP, CC or noise regulation were linked is also examined. Finally, findings of the projects are summarised.

In section two, critical variables for the analysis of local GHG inventories are inferred from section one. For the analysis a matrix was developed; as an example the following questions were specified:

• How do the methodologies which underlie different GHG inventory tools differ?
• What variables (activity data, emissions) were considered in the inventories and are available?
• Can different GHG inventory tools be compatible - and/or interoperable?
• Is the methodology applied comparable?
• Is a qualitative vs. quantitative analysis of the effect of the policies possible?
• Is there a regular update of data in the initiative considered and is data public available?
An overview of the main results of the analysis is provided, highlighting the methodological differences via a matrix that could be observed during the project.

In a third part a questionnaire based on the matrix information is applied to specific cities (Berlin, Madrid, Malmö, Milan, Ploiesti, Prague, Vienna and Dublin) to analyze in which way action plans vary.

Finally, the paper discusses these results and gives research and policy recommendations.
2 Compilation of different city projects

2.1 Covenant of Mayors (CoM)

2.1.1 Overview

One of the ambitious projects is the Covenant of Mayors (CoM) initiative. After 2008 when the EU climate and energy package was adopted the CoM was launched to support the implementation of sustainable energy policies by local authorities. The CoM has been voluntarily signed by more than 400 municipalities (local and regional authorities), which have, committed their own initiative, to the ambitious target of reducing CO₂ emissions and energy consumption in their cities beyond the 20% EU objectives by 2020. The share has to be increased by at least 20 % and the signatories commit to participating annually in the conference of European mayors for sustainable energy.

Besides the EU signatories (3699 signatories were published on the web in March 2012), cities from the United States, Argentina and New Zealand have expressed their interest in getting involved in the Covenant process.

With the signature municipalities have to adjust administrative structures, compile emission inventories based on the local energy consumption (as a base year it is recommended 1990) and prepare sustainable actions plans (SEAPs, 1189 SEAPs are published on the web in March 2012) in order to describe how the CO₂ emissions reduction will be reached. The project considers a wide range of information of local actions, benchmarks (relevant examples of local initiatives) on its webpage (http://www.eumayors.eu/about/covenant-of-mayors_en.html).

Signatories will have to submit a report evaluating results the state of implementation of actions every two years and emissions inventories every four years. Then cities will report to their citizens and to the Commission once every two years to monitor implementation. Having signed to the Covenant process the cities accept termination of their involvement in case of non-compliance.

The Commission gives support to the Covenant of Mayors Office (CoMO) and the Joint Research Center (JRC) to provide technical assistance for the preparation of action plans and to create and operate an office for co-ordination and networking of the cities.

Concerning financing, an estimated 36 % of the total EU budget for the 2007 to 2013 period is allocated to the structural cohesion funds. Financial sources are available at local, regional and national levels, including from:

- local authorities’ own resources,
- local partners’ resources, and
- municipal and regional subsidies.
- Public-Private Partnerships

At EU level, the Covenant is also a well-organized institutional co-operation with the involvement of the Committee of the Regions, the European Parliament and the European
Investment Bank (EIB). In the last 5 years the EIB spent almost EUR 30 billion supporting urban transport and renewal projects.

Figure 2-1 ‘Jessica’, Joint European Support for Sustainable Investment in City Areas

The above figure (Figure 2-1) presents the structural management of the joint European support for sustainable investment in city areas (Jessica). Member States are given the option of using some of their EU grant funding, their so-called structural fund grants, to make repayable investments in projects forming part of an integrated plan for sustainable urban development. These investments are delivered to projects via urban development funds and, if required, holding funds.

The cost of local projects differs from one municipality to another and cannot be described in detail here. The costs are reported within the action plan but are not available to the public (see Figure 2-2).

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2.1.2 Emissions Inventories at local level

The comparison of baseline emission inventories from numerous municipalities is challenging. Although a SEAP guideline and reporting tables were developed the decision of which emission factors are used and the selection of the calculation tool which is applied depends on the compiler. There are two different kinds of emission factors: a) the use of emission factors of the IPCC guidebook or b) life cycle assessment, LCA, emission factors\(^4\). Thus, the results and the quality of estimated CO\(_2\) emissions differ from SEAP to SEAP report. Other air pollutants or sources of noise are not considered in the inventory. The reports of the baseline emission inventory or time series are not available to the public. A database for the SEAP reports is developed by the Joint Research Center. In future the different emissions inventories will be analysed and discussed by the Joint Research Center for further reporting improvement.

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\(^4\) “The LCA emission factors include the actual emissions from all life cycle steps including final combustion, as mentioned earlier. This is of special relevance for biofuels: while the carbon stored in the biofuels themselves may be CO\(_2\) neutral.” Source: How to develop a sustainable action plan (SEAP) guidebook part 2, p. 11, European Union 2010
Regarding the signature and the respective SEAP report, the time series of CO₂ emissions can be presented from 1990 onwards (e.g. Energiekonzept 2020, Energie für Berlin, 2011, p. 2). Depending on the sectors transport, industry and residential sources (other sectors are not considered) the respective activity data (e.g. final energy consumption means fossil fuels in MWh and emissions in tons and CO₂ equivalent emissions tons) were reported with the reporting tables (see Figure 2-3). With the reporting of the SEAP, signatories are required at the same time to fill in the “SEAP template” in English.

### Figure 2-3 SEAP template for Baseline Emission Inventory

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<th>Inventory year</th>
<th>For Covenant signatories who calculate their CO₂ emissions per capita, please precise here the number of inhabitants during the inventory year:</th>
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<td>Emission factors</td>
<td>Please tick the corresponding box:</td>
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<td>- Standard emission factors in line with the IPCC principles</td>
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<td>- LCA (Life Cycle Assessment) factors</td>
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<td>Emission reporting unit</td>
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<td>- CO₂ emissions</td>
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<td>- CO₂ equivalent emissions</td>
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**Key results of the Baseline Emission Inventory**

**Green cells are compulsory fields**

**Grey fields are non editable**

A. Final energy consumption

Please note that for separating decimals dot (.) is used, no thousand separators are allowed.

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<th>Category</th>
<th>Electricity</th>
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<th>Uglite</th>
<th>Coal</th>
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<td>Total</td>
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</tbody>
</table>

Source: CoM, [http://www.eumayors.eu/support/faq_en.html?id_faq=44](http://www.eumayors.eu/support/faq_en.html?id_faq=44), the figures presents partly the SEAP template

### 2.1.3 Information on policies and measures

The CoM initiative is mainly focused on the energy consumption, renewable and the reduction of CO₂ emissions. Co-benefits between AP and noise are not considered at all and a link of air emission inventories is not foreseen. The study does not assess the effectiveness of measures. Costs for the respective actions measure are reported per sector as well with the SEAP report of the municipalities. More than 1190 SEAPs have been reported since 2008 and the Joint Research Center analyses some of these reports to obtain an impression of the effectiveness of the CoM in the past and the ways in which improvements can be implemented, in particular in terms of the comparability of actions and emission inventories. The SEAP defines concrete reduction measures together with time frames and assigned
responsibilities which translate the long-term strategy into action. The SEAP must be uploaded in the national language (and/or in English) using the on-line submission facility.

A database tool (UBC Good Practices Database, http://www.ubcwheel.eu/) for good practice was developed from the Baltic Sea region entities and is published on the web. For local authorities it provides a list of practical examples of sustainable development in cities including all topics from transport to health and from social aspects to economic instruments complemented with suitable tools.

2.1.4 Project networking, results

The CoM is one of the interconnected initiatives and receives support for the sharing of information, organisation of meetings and further communication from the ‘EUROCITIES’ network between the local entities. Furthermore, the Covenant of Mayors Office (CoMO) is managed by a consortium of local and regional authority networks (e.g. Energy Cities, Climate Alliance and others). The local entities are honoured an annual Award for the best SEAP. A web-published newsletter provides information for the local entities (e.g. financing of projects) and of the local initiatives outstanding projects can be recognised as Benchmarks of Excellence. The main focus of the initiative is a sustainable energy and low carbon future.

The most important result is without a doubt that despite the provision of the Guidebook, local inventories differ and comparability could not be assured. The data quality depends on the municipalities, their understanding and the information provided.

2.2 Megapoli

2.2.1 Overview

Megapoli (Megacities: Emissions, urban, regional and Global Atmospheric POLlution and climate effects, and Integrated tools for assessment and mitigation) started as a 3-year research (2008 – 2011) project and was funded by the European Commission through Framework Programme 7 (http://megapoli.dmi.dk/index.html). A cooperation of numerous European research groups of Member States and third countries was focused on spatial and temporal scales connecting local emissions (air quality, AQ) and weather (meteorology) with global atmospheric chemistry and climate. The concrete object of the project was to investigate and quantify interactions/impacts among megacities around the world, air quality and climate. Noise pollution or co-benefits with noise were not considered. The project focused in detail on the impacts of megacities and large air-pollution, should quantify feedbacks between megacity emissions, air quality, local and regional climate, and global climate change on a different spatial scale. Furthermore, integrated assessment tools for estimating the impacts of air pollution from megacities on regional and global air quality and climate were developed to evaluate the effectiveness of mitigation scenarios. The costs were about 5 million Euro in total for the project.
A three level approach for the integrated assessment was used in the project. Based on the third level (see Figure 2-4) all megacities under 5 million inhabitants were considered to investigate their effects on global air quality and climate. Global Chemical Transport Models (CTMs), Global Climate Models (GCMs) and satellite studies were also applied. For cities (Moscow, Istanbul, Mexico City, Beijing, Shanghai, Santiago, Delhi, Mumbai, Bangkok, New York, Cairo, St. Petersburg and Tokyo) in the second level a regional perspective was added to the global one. A combination of datasets (considering national and city emission inventories) with regional models (including selected urban scale model applications) was linked with integrated modelling tools. In the first level an urban and street scale perspective for some EU megacities was added to the regional and global ones.

2.2.2 Emissions inventories at local level

A European emission database for the substances NO₃, SO₂, NMVOC, CH₄, NH₃, CO and primary PM10 and PM2.5 for 2005 was developed by the Netherlands Organisation for Applied Scientific Research (TNO) (Kuehnen et al., 2010) and the primary datasets were available from the European Environmental Agency. The European emission inventory was based on national totals by source sectors (SNAP 976 1st level) which were then distributed over a high resolution grid (1/8° longitude x 1/16° latitude, roughly 6x6 km) by using source sector specific spatial distribution proxies (e.g., population density for emission from residential combustion). For the European emission inventory officially submitted data from

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5 http://megapoli.dmi.dk/maininfo/megfoc.html
6 Selected Nomenclature for Sources of Air Pollution, SNAP,
the Member States (UNFCCC\textsuperscript{7} reporting, CLRTAP\textsuperscript{8} reporting) were used. The data were in line with the reporting Guidelines of the IPCC\textsuperscript{9} and UNECE\textsuperscript{10} and followed the rules of TCCCA\textsuperscript{11} (van der Gon et al., 2009). As a gap filled methodology, emission values had been considered to equal the last reported emission (e.g. 2004 or earlier) by the Member States.

The local megacity (Paris, London, the Rhine-Ruhr area, Germany, and the Po-valley, Italy) inventories were compiled by local agencies based on local statistics and activity data to estimate the emissions within their domain. Further information about applied emission factors, used methodology and quality was not published. Therefore, the comparability with other emission data is difficult. Both emission inventories are based on the bottom-up approach.

For Europe local bottom-up inventories emission estimates were compared to regional down-scaled European emission inventories. The estimates showed significant differences. In particular for the cities London and Paris the results have shown that for most pollutants the European down-scaled estimates were much larger than the local bottom-up estimates. The discrepancies were discussed and could be caused by the used distribution patterns, number of emission sources, which have a high uncertain emission factor (e.g. residential combustion of coal and wood) or certain emission sectors not being included in the respective emission inventory. An overview of the emissions per pollutant and per megacity and country of origin is presented in Table 2.1. Emission results were published for the cities and countries in the delivery reports D1.2 and D1.6 and published on the project webpage (http://megapoli.dmi.dk/index.html). The estimated datasets were completely available for the project partners.

\textsuperscript{7} United Nation Framework Convention on Climate Change, UNFCCC
\textsuperscript{8} Convention on Long-Range Transboundary Air Pollution, CLRTAP
\textsuperscript{9} Intergovernmental Panel on Climate Change, IPCC
\textsuperscript{10} United Nation Economic Commission for Europe, UNECE
\textsuperscript{11} TCCCA, Transparency, Comparability, Consistency, Completeness, Accuracy
Table 2-1  Emissions of air pollutants in 2005 for the megacities and the totals for the countries in the final version of the MEGAPOLI European emissions map (tons/year)

<table>
<thead>
<tr>
<th></th>
<th>CH4</th>
<th>CO</th>
<th>NH3</th>
<th>NMVOC</th>
<th>NOx</th>
<th>PM_{10}</th>
<th>PM_{2.5}</th>
<th>SO2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Megacities</strong></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>Greater London</td>
<td>26001</td>
<td>88681</td>
<td>1415</td>
<td>61117</td>
<td>63162</td>
<td>2822</td>
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<tr>
<td>Ille de France</td>
<td>41652</td>
<td>250949</td>
<td>4994</td>
<td>123238</td>
<td>116919</td>
<td>18244</td>
<td>12484</td>
<td>26724</td>
</tr>
<tr>
<td>Rhine-Ruhr</td>
<td>59915</td>
<td>975111</td>
<td>18443</td>
<td>72609</td>
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<td>505482</td>
<td>74652</td>
<td>58768</td>
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<tr>
<td><strong>Country Totals</strong></td>
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<tr>
<td>United Kingdom</td>
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<td>2410973</td>
<td>317464</td>
<td>949708</td>
<td>1618823</td>
<td>150034</td>
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<td>1432331</td>
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<td>116089</td>
<td>496884</td>
</tr>
</tbody>
</table>

Source: Deliverable report 1.6, 2009, Tab. 3-1, p. 33

2.2.3 Information on policies and measures

The project linked emission inventories with an integrated assessment of AQ in megacities. Developed integrated assessment models could be coupled on mesoscale and microscale. Different abatement scenarios were applied to analyse the policy options which were effective in influencing the emissions of AP and GHG in megacities and how these options could be assessed. An overview of the results is given in the final summary report (A. Baklanov, 2011). As the main abatement instruments it was suggested:

- to replace solid fuels fired small combustion plants with efficient combustion techniques,
- to modernize old buildings in a more energy-efficient manor,
- to combine climate protection measures in the cement industry and
- to switch to renewable heat supply in the residential sector.

The outcome of the project was presented at the European Commission and should give support for new air pollution and climate change strategy and policies.

2.2.4 Project networking, results

The project and its results were presented on the official webpage. Meetings and milestones were announced and for inter alia communication a special registry was provided (MEGAPOLI Project final report, 2011). One outcome was that several European countries would not achieve the future threshold requirements of the Air Quality Directive (2008/50/EC) or the National Emission Ceilings (NEC) defined in the NEC directive (2001/81/EC), even with additional measures.

The main findings of the project can be described as:

- Quality and uncertainty of emission inventories
  The applied methodologies for emission inventories vary. While regional and national inventories often use national statistics and more general emission estimation methodologies (emission factors, activity data or proxies), local emission inventories use more detailed data (point source monitoring data, traffic counts, etc.) and implied
emission factors from measurements, but missing information could lead to higher uncertainty.

Pan European inventories, member states national top-down inventories, subnational regions and local bottom-up have to be compared and the integration work performed in MEGAPOLI should be updated periodically on a regular basis.

- Impacts/effects
  For further research the project findings identified the gap of knowledge regarding the mortality and morbidity of populations in megacities caused by poor air quality.

  It is proposed that the chain of models from emissions to air quality to exposure to health effects has to be investigated. The application of such integrated modeling chains would allow for the examination of cost-effective measures, policies and abatement strategies in order to ensure a sustainable development of megacities, including the health effects on the populations. For a better understanding of the interconnections between AP and CC and the improvement of emission factors more measurements campaigns on a local scale have to be conducted.

- Research needs
  The development and provision of so-called "shadow" scientific emission inventories are still needed for the implementation of new measures and to provide modellers with a consistent dataset across Europe to test the validity. A periodic intercomparison and integration of emission inventories carried out at different regional levels can improve the quality assurance of national inventories.

2.3 CityZen, mega CITY - Zoom for the Environment

2.3.1 Overview

The sophisticated CityZen project was a 3-year (2008 -2011) research project focusing on megacities and emission hot spots and was funded by the European Commission through Framework Programme 7. For Europe the emissions hot spots were the Benelux, Ruhr area and Po Valley. For case studies extreme weather conditions (summer 2003, & 2007) and feedbacks of air pollution and climate were investigated. 16 research institutions were involved and the cost was approx. four million Euro. The CityZen group worked together in joint activities within the Megapoli project. The CitiZen and Megapoli projects are among the WMO-GAW\textsuperscript{12} Urban Research Meteorology Environment Project, GURME\textsuperscript{13}.

CityZen chiefly focused on the development of city emission data and scenarios, ground-based measurements and satellite measurements (observations) for CH\textsubscript{4} and CO\textsubscript{2} (greenhouse gases) and AQ substances (e.g. NO\textsubscript{2}, SO\textsubscript{2}, HCHO, and CHOCHO) on a medium-scale. In particular, the

\textsuperscript{12} WMO: World Meteorological Organisation, GAW: Global Atmosphere Watch

\textsuperscript{13} GURME: GAW Urban Research Meteorology and Environment Project. The project aim is the evaluation of model performance to make an international common understanding and improve air pollution modeling in East Asia. Therefore, it is not relevant for this overview.
influence of megacities on climate change and climate forcing were estimated. Similar to Megapoli, the project estimated scenarios up to 2030 and mitigation options should give policy feedback (https://wiki.met.no/cityzen/).

2.3.2 Emissions inventories at local level

‘Emissions’ (air quality data were mentioned) for Europe were provided by the Institut National de l'Environnement Industriel et des Risques (INERIS). By combining satellite data with atmospheric models, emission estimates were made from the observations, so that the results of the project could underpin the clean air measures taken in the past, such as the EU Air Quality Directives, and provide information on the accuracy of emission estimates based on statistical data reported to environmental agencies. The data are not available to the public (see Gauss et al., 2011).

Furthermore, the UNECE/EMEP emission inventory (CLRTAP reporting of the MS) was used in consideration of the 1998-2007 period for modelling air quality over Europe with several state-of-the-art chemistry transport models (CTM) using the same emission inventory (Granier. C, 2010). Therefore, it can be assumed that the UNECE/EMEP and IPCC reporting guidelines were applied and all emission source relevant sectors (SNAP) were used. The emissions are provided for the following species: carbon monoxide (CO), nitrogen oxides (NOx), sulphur dioxide (SO2), total non-methane volatile organic compounds (NMVOCs), ammonia (NH3) and particulate matter (PM2.5 and PM10).

A global anthropogenic emissions dataset covering the period 1997-2000 was developed for the CITYZEN project by the CNRS group.

As mentioned in the report the dataset has been constructed from two datasets: a new global inventory which has been developed in the framework of the Intergovernmental Panel on Climate Change (IPCC) Assessment Report 5 (AR5), as well as the regional inventory for Europe described above. The emissions are provided by EMEP at a 0.5x0.5 degree resolution and have been regridded at a 0.1x0.1 degree resolution in latitude and longitude, using the fine scale global land cover database GlobCover (http://ionia1.esrin.esa.int). The emissions are given as an annual total per grid cell (in Mg/cell), and for different emissions sectors. By linear interpolation of the IPCC emissions in 1990 and 2000 the anthropogenic emissions for the years 1997-2000 were obtained. Furthermore, the results were compared with other global or regional emission inventories.

2.3.3 Information on policies and measures

On the project webpage (https://wiki.met.no/cityzen/policy_brief) statements about the ozone, particulate matter (PM), observations and a focus on the situation on the East Mediterranean region were published. The main results of the project were that:

- the ozone will be influenced in the troposphere and at ground-level by climate change, human actions, and changes in the biosphere during the next few decades.

- with the results of PM10 monitoring observation stations it could be verified that PM10 concentrations in Germany, UK, and BeNeLux had been decreasing (1998-2007). This can be linked with successful air quality regulation. More observation sites would underpin data and information and predictive capabilities. Long-term
monitoring of PM2.5 should be increased for getting a complete picture of impacts and vulnerability.

- air quality networks are still important for pollution observations. Satellite observations already provide useful information on pollutant distributions and patterns on regional scales. As resolution in space and time improve further, integration of satellite data into pollution observation strategies becomes increasingly important, but the interpretation of the results is difficult.

- regional conditions should be taken into account more when developing air pollution control strategies, considering the influence of natural sources and long-range transport. For the East Mediterranean air quality it will require a coordinated effort among the countries in the region and beyond. Therefore, the focus of the legislation should be pursued in a regional strategy for air quality and climate change mitigation to achieve improvements in air quality.

2.3.4 Project networking, results

With its webpage the project is still presented in the web and publication or results can be downloaded. Communication between the project partners was given via announcement of meetings and publication of reports and scientific literature.

One main result was that megacity areas exhibit large differences in their per capita sectoral emission production leading to very particular emission patterns for each megacity.

There are differences in the per capita sectoral emission production in cities which lead to very particular emission patterns for each megacity. In recent years monitoring sites in cities have been reduced and thus significant gaps in data and information have arisen, limiting effective model evaluation and predictive capabilities. Emission reduction measures proved to be efficient for ozone precursors and should be continued.

2.4 Soot free cities campaign

2.4.1 Overview

The ‘Soot free cities’ campaign was initiated and conducted by the German environmental and consumer associations (http://sootfreecities.eu/). It was carried out by ‘Friends of the Earth Germany’ in cooperation with the European Environmental Bureau and started to address the climatic effect of black carbon (soot) in March 2009. The campaign is still running. The co-benefits of AQ and live expectancy should be examined. The goal of the campaign is the reduction of BC emissions in the local transport sector (in particular for diesel fuel). This campaign is focused on the European Union and by conducting a city ranking best practices of local air abatement measures were compared and assessed in terms of which of the 17 selected cities made most use of them.

2.4.2 Emissions inventories at local level

Reported reductions of local PM10 emissions were evaluated for the period between 2005 and 2009. Over 20 municipalities received a detailed questionnaire. With the feedback of 14 cities and public information on three other cities a city ranking could be developed. If cities
did not reply to the questionnaire, information was taken from the internet, action plans and non-governmental organizations (NGOs) to fill gaps. The questionnaire considered nine categories of measures which have a high potential to reduce particulate matter (PM10). BC is not in the air quality measurements campaigns considered.

The categories could be split into the results of reduction success and information and participation.

1. Reduction success: urban traffic stations minus regional background stations,

Three categories focus on technical reduction measures

2. Low emission zones, bans of heavy emitters (i.e. heavy goods vehicles),
3. Public procurement / cleaner fleets,
4. Non-Road Mobile Machinery (NRMM)

5. Economic instruments (Congestion Charge, Parking Management, subsidies, etc.)

And sustainable transport measures:

6. Traffic and mobility management (modal split as background information)
7. Promotion of public transport
8. Promotion of cycling and walking
9. Transparency and communication

The ‘Transparency & Communication Policy’ topic on the webpage is linked with information on the air quality of the local entity. Therefore, measurement results are linked. But there is no publication of the initiative available, which gives an overview of the local data itself.

Under the ‘Reduction Success in Local Emissions’ topic the number of days exceeding the PM10 limit in 2005 with the latest reported data for 2009 were evaluated. A comparison of the measurements at traffic stations and background stations was conducted in order to better understand the role played by local traffic for both years. The data was collected from AirBase, the public air quality database system of the European Environmental Agency (EEA). In some cases, the data appeared inconsistent or incomplete, which resulted in a lower grading.

As mentioned in the report the methodology for analysing and evaluating the cities’ responses was based on the same method used by BUND for their two German city rankings. A table was developed with marks given for each of the main categories from the questionnaire. The evaluation of the measures followed a specific ranking system: for every city by giving five grades ++, +, 0, -, -- and translated the results with 5, 4, 3, 2, 1 points. The number of points was converted into the a grading system from A (100-90%), B (89-80%), C (79-70%) D (69-60%) and F (under 59%, failed). The methodology has an empirical approach.

In comparison with the Megapoli and CityZen projects this campaign does not provide a scientific assessment of the reduction potential of the different measures.
2.4.3 Information on policies and measures

The initiative will give support to local policy makers to motivate more and more cities and local entities to reduce their BC emissions and implement potential emission abatement strategies. Technical fact sheets with background information on investment costs, emissions and strategies are published. The main focus is to reduce BC which also has a global warming potential and harms health as an air pollutant. Co-benefits with other pollutants or GHG are not mentioned in this initiative, but the reduction of BC emission is linked with climate, climate change and air quality.

The ranking of the cities is presented via an interactive webpage. The main message of the initiative is that the EU air quality policy must be regularly adapted to the continuing development of technology, and pollutant limit values are to be dynamically tightened accordingly until the time when no environmental pollution is produced.

2.4.4 Project networking, results

The project and its results were presented on the official webpage. Meetings and activities were announced.

As a result it could be described that many local solutions exist which improve air quality and the ways in which the cities use these solutions. A combination of approaches for each individual city has to be taken into account: technical air quality measures (on cars, lorries, construction machinery, buses, trains, etc.) and measures to reduce individual motorised transport by increasing improvements of cycling and public transport. Furthermore, environmental zones, which lead to a modernisation of vehicle fleets, are the most effective single measure (Quitta, A. et al., 2012, p. 33). Therefore, every city has to develop its own action plan and consistently implement it.

The ranking mainly focused on efforts made to reduce particulate matter (PM10) and soot, or black carbon.

2.5 European Green City Index

2.5.1 Overview

The research project was conducted by the company Siemens. The aim of the project was to assess the environmental impact of Europe’s major cities. The methodology was developed by the Economist Intelligence Unit in cooperation with Siemens in 2009 (http://www.siemens.com/entry/cc/en/greencityindex.htm) to today. Feedback and information on the methodology were given by local authorities. The European Green City Index represents the environmental performance of all 30 European capital cities. No information is given on the cost of the study or per city. To realize the index the cities were scored across the eight following categories:

- CO₂ emissions,
- energy,
- buildings,
- transport,
- water,
- waste and land use,
- air quality and environmental governance.

Furthermore, 30 individual indicators (environmental areas, from environmental governance and water consumption to waste management and greenhouse gas emissions) per city were taken into account. Similar to the methodology of the ‘Sootfree cities campaign’ qualitative indicators were ranked on a scale of 0 to 10, with 10 points assigned to cities that met or exceeded the check-list of criteria. In the case of the “CO₂ reduction strategy” indicator, for example, cities were assessed according to the implementation strategies and realisation of the abatement policies.

2.5.2 Emissions inventories at local level

In general, data had been used from official sources like national statistical offices and national environmental bureaus. In most cases data cover the year 2007 (European Green City Index, 2010), which was the most recent year available for the following indicators:

- Total energy consumption from buildings
- Total fuel consumption from fleet
- Total miles driven from fleet
- Average fleet fuel efficiency
- Total airline miles traveled
- Total CO₂ relative to total revenue
- Fleet CO₂ relative to service revenue.

Where gaps in the data existed, the Economist Intelligence Unit produced estimates from national averages. The study pointed out that one-third of the 30 cities did not measure the full amount of energy consumed and therefore associated CO₂ and air pollutants (NOₓ, SO₂, O₃, PM10, SOx) emissions are underestimated in the city. In most cases, the cities calculate only how much energy is consumed from electricity, gas and district heating. To calculate associated CO₂ emissions for the city national CO₂ emissions factors associated with the combustion of each energy source were used and quantified. For the other air pollutants the annual daily mean of specific emissions was used.

2.5.3 Information on policies and measures

Furthermore, the assessment of the extensiveness of policies to improve air quality or CO₂ emissions reduction strategy of each city was considered in the ranking and to present the benefits at least in the report. However, co-benefits of CC and AP in detail were not underlined. But indeed if in the sector transport or energy CO₂ emissions reductions per facility or point source have been considered a decrease of AP emissions can be expected as well.

2.5.4 Project networking, results

In comparison with the other initiatives or projects an interaction of communication was not one of the main goals for this project. Therefore, a forum via internet is not presented.
For the German company Siemens sustainability and environmental protection is one of the marketing items and have to be taken into account for the environmental portfolio of Siemens where technical products and solutions (e.g. facilities, heating, smart solutions for insulation of buildings etc.) for environmental and climate protection can be sold and launched.

Certainly, one of the major key findings of the study is that wealth (GDP per capita vs. European city index score) and environmental performance significantly positively correlates. Therefore, it is not astonishing that the Nordic cities dominate the top ten of the index. Copenhagen is at the top of the index overall and in comparison with the ‘Soot free cities campaign’ the ranking of the cities are similar for the Nordic capitals.

Furthermore, the message of sustainability and green environment intended to ensure that all inhabitants in particular in big cities contribute with their behaviour and consumption to their own ambience and health.

2.6 Common Information to European Air, CiteAir

2.6.1 Overview

CITEAIR supported European cities and regions in their efforts to meet limit values and improve the air quality for their citizens. During 2008 to 2011, the CITEAIR II (Common Information to European Air, http://www.citeair.eu/) project was co-funded under the European Commission INTERREG IVC program. 11 European institutions are involved; the focus is on 90 cities in Europe. No information was provided on the budget.

The project based on the experience and users of the previous CITEAIR (http://citeair.rec.org/home.html) project (2004-2007, INTERREG IIIC) which air quality indices has implemented on the European level. Furthermore, the main aim of the previous project was to develop better and more efficient solutions (tools) for assessing the impact of traffic on air quality in large urban areas and to give guidance on efficient measures to abate adverse environmental situations. The following tools were developed:

- A tool to compare the air quality in European cities;
- A tool to benchmark the emissions from mobility modes;
- A tool to integrate greenhouse gases emissions into existing air quality assessment schemes;
- A tool to forecast air quality.

As a follow-up project, the new aim of CITEAIR II was to analyse and transfer a set of good practices and to improve the effectiveness of regional development policies in the area of air quality protection, sustainable transport and reduction of greenhouse gas emissions. The results and generated indices for the cities of CITEAIR are implemented on an interactive web service accessible at www.airqualitynow.eu. It provides a platform to compare past, current and future air pollution situation in different cities in an easy to understand.

2.6.2 Emissions inventories at local level

One task of the project was to develop an integrated emissions inventory database for CO₂, PM 10, NOₓ and NO₂ considering different sectors according the IPCC Guidelines 2006 and
applying different scenarios. The idea was to offer a tool for cities to create their own emission inventory based on the UNECE database ‘CollectER’ and to combine air and climate emissions into a single system. The developed guidebook elaborates guidelines on how to develop baseline information to formulate and monitor climate change and air quality programs in a consistent way (http://www.citeair.eu/index.php?id=10). As it is written in the guidebook (p.17) the uncertainty of the calculated emissions could be quite high on local level.

The proposed indices are presented on the common webpage at www.airqualitynow.eu and are designed to give a dynamic picture of the air quality situation in each city (see Figure 2-5).

**Figure 2-5: Tool for visualisation of air quality indices on the official webpage**

![Tool for visualisation of air quality indices](http://www.airqualitynow.eu/, 2012)

Another task was to present the air quality situation in European cities in an easy way, that all detailed measurements are transformed into a single relative figure: the Common Air Quality Index (CAQI).

The hourly index describes the air quality today, based on hourly air quality measurements and is updated every hour.

For the indices five levels were indicated using a scale from 0 (very low) to > 100 (very high). The calculation of the index is based on a review of a number of existing air quality indices, and it reflects EU alert threshold levels or daily limit values as much as possible. Like the hourly and daily index, the Year Average Common Air Quality Index (YACAQI) was calculated for traffic and city background sites.
2.6.3 Information on policies and measures

The webpages present all the legal and scientific background information on policies and measures. In contrast to the ‘Soot free cities campaign’ suggestions of implementation strategies are not given but the air quality status of cities and integrated urban emission inventories (see \url{http://www.citeair.eu/index.php?id=10}) via an interactive map on website (\url{http://www.airqualitynow.eu/}) should give local authorities an impression of how they can interact. Furthermore, local emission inventories considering AP and CO₂ could also be prepared.

2.6.4 Project networking, results

The project results are still available on the webpage and publication or results can be downloaded. With the guide (Communicating Air Quality) practical examples for communicating with the public and a proposal for a City Annual Air Quality Reports, which is a common reporting format, and a semi-automatic report generator could be developed. Furthermore, assistance in air quality management to identify tools and measure to improve air quality could be given to cities. With the help of the database CollectER data could be used for air quality modelling, giving detailed AQ information; in addition local knowledge is made available through the inventory. Furthermore, emissions forecasts based on industrial activity can be made and benchmarking across a sector of industry is possible. Applying varying EFs scenarios could be offered that reflect technology-driven improvements (such as modernizing the mobile sources and the logistical techniques).

2.7 METREX - The Network of European Metropolitan Regions and Areas

The METREX network (the Network of European Metropolitan Regions and Areas) started in 1996 with the support of the European Commission (METREX Manual, 2011). It facilitates a platform for the exchange of knowledge on metropolitan affairs and joint action on issues of common interest (\url{http://www.eurometrex.org/}).

Around 50 metropolitan regions and areas and partners are members in the network and cooperate together. METREX supports policies, programs and projects on a European scale. The Network works as a partner of European institutions, the research community, governmental organisation and other networks. In general, the network is self-funded and meetings are paid by delegate fees. Information on policies and measures are not in the main focus of the network. The different subprojects take this into account.

METREX itself does not measure or compile any pollution or GHG information. There is a range of key inter-related social, economic and environmental issues that are addressed in five sub projects of METREX. Two of these projects, which focus on more environmental issues, are discussed here in detail. Reports for the main activities and background information of the different projects are available online.
2.8 InterMETREXplus Project

2.8.1 Overview

InterMETREXplus was the successor project of the first InterMETREX project which was mainly used for metropolitan spatial planning practice under the management of METREX coordinating the work between research institutions and city entities. As an additional component climate change was taken into consideration.

Starting with four pilot partners the application of the Greenhouse Gas Regional Inventory Project (GRIP) model at the metropolitan level was applied. GRIP was conceived and developed through the Tyndall Centre (UK) for climate change research. InterMETREXplus was funded (budget around 1.16 Mio €) by the INTERREG IVC Operational Program\textsuperscript{14} which was published by the European Commission in April 2007. The aims of the InterMETREXPlus\textsuperscript{15} project extension were:

1. to develop the GRIP GHG inventory methodology in a user friendly tool which could be applied to all the pilot regions, and
2. to test the GRIP scenario tool at the metropolitan regional scale (Glasgow and the Clyde Valley).

2.8.2 Emissions inventories at local level

The emission inventory tool (see Figure 2-6) is an online web application (http://www.carboncaptured.org.uk/) which takes demographic and economic data into account. The inventory methodology utilises a mix of data sets to form an activity and emissions output. These may be either directly measured or based upon an estimated value (see Carnier, S., 2008).

The methodology is similar to the IPCC applied one (sectors and uncertainty description) but differs in the used data sets at the spatial level: regional energy consumption and supply statistics, the respective country’s national inventory, regional agricultural statistics, regional waste disposal. The data are available for an inventory year (e.g. only 2005) but not presented as a time series. The GRIP methodology was evaluated in 2009 by the Joint Research Centre of the EU (European Union, 2010) and subsequently recommended by the Covenant of Mayors (CoM).

\textsuperscript{14} The aim of the INTERREG IVC program was to improve, by means of interregional cooperation, the effectiveness of regional development policies in the areas of innovation, the knowledge economy, the environment and risk prevention as well as to contribute to economic modernisation and increased competitiveness of Europe (see EUCO 80/50 Outline Prospectus, Appendix 2).

\textsuperscript{15} (http://www.eurometrex.org/ENT1/EN/Activities/activities.asp?SubCat1=InterMETREXplus)
2.8.3 Information on policies and measures

With the presentation and comparison of the results per region and sector including statistical data, the consumption per capita is evident (see Table 2-2). Thus, mitigation strategies can be directly developed per sector (see InterMETREX Project Extension, 2007).

Table 2-2 Domestic fuel consumption and emissions the four regions

<table>
<thead>
<tr>
<th>Fuel</th>
<th>Glasgow Consumption (GWh)</th>
<th>Kt CO₂</th>
<th>Stockholm Consumption (GWh)</th>
<th>Kt CO₂</th>
<th>Bologna Consumption (GWh)</th>
<th>Kt CO₂</th>
<th>Veneto Consumption (GWh)</th>
<th>Kt CO₂</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity &amp; Heat</td>
<td>4060</td>
<td>1896</td>
<td>11833</td>
<td>512</td>
<td>1185</td>
<td>443</td>
<td>5175</td>
<td>1937</td>
</tr>
<tr>
<td>Gas</td>
<td>12766</td>
<td>2397</td>
<td>77</td>
<td>4.6</td>
<td>7667</td>
<td>1537</td>
<td>39533</td>
<td>7927</td>
</tr>
<tr>
<td>Solid</td>
<td>377</td>
<td>106</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>0.7</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Liquid</td>
<td>950</td>
<td>267</td>
<td>2558</td>
<td>682</td>
<td>515</td>
<td>284</td>
<td>2855</td>
<td>727</td>
</tr>
<tr>
<td>Total</td>
<td>18193</td>
<td>4666</td>
<td>14468</td>
<td>11398</td>
<td>9989</td>
<td>2265</td>
<td>47571</td>
<td>10594</td>
</tr>
<tr>
<td>Household</td>
<td>786786</td>
<td>880000</td>
<td>455100</td>
<td>1852900</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Per Household</td>
<td>25</td>
<td>5.93</td>
<td>16.44</td>
<td>1.36</td>
<td>20.6</td>
<td>4.9</td>
<td>25.6</td>
<td>5.7</td>
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<tr>
<td>Population</td>
<td>1747000</td>
<td>1900000</td>
<td>915000</td>
<td>4700000</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Per Capita</td>
<td>10.4</td>
<td>2.67</td>
<td>7.65</td>
<td>0.63</td>
<td>10.23</td>
<td>2.47</td>
<td>10.12</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Source: InterMETREXplus Project Extension, 2007

2.8.4 Project networking, results

The results and the project are presented via the network platform METREX.

With the online tool regions can compare their own energy consumption and CO₂ emissions per capita. The metropolitan spatial planning practice could be linked with information about mitigation potentials so that the respective emission source can be directly evaluated for
reducing GHG emissions (e.g. reducing the need to travel and increasing opportunities to use low carbon energy).

2.9 **EURO2 80/50 Project**

2.9.1 **Overview**

The EURO2 80/50 project was initiated in 2007/2008 and the Metropolregion Hamburg took over the leadership ([http://www.eurometrex.org/euco2/EUCO2_docs.htm](http://www.eurometrex.org/euco2/EUCO2_docs.htm)) (project duration 2008 – 2010, further steps until 2012 were conducted). The project applied the Greenhouse Gas (GHG) Regional Inventory Protocol (GRIP) (see Metropolitan Mitigation Measures Sourcebook, 2011, Regional Inventory Brochure and Outline Prospectus Brochure) using the methodology which was developed by the InterMETREX plus project considering more cities and regions. The main aim of the project was to examine in what ways and which region the target for Europe (to meet an 80% reduction in emissions) could be realized up to 2050. The project is divided in the following steps:

1. Compilation of regional energy data;
2. Simulation of GHG reduction scenarios with the GRIP model;
3. Conducting strategy workshops with participation of regional stakeholders where specific strategies should be proposed to the political, economic and social decision makers at the end of the GRIP process.

2.9.2 **Emissions inventories at local level**

GHG emissions inventories and energy baselines were formed for the partner region with the GRIP inventory methodology. Therefore, from 2008 until 2010, CO2 emissions and energy data for 18 cities and 3 regions were compiled and finally used in a series of regional scenario workshops. For mitigation scenarios and selecting mitigation strategies the year 2050 was considered and the emissions inventories used the baseline year of 2005. The inventory covered the six GHGs which were estimated for each key sector in each partner region. The data can be uploaded per year but there is no time series visualised.

2.9.3 **Information on policies and measures**

Applying different scenarios the project results could identify abatement strategies up to 2050. These support the EU in devising specific and long-term binding regulations and funding criteria on the subject of climate change considering regional circumstances (EU CO2 80/50 outline prospectus, 2010).

- **Low Carbon Electricity generation:** With the energy shift towards from fossil fuels to a higher amount of renewable sources the production of electricity will become a low carbon intensive one.

- **Emissions reductions in the building:** In the residential and the service sectors, demand reduction measures such as insulation together with low carbon fuels can deliver high CO2 emissions reductions.

- **Increased industrial efficiency can contribute substantially to emissions reductions if their energy consumption per unit of output can be reduced.**
- Road transport: Emissions reductions were realised through efficiency improvements and fuel switching to electro-mobility, hydrogen and bioenergy.

But at the end of the project only 35% of the scenarios achieved the target of an 80% reduction. Furthermore, given as a regional result, southern European stakeholders were less confident of their ability to mitigate emissions than the rest of Europe.

### 2.9.4 Project networking, results

The results and the project are presented via the network platform METREX.

On the webpage [http://www.euco2.org/](http://www.euco2.org/) different EU CO2 Pilot Project of city partners (Bologna, Stockholm, Veneto, Glasgow) and case studies are published. As an example: with the cooperation of the local entity in Hamburg (Senat of Hamburg) an extra funding of 25 Mio€ was launched to implement the Hamburg Climate Action Plan from 2008 to 2012.

### 2.10 Climate Cities Benchmark (CCB)

#### 2.10.1 Overview

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 IFEU Institute developed in the year 2009 the Climate Cities Benchmark (CCB) (Klimaschutz in Kommunen, 2011). The aim of the CCB is to analyse and balance CO2 emissions, comparing climate city activities for better understanding of onsite mitigation potentials.

The internet-based monitoring tool support local authorities analysing sustainable energy policies and climate action for their region. This tool is currently only available in Germany. The results of the benchmarking can be incorporated in local climate action (see [http://www.climate-cities-benchmark.net/](http://www.climate-cities-benchmark.net/)).

The CCB considers four elements: a city fact sheet, an activity profile, CO2 emission time series from 1991 – 2005 (later 2009) and a set of indicators (e.g. CO2 emissions per capita, transport, energy consumption etc.), which underline the items in which the city has achieved significant progress and which actions should be enforced (see [http://www.klimabuendnis.org/benchmark1.html?&L=2](http://www.klimabuendnis.org/benchmark1.html?&L=2)).

With the activity profiles the state of climate protection activities within the city can be visualised by 26 action fields in the following categories: climate policy, energy, transport and waste.

#### 2.10.2 Emissions inventories at local level

The CO2 emission inventory tool ECORegion tool uses the bottom-up approach and was developed by the Swiss company Ecospeed in cooperation with Climate Alliance and other partners. Within the scope of establishing the database the Climate Alliance developed a set of rules for monitoring local CO2 emissions which are in line with the IPCC and Covenant of Mayor guidelines. The database considers energy, emissions and further environmental
factors which are updated each year, and lists the time series. In the beginning the local inventory data on the number of inhabitants and of employees are needed to develop a comprehensive final inventory. The export of relevant inventory data to the baseline emission inventory of the SEAP template is possible. The local authorities get access following online registration.

2.10.3 Information on policies and measures

With the online presentation of the Climate Alliance information on actual policy, projects and measures is given to the public (http://www.klimabuendnis.org/home.html?&L=0). Currently, any information on policies and measures is given on the project webpage ‘climate cities benchmark’ and any information on co-benefits between AP and CC and noise as a pollutant is given. However, with the tool ECOregion activity profiles (see Figure 2-8) can be visualized which indicate further local policy and measures.

Figure 2-7 Activity profile from the tool ECOregion

Figure 2-7 Activity profile from the tool ECOregion


2.10.4 Project networking, results

The climate cities benchmark is presented and programs, events and presentation are published on the webpage of the Climate Alliance. Communication between members is possible following registration (only possible on the German webpage). The Climate Alliance webpage also provides publications which can be downloaded and registered members can access a specific forum.

Any results or information (a comparison of different cities’ CO2 emission inventories is lacking) on the cities which uses Ecospeed are presented. One main outcome was that activity
profiles per communities which showed the status and degree of implementation of mitigation measures in the four priority areas of climate policy, energy, transport and waste management could be developed. By applying specific indicators, the effects of the urban climate protection efforts can be assessed.

2.11 Fairmode Initiative

2.11.1 Overview

In 2008 the Forum for Air Quality Modelling was initiated as a cooperation between the European Environment Agency (EEA) and the European Commission Joint Research Centre (JRC) to bring together air quality modellers and users referring to the European Air Quality Directive (FAIRMODE, http://fairmode.ew.eea.europa.eu/). Co-partners were researchers of the Norwegian Institute for Air Research – NILU and of the Aristotle University Thessaloniki – AUTH. The important objectives of the Forum for Air Quality Modelling (FAIRMODE) were:

- to establish harmonised tools and methodology for enhancing communication between modellers and model users;
- to provide a centralised portal for information concerning air quality modelling;
- to establish a common infrastructure based on best practice for reporting and storing the information;
- to promote model validation and quality assurance of model results (developing guidance and recommendations) to identify limitations and
- to support the revision of the Air Quality Directive (AQD).

The forum is divided into two working groups and sub groups which work on a guidance document for the application of air quality models (lead by the EEA) and on quality issues (led by the JRC).

2.11.2 Emissions inventories at local level

An emission inventory was not developed but the sub-group (SG3) on urban emissions and projections information was focused mainly on the analysis of national reported emissions or air quality parameters. For scientific research the sub-group was established with the aim to improve and validate modelling tools (e.g. the Delta tool) on which decision-making could be based. All air pollutants of the Air Quality Directive are considered. A compilation of emission inventories of the Member States under the respective directive (National Emission Ceiling, Convention on Long-range Transboundaries, Pollutant Release Transfer Register, Large Combustion Plant Directive) is published and meta-information (information on networks, stations and measurement configurations) and statistics for all years are available in database systems (see http://acm.eionet.europa.eu/databases/airbase/query_retrieval.html or http://fairmode.ew.eea.europa.eu/fol065026/data-archives). Data can be downloaded per country, pollutant (component) and year. Emission information is reviewed by external
review teams according the respective guidance documents of the directives considering the most relevant emission sources.

A technical EEA reference guide (http://www.eea.europa.eu/publications/fairmode) for the application of models under the European Union's Air Quality Directive provides a general overview of the use of models:

- Ambient air quality, pollutant dispersion and transport models
- Good Practice Guide for Atmospheric Dispersion Modelling
- Guideline on Air Quality Models - Appendix W to Part 51
- Meteorological Monitoring Guide - WebMET

Furthermore, on the basis of Environmental Impact Assessment (EIA) the environmental consequences of a proposed project/activity can be predicted in a formal study process, applying existing EU and national legislation and methods (see http://aix.meng.auth.gr/AIR-EIA/info.html). In the 'Guidance document for modelling' it is stated (p.47) that independent checks of emission inventories need to be made with the help of a form of inverse modelling method, keeping in mind that the quality of the emissions estimate using inverse modelling will not only depend on the quality of the model used but also on how well conditioned (i.e. how many similar solutions are possible) the inverse problem is.

A guidance which combines all the air quality criteria and climate change aspects using the synergies to develop local emission inventories was not developed and is still lacking.

### 2.11.3 Information on policies and measures

Fairmode is a portal which offers information concerning the AQD. Submitted compliance data are based on model results, references and experiences of other users through case studies. With the Delta tool a benchmarking service was integrated to produce automatically reports on model performances. The content of the reports should include both quantitative and qualitative information, based on the selected core indexes and summary diagrams applied on the reduced set.

A draft document of recommendations for the review of the AQ directive as deduced from the consultation and discussions held so far with the community on the EU AQ Policy[^16] is presented. It includes a clear statement on the necessity of a further and continuing discussion with the FAIRMODE community recommends the enhanced work for a compilation and quality assurance of urban emission data.


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Analysis of co-benefits of air pollution, noise and climate change policies on local scale
2.11.4 Project networking, results

Fairmode is an EU-wide Air Quality Modelling Network and support the implementation of the revised EU Air Quality Directive. Several documents could be developed by the different working groups. The key results of the initiative can be summarized as follows:

- Inverse assessment models are necessary for quality assurance of plans and measures to control AQ exceedances;
- Model Quality Objectives (QO, e.g. uncertainty description of models) have to be defined more precisely. For modelling it should be stated precisely for modelling what the uncertainty will be compared to;
- It remains necessary to combine models and measurements for activities: assessment of air quality levels and establishing the extent of exceedances;
- Quality assurance of emission inventories; and
- Definition of criteria for the future development and organization of the monitoring networks necessary.

2.12 The clustering of projects

In this chapter the methodology for the possible clustering of the different projects or initiatives on the basis of the matrix table (see Annex) is described by analyzing the identified studies against various axes.

Cluster 1 takes into account local campaigns/initiatives/networks, which draw upon measures and local action plans but do not compile emissions themselves.

Cluster 2 takes into account a hybrid approach. Local emission inventories/air quality indicators were developed by the project and applied for the compilation of emission inventories by local authorities. This enables actions plans to be developed by third parties.

Cluster 3 takes into account a scientific approach. That means that a project or a cooperation of numerous scientists examine climate effects by compiling emission inventories, observing satellite data and conducting measurements by stations (integrated assessment modelling), GHG and AP. As a final objective the project supports politicians or local authorities in the implementation of improved regulations or local action plans.

The following Figure 2-9 presents the structuring of the studies analyzed.
The results of the analysis can be summarized as follows:

- **Cities involved**

  Most of the Mega cities campaigns take into account the major capitals in the western part of Europe. Cities in the Eastern part (see Figure 2-10) are not as well regulated regarding air quality and climate change and not very often involved in the presented campaigns. The integration of this part should be encouraged. Further examinations of the cities of Berlin, Madrid, Malmö, Milan, Ploiesti, Prague, Vienna and Dublin are envisaged in Part 2 of this study.

Transparency and comparability

Having reviewed all the offered information about the campaign/projects it became evident that there are a lot of documents available but the core information about the local authorities, data, applied methodology can only be accessed with intensive digging. This study would welcome any development towards greater transparency about the description of the methodology, the campaign/project structure itself and the comparability of results regarding the compiled emission inventories. Although all the methodologies are generally modelled in line with the IPCC or UNECE/EMEP guidelines, they differ in many aspects. The information of the used emission inventories about the compilation date (not inventory year) is not given. Due to the different recalculation processes inventories from one to another inventory year can differ dramatically depending on the sector. Therefore, an update or follow-up project after, for example, three years has to be taken into account.

Furthermore, the degree of urgency with which climate change needs to be tackled and the long lifespan of urban infrastructure means that cities need to take well-informed and effective decisions quickly. Greater compatibility of tools would render it easier to compare results and thus facilitate this process.

Guidelines/guidebooks

The study assessed that guidance documents were developed (see GRIP, Covenant of Mayors, IMACE guidebook of CITEAIR) or the compilation methodology for the development of an emission inventory was in line with the respective international guidelines (IPCC or UNECE/EMEP). Furthermore, for the implementation of AP/CC policies and measures best practice examples per technology (e.g. Sootfree city campaign) or region (see Covenant of Mayor, Klimaschutz in Kommunen, climate cities benchmark) were developed.

Pollutants

The selection of evaluated pollutant or GHG combinations varies extremely and depends on the objective of the analysis. Some projects or campaigns take into account only CO\textsubscript{2}, others cover GHG (considering the six gases of the Kyoto Protocol). Additional, particulate matter like black carbon (soot) or particulate matter taking into account the different sizes (aerosols) were considered for air quality reasons. Due to the different air quality protocols (e.g. Multi pollutant protocol) the amount of or impact of ozone precursors (\text{CH}_4, \text{NOx}, \text{CO}, \text{NMVOC}) and eutrophication substances (\text{SO}_2, \text{NO}_x, \text{NH}_3, \text{VOC}) were studied. However, the biggest share of CO\textsubscript{2} equivalent emissions is covered by local inventories. Co-benefits of AP and CC mitigation strategies are part of the main focus. The integration of the amount of noise and other pollutants should be encouraged, even more if there is evidence of the relative importance of a specific gas for the overall emissions.
Emission inventories

Most of the campaigns used bottom-up emission inventories for estimating CO₂ emissions. The emission inventories normally include all the relevant energy sectors (e.g. energy consumption of residential, industry or public transport). Additional sectors like agriculture, land use change and forestry or diffuse emissions are not considered in general. Results of the emission inventories on a local scale (see InterMETREX plus) are published in the respective publication, flyer or deliverable report. However, the activity data or emission factors used are not available (in particular for the baseline emission inventory which is compiled from the different signatories of CoM).

Furthermore, satellite observations results were combined with national emission inventories (top down approach) or stationary measurements to study the impact of AP and GHG on climate and regional or local conditions. Therefore, a more comprehensive study considering one city inventory and comparing the results or applying new tools would explore the main aspects and show the main uncertainties.

For many inventories the uncertainty of results is not published. It has to be taken into account what kind of accuracy (TIER level) was applied when the inventory was compiled.

Policy and measures

Most of the studies/campaigns do not link co-benefits of APs with GHGs (CC measure). Only research projects do so (Cityzen, Megapoli and CiteAir) but AQ is in particular a local and regional problem and local policy have to take this into account as well (see CiteAir). By collecting the SEAP baseline emission inventory it could be extended with AP emission factors. A combination of AP measurements and these SEAP baseline emission inventories would improve knowledge about the status quo for a region. Furthermore, local measures can be derived for the AP mitigation strategies and the action plans can be extended as well (e.g. with the Climate Cities Benchmark tool ECOregion).

Sectors (transport in this case)

Sectors are defined as the aggregation of specific emission sources. The emissions of the transport sector could differ in the way aviation emissions are considered. Sector-specific emissions can only be compared if the sectors are defined in exactly the same way, i.e. they cover the same emission sources. Therefore, it is necessary that IPCC guidelines, for example, are applied as a common base for local inventories.

All studies which compile inventories consider road transport. A comparison of data is not possible because local emissions inventories are not accessible for the public or the emissions per sector and region were not published. The CiteAir project publishes air quality indices (but not real time measurement results) on its webpage. Therefore, only information about air quality is given but the information is not comparable. Campaigns like ‘Soot free cities’ refer to sustainable local transport measures which include:
- traffic and mobility management,
- promotion of public transport, and
- promotion of cycling and walking.

National policy can influence:

- emissions reductions which can be realized through efficiency improvements and fuel switching to electric-mobility, hydrogen and bioenergy;

- total fuel consumption from fleet and total miles driven from fleet, and average fleet fuel efficiency and total airline miles travelled due taxation and promotion.
3 Conclusion

This project has shown that many there are already advanced campaigns/projects with tools in different European countries, highlighted the main methodological challenges of local GHG/AP accounting and presented an analytical framework for the assessment of inventory tools and methodologies. This report provides a brief conclusion about the results of different Megacity projects:

- Any of the presented projects considered the amount of noise produced as a co-benefit of CC/AP abatement strategies. Noise correlates in particular with better technical development of engines in the transport sector (aviation, on and off road). Furthermore, by combining the AP and CC emission inventories on a local scale the challenge in addressing air pollution and climate change over the coming decades will be to maximize synergistic policies at international, national, regional and local level and can be fully exploited in a cost-effective manner. Most of the inventories take account of CO2 only; others cover CO2, methane and nitrous oxide while other inventories cover only AP. A protocol could require emissions to be reported for at least the three most important GHG, i.e. CO2, methane and nitrous oxide. The inclusion of further gases should be encouraged, even more so if there is evidence of the relative importance of a specific gas for the overall emissions.

- The cities of Eastern Europe should be more involved and considered in further campaigns or studies. In particular, regarding the prognostic population increase the cities in the Eastern part will grow until 2050. Certainly, one of the key findings (which could be expected) is that there is significant positive correlation between wealth (GDP per capita vs. European city index score) and environmental performance. Nordic cities dominate the top ten list. Copenhagen leads the index overall and in comparison with the ‘Soot free cities campaign’ the ranking of the cities are similar for the Nordic capitals. Therefore, Eastern Europe should be more considered.

- In the previous chapters most of the projects suggested that emission inventories for the comparison of the results from the city reporting should be improved and more comparable air quality measurements or local statistics for calculating emission inventories on local level should be promoted. But it should be stressed that the main question is not whether there is greater comparability possible. Regarding the improvement of urban sustainable infrastructure cities need to take well-informed and effective decisions quickly. Greater compatibility of tools to create action plans would render it easier to compare results and thus facilitate this process.

- Beyond this, one of the key sectors for increasing the abatement of air pollution, noise and climate change is the transport sector. One pillar of this abatement will be to develop new, individual transport concepts as offered by automobile companies today (sharing vans, cars, scooters or bikes). Further technical improvement and in particular the implementation of regulatory instruments like subsidies to support regional and inner city transport service will be the other – and particularly challenging – pillar.
### 4 Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AP</td>
<td>Air Pollutants</td>
</tr>
<tr>
<td>AQ</td>
<td>Air Quality</td>
</tr>
<tr>
<td>BAT</td>
<td>Best available technique</td>
</tr>
<tr>
<td>BC</td>
<td>Black carbon</td>
</tr>
<tr>
<td>CC</td>
<td>Climate Change</td>
</tr>
<tr>
<td>CH₄</td>
<td>Methane</td>
</tr>
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<td>CiteAir</td>
<td>Common Information to European Air</td>
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<td>CLRTAP</td>
<td>Convention on Long-Range Transboundary Air Pollution</td>
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<td>Carbon dioxide</td>
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<td>Covenant of Mayors</td>
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<td>Covenant of Mayors Office</td>
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<td>CTM</td>
<td>Global Chemical Transport Model</td>
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<td>European Environment Agency</td>
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<td>European Monitoring and Evaluation Programme</td>
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<td>European Topic Centre for Air Pollution and Climate Change Mitigation /</td>
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<td>European Union</td>
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<td>GHG</td>
<td>Greenhouse Gases</td>
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<tr>
<td>GCM</td>
<td>Global Climate Model</td>
</tr>
<tr>
<td>GRIP</td>
<td>Greenhouse Gas Regional Inventory Project</td>
</tr>
<tr>
<td>GURME</td>
<td>GAW Urban Research Meteorology and Environment Project</td>
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<tr>
<td>ICT</td>
<td>Information and communication technologies</td>
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<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<td>JRC</td>
<td>Joint Research Center</td>
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<td>LCA</td>
<td>Life Cycle Assessment</td>
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<td>MS</td>
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<tr>
<td>Megapoli</td>
<td>Megacities: Emissions, urban, regional and Global Atmospheric POLlution and climate effects, and Integrated tools for assessment and mitigation</td>
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<tr>
<td>NEC</td>
<td>National emission ceiling</td>
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<td>NiCE</td>
<td>Networking intelligent Cities for Energy Efficiency</td>
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<tr>
<td>NH₃</td>
<td>Ammonia</td>
</tr>
<tr>
<td>NMVOC</td>
<td>Non Methane Volatile Organic Compounds</td>
</tr>
<tr>
<td>NOₓ</td>
<td>Nitrogen oxides</td>
</tr>
<tr>
<td>N₂O</td>
<td>Nitrous oxide</td>
</tr>
<tr>
<td>PM 10</td>
<td>Particulate Matter &lt; 10 µm</td>
</tr>
<tr>
<td>PM2.5</td>
<td>Particulate Matter &lt; 2.5 µm</td>
</tr>
<tr>
<td>SOₓ</td>
<td>Sulphur dioxide</td>
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<tr>
<td>SEAP</td>
<td>Sustainable actions plan</td>
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<td>SNAP</td>
<td>Selected Nomenclature for Sources of Air Pollution</td>
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<td>TAR</td>
<td>Third Assessment Report</td>
</tr>
<tr>
<td>TCCCA</td>
<td>Transparency, Comparability, Consistency, Completeness, Accuracy</td>
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<td>UBC</td>
<td>Union of the Baltic Citites</td>
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<tr>
<td>UNECE</td>
<td>United Nation Economic Commission for Europe</td>
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<td>UNFCCC</td>
<td>United Nation Framework Convention on Climate Change</td>
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<tr>
<td>VOC</td>
<td>Volatile organic compounds</td>
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<td>WMO</td>
<td>World Meteorological Organisation</td>
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5 References


DECISION No 406/2009/EC OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community’s greenhouse gas emission reduction commitments up to 2020.


Denby, B., Douros, I., Fragkou, L. 2011, Fairmode, Modelling of Nitrogen Dioxide (NO2) for air quality assessment and planning relevant to the European Air Quality Directive, FAIRMODE WG1 Version 3.3, p. 78.


Directive 2001/80/EC on the limitation of emissions of certain pollutants into the air from Large Combustion Plants.


Directive 2002/49/EC article 10.1.: Issue action plans aiming at improving the noise situation.


European Union, How to develop a sustainable action plan (SEAP) guidebook part 2, 2010.

Fairmode, Draft recommendations from FAIRMODE to the review of the EU Air Quality Policy, 2011, p.5.


Gauss, M., Im, U., Kanakidou, M., Granier, C., Richter, A., Klimont, Z., 2011, D.4.5.1 Report on improved emission inventories including scenarios, spatial scale-bridging model systems and the systematic observational evidence.


MEGAPOLI PROJECT FINAL REPORT – September 2011, [http://megapoli.dmi.dk/](http://megapoli.dmi.dk/)


Reference checked:  U. Doering  2.10.2012
## Annex 1 Overview of different city campaigns or projects

<table>
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<tr>
<th>Cluster</th>
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<tr>
<td>Cluster 1</td>
<td>European City Index</td>
<td>Smoke-free cities campaign</td>
<td>Metrex</td>
</tr>
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<td>Details</td>
<td>Project Website</td>
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### Overview

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<td>Project Website</td>
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<td>Siemens (Germany)</td>
<td>Soot-free cities campaign</td>
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<td>Siemens (Germany)</td>
<td>Metrex</td>
<td>Siemens (Germany)</td>
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### What are the project's objectives?

The project aims to:

- Include 30 individual indicators per city, touching on a wide range of environmental areas, from environmental governance and water consumption to waste management and greenhouse gas emissions.
- Enhance the understanding and decision-making abilities of all those interested in environmental performance, from individual citizens through to leading urban policymakers.
- To demonstrate that local abatement plans to improve air quality exist and to find out how cities use these solutions.
- To provide a platform for the exchange of knowledge, expertise and experience among metropolitan officials, and joint action on issues of common interest.

### Who is going to perform/participate on the project?

30 cities, among them are European Union capitals and others are researched by Siemens and the economists union.

0. Deutsche Umwelthilfe e.V., Naturschutzbund Deutschland e.V., Thüringer Grüne/Deutsche e.V., ClimateWorks Foundation and the ranked cities

### What are the future prospects/follow projects?

Cities on different continents are investigated as well, resulting in comparability of investigations.

- The measurement campaign is being continued.
- Network has members from some 50 metropolitan regions and areas and partners in many others.

### In what manner is the project going to be realized?

A study is being elaborated.

- The methodology for assigning and evaluating the cities' responses was based on the same method used by BUND for their two German city rankings.
- Metrex is split in five sub projects: EUCO2 80/50 Project, InterMETREXplus Project, InterMETREX Project, PolyMETREX Project, and SocioMETREX Project.

### Description of study's (Projects) final deliverables

### Updates planned? Update frequency?

No updates planned.

- The campaign is being continued.
- Annual conferences about future activities.

### Organisation/really who is responsible for the emission inventory?

The European intelligence Union elaborates the study, sponsored by Siemens.

- The methodology for assigning and evaluating the cities' responses was based on the same method used by BUND for their two German city rankings.
- GRIP was developed under the METREX project.

### Project duration

- From 2009 until today.
- Started in March 2009.
- Since 1996 ongoing network.

### Which cities were involved?

- Not considered.
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<td>Pollutants included? (list)</td>
<td>CO2 emissions and air pollutants (NOx, SO2, O3, PM10, SOx)</td>
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<td>Emissions inventories at local level?</td>
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<td>Substances</td>
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<td>Noise information included?</td>
<td>No information concerning noise issues</td>
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<td>Are there activity data (e.g. local statistics, information about energy consumption) available?</td>
<td>Yes</td>
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<td>Primary sources included</td>
<td>National statistical offices, local city authorities, and city and regional environmental bureau</td>
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<td>Emissions inventories at local level?</td>
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<tr>
<td>Substances</td>
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<td>Are there activity data (e.g. local statistics, information about energy consumption) available?</td>
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<td>Primary sources included</td>
<td>National statistical offices, local city authorities, and city and regional environmental bureau</td>
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<td>In substantially emission data quality available? If yes - address for download. If not - is it available on request?</td>
<td>Yes, in document and website</td>
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<td>City for 2007</td>
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<td>Industry and Residential</td>
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<td>Mobile Sources (Transport)</td>
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<td>Other Diffuse Sources</td>
<td>Water and wastewater treatment</td>
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<td>Environmental Government</td>
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<td>Description of methodology followed</td>
<td>Bottom-up emission city inventory used</td>
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<td>Industry and Residential</td>
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<td>Name of any guidance documents used/ suggested</td>
<td>METCO-CREES Best practice examples from German and European cities for reducing soot from traffic, [bc_measures_2012.pdf]</td>
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<td>Total Project cost</td>
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<td>Cost evaluation for cities</td>
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Analysis of co-benefits of air pollution, noise and climate change policies on local scale
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<th>Seed free cities campaign</th>
<th>Metrics</th>
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<td>Information on policies and measures</td>
<td>Is information available on implemented and/or planned policies and measures in the cities?</td>
<td>Yes, there were investigations including Technical measures - Introduction of filter systems, Regulatory measures - Environmental zones, Pricing measures - Congestion charge, Organisational measures - Public transport priority, Infrastructure measures - Reallocation of road space, Promoting walkability</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td></td>
<td>General description of information</td>
<td>Yes in report described.</td>
<td>Interactive map on website</td>
<td>In general, information on policies and measures is not the focus, but further information can be found under the relevant projects or in existing documents.</td>
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<td></td>
<td>Does the study assess the effectiveness of these measures? Quantitative? Qualitative?</td>
<td>Yes - modelling the measures in cities and show the result in ranking on website</td>
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<td>Does the study look at co-benefits of AQ and GHG policies?</td>
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<td>Does the study link an emission inventory with an assessment of AQ in the cities covered?</td>
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<td>Are specific ‘good practices’ identified? If yes, what are these?</td>
<td>No</td>
<td>SOOT FREE CITIES Best practice examples from German and European cities for reducing soot from traffic (bc_measures_2012.pdf); a combination of approaches for each individual city: *technical air quality measures (on cars, lorries, construction machinery, buses, trains, etc.) *and measures to reduce individual motorised transport, for example through improvements of cycling and public transport.</td>
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<td></td>
<td>Was there a network or ‘sharing’ forum set up for the cities participating in the study? If yes, details</td>
<td>No</td>
<td>METREX offers a network which was made to disseminate information.</td>
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<td></td>
<td>Was there a list of findings/conclusions from the study? If yes, summarize all main conclusions</td>
<td>Nordic cities dominate the index top ten. There is a strong correlation between wealth and high overall ranking on the index. Wealthier cities can invest more money in efficient infrastructure and afford specialist environmental managers. Among west European cities (which also represent the low-income cities of the index), Vilnius performs best overall and is in 13th place. It is followed most closely by Riga, in 15th place. Smaller cities have a better performance for environmental protection and abatement of air pollution. People have to take only small ways in purchase. Cities with an active civil society perform well in the index. Although it was beyond the scope of this study to measure specific cities engaged in environmental issues, a strong correlation was found between high performing cities in the index and cities identified as active in environmental issues that explore the strength of civil society in European countries.</td>
<td>METREX does accommodate other projects and acts as a rooftop organisation. Metrex Manual. METREX website: <a href="http://www.eurometrex.org">www.eurometrex.org</a></td>
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Analysis of co-benefits of air pollution, noise and climate change policies on local scale
Analysis of co-benefits of air pollution, noise and climate change policies on local scale

Cluster 2 - Climate Cities Benchmark

Overview

The Climate Cities Benchmark consists of four elements: 1. City fact sheets, 2. Activity profiles, 3. CO2 emission display, 4. Set of indicators elements: 1. City fact sheets, 2. Activity profiles, 3. CO2 emission display, 4. Set of indicators. The project is focused on the implementation of sustainable energy policies. The goal is to increase energy efficiency and use of renewable energy sources on their territories. From 2008 onwards the Covenant of Mayors supports the European Secretariat Executives in their work dealing with the implementation of the European Union’s 20% CO2 reduction objective by 2020. The project started in March 2004 and runs until the end of 2007. The project was continued by Cite Air II.

Actions

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<td>Cluster 2</td>
<td>None and contact details of project coordinator</td>
<td>The European Secretariat Executives Coordinating office</td>
<td>Ulrike Janssen and Thomas Brose Climate Alliance Goverantorstr. 29, 60486 Frankfurt am Main Germany Tel. +49-69-717139-0 Fax: +49-69-717139-93 Email europe(at)climatealliance.org</td>
<td>Cluster 2</td>
<td>ClimeNHCD RC, N-D Hughes Leander City Council Mainz Kasseler Str. 48 D-55124 Mainz Germany Tel. +49-6131-12648 Fax: +49-6131-12647 Email: <a href="mailto:hodgd001@leicester.gov.uk">hodgd001@leicester.gov.uk</a></td>
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<tr>
<td>Cluster 2</td>
<td>What are the project’s objectives?</td>
<td>To analyse and balance CO2 emissions, comparing climate city activities for better understanding of its mitigation potentials.</td>
<td>To fully develop better and more efficient solutions for assessing the impact of urban air quality in large urban areas, to share professional views and to provide the environmental situation based on common guidelines.</td>
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<td>What is going to happen/participate on the project?</td>
<td>Currently more than 1860 cities, municipalities and districts as well as provinces, NGOs and further organisations are members of the European Union 20% CO2 reduction objective by 2020.</td>
<td>Approximately 12,000 cities, provinces and districts as well as provinces, the European Union 20% CO2 reduction objective by 2020.</td>
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<tr>
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<td>Who is going to perform/participate on the project?</td>
<td>Ulrike Janssen and Thomas Brose Climate Alliance Goverantorstr. 29, 60486 Frankfurt am Main Germany Tel. +49-69-717139-0 Fax: +49-69-717139-93 Email europe(at)climatealliance.org</td>
<td>Ulrike Janssen and Thomas Brose Climate Alliance Goverantorstr. 29, 60486 Frankfurt am Main Germany Tel. +49-69-717139-0 Fax: +49-69-717139-93 Email europe(at)climatealliance.org</td>
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<td>Cluster 2</td>
<td>What are the future prospects/follow projects?</td>
<td>There are no follow projects announced</td>
<td>There are no follow projects announced</td>
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<td>Organisation/entry who is responsible for the emission inventory.</td>
<td><a href="http://www.klimabuendnis.org">www.klimabuendnis.org</a></td>
<td><a href="http://www.klimabuendnis.org">www.klimabuendnis.org</a></td>
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<td>Project duration</td>
<td>Focused on GHG mitigation until 2020</td>
<td>According to the project object the duration will last until 2020.</td>
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<tr>
<td>Cluster 2</td>
<td>Which cities were involved?</td>
<td>Presently more than 1600 cities, municipalities and districts as well as provinces, NGOs and further organisations are members of the Climate Alliance. Mailny EU Countries and districts as well as provinces, NGOs and further organisations are members of the Climate Alliance.</td>
<td>Presently more than 1600 cities, municipalities and districts as well as provinces, NGOs and further organisations are members of the Climate Alliance.</td>
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<td>Criteria</td>
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<td>Patients included? (NOx, O3, PM10/2.5, AP, CO)</td>
<td>NO (NOx)</td>
<td>CO</td>
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</tr>
<tr>
<td>Noise information included?</td>
<td>No information concerning noise issues</td>
<td>No information concerning noise issues</td>
<td>No information concerning noise issues</td>
<td></td>
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</tr>
<tr>
<td>Are there activity data (e.g. energy consumption, emissions data) available?</td>
<td>Activity data in the following categories: climate policy, energy, transport and waste</td>
<td>Activity data in the following categories: climate policy, energy, transport and waste</td>
<td>Activity data in the following categories: climate policy, energy, transport and waste</td>
<td></td>
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</tr>
<tr>
<td>In database/summary data package available?</td>
<td>The database and emissions are not published itself. <a href="http://www.airqualitynow.eu">www.airqualitynow.eu</a></td>
<td>The database and emissions are not published itself. <a href="http://www.airqualitynow.eu">www.airqualitynow.eu</a></td>
<td></td>
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<tr>
<td>Timeseries available?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td></td>
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</tr>
<tr>
<td>Data quality (TECA with focus on comparability and methodology)</td>
<td>Data quality regulations are 100% compliant with Covenant of Mayors. The data quality depends on the municipalities and to get a full emission inventory it is necessary to integrate local sources into the inventory. For this reason, the data quality depends on the municipalities.</td>
<td>Data quality regulations are 100% compliant with Covenant of Mayors. The data quality depends on the municipalities and to get a full emission inventory it is necessary to integrate local sources into the inventory. For this reason, the data quality depends on the municipalities.</td>
<td>Data quality has been assessed by CAQI and YACAQI indices</td>
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<tr>
<td>Sectors</td>
<td>Stationary Sources (e.g. Power plants)</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td></td>
<td>Industry and Residential</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
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<tr>
<td></td>
<td>Mobile Sources (Transport)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td></td>
<td>Other diffuse Sources</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td></td>
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<tr>
<td></td>
<td>Agriculture</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td></td>
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</tr>
<tr>
<td>Guidance</td>
<td>Description of methodology followed</td>
<td>Hybrid approach - with a combination of bottom up and top down. Top down methodology which was elaborated to guide local entities on their way to an emission inventory. Bottom up methodology - Communicating Air Quality to the public but using voluntary sources.</td>
<td>Bottom up methodology - Communicating Air Quality to the public but using voluntary sources.</td>
<td>Guidelines on integrated emission inventories (plus BMACE database and BMACE guidelines)</td>
<td><a href="http://www.benchmark-kommunaler-klimaschutz.net">www.benchmark-kommunaler-klimaschutz.net</a></td>
<td>Guidebook on Air Quality forecast</td>
<td>Guidebook on mobility and exposure indicators</td>
</tr>
<tr>
<td></td>
<td>None of any guidance documents used/suggested</td>
<td>BMACE guidelines</td>
<td>BMACE guidelines</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Project cost</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cost evaluation for cities</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
<td>No information available</td>
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</tbody>
</table>

Analysis of co-benefits of air pollution, noise and climate change policies on local scale
### Actions

#### Information on policies and measures

Is information available on implemented and planned policies and measures in the cities?

- Yes
- No

Yes, the SEPA every municipality hands in describes local measures. Yes, there are numerous Guidance documents describing measures.

#### General description of information

Small authorities can complete a CO2 inventory, which is comparable to other sustainable energy action plan (SEPA) is a document, elaborated by local administrations on behalf of the CoM initiative. Interactive map on website http://www.airqualitynow.eu/

#### Does the study assess the effectiveness of these measures? Quantitative? Qualitative?

- Yes
- No

Yes, the effectiveness is one of the criterias

#### Does the study look at co-benefits of AQ and GHG policies?

- Yes
- No

Yes, the project aim is to do research especially on air quality including GHG

#### Does the study look at co-benefits of AQ/GHG policies with noise?

- Yes
- No

No

#### Does the study link air emission inventories with an assessment of AQ in the cities covered?

- Yes
- No

Yes

#### If yes, brief description of the methods used, involve etc.

Preparation of a local emission inventory considering AP and CO2

#### Are specific ‘good practices’ identified? If yes, what are these?

- Yes
- No

Not identified

The UBC Good Practice Database offers good practices from the Baltic Sea region. It was developed to answer to the need of local authorities to find practical examples complemented with suitable tools. The practices cover sustainable development in cities covering all topics from energy saving to waste management and they are classified in 13 thematic categories. http://www.ubcwheel.eu/

#### Conclusions/other

Was there a network or ‘sharing’ forum set up for the cities participating in the study? If yes, details

- Yes
- No

Yes, there is the ‘EUROCITIES’ network which give support for the communication and organisation of European local authorities. Furthermore, the Covenant of Mayors Office (CoMO) is managed by a consortium of local and regional authorities, led by Energy Cities, and supported by Covenant Alliance (COA), Euronet and European Energy Cities. With its annual Award for the best SEAP the municipalities are honored. A monthly newsletter provides information on the SEAPs, and there is the Benchmark of Excellence of the local initiatives as a outstanding project is proposed.

The internet presentation of the project allowed communication, announcement of meetings and publications of reports and scientific literature.

### Cluster 2

<table>
<thead>
<tr>
<th>Actions</th>
<th>Details</th>
</tr>
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<tbody>
<tr>
<td>Project</td>
<td>Climate Cities Benchmark (Climate Alliance)</td>
</tr>
<tr>
<td>Council of Mayors</td>
<td>C2</td>
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</table>

Data related to the actions and measures are detailed in the following tables.
### Analysis of co-benefits of air pollution, noise and climate change policies on local scale

<table>
<thead>
<tr>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description of study’s (Projects) focal deliverables</td>
<td>- Forecasting common air quality indices and integrating greenhouse gas emissions into benchmarking model to assess CO2 performance</td>
<td>Comparable emission inventory for each country program taking demographic and economic data into account</td>
<td>EUCO2 80/50, Climate Change / Urban Change, Outline Prospectus</td>
</tr>
<tr>
<td>Updates plan? Update frequency?</td>
<td>- Preparing and revising publication on <a href="http://www.airqualitynow.eu">http://www.airqualitynow.eu</a></td>
<td>No</td>
<td>Implementation of effective mitigation/adaptive practice demonstration</td>
</tr>
<tr>
<td>Organisation</td>
<td>Climate Change Agency</td>
<td>GRIP is a web-based tool developed by Tyndall University</td>
<td>see GRIP</td>
</tr>
<tr>
<td>18 European metropolitan regions lead partner and coordinator is the Metropolitan Region of Hamburg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project timeline</td>
<td>2009 to 2011</td>
<td></td>
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### Analysis of co-benefits of air pollution, noise and climate change policies on local scale

<table>
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<th>Actions</th>
<th>Details</th>
<th>Cluster 1</th>
<th>Cluster 2</th>
<th>Cluster 3</th>
<th>Cluster 4</th>
<th>EUCO2 SubProject</th>
</tr>
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<tbody>
<tr>
<td>Emissions inventories at local level</td>
<td>Reducers</td>
<td>PM10/2.5, NOX, SO2, SOe, VOC, HC, CO</td>
<td>PM10/2.5, NOX, SO2, SOe, VOC, HC, CO</td>
<td>PM10/2.5, NOX, SO2, SOe, VOC, HC, CO</td>
<td>PM10/2.5, NOX, SO2, SOe, VOC, HC, CO</td>
<td>EUCO2 SubProject</td>
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<td>Noise information included?</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Noise information included?</td>
</tr>
<tr>
<td>Are there activity data (e.g. local statistics, information about energy consumption) considered?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Activity data considered?</td>
</tr>
<tr>
<td>Are there activity data (e.g. local statistics, information about energy consumption) available?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Activity data available?</td>
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<tr>
<td>Data quality (ICCPG with focus on comparability and methodology)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Data quality?</td>
</tr>
<tr>
<td>Sectors</td>
<td>Stationary Sources (e.g. Power plants)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Stationary Sources</td>
</tr>
<tr>
<td>Industry and Residential</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Industry and Residential</td>
</tr>
<tr>
<td>Mobile Sources (Transport)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Mobile Sources</td>
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<tr>
<td>Other Emission Sources</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Other Emission Sources</td>
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<tr>
<td>Agriculture</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Agriculture</td>
</tr>
</tbody>
</table>

### Guidance

- **Description of methodology framework:**
  - There are several methodologies for developing an emission inventory on local scale and a guideline about air quality forecasting published.
  - This was not the focus of the follow-up project.

- **Name of any guidance documents used/suggested:**
  - Guidebook on integrated emission inventories (also: MAPE database and MAPE guidelines)
  - Guidebook on mobility and exposure indicators (pamphlet as separate document)

- **Web address for guidance document:**
  - http://www.carboncaptured.org.uk/tool.php#howToUse

- **Total Project cost:**
  - No information available
  - Budget of €1.16m

- **Cost evaluation for cities:**
  - No information available

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<table>
<thead>
<tr>
<th>Cluster</th>
<th>Actions</th>
<th>Details</th>
<th>Project</th>
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<th>Cluster 3</th>
<th>Cluster 4</th>
<th>Cluster 5</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Information available on implemented and/or planned policies and measures in the cities?</td>
<td>Yes. &quot;Integrated Urban Emission Inventories&quot; (see <a href="http://www.citeair.eu/index.php?Id=10">http://www.citeair.eu/index.php?Id=10</a>)</td>
<td>Yes. InterMETREX Project Extension</td>
<td>No. Yes.</td>
<td>EUCO2 80/50: Regional Inventory Brochure</td>
<td>METREX offers a network platform. However, the webpage of EUCO2 80/50 presented background information and publications.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>General description of information</td>
<td>Local air quality is presented as a weather forecast, presented on an interactive webpage</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Does the study assess the effectiveness of these measures? Quantitative? Qualitative?</td>
<td>Yes. calculating of indices between traffic and background conditions a hourly, daily and annual comparison of cities is available</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the study look at co-benefits of AQ and GHG policies?</td>
<td>Yes. No. No.</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the study look at co-benefits of AQ/GHG policies with noise?</td>
<td>Yes. No. No.</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Does the study link air emission inventories with an assessment of AQ in the cities concerned?</td>
<td>Yes.</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>If yes, brief description of the methods used, models etc</td>
<td>Preparation of a local emission inventory considering AP and CO2</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td>Yes. offered a methodology to quantify metropolitan mitigation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are specific ‘good practices’ identified? If yes, what are these?</td>
<td>Dissamination of Air Quality Data for Europe, accessible for everyone</td>
<td>Yes: mainly GHG mitigation strategies like increase of public transport, share of renewable energy use, increase of energy efficiency</td>
<td>Yes: mainly GHG mitigation strategies like increase of public transport, share of renewable energy use, increase of energy efficiency</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Was there a network or ‘sharing’ forum set up for the cities participating in the study? If yes, details</td>
<td>The internet presentation of the project allowed communication, announcement of meetings and publication of reports and scientific literature.</td>
<td>METREX offers a network. InterMETREXplus is presented on the webpage.</td>
<td>METREX offers the network platform. However, the webpage of EUCO2 80/50 presented background information and publications.</td>
<td></td>
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<tr>
<td></td>
<td>Was there a list of findings/conclusions from the study? If yes, summarise all main conclusions</td>
<td>With using the database CollectER data can be used for quality modeling, save was taken that the output from the database can be fed directly to the AQ model, giving optimal AQ information. Local knowledge is made available through the inventory, providing fresh insights into the situation. Emissions forecasts based on industrial activity can be made; Benchmarking across a sector of industry is possible; Scenarios can be made with varying EFs, that reflect technology driven improvements (such as re-evaluating the inside-out and the logistical techniques). Data availability and accuracy can be a problem (historical record). A better spatial distribution of mobile sources emissions may result in improved performance of the national emissions inventory.</td>
<td>With the online tool regions can compare their own energy consumption and CO2 emissions per capita. A result of several scenario workshops could be summarized that two areas where Metropolitan regions (through policy measures) could restructure their existing urban form in order to reduce emissions and increase sustainability are: Reducing the need to travel, Increasing opportunities to use low carbon energy.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Some key findings:</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>1. Only 35% of the scenarios reached the target of an 80% reduction.</td>
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<tr>
<td></td>
<td>2. Southern European stakeholders were less confident in mitigation chances than the rest of Europe.</td>
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<tr>
<td></td>
<td>3. Low Carbon Electricity generation is key to mitigation.</td>
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<tr>
<td></td>
<td>4. A 100% decarbonised grid would on its own reduce European CO2 emissions below 20%.</td>
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<tr>
<td></td>
<td>5. Emissions reductions in the building sector are key to mitigation.</td>
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<tr>
<td></td>
<td>6. Increased Industrial efficiency can contribute substantially to emissions reductions.</td>
<td></td>
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<tr>
<td></td>
<td>7. Switching to electrical energy in electricity driven processes will further reduce emissions.</td>
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<td></td>
<td>8. Road transport is key to mitigation.</td>
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</tbody>
</table>

**Analysis of co-benefits of air pollution, noise and climate change policies on local scale**
Project: Project Megapoli City Zen Fairmode Initiative (GRIP)

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

http://www.carboncaptured.org.uk/

Not only cites, but all regions of countries of EU contribute to carbon capture.

What are the project's objectives?

- To assess impacts of large agglomeration and large emissions: European urban agglomerations have regional and global impacts on climate change through different pathways of carbon emissions, land use, material transfer, and transport.
- To develop and implement mitigation options: Integrate current policies and develop new methods to assess the potential impacts of future actions.
- To assess the effectiveness of mitigation options: Provide technical and policy support to assess the effectiveness of different mitigation strategies.

Who is going to perform/participate in the project?

The MEGAPOLI consortium consists of 23 full partners from 11 European countries, 12 international research non-funded partners from USA, Canada, and Japan, and 9 end users/stakeholders. The project coordinator is Alexander Baklanov, coordinator, steering group chair, Danish Meteorological Institute (2008-2011) 2008-2011 2008-2012 (it is not clear if more activities are planned in future) There is no project deadline Project duration

Project Website

http://megapoli.dmi.dk/index.html

Analysis of co-benefits of air pollution, noise and climate change policies on local scale

Cluster

Cluster 3

Cairo, St. Petersburg, Tokyo

Mexico, India, Chile and Thailand, and 9 end users/stakeholders.

Emissions for Europe provided by INERIS

A pyramid strategy was developed of undertaking detailed measurements in and around selected megacities/hot spot regions. Quantify and understand current air pollution distribution and estimate how megacities/hot spots influence climate change, air quality and the development in and around selected megacities/hot spot regions.

Objective 1: to assess impacts of megacities and large air-pollution "hot-spots" on climate, regional and global air quality and climate change, and to put on the new air quality directive requirements, mainly on the promotion of good modelling practices and the interaction between modellers and model users.

Objective 2: to quantify feedbacks between megacity emissions, air quality, local, regional and global air quality and climate change and to provide technical and policy support to assess the effectiveness of different mitigation strategies.

Objective 3: to develop and implement improved, integrated tools to assess the impacts of megacities and large air-pollution "hot-spots" on climate, regional and global air quality and climate change; to estimate how megacities/hot spots influence climate change and provide technical and policy support to assess the effectiveness of different mitigation strategies.

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- To assess impacts of large agglomeration and large emissions: European urban agglomerations have regional and global impacts on climate change through different pathways of carbon emissions, land use, material transfer, and transport.
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Objective 2: to quantify feedbacks between megacity emissions, air quality, local, regional and global air quality and climate change and to provide technical and policy support to assess the effectiveness of different mitigation strategies.

Objective 3: to develop and implement improved, integrated tools to assess the impacts of megacities and large air-pollution "hot-spots" on climate, regional and global air quality and climate change; to estimate how megacities/hot spots influence climate change and provide technical and policy support to assess the effectiveness of different mitigation strategies.
Analysis of co-benefits of air pollution, noise and climate change policies on local scale

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<thead>
<tr>
<th>Source</th>
<th>Details</th>
<th>Project</th>
<th>General</th>
<th>Impacts</th>
<th>Policies &amp; Measures</th>
<th>Recommendations</th>
<th>Open issues</th>
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<td>FAIRMODE</td>
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Further research recommendations:
- Implementing combined climate protection measures in the cement industry by 2030 and 2050.
- Replacing solid fuel fired small combustion plants with efficient combustion technologies by 2030 and 2050.
- Expanding electricity generation from renewables in large combustion plants.
- Switching to renewable heat supply in residential sector by 2030 and 2050.

Several results were obtained from the project, including:
- A significant decrease in air pollution levels and establishment of the extent of exceedances.
- A combination of models and measurements for activities such as air quality assessment.
- New definitions of the model quality objectives (see Guidance on model quality policy).
- Draft recommendations from FAIRMODE to the review of the EU Air Policy.

Online inventory tool - standard, comparable, with uncertainties.

The main aim of FAIRMODE is to promote in a harmonised manner the exchange of experiences of other users through case studies.

It includes a scenario tool which can be used to show the implications of emission mitigation measures. It includes a scenario tool which can be used to show the implications of emission mitigation measures.