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Introduction

European cities are growing and developing rapidly. Currently, around two-thirds of the EU's population live in cities, and it is expected that this share will grow to around 80% in 2050. In order to improve the urban environments, it is needed to anticipate future developments and take action to improve public health where possible.

There were more than 500.000 premature deaths attributable to PM_{2.5}, NO₂ and O₃ exposure in the EU- 28 in 2013¹. Air quality is therefore one of the major determining factors for the quality of living environment in cities, the Partnership on Air Quality established under the Urban Agenda for the EU focuses on addressing this topic.

The Urban Agenda for the EU – which started with the Pact of Amsterdam, agreed on 30 May 2016 by the EU Ministers responsible for Urban Matters² - has introduced a new working method of thematic Partnerships being elaborated by partners representing various governance authorities aiming to tackle social challenges by focussing on cities. It aims to promote cooperation between Member States, Cities, the European Commission and other stakeholders, in order to stimulate growth, liveability and innovation in the cities of Europe. The Partnership on Air Quality is one of the 12 priority themes of the “urban agenda for the EU”.

The Partnership on Air Quality consists of:

- 4 Member States: The Netherlands (coordinator), Croatia, Czech Republic, Poland
- 6 Cities: Helsinki (FI), London (UK), Utrecht (NL), Milan (IT), Constanta (RO), and Duisburg (DE - Representing the Consortium Clean Air Ruhr Area)
- 2 Stakeholder networks: EUROCITIES and HEAL (Health and Environment Alliance)

The Partnership is also actively supported by the European Commission (DG Regional and Urban policy, DG Environment, DG Research & Innovation, DG Agriculture, DG Growth, the Joint Research Centre (JRC), and by the URBACT programme.

The main objective of the Partnership on Air Quality is to improve air quality in cities and to bring the ‘healthy city’ higher on the local, national and EU agendas as part of the Urban Agenda. This will be done through improving regulation and the implementation of regulation, funding mechanisms and knowledge at all levels, as well as the coordination between them.

Currently there are many cities which have difficulty complying with the air quality standards as set by the EU, rendering their environment unhealthy for EU citizens³. The Air Quality Partnership, therefore, tries to explore the gaps, overlaps and contradictions in existing regulations and map out the resources and available funding put in place to assist cities improve air quality. In addition, through the Air Quality Partnership cities have the chance to exchange knowledge and share the best practices currently being implemented in cities around Europe, their surrounding regions and

¹ ETC/ACM, 2016c, Quantifying the health impacts of ambient air pollution — Methodology and input data, de Leeuw, F. and Horálek, J., Technical Paper 2016/5, European Topic Centre on Air Pollution and Climate Change Mitigation.

² See: <https://ec.europa.eu/futurium/en/content/pact-amsterdam>.

³ More than 130 cities across the European Union persistently exceed air quality standards.

across Member States. Following the scoping exercise of existing regulation, committed resources and knowledge, advice can be given on improving the EU policy and funding landscape. The Partnership works on proposals for better regulation (and implementation), funding and knowledge in this area.

The overall duration of the Partnership will be three years (2016-2018) and during this period actions and recommendations will be elaborated/implemented with the aim to establish a set of practical and efficient pathways and guidance to improve air quality in urban areas based on a comprehensive inventory of current practices, experiences, new research and smart combinations of opportunities and innovations as well as the identification of bottlenecks in legislation and gaps in funding.

The first step consisted of the identification of the relevant issues regarding urban air quality. Based on the input of the different partners during several meetings between December 2015 and June 2016, four concrete topics have been identified to focus on until mid-2017.

The four topics are:

Topic 1: Modelling city-specific situations

Topic 2: Mapping of regulation and funding.

Topic 3: Assessment of air quality good practices and identification of barriers.

Topic 4: Guidelines for cities air quality action plans.

This paper illustrates the main findings of the Partnership's work on those four topics. On the evidence gathered the Partnership will base actions and recommendations. A public feedback based on this paper will seek to complement the Partnership's findings.

Partnership Air Quality topics

The following four topics, as chosen by the Partnership⁴, explore how air quality can be improved in EU cities:

Topic 1: Modelling city-specific situations

Local measures are often developed for specific local circumstances, so it is useful to share best practices between different cities. The exchange of details and experience with these local measures is required to complement the overview of efficient and effective measures and to help other cities to develop their own specific strategies to improve air quality taking into account local circumstances.

Healthy living and urban air quality can be improved by mitigation of the relevant emission sources of air pollutants or their precursors. Urban air quality is not only influenced by urban sources (i.e. traffic, public transport, space heating, industry) but also by sources situated outside the city. This so called “background concentration” is composed of/influenced by the emissions from non-urban (regional, national and international) emission sources such as agriculture, shipping (inland and coastal), industrial activity, non-urban transport, waste management, power production, natural sources and emissions in distant urban areas. Decisions made at international, EU and Member State level are best to tackle the effects and control the emissions of industrial activity, shipping, agriculture, power production, non-urban transport including aviation. Cities can only mitigate the effects of these emissions.

Decisions on which urban sources could best be mitigated require reliable data on the background sources (which determine the background concentration and the city’s own contribution to the air quality) and projections of future background concentration levels. Only if this information is available one can assess in advance to what extent mitigation measures in the city can actually contribute to the improvement of urban air quality (and environmental performance in general). Air quality modelling is a common approach in the (ex ante) assessment of effectiveness of (proposed) mitigation measures. This approach is based on models requiring input data on urban emissions to simulate background concentrations. Background concentration – and its future evolution – is for a large part governed by the effectiveness of related emission reduction measures and as such guided by EU, national, regional and local policies. Thus, the improvement of urban air quality is the result of a complex interaction of EU, national, regional and local legislation and policies.

Aims of topic 1:

- To get an overview of air quality in Partnership cities and on the share of different emission sources affecting it.
- To find out how modelling has been carried out by different cities to identify measures that can improve air quality.
- To establish a firm information base of emission sources affecting air quality and of measures taken to improve air quality in Partnership cities.

⁴ URBAN AGENDA FOR THE EU ACTION PLAN, Partnership Air Quality, 9 feb 2016

Because of the limited amount of cities the mapping is to be regarded as case studies. The content of and the results of this topic will feed into and interact with the Partnership's activities on Mapping of regulation and funding and on Assessment of air quality good practices and identification of barriers, and eventually form the basis for formulating Guidelines for cities air quality action plans .

The following activities were conducted for Topic 1, thereby focusing first on the cities represented in the Partnership.

- Inventory of sources of air pollution and better understanding of the effects of air pollution caused by local, regional, national and European sources.
- Source allocation of air pollution, to understand “key sectors/pollutants/geographical areas” influencing air quality.
- Inventory of practical measures in relation to the reduction of (specific sources of) air pollution and the effect on health conditions. Information of measures, indicators (e.g. modal share, traffic volumes) and costs (if available).
- Analysis of measures on the basis of modelling carried out by cities in their Air Quality plans.
- Synthesis and elaboration of data from the above activities. Making comparisons of the type of modelling used and the impacts of different measures on Air Quality in various cities.

Topic 2: Mapping of EU regulation instruments and funding

The negative effects of ambient air pollution on human health have been well documented. In particular, there is no evidence of a safe level of particulate matter (PM) below which no adverse effects occur. The current level of air pollution in European cities is contributing to a significant burden of mortality, hospital admissions and exacerbation of existing health problems, such as respiratory and cardiovascular diseases. As exposure to air pollution is largely beyond the control of individuals, action is required at various levels of public authority. The Ambient Air Quality Directive (2008/50/EC) was introduced in May 2008. It sets out limit values for a number of pollutants with dates by which they were to have been attained. However, more than six years after the Directive was transposed into national legislation across the Member States, there are widespread exceedances of the limit values across Europe, specifically with regard to particulate matter (PM₁₀), nitrogen dioxide and ozone. In 2014, PM₁₀ and nitrogen dioxide limit values were exceeded in 23 Member States and the European Commission had opened infringement procedures against 19 Member States as of October 2016. Exceedances of PM₁₀ are typically driven by primary sources including solid fuel burning in residential buildings, road traffic and industry. Diesel vehicles are the main cause for exceedances of the nitrogen dioxide limit value.

As Member States and cities try to improve air quality and meet the legal limits there may be a need for new innovative regulatory concepts. This Partnership looked at the possibility that some of the gaps and bottlenecks can be remedied by more appropriate or better targeted funding. The Partnership, through mapping of existing EU regulation and legislation directly or indirectly affecting air quality, identified gaps in EU regulations regarding pollutants and sources of pollution, as well as ways to improve fiscal and other incentives given at Member State level to improve air quality.

There are numerous EU directives, regulations and other legal and non-legal instruments in place which aim specifically at the improvement of air quality and healthy living in cities, or regulations which have an indirect effect on these objectives (e.g. climate policies). For instance EU actions are



aimed at specific emission sources, harmonizing the process of issuing environmental permits, or the type approval of vehicles across the EU. Member States (and Regions in some cases) have developed additional legal instruments to improve air quality. Cities strive to improve the health of their citizens through city planning and through schemes targeting urban transport. The Partnership's analysis of the existing legislation and a selection of city led air pollution schemes (e.g. bus retrofitting, Low Emission Zones (LEZs), etc.) showed that these different regulations do not always work together optimally and in some (worst) cases they might even counteract each other.

Since in many places in Europe there is still non-compliance with the air quality standards, it was also assessed that the implementation of existing legislation is not sufficient.

Furthermore it was concluded that the air quality legislation is mainly focussed on emission standards and not enough on the average exposure of the population to air quality pollutants.

Topic 3: Air quality good practices and identification of barriers

In cities all over Europe actions are being implemented to improve urban air quality and health. The Partnership analysed existing applications of air quality measures with a view to help cities choose the ones that would work best in their specific local context.

The partners collected also examples of innovative approaches currently developed to address air quality issues. Apart from technological innovations, for instance innovative modality options like e-bikes, cargo bikes or car sharing, healthy designs of public areas stimulating cycling and walking, nature-based solutions in cities to reduce background concentration of air pollution, citizen science (measuring air quality with small measuring devices in order to create a large dataset on air quality), urban strategy (modelling quality of the living environment in different city designs and settings), behavioural change and public participation projects. The possible large scale effectiveness of these innovations is not always clear, as they often involve start-ups and small scale pilot projects, or they are simply not known to a larger public or the technology is not yet reliable enough (e.g. some small sensors). In order to enable cities to make an informed choice on innovations and to keep up with current developments, an overview of best practices should include examples of effective and efficient innovative approaches.

Under Topic 3 - Recommendations on air quality best practices, the Partnership envisaged to compile an overview of examples of best practices to improve air quality and to identify the barriers cities are facing. The Partnership's analysis focuses on practices already identified under the Modelling of city-specific situations and the Mapping of EU regulation instruments and funding, complemented by a desk study on other EU examples.

The following activities were conducted for topic 3:

- Collection of (recommended and transferable) examples of best practices building on the results from topic 1 and 2. Including both effective and non-effective measures (in health, environmental and financial terms), policies and funding practices.
- Compilation of best practice documents on specific topics.
- Sharing knowledge on best practices outside the Partnership.

Topic 4: Guidelines for cities' air quality action plans

Currently many cities are developing their own air quality action plans not knowing what other cities have already developed. There is not yet a structured exchange on current practices for the elaboration of air quality action plans (and their relation to public health). This practice leads to inefficiencies as the knowledge and experiences (process optimization, pitfalls, stakeholder interactions, governance, monitoring etc.) from front-runners is often ignored. Hence, there is a clear need for streamlining and providing guidance on processes and practices in air quality action planning.

In Topic 4 – Guidelines for cities air quality action plans, this guidance will be elaborated including the results of the previous Partnership's activities. This topic will result in a basic set of guidelines for cities for the preparation of air quality action plans. This set of guideline is expected to facilitate local decision making, uniformity in air quality plans and safeguard compliance with EU legislation and, by doing all that, it will help cities bring down atmospheric concentrations of air pollutants and thus improve public health. These guidelines are both beneficial for cities with exceedances of Air Quality limit values and cities with no exceedances and the urge to draft a voluntary Air Quality Action Plan. This topic will also give recommendations on possible pilots or demonstration projects to be implemented in cities within the Partnership and beyond. These pilots are to demonstrate the actual improvement of air quality through usage of the identified examples of best practices.

The following activities were conducted for Topic 4:

- Extract relevant information from previous Partnership's work for the elaboration of a basic air quality plan
- Describe relevant issues to be addressed, required process steps, stakeholder involvement and funding issues

Draft guidelines will be prepared, including recommendations.

Main findings and issues

The Partnership's work is half way now. Identification of main issues and of topics to be addressed has been done. Actions and recommendations will be derived from this. This chapter presents the main findings so far. These findings are based on the work done by the Partnership, notably between local, national and EU partners, as well as on the inputs gathered through stakeholder surveys.

1. Main air quality pollutants

Particulate Matter (PM), nitrogen dioxide (NO₂) and ground-level ozone (O₃), are now generally recognised as the three pollutants that most significantly affect human health⁵. They can have adverse effects on both the environment and human health. In 2013 the International Agency for Research on Cancer (IARC) classified the particulate matter (PM) in outdoor air pollution as carcinogenic to humans. Especially children up to 19 are vulnerable to air pollution. It is of utmost importance to protect children from these pollutants, which are dangerous for healthy urban living.

Effects on human health of air pollutants in ambient air are⁶:

- **PM_{2.5}, PM₁₀ and ultrafine particles:** Exposure to fine Particulate Matter (i.e. PM_{2.5}) is widely recognised as the principal cause of health concern across the EU, but there is little or no regulation on the species components of PM. Directive 2008/50/EC (Annex IV) requires Member States to undertake speciated monitoring for anions/cations and Elemental/Organic Carbon (EC/OC) at rural background locations, so as to judge the enhanced levels in more polluted areas (including urban background and roadside locations). There are currently no controls on emissions of speciated PM, and specifically EC/OC (SLCPs). Particulate matter that is small enough can enter the lungs and cause health problems. This air pollutant is most strongly associated with health effects, in terms of chronic mortality. However, unlike the gaseous pollutants, PM is not a single discrete component and is instead made up of contributions from numerous sources, both local and transboundary, and comprises both primary and secondary material across a range of sizes. These include metals, Polycyclic Aromatic Hydrocarbons (PAHs), sulphate particles, and black carbon; in 2012, the International Agency for Research on Cancer (IARC) classifies diesel engine exhaust as a carcinogen. However, WHO Guidelines and EU Limit Values focus control on the total mass of particles, as PM₁₀ and PM_{2.5}.
- **Nitrogen Dioxide:** High levels of nitrogen dioxide exposure can lead to coughing and shortness of breath. People who have extensive exposure to NO₂ for a long time have a higher risk of respiratory disease. Recently also negative effects on cardiovascular system and cognitive functions were found.
- **Ozone:** Ozone near the ground can cause a number of health problems. It can irritate the respiratory system, aggravate asthma and chronic lung diseases and may cause permanent lung damage.
- **Short lived climate pollutants (SLCP)** are gases or particles that have climate warming effects with atmospheric lifetimes shorter than carbon dioxide, but often persisting for only weeks or

⁵ <https://www.eea.europa.eu/themes/air/intro>

⁶ EEA Air Quality in Europe Report 2016.

even days. Important examples include black carbon, methane, ozone and hydrofluorocarbons. Importantly, some SLCPs are also toxic air pollutants.

Health impacts related to PM_{2.5} dominate⁷ the health impacts. More in detail, the following table shows premature deaths⁸ attributable to fine particulate matter (PM_{2.5}), ground-level ozone (O₃) and nitrogen dioxide (NO₂) exposure in 2013 in 41 European countries and the EU 28⁹.

Table 1 Premature deaths attributable to PM_{2.5}, NO₂ and O₃ exposure in 41 European countries and the EU-28 in 2013¹⁰.

	PM _{2.5}	NO ₂	O ₃
Europe	467 000	71 000	17 000
EU-28	436 000	68 000	16 000

2. Findings on air quality and health

The main findings on this topic can be summarized as follows:

- Air quality planning in cities could complement the ‘focus on exceedances of limit values’, with an additional ‘focus on health protection of citizens’.
- Depending on the pollutant, urban sources can be of more or less importance. For NO₂, for instance, traffic and space heating are in most of cities the main contributors and actions at urban level can be very useful to reduce concentrations, exceedances and improve exposure of citizens. Anyway urban air quality is not only influenced by urban sources (among others individual car traffic, heavy goods transport, space heating, industry) but also by sources from outside the city. This so-called background concentration is composed of/influenced by the emissions from non-urban emission sources such as agriculture, shipping, natural sources and emissions in distant urban areas, including also trans-boundary pollution.
- Transboundary pollution (i.e. international emissions) can largely influence local concentrations (i.e. coal burning).

Nitrogen dioxide (NO₂)

For **Nitrogen dioxide (NO₂)**, the analysis of the evidence gathered, supported by previous knowledge on the topic and by the *Screening for High Emission Reduction Potential on Air (SHERPA)*¹¹ modelling for “urban background concentration”, shows that:

- It is difficult to meet NO₂ Limit Values in most of the cities.
- The main problems are at the street level.
- The main sources are often local (i.e. traffic) although the composition of air pollution sources are different per city.
- To address this problem, a mix of local and national/European actions would be needed.
- Cities can play an important role in reducing NO₂ exposure.

⁷ EEA, 2016; IIASA, 2014.

⁸ Premature deaths are deaths that occur before a person reaches an expected age. This expected age is typically the age of standard life expectancy for a country and gender. Premature deaths are considered to be preventable if their cause can be eliminated.

⁹ EEA, 2016.

¹⁰ ETC/ACM, 2016c, Quantifying the health impacts of ambient air pollution — Methodology and input data, de Leeuw, F. and Horálek, J., Technical Paper 2016/5, European Topic Centre on Air Pollution and Climate Change Mitigation.

¹¹ <http://aqm.jrc.ec.europa.eu/sherpa.aspx> .

Particulate matter (PM_{2.5} and PM₁₀)

- For **fine particles** with a diameter of 2.5 µm or less (PM_{2.5}) the analysis supported by previous knowledge on the topic and by the SHERPA modelling¹² for 'urban background concentration' shows that it can be difficult for many cities to meet PM₁₀ and PM_{2.5} limit values.
- From the health point of view:
 - Health impacts due to PM_{2.5} concentrations is a key issue.
 - There is no evidence of a safe level of particulate matter (PM) below which no adverse effects occur and WHO guidelines for PM_{2.5} is lower (i.e. more stringent) than the EU limit values. This could be taken into account, when reflecting on the health impacts due to air pollution.
 - Significant reductions in Years of Life Lost¹³ due to PM_{2.5} exposure typically require action at different levels. The health impact reduction due to local actions is different depending on the city and the cities themselves cannot completely solve their air quality problems, but national/international cooperation is needed as the following graph shows
- From the phenomenological point of view:
 - Primary PM is directly emitted in the atmosphere, secondary PM is created through chemical reactions from different precursors (NO_x, NH₃, SO₂, VOCs).
 - Both primary and secondary sources in different geographical areas contribute to urban background concentrations.
 - Regional/national/European emissions contribute to PM_{2.5} background concentrations; both primary and secondary PM can be transported long distances.
 - At urban level it is possible to act to reduce primary pollutants emissions and relative concentrations; more difficult it is to control the concentrations of secondary pollutants.
 - The definition of sectorial and geographical sources is more complex than in the NO₂ case. It is clear, for example in Utrecht, how actions at the city level (mainly related to traffic) can only contribute to the reduction of part (e.g. 10%) of the urban background concentration in the city. To address the rest of the urban background concentrations, action at other levels (regional, national, European) and on other sectors is needed.
 - However, actions at city level can reduce some toxic components of PM (PAH, BC, metals) and relative citizens exposure. Awareness on this would improve citizens' support for urban measures aiming at air quality improvement.

3. Air quality measures

Cities current experience was collected through a survey to which 35 cities in 18 countries responded. The cities are from Northern (10 cities from 5 countries), Eastern (5 cities from 3 countries), Southern (8 cities from 6 countries) and Western (12 cities from 4 countries) European countries. The findings presented below only take into account the cities which participated in the survey. It is important to make sure that the obstacles are removed that prevent cities from adopting measures that make sense in their local context. This has to be further explored in interviews and workshops with city experts.

¹² The SHERPA model can help to understand the sources and type of interventions needed to improve air quality in cities.

¹³ Years of life lost (YLL) are defined as the years of potential life lost owing to premature death. It is an estimate of the average years that a person would have lived if he or she had not died prematurely. YLL take into account the age at which deaths occur, giving greater weight to deaths at a younger age and lower weight to deaths at an older age. It gives, therefore, more nuanced information than the number of premature deaths alone.

Known Air Quality Measures

Over 50 known air quality measures were reported by cities. Information gathered from different cities on the application of measures and experiences, as well as on expected obstacles were shared. For most measures the cities experienced/expected one or more obstacles.

Additional/Innovative Air Quality Measures

Most cities also shared several additional and or/innovative measures. In total 57 additional/innovative measures were identified through a questionnaire, 45 of which included obstacles. The majority of the additional/innovative measures including obstacles, received from Northern, Southern and Western European cities focused on road traffic. Most of those measures mostly have connections with the other policy objectives like climate change, followed by public health. For the measures reported by Eastern Europe cities, the focus mainly lies on the reduction of emissions from energy (incl. space heating) and on public health policies. Some notable measures are those that combine air pollution policy with other policy fields (climate and energy policy, urban planning, healthy urban living policy, noise policy, etc.) and approaches that work on fostering awareness raising, public participation and public support for measures.

In the questionnaire cities were asked to mention which air quality measures they are implementing in five different sectors, and to identify which of the following known barriers they have encountered during their implementation:

- Social: no political and/or public support/acceptance.
- Financial: high (investment) costs, (more) funding needed.
- Legal: no legislation or legislative power for city.
- Other:
 - Urban Planning: lack of infrastructure and/or space.
 - Impact: local air quality measures can mainly tackle transport as a source of pollution and all other sources need to be primarily addressed by the National or EU level or more (administrative and financial) powers should be given to cities.
 - Technical: technical issues (i.e. not familiar with technical or other obstacles).

Most measures identified as being taken by cities are on road traffic. Eastern cities focus more on emission reduction from energy. Below the key obstacles encountered by cities at the different levels of governance are summarised.

Obstacles related to EU policy (as mentioned in the questionnaire by cities)

- Difficult procedures to allocate funding to clean air projects from European funds (e.g. CAP-funds or EIB). However, it was also mentioned that it is questionable whether the EU should give specific financial support to cities for air quality measures, since cities have their own budgets and responsibilities.
- Uncertainty of about real driving emissions and future diesel emission factors hampered the introduction of effective Urban Vehicle Access Restrictions (UVAR) and/or Low Emission Zones (LEZ).
- Internal market restrictions for taxes/subsidies to promote the use of cleaner energy.
- Shipping measures require coordination mechanisms with other harbours. Shipping can relate to ports and to vessels. New vessels will be covered by the Directive on Non-Road mobile machinery emissions (NRMM)¹⁴. For sea vessels there are the EU Directive 2012/33/EU

¹⁴ DIRECTIVE 97/68/EC OF THE EP AND OF THE COUNCIL of 16 December 1997 on the approximation of the laws of the Member States relating to measures against the emission of gaseous and particulate pollutants from internal combustion engines to be installed in non-road mobile machinery (NRMM)

regarding the sulphur content of marine fuels¹⁵, and International Maritime Organisation (IMO) rules. However, it is perfectly feasible that the EU requires ships to switch to clean power when they are stationed in harbours and therefore close to urban areas.

Obstacles related to national policy (as mentioned in the questionnaire by cities)

- There is a lack of policies to tackle smaller “forgotten” sectors, i.e. shipping, uncontrolled emissions from farming/agriculture, mobile refrigeration units, heating and power (specifically biomass). Cities do not have (or use) the jurisdiction and competency to develop measures to tackle agriculture, shipping emissions. Furthermore, shipping measures require coordination mechanism with other harbours and even EU standards. It was also assessed that there is a lack of legal measures to tackle emissions at sources (i.e. emissions standard limit values).
- The measure on road traffic with huge levels of barriers was the ‘Low emission zones (LEZs) for cars’ (subcategory ‘Bans on polluting vehicles’). In particular social obstacles, i.e. no public and/or political support, and legal obstacles, i.e. no clear/official regulations, are experienced/expected with this measure. Another measure where a lot of obstacles are experienced/expected is for another road traffic measure, ‘Pollution weighted congestion charges’ (subcategory ‘Clean vehicles’). For this measure both social and legal obstacles are experienced/expected.
- Lack of financial and legal support from national governments for LEZ, or to allow local funding of air quality projects with local pollution weighted congestion charges. However, it was also mentioned that it is questionable whether national authorities should give specific financial support to cities for air quality measures, since cities have their own budgets and responsibilities.
- Lack of financial and legal support from national governments for local experiments.
- Lack of quality assurance (impact) of local air quality plans by national governments.

Local/regional obstacles (as mentioned in the questionnaire by cities)

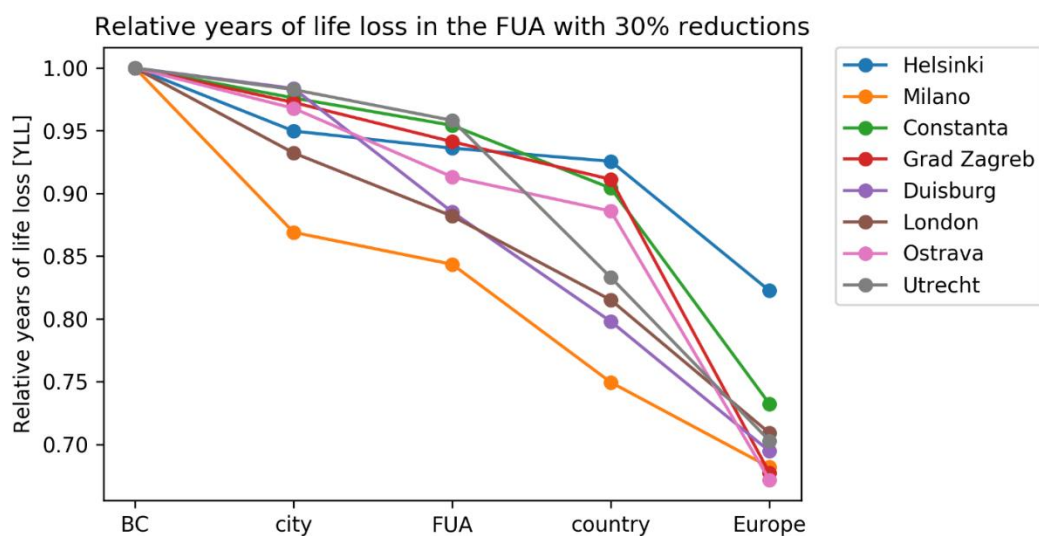
- Slow implementation of EU legislation.
- Lack of (public) awareness and support for local measures.
- Lack of coordination mechanisms with neighbouring regions to reduce sources outside the city or region (e.g. cattle and poultry, which is a regional source of emissions with relatively high impact on some cities. The most important pollutant is particular matter, with ammonia (NH₃) being an important source of secondary particulate matter).
- Lack of a structured exchange on current practices for the elaboration of air quality action plans (and their relation to public health). This has been assessed to lead to inefficiencies, since knowledge and experiences (process optimization, pitfalls, stakeholder interactions, governance, monitoring, etc.) from front runners are ignored or at least difficult to access. This is also related to a lack of capacity and/or knowledge.

¹⁵ DIRECTIVE 2012/33/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 21 November 2012 amending Council Directive 1999/32/EC as regards the sulphur content of marine fuels.

Main findings related to regulation, knowledge and funding

1. Findings on EU air quality regulations

The findings generally point at actions to improve regulation. However, most findings could also point at actions aimed at improving the implementation of regulations at European, national and city level. The following chart shows that any action on local, national or European level should be complemented by measures on other levels. It shows the relative improvement of health due to measures on different levels (FUA=functional urban area). It also shows the differences between cities due to their size and geographical location.



1.1. Establishment and implementation of air quality legislation

Bottlenecks to be addressed

It was assessed that there should be a **much stronger and systematic dialogue between Cities and National/Regional authorities**; frameworks for some useful/effective measures could be established or strengthened, as well as coordination mechanisms with neighbouring regions to reduce sources outside the city or region. These could be regulatory measures or introduced as good practices.

The way in which the **monitoring and assessment requirements** of the Ambient Air Quality Directive, 2008/50/EC, are interpreted can make a significant difference to the size of the air quality problem to be addressed. This in turn plays into local decisions on priorities and public funding. However, this issue has not been extensively researched and so it is not clear to which extent different interpretations of the Directive would impose different requirements on urban authorities across the Union.

There is a **lack of regulations to enforce and support the adoptions of cities Air Quality Action Plans in the view of 'citizens' health' protection**, considering cities as 'hot spot' areas for exposure

and the percentage of the urban population exposed to air pollutant concentrations above EU and WHO reference thresholds.

There is a **lack of tools for checking of content and quality of Air Quality Action Plans submitted within e-reporting**, which are drafted in national language. There is also a lack of quality assurance (impact) of local air quality plans by national governments.

Action on air quality at local level requires **local leadership, knowledge, capacity and resources to invest**. However, such action can also be incentivised, undermined, or blocked, by policy and legislative structures set up at local, national or regional level. For example, the introduction of urban low emission zones in Germany is subject to local level decision making. However, all German low emission zones follow a common structure and format, a structure set up by the Federal Government. It could be suggested that the lack of such a framework in, for example, the UK has restricted the uptake of low emission zones and those that do exist tend to follow very different patterns.

An important finding is that **integrated approaches combining different policy areas** can be more effective in creating healthier cities than focussing on air quality in isolation. While extending these as legal requirements may not be considered appropriate, it may be useful to explore ways to incentivise the development of national/regional integrated policy frameworks (e.g. align climate policy, mobility policy and public transport policy and air quality policy) to enable more coordinated action.

1.2. Control of the components of air pollution

Bottlenecks to be addressed

Urban areas can exercise measure of control on particulate matter primary sources, such as on industry, domestic heating (only in the cases where cities have powers over these sectors) and mainly transport. Cities also emit the precursors of secondary PM and contribute to the background emissions. Many authorities have been active in promoting clean vehicles and retrofitting Diesel Particulate Filters to older diesel buses, and such measures have been successful in controlling primary emissions from transport. However, **it is not clear to what extent these efforts are influencing the total mass of particulate matter** (and specifically PM_{2.5}).

The measures identified as being taken by cities **mostly focus on road traffic**. Eastern European cities focus more on **emissions reduction from energy** (mostly heating).

There are **gaps in the regulations/policies tackling emissions from sectors like shipping, farming/agriculture, Heavy Goods Vehicles refrigeration units, heating and power (specifically biomass)**. Cities do not always have (or use) the jurisdiction and competency to develop measures to tackle agriculture/shipping emissions. But this strongly depends on the legal framework and on the ambition of the national, regional and local authorities involved. For example, using power from the shore while being in the harbour is something cities can facilitate. Furthermore, shipping measures require coordination mechanism with other harbours and even EU standards.

It was also assessed that there is a **lack of legal measures to tackle emissions at sources level** (i.e. emissions standard limit values).

Emissions from small diesel engines used to power refrigeration units on lorries are unregulated and represent a reason of increasing concern. Emissions from these engines are disproportionately polluting, especially within urban areas where such engines are left running even when the main engine is switched off.

Below is a listing of the issues identified, arising from the review carried out by the Partnership:

- a. Failure of Euro Standards to control NO_x emissions (specifically from Light Duty Vehicles), control of PM species such as elemental carbon and organic carbon, although measurements of chemical composition of PM_{2.5} is set by Annex IV 2008/50/EC Directive, emissions from brake and tyre wear.
- b. Fugitive dust emissions from construction sites.
- c. Emissions from non-intensive farming (cattle, poultry, manure spreading).
- d. Emissions from shipping and ports.
- e. Emissions from mobile refrigeration units.
- f. Emissions from space heating and power (specifically biomass).

2. Findings on air quality and funding

Bottlenecks to be addressed

Funding is one of the fundamental issues in adopting and implementing measures timely and effectively.

There are many projects and actions relevant for the better funding and financing for air quality measures since this goal, i.e. air quality and related policies, is usually a component of the sustainable urban development funding and financing effort, or it is meant as a side positive effect entailed by broader urban policies. Projects in this sector are substantially heterogeneous and aiming at impacting on several components of the productive, political and social assets of countries. The following issues regarding 'funding' were identified:

- It was assessed that there is a **lack of availability of specific funding for Air Quality for City Administrations**, and air quality improvement could be more easily achieved as a target if it is the 'title' of funding items and not only a by-product of mobility, energy and other sectors. Although it was also stated that funding options for cities are already complex and fragmented and adding an extra fund will only contribute to this. Also, integrated funding helps with promoting integrated thinking (so e.g. assessing infrastructure projects with regard to their impact on air quality, promoting nature-based solutions, etc.).
- There is a **lack of funding dedicated to areas where costs of local abatement measures for Limit Values compliance achievement are remarkable** (stronger measures and wider range of action to be taken). Lack of financial support from national governments for effective (but costly) measures, or to allow local funding of air quality projects with local pollution weighted congestion charges. This can mean that the responsible regions and national authorities have not considered it a priority in Operational Programmes or Rural Development Programmes.
- There is a **limited accessibility to information on funding resources and procedures**, which is essential to acquire funding for clean air projects from European funds. However, information regarding operational programmes funded by the European Structural Investment Funds are available on the website of responsible authorities of Member States and Regions. Furthermore, the Commission created a tool that gives access to data on financing and achievements under the ESI Funds 2014-2020¹⁶. The platform visualises, for over 530 programmes, the latest data available (end-2015 for achievements, end-2016 for finances implemented, daily for EU payments).

¹⁶ <https://cohesiondata.ec.europa.eu/>

- There are **internal market restrictions for taxes/subsidies to promote the use of cleaner energy**.
- A key component of good policy making is **ex ante assessment of the impacts of a policy on air quality and ex post evaluation to see if those impacts materialised**. It is not clear to what extent funding mechanisms have been subject to such assessment in terms of air quality benefits and, in particular, in terms of the long-term impacts on air quality. Such information would be extremely helpful to direct local and regional authorities towards the most effective funding schemes and to modify and implement such schemes. It is not within the scope of the Partnership to undertake such an evaluation but it may be possible to gather information on what has been undertaken to date and recommend further action in this area. Evaluation mechanisms though are already in use in relations to EU funds. For example, The Common Agricultural Policy schemes are regularly submitted to a periodic mandatory ex-post evaluation carried out by independent contractors, providing not only the assessment of the different functioning scheme, but also conclusions and recommendations for the European Institutions and the national Administrations. These reports are published on the website of the European Commission. The Articles in the recent National Emission Ceilings Directive 20196/2284 related to the use of EU funding and the reporting will already address a lot of these findings.

3. Findings on air quality and knowledge

Bottlenecks to be addressed

Knowledge on the impact/effectiveness of air quality measures (not only regarding contributions to emission reduction, but especially on health effects improvement and related external cost gain), future developments and methods to forecast scenarios are the basis for developing effective air quality policies and select effective measures. The selection of the measures to obtain Limit Values compliance depends on the effectiveness of each individual measure; but this parameter depends the duration of the measure or time necessary for achieving compliance for the selected pollutant, thus the **assessment of the relative effectiveness of measures to be evaluated/implemented** is of crucial importance. Estimation of how much each measure reduces the concentrations at the exceedance location(s) is therefore very challenging as it requires detailed air quality and emission data available, modelling capability, software tools and huge computational time to assess the whole city territory with a good detail.

It was mentioned there is a **lack of knowledge on how to promote public awareness and participation**. How to make people more aware of health risks related to air pollution? How to organise participatory processes around air quality, to tap into community knowledge and build ownership (e.g. Citizens' panels in Gdansk, PL)? How to tap into the public mobilisation inspired by environmental organisations and support them in their activities?

It was assessed that there currently is a **lack of access to modelling approaches to assess the impact of measures, and difficulties in implementing and use them** is observed by several cities. It was noted that there are difficulties to access to instruments/methods/tools to verify the effectiveness of the planned and adopted measures in terms of concentration/health effects and external costs.

It is **difficult to estimate how emission factors will change in the future**. Because conformity factors are larger than 1 there is a uncertainty about the impact of new Euro emission limit values as regards NO_x and NO₂ for diesel cars and their real emissions. It is expected that with the introduction of Real Driving Emissions tests NO_x emissions will decline. But the current uncertainty

has impacts for the accuracy of the calculations regarding expectations about economic growth in the future and growth of mobility, and expectations about socio-economic growth of the city (i.e. numbers of workers and citizens). These issues makes it difficult for cities to select and implement measures that would reduce NO₂ concentrations in traffic environment.

Lack of knowledge in citizens about the fundamental role of local policies on traffic regulation measures and potential role in reduction of citizen exposure with health benefits on specific local and toxic pollutants regulated (NO₂, benzene) and not regulated (PAH, BC, PN). This knowledge/awareness in citizens would help to achieve wider support of private traffic limitation measures. It is important to choose the correct pollutant/indicator in assessing the effectiveness of such measures in relation to improving health.

Need for measures tailored to the specific area where a city is located (orographic and meteorological characteristic, economic situation, type of industry).

Source apportionment is an important tool for identification of sectors contributing to health impact and concentrations of specific pollutants in air - a baseline for drafting Air Quality Action Plans. It was mentioned that it is important to have/use upgraded and complete local emission inventories.

In most Members States responsibility for drafting and implementing Air Quality Action Plans from Art. 23 of Directive 2008/50/EC is given to local or regional authorities, while measures defined by the Air Quality Action Plans should address different sectors, also of competence of authorities operating at different governance levels. In the majority of Members States there is a **lack of a national coordination body or competent authority and/or mechanism on national level to support drafting and implementation of local Air Quality Action Plans, to harmonize Air Quality Action Plans of different zone and agglomeration** (e.g. more or less developed).

There is a **need for increased scrutiny of, and exchange of information about, national and local air quality plans from different cities/countries**: Member States' national Air Quality Plans contain important information about actions being taken to address air quality at national, regional and local levels. However, it is not clear how accessible this information is, even to other Member States or local authorities within Member States.

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