CATALOGUE OF ACTIONS TO COPE WITH SEVERE AIR POLLUTION EPISODES

Mitigation and adaptation actions for CE Functional Urban Areas

SHORT TERM MITIGATION ACTIONS

LONG TERM MITIGATION ACTIONS

SHORT TERM ADAPTATION ACTIONS

LONG TERM ADAPTATION ACTIONS

Towards better air and health in European cities

The concepts of “mitigation” and “adaptation” date back to the framework of climate change and became fundamental topics in this debate.

The International Panel on Climate Change (IPCC) defines mitigation as: “An anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases." On the other hand, IPCC defines adaptation as the “adjustment in natural or human systems to a new or changing environment.” In short, and translating these concepts to air quality, mitigation comprises any action to reduce the causes of air pollution while adaptation involves actions taken to counteract new or changing environmental challenges and reduce the vulnerability of communities and ecosystems to the effects of air pollution.

In the real world, it is sometimes difficult to establish a clear distinction between mitigation and adaptation strategies since there are many interrelated aspects and often there is the need to focus on both aspects at the same time in order to design solutions which can provide co-benefits for overall public health. In other words, it is very difficult to achieve a reduction of the adverse health impact of poor air quality thinking about mitigation and adaptation strategies individually. In the framework of reduction of the long-term exposure, mitigation strategies are generally considered more effective, since mitigation measures have a more general and stronger impact on a longer time scale than adaptation measures, which in turn could be more effective in the short term to achieve reduction of adverse health effects.

SHORT TERM MITIGATION ACTIONS

Banning open fires

Burning household or garden waste is never a safe option. It creates harmful toxins that pollute the air, soil, and water around us. Green waste, along with paper, cardboard, some industrial wastes, plastics, tyres, and rubber are flammable and easy to burn but hazardous for our health. Despite being a convenient option, burning green waste is also a bad waste disposal idea, whether in your own backyard or in your local landfill. This is because in the long run, burning green wastes has a great impact. Particulate matter, benzopyrene, carbon monoxide, nitrogen oxide, dioxins, and ozone-forming chemicals are some of the substances released into the air from burning yard waste. This is especially important during severe air pollution episodes and many municipalities are declaring illegal burning biomass or waste during severe air pollution episodes or during the whole winter season. The reduction of biomass burning for residential heating has been identified has one of the primary short- and long-term mitigation actions.

Key actors

- Farmers
- Citizens of the rural/suburban areas
- Municipal police

Expected impact

- Signifcant decrease of primary emissions of several pollutants including PM
- Reduction of fire risk

Threats

- Biomass burning for residential heating is difficult to ban because it is the only heating system of several houses
- Opposition is also associated to the low cost of biomass burning heating systems

Traffic restrictions

Several cities across Europe apply traffic restrictions during severe air pollution episodes. These measures are generally focused on areas surrounding the city centre and the specific categories of vehicles having the largest impact in terms of emissions. The effectiveness of these measures is questionable and controversial. While traffic restrictions, when duely applied, can produce significant decrease in the so called primary pollutants such as nitrogen dioxide, carbon monoxide, benzene, and black carbon, only minor benefits can be achieved in relation to particulate matter. The reason for that is mainly related to the primary role of secondary particulate in particular during severe air pollution episodes. Considering the major role of PM pollution in Central Europe area, this is an important shortage. Therefore, traffic restrictions may have considerable benefits in terms of reduction of toxicity of the mixture of air pollutants, but only a minor effects in terms of PM reductions. Only applying traffic restrictions significantly in advance and in large areas can make them more effective in reducing PM concentrations.

Key actors

- Regional authorities and municipalities
- Citizens
- Municipal police
- Economic activities

Expected impact

- Significant decrease of traffic related primary pollutants
- Minor reduction of PM concentrations due to the primary role of secondary large scale PM
- Increased use of public transport and decrease of traffic fluxes

Threats

- Difficulties in informing citizens promptly and effectively about traffic restrictions during SAPE
- Social inequalities due to mobility restrictions for low income people

SHORT TERM MITIGATION ACTIONS

Reducing mobility

The impact of the Covid-19 pandemic has not been limited to the health effects. However, this unprecedented threat to health, economy and society as a whole represented the occasion to think about the way and the reasons why we daily move as well. It became clear that compulsion can become a choice, staying home can become the way to live and work better and reduce our exposure. As we know, commuting has a great impact on air quality and on our personal exposure to atmospheric pollutants. The analysis carried out on primary air pollutant concentrations during lockdown periods clearly showed this with, for example, NO_2 concentrations dropping up to 40%. In addition, it is well established that exposure while commuting may be a major contribution to total exposure. It is advisable to allow and facilitate smart working during severe air pollution episodes.

Key actors

- Workers
- Employers

Expected impact

- Reduction of traffic fluxes
- Reduction of emissions of traffic related pollutants
- Reduction of personal exposure while commuting

Threats

- The organization of work must be flexible
- Technological tools must be appropriate
- Increased emissions from domestic heating may be a side effect if domestic heating systems are not efficient
- Not all types of working activities allow the application of smart working

SHORT TERM MITIGATION ACTIONS

Limiting ammonia emissions

Ammonia is a highly reactive gas that has important effects on atmospheric chemistry and sensitive terrestrial or aquatic ecosystems. With regards to air quality, during the winter season ammonium nitrates can have a dominant role in increasing PM_{10} concentrations well above EU daily limit value. It is well known that in European countries, agriculture accounts for more than 80% of the total emission. The process of ammonia volatilization leading to emission is relatively simple and well understood. When slurries are spread on land, a large amount of ammonia is emitted in the air in the first few hours and then continue to decrease for several days. There are several practical or low cost opportunities for decreasing ammonia emissions, but the focus should be on when and how slurries or solid manures are spread on the land. This type of activities should be regulated in a more strict and effective way and specific regulation should be imposed during severe air pollution episodes.

Key actors

- Regional and local authorities
- Farmers
- Association of farmers
- Environmental protection agencies and research institutes

Expected impact

- Signifcant decrease of primary emissions of ammonia
- Significant decrease of ammonia nitrates which greatly contribute to winter PM, in particular during SAPE

Threats

- Difficulties in combining the optimal timing of spread of slurry on land and ammonia emission reductions
- Need of scientific and technical support to define guidelines on how to carry out slurry spread over land
- Need of training activities for farmers

LONG TERM MITIGATION ACTIONS

Renewing domestic heating

Solid fuel burning is, besides traffic, one of the most important sources of air pollution and PM in particular. Annual average contributions of 15 and 20% of PM_{10} and $PM_{2.5}$, respectively, were estimated. Due to the extensive use of wood and coal for household heating, in winter the PM fraction originating from biomass and coal burning becomes much larger. In many cases, this source significantly contributes to the exceedances of the European air quality limit values. The fractional contribution of solid fuels to the bulk particulate matter load is in the range of values reported for mountain sites or for countries with colder climates. Taking into account that currently the equipments are largely represented by outdated and inefficient boilers and stoves, strategies to promote the replacement of older solid fuel based domestic heating systems through financial incentives are recommended. EU Policies for use and development woody biomass burning need balanced approach including environmental, social and economical perspectives.

Key actors

- Regional authorities
- Citizens
- Heating providers
- Heating system installers
- Municipal police

Expected impact

- Relevant decrease of emissions and concentrations of several hazardous pollutants including PM
- Improvement of indoor air quality

Threats

- High cost of changing heating system
- Social inequalities linked to the ban of older heating systems
- Low cost of biomass and coal based burning heating systems
- Control activities difficult and demanding

LONG TERM MITIGATION ACTIONS

Improving urban planning

When integrating air quality in urban planning, it is crucial to consider several variables affecting population exposure and the way in which different sources contribute to pollution levels. Building materials, urban sprawl, urban development focused on eco mobility and green infrastructure are the key criteria to redirect urban development towards better air.
Green infrastructure in cities is an urban planning solution for improving air quality as well as enhancing the sustainability of cities. These green solutions include street trees, vegetation barriers (including hedges), green (or living) walls, and green roofs. They act as porous bodies which influence local dispersion of pollution and by facilitating the deposition and removal of airborne pollutants makes the air cleaner. Apart from air pollution reduction, other benefits of urban green infrastructure include urban heat island mitigation, the potential reduction in energy consumption, better stormwater management, and climate change mitigation.

Key actors

- Regional and local authorities
- Associations of architects and engineers
- Citizens

Expected impact

- Improvement of the quality of life in urban areas for all citizens
- Improvement of sustainable mobility

Threats

- Difficulties in combining the development of new urban planning approach with existing urban structure
- Need for long-term view and results
- Need for public financial investments

LONG TERM MITIGATION ACTIONS

Improving mobility planning

An essential action to be taken to improve air quality in EU Functional Urban Areas is combining traditional and innovative mobility policies. More traditional policies include creating good conditions and services for cyclists, as well as efficient public transport. Traditional policies include also reduction or ban of heavy vehicles inside the city centre, lowering speed, banning studded tyres and older diesel vehicles and promoting use of e-cars. However, local administrations must also tackle CE challenges of reducing CO_2 emissions and improving air quality through innovative solutions such as connected and automated driving (CAD), Mobility as a Service (MaaS) including shared mobility. These solutions have a high potential for reducing CO_2 emissions and improving air quality and will affect the operation and business models of public and private transport/mobility services. Adapted policy design relies strongly on the capability to assess mobility solutions and their potential environmental and socio-economic impact.

Key actors

- Regional and local authorities
- Public and private transport companies and agencies
- Citizens
- Workers and employers
- Tourists

Expected impact

- Improvement of the quality of life
- Reduction of traffic related pollutants
- Healthier mobility

Threats

- Need for a long time and long view to apply new approaches to mobility
- Uncertainties in choosing best technological and organizational options
- Difficult trade off between private and public mobility

LONG TERM MITIGATION ACTIONS

Supporting low-carbon logistics

Freight transport accounts for a large proportion of total air pollutant emissions from the global to city scale. Unfortunately, goods transport means are far from being sustainable from an environmental point of view. Most freight vehicles are quite old and diesel-powered resulting in large emissions of particulates and greenhouse gases. Urban freight transport involves many different stakeholders, both those within the urban area that are not directly involved in the freight transport movements (city authorities, residents, tourists/visitors) and the actors in the supply chain. The interaction between these different stakeholders increases the complexity of the search for solutions to achieve sustainable urban distribution. This is particularly the case because logistics decisions are usually taken based on commercial and operational factors rather than considering wider point of view such as sustainability issues.

Key actors

- Regional and local authorities
- Economic activities
- Courier service

Expected impact

- Reduced use of high polluting commercial diesel vehicles
- Sustainable, low emission and efficient way of transporting goods
- Lower pressure on the traffic system inside the urban areas

Threats

- High complexity and changing needs of transport systems for goods
- Need of strict collaboration between public and private sector
- Huge infrastructural investments

LONG TERM MITIGATION ACTIONS

Increasing energy efficiency

Buildings currently account for over 40% of the European primary energy demand and 36% of European CO_2 emissions. Buildings are among the biggest consumers of energy and the largest contributors to global greenhouse and hazardous pollutant emissions. In response the EU has set a range of energy targets for all new buildings to be adopted by 2030. By improving the energy efficiency of buildings and the products used, we can reduce total EU energy consumption and help to attain long-term objectives. Sustainable buildings can reduce environmental impact up to zero acting with regards to both direct and indirect emissions of air pollutants. Energy efficiency of these buildings reduce to a minimum the energy demand and related installed renewable energy sources allow to heat houses without burning fossil fuels. Advanced technological solutions can provide enough energy to cool and to make it work household appliances and lighting systems.

Key actors

- Regional and local authorities
- Building companies
- Citizens

Expected impact

- Signifcant decrease of hazardous and greenhouse gases emissions related to heating and cooling of buildings
- Healthier living enviroments
- Stimulus to economic activities

Threats

- Difficulties related to upgrading existing buildings in some area of towns such as city center with older buildings
- Need for public subsidies to achieve substantial change in energy efficiency of buildings
- Need for long-term view and results

LONG TERM MITIGATION ACTIONS

Lowering vehicle emissions

The global shift towards low-carbon, circular economy has started and its pace is accelerating. To ensure Europe stays competitive and able to respond to the increasing mobility needs of people and goods, the Commission's low-emission mobility strategy sets clear guiding principles to Member States to prepare for the future. Transport in the EU still depends on oil for about 94% of its energy needs. Through the Strategy, the Commission is looking into how to accelerate the use of low-emission alternative energy, such as advanced biofuels, electricity, hydrogen and renewable synthetic fuels by providing strong incentives to innovate. With such policy measures the share of low-emission energy could increase, providing about 15-17% of transport energy demand in 2030 and replacing oil products. The Commission is also looking into better synergies between the energy and transport systems, for example addressing distribution challenges of electricity at peak times. This would make charging of electric vehicles easier.

Key actors

- National and European authorities
- Car manufacturers
- Economic activities
- Private and public transport

Expected impact

- Signifcant decrease of primary emissions of several pollutants
- Reduction of noise pollution
- Improvement of street safety

Threats

- Need for incentives for car fleet renewal
- Need to assess a comprehensive life cycle impact assessment of new vehicles
- Relevant forecasted increase of energy demand
- Need for transition to renewable energy sources

SHORT TERM ADAPTATION ACTIONS

Reducing exposure in schools

Children spend a relevant number of hours in school every day and school environment may play a key role to protect the health of our children/teenagers. Several studies have shown that It is possible to make the school environment a preferential setting to reduce children exposure to air pollution and prevent health effects in young people. Great interest and enthusiastic response by students and teachers are generally observed when they are involved in measurement campaigns, educational and information activities about air quality status and its daily variations. Such type of meeting become also the occasion to establish a dialogue between public authorities and young people on environmental issues. Useful indications can be provided to schools in relation to the importance of ventilation in classroom and the possible use of air purifiers, especially during severe air pollution episodes and in classrooms including children with specific pathologies. It is worth to note that while pandemic represented a big challenge for schools, it was also the occasion to further think about how to improve school environment

Key actors

- Local authorities
- Students and teachers
- School managers

Expected impact

- Improvement of well being in school environments
- Reduction of exposure to PM during SAPE
- Improvement students awarness about air pollution

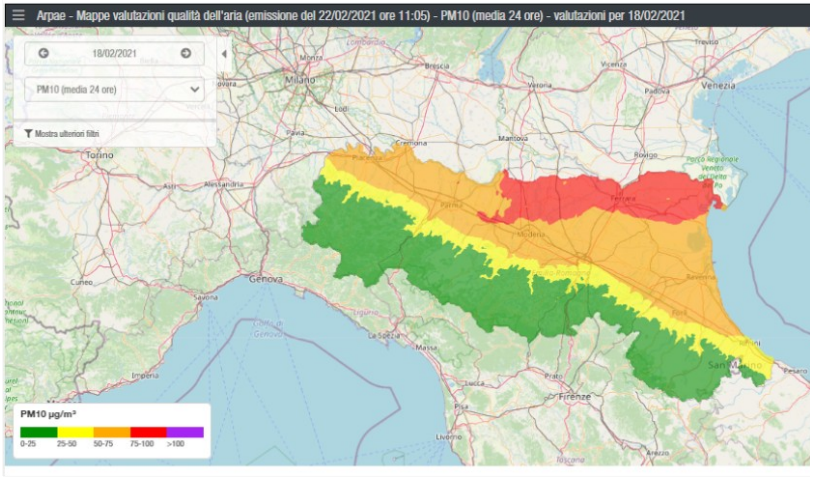
Threats

- Need for an effective way to promptly communicate severe air pollution episodes
- Difficulties in applying specific protocols during SAPE
- Uncertainties in defining an appropriate trade off between high air exchange rate and protection from air pollutants coming from outdoors

SHORT TERM ADAPTATION ACTIONS

Implementing alert system

A key aspect in order to define a potentially critical situation from the point of view of peak episodes of air pollution is linked to the refinement of pollution forecast. This specific field is gaining more and more interest and even if these activities are not comparable to those related to meteorological forecasts, yet they are very promising in order to set up environmental surveillance when adverse conditions are present. A close connection between the public health and environmental monitoring and forecasting systems is crucial to obtain a quick and efficient exchange of information and to set up an optimized response in case of a SAPE some days in advance. Only prompt measures can reduce the health effects on the population and in this view the enhanced use of appropriate means of communication for timely dissemination of information is a key element. The development of specific App for smartphones represents in this sense an ideal way to provide people with personalized and specific information and advises.



Key actors

- Environmental protection agencies or national environmental bodies
- Regional and local authorities
- Communication media

Expected impact

- Possibility to put in place actions prior to SAPE
- Possibility of real time information for citizens about air quality status

Threats

- Errors affecting forecasting systems causing false alarms or missed events

SHORT TERM ADAPTATION ACTIONS

Protecting vulnerable people

An efficient prevention system is certainly based on the definition of the “target” for the intervention. Most damages due to the short-term exposure to air pollutants is caused by a worsening of pre-existing conditions or chronic pathologies, such as cardio-vascular, cerebro-vascular and respiratory diseases, the use of drugs, the social condition. Therefore, the recognition of people at risk is essential to adopt preventive measures, as well as the early identification of adverse effects related to air pollution is important for an efficient therapy. It is not possible to take care of each person living in urban areas, even if the health service should restrict the intervention only to elderly people. General practitioners together with health system resources should identify vulnerable people and suggest them how to behave in presence of a critical situation. Prevention plans must be arranged and adopted at the local scale (Regions, Municipalities) finally reaching people involved in care activities for the weakest citizens (at home, in hospital or in care homes).

Key actors

- Physicians and health professionals
- General practitioners
- Caregivers
- Associations of vulnerable people
- Social services

Expected impact

- Fruitful collaboration between environmental and health professionals to implement timely prevention actions
- Possibility of setting up a sort of continous support for vulnerable people to face environmnetal hazards

Threats

- Difficulties in implementing the process of daily information of health and social professionals about air quality status and forecasts
- Need for further analyses of possible preventive actions

LONG TERM ADAPTATION ACTIONS

Increasing awareness

Raising environmental awareness is essential for reducing air pollution. While many studies have found that students and teachers think that air pollution is one of the major environmental problems, it is also evident that the knowledge level of students about air pollution is generally low and sometimes lacking the scientific point of view. Therefore, increasing the knowledge level and awareness is highly important. Despite it is considered that the individuals acquire awareness about air pollution generally through media or publicity campaigns, personal experiences have much more impact on raising awareness on pollution. Children can be even involved in citizen science campaigns to better understand their exposure. In this way they can learn about air pollution and health effects and, in the light of this knowledge, discuss with parents about environmental issues. This can also be an occasion for public authorities and environmental agencies to engage local communities and explained how they work to improve air quality.

Key actors

- Environmental education centres
- Teachers and school managers
- University
- Local authorities
- Environmental agencies

Expected impact

- Increase of knowledge and awareness about air quality issues
- Collaboration between citizens and local authorities in setting up and promoting mitigation and adaptation actions

Threats

- Reduced effectiveness of educational activities if not included in multi year programs

LONG TERM ADAPTATION ACTIONS

Improving spatial mapping

The Air Quality Directive defines in Europe the criteria for air quality monitoring. Although the primary role is assigned to fixed monitoring stations, their high costs of installation and maintenance allow only for a relatively sparse monitoring, which is not anymore adequate to meet the increasing demand of detailed air quality information. In order to face this problem and increase the knowledge of spatio-temporal distribution of air pollution, supplementary techniques have been proposed. They include mobile monitoring, passive samplers , models and new sensor-based monitoring systems. While air quality models are very useful in spatial mapping and scenario analysis, in recent years increasing importance have gained sensor-based systems. Sensor use may also affect a wide range of possible applications including citizens science experiences, emergency intervention, near-source monitoring, hot-spot identification, mobile and personal monitoring . The main advantages are related to the fact that they are small and portable, apparently easy to use and deploy, and much less expensive than reference instruments.

Key actors

- Local authorities
- Environmental protection agencies
- University and research bodies
- Private environmental companies

Expected impact

- Hot spot of air pollutant concentrations inside urban areas
- Assessment of variability of pollutants concentration at high spatial and temporal resolution
- Increased access to detailed information on air quality for students

Threats

- Need for experienced professionals in using sensors and new cutting-edge monitoring devices
- Risk of bad quality measurements in case of use of low cost sensors by non professionals

LONG TERM ADAPTATION ACTIONS

Changing personal habits

Indoor pollution may account for a significant part of personal exposure also due to the percentage of time spent indoors (about 90%). Thus, citizens can effectively act to reduce their exposure making indoor air quality in homes better and safer. Indoor hazards can be of chemical, biological or physical type. Combustion sources, together with cleaning products are the main sources of chemical pollutants. Nowadays technology enable to significantly reduce emissions from cooking and heating systems and the choice of proper building materials and furniture can limit exposure to volatile organic compounds. It is important to point out that there is a trade off between reducing the inflow of air pollutants coming from outdoors and increasing the outflow of pollutants originating indoors. Ventilation play a major role in this trade off and understanding the characteristics of each house enable to achieve a good compromise. Another important possibility to reduce personal exposure is planning physical activities in low emission areas and in days and hours when air pollutant concentrations are relatively lower.

Key actors

- Citizens
- Environmental protection agencies
- Local authorities

Expected impact

- Increased awarness on personal possibility to reduce exposure to air pollutants
- Awarness of the importance of indoor air pollution sources and of the natural ventilation of houses
- Increased awarness of the importance of everyday habits

Threats

- Tendency of people to wait for public actions assigning less relevance to personal habits and actions
- Need for capillary educational activities by recognised experts

European Union

Interreg CENTRAL EUROPE

AWAIR

AN INTEGRATED APPROACH TO AIR POLLUTION

arpae agenzia prevenzione ambiente energia emilia-romagna

ZUGLÓ

Comune di Parma

cinsa

KATOWICE for a change

GIG Research Institute

DISCOVER MORE ABOUT AWAIR

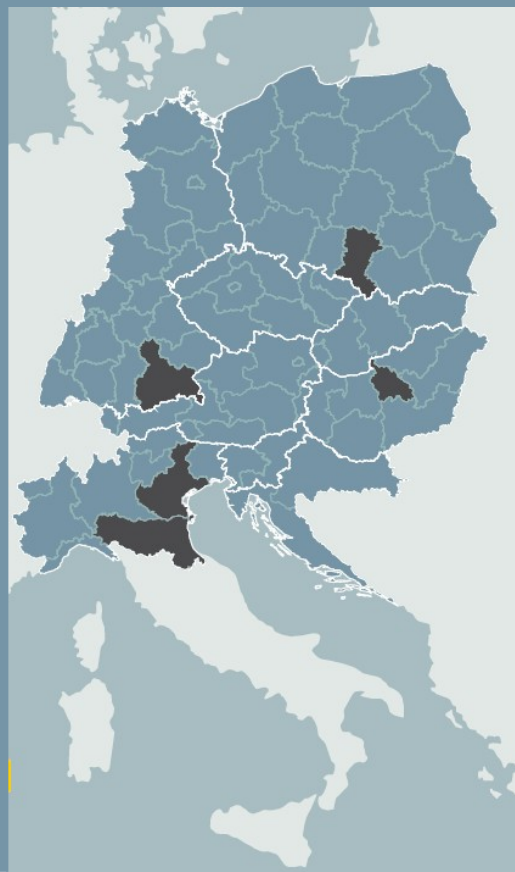
4 COUNTRIES

1.59 MILLION EURO ERDF

1.93 MILLION EURO PROJECT BUDGET

5 REGIONS

7 PROJECT PARTNERS



Web https://www.interreg-central.eu/Content.Node/AWAIR/AWAIR.html

www.facebook.com/awairproject

@projectawair

HelmholtzZentrum münchen
German Research Center for Environmental Health