Background document for Topic 1 - Clean Air in Cities

Health effects and urban scale linkages - health issues and population exposure in cities from transboundary to local scale - CLRTAPs role and contribution to improve the air quality in cities.

Background

Clean air is essential for healthy living. Despite large efforts to bring down atmospheric concentrations and improvements over the last decade, air quality is far from reaching the standards. For now, air pollution remains to be one of the major environmental causes of premature deaths. According to estimates by the WHO, worldwide 3 million people die prematurely every year due to exposure to ambient air pollution[1]. Exposure to air pollutants such as Particulate Matter (PM), nitrogen dioxide (NO_2) and ozone (O_3) is an ongoing threat to public health. The negative impacts of air pollution are most distinctly felt in urban areas (the majority of citizens lives in urban areas) but urban areas are at the same time also hotspots for sources of air pollution. Besides the premature deaths, millions of people suffer from respiratory and cardiovascular diseases caused by air pollution.

Figure 1 – Cities exceeding WHO Guidelines for safe air (Source: Breathlife)

The OECD estimated the number of premature deaths due to outdoor air pollution would increase from approximately 3 million people in 2010 to 6-9 million annually in 2060, in case countries would not take measures to improve air quality. In the same report, OECD projects next to an increased number of cases of illness due to air pollution also increased healthcare costs per illness resulting in an increase of global healthcare costs from USD 21 billion in 2015 to USD 176 billion in 2060.

[1] http://www.who.int/airpollution/en/

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By 2060, the annual number of lost working days, affecting labour productivity, are projected to reach 3.7 billion (currently around 1.2 billion) for the world. The market costs of air pollution, flowing from reduced labour productivity, additional health expenditures and crop yield losses, are projected to lead to global annual economic costs of 1% of global gross domestic product (GDP) by 2060[2].

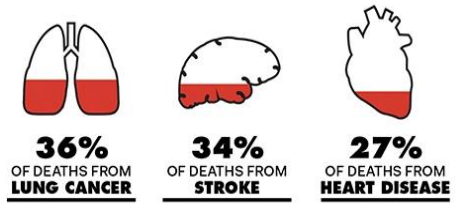

Figure 2 Source: WHO - http://www.who.int/airpollution/en/

> *"A significant proportion of the urban population in Europe and North America is exposed to concentrations of fine particles and ozone that are near or above the WHO guideline level."*
>
> ***UNECE Report* Towards Cleaner Air, *Key Finding 3*[3]**

Air Quality in Cities

Although poor air quality can be a problem everywhere, the negative effects are most distinctly felt in urban areas where people live: our cities are generally hotspots for air pollution. Around 55 per cent of the world's population lived in urban areas[4]. In Europe, this number is even higher as almost three quarters of the EU's population live in urban areas and economic activities are to a large extent concentrated in or close to urban areas.

Figure 3 EU urban population exposed to air pollution above WHO guidelines – Source: EEA 2017 - Air quality in Europe 2017

It is estimated that more than 80% of the population of European cities is exposed to annual $PM_{2.5}$ concentrations that exceed the WHO air quality guideline concentrations[5]. To improve their air quality, many cities take measures to reduce local emissions. The main sources of local air pollution in urban areas are transport and the use of coal or wood for residential heating. Contribution of local sources adds to background concentrations and local actions for improving air quality have to focus on those topics. But cities are also air pollution sources themselves that contribute to background air pollution formed and transported over large scales areas. Therefore reducing emissions from local sources help in reducing exposure in hot spot

[2] OECD (2016), The Economic Consequences of Outdoor Air Pollution, OECD Publishing, Paris: http://dx.doi.org/10.1787/9789264257474-en.
[3] Maas, R., P. Grennfelt (eds), 2016. Towards Cleaner Air. Scientific Assessment Report 2016. EMEP Steering Body and Working Group on Effects of the Convention on Long-Range Transboundary Air Pollution, Oslo: https://www.unece.org/index.php?id=42861.
[4] Unites Nations 2016, The World's Cities in 2016: http://www.un.org/en/development/desa/population/publications/pdf/urbanization/the_worlds_cities_in_2016_data_booklet.pdf.
[5] EEA 2017 - Air quality in Europe 2017: https://www.eea.europa.eu/publications/air-quality-in-europe-2017.

areas in the cities but should also contribute to reducing background air pollution levels (that are also influenced by national and international sources). Proven solutions to improve air quality in cities are available and catalogues of measures exist to help cities find them. The question is to what extent those measures will be sufficient and effective in order to solve the local problem with poor air quality.

> *"Technical measures are available to reduce fine particles and ozone to levels below the WHO guidelines in most parts of Europe and North America (…). Successful examples of healthy lifestyles that contribute to cleaner air are also available."*
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> ***UNECE Report* Towards Cleaner Air, *Key Finding 6***

Regional and transboundary air pollution will for many cities give a significant (sometimes dominant) contribution, in particular with respect to fine particulates ($PM_{2.5}$) and ozone. As a result of this, air quality in many cities can't be reached only with local measures. Future strategies on air pollution will therefore need both local and regional/international measures, to reach optimal benefits[6].

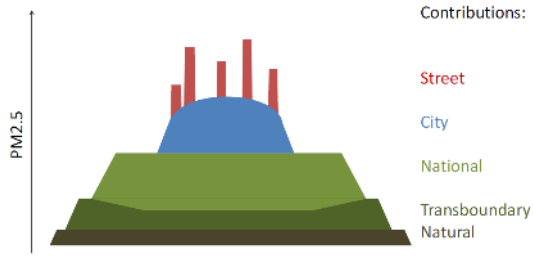

Figure 5 Build up of PM2.5 concentrations from different geographical origins. Source: IIASA 2014 - TSAP Report #12.

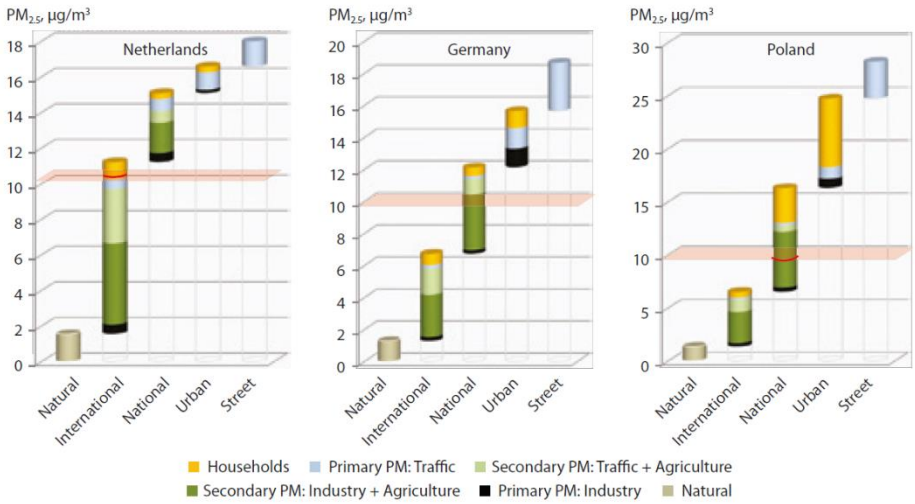

Figure 4 Origin of $PM_{2.5}$ concentrations in cities (Source: IIASA 2014 - TSAP Report #12) – this shows that local $PM_{2.5}$ concentrations are strongly influenced by secondary particles from transboundary sources.

[6] Kiesewetter, G. and M. Amann, 2014. Urban PM2.5 levels under the EU Clean Air Policy Package. TSAP Report #12, International Institute for Applied Systems Analysis (IIASA): http://ec.europa.eu/environment/air/pdf/TSAP_12.pdf

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The reduction of the exposure of population can be looked at from three angles: (1) what measures can be taken on city level, (2) what measures can be taken on a regional, national or international level and (3) what are the interdependencies between the both. Of course, the answers to these questions depend highly on the targeted pollutants and effects. One of the most challenging issues we must face is to find the most effective solutions, with synergetic benefits, both on pollutant and environmental aspects (air quality, climate, eutrophication), as on geographical scale. Strategies applicable at various geographical scales (local, national and European) have different impacts and different constraints, especially from the governance point of view.

Next to the contribution to $PM_{2.5}$ in cities from regional, national and international level, the role of agricultural emissions is now an evidence. This is through ammonia emissions, 90-95% of which come from agriculture. There is compelling evidence[7] that ammonia emissions are a threat to human health due to their contribution to formation of secondary particulate matter. This way it can contribute significantly to high concentrations of particulate matter in urban areas, up to 58% on average for Belgian cities[8]in some periods of the year when ammonia emissions are the highest The French National Center for Scientific Research determined that 62% of the fine particles in severe air pollution episode in Paris during Spring 2014 were ammonia-induced[9].

> *"Because transboundary sources are often major contributors to urban pollution, many European cities will be unable to meet WHO guideline levels for air pollutants through local action alone. Even national and Europe wide action may not be enough in some cases."*
>
> ***UNECE Report* Towards Cleaner Air, *Key Finding 4***

Role of the Convention

Even if the Convention on Long-Range Transboundary Air Pollution has as its main objective to consider transboundary air pollution, it has become increasingly evident that its strategies need to take into account the air quality in urban areas, in particular since the main focus has turned from ecosystems to human health. Engagement on all levels, from the international level to the local level, is necessary to come up with appropriate policies and especially implementation of those policies.

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[7] ETC/ACM Technical Paper 2013/12: Bessagnet, et al. (2013). Sensitivity analysis of ammonia emission reductions on exceedances of PM air quality standards: https://www.researchgate.net/publication/260600636_Sensitivity_analysis_of_ammonia_emission_reductions_on_exceedances_of_PM_air_quality_standards.

[8] Amann, 2012. Future emissions of air pollutants in Europe – Current legislation baseline and the scope for further reductions, TSAP Report #1, International Institute for Applied Systems Analysis (IIASA): http://www.iiasa.ac.at/web/home/research/researchPrograms/air/policy/TSAP-BASELINE-20120613.pdf.

[9] http://www2.cnrs.fr/presse/communique/3481.htm

Clean Air in Cities

One of the aspects that where the Convention could play a role is to search for potential synergies with other policies. One of the most obvious candidates would be climate and energy policies as the sources of air pollution and greenhouse gases are often the same. The Scientific Assessment Report 2016 highlights that the costs of air pollution abatement in 2030 can be reduced substantially (almost 60%) by implementing a successful climate and energy policy, for example, by energy saving and replacing fossil fuels by renewable energy. This points to significant co-benefits, as well as to reducing the risk of applying climate change measures with significant negative impacts on air quality".

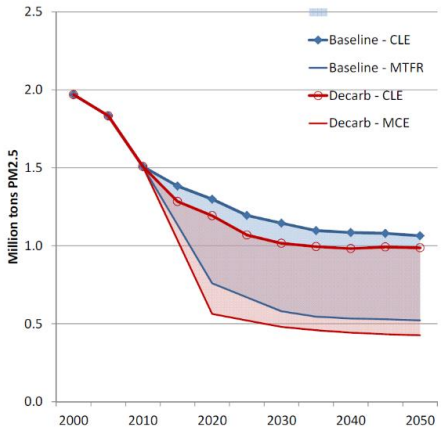

Figure 6 Time evolution of $PM_{2.5}$ emissions for the different scenarios for the EU-27 (Source: IIASA 2012 - TSAP Report #1)

> *"An integrated approach to climate change and air pollution could lead to significant co-benefits, as well as to reducing the risk of applying climate change measures with significant negative impacts on air quality."*
>
> ***UNECE Report* Towards Cleaner Air, *Key Finding 8***

Objective of the session

The objective of this working group is to further assess the interlinkages between urban and regional air pollution and how local, national and international policies may interact in order to maximize the overall health benefits. In order to come up with effective measures and to increase the feasibility and hence changes of actual implementation, strategies that tackle air quality problems showing synergies with one or more of the other urban challenges they face (such as climate and mobility) should be considered. The outcome is expected to result in a number of recommendations on how cities and international bodies (CLRTAP, EU etc.) could increase their collaboration to meet air quality guidelines in the most cost-efficient way. Several aspects, that could be considered either as drivers or obstacles in developing efficient air policies to reduce urban exposure will be considered in the session. They relate to science, technology, social acceptance and governance aspects.

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