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Integrated Assessment of Air Pollution Control Measures for Megacities

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Air pollution in large cities is still a matter of concern. Especially the concentration of fine particles (PM10 and PM2.5) is largest in large cities leading to severe health impacts. Furthermore the PM10 thresholds of the EU Air Quality Directive are frequently exceeded. Thus the question arises, whether the initiated policies and measures for mitigating air pollution are sufficient to meet the air quality targets and – if not – which efficient further pollution mitigation measures exist.

These questions have been addressed in the EU research project MEGAPOLI for the four European megacities respectively agglomerations London, Paris, Rhine-Ruhr area and Po valley. Firstly, a reference scenario of future activities and emissions has been compiled for the megacities for the years 2020, 2030 and 2050 for all relevant air pollutants (CO, NH3, NMVOC, NO_x, PM10, PM2.5 and SO_2) and greenhouse gases (CO_2, CH4 and N2O). The reference scenario takes into account as well population changes as technical progress and economic growth. As pollution flowing in from outside the city is about as important as pollution caused by emissions in the city, the analysis covers the whole of Europe and not only the city area.

Emissions are then transformed into concentrations using atmospheric models. The higher concentrations in cities were estimated with a newly developed 'urban increment' model. Results show, that in the megacities the limits of the Air Quality Directive (2008/50/EC) will be exceeded. Thus additional efforts are necessary to reduce emissions further.

Thus, a number of further measures (not implemented in current legislation) were selected and assessed. These included mitigation options for road transport, other mobile sources, large combustion plants, small and medium combustion plants and industry. For each measure and in addition for various bundles of measures a cost-benefit analysis has been carried out. Benefits (avoided health risks and climate change risks) have been calculated for each measure using the impact pathway or full chain approach. First the changes of emissions – compared with the reference scenario – are estimated, that occur, if the different options are implemented. Then, for each policy scenario the concentrations of pollutants are estimated. Using concentration-response-relationships, impacts, especially risks to human health, are calculated. These impact are then converted into DALYs (disability adjusted life years) and further into monetary values using contingent valuation methods (willingness to pay approach).

The most efficient measures are the use of solar energy for heating,insulation of buildings combined with a mechanical ventilation system, wind energy for electricity production, use of more efficient combustion techniques and low and later zero emission zones for vehicles in cities. However, even if all available options are implemented, the air quality requirements for PM10 will not be met under all meteorological conditions.