Benefits of Integrating Air Pollution and Climate Change Policy

Key Findings

- **Current scientific evidence shows that air pollution and climate change policies must be integrated now to achieve sustainable development and a low carbon society.**
- **Integrating climate and air pollution control programmes leads to significant cost savings and important benefits to human health and the environment. In both developing and industrialized countries, abatement of air pollution and greenhouse gases (GHGs) has generally been treated separately.**
- **The greenhouse gases already in the atmosphere commit the planet to a warming of over 2°C. Air pollution, in the form of aerosols, is reflecting enough sunlight to mask this committed global warming by about 40 per cent.**
- **Necessary air pollution policies, required to reduce aerosols to protect human health and the environment, will lead to the unwanted affect of accelerated warming, because of the removal of the 'cooling' effect of these aerosols on climate.**
- **The potential for accelerated warming increases pressure to reduce GHG emissions, both of long-lived (e.g. CO_2) but also short-lived substances (e.g. black carbon and ozone), and also emphasises the global need to adapt to climate change.**
- **Black carbon, or soot, is an air pollutant causing major health impacts and also a major contributor to global warming. Regionally, such as in the Arctic and Himalayan-Tibetan glacier regions, it is responsible for levels of global warming that rival those caused by CO_2.**
- **Ground-level, or 'tropospheric' ozone is an air pollutant that is increasing, particularly in Asia. It significantly reduces crop yields, diminishes food security and damages human health. It is also the third most important greenhouse gas (see the separate SEI policy brief entitled: "Ozone, a threat to food security in South Asia").**
- **Strategies to reduce the relatively short-lived black carbon, ozone and methane (a precursor of ozone formation and a potent GHG) will have immediate climate benefits, potentially avoiding key 'tipping points', as well as providing important air quality benefits.**

Integrating climate change and air pollution policy

Global climate change has resulted primarily from the accumulation of carbon dioxide (CO_2) and other greenhouse gases (GHGs) in the atmosphere over the last 150 years. However, recent studies indicate that, on average, 40 per cent of the potential warming by GHGs is being masked by certain aerosols (and aerosol-cloud interactions) that increase the reflection of sunlight. Figure 1 shows that the magnitude of the radiative forcing of aerosols – both black carbon that warms the atmosphere and aerosols that exert a cooling effect – is potentially greater than reported by the Intergovernmental Panel on Climate Change (IPCC) in their fourth assessment report in 2007. This underlines the importance of addressing air pollutants comprehensively as part of the efforts to address global warming.

Many aerosols result from air pollution emissions and lead to well-documented impacts on human health, such as respiratory diseases. Policies to reduce these pollutants and protect human health and the environment contribute to the acceleration of warming because they result in the removal of the 'cooling' effect of some aerosols. Figure 2 shows that the period in which there were high concentrations of 'cooling' aerosols across Europe and North America (largely in the form of sulphates), coincided with a period (1940-80) when a warming trend was not apparent. Whilst cause and effect are not yet clearly established, once sulphur emissions had been reduced through implementation of policies to limit emissions, a warming trend was observed. This may imply that the unmasking of the warming from GHGs in the atmosphere could be very rapid. Importantly, rapid acceleration of warming can be mitigated to a certain extent by

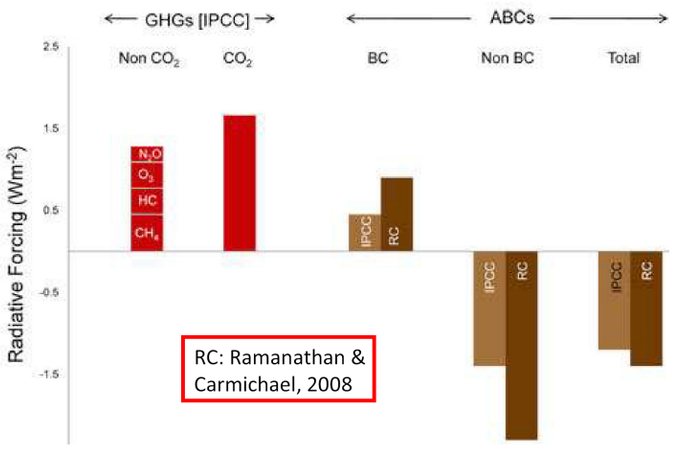

Figure 1. Global Radiative Forcing due to Greenhouse Gases and Atmospheric Brown Clouds (Source: Ramanathan and Feng 2008)

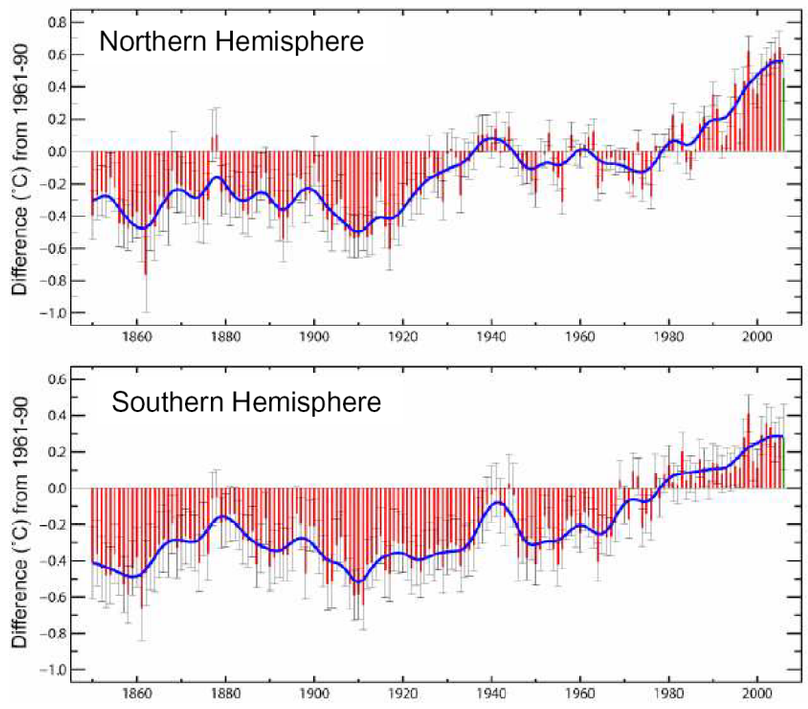

Figure 2. Global and hemispheric annual combined land surface air temperature (°C) relative to the 1961 to 1990 mean.
(Source: Trenberth et al, 2007)

Box 1: The Stockholm Co-benefits Conference

The conference/workshop brought together international policymakers and scientists to consider ways to develop and implement programmes that simultaneously decrease emissions of air pollutants and greenhouse gases (GHGs). The meeting, hosted by Sweden and funded by Sida, the Swedish International Development Cooperation Agency, was attended by representatives from 30 countries, from UNEP, the UNFCCC secretariat, the secretariat of the Convention on Long Range Transboundary Air Pollution and the Global Atmospheric Pollution Forum (see Box 2). In addition the European Commission and its Joint Research Centre were present and the French Presidency of the EU gave an introductory speech.

The goal of the event was to provide recommendations to relevant international negotiating fora. The intention was also that the results would be disseminated to a number of regional conferences planned in 2008 and 2009. The event examined:

- The science linkages between air pollution and climate change;
- The effectiveness of integrated assessment techniques to link air pollution and climate policy;
- The challenges in developing and applying integrated approaches at various policy and geographic levels; and
- How to develop strategies, frameworks and processes for better integrating air pollution and climate change programmes.

Acknowledgements

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controlling the concentrations of more short-lived warming agents – methane, ozone and black carbon – using integrated co-benefits strategies.

Methane, ozone and black carbon aerosols are major warming components compared with CO_2. According to the IPCC, the mean anthropogenic radiative forcing resulting from all GHGs is estimated to be +3.05 Wm^{-2} of which methane accounts for +0.48 Wm^{-2} and tropospheric ozone for +0.35 Wm^{-2}. In addition, it is estimated that black carbon accounts for +0.34 Wm^{-2} in the atmosphere and an additional +0.1 Wm^{-2} on snow. Regionally, black carbon heating effects can rival that due to CO_2 increases, for example in the Arctic and the Himalayan-Tibetan glacier regions.

As well as acting as warming agents, ground-level ozone and black carbon aerosols are also air pollutants (as is methane, which is a precursor of ozone formation). Ozone affects crop yield, and therefore food security, and also human health. Black carbon is a key component of particulate matter which is the main contributor to the health impacts of air pollution, causing the premature deaths of hundreds of thousands of people each year. Compared to CO_2, these substances live for a short time in the atmosphere, anything from a few days or weeks for ozone and black carbon, to a decade for methane. Urgent action to decrease their concentrations in the atmosphere will improve air quality (reducing risks to health and crop yields) and combat short-term accelerated warming (reducing risks of crossing critical temperature and environmental thresholds).

This is especially important as policies to reduce aerosols are implemented in Asia and other parts of the developing world over the next few decades. This will slow progress to 'tipping points' but reduction in emissions of long-lived GHGs (e.g. CO_2 and N_2O) must also be tackled as a matter of urgency.

Developing a global consensus

The response to air pollution around the globe will affect the degree of global warming that we will experience. Implementing strategies to reduce emissions of air pollutants will affect greenhouse gas emissions and vice-versa. In some cases, solving one problem will make another worse, but by considering these issues together win-win strategies can be developed. To be effective this requires consensus about the science, polices that look at the bigger picture and genuine implementation.

In September 2008, the Global Atmospheric Pollution Forum organised a major conference on "Air Pollution and Climate Change: Developing a Framework for Integrated Co-benefits Strategies", in Stockholm (see Box 1). Presentations by eminent scientists, such as Dr Ramanathan from the Scripps Institution of Oceanography, University of California, and Dr. Frank Raes from the EC Joint Research Committee, clearly demonstrated the significant links between substances that are traditionally considered to be air pollutants and global warming agents.

The conference also showed that there had been considerable advances in the integrated assessment of co-benefit opportunities. Policy case studies in Asia, Europe and the US demonstrated that co-benefits were real, were considerable and that policies were more cost-effective by considering both climate change and air pollution.

Box 2: Details about the forum

What is the Global Atmospheric Pollution Forum?

The Global Atmospheric Pollution Forum is an informal partnership of governmental and non-governmental organizations supporting the sharing of information and the development of solutions to local, regional, hemispheric and global air pollution problems. The Forum encourages the convergence of approaches, facilitates cooperation, and helps find consensus on effective ways of addressing air pollution. It is currently perusing a major programme on co-benefits.

What are the main organizations that comprise the Forum?

Its founding member partner organizations include the UN Environment Programme (UNEP); the UN Economic Commission for Europe's Convention on Long-range Transboundary Air Pollution (LRTAP); the Clean Air Initiatives for Asia and Latin America; the Air Pollution Information Network for Africa (APINA); Acid Deposition Monitoring Network in East Asia (EANET); the Inter-American Network for Atmospheric and Biospheric Studies (IANABIS) in Latin America; the Malé Declaration on Control and Prevention of Air Pollution and Its Likely Transboundary Effects for South Asia; the Stockholm Environment Institute (SEI) and the International Union of Air Pollution Prevention and Environmental Protection Associations (IUAPPA). SEI and IUAPPA currently form the secretariat of the Forum.

www.gapforum.org

The conference participants agreed conclusions that emphasised that there are major advantages in considering mitigation policies that take account of climate change and air pollution simultaneously. The conclusions are set out in a GAP Forum paper available on www.gapforum.org and will be submitted to the Executive Body of the LRTAP Convention and other relevant stakeholders, including the secretariat of the UNFCCC, national governments and regional networks.

References

Ramanathan, V. and Feng, Y. (2008). *On avoiding dangerous anthropogenic interference with the climate system: Formidable challenges ahead*. PNAS 105 no. 38, 14245–14250

Ramanathan V, Carmichael G (2008) Global and regional climate changes due to black carbon. *Nature Geoscience* 1:221–227.

Trenberth, K.E., et al, 2007: *Observations: Surface and Atmospheric Climate Change. In: Climate Change 2007: The Physical Science Basis*. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Recommendations

Integrate climate and air pollution co-benefits in decision-making.
We should no longer treat these two issues separately as we strive to achieve sustainable development and a low carbon society.

Decrease concentrations of methane, ground-level ozone and black carbon.
Ground-level ozone and black carbon aerosols are air pollutants and like CO_2 are major warming agents. Achieving their reduction requires extensive commitment, and regional and global cooperation.

Ozone reductions are best achieved by cutting emissions of all precursors.
These include nitrogen oxides and volatile organic compounds, as well as methane.

Cost-effective options need to be prioritised.
Opportunities for decreasing emissions of methane and other ozone precursors in industry, agriculture, mining and transport are widely recognized and relatively inexpensive.

An integrated effort is required.
Decreasing concentrations of methane, ground-level ozone and black carbon should occur alongside CO_2 emission cuts and the required climate change adaptation measures.

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