



IEAGHG Information Paper: 2016-IP9; The Air Pollution/Climate Change Conundrum

The impacts of air pollution are well documented once such example is a topical news report published in February 2016 based on data collated by the Global Burden of Disease Project¹. The statistics are that:

- More than 5.5 million people worldwide are dying prematurely every year as a result of air pollution.
- Most of these deaths are occurring in the rapidly developing economies of China and India.
- The main culprit is the emission of aerosols from power plants, factories, vehicle exhausts and from the burning of coal and wood.

Similarly the WHO reported that in 2012 around 7 million people died - one in eight of total global deaths – as a result of air pollution exposure. The WHO indicate that air pollution is the world's largest single environmental health risk. Regionally, low- and middle-income countries in the WHO South-East Asia and Western Pacific Regions had the largest air pollution-related burden in 2012, with a total of 2.6 million deaths related to outdoor air pollution².

There is no doubt that air pollution is a significant issue in many regions and that reducing air pollution can result in a significant reduction of health care costs in countries affected.

The USA and Europe faced up to the issue of air pollution in the 1970's which was covered by policy actions to reduce Acid Rain. Acid rain is caused by emissions of sulphur dioxide and nitrogen oxide, which react with the water molecules in the atmosphere to produce acids. Acid rain itself does not directly affect human health. The acid in the rainwater is too dilute to have direct adverse effects. However, the particulates responsible for acid rain (sulphur dioxide and nitrogen oxides) do have an adverse effect. Increased amounts of fine particulate matter in the air do contribute to heart and lung problems including asthma and bronchitis³. In the USA, The Acid Deposition Act was introduced in 1980 and the Clean Air Act in 1989, to reduce the release of sulphur dioxide and nitrogen oxide into the atmosphere. In a response to clean up Europe's air, in 1979 the United Nations Economic Commission for Europe (UNECE) implemented the Convention on Long Range Transboundary Pollution, with the aim of reducing acidic emissions. Since its implementation, sulphur emissions across Europe have fallen significantly, but with the increase in vehicle traffic nitrogen oxides emissions have been reduced only slowly⁴.

On the flip side it seems to be well documented scientific fact that the Arctic is warming much more rapidly than the global average. This is a phenomenon known as Arctic amplification. The main cause of the warming is considered to be the loss of sea ice in the region. As Arctic sea ice melts, energy from the sun that would have been reflected away is instead absorbed by the ocean. A new piece of research blames the problem on Europe cutting air pollution and in particular sulphur dioxide emissions into the atmosphere. See: <http://www.carbonbrief.org/cuts-in-europes-air-pollution-have-boosted-arctic-warming>.

Therefore whilst that cutting the health related issues and social costs for acid rain was a good thing, we seem to have solved one problem but added to another in Europe at least.

The issue of chronic air pollution has now moved from Europe and North America to South and South East Asia. The worry then becomes that, with all the pollution in Chinese cities from coal burning and

¹ The Global Burden of Disease (GBD) provides a tool to quantify health loss from hundreds of diseases, injuries, and risk factors, so that health systems can be improved and disparities can be eliminated. See <http://www.healthdata.org/gbd/about>

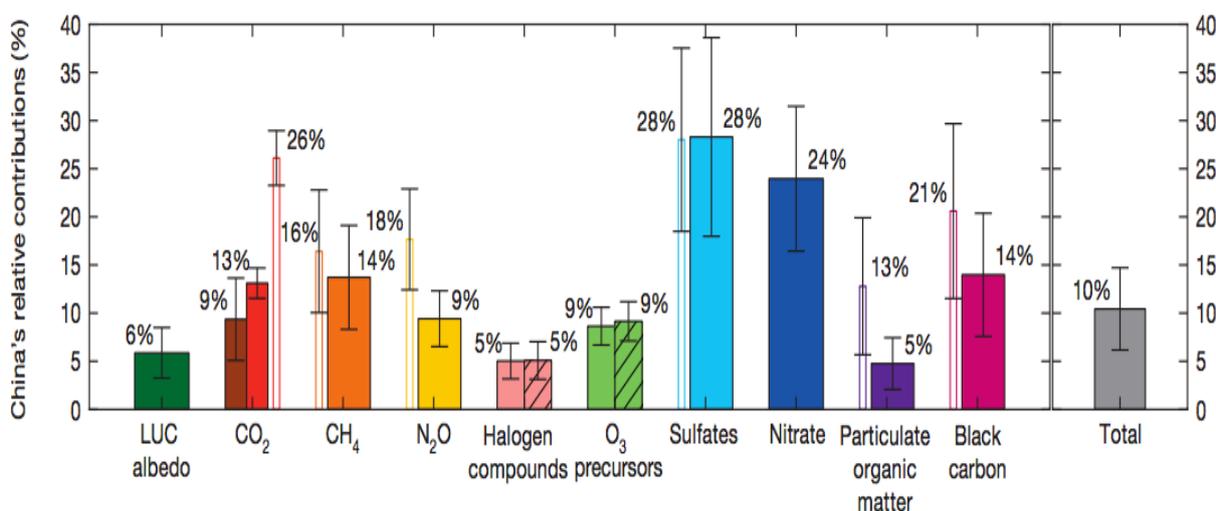
² <http://www.who.int/mediacentre/news/releases/2014/air-pollution/en/>

³ https://en.wikipedia.org/wiki/Acid_rain

⁴ http://www.enviropedia.org.uk/Acid_Rain/Europe.php

cars we now observe. From a health perspective countries must and will take action as China is doing, to tackle the sulphur related pollution issues⁵ but will we then see higher ocean surface temperatures and high temperatures across the Asian land mass? This is an issue we first highlighted in 2013, See *IEAGHG Information Paper; 2013-IP4: Global Sulphur-dioxide emissions and their impact on Health and Climate change*. The work we referred to at that time was research published by IASA regarding global trends in sulphur dioxide emissions. The researchers at that time declining global sulphur-dioxide emissions will likely result in an increase in the rate of future climate change.

This concern voiced above is mirrored in a new study published in Nature: See: <http://www.nature.com/nature/journal/v531/n7594/full/nature17165.htm>. This study suggests that China is responsible for 28% of the sulphate aerosols currently in the atmosphere (light blue bar in the graph below), 24% of nitrate aerosols (dark blue) and 14% of black carbon (pink).



The relative contribution from China to greenhouse gases and aerosols affecting global temperature. Source: Li et al., (2016)

Their view is that over the past few decades, this has been pulling in the opposite direction to rising CO₂, methane and black carbon emissions, effectively muting China's relative impact on global temperature increase. Note in an earlier note IEAGHG highlighted the issues pertaining to Black Carbon - see IEAGHG Information Paper 2014-IP17, Black Carbon – A double Edged Sword? With Black Carbon the health impacts are well documented by the impact of these aerosols on the climate are not as clear as that for sulphur aerosols.

The implication the researcher's state is that if China follows the rest of the world in cutting sulphate aerosols in a bid to reduce air pollution, global temperatures could rise even faster in the coming decades since there would be less of a cooling effect to offset the warming from greenhouse gas emissions.

In summary, air pollution causes serious health issues globally and leads to premature death in poor and elderly communities. For that reason it needs to be curtailed. However the sting in the tail is that cutting air pollution can potentially increase surface warming and hence the impacts of climate change. But this is not something that should stop positive action to reduce air pollution we just need to be aware of the benefits and consequences.

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⁵ IEAGHG Information Paper; 2013-IP4: Global Sulphur-dioxide emissions and their impact on Health and Climate change