Air pollution contributes to climate change and climate change will likely exacerbate air pollution in some regions of the world, even if emissions of reactive air pollutants remain constant. As a result, there is an increasing dialogue between the scientific and regulatory communities to coordinate efforts to reduce emissions of reactive air pollutants, greenhouse gases, and fine particulates and their precursors so that controls are beneficial for both air quality and climate. The newly launched IGBP Air Pollution & Climate Initiative is intended to facilitate such discussions and coordination.

Mitigation of methane (CH\textsubscript{4}) emissions provides an opportunity to simultaneously improve air quality and reduce the rate of climate change. In addition, CH\textsubscript{4} is the primary constituent of natural gas and an important energy source. As a result, efforts to prevent emissions or capture and use CH\textsubscript{4} offer significant environmental, energy and economic benefits [USEPA, 2006].

At approximately 1.8 ppm, CH\textsubscript{4} is the most abundant non-carbon dioxide (CO\textsubscript{2}) greenhouse gas (GHG) in the atmosphere today [Montzka et al., 2011]. CH\textsubscript{4} accounts for approximately 15% of current radiative forcing, of all O\textsubscript{3} precursors, CH\textsubscript{4} emissions result in the largest decrease in RF per unit reduction of surface O\textsubscript{3} concentrations. Shown in Figure 1 is the calculated decrease in RF per unit (parts per billion by volume, ppbv) decrease in global surface O\textsubscript{3} concentrations resulting from a 20% global decrease in anthropogenic emissions of each of the key O\textsubscript{3} precursors: NO\textsubscript{x}, NMVOC, CO and CH\textsubscript{4} of all O\textsubscript{3} precursors, CH\textsubscript{4} emissions result in the largest decrease in RF per unit reduction in surface O\textsubscript{3} (West et al., 2007). Thus, of all O\textsubscript{3} abatement strategies, methane controls reduce the rate of climate warming most.

Model simulations indicate that had global anthropogenic methane emissions been reduced by 20% in 2010 the average daily maximum 8-h surface ozone would decrease by approximately 1 ppbv globally (West et al., 2006). By using epidemiologic ozone mortality relationships, this ozone reduction was projected to prevent approximately 30,000 premature all-cause mortalities globally in 2030, and 370,000 premature all-cause mortalities between 2010 and 2030 (West et al., 2006).

Increasing evidence points to elevated O\textsubscript{3} concentrations as an important and usually overlooked stress on global crop yields (Avnery et al., 2011a; Van Dingenen et al., 2009; Wang and Mauzerall, 2004). Recent model simulations quantified the present and potential future (year 2030) impact of surface O\textsubscript{3} on the global yields of soybean, maize, rice and wheat given both upper- and lower-boundary projections of reactive O\textsubscript{3} precursor emissions (Avnery et al., 2011a; b; Van Dingenen et al., 2009). Van Dingenen et al., 2009; and Avnery et al., 2011b reported substantial future yield losses globally.
US$3.5-15 billion worldwide (USD$_{2000}$) (Avnery et al., submitted 2011). With a lifetime of about a decade and a GWP$_{100}$ of over 20, methane mitigation provides an opportunity to slow the acceleration of climate change. Because neither the air quality nor climate benefits of CH$_4$ mitigation depend strongly on the location of the CH$_4$ emission reductions, the lowest cost emission controls can be targeted (Fiore et al., 2008). Large potential for methane emission reductions exists, including the recovery of methane from coal, oil and gas extraction and transport, methane capture in waste management, and modifications of some rice cultivation and livestock management practices (UNEP/WMO, 2011). Widespread implementation is achievable with existing technology but requires significant strategic investment and institutional arrangements (UNEP/WMO, 2011). Many measures achieve cost savings over time, however initial capital investments are necessary in some cases. Figure 2 provides a cost curve for various methane mitigation options and indicates that at least 10% of projected 2030 methane emissions can be eliminated at a net cost saving (ClimateWorks, 2011).

Given the challenges of successfully implementing these mitigation strategies globally, further research which spans the scientific and stakeholder communities is needed to optimize near-term mitigation strategies in countries around the world and to evaluate the cost-benefit ratio for individual measures. This is an area where the newly launched IGBP Air Pollution & Climate Initiative, whose members span the scientific and stakeholder communities and include representatives from developed and developing countries, will have an opportunity to facilitate the implementation of cost-effective methane mitigation strategies which benefit air quality, human health, agricultural yields and climate.

References


