Long-Term Multigas Mitigation Strategies using MESSAGE

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While non-CO_2 greenhouse gases like CH4, N2O, CF4, SF6, and halocarbons have so far contributed about 40% to changes in the radiative balance of the planet (1750 – 2000), most studies in the past (with a few exceptions) have focused entirely on CO_2 emissions, the dominant source of climate change. The contribution of non-CO_2 gases, however, could increase greatly if they are allowed to stay unabated, particularly if climate policies were to focus on CO_2 only. With this in mind, this study utilizes the most up-to-date information on economics and technological potential of various non-CO_2 mitigation technologies, and analyzes the cost-effectiveness of climate change mitigation strategies with a 'multigas' focus. For this purpose, we develop mitigation scenarios aimed at achieving long-term stabilization of global atmospheric temperature at 2°C as compared to 2000. We use the MESSAGE model for a thorough bottom-up representation of the various gases and corresponding mitigation technologies. This approach not only endogenizes the energy feedback effects from non-CO_2 gases but also takes into account the ancillary benefits resulting from them. We analyze two mitigation scenarios - one allowing only for CO_2 mitigation and another with multigas mitigation. Our results show that in a CO_2 only scenario, there are significant ancillary benefits resulting from the other gases. In a multigas scenario, while the bulk of the reductions still come from CO_2, there are considerable reductions in other gases, particularly for CH4 and N2O. Comparing the required carbon taxes in both cases illustrates that inclusion of non-CO_2 gases leads to enormous cost benefits in the long run. We conclude that improving the treatment of these gases in energy-economic models and scenario studies is an important objective for the analytical community.

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