

Reviewer's report

Title: A framework for estimating the ancillary human health benefits of improved air quality resulting from climate change mitigation

Version: 1 **Date:** 9 June 2008

Reviewer: Nino Kuenzli

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This is a timely and interesting review of current approaches taken to understand at list parts of a more complex issue, mainly greenhouse gas reduction strategies and its relation with air quality and, thus, health. The paper highlights inconsistencies across approaches taken so far, which all amplify the inherent uncertainties related to such estimation endeavours.

While I have no specific comments to the well done review sections, I identify some mismatch between the promising broad title and the more restricted area addressed in the paper itself. The title is more comprehensive than the paper but it would be very interesting to comply with the promises. The missing aspect is described below:

The framework is to a large extent based on the assumption that GHG mitigations result in ancillary benefits due to improvements in air quality. In my opinion, these boundaries of the framework are too narrow and result in an incomplete framework, view, and debate. While I fully agree that the most efficient and attractive GHG mitigations would be those that result, at the same time, in reduced air pollution, it is unfortunately not a given that this will be the case. The manuscript shortly refers to tradeoffs, but in general, the paper is written under the premise of ancillary benefits.

If the authors want to address the problem the title implies I suggest to give further thoughts and summaries about the tradeoffs, and to revise the respective sections to make it more explicitly applicable to scenarios where GHG mitigations are not or negatively correlated with air pollution mitigations, thus resulting in additional costs rather than health benefits. It would be good to be comprehensive on these issues for the key path of action addressed in this manuscript, mainly GHG versus air pollution.

It would be nice to see these (GHG / air quality) tradeoffs reviewed to the extent available, and to have the authors come up with a discussion of those tradeoffs. Let me mention just a few of the more obvious dynamics to make the point clear that GHG and clean air policies not to be "linearly correlated" by default:

- The increase in urban density can be an urban planning strategy to reduce transport-related GHG production. This may well result – at least for many years to come – in a larger number of people being exposed to high levels of pollution or even in an absolute increase in air pollution in such urban areas, unless ancillary strategies are implemented specifically under a clean air (rather than

GHG) policy perspective.

- Alternative vehicles are available that consume less fuel, namely motorcycles, which have seen an enormous revival in some areas of the world. The current fleet of these vehicles is far less clean than modern cars, thus a source of high pollution, typically occurring in proximity to large numbers of people.
- Along the above lines of thoughts, bikes could be an excellent element in GHG-mitigation strategies in urban areas around the world. Without drastic changes in urban planning and car fleets, this may however result in an increase of peoples (bikers) exposure (or dose) to toxic substances and accidents.
- The sudden move toward a 'biofuel' economy runs under the label of GHG-mitigation strategies. It has by no means been paralleled by a comprehensive assessment of its effects on air quality and health, and it should not be taken as a given that these "GHG-mitigations" to be a benefit for air quality or health while GHG may be reduced – not to speak about the profound implications of the "biofuel" economy on the costs of basic foods with all its deleterious health effects among the socially deprived populations and regions in the world.
- The "diesel tradeoff" has been mentioned and it certainly belongs to this list of what is sold as GHG policies while conflicting with air pollution mitigation.
- Like some of the above examples already show, it is rather likely to see many more lobbies "highjacking" policies under the currently fashionable GHG perspective while being ignorant about the ancillary costs and health hazards. Some of the latter may be more immediate and more certain than the projected GHG benefits. Only a comprehensive estimation framework will detect such tradeoffs.

While not a necessity for this manuscript, it could be emphasized that climate change and its mitigations have far broader implications, thus, while GHG and air pollution mitigations may come with parallel benefits, a range of "ancillary actions" and GHG-related changes may have profound and complex implications on all aspects of key elements of the proposed framework, namely GHG, air quality, and health. These 'externalities' of the framework may be important and add uncertainty to the framework itself. E.g., as heat waves increase, production and use of air conditioners may (or did) go up dramatically. While this may increase GHG (if energy is produced with fossil fuels) and deteriorate ambient air quality, it may reduce health problems among the users of air conditioners, given healthier temperatures and indoor air quality.

In summary, I think an "estimation framework" is very much needed, but it should not be restricted to the scenario of a positive correlation between GHG and air pollution mitigation. It would be welcomed to see the complexities of the latter relationship being addressed in the paper rather than to change the title and some wording to keep the paper within the current borders of a scenario that implies a positive correlation between the two.

Level of interest: An article of importance in its field

Quality of written English: Acceptable

Statistical review: No, the manuscript does not need to be seen by a statistician.