Atmos. Chem. Phys. Discuss., 12, C6882–C6884, 2012
www.atmos-chem-phys-discuss.net/12/C6882/2012/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "The impact of a future H_2-based road transportation sector on the composition and chemistry of the atmosphere – Part 1: Tropospheric composition and air quality" *by* D. Wang et al.

Anonymous Referee #1

Received and published: 13 September 2012

The paper discusses the impact of a future H2 based transportation sector on air quality and atmospheric chemistry of the troposphere. The possibility of a H2 based transport sector has lost some steam in recent years with wider acceptance of electric and batter powered transportation and thus diminishing the value of this study on a purely impact basis. Where as an impacts paper it covers the ground necessary for generating a technical report for a funding agency. As a result, there are no new ideas in either in making these assessments or new scientific arguments for the sinks and sources or proposing any new metrics. The paper provides no observational evaluation for any

of the species discussed, granted these models have been evaluated previously for O3,CO,NOx etc. I am not aware of any papers based on these models that discuss H2 itself and I am wondering what is represented in a model like CMAQ? As far as the impact assessments, the discussion is mostly in terms of percent changes in a given outcome (i.e. ozone % change with a change in emissions). It would probably be more useful if some of these were presented as ratios, molecule of H2 emissions to delta change in ozone under scenario xyz, as an example. The use of the state-of-the art models places this study above probably much of the work previously reported on H2 economy impacts on air quality and thus potentially deserving to be widely available. Due to the lower visibility of technical reports submitted to agencies in the US compared to peer-reviewed publications this report probably meets the criteria for getting published in ACPD. One major concern is the absence of a lifecycle analysis approach to the problem. Though benign (to air quality) technologies that produce H2 from sun + algae may become available, It is much more likely that industrial scale production using conventional technologies is more likely. Though, one can assume that it is much more easier to control emissions from a point sources than mobile sources, as claimed by the authors, it is not certain that it will happen. Take the example of cleaning up emissions from thermal power plants within US and other countries, long and protracted legal wrangling and mounting scientific evidence has still not produced the desired emission reductions even in SO2 emissions. Including the emissions from production step is probably a necessary element in producing impact reports/papers to create a more appropriate assessment. This assessment assumes H2 is available. The generation of which to replace the entire surface transportation sector could eventually be an enormous industrial enterprise that could rival the petrochemical industrial complex. Ignoring this significant emission change seems to be a major drawback for the paper. It would be useful to address this in some form in a revised submission. Specific Questions. a) was H2 lower boundary condition in the models set as a mixing ratio BC or a flux boundary condition? b) Section 4.2 Ozone, line 14; in figure 3b and 3e what is going on at the tip of Africa? The ozone here shows an increase. c) Section

4.2, line 15: “these regions ozone production is VOC limited . . .’, if VOC goes down shouldn’t you see a decrease in ozone under these conditions? d) In section 3 Model Description, line 25: How many years was the model used to simulate the same year? It is said that the lifetime of H2 is between 1 and 2 years. Did the model simulations last long enough to reach steady state? e) What is the lifetime of H2 in your calculations? f) It is seems odd that CMAQ used MM5 and not the CAM dynamics for the simulations? g) Were the CMAQ BC’s for gases comes from CAM-CHEM? h) How are the CMAQ simulations performed? Are these simulations for a full year? repeat the same year for a steady state? i) The CMAQ results are presented as 8-hr averages and peak values, where as the CAM-CHEM results are presented as annual averages. It is hard to compare these two analysis. It would be useful if the CAM-CHEM results are also plotted as 8-hr averages and peak values.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 19371, 2012.