

## ***Interactive comment on “Forty years of improvements in European air quality: the role of EU policy–industry interplay” by M. Crippa et al.***

### **Anonymous Referee #2**

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#### General Comments

1. Overall, I think is an important study, with great detail and care put into developing the emission scenarios. I think the work done to synthesize information on emissions and technology use could be highlighted more – the relevant tables and figures are all in the supplementary material. The methods used are sound and clearly documented. Most of the comments I have are about clarity in the presentation of results.

2. I don't see the STAG\_FUEL scenario as having much real-world meaning. To me it would make sense to consider either

(a) stagnating fuel use, but improvements in fuel quality and in end-of-pipe technologies, or

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(b) stagnating fuel mix/fuel quality, but improvements in end-of-pipe technologies.

With (1), you could compare the scenario to REF\_2010 to see how much additional pollution could have been prevented if fuel use remained constant at 1970 levels. With (2), you could separate out the effects of cleaner fuel vs. improvements in end-of-pipe technologies.

On page 20251, you say that STAG\_FUEL “aims at assessing the offset of the emission savings with technology and end-of-pipe abatement by the increase in fuel consumption.” However, because the fuel mix stays the same, I don't think this is truly what's being assessed with STAG\_FUEL.

3. When the authors refer to increases and decreases in emissions in the text, I am often confused about which direction the comparison is going in, ie., which scenario is being subtracted from which. I would generally suggest that the authors go over this and edit for clarity. A few examples are indicated in the “specific comments” below.

4. In Section 4.1, when the authors discuss changes in O<sub>3</sub> and PM<sub>2.5</sub> concentrations as predicted by the TM5-FASST model, there needs to be at least some mention of trends in measured concentrations. Given available observation data, are trends or tendencies predicted by the TM5-FASST model consistent with what actually happened between 1970 and 2010?

5. There are several cases in which figures that are currently included in the supplement are the subject of significant discussion in the main body of the paper. When this is the case, I suggest the authors move the relevant figure to the main body of the paper. (Specific instances are noted under “specific comments” below.)

#### Specific Comments

p. 20247, line 17: “...understanding the impacts of primary and secondary anthropogenic air pollutants which are released into the atmosphere...”

Please rewrite this sentence. As written, it makes it sound like secondary pollutants

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are also “released into the atmosphere,” which is not correct.

Top of section 3.2.1, p. 20259. “Figure S4.1 ...”. If you are leading off the discussion with this figure, it belongs in the main body of the paper, not the supplemental material.

p.20261, lines 5-6: “contrary to a global-scale emissions doubling...” It is unclear to me why a global-scale emissions doubling is expected, or what this comparison is referring to.

p.20262, lines 10-14. “Furthermore, EURO standards reduced NO<sub>x</sub> emissions, at the expense of increasing NH<sub>3</sub> emissions (which is the only substance that increased in emission under the STAG\_TECH scenario).” Shouldn’t this be decreased? STAG\_TECH has less NH<sub>3</sub> emissions than REF\_2010, is that correct?

p.20262, beginning of 2nd paragraph: Since Figure S4.2 is being discussed in some detail, I would suggest it be part of the main body of the paper rather than the supplement.

p. 20262, lines 8-10. “NH<sub>3</sub> emissions increased with the implementation of catalysts on gasoline vehicles, leading to a decrease of 70% in NH<sub>3</sub> European emissions when catalysts are not considered...” To me this comparison is backwards, since time only moves forwards. From 1970-2010 the emissions of NH<sub>3</sub> increased because of catalysts. Talking about an emissions decrease doesn’t make sense to me.

Figure 2. Without studying this figure very closely, it is not clear to me what it is showing. I think a table describing the different scenarios in words rather than pictures might be more effective and easier to understand.

Figure 9. I find this figure not very easy to understand. Why do the authors show REF\_1970 - REF\_2010, instead of the other way around? At least for this reviewer, when REF\_1970 - REF\_2010 is used, then I need to think about time going backwards, which is not very intuitive. For loss of life expectancy and crop loss, I suggest that the authors change their axis labels to have a more quickly-grasped real world meaning.

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For instance, an “increase in life expectancy” would be more intuitive than a negative loss in life expectancy.

Tables SI-2. This is not critical, but it would be interesting to be able to compare emissions totals to other European emission inventories (e.g., the TNO-MACC inventory, see Kuenen et al., ACP 2014). For that purpose, I would be interested in seeing total emissions for a “standard” European domain (e.g., the EMEP model domain, or the TNO domain). I assume this would be OECD Europe + Central Europe + part of Russia + Turkey, etc., but as is it is not directly comparable to other European emission inventories.

Figures SI-6.3.1 and SI-6.3.2. These figures are quite interesting, the authors could consider putting at least the ones for Europe in the main text.

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Interactive comment on Atmos. Chem. Phys. Discuss., 15, 20245, 2015.

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