

Review 40 years of improvements in European air quality

This paper gives a good illustration of the type of ‘hindsight’ scenarios that can be constructed using a long term global emission database in combination with an atmospheric model and a set of impact indicators.

The paper includes the actual development between 1970 and 2010 (the REF scenario), which is the result of population and GDP-growth, increased energy efficiency, changes in the fuel mix, cleaner fuels and changes in emission factors due to end-of-pipe abatement measures.

Instead of decomposing the actual historical development as was done for Europe (Rafaj et al, 2013 referenced in the manuscript) and draw conclusions on the relative importance environmental policy, energy mix policy and increased technological efficiency in decoupling emission trends from economic growth, the authors have chosen to draw conclusions on the basis of a comparison between the REF scenario and two other scenarios: a scenario assuming that the environmental measures as listed in figure 1 would not have been taken (STAG-TECH) and a scenario that assumes that no growth in energy demand would have occurred between 1970 and 2010 (STAG-FUEL).

STAG-TECH 2010 minus REF 2010 shows the quantitative importance of environmental measures taken between 1970 and 2010. Both scenarios assume the same development in energy policy and GDP development.

The STAG-FUEL scenario is different: it is a mix of everything, e.g. it assumes that no shifts in the fuel mix would have taken place between 1970 and 2010 (no shift from coal to gas or to non-fossil fuels), which is OK for a retrospective scenario, but – implicitly - it also assumes that additional energy policy measures would have been realized to compensate for GDP-growth in order to keep fuel use constant. The introduction of such an assumption in a retrospective scenario makes the STAG-FUEL scenario irrelevant for drawing conclusions on the effectiveness of policies. Undefined but heroic energy efficiency measures and investments in the use of non-fossil fuels would have been needed to keep up with GDP-growth.

The STAG-FUEL scenario is used in the paper to show that environmental measures were off-set by increased energy use, which is only part of the message. Without energy policy (changes in fuel mix) and technological efficiency improvements energy use would have increased even more. There was a clear decoupling between GDP and energy use. Environmental policy and energy policy have in the past both contributed to emission reductions (and will continue to do so in the future).

I would advise to reconsider the so-called “STAG-FUEL”-scenario. In my view it would be better to develop a scenario assuming that emissions would have increased proportionally to GDP (STAG-ALL) and a scenario assuming only efficiency improvements but with a constant fuel mix scenario and constant emission factors (STAG-MIX+TECH). Together with the STAG-TECH scenario the relative importance of efficiency measures (STAG-ALL minus STAG-MIX+TECH), fuel mix changes (STAG-MIX+TECH minus STAG-TECH) and environmental measures (STAG-TECH-REF) could then be quantified.