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Impact of a future H2 transportation on atmospheric pollution in Europe

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Traditionally fuelled road traffic is a major source of greenhouse gases and pollutants. Greenhouse gases (e.g. CO_2 and CH4) affect the global atmosphere and contribute to global warming. The pollutants emitted by vehicles (e.g. CO, NO_x, SO_2, particulate matter, volatile organic compounds) are toxic for man and environment and decrease air quality especially in highly populated areas.
Burning H2 produces only water, thus H2-powered vehicles are seen as a possibility to reduce greenhouse gas emissions and improve air quality; because of this, H2 usage as a fuel is foreseen to significantly increase in the future.
Large scale usage of H2 as a fuel has the potential to affect the atmospheric composition in different ways. On one hand, emissions associated to fossil fuel burning will decrease. On the other hand, large quantities of H2 used will likely lead to increased H2 emissions from leakages during production, transport and storage. Additional H2 in the atmosphere will affect the chemistry of many species, in principal by decreasing the availability of OH radicals, with the result of increasing the lifetime of greenhouse gases and pollutants. Thus the net effect of H2 vehicles on the atmospheric composition depends on the relative strength of these two contrary effects.
In order to evaluate the potential influence of a future H2 road transportation on local and regional air quality, we implemented H2 in the atmospheric transport and chemistry model LOTOS-EUROS. We simulated the future (2020) using emission scenarios with different proportions of H2 vehicles and different H2 leakage rates. The reference future scenario does not include H2 vehicles, and assumes that all present and planned European regulations for emissions are fully implemented.
We find that in general the air quality in 2020 will be significantly better than at present in all scenarios, with and without H2 cars. In the future scenario without H2 cars, the pollution is reduced due to the strict European regulations. The scenarios with H2 cars lead to an additional small improvement in air quality.
Our study shows that, if present and planned European regulations are fully successful, the additional improvement in air quality brought by H2 cars would be relatively small. However, as regulations tighten, they also become more difficult to fulfill technologically, thus H2 vehicles can in principle be a part of the solution.