Lessons from Gothenburg on setting air pollution ceilings

The 2010 deadline for the Gothenburg Protocol ceilings for transboundary air pollutants is fast approaching and new ceilings may soon be set for 2020. Recent research indicates that, although the ceilings have been effective, they could benefit from more flexibility to allow for the inherent uncertainty in modelling future energy use, technologies and growth.

The UN Gothenburg Protocol to abate acidification, eutrophication and ground-level ozone was adopted in 1999. Its mechanism was to set emission ceilings for 2010 for four pollutants: sulphur dioxide (SO₂), nitrogen oxides (NOx), volatile organic compounds (VOCs) and ammonia (NH₃). These ceilings were based on future projections of national emissions, effects and abatement potentials.

The study was the first to evaluate the accuracy of the estimations used to set the ceilings of the Gothenburg protocol. It compared the original Gothenburg predictions to values from current reviews of national data and emissions. It also compared original assumptions used in the model used at the time to current assumptions in air pollution models. Six countries were examined: Ireland, Italy, the Netherlands, Spain, Sweden and Portugal to evaluate the variation of the Gothenburg projections and identify lessons for future negotiations.

The Gothenburg emission ceilings were compared with more recent national emission projections for 2010. In most areas, countries are expected to have made either sufficient or supplementary progress in reducing emissions of the four pollutants. However, some challenges remain. For example, in Spain the paper cites recent NOx and VOC emissions forecasts that are notably greater than the ceilings. In general, NOx emissions seem set to remain the greatest challenge for compliance.

The research also compared the current 2010 values and forecasts for several primary drivers of emissions to the corresponding figures assumed in the setting of ceilings in the Gothenburg Protocol. These indicated a substantial difference in some countries. For example, population and GDP were both underestimated in Ireland and Spain. These countries experienced a large growth in the construction industry and transport activity, which are large consumers of energy. In fact the 2010 projection presented for energy use in Spain was 28 per cent greater than the Gothenburg projection. However, for other countries, such as Sweden, Italy and the Netherlands, energy use was overestimated. The accuracy of the Gothenburg projections of emissions from livestock and fertiliser use also varied between countries.

The research investigated the Gothenburg assumptions about policy impact by examining the case study of the Euro standard which regulates the maximum acceptable emissions from road vehicles. The impact of Euro standard on emissions has not been as great as was expected when the Gothenburg ceilings were originally set. If current predictions of emissions were adjusted to use the original Gothenburg assumptions about impacts of the Euro Standard then Italy, Spain and Ireland would be on path to comply with their NOx ceilings.

The results demonstrated that setting ceilings on emissions is difficult due to uncertainties in estimating growth levels and the effectiveness of existing policies and technologies. Challenges will increase when reductions in emissions become more reliant on demand management or fuel switching, which involves modelling human behaviour – a notoriously difficult task. Greater flexibility in assessing compliance and developing targets is needed to ensure that such agreements can continue to be leveraged effectively for cost-effective environmental and health related gains.


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