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Editorial note

Of all industrial sectors, the chemical sector is certainly the most complex in terms of the number of compounds produced and the interrelation of material flows, energy flows and emissions. Due to its complexity the chemical sector is a particular challenge for statisticians, modelers interested in energy use and emissions and also for emission inventory experts preparing the national greenhouse gas emission (GHG) inventories. It has been repeatedly acknowledged that the approaches used for quantifying national GHG emissions from the chemical sector might be oversimplified and/or incomplete. National emission inventories are hence subject to considerable uncertainties in this respect. While GHG emissions related to the direct use of fuels and of electricity are, in principle, relatively simple to determine, the picture becomes more blurred when studying the fate of hydrocarbon feedstocks. The main reasons are that parts of the feedstock are oxidized in chemical processes and that fuel-grade byproducts are sometimes used for energy purposes or as feedstocks in the same or, possibly more frequently, in other processes.

Apart from incomplete insight and the resulting uncertainties just mentioned it is highly relevant to study energy and emission analyses for the chemical sector for two basic reasons: firstly, polymers, being the key group of bulk chemicals in terms of quantities, have been the fastest growing type of bulk material in Europe and worldwide in the last decades and will most likely clearly outpace aluminium, glass, paper/board, steel, cement and bricks/tiles also in the decades to come, with important implications for emissions. And secondly, with the exception of primary aluminium, conventional petrochemical polymers are the most energy intensive bulk materials to produce because they require not only process energy but also feedstock energy: while the total average energy use (process energy plus feedstock energy, expressed in primary energy terms) for polymer production is around 80–90 GJ/t (with large ranges depending on the product), the respective values for recycled aluminium, primary steel, paper/board, (flat) glass, secondary steel, cement and bricks/tiles are around 26 GJ/t, 23 GJ/t, 15 GJ/t, 12 GJ/t, 8 GJ/t, 5 GJ/t and 3 GJ/t, respectively (only primary aluminium is much more energy intensive to produce, with around 180 GJ/t).

This Special Issue deals with CO_2 emissions from chemical feedstocks and other refinery products that are not used as fuels. In energy statistics, these feedstocks and refinery products are often referred to as "non-energy use" (certain statistics use a somewhat different terminology, see first paper in this Special Issue). Example for such products apart from

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polymers and their precursors are solvents, surfactants, (ammonia) fertilizers, electrodes, lubricants and bitumen.

In order to improve GHG emissions accounting related to the non-energy use of fossil fuels, the non-energy use and CO_2 emissions (NEU-CO_2) network was formed some years ago. A good deal of their work has been posted on the network's website under http://www.chem.uu.nl/nws/www/nenergy/. This Special Issue points to the key problems and sources of uncertainties. It does so, in part, by means of country analyses for Italy, Korea, the Netherlands and the USA. Except for the analysis for the USA, all other country analyses have been performed by using, at least partly, a model which was developed by the NEU-CO_2 network. This model, which is called Non-Energy use Emission Accounting Tables (NEAT), is based on Materials Flow Analysis (MFA). The NEAT model is explained in detail in one of the papers of this Special Issue. Both the NEAT model and other MFA approaches have proved to be valuable tools to prepare independent emission estimates, to estimate uncertainty ranges and to prove the need for international harmonisation of energy statistics with regard to non-energy use. In this Special Issue, this is demonstrated in various ways.

Editor
Ernst Worrell *
Guest Editor
Maarten Neelis[1]
Martin Patel[1]
Lawrence Berkeley National Laboratory
Environmental Energy Technologies Division
1 Cyclotron Road, Berkeley, CA 94720, USA
* Corresponding author. Tel.: +1 510 483 6794
fax: +1 510 483 6996
E-mail addresses: eworrell@lbl.gov (E. Worrell)
m.patel@chem.uu.nl (M. Patel)
[1] Present address: Utrecht University, Department of Science
Technology and Society (STS), Heidelberglaan 2
NL-3584 CS Utrecht, The Netherlands
Tel.: +31 30 253 76 34
fax: +31 30 253 76 01
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