Jonathan Cullen Abstract

Resource efficiency in steel-making

The production of steel goods alone accounts for nearly 10% of global emissions from energy and industrial processes. Recent research has focused on connecting steelmaking processes to the stocks of final steel-based products, to better understand where action can be taken to improve resource efficiency and reduce carbon emissions. This has included studies mapping the mass flows steel at the global level, and separately quantifying the energy inputs and carbon emissions across the steel supply chain.

Our current research attempts to develop new methods for processing multi-resource data in a consistent manner while simultaneously accounting for different resource types. A matrix framework is used alongside nonlinear optimisation techniques to reconcile contradictory and sparse resource data for global steel production and use. This framework allows:

· multiple resources (e.g. mass and energy flows) to be independently balanced but analysed together across a complex system
· energy and mass flows to be combined into a single 'exergy' metric to provide an overall resource balance
· both embedded and embodied exergy (and/or energy/emissions) to be measured and traced along a steel supply chain
· the development of a more equitable method for allocating present emissions from steel production to future post-recycling uses of steel

The research allows the relative importance of products and processing routes to be assessed, and the impact of process efficiency gains, manufacturing yield improvements and product design changes to be evaluated, across the whole steel supply chain.