Industrial Energy Use from a Bottom-up Perspective

Author: J.B. Norman (j.b.norman@bath.ac.uk)
PI: Prof. G.P. Hammond (University of Bath), Co-Is: Dr. N. Eyre (University of Oxford), Dr. N. Strachan (University College London)

Introduction and aim of the project

This poster presents an ongoing UK Energy Research Centre project involving the University of Bath, University of Oxford, University College London and the Environment Agency. The project aims to evaluate industrial energy use and improvement potential via bottom-up case studies set within the context of UK industry wide understanding to form a hybrid top down/ bottom-up model.

The proposed outputs of the project are:

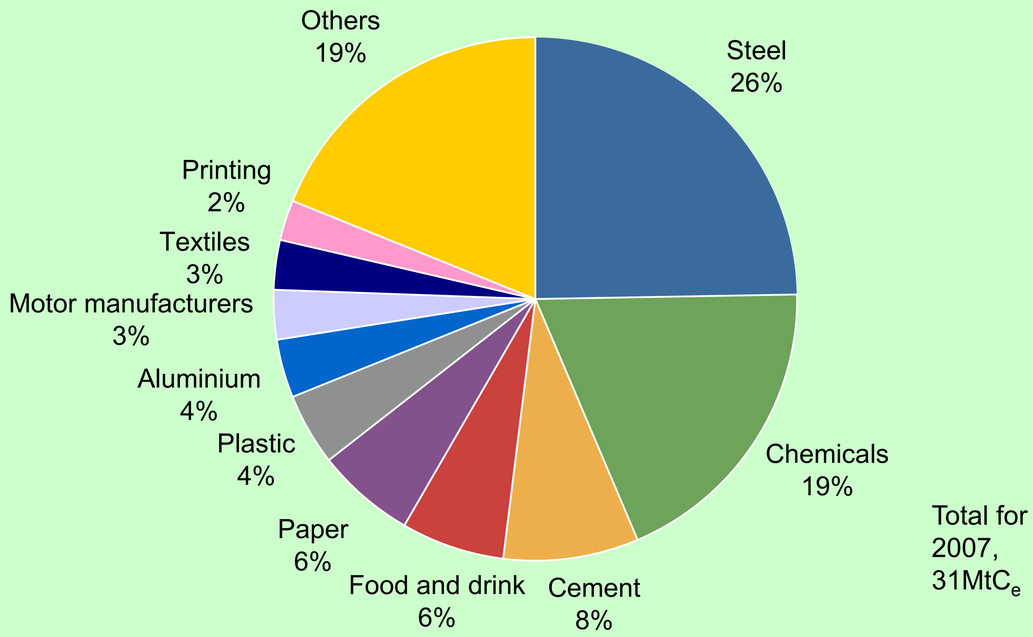
•A publically available usable energy database.

•To estimate the potential for emission reductions in the UK industrial sector, both in the near term (2015-2020) and longer term (2050). Subsequently identify the areas investment could be targeted most effectively.

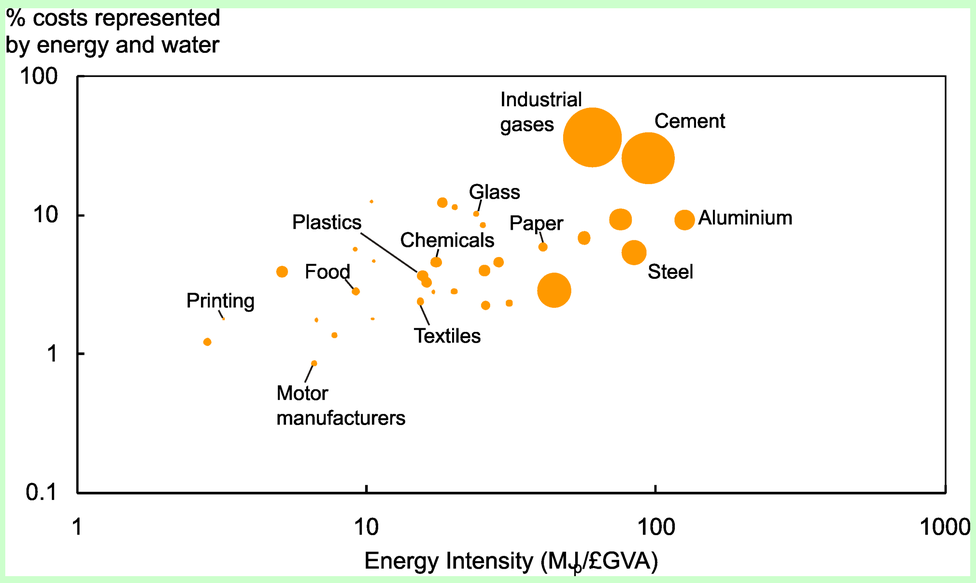
•Revamp the industry sector within the UK MARKAL model and estimate the industrial sector's role in UK carbon budgets.

Choosing subsectors

Due to the variability of energy use throughout industry not all subsectors can be modelled in detail. The first task is therefore to prioritise subsectors based on their level of emissions and improvement potential.



The proportion of industry greenhouse gas emissions, from energy use and processes, represented by different subsectors, are shown above.



The attitude of industry towards energy use varies considerably by subsector (and beyond this by company). Energy intensity, energy costs and the mean energy use per site (represented by the area of the data point) are shown above for different subsectors.

Resources

Gathering information is an integral part of the project. A number of resources will be utilised:

-Published statistics

-Benchmarking and best practice studies

-Academic literature reviews

-Case studies with partner companies

-Information from equipment manufacturers

Modelling subsectors

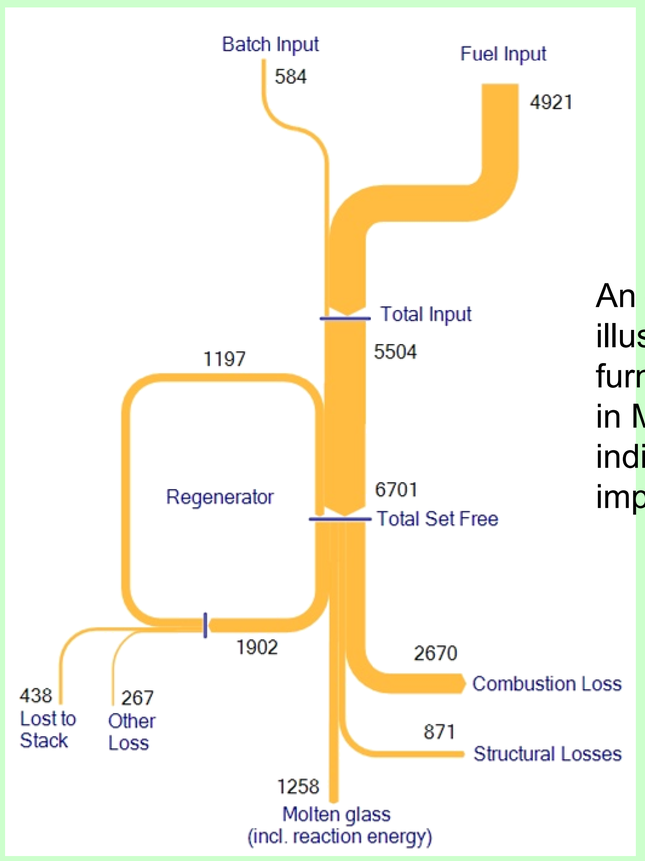
A bottom-up study of the selected subsectors will include:

•Understanding the current level of emissions and variation in energy use throughout the subsector.

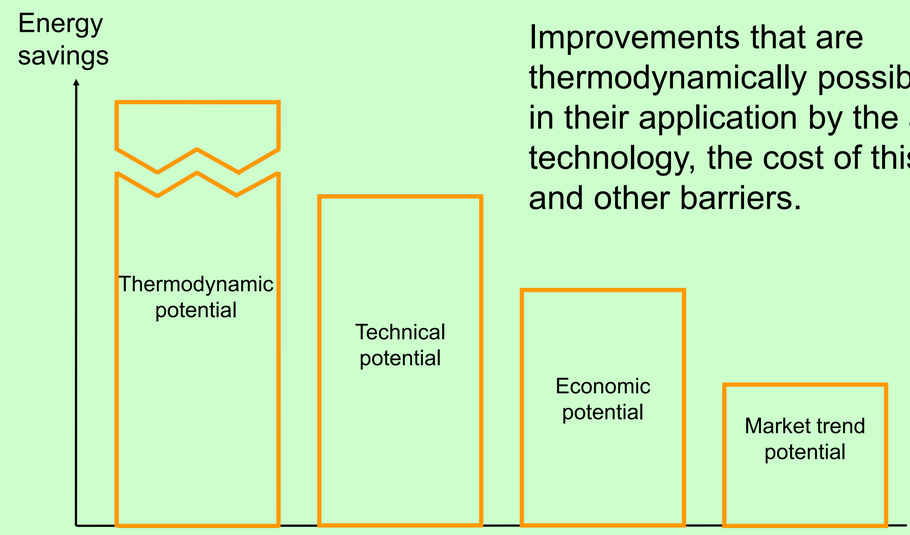
•A thermodynamic analysis of energy use.

•Examining historical improvements (decomposing changes in emissions).

•Identifying and characterising technologies with the potential to reduce emissions.



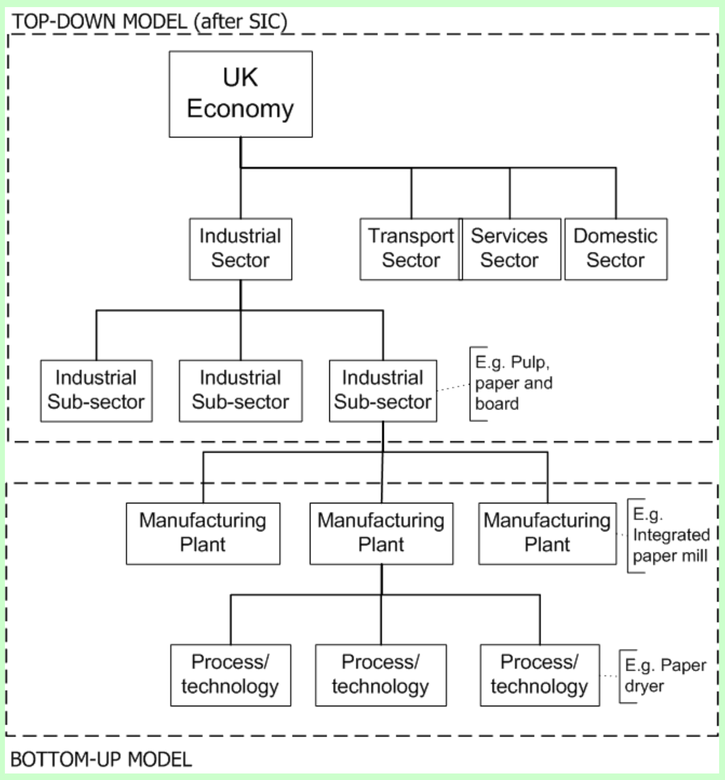
An exergy analysis, such as that illustrated here, for a glass furnace, showing flows of exergy in MJ per tonne of output, can indicate areas of a process where improvement is possible.



Improvements that are thermodynamically possible are limited in their application by the availability of technology, the cost of this technology and other barriers.

Towards a complete model

As the bottom-up studies cannot cover the entire sector they will be combined with the coverage of a top-down model via soft linking. This approach involves iterating between models until convergence is achieved.



Sustainable Energy Research Team (SERT)
Dept. Mechanical Engineering.
University of Bath, Bath, BA2 7AY
www.bath.ac.uk/mech-eng/sert