

Science for Environment Policy

A de-material world: receiving the benefits of materials while using less

An overview of 'material efficiency' is provided in a recent study, which assesses a range of technical and sociological approaches to material efficiency. The need for drastic efficiency improvements is highlighted by the researchers, as well as cuts in the total amount of materials used.

Global demand for material extraction and processing is expected to double over the next 40 years, with critical implications for greenhouse gas (GHG) [emissions](#) and other pollutants, as well as resource security. Significant increases in [material efficiency](#) (defined here as the materials used per benefit derived) are therefore needed, particularly since industry currently uses a third of global energy, mostly in the production of bulk materials.

The study provides an overview of material efficiency by summarising a white paper on the topic¹, plus 15 further research papers, presented at a 2012 discussion meeting in the UK². It concludes that we must not only use fewer materials per unit of output, for instance, by designing ever smaller goods, but we must also reduce the total amount of materials used.

Simple gains in the efficiency ratio tend to be significantly outweighed by overall increases in consumption, as well as by rebound effects, where savings in one area result in greater consumption in another, the researchers argue. They suggest that there is limited potential for improvements in material processing as many production processes already operate close to their optimum level, and various ores are expected to decrease in quality along with the energy sources used to process them.

Four high profile approaches to reducing GHG emissions from material production are considered by the study: recycling, material substitution, lower carbon electricity for industry, and carbon capture from industry. These are deemed insufficient to achieve the carbon reductions required, so additional material efficiency measures are also required, such as lightweight design, reducing yield losses, diverting manufacturing scrap, re-using components, longer-life products, and more intense use (such as business models based on leasing rather than selling).

Socioeconomic aspects are also explored, and the researchers question the logic of a growth economy which focuses on consumption of resources, rather than the benefits derived (e.g. petrol consumption rather than transport provided), and note that human wellbeing does not appear to improve beyond certain levels of consumption.

They consider reasonable levels of wellbeing and social equality to be central features of a lower material society, along with more localised economies and recommends celebrating 'local heroes' associated with lower mobility and consumption, rather than today's celebrities, typically associated with high consumption.

Difficulties in implementing material efficiency strategies are explored, particularly carbon pricing. The study concludes that, even if high carbon prices were agreed internationally, industry is still likely to prioritise lower labour costs over material throughputs unless tax regimes were overhauled. Strong political leadership on the matter is therefore called for, to help realise the wellbeing benefits of a material-efficient society.



2 May 2013
Issue 326

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Source: Allwood, J. A., Ashby, M. F., Gutowski, T. G., Worrell, E. (2013). Material efficiency: providing material services with less material production. *Philosophical Transactions of the Royal Society*. 371; 20120496.

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To cite this article/service: "Science for Environment Policy": European Commission DG Environment News Alert Service, edited by SCU, The University of the West of England, Bristol.

1. See: Allwood, J. M., Ashby, M. F., Gutowski, T. G., Worrell, E. (2011) Material efficiency: A white paper. Resources, Conservation and Recycling. 55:3. 362-381, DOI: 10.1016/j.resconrec.2010.11.002.

2. See:
<http://royalsociety.org/events/2012/material-efficiency/>