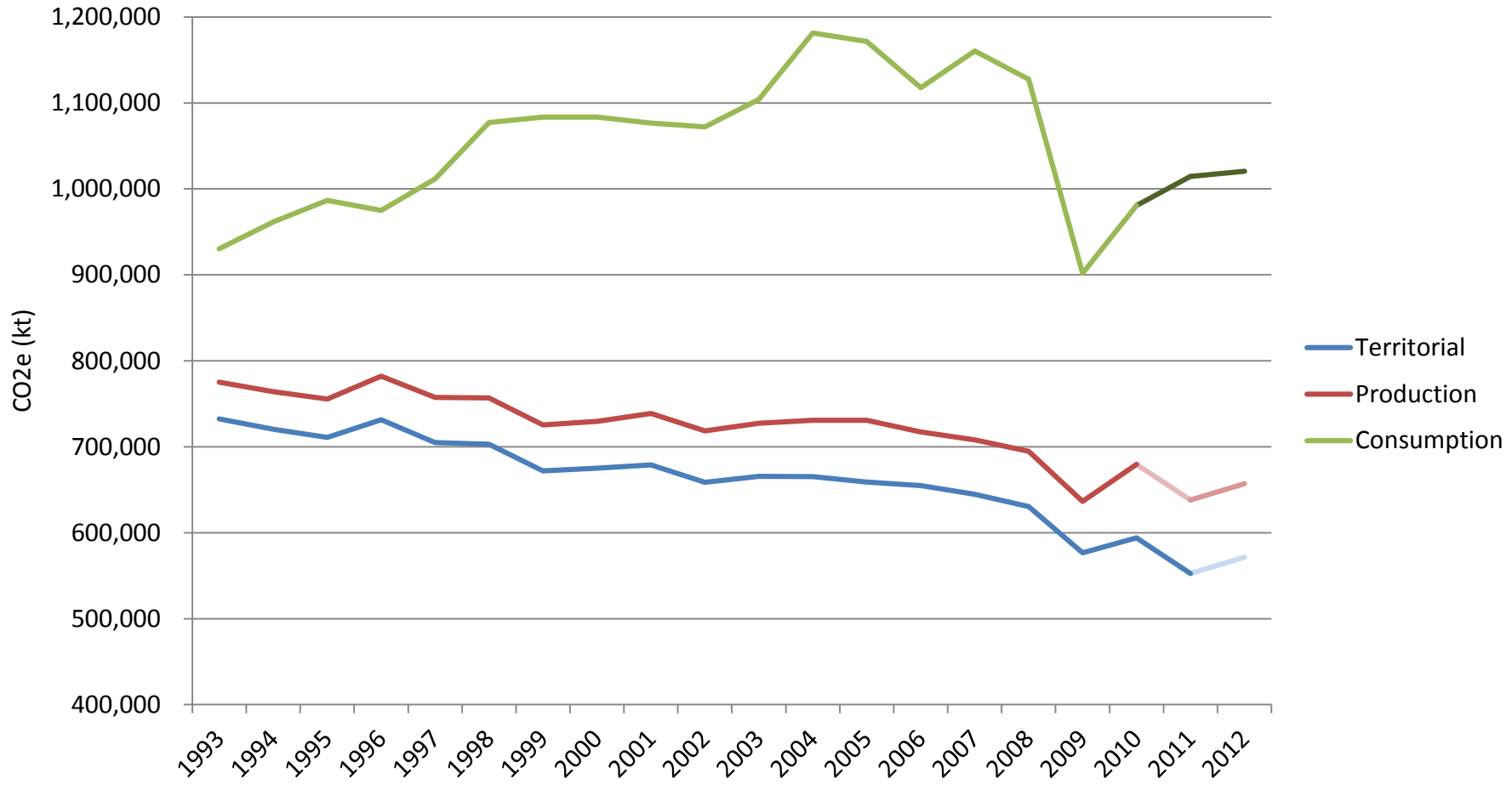
UNIVERSITY OF LEEDS

Consumption based Accounting and Energy and Climate Policy

Professor John Barrett

UK GHG Emissions

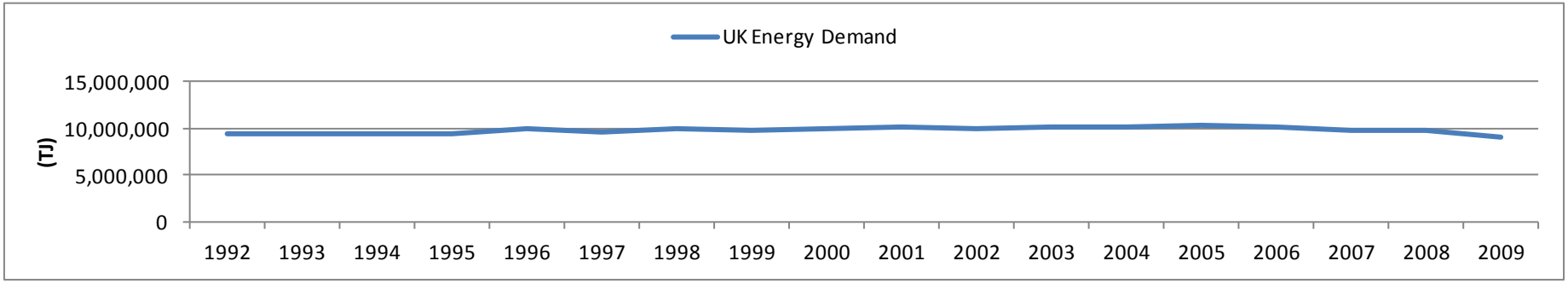
UNIVERSITY OF LEEDS

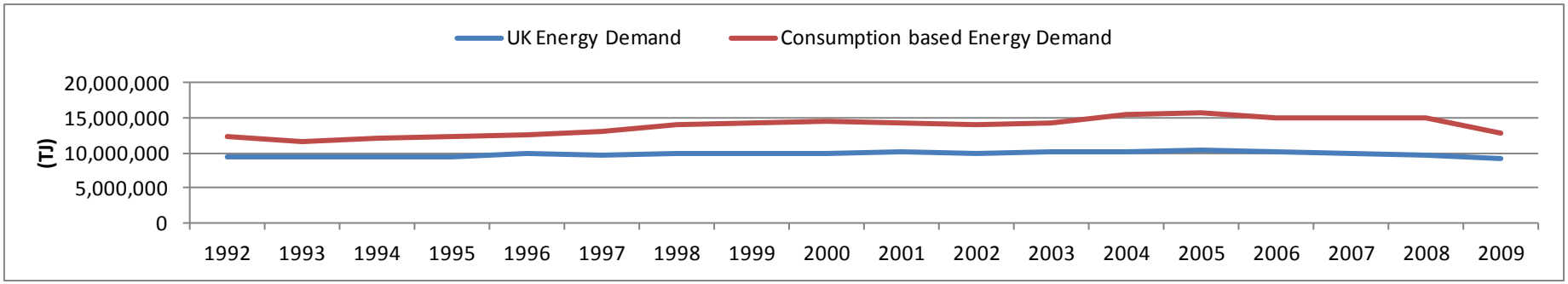


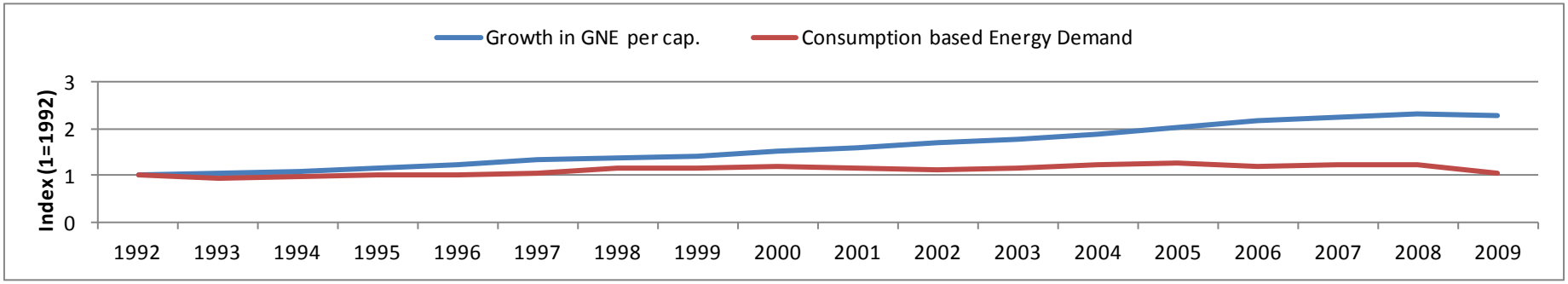
Source: Barrett et al, 2013

Energy Demand

UNIVERSITY OF LEEDS



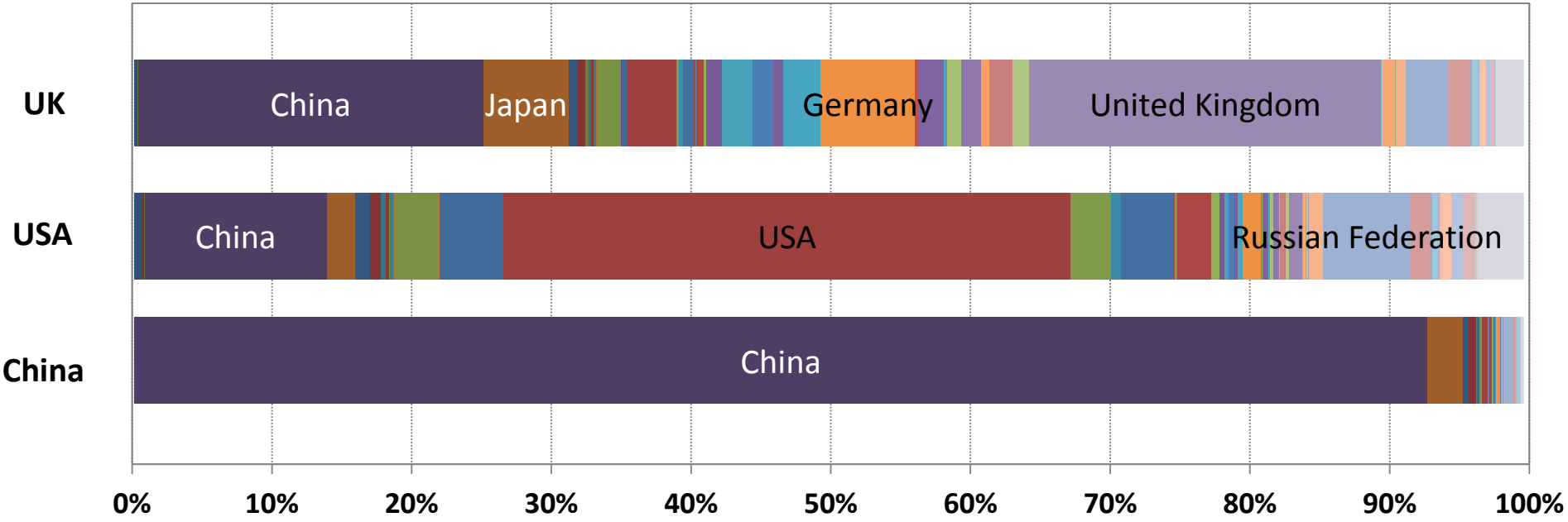




Source: Barrett, and Owen, in preparation

Steel consumed in the UK

UNIVERSITY OF LEEDS

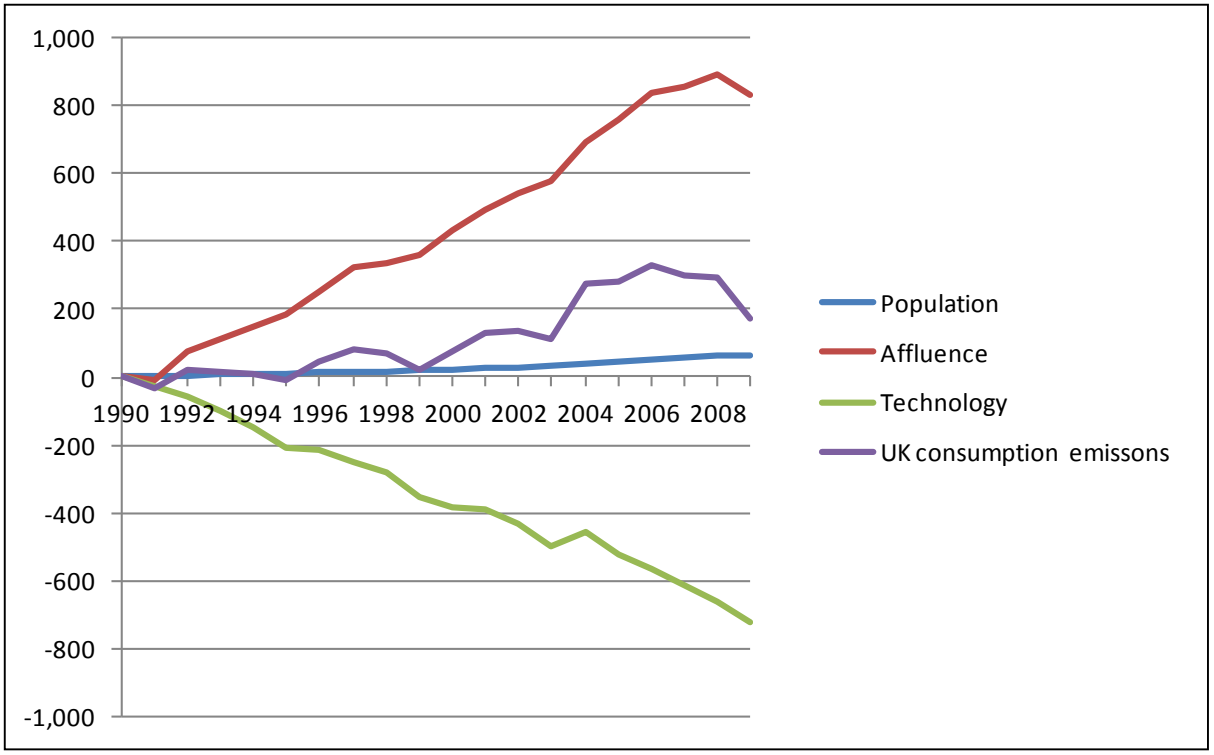


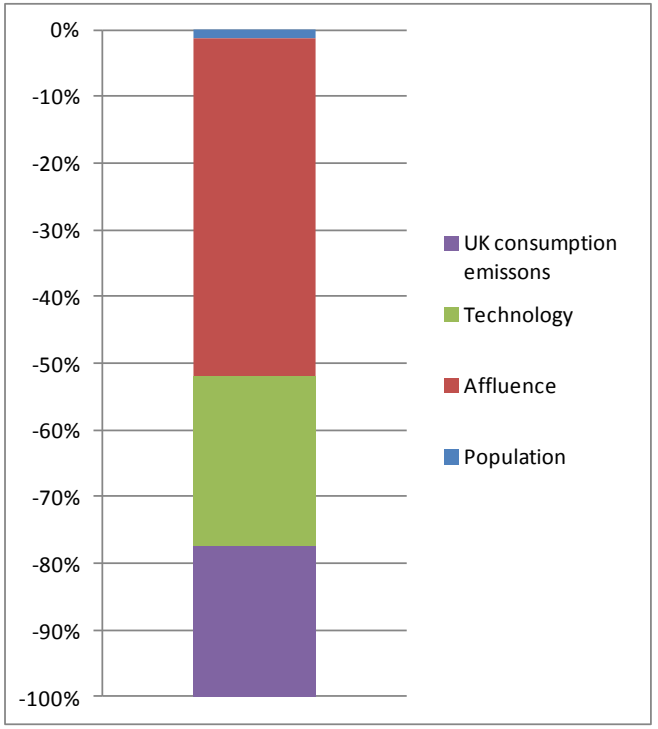
Share of domestic consumption by country of origin of steel

Source: Barrett et al, 2011

Global Drivers of Emissions in the UK

UNIVERSITY OF LEEDS

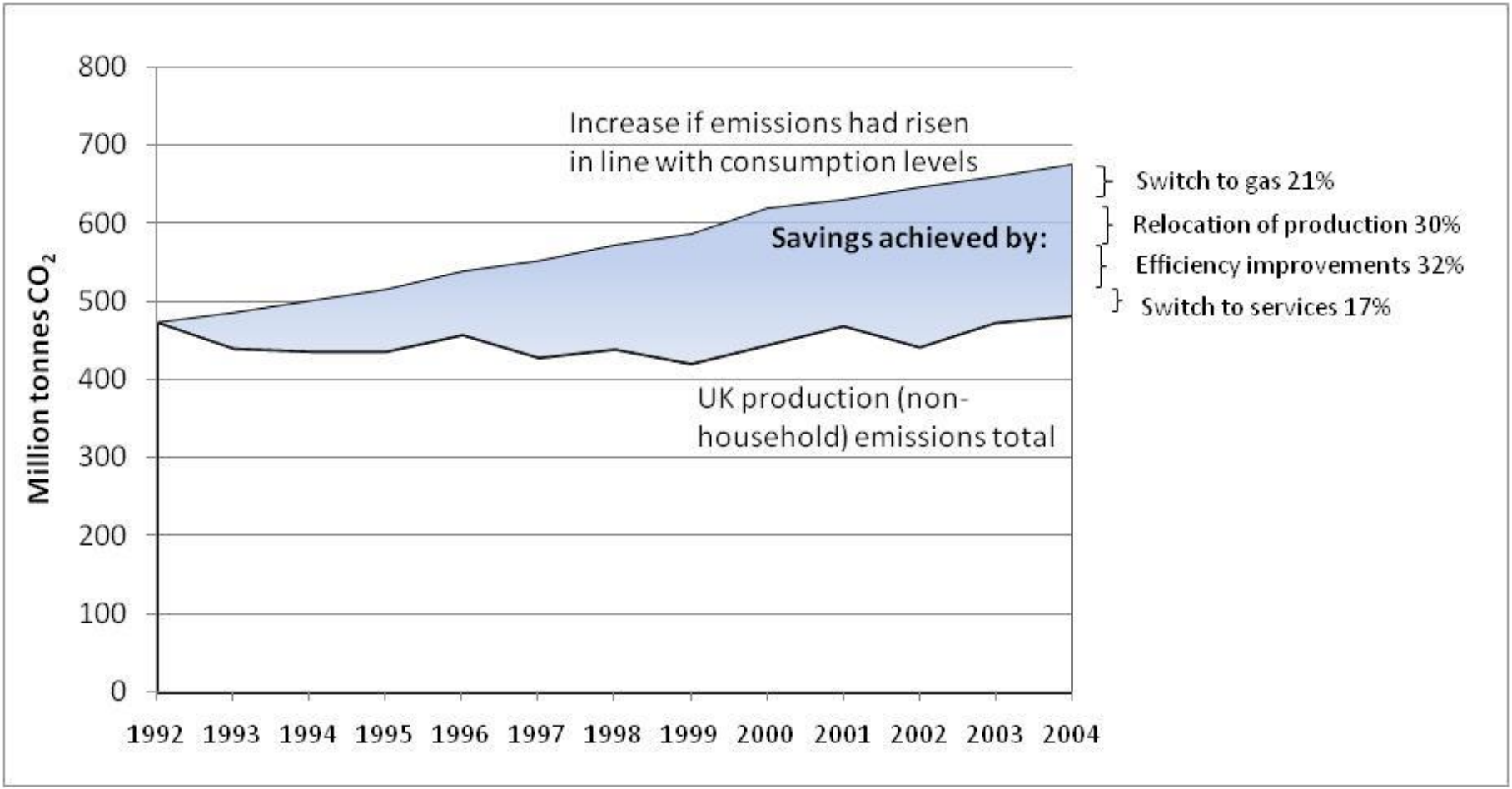




Source: Scott et al, 2013; Barrett et al, in preparation

Drivers of Emissions

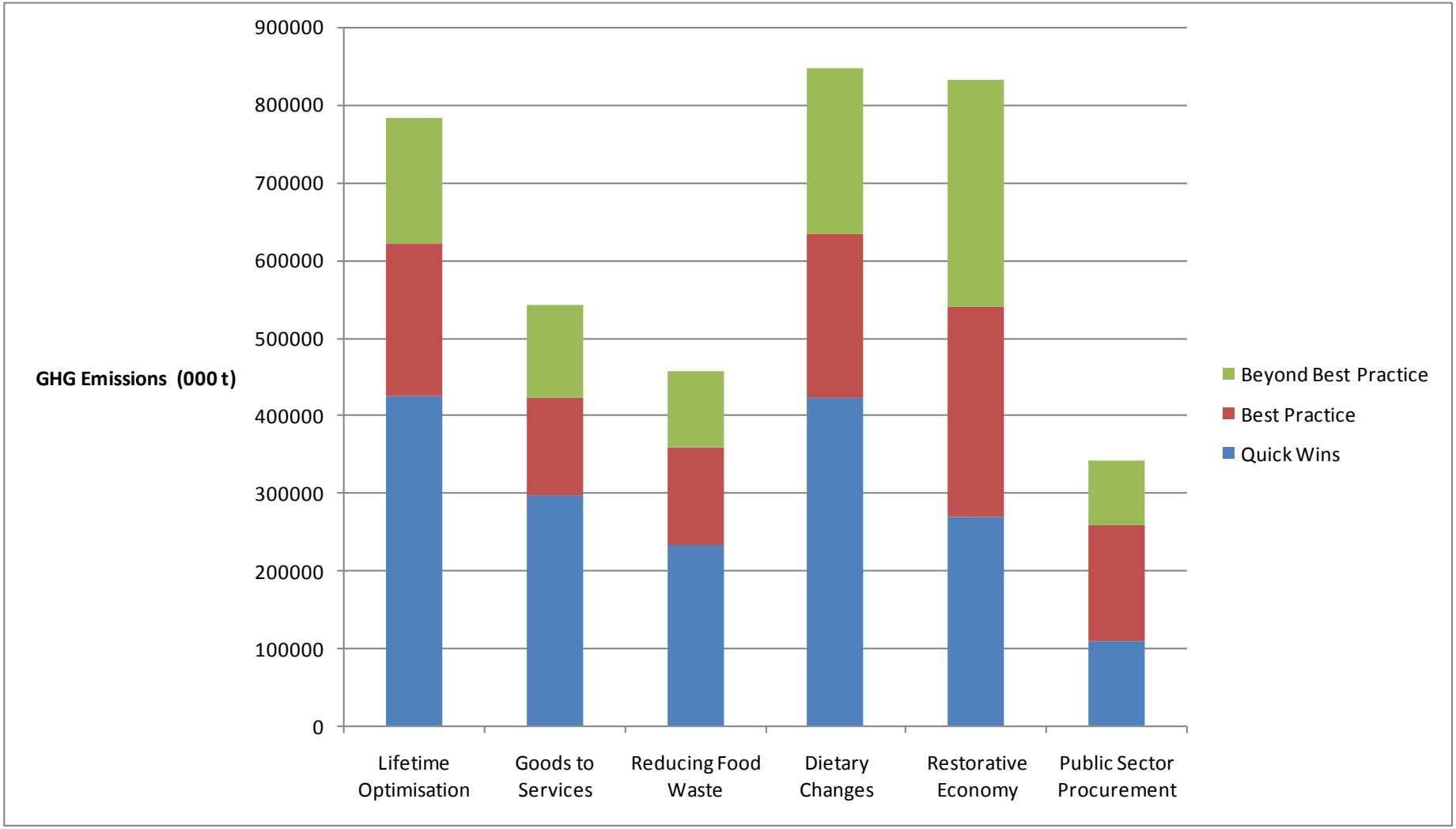
UNIVERSITY OF LEEDS



Source: Defra, 2008

Production and Consumption Policies

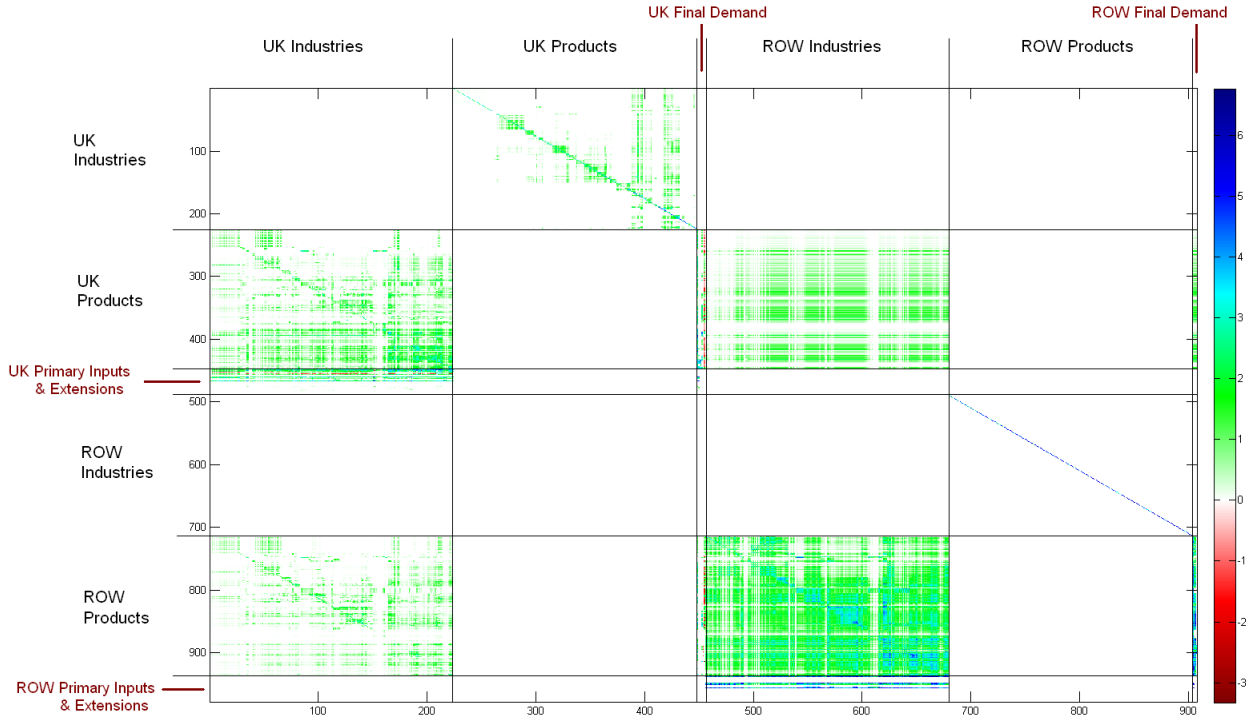
UNIVERSITY OF LEEDS

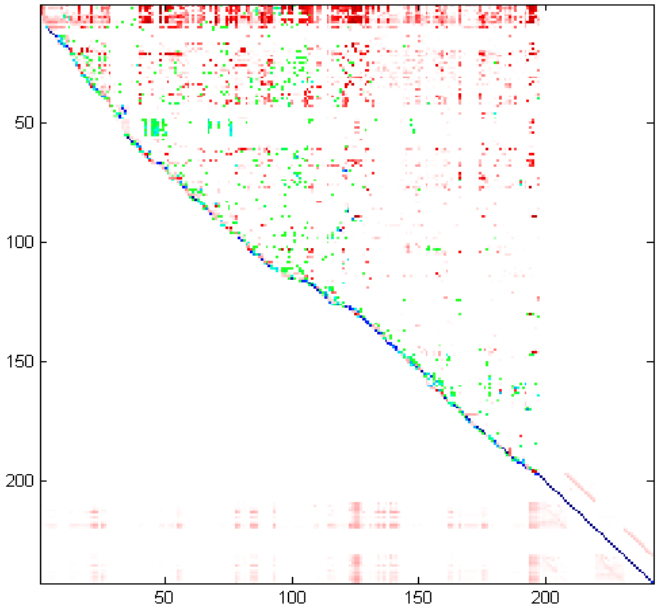


Source: Barrett and Scott (2012); Scott et al (2009)

Full Integrated Hybrid Approach

UNIVERSITY OF LEEDS

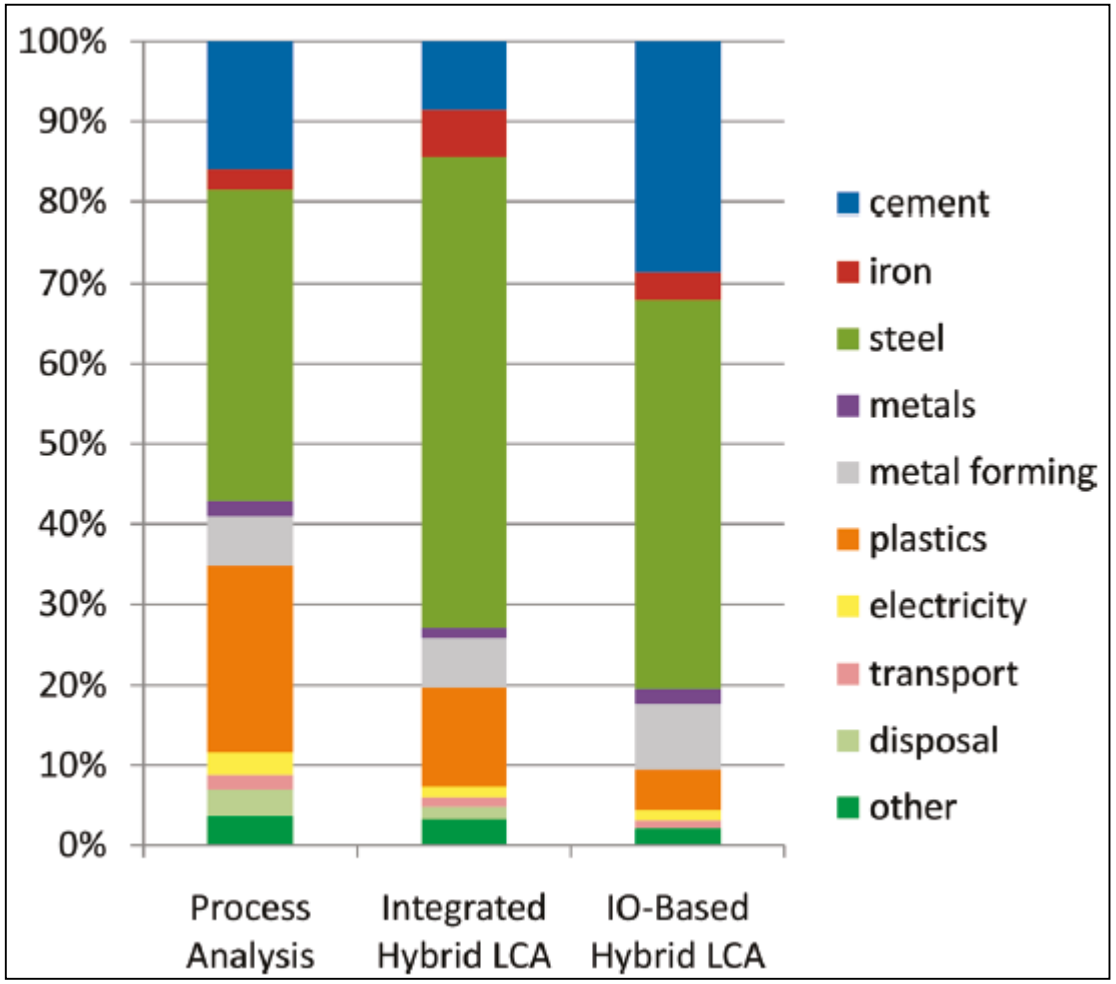


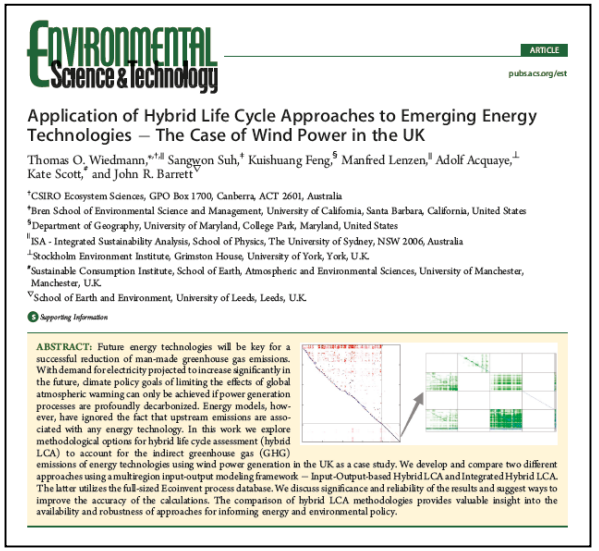


Source: Wiedmann et al (2012)

Lifecycle Emissions of Technologies

UNIVERSITY OF LEEDS





Environmental Science & Technology

ARTICLE

pubs.acs.org/est

Application of Hybrid Life Cycle Approaches to Emerging Energy Technologies — The Case of Wind Power in the UK

Thomas O. Wiedmann,*,†,‖ Sangwon Suh,† Kuishuang Feng,§ Manfred Lenzen,‖ Adolf Acquaye,⊥ Kate Scott,# and John R. Barrett▽

†CSIRO Ecosystem Sciences, GPO Box 1700, Canberra, ACT 2601, Australia
‡Bren School of Environmental Science and Management, University of California, Santa Barbara, California, United States
§Department of Geography, University of Maryland, College Park, Maryland, United States
‖ISA - Integrated Sustainability Analysis, School of Physics, The University of Sydney, NSW 2006, Australia
⊥Stockholm Environment Institute, Grimston House, University of York, York, U.K.
#Sustainable Consumption Institute, School of Earth, Atmospheric and Environmental Sciences, University of Manchester, Manchester, U.K.
▽School of Earth and Environment, University of Leeds, Leeds, U.K.

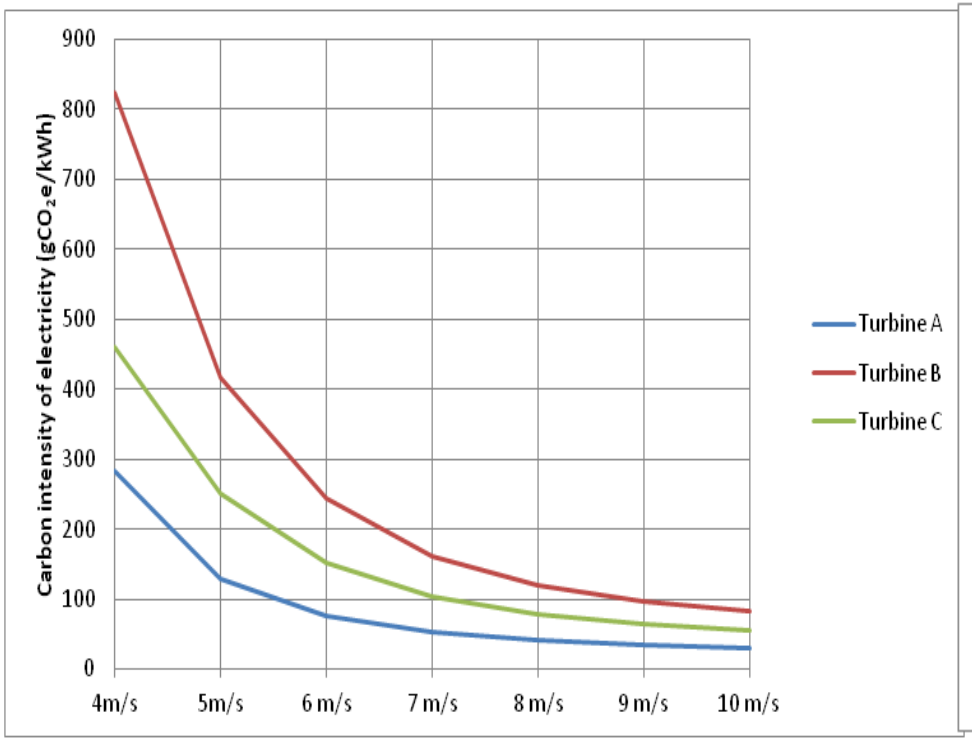
Supporting Information

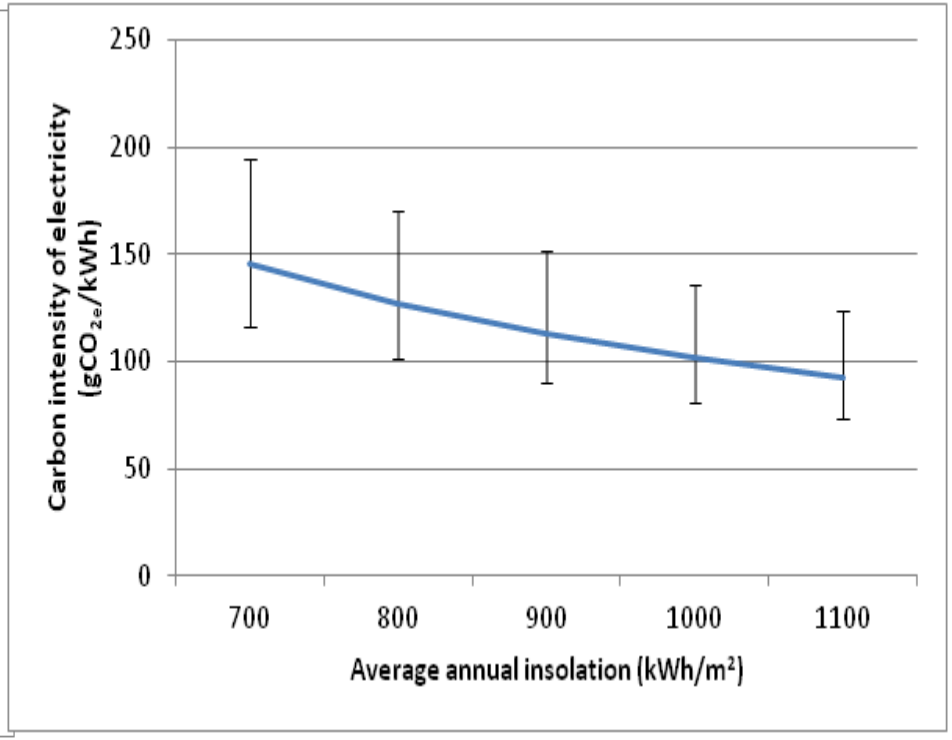
ABSTRACT: Future energy technologies will be key for a successful reduction of man-made greenhouse gas emissions. With demand for electricity projected to increase significantly in the future, climate policy goals of limiting the effects of global atmospheric warming can only be achieved if power generation processes are profoundly decarbonized. Energy models, however, have ignored the fact that upstream emissions are associated with any energy technology. In this work we explore methodological options for hybrid life cycle assessment (hybrid LCA) to account for the indirect greenhouse gas (GHG) emissions of energy technologies using wind power generation in the UK as a case study. We develop and compare two different approaches using a multiregion input-output modeling framework — Input-Output-based Hybrid LCA and Integrated Hybrid LCA. The latter utilizes the full-sized Ecoinvent process database. We discuss significance and reliability of the results and suggest ways to improve the accuracy of the calculations. The comparison of hybrid LCA methodologies provides valuable insight into the availability and robustness of approaches for informing energy and environmental policy.

Source: Wiedmann et al (2012)

Lifecycle Emissions of Micro-generation

UNIVERSITY OF LEEDS





Source: Bush et al, in press

Introducing UK INDEMAND: Motivation

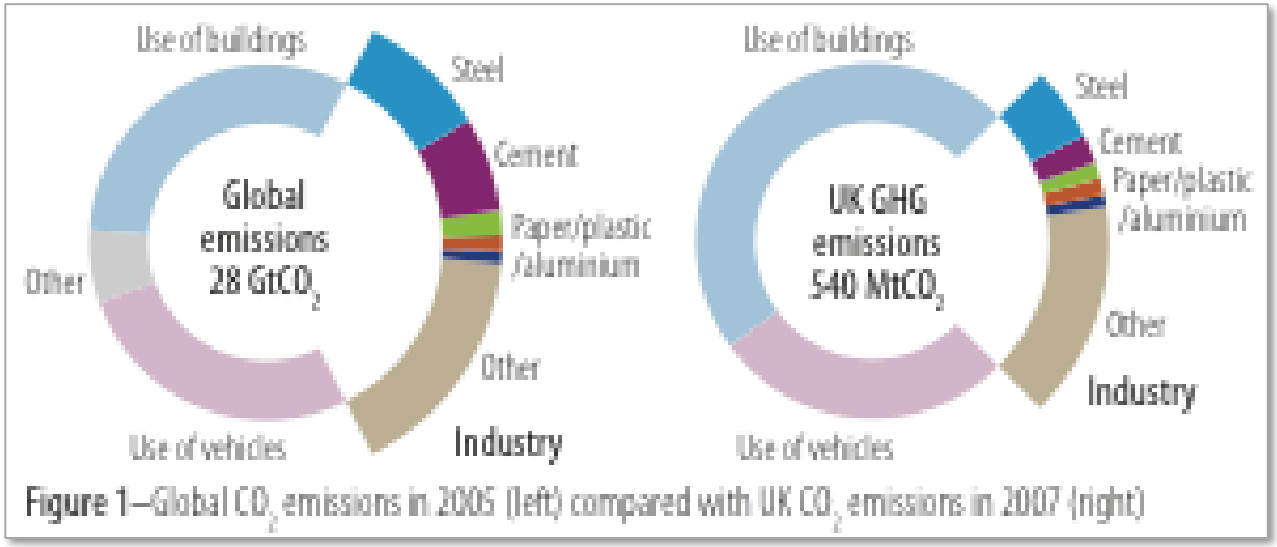


Figure 1—Global CO_2 emissions in 2005 (left) compared with UK CO_2 emissions in 2007 (right)

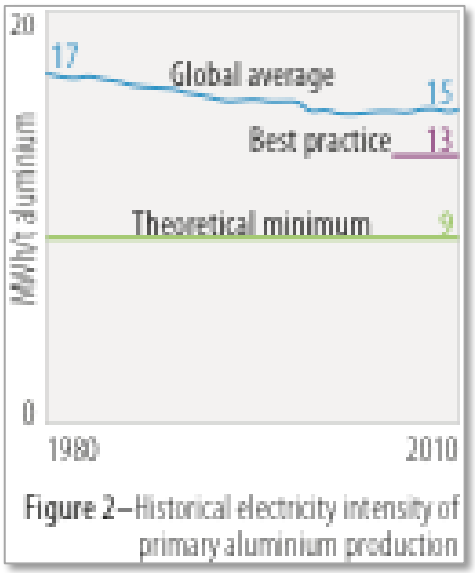
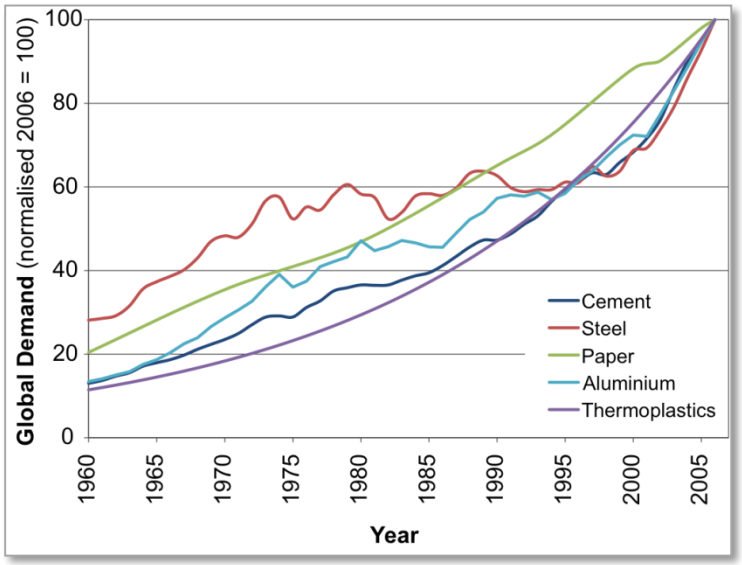


Figure 2—Historical electricity intensity of primary aluminium production



Planned outputs

National Material Flow Analysis:

Energy, Exergy and Decomposition Analysis

Trade & production and consumption of main materials

Combined material/

energy and monetary flow

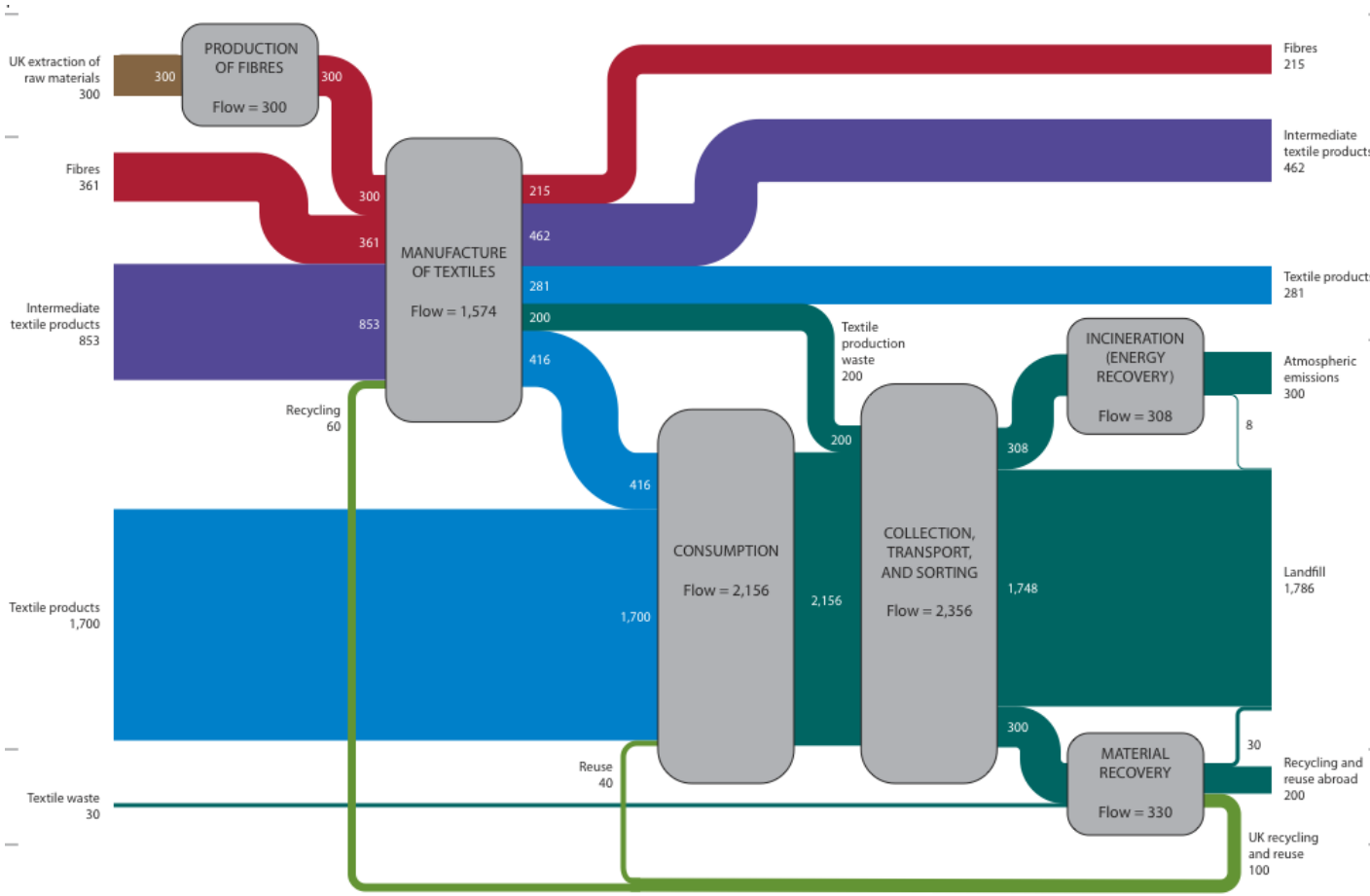
Stock estimates

Supply chains

Major products

Efficiency

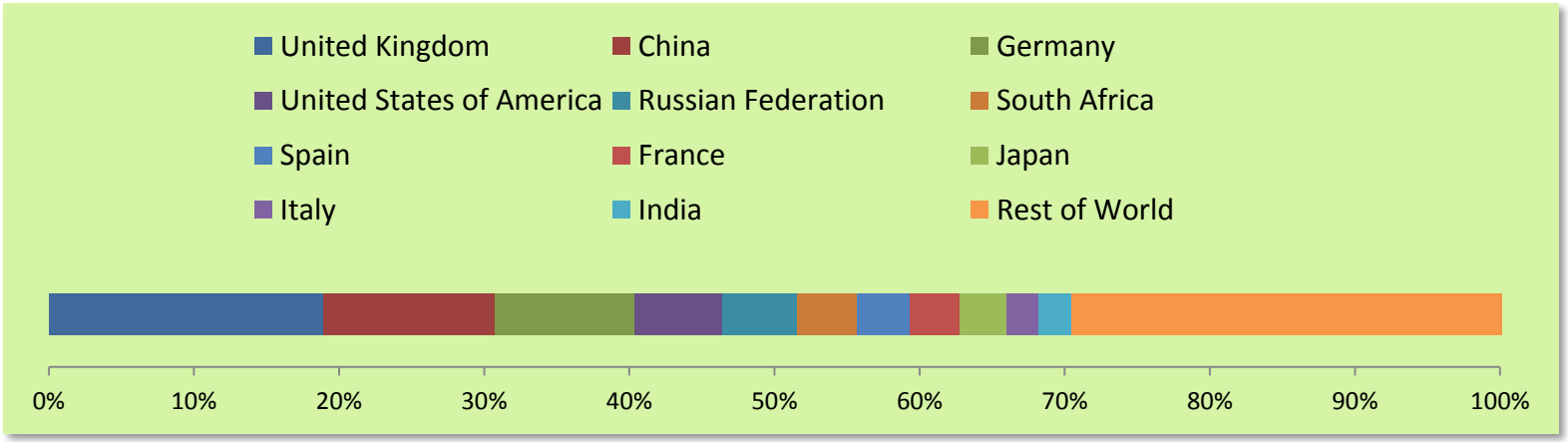
Time Series Analysis



Planned outputs

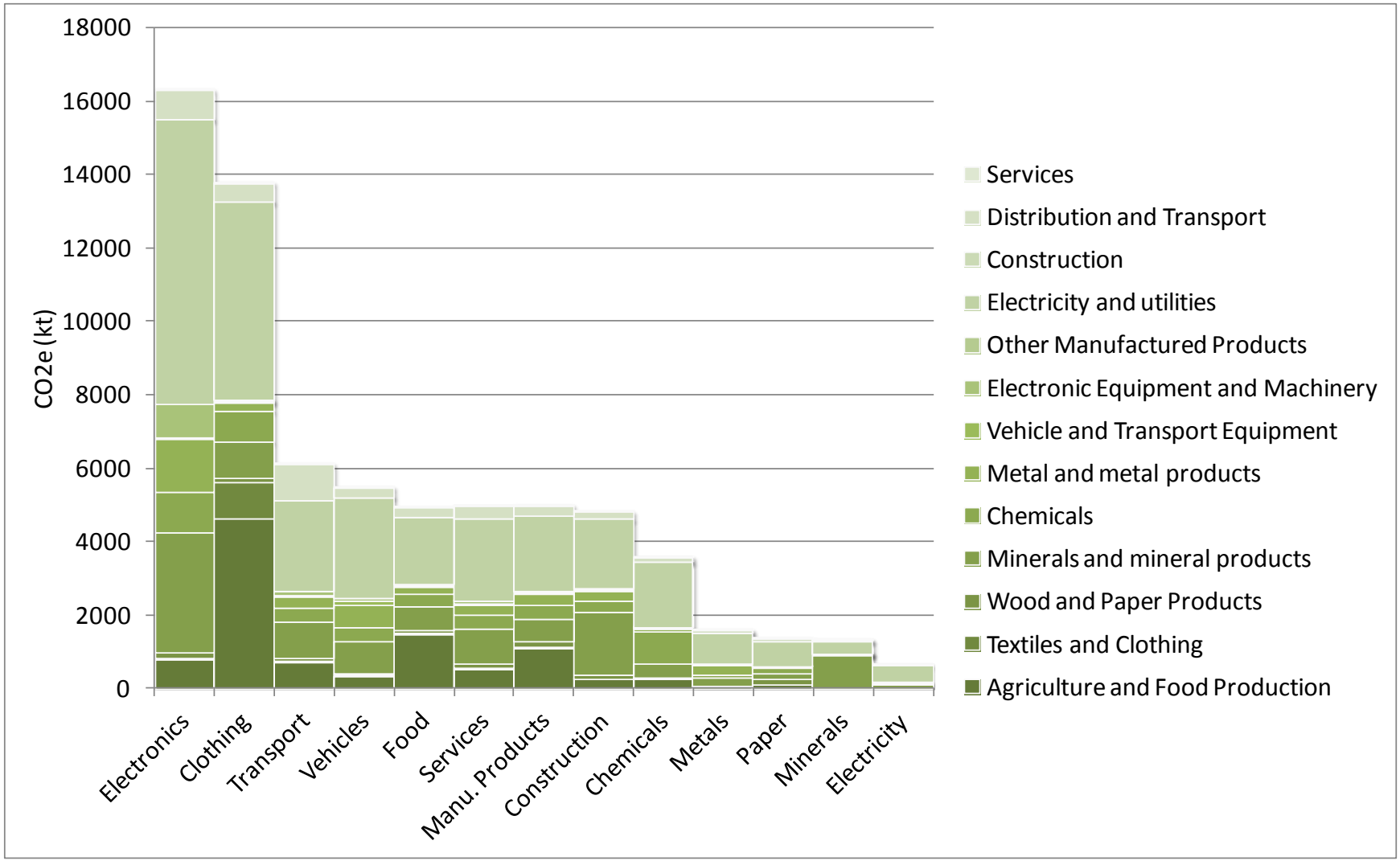
Economic and trade based analysis:

- Complete time series of energy demand and flows through 110 industry sectors for the last 20 years.
- Includes the energy required to deliver UK consumption and capital investment in every country
- Develop of a hybrid “physical / monetary and energy model” to more accurately reflect the flow of carbon intensive materials
- Construction of “Consumption-based National Accounts” for the UK (1993 to 2011) (joint output with Cambridge)
- Development of a reference scenario for UK consumption-based emissions building on CCC analysis
- Application papers on “Employment Leakage” and “Resource Scarcity”



Planned outputs

Economic and trade based analysis:



References

UNIVERSITY OF LEEDS

- Barrett, J., C. Le Quéré, M. Lenzen, G. Peters, K. Roelich, and T. Wiedmann. 2011. UK Energy Research Centre Response to the Energy and Climate Change Committee Consultation on Consumption-based Emission Reporting. London, UK: UKERC. http://www.publications.parliament.uk/pa/cm201012/cmselect/cmenergy/writev/consumpt/con20.htm.
- Barrett, J., Peters G., Wiedmann T., Scott K., Lenzen M., Roelich K., C. Le Quéré (2013) Consumption-based GHG Emission Accounting: a UK case study. Climate Policy, Vol 13., No.4., 451-470.
- Barrett J., Owen A., Sakai M. (2011) UK Consumption Emissions by Sector and Origin, Report to the UK Department for Environment, Food and Rural Affairs by University of Leeds.
- Barrett J. and Scott K. (2012) Link between Climate Change Mitigation and Resource Efficiency: A UK Case Study, Global Environment Change, Volume 22, Issue 1, February 2012, Pages 299-307.
- Barrett J., Vanner R., Sakai M., Owen A. (2012a) GHG Emissions Embodied in Trade – Is Border Adjustment an appropriate and effective response, Report to the Centre for Low Carbon Futures, York.
- Scott K., Barrett J. Baiocchi G., Minx J. (2009) Meeting the UK climate change challenge: The contribution of resource efficiency, published by Waste Resources Action programme (WRAP).
- Wiedmann T. and Barrett J. (2013) Policy relevant Applications of Environmentally Extended MRIO Databases – Experiences from the UK. Economic Systems Research, 25:1, 143-156.
- Wiedmann T., Suh S., Feng K., Lenzen M., Acquaye A. Scott K., Barrett J. (2012) application of Hybrid Life Ccle Approaches to Emerging Energy Technologies – the Case of Wind Power in the UK. Environmental Science and Technology, 2011, 45, 5900-5907