

MEMORANDUM FROM RESEARCH COUNCILS UK (RCUK) IN RESPONSE TO THE HOUSE OF LORDS SCIENCE AND TECHNOLOGY SELECT COMMITTEE INQUIRY ON WASTE REDUCTION

1. Research Councils UK is a strategic partnership set up to champion the research supported by the seven UK Research Councils. RCUK was established in 2002 to enable the Councils to work together more effectively to enhance the overall impact and effectiveness of their research, training and innovation activities, contributing to the delivery of the Government's objectives for science and innovation. Further details are available at www.rcuk.ac.uk
2. This evidence is submitted by RCUK on behalf of the Engineering and Physical Sciences Research Council and the Economic and Social Research Council and represents their independent views. It does not include or necessarily reflect the views of the Science and Innovation Group in the Department for Innovation, Universities and Skills. The submission is made on behalf of the following Councils:

Engineering and Physical Sciences Research Council	(EPSRC)
Economic and Social Research Council	(ESRC)

3. The ESRC Centre for Business Relationships, Accountability, Sustainability and Society (BRASS)¹ at Cardiff University, is planning to submit evidence for this Inquiry direct to the Committee.

BETTER DESIGN AND THE USE OF MATERIALS

What role can better design and materials play in minimising the creation of waste? Are there any barriers to how knowledge in this area can best be translated and applied?

4. Design can play an important role in minimising waste through several parts of the design process. Design for manufacture can reduce the need for extensive machining or other material reduction processes; design for use can help ensure that minimum amounts of material are used; design for recycling and reuse can help to ensure that materials go back into the production cycle rather than into landfill. Knowledge of materials properties is important in facilitating all of these stages of the design process. The need for a holistic view across the areas identified is a barrier to this process; engineering, and other designers, need to have constant access to up-to-date information on materials properties and manufacturing processes. A further consideration is any additional cost to the customer accrued from the whole life of the product and the need to understand the extent to which end users are willing to meet these costs.
5. Research at the ESRC Centre for Business Relationships, Accountability, Sustainability and Society (BRASS)² has highlighted the need for holistic 'physical lifecycle' approaches to product management, in which product design, manufacture, forward logistics, reverse logistics and remanufacturing are all treated as integrated

¹ <http://www.brass.cf.ac.uk/>

² <http://www.brass.cf.ac.uk/>

components of a total system. Such a change would require significant alterations in management practice and education.

What factors influence the use of materials? In what way do considerations of sustainability feature in the selection of most commonly used materials?

6. The factors that influence the use of materials will vary depending on the nature of the product or structure under consideration. For example: for items such as planes, trains or buildings, reliability and structural integrity are essential considerations and the process of certification, and of gaining the confidence of designers and the public, can be a lengthy process; in other areas more cosmetic factors such as texture and feel are important; in more utilitarian products, cost is a significant consideration.
7. Designers' knowledge base about materials that are available, and how to ensure that the design process can change to adapt to developments in cutting edge materials and manufacturing science, as well as questions of sustainability in terms of continuity of availability at reasonable price will continue to be an influencing factor in the considerations of which materials are commonly used.

To what extent do product designers and engineers take into account the availability and the end of life impacts of raw materials?

8. Continuity of supply continues to be an important consideration for designers (see above), but end of life impacts are becoming increasingly important, particularly where these are reinforced by legislation such as the Waste Electrical and Electronic Equipment (WEEE) Directive³.

What impact does the development of new materials have on design? How much interaction is there between material scientists and designers?

9. Designers are always interested in new materials and the innovative products and looks that can arise as a consequence. However, over the whole life of a large project, the design process can take many years and work to a materials specification that is out dated when the manufacturing process commences.
10. Interaction between materials scientists and designers could be improved and the Institute of Materials, Minerals and Mining (IoM3)⁴ has a series of initiatives, including with the Royal College Arts, to address this.

Can better designed products offset the increase in consumption?

11. Better designed products are intended to help sales, so, of themselves, may increase consumption and create new markets. However if the term 'better designed products' refers specifically to products that minimise material use then they could offset the increase in consumption, although this is not always the case. For example, the weight of airframes and engines has been significantly reduced, but the overall weight of commercial aircraft has not changed markedly due to the increase in provision of in

³ <http://www.netregs.gov.uk/netregs/275207/1631119/?version=1&lang=e>

⁴ <http://www.iom3.org/>

flight entertainment systems and other facilities. Recent increases in fuel costs may, however, tend to counteract this tendency. Careful consideration needs to be given to whether the better designed products will themselves create or lead to new forms of consumption behaviour and/or practice and to potential 'rebound effects' which may reinforce or undermine any impact on waste reduction.

Are there any other gaps in knowledge and how are they being addressed?

12. There are gaps in knowledge and understanding relating to how to recognise materials when an artefact is being disassembled, and how best these materials can be recycled or reused once they have been identified. Related to this are questions of who should bear any increased research and development costs; customer expectations and tolerance of these issues are important but not always clear.
13. The EPSRC-funded Network on Product Lifespans⁵, led by Dr Tim Cooper at Sheffield Hallam University, aims to identify research and development requirements and promote collaboration relating to product durability and product life span. EPSRC has also funded networks and research proposals on the Sustainable Use of Materials⁶. Research areas include sustainable use of materials in electrical and electronic products, and reuse and recycling of road vehicles.

BUSINESS FRAMEWORK

Does the current policy, regulatory and legal framework support and incentivise the development of better, more sustainable products and processes? How is the framework communicated to businesses and what is the level of awareness and understanding among businesses?

14. Research at the ESRC Centre BRASS has examined business policies and practices in relation to waste. For example, a survey of 50 companies in Cardiff in 2003⁷ found that:
 - Many businesses were unaware of Duty of Care Regulations;
 - Little recycling was carried out due to lack of provisions and facilities from the council and lack of storage for recycling containers at the premises;
 - Monitoring of waste expenditure was not always common practice, especially with smaller businesses who would perhaps benefit most from this;
 - The majority of small businesses (under 20 employees) had no Environmental Policy;
 - Energy, waste, water, packaging, materials recycling or re-use was not a common occurrence and usually only one or two of these practices were carried out, if any.
15. The current framework does seem to incentivise the development of more sustainable products and processes; EPSRC has noted that it receives research proposals which cite this as a rationale for the funding of projects.

⁵ <http://extra.shu.ac.uk/productlife/>

⁶ <http://gow.epsrc.ac.uk/ViewGrant.aspx?GrantRef=EP/C013581/1>

⁷ http://www.brass.cf.ac.uk/projects/Socio-Environmental_Impacts_of_Business--Commercial_and_Industrial_Waste_Survey_2003--Key_Findings.html

How central is sustainable design to business thinking? What initiatives are in place to encourage this and are they meeting business needs?

16. Corporate and social responsibility is a consideration for some businesses. Some businesses are also starting to consider re-use and recyclability as an integral aspect of the design process (“design for recycling” and “through life management” thinking).

GOVERNMENT POLICY

What is and should be the role of Government in addressing the issue of waste reduction?

17. Research under ESRC's Sustainable Technologies Programme at the University of Surrey⁸ concluded that achieving pro-environmental behaviour change demands a more sophisticated policy approach. A concerted strategy is needed to make behaviour change easy: ensuring that incentive structures and institutional rules favour pro-environmental behaviour; enabling access to pro-environmental choice; engaging people in initiatives to help themselves; and exemplifying the desired changes within Government's own policies and practices.
18. The research found that Governments influence and co-create the culture of consumption in a variety of ways. In some cases, this influence proceeds through specific interventions – such as the imposition of regulatory and fiscal structures. In other cases it proceeds through the *absence* of such interventions. Most often it is a combination of both. It also suggests that Government has a key role in facilitating external conditions that favour sustainable behaviour. Evidence suggests that 'situational factors' such as absence of, or poor access to, convenient recycling infrastructure or appliances, lack of clear information, and so on, can hinder the pro-environmental or pro-social choice of even the most motivated individuals.
19. The research highlighted how the social context of environmentally significant behaviour is framed by a wide range of policy institutions; the regulatory framework; the structure of the market; planning law; product standards; trading standards; marketing standards; family law; distribution policy and so on. The detailed design of these institutions has enormous potential to drive or to hinder pro-environmental change.
20. Another key lesson from the research was the importance of community based social change. Individual behaviours are shaped and constrained by social norms and expectations. Negotiating change is best pursued at the level of groups and communities. Social support is particularly vital in breaking habits and in devising new social norms.
21. The research also highlighted the importance of the Government 'practicising what it preaches', for a number of reasons. Firstly, public sector consumption constitutes a significant proportion of total consumption. Secondly, procurement practices can play

⁸ <http://www.sustainabletechnologies.ac.uk/> for further information on a range of related research projects, see reports at http://www.sustainabletechnologies.ac.uk/outputs_proj.htm or Programme summary report *Catalysing Innovation for Sustainability* at <http://www.sustainabletechnologies.ac.uk/final%20pdf/online%20version.pdf>

a key role in stimulating markets for sustainable products and services. Thirdly, the process of changing behaviour across Whitehall provides invaluable lessons to policy-makers about what is involved. Finally, Government policies and practices send important signals to people about public priorities, and social and cultural preferences. Unfavourable or inconsistent policy signals can undermine the best efforts of Government to motivate sustainable consumption.

22. The Defra Waste and Resources Research Advisory Group⁹ includes EPSRC and ESRC representation. This Advisory Group was set up by Defra in 2004 to advise on implementation of the Defra Waste and Resources Evidence Programme and aims to provide strategic foresight in to the technical and policy challenges that lie ahead in the field of waste and resources management, and to take an overview of research funding activities across the waste-related area.

What lessons can be learnt from other countries - within the EU and globally?

23. A recent ESRC Report *Consumption: reducing, reusing and recycling*¹⁰ summarises some key international efforts to become more resource efficient by significantly reducing waste or achieving higher rates of recycling or reuse. The author, Ben Shaw (Senior Research Fellow, Environment Group, Policy Studies Institute), argues that, despite recent improvements, the UK is still a long way behind the best performing countries and regions where taxation and household waste charges have been used to reduce landfill. However, he also notes that even the toughest penalties have not been enough to prevent a significant accumulation of waste and argues that waste reduction needs to be tackled higher up the chain of production and consumption: "Waste reduction must be a goal of UK environmental policy, and not tackled through waste policy alone"¹¹.
24. The author also argues that although there are some inherent problems with 'zero waste' as a concept (and as a policy objective), there are lessons to be learnt by critically considering the achievements of existing practice, wherever in the world that may be found. For example:
 - We should set a per capita residual waste target to drive both recycling and prevention, backed up by variable charging of householders;
 - We should be among the first countries to tackle consumption by making innovative and transformative producer responsibility agreements;
 - We could be much more ambitious in our recycling targets;
 - We should try harder on construction and demolition waste;
 - We should develop more 'closed loop' systems for organic wastes, for instance by returning composted food waste to the land as fertiliser, rather than losing this valuable resource.

⁹ <http://www.defra.gov.uk/environment/waste/wip/research/wrrag/index.htm>

¹⁰ http://www.esrc.ac.uk/ESRCInfoCentre/Images/Consumption-%20reducing_reusing_and_recycling_tcm6-20192.pdf

¹¹ Ibid, page 11.

25. The report gives examples of zero waste initiatives which have been tried - from the high-tech, large-scale waste management systems of consumerist San Francisco, to the locally based, small-scale initiatives in the Philippines.
26. Further research supported by the ESRC "Waste of the World"¹², co-ordinated by the University of Sheffield, is examining newly emerging global economies in hazardous and non-hazardous wastes, examining both flows and trades in such wastes, and examining contrasting technologies of waste management in different parts of the world. For example, one project is examining experience in Denmark, where over 50% of waste is incinerated, to see if any lessons can be learnt for the UK. Another project is looking at clothing recycling in the UK and India, contrasting different approaches such as the development of second-hand clothing markets and the mutilation and pulping of clothing material for re-weaving.

CONSUMER BEHAVIOUR

How can better product design be used to effect a change in consumption patterns and behaviour?

27. Research at the University of Manchester, supported under ESRC's Sustainable Technologies Programme¹³, on sustainable domestic technologies in kitchens and bathrooms¹⁴, has suggested that in order for design initiatives to be successful greater attention needs to be given to how the product / service will interact with embedded habits, routines and practices and the broader domains, for example the design and use of kitchens, bathrooms etc within which they occur, rather than focusing on individual technological solutions and seemingly voluntaristic action. The research notes that whilst household appliances are more efficient than ever (the electricity consumed by new refrigerators and freezers dropped by 35% between 1994 and 2004), the amount of energy they consume has remained stable; the domestic sector has generally been unable to decouple resource intensity from patterns of domestic consumption. The research highlights that the key issue is not the efficiency of one technology or another, but the resource intensity of the practices and the expectations such technologies sustain. These practices and expectations were found to be malleable, with potential for them to involve less consumption, but this was largely a result of changing routines as a part of 'normal life', which may be stimulated, facilitated or impeded by physical environmental / technological factors, rather than as a result of conscious efforts to achieve more sustainable consumption by consumers.
28. See also response above to 'Can better designed products offset the increase in consumption?'

¹² <http://www.thewasteoftheworld.org/>

¹³ <http://www.sustainabletechnologies.ac.uk/>

¹⁴ <http://www.sustainabletechnologies.ac.uk/final%20pdf/Project%20Innovation%20Briefs/Innovation%20Brief%205.pdf>

What role do marketing strategies play in influencing more sustainable design?

29. Research at the University of Leeds under ESRC's Sustainable Technologies Programme¹⁵ suggests that marketing campaigns are working to reinforce or change attitudes in terms of increasing public concerns about environmental issues but that consumers are struggling to translate this into their purchasing of 'greener' products or services. The research suggested that this may in part be explained by the increasingly complex decision-making processes and choices that consumers face which may often result in trade-offs between conflicting issues (for example there may be many environmental or ethical issues surrounding each choice) and can involve a complexity of information. It found that being an 'ethical' consumer is double the work and that for 'green' consumers for whom time is a scarce resource this can be an important constraint on their ability to act on their intentions. In terms of marketing strategies the research suggested that it is important to be aware of all the possible contact points between the product / service and consumers (e.g. media articles about products, in-store product information, etc) and the importance of presenting a coherent and transparent philosophy and messages across all of these contact points. The research suggests that consumers want more reliable information on the impacts of the products and companies. They also want to know which impacts to prioritise when comparing products. Consumers need clear direction through incentives and disincentives rather than just education.
30. The ESRC Centre BRASS has conducted research on a number of different aspects of waste reduction at the production stage and in consumption. In the recent ESRC Report - *Consumption: reducing, reusing and recycling*¹⁶ –Professor Ken Peattie argues that a key tool in the development and implementation of consumption reduction policies is 'social marketing' (SM), which involves using commercial marketing techniques to influence their behaviour for the benefit of society as a whole. Key features of social marketing approaches in this context include:
- SM campaigns can involve the *de-marketing* of a particular type of product or behaviour (e.g. littering) or the *promotion* of a particular type of product or consumer behaviour (e.g. engaging in recycling);
 - Like commercial marketing, SM is founded on *research* that seeks to understand the target market, the competition and the marketing context;
 - SM has its own *marketing mix* based on 'propositions' not products: 'accessibility' to information, solutions and alternatives; two-way communication rather than promotion; and 'cost of involvement' rather than price.
31. Potential benefits of a Social Marketing approach include:
- Instead of focusing on the message, SM focuses on the *target audience's point of view*, taking account of any physical or emotional barriers that may prevent people from changing their behaviour;

¹⁵<http://www.sustainabletechnologies.ac.uk/final%20pdf/Project%20Innovation%20Briefs/Innovation%20Brief%207.pdf>

¹⁶http://www.esrc.ac.uk/ESRCInfoCentre/Images/Consumption-%20reducing_reusing_and_recycling_tcm6-20192.pdf

- The focus on the *benefits* of a greener lifestyle avoids sending ineffective guilt messages about environmental damage. This could help connect consumers with the idea of sustainability and encourage them to reduce their consumption.

Are there any gaps in knowledge in this area?

32. Whilst we have made significant steps forward in understanding consumer attitudes, behaviour and practices, considerable challenges still remain in developing effective strategies and drawing together different approaches for achieving change which will be effective for different groups of consumer and in different contexts. The ESRC, Defra and Scottish Executive will shortly be launching a consultation to consider the possibility of establishing a joint research centre which would consider these issues further. Such a new research centre would complement existing research initiatives in the field. This includes the ESRC Group on Lifestyles, Values and Environment (RESOLVE)¹⁷ at the University of Surrey, which was funded as a part of the Research Councils Energy Programme, and the ESRC Centre BRASS¹⁸.

OTHER COMMENTS

The Committee would also be interested to hear about any other issues not already covered by this call for evidence that are relevant to the scope of the inquiry.

33. The notion of the 'closed loop' – recycling resources so that, where possible, they go back to their original use is gaining ground. Examples, include turning plastic bottles back into plastic bottles, returning composted food waste to the land as fertilizer and designing manufacturing systems so that all processing aids, such as solvents, are cycled indefinitely within the factory or, better still, eliminated completely. Closed loop thinking is potentially useful as much current 'recycling' is actually 'downcycling', involving only one or two further uses of the materials before they become waste.
34. Another ambitious approach is 'cradle-to-cradle', a vision of the future in which all resources circulate around one of two cycles – a biological cycle where things that come from the land are returned to the land but with all toxic, persistent and bioaccumulative materials removed and a technical cycle whereby non-renewable resources are not allowed to escape from economic productivity but are endlessly recycled. These notions are discussed further in an ESRC public policy seminar series briefing report on *Consumption: reducing, reusing and recycling*¹⁹.

¹⁷ <http://www.surrey.ac.uk/resolve/>

¹⁸ <http://www.brass.cf.ac.uk/>

¹⁹ http://www.esrc.ac.uk/ESRCInfoCentre/Images/Consumption-%20reducing_reusing_and_recycling_tcm6-20192.pdf