Technology Strategy Board response to House of Lords Science and Technology Select Committee inquiry into Waste Reduction

We are pleased to respond to the Committee's call for evidence for the inquiry into Waste Reduction.

The role of the Technology Strategy Board (an executive NDPB) is to:

- promote and support research into, and development and exploitation of, science and technology for business benefit for economic growth and quality of life;
- deliver a programme of financial support to encourage business investment in, and use of, technology across all sectors in UK;
- provide leadership to Government departments and agencies and work with RDAs, DAs and the Research Councils on technological developments and innovation of importance to UK business;
- advise Government on areas where barriers exist to the exploitation of new technologies - and put forward recommendations for removing them.

The Technology Strategy Board supports research across the whole of the economy. It focuses on a number of Key Technology Areas which provide the framework for deciding where the Technology Strategy Board should invest funding and support activities. Focused on areas where the UK has capacity to develop and exploit the technology, and where there is global market potential, they consist of horizontal technologies which underpin many areas of the global economy and application areas which represent main market opportunities. The areas are:

Horizontal Technologies

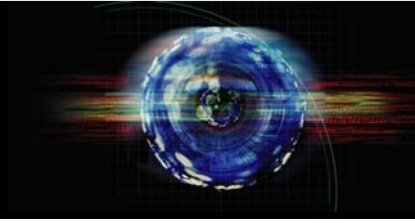
- Advanced Manufacturing
- Advanced Materials
- Bioscience
- Electrical, Electronics & Photonics
- Information and Communication Technologies

Application Areas

- Environmental Sustainability
- Energy Generation and Transmission
- Healthcare
- Transport (focus on aerospace & automotive)
- Creative Industries
- High Value Services
- Built Environment

The interventions used by the Technology Strategy Board include support for Collaborative Research & Development projects, Knowledge Transfer Networks and Innovation Platforms which are focused on major societal challenges and help to link research to public procurement opportunity.

In the specific area of resource efficiency and waste, the Technology Strategy Board is currently supporting collaborative R&D projects with funding of £36 million delivered through six calls held since November 2004:



- Waste management & minimisation (November 04)
- Meeting the challenge of the Zero Emission Enterprise (April 05)
- Contaminated land remediation technologies (November 05)
- Design & Manufacture of Sustainable Products (November 05)
- Energy Efficiency Technologies (including Building Design & Controls and Manufacturing Processes) (April 06)
- Zero Emission Enterprise 2 (Autumn 2006)

In addition to these calls, the Technology Strategy Board is supporting many other projects (650 collaborative R&D projects currently with funding of over £500m) many of which also have some form of positive environmental impact. The advanced materials research also supports research on recycling.

With the exception of Waste management & minimisation and Contaminated land remediation technologies, the resource efficiency and waste reduction calls have focused on promoting innovations in the upper levels of the waste hierarchy. Two case studies can be found at Annex A.

Better design and the use of materials

A report by the European Environment Agency concluded that gains in technical efficiency are being offset by increases in consumption.[1] This is not to say that better design cannot offset the increase in consumption but the trajectory is not yet right and technical and non-technical interventions will be necessary to achieve this. Benefits in efficiency may be offset, or even negated in what has been termed the "Rebound Effect". Improved efficiency levels reduce the cost of goods or services, which are then consumed more intensively. Alternatively cost savings may be redeployed elsewhere in increased discretionary spending (for example a new flat screen television, or a holiday overseas). The extent of the Rebound Effect is controversial, but certainly the relationship between improved efficiency (through product design) and decrease in consumption is not linear.

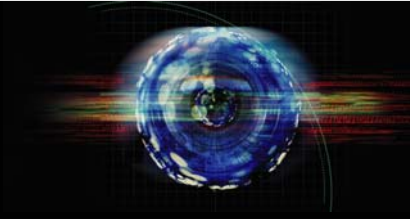
The UK has good academic capability in the area of life cycle assessment (LCA) and large multinational companies often also have expertise, although this may not be UK-based. Mid-sized and small companies generally do not have sufficient capability in LCA, which is perceived as being expensive and time-consuming. There is scope for best practice sharing and development of cheaper, quicker LCA-based tools that can be used early in the innovation process.

A database which allows designers to judge one material against another would be a useful introduction. We are aware that Materials UK has been exploring this. The problem is that data exists at a number of levels and that needed to make life-cycle relevant decisions is not validated. That leads through to the fact that, without valid comparisons, it is impossible to have a regulatory or standards framework that works.

Business framework

The Technology Strategy Board has supported initiatives to encourage business to design out waste as early in the process as possible, rather than introduce end of

[1] Sustainable use and management of natural resources, EEA report No 9/2005. http://reports.eea.eu.int/eea_report_2005_9/en



pipe solutions. Two initiatives in particular, 'Meeting the challenge of the Zero Emission Enterprise' and support for collaborative R&D projects in the area of Design and Manufacture of Sustainable Products have looked at designing better processes and also designing better and more sustainable products.

'Meeting the challenge of the Zero Emission Enterprise' competition first held in April 2005 and again in November 2006 aim to encourage business and academic communities to focus more on the top of the waste hierarchy. The Zero Emission Enterprise was proposed as a 'challenge' to encourage projects which offered integrated solutions to tackling the negative impacts produced by an enterprise. This could be achieved through encouraging better process design, the use of new or improved materials, and process optimisation, which includes better in-line recovery, separation and reuse of materials.

The projects supported are expected to deliver innovative solutions to the challenge of eliminating the amount of industrial and commercial waste (covering solid, liquid and gaseous waste streams) being generated as well as creating processes that are more resource efficient. Additional benefits from actions in this area would also likely include water savings, energy efficiency gains and reduced effluent and gaseous emissions.

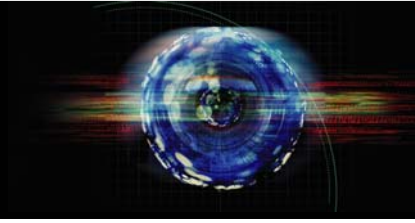
Projects being supported include the replacement of old, energy intensive and wasteful process with a low energy, low waste, solvent free and cost-effective manufacturing process and a project looking to deliver solutions to the identified problems, spanning the full life cycle of a decorative paint, which address all the identified environmental impacts.

The Design and Manufacture of Sustainable Products call held in November 2005 offered a challenge to organisations to collaborate in the research and development of innovative, sustainable products. Falling product prices due to globalisation of production, high product churn rates due to fashion, shorter product development timescales and high rates of technological change are all having an impact. Technological solutions to overcome the challenges could include: materials substitution, lightweighting, de-materialisation and decarbonisation; design for efficiency during use; and design for disassembly and remanufacture, re-use and recycling; and novel approaches such as inspiration from nature (biomimetics) or combinations of innovative products with tailored services.

Innovative producers are responding to these challenges in part by adopting a sustainable design approach to new products and services. The best of these offer features, form and function as good as or better than conventional products, with more benign environmental impacts, and with positive effects on the producers' costs and competitiveness.

Projects supported include:

Future Generation Plastics for Ultimate Sustainability (FuturePlas) project which is looking to reduce the amount of plastic used to make a component by 30%, reduce component weight by 30% (hence reduce energy use through life), and improve the recyclability of reinforced plastics (thereby diverting material from landfill). This will be achieved by developing the next generation of lightweight, high strength, recyclable polymers, reinforced with polymer fibres, to produce self-reinforced plastics.



REFLECT: Resistant Flooring from Ecological Technology. Interface, a world leader in sustainable business practice, and Queen Mary University of London are, propose to work with partners to develop further a patented ecological engineering material "Zelfo", as a "closed loop" hard flooring system. The project will provide a sustainable option in the fast growing hard flooring market.

The Technology Strategy Board also supports a number of Knowledge Transfer Networks (KTNs) including the Resource Efficiency KTN focused on minimisation and recycling of industrial waste, the Integrated Pollution Management KTN focused on contaminated land and groundwater remediation and the Materials KTN. KTNs bring together people from businesses, universities, research, finance and technology organisations to stimulate innovation through knowledge exchange.

Government procurement

Government procurement can be a powerful tool to create new markets, and pull through innovative technologies to serve these. Sustainable procurement policies exist, at national, regional and local levels, but need to be supported by demonstration activities which de-risk the process.

Innovation Platforms being taken forward by the Technology Strategy Board are designed to link research with procurement opportunity in areas where there are major societal challenges. We are currently supporting Innovation Platforms in areas including Low Impact Buildings and Low Carbon Vehicles.

An Innovation Platform creates the opportunity to bring together key partners (Government and business) to address a major societal challenge and to open up market opportunities to increase business investment in R&D and innovation. Drawing on Technology Strategy Board and other funding mechanisms, Innovation Platforms involve the integration of a range of technologies, combined with better co-ordination of policy and regulation, linked through to public procurement opportunities. Using a challenged based approach where public procurement opportunities are made more visible over a longer period of time would give business greater confidence to invest in the research necessary and so pull through technologies to the market much quicker.

Annex A
Case studies

Using thermal plasma technology to create a valuable product from hazardous waste

As work to recover energy from waste increases in the UK, an important issue for the industry is the development of sustainable methods for managing air pollution control (APC) residues. These are a hazardous waste generated by cleaning gaseous emissions to the levels required by regulation. Tetronics Ltd is leading a consortium to research the use of plasma technology in creating an integrated solution that produces an ecologically stable glass-ceramic product for use in the construction industry.

Air pollution control (APC) residues are a highly alkaline hazardous waste, containing volatile heavy metals, dioxins, furans and a high soluble salt content, that result from the commercial recovery of energy from waste (EfW). In the UK, the current APC disposal methods in use are likely to become commercially unsustainable, due to increasingly stringent environmental regulations. At the same time, new energy recovery capacity is expected to add to the 128,000 tonnes of APC residues currently produced in the UK each year, by an additional 40,000 tonnes every year for up to seven years.

Tetronics Ltd, a world leader in DC plasma technology, and Imperial College London have created a consortium to run a three-year collaborative project exploring the potential of applying plasma technology to the APC disposal challenge. Plasma technology is an advanced thermal conversion technology that delivers high destruction efficiencies to produce a stable vitrified slag with exceptional ecological performance characteristics. Costing £2.4 million, the project is part-funded by the Technology Strategy Board and was launched in late 2005.

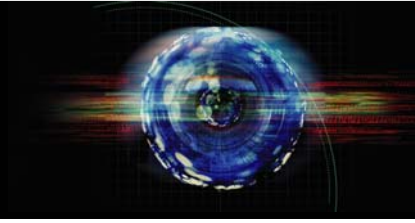
Tetronics Ltd and Imperial College London, leading researchers in process development, waste reuse and materials science, are running the project in partnership with incinerator operators Onyx SELCHP and Grundon, environmental consultants Enviros, Hampshire County Council, and industrial symbiosis companies Akristos and Ballast Phoenix.

Key benefits

• Reducing hazardous waste in the UK – APC residue currently totals 128,000 tonnes annually, with an expected increase of 40,000 tonnes per year over the next four to seven years.

• The creation of a proven, commercially viable waste management technology that allows treatment close to source with minimal environmental impact

• The development of an integrated process that transforms APC residues into a useful product, with the potential of saving 170,000 tonnes of virgin raw materials each year.



The current market value of APC residue landfill disposal is some £21 million-a-year, and with rising volumes and increasing levels of landfill tax this may reach £47 million-a-year within three to six years.

The team believes that a plasma-based technology addressing the environmental issues will take a significant percentage of this market, creating a major commercial opportunity alongside its environmental and social advantages. It also expects that applying plasma technology to APC management will significantly reduce reliance on landfill disposal and cut the use of raw materials in construction. In addition, the efficiency of the process minimises the scale of treatment plants, enabling economically viable local waste management.

Recycling carbon fibre

Researchers working on the HIRECAR (High Value Composite Materials from Recycled Carbon Fibre) collaborative R&D project are finding ways to recycle carbon fibre composite materials for use in car manufacture and other applications.

Current annual worldwide carbon fibre consumption is 30,000 tonnes. The principal markets are aircraft, racing cars and sporting goods. At present there is no way to recycle carbon fibre materials – more than 100 tonnes of highly valuable material, either end-of-life goods or scrap from manufacture, goes into landfill every year in the UK alone. These materials can cost as much as £120 a kilo. The high stiffness and strength and low density of carbon fibre composites could be used in new designs to reduce the weight and increase the safety of family cars, resulting in significant reductions in emissions and fuel consumption.

A research project funded by the Technology Strategy Board is working on ways to extract the high value carbon fibre from end-of-life components and from manufacturing scrap, typically offcuts of woven 'prepreg' – materials impregnated with epoxy resin which are typically used in military aircraft and racing cars.

The University of Nottingham is the lead partner in the project, which also involves: Advanced Composites Group, Dow Automotive, Ford Motor Company, Technical Fibre Products and Toho Tenax GmbH. The project started in March 2005 and runs for three years.

Key benefits

- reducing the environmental impact
- new ways to restrict noise and fuel emissions
- finding sustainable solutions to problems that affect all major uses of carbon fibre

Objectives

The aim of the project is to find ways to recycle scrap carbon fibre materials and convert them into useful materials. This will provide a sustainable lifecycle for carbon fibre for use in automotive applications and enable a step-change in design and performance of vehicle structures. It will help automotive manufacturers meet EU end-of-life directives for the next generation of vehicles. These state that 80% of the materials used in a new car have to be genuinely recyclable. At present, this limits the amount of carbon fibre that can be used in vehicles – because there is no viable way to reuse it.

Use of carbon fibre in cars will reduce the weight of vehicles, and so lower fuel consumption. It will also increase car safety, because the carbon fibre materials are extremely strong and can absorb much higher levels of impact energy.

Solutions

The team has developed two methods for recovering the carbon fibre materials: The preferred route for end-of-life components is a fluidised bed technology where the fibres and resin are separated at high temperatures, energy is extracted from the polymer and the fibres are left in a clean condition, but with slightly reduced properties. The use of supercritical fluids on scrap new materials has been studied for the first time.

The project is looking at three ways of using the recycled carbon fibres: in bulk moulding compounds for smaller, non load-bearing components; as a sheet-moulding compound, where carbon fibre is rolled together with sheets of polymer; and as recycled materials in load bearing, 3D shell structures, such as the floorpan of the vehicle.

Results

Recycled carbon fibres have been made into bulk and sheet moulding compound forms and have been successfully moulded into laboratory-scale samples. The team intends to characterise the issues around supercritical fluid type, temperature, pressure, and yield for the typical epoxy-based resins used in composite material manufacturing processes.

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