

ENVIRONMENTAL INNOVATIONS ADVISORY GROUP

EIAG PAPER

Prioritising Environmental Technologies

Prepared for EIAG
by
Roy Williamson
TechEnergy Ltd

December 2005

This document was published to stimulate discussion and debate following a consultation and technology-prioritisation exercise carried out by the joint DTI/Defra Environmental Industries Unit for the Environmental innovations Advisory Group.



Synopsis

Five technology areas were identified as priorities for focus and consideration, each containing 3-6 specific technologies:

- Data Capture and Management
- Separation and recovery from solid waste streams
- Sustainability: Energy from Waste and biogenous sources
- Pollutant Removal
- Sustainability: Resources

Priority technologies have been identified to have:

- significant market potential
- appropriate scope for technological improvement
- be at a stage of development where Government intervention can be a prime requirement for commercial development and success.

The UK has competitive strength in measuring, monitoring and controlling environmentally relevant parameters and processes and the removal of pollutants.

The UK has fundamental weakness in how to re-claim, recycling or re-use resource material, including for energy production. In recycling resources there is weakness is designing for this purpose, and for incorporation of reclaimed resource into new products or re-use.

It is recommended that a strategic focus be placed on the re-claiming, recycling, re-using competitiveness of the UK, and the underpinning design infrastructure, plus review of how to best support the UKs competitive capability in measuring, monitoring and controlling environmentally relevant parameters and process and removal of pollutants.

Background

In today's world we need to make our support for innovation more effective. This means setting priorities and working closely with industries to see which technologies are most likely to lead to competitive advantage. To assist in focusing and aligning UK Government efforts with those required by industry, the joint DTI/Defra Environmental Industries Unit (EIU) carried out a technology prioritisation exercise based on open consultation with UK stakeholders in the environmental industries sector.

Responses received represented a broad range of environmental interest and stakeholder-types including RDAs, large businesses, SMEs, academics, Faraday Partnerships and trade associations, who provided assessments of technology areas that they are familiar with plus any areas that they thought should be included.

To extract priorities for Government consideration, a scoring system was applied to each technology accounting for assessments received with bias towards ideal situations for Government involvement.






Status of Technology and UK competitiveness

The table on the following page summarises assessments made during the consultation for technologies identified as priorities for Government attention.

Legend

Colour coding indicates status appropriate to Government objectives for support, highlighting area where action may be required with urgency, explained through the following ideal conditions:

- Large scope for supporting innovative technology development grow UK supplier competitiveness
- Large market potential and associated revenues
- UK supplier base competing or leading
- Technologies at industrial development stage where Government support is appropriate with respect to innovation cycle funding, and may have greatest impact.

	Technology Improvement	Market Potential	UK competitive capability	Stage of development.
	Large scope for technology Innovation	Large (Global)	Competitive or Leading (major)	Industrial Development
	Innovation/ Incremental	Large/ Medium	Competitive or Leading (minor)	Industrial Development/ Research or Scale-Up
	Incremental	Medium	Competitive / Lagging	Research or Scale-Up
	Incremental/ Mature	Medium/ Niche	Lagging (minor)	Scale-Up /Evaluation
	Mature	Niche	Lagging (major)	Evaluation

For Government perspective, with the above conditions in mind, the legend may be interpreted simply as:

 green/left: good through to  red/right: poor.

Status of Technologies as appropriate to Government support.		Technology Improvement	Market Potential	UK competitive capability	Stage of development.
Data Capture and Management	Remote monitoring systems (measurement/ metering).				
	Sensors/ Sensor and control systems				
	Real time monitoring/warning systems				
	Intelligent diagnostic and prognostics including data-mining, simulation and modelling.				
Separation and recovery from solid waste streams	Process techniques for recovered materials				
	Solid waste separation techniques and systems.				
	Waste logistics including collection for recycling.				
	Product adoption to incorporate recycled materials.				
	Special/hazardous waste separation.				
	Design for recycling.				
	Handling/ management of hazardous waste.				
Sustainability: Energy from Waste and biogenous sources	Adaptation/ development of existing technologies: alternative fuels.				
	Biochemical/ bio catalytic processes e.g. anaerobic digestion.				
	Integrated bio-refinery applications.				
	Thermo chemical/ thermolytic processes e.g. gasification, pyrolysis.				
Pollutant Removal	Advanced water treatment technology				
	Effluent treatment methods				
	Biological treatment systems				
	Wastewater reuse.				
Sustainability: Resources	Modelling of conventional-sustainable mixed processes				
	Design/development of sustainable products / processes				
	Water efficient processes.				

green/left: good through to red/right: poor.

Data Capture and Management

Better management of resources can create significant benefits to customers and businesses alike. Underpinning such capability are a raft of technologies and capabilities including: improved or novel sensor technologies; more accurate or quicker information from remote, harsh or inaccessible locations; Monitoring and control systems including real-time information communication and modelling and analysis to diagnose and predict.

There is a significant scope for technology development in this area for environmental application and a large market which is likely to grow. The UK is regarded as having a competitive capability in this area and technologies are at an appropriate stage of development to warrant Government review and potential support.

Separation and recovery from solid waste streams

New directives such as Waste Electrical and Electronic Equipment (WEEE), Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) and end of life product legislation are forcing for better management of solid and hazardous materials from collection through to separation and recycling into new products or remanufacture.

Market potential is significant in this area as more Governments worldwide recognise the requirement to reduce waste production and extract hazardous materials from waste streams. Technology is moving towards scale-up / evaluation in some areas, however there remains scope for improvement.

There does not appear to be a strong UK presence in any technology within this area, with two technology areas identified where the UK is significantly lagging in terms of competitiveness being:

- Product adoption to incorporate recycled materials.
- Design for recycling.

Both the above areas may have an important role to play in the sustainable production and consumption agenda. It may be useful to review this area with focus on the above two, to identify whether to pursue the development of UK capability or concede to overseas technology suppliers.

Sustainability: Energy from Waste and biogenous sources

The Government is committed to reducing greenhouse gas emissions. A key element of its strategy is the promotion and development of large and small scale power generation from renewables as well as the development of combined heat and power (CHP). The UK's commitment is given effect through a number of different initiatives including the Renewables Obligation and exemption from the Climate Change Levy for supplies from renewable and Good Quality CHP generation. Renewable generators are also entitled to certificates that identify the electricity they generate as having been generated from renewable sources REGOs.

Energy from bio and waste streams can meet both of the objectives, and the UK well placed to provide this technology capability to a global market. Technologies are at appropriate stages of development for Government review, however the window of opportunity to assist in this area may be small since the UK is identified to be lagging competitively. Identified areas for particular consideration are:

- Adaptation/ development of existing technologies: alternative fuels
- Integrated bio-refinery applications.

The above areas may have an important role to play in achieving UK Government objectives for sustainable power generation, including UK commitment to the Kyoto protocol: a 12.5% reduction in CO₂ emissions is required in the time frame 2008-2012.

It may be useful to review this area with focus on the above two, to identify whether to pursue the development of UK capability or concede to overseas technology suppliers.

Pollutant Removal

The UK is well placed both in terms of competitiveness and stage of technology development to supply a large market potential. Pollutant removal can enable re-use of resources or reduced overheads for treatment.

It may be useful to consider how best to maintain this position in most of the identified technology areas, as well as consider how to address and apparent weakness in water re-use capability, in contrast to the evident strength in water efficient technologies.

Sustainability: Resources

In the areas identified there is large market potential and large technology development potential. The UK has technologies in a state of industrial development however it the UK is not yet competitive, except in water efficient technologies where the UK is well positioned. There is a noticeable weakness around design aspects for sustainability, specifically for recyclability, sustainable products and processes and the integration of sustainable processes into conventional systems.

As well as supporting and nurturing the UK's strong position in water efficient technologies, a review of the UK's design capability, as appropriate to meet UK objectives may be considered.

Annex 1 Consultation details

Following are details of the open consultation to prioritise technologies of the environmental industries sector. The consultation was prepared in conjunction with the Environmental Industries Advisory Group (EIAG). Respondents were asked to provide information based on their experience and knowledge of on the following:

- Scope for technological improvement;
- Market potential;
- The UK's competitive capability;
- Stage of development of a range.

Respondents were also given the opportunity to submit their own priorities and assess these in the same manor as technologies originally listed. The consultation requested respondents to assess the following technologies and make indication for each based on the defined criteria:

Scope for technological improvement	High	There are significant developments that can be made to improve existing technology or provide a step change in solutions.
	Medium	The technology is becoming established with scope for incremental improvement.
	Low	The technology is mature.
Market potential	High	The existing or anticipated global market is large.
	Medium	The market is limited but of significant size.
	Low	The global market for the technology is small.
The UK's competitive capability	Leading	UK technology is preferentially chosen in overseas markets.
	Competitive	UK technology competes in overseas and UK markets on an equal basis.
	Lagging	Overseas technology is preferentially chosen in the UK market.
Stage of development	Research	The technology is still at the proof of concept or fundamental research level.
	Industrial Development	The technology is being applied or evaluated by industry.
	Scale-up	The technology is proven for industrial purposes and is being developed for commercial deployment.
	Evaluative demonstration	The technology is at the proof of pre-commercial product stage.

Responses to the consultation were received from the following organisations, showing a good range of organisation types and geographic locations.

Organisation	Postcode	Type of Organisation
Manchester Metropolitan Uni. / Advanced Bioprocess Development Limited	M1 5GD	Academic / SME
University of Cambridge	CB2 3EQ	Academic Institute
Centre for Ecology and Hydrology Wallingford	OX10 6HU	Academic Institute
Coventry University	CV1 5FB	Academic Institute
Cranfield University	MK43 0AL	Academic Institute
Plymouth Marine Laboratory	PL1 3DH	Academic Institute
UCL	WC1H6BT	Academic Institute
University of Exeter	EX4 4QF	Academic Institute
FIRSTFARADAY	OX2 6PN	Faraday Partnership
TerraDat UK Limited	CF10 5FR	Geophysical Survey Company
Bendalls Engineering	CA2 OEH	Large Corporate
City Technology Limited	PO6 1SZ	Large Corporate
Merseyside Waste Disposal Authority	L2 5QY	Local Government
Chris Hadley Consulting	BL8 1XH	Marketing Consultancy
ATKINS Environment	KT18 5BW	Multi-national -UK owned
Golder Associates UK	NG12 5BL	Multi-national employee-owned consultancy. UK company is SME.
Cleanaway Limited	CM13 3BE	Multi-national non-UK owned
Organodiesel Ltd	WA4 1PK	not-for-profit company
THinc	DG11 1RB	Packaging/Environment - Recycling
CIWM	NN1 1SX	Professional Institution
Advantage West Midlands	B7 4BN	Regional Development Agency
Fuel Cell Application Facility	TS10 4RF	Regional Development Agency owned Company
Contaminated Land: Applications In Real Environments (CL:AIRE)	SW1H 9BP	RTO
C-Tech Innovation Limited	CH1 6EH	RTO
DARP Environmental Ltd	EX4 4RN	RTO
Advanced Oxidation Ltd	TR10 9EP	SME
Alphasense Ltd.	CM 6 1XN	SME
Edward Stenhouse Limited	TN7 4ES	SME
EECO Ltd	CM6 2JG	SME
Environmental Treatment Concepts Ltd	PO17 5LJ	SME
Ferrodax Ltd	CH43 9TT	SME
Hazrem Environmental Ltd	CF81 9FW	SME
Land Instruments	S18 1DJ	SME
Norfolk Environmental Waste Services Ltd.	NR10 3HH	SME
Oaktech Environmental	M4 6JW	SME
HPA	RG10 9TH	Trade Association

Annex 2 Scoring and Weighting

Responses to each of the technology areas were allocated a score according to the criteria, as detailed in the following table:

Scope for technological improvement	High	5
	Medium	3
	Low	1
Market potential	High	5
	Medium	3
	Low	1
The UK's competitive capability	Lagging	3
	Competitive	2
	Leading	1
Stage of development	Industrial Development	4
	Scale-up	3
	Evaluative demonstration	2
	Research	1

Additionally, to identify clear priorities from the 66 individual technology areas in the consultation, including those suggested by respondents, a weighting was applied to the approve criteria based on strategic importance. The weighting devised and applied followed the cubic distribution shown in Figure 1.

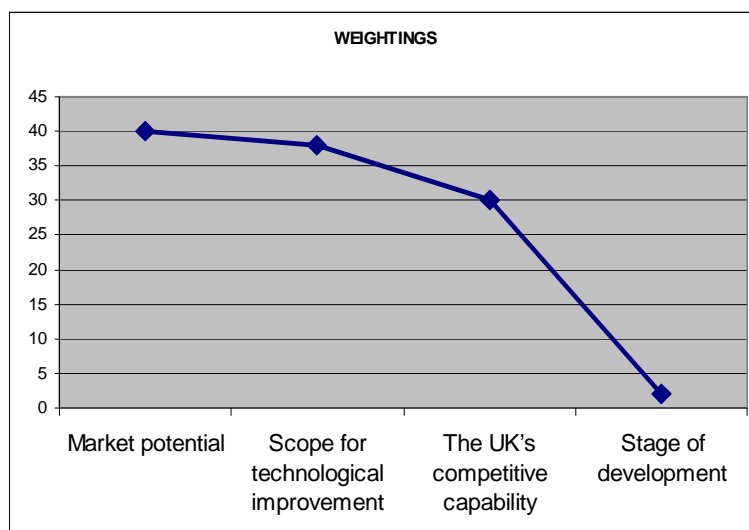


Figure 1 Weightings distribution

Annex 3 Scoring Distribution

The table below list scores for each technology. Scores are illustrated comparatively in the figure following the chart.

AREA	TECH	SCORE
Data Capture and Management	Remote monitoring systems (measurement/ metering).	7274
	Sensors/ Sensor and control systems (harsh environments/ new chemical sensors, biosensors, ground probing radar, etc.).	5652
	Real time monitoring/warning systems (leakages, building control).	5416
	Intelligent diagnostic and prognostics including data-mining, simulation and modelling.	5156
	Telemetry/positioning systems (GPRS/ local).	3570
	Sensor networks.	3288
	Radio tagging (RFID) for location or identity.	2986
	Space syntax analysis of urban and building form	428
	Risk management modelling	344
Separation and recovery from solid waste streams	Process techniques for recovered materials (e.g. upgrading/ conversion methods).	5724
	Solid waste separation techniques and systems.	5080
	Waste logistics including collection for recycling.	4968
	Product adoption to incorporate recycled materials.	4960
	Special/hazardous waste separation.	4642
	Design for recycling.	4578
	Handling/ management of hazardous waste.	4002
	Breaking techniques and systems.	3380
	Remanufacturing.	2464
	Oil/solvent/chemical recovery.	2440
	Utilisation of hazardous materials.	2270
	Reliable in situ measurement	482
	Utilisation of high-volume mineral wastes.	482
	Reliable on-site in situ screening tools	452
	Reliable on-site ex situ screening tools	452
	Predictive extrapolation of discrete measurements	452
	Environmental Forensics tools	452
	Improved separation using Tangential Flow Separation and electronic conditioning0	428
	Standardised data representation and exchange using ISO 10303, 13584, 159260	424
	Reduction in polymer use with increased separation efficiency using electronic conditioning0	422
Non-invasive site investigation toolbox	332	
Sustainability: Resources	Modelling of conventional-sustainable mixed processes (including performance and life cycle analysis).	4448
	Design/development of sustainable products (e.g. bio packaging)/ processes (e.g. bio catalysis and bio transformations).	4348
	Water efficient processes.	3862
	Integration of sustainable processes into plant.	3598

	Biogenous resource material production and collection.	2390	
	Alternative, non-toxic chemicals, e.g. for pesticides, herbicides, solvents, polymers and lubricants.	2216	
	Toxicity evaluation.	1744	
	Alternative uses for waste materials e.g. the process we have is utilising waste materials and turning them into cement substitutes.	428	
	Non Chemical removal of hard water minerals to improve energy efficiency, save water, including recycling (particularly cooling systems); reduce maintenance breakdowns and replacement costs.	422	
Sustainability: Energy from Waste and biogenous sources	Adaptation/ development of existing technologies and systems for operation using alternative fuels.	5926	
	Biochemical/ bio catalytic processes e.g. anaerobic digestion.	4926	
	Integrated bio-refinery applications.	4372	
	Thermo chemical/ thermolytic processes e.g. gasification, pyrolysis.	4308	
	Alternative fuel combustion processes	3490	
	Biogenous resource production, collection and processing.	3230	
	Landfill and coal mine gas collection.	2558	
	Fuel stream analysis, characterisation and standards.	1752	
	Fuel cells - Direct alcohol oxidation from Biomass sources	452	
	bio diesel manufacture	408	
	Pollutant Removal	Advanced water treatment technology (including physico-chemical, biological, UV).	5904
Effluent treatment methods		4606	
Biological treatment systems including bioremediation, enzymes, biosparging).		4574	
Wastewater reuse.		4208	
Pollutant detection.		3688	
Chemical/ pollutant/ water separation technologies.		3374	
Air borne pollutant control and removal.		2814	
Odour Control.		2372	
Filtration Media.		1382	
Technology selection and design rules (inc. environmental footprint assessment)		726	
Reliable application of ex situ land remediation techniques		488	
Reliable application of in situ land remediation techniques		488	
Passive below ground water treatment systems		458	
Water Softening and removal of undesirable ion and material using Tangential Flow Separation and electronic fluid conditioning		424	
Atmospheric CO2 Removal & Storage		422	
Reliable exploitation of monitored natural attenuation (MNA) processes		372	
Solutions for difficult contaminant and/or difficult environments		372	
Containment systems		348	

