

BIS | Department for Business
Innovation & Skills

**POTENTIAL FOR RESOURCE EFFICIENCY
SAVINGS FOR BUSINESSES**

Urban Mines were commissioned by BIS to undertake the research for this report. Urban Mines were supported by Enworks and Resource Recovery Forum

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Executive Summary

Urban Mines were commissioned by BIS to write this report to provide information on the potential monetary savings that could be made from improved business performance by better management of commercial and industrial (C&I) waste streams. This was done through identifying the potential for resource efficiency savings from improved waste management – concentrating on energy, waste and water savings, greenhouse gas savings and using waste materials as secondary materials for re-use and substitution. The purpose of the research was to provide information and recommendations through the compilation of case studies that can be used by BIS to support businesses in similar sectors.

The work was carried out over a short period from February to March 2009 by Urban Mines, supported by ENWORKS and the Resource Recovery Forum. Any references to “we” in this report should be taken as referring to Urban Mines.

Potential opportunities and savings have been classified by sector to allow future use by specific trade associations and individual companies.

ENWORKS “Toolkit”

The ENWORKS toolkit was set up in 2004 to record resource efficiency related work carried out by 5 sub-regional partnerships of local organisations in the North West region. The toolkit records verified material gathered over a 5 year period and provides a unique record on resource efficiency achievements within a range of business sectors. The data from the ENWORKS toolkit is reviewed to analyse annual cost savings and, by sector, per employee, via turnover. The environmental benefits realised as a result of implementing resource efficiency opportunities are also illustrated for both achieved and pipeline savings. It is important to note that the results of the analysis are based on only the number of businesses that entered information and data onto the toolkit and not all the businesses in the North West region. The results are therefore only estimates and should be interpreted in that context.

All indications show that savings from resource efficiency can be achieved across the sectors regardless of where the business is located, and thus the results from the North West region can reflect potential savings across the whole of the UK.

Case Studies

To obtain information to compile individual case studies, invitations to participate were issued by email via stakeholder networks such as the Resource Recovery Forum, Remade Network UK, and Urban Mines’ stakeholder network. These were followed up by telephone approaches both to individual companies and business support agencies. This was supplemented by internet research, particularly looking at resource efficiency awards. The resulting case studies featured in the report seek to provide examples from across the whole of the United Kingdom and illustrate the work of a range of existing business support bodies, programmes and initiatives. The case studies are produced in another BIS publication called, “Practical Resource Efficiency Savings – Case Studies” URN10/782. <http://www.bis.gov.uk/assets/biscore/business-sectors/docs/10-782-practical-resource-efficiency-case-studies.pdf>

Results and Conclusions

Analysis from the ENWORKS toolkit data provides the following results:

Executive Summary (continued)

Achieved cost savings from resource reduction

The Environmental technologies sector achieved the highest cost savings. The sectors with the lowest cost savings, i.e. the Energy, Power and Utilities and Automotive sectors, have the highest capital investment.

Achieved cost savings as a result of material substitution

Cost savings are achieved in the Construction, Chemicals and Food and Drink sectors. This could be attributed to increased use of recycled materials, substituting raw and other materials such as packaging and fuels.

Achieved cost savings from diverting waste from landfill

The Environmental Technologies sector registers the highest annual cost savings. The Energy, Power and Utilities sector registers the lowest cost savings with no capital investment. The Construction sector invests the most in diverting waste from landfill compared to other sectors.

Achieved environmental benefits as a result of resource reduction:

Energy:

The highest annual carbon dioxide (CO₂) savings are achieved by the Energy, Power and Utilities sector. The Environmental Technologies sector achieves the lowest annual CO₂ savings. The Textiles and Chemicals sectors have the highest unit savings, with the lowest in the Environmental Technologies sector.

Water:

The highest annual water savings are seen in water intensive sectors, with the highest in the Aerospace sector, followed by Textiles, Food and Drink and Chemicals sector. The Environmental Technologies sector achieves the lowest unit savings.

Materials:

The highest annual material savings are achieved by the Food and Drink sector, followed by the Textiles and the Construction sector. The lowest savings are achieved by the Aerospace and Automotive sectors.

Pipeline Cost savings and Environmental benefits as a result of resource reduction:

Energy:

The Energy, Power and Utilities sector has the highest potential annual CO₂ savings, with lowest in the Environmental Technologies sector. With regards to potential unit savings, the Energy, Power and Utilities and Food and Drink sectors have the highest annual unit savings. The lowest unit savings are again seen in the Environmental Technologies sector.

Water:

The Aerospace sector has the highest potential unit savings of water, with the lowest savings in the Energy, Power and Utilities.

Materials:

The Construction sector has the highest potential unit savings, with the Environmental Technologies sector having the lowest potential unit savings.

Executive Summary (continued)

Achieved environmental benefits from material substitution

Energy:

The Chemicals sector is the only sector that registers significant CO₂ and unit savings in energy use.

Materials:

The Construction and Food and Drink sectors achieved material unit savings, although the savings for the Food and Drink sector are very low. No data was recorded for water use for other sectors hence these are not presented in the analysis.

Pipeline environmental benefits from material substitution

Potential savings from material substitution are recorded for only energy use and material use, with the majority of the sectors recording savings from material substitution in energy use. In terms of energy, the highest potential CO₂ and unit savings are seen in the Food and Drink sector. Although potential unit savings for materials use are relatively low for all the sectors recorded on the toolkit, the Construction sector has significantly high unit savings in comparison with the other sectors.

Achieved environmental benefits from diverting waste from landfill

The savings are seen for only materials, with the highest savings achieved by the Environmental Technologies sector, followed by the Construction sector. This could be attributed to the new technologies that have been developed over time to recycle waste, recover energy from waste and re-use of waste in processing and construction, reducing the amount of waste that is sent to landfill. The lowest savings are achieved by the Energy, Power and Utilities and Chemicals sectors.

Pipeline environmental benefits from diverting waste from landfill

The Energy, Power and Utilities sector has the highest potential savings, followed by the Construction sector and Environmental Technologies sector. The lowest potential savings are seen in the Automotive sector.

Case Study Results

Many organisations were contacted to compile information to create illustrative case studies. Some of the case studies are newly compiled to illustrate interesting wins from resource efficiency whilst some of the case studies are based on previous information produced by individual support bodies (these have been updated where possible and reformatted to provide a consistent two page style case study).

18 case studies have been produced and are detailed in another BIS publication called, "Practical Resource Efficiency Savings – Case Studies" URN10/782.

<http://www.bis.gov.uk/assets/biscore/business-sectors/docs/10-782-practical-resource-efficiency-case-studies.pdf>

To conclude, analysis of the case studies has been performed to identify some of the lessons learnt and achievements through resource efficiency that could be applicable to other businesses in these sectors. These are displayed below by sector:

Executive Summary (continued)

Construction

Easy Win:

Source construction materials locally wherever possible.

General:

Re-use and Recycle Materials and Equipment – with careful planning rates as high as 95% can be achieved.

Waste:

Measuring waste generated accurately through construction projects helps subsequent management.

Food, Drink and Tobacco

Easy Win:

Undertaking a simple environmental audit can help identify opportunities for improving resource efficiency.

Water:

In food production, investing in an up-to-date water treatment process will not only reduce discharge to the mains sewer with financial savings but can also assist in re-thinking how water is used within production, water re-used across the process and consequent savings for less frequent descaling of machinery leading to less use of caustic detergent.

Waste:

Simple plant modifications can prevent spillage of food in production reducing waste. Reviewing transit packaging (maybe with thinner cardboard) can have knock on benefits from allowing higher weights to be carried per pallet thus reducing handling, fuel and time costs.

Textiles

Easy Win:

Simple Energy efficiency measures such as time settings for night storage heating, encouraging staff to turn off warehouse lighting or, better still, installing sensors can help reduce energy consumption.

Waste:

Waste textile fibres can be recycled and turned into carpet underlay. Lean manufacturing application – to achieve more with less – can help reduce waste significantly – especially if applied not only to the production process, but to supply chain, new product development – in short every area of the business!

Power and Utilities:

There is great potential to use combined heat and power generation systems within the power and utilities sector itself.

Using biogas, water utility companies can generate high value electricity from waste and then utilise the heat generated as a by product around their own site operations.

Executive Summary (continued)

Chemicals/non-metallic minerals manufacturing

Easy Wins:

Separating hazardous and non-hazardous wastes is increasingly important (driven by legislation) and by stopping cross contamination, financial savings can be realised. Ultimately, improved controls can lessen subsequent waste management treatment requirements.

Simple training of staff and outlining of best practice through the use of tool-box talks can assist in achieving significant savings and in staff engagement.

Waste:

Opportunities exist from improved solvent management, segregating solvent types used/generated may allow waste solvents to be re-used or sold as recovered solvent streams.

Energy:

Re-using waste heat from internal flues can be used to pre-heat internal boilers with consequent financial and CO₂ savings.

Metal Manufacturing

Easy Wins:

Always review compressed air systems to identify leaks – there is a simple piece of kit that can easily measure and identify leaks.

Upgrade to lighting systems with more efficient; fittings, bulbs and light sensors and to make full use of skylights and natural daylight. Reviewing leaking pipes and faulty ball valves can save significant money.

Energy:

For lighting consider PIR (passive infrared sensors) sensors to de-activate lighting when not required. In open warehouse settings fit new heating units with shut offs so they are de-activated when doors and shutters are open.

Waste:

Undertaking a detailed waste audit can pay dividends. Simple measures such as greater care in handling raw materials can reduce spillage and cross contamination, leading to cost savings of raw material and waste management costs.

Water:

Use of percussion taps throughout a site and introduction of passive infrared detectors in the toilets can result in significant water savings.

Executive Summary (continued)

Machinery and Equipment (other Manufacturing)

Easy Wins:

Re-using pallets rather than straight recycling can achieve financial savings on site.

Critically reviewing cleaning processes can save money; changing from single-use tissues (for machinery wipe down) to washable cotton wipes reduced costs from disposal to easily cover increased costs of the wipes and resulted in cost savings (the previous single use tissues were producing hazardous waste).

Waste:

By analysing additives to condenser units, and by changing the raw material specification, a company was able to convert its waste generated in the process manufacturing from hazardous to non-hazardous, significantly reducing costs of waste management.

Water:

Installing underground tanks for collection and treatment of rainwater from the roof of plant may allow re-use in the production process helping to conserve water and reduce costs. This could be in the form of settling tanks and reed bed filters so that water is a higher standard of cleanliness for multiple re-use applications.

Retail

Easy Wins:

Installing flush devices within customer and staff toilets saves water and money.

Charging up fork lift trucks at night using timers can save money through lower night time energy tariffs. Ensure battery charge up does not take place until 80% depleted.

Materials:

Fitting remould tyres to a large retail fleet ensured good environmental payback with reduced CO₂ emissions, oil and rubber resource savings.

Water:

Replacing turn taps on sinks with push taps down and/or aerator spray taps again produces savings. Improving the management of site drainage can divert run-off away from the sewer system (if meets specifications) and save costs in sewerage treatment.

Energy:

Fitting vending machines and water coolers with timer switches to ensure they are switched off when not in use (overnight, bank holidays, etc) can save energy and costs. Reducing temperature in the office by at least 1 or 2°C can save electricity and money.

Waste:

For a shopping centre: providing communal waste management facilities can make recycling economically viable and practical to implement.

Executive Summary (continued)

Other Services

Easy Wins:

Do not heat spaces, such as warehouse areas, if not required (for example in summer months).

To reduce a water-meter fixed charge, a 50mm water meter was replaced by a 40mm meter.

Energy:

Establishing an energy management team to implement opportunities in priority areas identified through energy benchmarking.

Fitting dual-flush mechanisms in all toilets and reducing the building's water pressure can lead to savings and reduced water consumption.

Waste:

Implement a waste segregation scheme to include: paper, glass, batteries, aluminium, plastic cups, furniture and toner.

1 Introduction

Urban Mines was commissioned by BIS in February 2009 to provide information on the potential for improved business performance by paying better attention to minimisation and management of commercial and industrial (C&I) waste streams. The purpose of the research was an assessment that could provide information and recommendations through compilation of case studies that can be used by BIS to identify the most effective ways to support businesses to improve waste management practices.

BIS recognises that the UK is undergoing a transformation in the way waste is managed, shifting from an historical reliance on landfill to a new approach where waste is increasingly viewed as a valuable resource of secondary raw materials and energy. There are many reasons for this but a particular driver is EU legislation to curb landfill of biodegradable waste and landfill tax price rises. This is reflected in the Waste Strategy for England 2007 as is the desire to also increase the percentage of C&I waste that is diverted from landfill.

The UK has an improving record in recycling municipal waste with recycling rates increasing from 7% to over 30% in less than a decade. However, municipal waste forms less than 10% of the waste generated with the majority of the waste arising from construction & demolition and C&I sources. Indeed the report for the North West Environment Agency by Urban Mines (C&I waste data analysis for the NW region, December 2008) showed the potential for recycling and recovery of waste currently going to landfill as being highest within the commercial sector (including retail and wholesales and other services).

There is a need to join up the potential opportunities from waste arisings in the C&I sector (for recycling, re-use, recovery) and to minimise the prevention of waste in the first instance and highlight the numerous businesses large and small that are already changing their waste management practices and benefiting by doing so. There are also many specialist business support organisations already helping businesses with undertaking these changes and this report highlights examples of their achievements through working in partnership with business.

1.1 Key Objectives

There are 3 key objectives that this study seeks to address:

- Identify the potential for resource efficiency savings in the commercial and industrial business sectors arising from improved waste management, in particular identifying "quick-wins".
- The potential for improvement should be quantified in terms of energy and raw material costs, greenhouse gas savings and likely pay-back time. This is to include waste materials being used as a secondary raw material (i.e. substitution of materials, replacing virgin raw materials and waste as a fuel in an energy-from-waste plant).
- Compilation of a set of case studies suitable for publication which clearly demonstrate where particular companies have improved performance by paying more attention to waste management practices.

1 Introduction (continued)

1.2 Scope and Timetable

The project has a short timetable with completion required by the end of March 2009. It was therefore agreed that case studies should be compiled from benefits that have accrued from businesses since 2006 and using information that may already be in existence, "re-packaging" the material into consistent easy to read format for the case studies. Where possible, individual companies have been contacted directly and interviewed to compile new case study information. However, all information has been verified (as far as practicable) to evaluate the resource efficiency and financial benefits illustrated. Indeed the verification process did lead to some case studies being rejected. It was also agreed that the case studies should exhibit benefits from various sized businesses (SMEs and larger) from England, but also including examples as far as practicable from Scotland, Wales and Northern Ireland.

The research will continue to support government policy over resource efficiency and management, and assist in the drive towards a low carbon economy as detailed in the Low Carbon Industrial Strategy.

<http://www.bis.gov.uk/files/file52002.pdf>

1.3 Project Delivery Team

The approach to this project delivery is through a consortium led by Urban Mines (a not-for-profit limited company and registered charity) which specialises in achieving sustainable waste management solutions, with Groundwork UK, the body accountable for the ENWORKS programme, and the Resource Recovery Forum. The roles of the delivery team are shown in Table 1 below:

Table A1 Delivery Bodies

Delivery body	Role within the Project
Urban Mines	Project management, co-ordination and liaison with BIS Independent analysis & interpretation of ENWORKS data to identify trends within sectors re Resource Efficiency and cost Identification and verification of case studies Report
Resource Recovery Forum	Identifying case study material, engaging with stakeholders in the Resource Efficiency arena Report
ENWORKS	Access to ENWORKS toolkit and data access support and guidance Report

2 Sector Focus

In 2007 work was carried out to identify the potential energy, waste and water savings made through adopting resource efficiency and waste minimisation in the commercial and industrial business sectors (Quantification of the business benefits of Resource Efficiency, Oct 2007, a report for DEFRA by OakDene Hollins and Grant Thornton). Table A2 overleaf shows the potential savings for each sector as calculated in their work.

From a recent study by Urban Mines for the Environment Agency (C&I waste data analysis for the NW region, December 2008) it was found that the greatest potential for diversion of C&I waste arisings for recycling and recovery lies within the commercial sectors at 80% potential (some of this potential is easy wins such as paper and card for example). 2.5 million tonnes of waste per annum are available either for recycling or recovery. The survey of Commercial and Industrial Waste for the North West was based on data gathered during a major commercial & industrial waste survey conducted in the North West during 2006-07. This survey, undertaken by Urban Mines, involved visits to 981 commercial and industrial premises selected at random where all waste arisings were recorded. This information was banded by SIC code (Standard Industrial Classification) and number of employees, before being extrapolated to produce figures for the whole region. In addition PPC (Pollution, Prevention and Control) data was also added to take the sample to over 1,000 companies. This data was then extrapolated for the whole of the UK on behalf of the East of England Regional Assembly (for all the RTABs (Regional Technical Advisory Bodies) in England) and will shortly be published ("National Study into C&I waste arisings", ADAS). This demonstrates nicely the acceptance that waste arisings are consistent across sectors from one region to another.

The C&I waste data analysis for the NW region, Environment Agency, December 2008 report, also noted that recycling is well underway in the industrial sectors, illustrating the potential to highlight case studies and easy wins for the benefit of those companies not currently undertaking resource efficiency and good waste management practice.

2 Sector Focus (continued)

Table A2: A summary of the significant energy, water and waste savings opportunities by subsector

Activity	Energy			Waste			Water		
	Estimated Savings Opportunity (£M)	% of overall energy savings	Activity	Estimated Savings Opportunity (£M)	% of overall waste savings	Activity	Estimated Savings Opportunity (£M)	% of overall water savings	
Transport (road freight)	2,017	60.3	Food & Drink	858	32.3	Public administration	85.8	19.4	
Chemicals, rubber & plastics	189	5.7	Retail	489	18.3	Food & Drink	60	13.6	
Retail	141	4.2	Construction	239	9.0	Education	39.7	9.0	
Hotels & Catering	109	3.3	Chemicals, rubber & plastics	235	8.8	Chemicals, rubber & plastics	38.9	8.8	
Commercial offices	101	3.0	Travel agents	233	8.8	Agriculture	37.8	8.6	
Basic metals / mechanical engineering	83	2.5	Machinery, electrical & transport equipment	195	7.3	Health & social work	30.4	6.9	
Food & Drink	77	2.3	Hotels & Catering	70	2.6				
Warehouses	77	2.3							

Source: Quantification of the business benefits of Resource Efficiency, Oct 2007, a report for DEFRA by OakDene Hollins and Grant Thornton). Estimated Savings opportunity unit of measurement is £millions covering the whole of the United Kingdom.

2 Sector Focus (continued)

BIS concluded that it would be useful to undertake a sector specific analysis to both identify the potential opportunities and savings by sector and illustrate case studies by sector to assist in targeting specific trade associations and individual companies to aid dissemination and take up.

A simple sector matrix was therefore compiled using SIC codes to target examples for the case studies. This is shown in Table A3. Details about the 9 sectors and additional 3 sectors from the ENWORKS toolkit are contained in Appendix 2.

Table A3 Case Study Matrix based upon SIC (Standard Industrial Classification) codes

Sector	Energy / Water / Waste	GHG (Carbon Saving)	Financial Saving
Construction	√	√	√
Food, Drink & Tobacco	√	√	√
Textiles/wood/ paper/publishing	√	√	√
Power & Utilities	√	√	√
Chemical/non-metallic minerals manufacturing	√	√	√
Metal Manufacturing	√	√	√
Machinery & Equipment (other manufacturing)	√	√	√
Retail & Wholesale	√	√	√
Other Services	√	√	√
Additional Sectors reviewed through the ENWORKS toolkit			
Automotive			
Aerospace			
Environmental Technologies			

3 Methodology

3.1 The “ENWORKS Toolkit”

To identify resource efficiency achievements we chose to work with ENWORKS who are almost unique within the UK in collecting and holding comprehensive data on C&I waste management efficiencies within business through their grant aided programme.

We believe that the ENWORKS Toolkit provides one of the few sources of verified material gathered over a 5 year period across a range of sectors showing the savings possible through improved resource efficiency. We have thus drawn upon the toolkit data to perform a number of queries to extract data for analysis for this report.

Full details about the toolkit are contained in **Appendix 3**

All indications are that opportunities from resource efficiency can be consistently achieved across the sectors regardless of where the business is located. The Oakdene Hollins and Grant Thornton report for DEFRA (Quantification of the business benefits of resource efficiency, 2007) assumed that the savings per employee is uniform across regions and noted that they did not take into account any regional cost variations that might affect companies (for example of cost of water supply across different water companies). Within this report the North West sector achieved the second highest combined water, waste and energy savings behind the South East region but ahead of London, hence showing little variation relating to north and south.

Table A4 Cost savings resulting from resource efficiency actions measured on a regional basis, showing the North second highest behind the South East region.

Region	Role within the Project
South East	871
North	713
London	630
East	615
South West	582

Source: Defra, October 2007, Quantification of business benefits of resource efficiency.

3 Methodology (continued)

3.2 Data obtained through consultation

To obtain information to compile the individual case studies we have worked with the Resource Recovery Forum and through our own networks, such as the ReMaDe Network UK, to issue invitations via email, followed up by telephone, to take part in the project. We have invited both support bodies that are working with businesses to achieve resource efficiency and to target directly SMEs or larger businesses that wish to publicise their resource efficiency activities and benefits obtained through reviewing their internal response to resource management. Through these mediums the invitation to participate was sent out to over 1000 stakeholders in resource efficiency and businesses across the UK. The organisations/businesses that responded are shown in **Appendix 1**, together with the list of the final companies featured as case studies within the report.

The invitation for data to be gathered through the support bodies has also been supplemented by desk top internet research for potential case studies on materials such as analysing Resource Efficiency Awards (e.g., ENWORKS, Chemical Industry awards, NISP awards, EA Water awards, EDIE awards, UK CEED Energy Efficiency awards and the Rushlight awards).

Follow up has been carried out with the organisations that responded, or were approached directly, to review suitable case study materials. These have been based upon, where an existing case study exists, a resource efficiency success achieved since 2006 and where the learning could be replicated to similar businesses in that sector (or across other business sectors). In addition, case studies have been developed through interview with the company to explore the development of a new case study based upon recent success through resource efficiency implementation.

An effort has been made when selecting the case studies featured in this report to reflect the target sample matrix as illustrated in Table A3.

4 Analysing Resource Efficiency by Sector

4.1 Annual Cost Savings

These results have been obtained through analysis of the ENWORKS data (outlined in section 2.2.1 and Appendix 3) and although the data has been obtained from businesses based in the North West region we believe that this is representative of businesses in these sectors across the United Kingdom. The number of businesses that have inputted data onto the ENWORKS toolkit does vary across the different sectors and for some of the data queries were not completed for all businesses, however this does not affect the analysis as the review has been based upon savings per business and savings per opportunity.

In the Toolkit, the businesses declare themselves to belong to one of a defined set of Sectors/Clusters that are linked to those prioritised within English Regional Economic Strategies. The explanation about the sectors is further outlined in Appendix 2.

The number of businesses varies for each of the sectors due to the data or information entered by businesses on the toolkit, in particular if base line data is not held prior to support and resource efficiency changes then it is not possible to record the change and therefore may not allow annual savings to be determined.

It is important to note that the results of the analysis are based on only the number of businesses that entered information and data onto the toolkit and not all the businesses in the North West region. The results therefore should be interpreted in that context.

The following tables summarise the results of the analysis and show the achieved costs savings and achieved and pipeline resource efficiency as a result of resource reduction, material substitution and diversion of waste from landfill. The cost savings, unit savings and reduction in carbon dioxide (CO₂) emissions are shown on a per opportunity (each improvement action identified within a business, e.g. through an audit or site visit, is logged as an opportunity on the toolkit) and per business basis.

Table A5. Achieved annual cost savings as a result of resource reduction

Sector	Number of businesses	Number of SMEs	Annual savings per Opportunity (£)	Annual savings per business (£)	% Capital Investment of annual savings	Payback Period (Years)
Environmental Technologies	18	11	27,386	51,729	12.79	0.13
Food and Drink	112	67	18,886	37,941	83.01	0.83
Textiles	54	34	12,673	34,733	32.50	0.33
Construction	74	40	12,329	27,323	49.39	0.50
Chemicals	47	22	10,827	26,722	36.25	0.36
Aerospace	18	14	9,832	25,127	6.18	0.06
Automotive	66	41	8,767	18,464	141.23	1.41
Energy, Power and Utilities	14	8	6,610	21,245	345.36	3.45

4 Analysing Resource Efficiency by Sector (continued)

Table A5 illustrates the cost savings by sector as a result of resource reduction based upon actual data and shows the number of businesses on which this information is based as well as how many of these businesses are small and medium enterprises (SMEs).

Generally, sectors with the highest cost savings per opportunity have the highest cost savings per business as well. The environmental technologies sector has the highest annual cost savings per opportunity (£27,386) and per business (£51,729). The Energy, Power and Utilities sector has the lowest annual cost savings per opportunity at £6,610 while the Automotive sector has the lowest annual cost savings per business at £18,464. In addition, the Energy, Power and Utilities sector has the highest percentage of capital investment of its annual savings (345%), hence the longest payback period. In contrast the Aerospace sector has the lowest percentage of capital investment of its annual savings (6%) hence the shortest payback period. It is worth noting, however, that the Food and Drink sector, although with relatively high annual cost savings (£18,886 per opportunity and £37,941 per business), it has a relatively high percentage of capital investment of its annual savings (83%), hence a longer payback period compared with other sectors with relatively high savings, such as the Environmental Technologies sector. The Energy, Power and Utilities and Automotive sectors seem to invest highly (more than any other sector) in reduction of resources but have less cost savings. This could be because it takes longer to recoup the benefits of any investment in these sectors.

Table A6. Annual cost savings as a result of material substitution

Sector	Number of businesses	Number of SMEs	Annual savings per Opportunity (£)	Annual savings per business (£)	% Capital Investment of annual savings	Payback Period (Years)
Chemicals	1	1	25,000	25,000	0.00	0.00
Construction	3	3	28,821	28,821	57.82	0.58
Food and Drink	4	3	1,076	1,076	74.38	0.74

Table A6 illustrates the annual cost savings as a result of material substitution. As mentioned earlier, these results are based on only those businesses that entered data and information on cost savings due to material substitution, as such only 3 sectors are shown in Table A6 above. The businesses featured in the Toolkit have realised some of these savings through substitution but due to the limits on the data it is not clear whether this provides a clear indication of typical savings. It is perhaps these 3 sectors that are more experienced in material substitution in general. For example in the Food and drink sector, some companies have substituted electric cooker units with wood pellet/biomass cookers, diesel use with electric forklift trucks and have substituted non-recyclable packaging with recyclable paper and plastic packaging. In the Construction sector, there is increased common practice for replacement use of recycled crushed aggregates. It is worth noting that the business recorded on the toolkit for the Chemicals sector does not record percentage of capital investment of its annual savings although it registers significant cost savings (£ 25,000/year).

4 Analysing Resource Efficiency by Sector (continued)

Table A7 below summarises achieved annual cost savings from diversion of waste from landfill. Again, the sectors with the highest annual cost savings per opportunity have the highest annual cost savings per business. Although the results for the Environmental Technologies sector are based on only 3 businesses, the sector registers the highest annual cost savings (£25,190 per opportunity and £125,948 per business) with its percentage of capital investment of its annual cost savings at 26%. The Energy, Power and Utilities sector registers the lowest cost savings (£411 per opportunity and £1,437 per business), however, with no capital investment. It is important to note that the results of the Energy, Power and Utilities sector are based on only 2 businesses. Based on the data, the Construction sector is seen to invest the most in diverting waste from landfill compared to other sectors.

Table A7 Achieved annual cost savings as a result of diversion of waste from landfill

Sector	Number of businesses	Number of SMEs	Annual savings per Opportunity (£)	Annual savings per business (£)	% Capital Investment of annual savings	Payback Period (Years)
Environmental Technologies	3	2	25,190	125,948	26.00	0.26
Food and Drink	18	11	6,494	10,462	21.00	0.21
Textiles	11	5	9,253	17,665	15.00	0.15
Construction	11	6	6,978	11,411	40.00	0.40
Chemicals	8	5	624	1,014	25.00	0.25
Aerospace	3	0	1,634	3,812	0.87	0.01
Automotive	15	8	3,518	6,801	16.00	0.16
Energy, Power and Utilities	2	2	411	1,437	0.00	0.00

4.2 Environmental Benefits realised as a result of resource reduction

Table A8 below illustrates the cost savings, unit savings and CO₂ savings as a result of resource reduction in energy, water and materials for various sectors.

4 Analysing Resource Efficiency by Sector (continued)

Table A8. Achieved savings from resource efficiency through resource reduction

Sector	Energy						Water				Materials			
	Number of Businesses	Number of SMEs	CO ₂ savings/ Opp (t/year)	Unit savings/ opp (kwh/year)	Unit savings per business (kwh/year)	CO ₂ savings/business (t/year)	Number of businesses	Number of SMEs	Unit savings/ opp (m ³ /year)	Unit savings per business (kwh/year)	Number of businesses	Number of SMEs	Unit savings/ opp (t/year)	Unit savings per business (kwh/year)
Aerospace	8	1	41	110,047	206,338	77	10	6	6,686	7,355	6	1	28	61
Energy, Power and Utilities	6	3	387	506,861	675,814	516	7	5	142	182	6	2	112	205
Textiles	22	13	140	548,927	923,195	235	28	18	4,902	6,653	18	6	2,702	6,754
Food and Drink	32	22	149	369,938	762,997	307	69	42	3,809	4,195	33	17	47,672	66,451
Automotive	24	15	71	222,547	417,276	133	37	21	397	440	24	8	36	53
Chemicals	14	9	104	416,128	1,397,000	350	32	12	2,638	3,215	16	5	250	328
Environmental Technologies	4	4	4	11,237	25,282	10	11	8	34	37	7	3	1,395	1,594
Construction	19	14	51	144,908	427,097	151	44	18	123	131	25	7	2,042	2,777

¹ Opp – Opportunity

² t/year – tonnes/year

4 Analysing Resource Efficiency by Sector (continued)

4.2.1 Energy Savings

With regards to energy use, the highest annual carbon dioxide (CO₂) savings are achieved by the Energy, Power and Utilities sector at 387 tonnes per opportunity and 516 tonnes per business. However, the Textiles sector has the highest unit savings per opportunity at 548 kwh/year while the Chemicals sector has the highest unit savings per business at 1,397,000 kwh/year. The lowest annual CO₂ savings are seen in the Environmental Technologies sector at 4 tonnes/opportunity and 10 tonnes/business. The lowest unit savings are seen in the Environmental Technologies sector at 11,237 kwh/opportunity and 25,282 kwh/business. This perhaps reflects the existing awareness and practice in reducing energy wastage, or possibly those represented within the toolkit are new(er) companies/products so the equipment is better and more efficient. For example, one of the companies in the Environmental Technologies sector featured in the toolkit, refurbished its lighting and air compressor systems to reduce on energy usage, hence the savings. It is however, difficult to understand the reasons behind the results and with the case of the Environmental Technology sector this is only based upon 4 companies in the sample base. At this stage it is best to deduce that there may be a large number of factors behind the results.

4.2.2 Water Savings

As shown in Table A8, no CO₂ savings were recorded for any sector for water use. The highest annual water savings are seen in water intensive sectors, with the highest savings in the Aerospace sector (6,686 m³/opportunity and 7,355 m³/business), followed by the Textiles sector (4,902 m³/opportunity and 6,653 m³/business), Food and Drink sector (3,809 m³/opportunity and 4,195 m³/business) and Chemicals sector (2,638 m³/opportunity and 3,215 m³/business). With regard to the Textiles sector, there were at least 2 leather companies, with the majority not Leather companies. Water savings in the leather companies varied from as high as 53,000 m³ per year for borehole water to as low as 8 m³/year for water-mains. The Environmental Technologies sector has the lowest unit savings at 34 m³/opportunity and 37 m³/business.

4.2.3 Materials Savings

Based on Table A8, the highest annual material savings are achieved by the Food and Drink sector, at 47,672 tonnes per opportunity and 66,451 tonnes per business, followed by the Textiles sector at 2,702 tonnes/opportunity and 6,774 tonnes/business and the Construction sector at 2,042 tonnes/opportunity and 2,777 tonnes/business. The lowest savings are seen in the Aerospace sector at 28 tonnes/opportunity and 61 tonnes/business and in the Automotive sector at 36 tonnes/opportunity and 53 tonnes/business.

4 Analysing Resource Efficiency by Sector (continued)

Table 9 Pipeline savings from resource efficiency through resource reduction

Sector	Energy						Water				Materials			
	Number of Businesses	Number of SMEs	CO ₂ savings/ Opp (t/year)	Unit savings/ opp (kwh/year)	Unit savings per business (kwh/year)	CO ₂ savings/business (t/year)	Number of businesses	Number of SMEs	Unit savings/ opp (m ³ /year)	Unit savings per business (kwh/year)	Number of businesses	Number of SMEs	Unit savings/ opp (t/year)	Unit savings per business (kwh/year)
Aerospace	23	11	56	174,295	659,291	213	17	7	9,005	11,124	8	2	381	524
Energy, Power and Utilities	11	7	136	321,621	1,023,341	433	6	5	103	172	3	1	518	518
Textiles	66	45	55	239,335	881,187	203	36	22	3,361	5,602	19	8	57	93
Food and Drink	133	58	78	280,810	1,150,689	321	101	34	5,904	9,119	25	7	103	177
Automotive	67	43	36	98,427	376,079	136	60	39	1,301	1,865	24	10	193	286
Chemicals	51	28	107	299,124	1,026,406	366	39	23	3,956	7,101	33	14	692	1,028
Environmental Technologies	21	13	19	46,730	160,217	65	17	13	169	209	4	3	3	7
Construction	101	77	23	67,454	235,086	80	59	40	970	1,365	33	14	1,634	1,981

Table A9 shows data captured by ENWORKS that reflects the additional opportunities identified within companies that have not yet been realised – these include opportunities identified through the initial scope audit, following more detailed investigation, those that are feasible, and those that subsequently may be non-feasible (the improvement action is not currently practicable or affordable or the technology is unproven) and those which are in the implementation stage (being adopted and savings figures are being monitored and finalised). From the current status of the data within the Toolkit it is not possible at this stage to predict what will be fully implemented by each of the companies as economic conditions for example will influence what is currently feasible and what is not.

4 Analysing Resource Efficiency by Sector (continued)

4.2.4 Pipeline Energy Savings

With regard to energy, the Energy, Power and Utilities sector has the highest potential annual CO₂ savings at 136 tonnes/opportunity and 433 tonnes/business followed by the Chemicals sector at 107 tonnes/opportunity and 366 tonnes/business and the Food and Drink sector at 78 tonnes/opportunity and 321 tonnes/business. The lowest potential annual CO₂ savings are seen in the Environmental Technologies sector at 19 tonnes/opportunity and 65 tonnes/business. With regards to potential unit savings, again the Energy, Power and Utilities sector has the highest annual unit savings per opportunity at 321,621 kwh/opportunity, while the Food and Drink sector have the highest annual unit savings per business at 1, 150,689 kwh/business. The lowest unit savings are again seen in the Environmental Technologies sector at 46,730 kwh/opportunity and 160,217 kwh/business.

4.2.5 Pipeline Water Savings

Again there are potential water savings in all sectors. The Aerospace sector has the highest potential unit savings of water at 9,005 m³/opportunity and 11,124 m³/business with the lowest annual unit savings being in the Energy, Power and Utilities sector at 103 m³/opportunity and 172 m³/business. It is however worth noting that the number of businesses considered for the Energy, Power and Utilities sector is low compared to the rest of the sector.

4.2.6 Pipeline Material Savings

There are potential varied material opportunity savings in all sectors, all being measured in tonnes per year. The Construction sector has the highest potential unit savings at 1,634 tonnes per opportunity and 1,981 tonnes per business with the Environmental Technologies sector having the lowest potential unit savings at just 3 tonnes per opportunity and 7 tonnes per business. Although it could be argued that the low savings in the Environmental Technologies sector could be attributed to the few businesses considered for that sector, it is important to note that the lowest number of businesses is seen in the Energy, Power and Utilities sector, but it has the third highest potential unit savings per opportunity and the fourth highest savings per business.

4.3 Environmental Benefits realised as a result of material substitution

The ENWORKS database also records the opportunities realised through material substitution. These are shown in Table A10 overleaf.

4 Analysing Resource Efficiency by Sector (continued)

Table A10. Achieved resource savings as a result of material substitution

Sector	Energy						Materials			
	Number of Businesses	Number of SMEs	CO ₂ savings/ Opp (t/year)	Unit savings/ opp (kwh/year)	Unit savings per business (kwh/year)	CO ₂ savings/ business (t/year)	Number of businesses	Number of SMEs	Unit savings/ opp (t/year)	Unit savings per business (kwh/year)
Food and Drink	-	-	-	-	-	-	2	1	0.15	0.15
Chemicals	1	1	107	249,004	249,004	107	-	-	-	-
Construction	-	-	-	-	-	-	3	3	491	491

As shown in Table A10, based on the limited data in the Toolkit the Chemicals sector is the only sector that registers significant savings in energy use with annual CO₂ savings of 107 tonnes per opportunity and per business, unit annual savings of 249,004 kwh per opportunity and per business. These results are however based on data for just 1 business. The Construction and Food and Drink sectors achieved material unit savings, although the savings for the Food and Drink sector are very low at 0.15 tonnes/year compared. No data was recorded for water use and other sectors hence these are not presented in the analysis.

Table A11. Pipeline resource efficiency benefits as a result of material substitution

Sector	Energy						Materials			
	Number of Businesses	Number of SMEs	CO ₂ savings/ Opp (t/year)	Unit savings/ opp (kwh/year)	Unit savings per business (kwh/year)	CO ₂ savings/ business (t/year)	Number of businesses	Number of SMEs	Unit savings/ opp (t/year)	Unit savings per business (kwh/year)
Energy, Power and Utilities	-	-	-	-	-	-	1	1	1	1
Textiles	-	-	-	-	-	-	1	1	150	150
Food and Drink	6	2	276	641,722	962,583	414	2	2	0.01	0.01
Automotive	2	2	40	93,225	93,225	40	-	-	-	-
Chemicals	-	-	-	-	-	-	1	1	1	1
Construction	3	1	53	122,969	204,948	88	9	7	4,272	5,221

4 Analysing Resource Efficiency by Sector (continued)

In Table A11, again based on the data and information in the toolkit, potential savings from material substitution are recorded for only energy use and material use, with the majority of the sectors recording savings from material substitution in energy use. In terms of energy, the highest potential CO₂ savings are seen in the Food and Drink sector. Again the Food and Drink sector has the highest potential unit savings. Although potential unit savings for materials use are relatively low for all the sectors recorded on the toolkit, the Construction sector has significantly high unit savings in comparison with the other sectors. As the Food and Drink, Automotive and Construction sectors have relatively high potential savings due to material substitution, perhaps these sectors reflect industry's willingness to be more innovative in material substitution and new technology applications are becoming more practicable to use.

4.4 Environmental Benefits realised as a result of diversion of waste from landfill

Table A12 and Table A13 below summarise results of savings as a result of diverting waste from landfill. As expected, the savings are seen for only materials.

Table A12 Achieved savings from diverting waste from landfill

Sector	Materials			
	Number of businesses	Number of SMEs	Unit savings/opp (t/year)	Unit savings per business (kwh/year)
Aerospace	3	0	12	27
Energy, Power and Utilities	2	2	8	28
Textiles	11	5	64	128
Food and Drink	17	11	61	100
Automotive	15	8	13	26
Chemicals	8	5	10	17
Environmental Technologies	3	2	1,179	5,897
Construction	11	6	401	657

Based on the results in Table A12, the highest savings from waste diversion from landfill are achieved by the Environmental Technologies sector at 1,179 tonnes per opportunity and 5,897 tonnes per businesses followed by the Construction sector at 401 tonnes/opportunity and 657 tonnes per business. This could be attributed to the new technologies that have been developed over time to recycle waste, recover energy from waste and re-use of waste in processing and construction, reducing the amount of waste that is sent to landfill. The lowest savings are achieved by the Energy, Power and Utilities and Chemicals sectors.

4 Analysing Resource Efficiency by Sector (continued)

Table A13 Pipeline savings from diverting waste from landfill

Sector	Materials			
	Number of businesses	Number of SMEs	Unit savings/opp (t/year)	Unit savings per business (kwh/year)
Aerospace	8	2	97	181
Energy, Power and Utilities	6	5	679	905
Textiles	23	12	39	76
Food and Drink	48	33	115	182
Automotive	18	11	31	49
Chemicals	17	8	117	165
Environmental Technologies	8	5	332	373
Construction	43	34	399	594

Table A13 shows the potential savings as a result of diverting waste from landfill. The Energy, Power and Utilities sector has the highest potential savings at 679 tonnes/opportunity and 905 tonnes/business followed by the Construction sector at 399 tonnes per opportunity and 594 tonnes per business and Environmental Technologies sector at 332 tonnes per opportunity and 373 tonnes per business. The lowest potential savings are seen in the automotive sector at 31 tonnes/opportunity and 49 tonnes/business.

Appendix 4 shows the grant areas and examples of organisations that offer aid or grants in realising savings for various resources as well as reduce CO₂ emissions.

5 Conclusions and Recommendations

A previous national study (Oakdene Hollins and Grant Thornton report for DEFRA 2007) has sought to quantify the business benefits of resource efficiency and demonstrate that there are potential energy, waste and water savings to be gained within all business sectors. The ENWORKS toolkit based on over 1000 businesses (387 were used in the analysis) contains “live” up to date data illustrating the actual and pipeline savings identified across all business sectors within the North West region. From the North West C&I survey undertaken in 2007 and work in progress with the C&I survey in Wales (both carried out by Urban Mines) similar types of waste arisings are commonly being produced by business sectors regardless of where they are situated. Similarly by working with the different business sectors across the North West region from Cheshire to Cumbria, it is also seen that businesses in similar sectors can benefit and implement successful resource efficiency measures regardless of their geographical location. The ENWORKS toolkit therefore gives us an interesting insight into the different opportunities realised within the different sectors. It is important to note that the results of the analysis are based on only the number of businesses that entered information and data onto the toolkit and not all the businesses in the North West region. The results are therefore only estimates and should be interpreted in that context. The results of the analysis are summarised as follows:

Achieved cost savings from resource reduction:

The Environmental Technologies sector achieved the highest cost savings. The sectors with the lowest cost savings, i.e. the Energy, Power and Utilities and Automotive sectors, have the highest capital investment.

Achieved cost savings from material substitution:

Cost savings are achieved in the Construction, Chemicals and Food and Drink sectors. This could be attributed to increased use of recycled materials substituting raw materials and other materials being substituted such as packaging and fuels.

Achieved cost savings from diverting waste from landfill:

The Environmental Technologies sector registers the highest annual cost savings. The Energy, Power and Utilities sector registers the lowest cost savings with no capital investment. The Construction sector invests the most in diverting waste from landfill compared to other sectors.

5 Conclusions and Recommendations (continued)

Achieved environmental benefits as a result of resource reduction:

Energy:

The highest annual carbon dioxide (CO₂) savings are achieved by the Energy, Power and Utilities sector. The Environmental Technologies sector achieves the lowest annual CO₂ savings. The Textiles and Chemicals sectors have the highest unit savings, with the lowest in the Environmental technologies sector.

Water:

The highest annual water savings are seen in water intensive sectors, with the highest in the Aerospace sector, followed by Textiles, Food and Drink and Chemicals sector. The Environmental Technologies sector achieves the lowest unit savings.

Materials:

The highest annual material savings are achieved by the Food and Drink sector, followed by the Textiles and the Construction sector. The lowest savings are achieved by the Aerospace and Automotive sectors.

Pipeline environmental benefits as a result of resource reduction:

Energy:

The Energy, Power and Utilities sector has the highest potential annual CO₂ savings, with lowest in the Environmental technologies sector. With regards to potential unit savings, the Energy, Power and Utilities and Food and Drink sectors have the highest annual unit savings. The lowest unit savings are again seen in the Environmental technologies sector.

Water:

The Aerospace sector has the highest potential unit savings of water, with the lowest savings in the Energy, Power and Utilities.

Materials:

The Construction sector has the highest potential unit savings, with the Environmental Technologies sector having the lowest potential unit savings.

5 Conclusions and Recommendations (continued)

Achieved environmental benefits from material substitution:

Energy:

The Chemicals sector is the only sector that registers significant CO₂ and unit savings in energy use.

Materials:

The Construction and Food and Drink sectors achieved material unit savings, although the savings for the Food and Drink sector are very low. No data was recorded for water use and other sectors hence these are not presented in the analysis.

Pipeline environmental benefits from material substitution:

Potential savings from material substitution are recorded for only energy use and material use, with the majority of the sectors recording savings from material substitution in energy use. In terms of energy, the highest potential CO₂ and unit savings are seen in the Food and Drink sector. Although potential unit savings for materials use are relatively low for all the sectors recorded on the toolkit, the Construction sector has significantly high unit savings in comparison with the other sectors.

Achieved environmental benefits from diverting waste from landfill:

The savings are seen for only materials, with the highest savings achieved by the Environmental Technologies sector, followed by the Construction sector. This could be attributed to the new technologies that have been developed over time to recycle waste, recover energy from waste and re-use of waste in processing and construction, reducing the amount of waste that is sent to landfill. The lowest savings are achieved by the Energy, Power and Utilities and Chemicals sectors.

Pipeline environmental benefits from diverting waste from landfill:

The Energy, Power and Utilities sector has the highest potential savings, followed by the Construction sector and Environmental technologies sector. The lowest potential savings are seen in the Automotive sector.

5 Conclusions and Recommendations (continued)

This research has concentrated on identifying the potential savings that businesses can make via resource efficiency measures and, in particular, any quick wins that can be achieved and that other businesses can usefully use and replicate. In order to do this we have contacted businesses, business support agencies and organisations assisting businesses. Compiling case study material takes time and effort, and many businesses do not have the resources in terms of time and expertise to publicise their achievements, some do not want to share their experiences and some could not take part due to time constraints.

In compiling the case studies we also found that many of the support agencies did not have resources to supply case study compilation either as they are often concentrating on helping their businesses achieve the savings and outputs required for their grant programme. This BIS study has therefore helped create some new case studies, revise some existing and compile set format case studies using information gathered directly by business or support agencies.

The case studies have been compiled to illustrate good practice both within SMEs and larger businesses and illustrate improvements carried out on their own or with some support from business support organisations. We have selected case studies to illustrate the work of a diverse range of support bodies working in different regions across the United Kingdom.

The following are some of the identified easy win recommendations realised from the resource efficiency benefits achieved in the case studies for each of the sectors:

5 Conclusions and Recommendations (continued)

Generic Easy Win Opportunities for application across all business sectors:

General:

Undertaking a simple environmental audit can help identify opportunities for improving resource efficiency, and subsequently adopting a costed environmental action plan will help aid implementation.

Simple training and outlining of best practice to staff through the use of tool-box talks can achieve significant savings and staff engagement.

Energy:

Turning down the thermostats in the offices to 19 degrees centigrade will provide a comfortable temperature for working and save energy costs.

Simple energy efficiency measures such as time settings for night storage heating, encouraging staff to turn off warehouse lighting or better still installing sensors to reduce energy consumption, and managing the use of lighting in office environments.

Undertake an upgrade of lighting systems with more efficient fittings, bulbs and light sensors to make full use of skylights and natural daylight.

Setting clear energy reduction targets – say 10% annual reduction, can help drive initiatives through such as revised work procedures and increasing staff awareness to switch off appliances such as computers when not in use and turning off radiators rather than opening windows to reduce the temperature of the working environment.

Water:

Reviewing pipes and ball valves for leaks and faults, and installing dual-flush devices within customer and staff toilets would lead to significant cost savings.

Review washing and cleaning water requirements, and consider installing push taps and flow restrictors.

Materials:

Re-using pallets rather than straight recycling can potentially achieve financial savings on site.

Review routing of your vehicles to reduce mileage and save fuel.

Waste

Where waste is created, install a simple segregation scheme to separate out materials that can easily be recycled such as paper and card, metals and glass, so that materials can be sold off to generate additional income such as from metal scrap materials.

Asking your current waste contractor to provide recycling services can help negotiate price reductions for waste management.

5 Conclusions and Recommendations (continued)

Construction

Easy Wins:

Source construction materials locally wherever possible.

At design stage for construction review air tightness of the envelope of the building and energy saving installation measures – to meet targets and result in energy savings for the end user.

Waste management – install source segregation for key waste streams and review potential material exchange schemes to divert materials from landfill and save money through recycling.

Simple labelling and control of skips to avoid contamination of materials.

Work with suppliers to reduce packaging of materials delivered to site.

General:

Re-use and Recycle Materials and Equipment – with careful planning, rates as high as 95% can be achieved.

Materials:

Trade Construction Pack issued to all parties to control resources using electronic system.

Waste:

Measuring waste generated accurately through construction projects helps subsequent management.

5 Conclusions and Recommendations (continued)

Food, Drink & Tobacco

Easy Wins:

Charging fork lift truck batteries when 80% depleted to reduce the cost of energy.

Water:

In food production, investing in up- to-date water treatment process cannot only reduce discharge to main sewer with financial savings but can assist re-thinking water used within production, water re-used across the process and consequent savings for less frequent descaling of machinery and less use of caustic detergent used to clean equipment.

Waste:

Investing in equipment such as optical sorting over manual sorting can realise significant benefits to reduce the level of rejects in food production.

Simple plant modifications can prevent spillage of food in production reducing waste.

Reviewing transit packaging (maybe with thinner cardboard) can have knock on benefits from allowing higher weights to be carried per pallet, thus reducing handling, fuel and time costs.

Critically review waste generated from food production – is there an alternative to landfill? Examples include waste sunflower oil used in frying, waste crisps and vegetable packaging for cattle feed.

Textiles

Easy Wins:

Undertake environmental audit to review in particular waste materials, and re-evaluate re-use – for example residual yarn taken away for recycling can be rewound for reprocessing thus saving on primary raw material cost.

Waste:

Waste textile fibres can be recycled and turned into carpet underlay.

Lean manufacturing application – to achieve more with less – can help reduce waste significantly – especially if applied not only to the production process, but to supply chain, new product development – in short every area of the business!

5 Conclusions and Recommendations (continued)

Power & Utilities

There is great potential to use combined heat and power generation systems within the power and utility sector itself. Using biogas, water utility companies can generate high value electricity from waste and then utilise the heat generated as a by product around their own site operations.

Chemicals/non-metallic minerals manufacturing

Easy Wins:

Separating hazardous and non-hazardous wastes is increasingly important (driven by legislation) but by stopping cross contamination financial savings can be realised and improved control can lessen subsequent waste management treatment requirements.

Waste:

The recovery and re-use of liquid waste processes should be critically reviewed and implemented where practicable. Also control and processing may render previously classified hazardous materials as inert when becoming solid.

Opportunities exist from improved solvent management, segregating solvent types used/generated may allow waste solvents to be re-used or sold as recovered solvent streams.

5 Conclusions and Recommendations (continued)

Metal Manufacturing

Easy Wins:

Always review compressed air systems to identify leaks – there is a simple piece of kit that can easily measure and identify leaks.

Installing strip curtains to doors to reduce energy wastage, improving stock management and raising the profile of energy efficiency measures can all help with reductions in energy costs.

Energy:

Investigate PIR (passive infrared sensors) sensors to de-activate lighting when not required. In open warehouse settings fit new heating units with shut offs so they are de-activated when doors and shutters are open. Increase staff awareness through energy data logging and switch off programmes to coincide with breaks, lunch and end of shifts. Fitting bespoke insulation jackets on furnace equipment can achieve significant financial savings.

Waste:

Undertaking a detailed waste audit can pay dividends. Simple measures such as greater care in handling raw materials can reduce spillage and cross contamination and subsequent costs savings of raw material and waste management costs.

Water:

Reviewing leaking pipes and faulty ball valves can save significant money. Similarly, use of percussion taps throughout a site and introduction of passive infrared detectors in the toilets resulted in significant water savings.

5 Conclusions and Recommendations (continued)

Machinery & Equipment (Other Manufacturing)

Easy Wins:

Critically reviewing cleaning processes can save money; changing from single-use tissues (for machinery wipe down) to washable cotton wipes reduced costs from disposal to easily cover increased costs of the wipes and resulted in cost savings (the previous single use tissues were producing hazardous waste).

Waste:

By analysing additives to condenser units and by changing the raw material specification a company was able to convert its subsequent waste generated in the process manufacturing from hazardous to non-hazardous, significantly reducing costs of waste management.

Water:

Installing underground tanks for collection and treatment of rainwater from the roof of a plant may allow re-use in the production process helping to conserve water and reduce costs. This could be in the form of settling tanks and reed bed filters so that water is a higher standard of cleanliness for multiple re-use applications.

5 Conclusions and Recommendations (continued)

Retail

Easy Wins:

Charging up fork lift trucks at night using timers can save through lower night time energy tariffs. And ensuring charge up does not take place until 80% depletion achieved.

Critically review out of hours energy consumption to support the adoption of more formal energy monitoring systems.

Install waste segregation to reduce cross contamination of waste types.

Materials:

Fitting remould tyres to a large retail fleet gave good environmental payback with reduced CO₂ emissions, oil and rubber resource savings.

Critically reviewing existing waste management contracts can provide opportunities for waste minimisation, re-use, recycling and diversion of wastes away from landfill disposal.

Water:

Replacing turn taps on sinks with push taps down and/or aerator spray taps again produces savings. Improving the management of site drainage can divert run-off away from the sewer system (if meets specifications) and save costs in sewerage treatment.

Energy:

Implementing driver efficiency training and installing navigation equipment can provide savings all round.

Fitting vending machines and water coolers with timer switches to ensure they are switched off when not in use (overnight, bank holidays, etc) can save energy and costs. Reducing temperature in the office by at least 1 or 2°C can save electricity and money.

For a shopping centre, providing communal waste management facilities can make recycling economically viable and practical to implement. This can be achieved through: improving facilities for cardboard segregation and collection, segregating and baling polythene and introducing rainwater harvesting tanks to collect rainfall runoff for irrigation purposes across the shopping centre. Financial savings achieved can help support non-financial environmental initiatives within the shopping centre such as publicity campaigns.

5 Conclusions and Recommendations (continued)

Other Services

Easy Wins:

Do not heat spaces, such as warehouse areas, if not required (for example in summer months).

Consider whether you can reduce a water-meter fixed charge by replacing a 50mm water meter by a 40mm meter.

Energy:

Establishing an energy management team to implement opportunities in priority areas identified through energy benchmarking – starting with simple areas such as lights, can lead to savings and a motivated workforce. Are separate heaters better in a warehouse environment in some cases than running boilers? Voltage power optimisation can be introduced to reduce energy consumption, improve power factor, improve equipment lifetime and protect equipment from transients (energy spikes). Fitting energy efficiency lamps and PIRs in lifts and garage areas (areas infrequently used) can provide savings. Implement a switch off policy with security staff. Fitting temperature controlled radiator valves and double glazing and draught proofing strips to windows and internal doors.

Water:

Fitting dual-flush mechanisms in all toilets and reducing the buildings water pressure can lead to savings and reduced water consumption. Track water usage and identify any water leaks or dripping taps. Consider the installation of a rainwater/grey water recovery system for use in toilet flushing.

Waste:

Implement a waste segregation scheme to include: paper, glass, batteries, aluminium, plastic cups, furniture and toner. Increase your recycling rate and divert materials from landfill.

Appendices

Appendix 1 – Organisations responding to the call for case studies and subsequent list of Case Studies compiled.

The organisations/businesses that responded to the call for case studies include:

- Envirowise (Scotland and England)
- NISP (co-ordinated by their central office)
- Groundwork Pennine Lancashire, Groundwork Merseyside, Groundwork Manchester Salford, Tameside and Trafford, Groundwork Cheshire, Groundwork West Midlands, Groundwork London, Groundwork Leeds
- Cumbria Rural Enterprise Agency
- UK Centre for Economic and Environmental Development (CEED)
- Sainsbury PLC
- Howarth Environmental
- WRAP
- Carbon Trust
- Resource Efficiency KTN
- Environment Agency
- Manufacturing Advisory Service (Yorkshire and Humberside)
- Aerothermal
- Centre for Re-Manufacturing
- Wilson James
- Kier Construction
- British Retail Consortium
- Liverpool Chamber of Commerce
- Resource Efficiency Yorkshire & Humber
- Northampton University
- NWDA
- Warwickshire County Council Business Efficiency Club
- Construction Excellence
- EEDA
- Marshalls PLC
- Ener-g

Appendices (continued)

- Centre for Re-use and Re-Manufacturing
- Association for Organics Recycling
- Resource Efficiency Yorkshire
- Peter Jones
- Professor Chris Coggins
- Construction Products Association
- BREW centre for Local Authorities

Illustrating the companies who responded to the call for case studies and were subsequently able to agree information for use within the report

Sector	Company	Size of Company	Notes
Construction	Wilson James /Unilever	Large Company	New Case Study
Food, Drink and Tobacco	Bakkavor (Bourne Salads)	SME	Case Study prepared from existing material
Textiles (Wood, Paper, Publishing)	James Robinson fibres	SME	New Case Study
Power & Utilities	Ener-g	Large Company	New Case Study
Chemical/non-metallic minerals manufacturing	Aerothermal	SME	New Case Study
	Dow Corning	Large Company	Case Study prepared from existing material
	RAS Cards	SME	New Case Study
Metal manufacturing	Alloy Bodies	SME	New Case Study
	Mahle Engine Systems UK	Large Company	Case Study prepared from existing material
	SNA Europe	SME	New Case Study
Machinery & equipment (other manufacturing)	Denso Manufacturing Ltd	Large Company	Case Study prepared from existing material
	Tullis Russell Coaters Ltd	SME	New Case Study
Retail & Wholesale	Sainsbury	Large Company	New Case Study
	SPL	SME	New Case Study
	High Chelmer Shopping Centre	N/A	Case Study prepared from existing material
	Argos Direct	Large Company	Case Study prepared from existing material
Other Services	Plough Inn	SME	New Case Study
	20:20 Mobile	Large Company	New Case Study
	DLA Piper	Large Company	Case Study updated from existing material
	Atherstone Repair Centre	SME	New Case Study

Appendices (continued)

Appendix 2 – Sector Classification

The 9 sectors chosen for the case study matrix have been taken from the section level based upon the SIC 2003/SIC2007 sections and divisions (<http://www.ons.gov.uk/about-statistics/classifications/future-developments/operation-2007/index.html>)

The “Environmental Technologies” sector has specifically been kept out of the compiled case study examples in Appendix 1 as it is believed that this sector being involved in direct delivery involving waste, water, energy and resource efficiency applications should be aware of potential savings in its own field for application in its own operations.

The sectors within the ENWORKS toolkit have been sorted to correspond as far as possible with the defined SIC codes. In the Toolkit however the businesses declare themselves to belong to one of a defined set of Sectors/Clusters that are linked to those prioritised within English Regional Economic Strategies and hence we use within the toolkit the additional sectors of Aerospace and Automotive and Environmental Technologies. There is no SIC code for Environmental Technologies. All the environmental industries are distributed amongst the other sectors. For instance, waste management are part of sector E with water supply in the 2007 revised classifications but in 2003 SIC in section O – Other community, social and personal services activities. Recycling is in the manufacturing section.

The sector of Environmental Technologies used by ENWORKS corresponds to companies processing, manufacturing, consulting providing expert support within such areas as waste management and recycling, water and waste water treatment, resource efficiency, contamination and remediation, environmental monitoring, air and noise control and marine pollution control.

Appendices (continued)

Appendix 3 – The ENWORKS “Toolkit”

ENWORKS' mission is for an “improved economy and environment of the North West region achieved through engaging business in environmentally sustainable business practice”. ENWORKS have been delivering resource efficiency support since late 2003 through 5 sub-regional partnerships of locally-based not-for-profit organisations, now supplemented by a bank of private sector consultants. Their current programme of work runs until March 2010 and is tasked with advising 2800 businesses and making significant financial and environmental savings (e.g. £50million cost savings & 200,000 tonnes of CO₂). In order to capture and report the economic and environmental impacts of their resource efficiency support, ENWORKS use their Online Resource Efficiency Toolkit (“the Toolkit”).

The ENWORKS Toolkit is a bespoke, web-based piece of software, first developed in 2004 and in continuous use since that point. There are now thousands of records (over 11,000) listing identified improvement opportunities, with North West companies (over 2700) within the Toolkit, and it has won awards including one from UK Centre for Economic and Environmental Development (CEED).

The ENWORKS Toolkit works as follows:

Each improvement action that is identified in a business is added to the Toolkit as an Opportunity. The savings associated with each Opportunity (both financial and resource based) are classified according to the method by which they can be / have been achieved using one of the following Opportunity Types: Resource Reduction, Waste Diverted From Landfill or Energy/Material Substitution.

To enable the progress of improvement actions to be tracked, each Opportunity is assigned a Status from the following list: Initial Scope, Investigation, Feasible, Non Feasible, Implementation & Achieved. The Status of the Opportunity will change over time as it is progressed towards Achieved.

The Toolkit then collates and reports the financial and resource savings recorded by Opportunity Type (i.e. Resource Reduction, Waste Diverted From Landfill or Energy/Material Substitution), by resource type (e.g. electricity, mains water, packaging) and by Opportunity Status.

When reporting by Opportunity Status, the first five Statuses are commonly aggregated into a ‘Pipeline’ status to allow a simple comparative analysis of savings that have been Achieved versus those that are still being progressed.

Appendices (continued)

Each business with an account on the Toolkit is also classified by Sector/Cluster. The list of available Sectors/Clusters is determined by the priority sectors identified within the Regional Economic Strategies of English Regional Development Agencies. This classification can also be used when generating reports to enable comparative analysis of improvement actions and savings by sector.

As an additional, non-mandatory function, the Toolkit also allows businesses to record their baseline expenditure on a range of resources (e.g. electricity, mains water, packaging) plus some key business data (e.g. turnover and number of employees). This data is then used to report 'average' savings across these measures. It must be noted that data from these reports only includes those businesses that have recorded their baseline position and not all businesses with savings on the Toolkit.

In the first instance therefore ENWORKS have given Urban Mines access to their Toolkit to review cumulative results and analyse the data set which covers over 1000 businesses.

The ENWORKS Toolkit has been adopted by other English Regional Development Agencies in the South East, London and the West Midlands to record and report the savings of their funded business support on resource efficiency, although data has only been collected in these regions over the last couple of years.

Appendices (continued)

Appendix 4 – List of Grant sources that could support businesses with implementing resource efficiency activities

Field	Sector	Grant Area	Description	Details
Waste Minimisation	All sectors	Envirowise	Free, independent support to businesses on resource efficiency and saving money	http://www.envirowise.gov.uk Advice Line 0800 585794
Waste Minimisation	Waste Sector in particular Some additional within Environmental Technology	WRAP	WRAP can provide tailored, practical solutions to help your business. Support is available to SMEs and covers the following areas: - marketing and sales - management support - operations - raising finance - access to grants - access to leases (eEquip)	http://www.wrap.org.uk/wrap_corporate/funding/index.html Helpline 0808 1002040
Water Efficiency	All sectors	Envirowise	Provides structured information and support to businesses in England to help them achieve water efficiency savings.	http://www.envirowise.gov.uk Advice Line 0800 585794
Water Efficiency	All sectors	Waterwise	Focused on decreasing water consumption in the UK and building the evidence base for large scale water efficiency.	http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/about_us/about_waterwise.html

Appendices (continued)

Field	Sector	Grant Area	Description	Details
Energy Efficiency/ CO ₂	All sectors (some qualifying criteria based upon scale of activity)	Carbon Trust	<p>The Carbon Management programme assesses and quantifies emission reduction opportunities that lead directly to action.</p> <p>The Carbon Survey provides tailored, expert carbon saving advice, including assistance on building design, for UK businesses.</p> <p>Interest free energy efficiency loans are offered to small-medium sized companies in the UK to help them overcome the capital barriers for the purchase of energy efficient equipment.</p> <p>The Carbon Trust has an Advice Centre staffed by dedicated business account managers providing expert energy efficiency advice and services.</p>	<p>http://www.carbontrust.com/EN/Solutions.aspx</p> <p>Contact us 0800 0852005</p>
Energy Efficiency/ CO ₂	All sectors	<p>Low Carbon Building Programme Phase 2</p> <p>Managed by BRE</p>	<p>Grants for the installation of microgeneration technologies are available to public sector buildings and charitable bodies.</p> <p>Applications are being accepted now until the end of June 2009.</p>	<p>http://www.lowcarbonbuilding.sphase2.org.uk/</p>
Energy Efficiency/ CO ₂	All sectors	Enhanced Capital Allowance Energy Scheme	Provides businesses with enhanced tax relief for investments in energy-saving equipment	www.eca.gov.uk/etl
Energy Efficiency/ CO ₂	All sectors	Energy Saving Trust	Offering advice can help save money and fight climate change by reducing carbon dioxide emissions from your home.	<p>http://www.energysavingtrust.org.uk/</p> <p>Contact us 0800 512012</p>

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