



Department
for Environment
Food & Rural Affairs

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Resource management: a catalyst for growth and productivity

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Introduction

1. The government is committed to driving economic growth, reducing the deficit and increasing UK exports. Moving towards a more circular economy can contribute to this and is essential for our future growth, increased resilience and environmental and human health.
2. Resource and waste management activity already makes a significant contribution to the economy. It does so directly by capturing value from waste, and indirectly by generating sales for companies that supply goods and services that support resource management, reducing costs for households and business that rely on it, and contributing to wider resource security.
3. It is estimated that the core waste sector generated £6.8bn in gross value added (GVA)¹ and supported 103,000² jobs in 2013. Broadening the definition to include repair, re-use and leasing activity that help extend the life of products, the contribution to the economy could be much greater. Data for 2013 suggests it could have been as high as £41bn to approximate GVA (aGVA)³ and 672,000 jobs, with £18.9bn of this being generated in the automotive sector, but it is difficult to determine exactly how much of this directly relates to activity that extends the life of products and reduces waste.

¹ Gross Value Added is used to quantify a sectors contribution to wider economic growth (measured through Gross Domestic Product). The figure quoted is from National Accounts for SIC 38 (Waste collection, treatment, recovery and disposal) and is in current prices.

² Office of National Statistics – Annual Business Survey – SIC 38

³ Office of National Statistics – Annual Business Survey - ABS aGVA in basic prices data has been used as it allows sub sectors (e.g. repair or leasing of machinery) to be identified. It is not as robust a measure as National Accounts but allows approximate estimations of wider GVA and jobs to be made. The estimate is based on SIC codes 47.79, 95.2, 77.2, 95.1, 33.1, 77.1, 77.3, 45.11/2, 45.2.

4. This paper considers the recent and potential future contribution of the sector to wider economic growth across three broad themes:
 1. **Extracting greater value from waste;**
 2. **Increasing resource efficiency; and,**
 3. **Increasing the export of goods and services.**
5. These have been selected as they represent opportunities to increase production or productivity which are important determinants of growth both in the short and long term.

Analysis of opportunities

1. Extracting Value from Waste

You've told us that:

"A circular economy, where the UK increasingly re-uses and recycles the resources it already has, could help generate 50,000 new jobs with £10bn investment, boosting GDP by £3bn" – David Palmer-Jones, Chairman, Environmental Services Association (2013) – Going for Growth – A Practical Route to a Circular Economy

"The circular economy approach offers developed economies an avenue to resilient growth, a systematic answer to reducing dependency on resource markets, and a means to reduce exposure to resource price shocks" – *Towards the Circular Economy* – Economic and business rationale for an accelerated transition - Ellen MacArthur Foundation

Economic theory suggests:

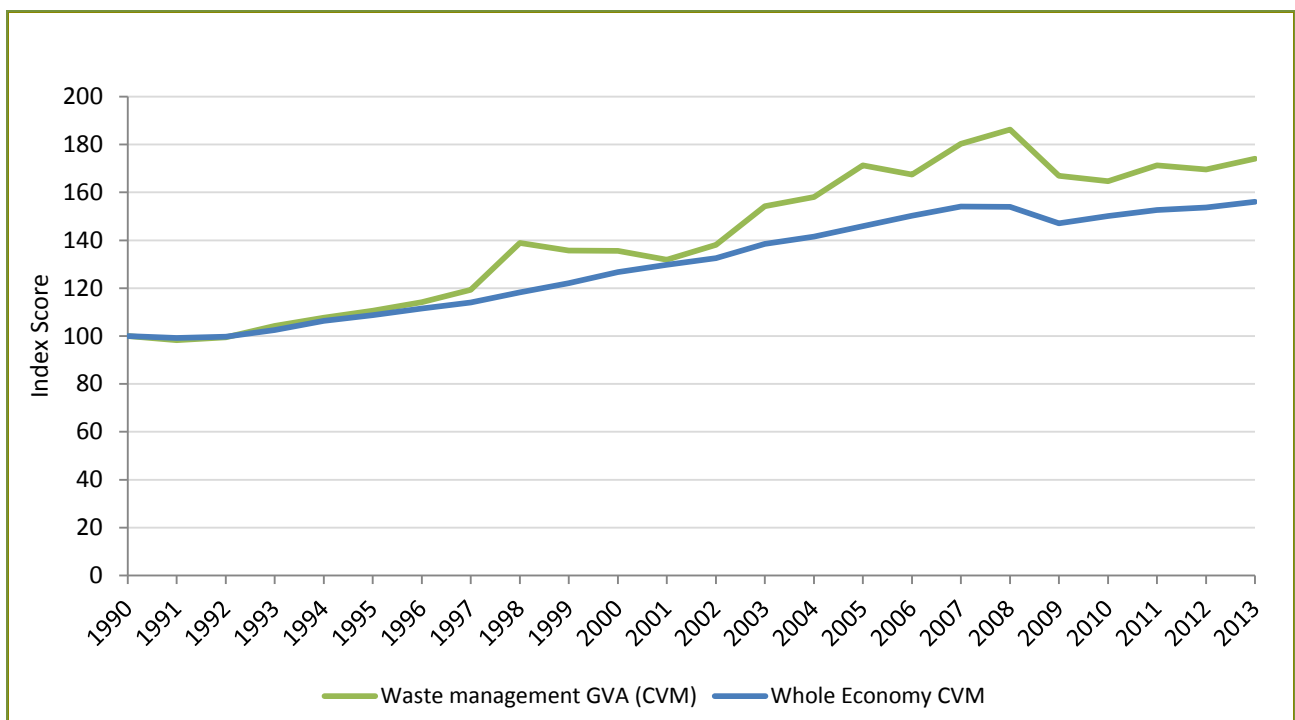
- We can measure a sector's contribution to the economy in terms of its gross value added (GVA), i.e. how much value a sector adds. This is done by taking away input costs from the value of the sector's output. The GVA of a sector can be increased by reducing input costs or finding new, higher value markets for the output of the sector. In the waste sector, GVA can also be increased at the expense of activity in other sectors by new regulations, so it is important to understand what is driving the growth of the sector in order to interpret this kind of statistic. Investing in infrastructure enables the waste and recovery value-chain to be realised.
- Market forces will cause labour and capital to generally move to where they earn the greatest profit, through a mixture of productivity and efficiency improvements and new markets. This enables economic growth as measured by GVA. Labour and capital would be expected to flow into or out of the waste sector, and up or down the waste hierarchy, depending on where the highest value can be extracted.

- Technological and process innovations play an important role in enhancing productivity and efficiency, and are therefore important enablers of growth. Industrial research is very likely to be targeted at areas with the highest potential value/rate of return.

We've noticed:

- **Over the past two decades the Gross Value Added of the waste and resource management sector has grown at a faster rate than the wider economy.** However, at the start of the 2008-9 recession the GVA of the waste sector fell considerably and while now improving has not yet recovered to its pre-recession level.

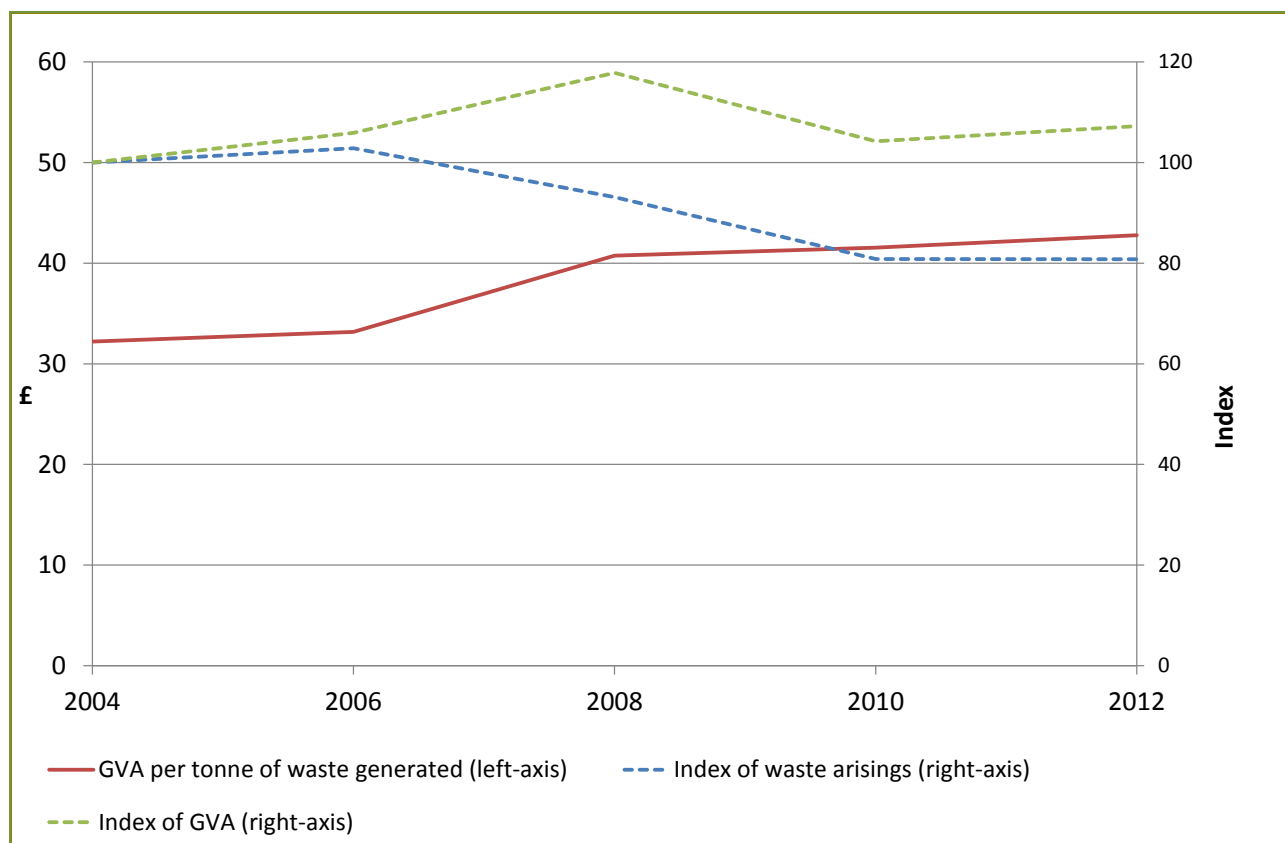
Figure 1 – Index of GVA over time of the waste management sector and the whole economy in constant prices (CVM measure)⁴.



- **Over the past decade the value we extract from managing our waste resource has increased significantly** - The GVA/tonne of waste managed by the sector has risen from £32 in 2004 to £43 in 2012 (after adjusting for inflation), representing a 33% increase in real terms over the 8 year period. There has been a significant reduction in waste arisings and relatively stable GVA over the period.

⁴ UK National Accounts Chain Value Metric (CVM) – waste sector defined by SIC 38

Figure 2 - Gross value added by UK waste sector in constant prices (CVM measure) per tonne of UK waste generated⁵.



- **We are extracting value through recycling** – We already extract considerable value from the materials we recover and expect this to continue. In 2012, the value of UK household dry recovered material⁶ is estimated to have been worth £0.3bn to £0.5bn.
- This is in addition to a significant volume of recovered materials from commercial, industrial, construction and demolition waste. The value of this has not been quantified, but in comparison to the value of UK household collected dry recovered materials, and given the UK exported £5bn in recovered materials in 2012, it is reasonable to conclude it was significant and worth several billions of pounds.
- Using a slightly different measure of GVA per tonne, in current prices to allow comparisons between industries instead of over time, it appears the waste industry adds a lot more value than comparable extractive industries in the UK. In current price terms in 2012, the waste industry added almost £41 of GVA for each tonne it treated

⁵ Source Eurostat – Tonnages have been adjusted to avoid double counting and mining waste and dredging spoils are excluded as we do not believe these are treated by the waste sector (as defined by ONS for calculating the sectors GVA) so are not relevant for this GVA per tonne metric. Please note that whilst figures for arisings are reasonably robust for all years, for years prior to 2010 there were some significant methodological differences compared to later years. Readers are advised therefore to exercise caution when drawing any observations or conclusions from looking at trends which include years prior to 2010.

⁶ Metal packaging, glass, paper and board, plastic, textiles and footwear

compared to the “other mining and quarrying” sector which adds £16 for each tonne it produces. The difference is perhaps not surprising, given the waste industry is delivering a service by removing waste as well as generating new raw materials (which are approximately comparable to materials generated by the “other mining and quarrying” sector).

- **We are also extracting value through energy recovery** – In 2013 it is estimated that £447.4m of electricity (9005 GWh) was generated from waste⁷. Of this, £155.5m (3130 GWh⁸) was generated through residual waste treatment⁹, £35.1m (707 GWh) was generated through Anaerobic Digestion (AD)¹⁰, and £256.8m (5169 GWh) was generated through the capture of landfill gas. While landfill gas capture generated the most electricity in 2013, much of this was from closed landfill. In the future energy generation from landfill is expected to peak and slowly decline as biodegradable waste is diverted from landfill and emissions from closed landfill tail off. By 2020 we project that the operational electricity generation capacity from residual waste treatment will increase to approximately 893 MW worth £330.4m¹¹. There is also a healthy pipeline of AD projects with planning consent capable of generating 272 MW of electricity if built¹².
- **Where cost effective, these and other factors help improve the efficiency of waste management, reducing the cost to the public sector and businesses of managing waste** – Between 2008/09 and 2012/13 the total cost of managing Local Authority waste, in constant prices and excluding landfill tax, fell by 3.5%. Taking into account the growing number of UK households this resulted in the cost per household, excluding landfill tax, falling by 5.7%. As both these figures exclude landfill tax they do not directly reflect changes to the bills faced by businesses and households, but they demonstrate the efficiencies that have been made, and without them, bills are likely to have been higher. Local Partnerships and Waste Resources Action Programme (WRAP) are working with Local Authorities to help them identify and apply relevant best practice to increase their efficiency further.
- **Material recovery and landfill diversion have also generated economic benefits that are reflected in the labour market** – They support jobs which are dispersed geographically and by occupation and skill/pay levels. These jobs compare favourably

⁷ Calculated using GWh output data from the Decc Digest of the UK Energy Statistics 2014 and an average wholesale energy price of £49.68 per megawatt hour (APX power spot exchange).

⁸ Based on an 85% load factor

⁹ £98.7m of which was from biodegradable waste.

¹⁰ Note – some of the energy generated through AD will be from farm waste.

¹¹ Estimate based Defra Waste Infrastructure Delivery Programme (WIDP) monitoring of Private Finance Initiative (PFI), Public Private Partnership (PPP) and Merchant plants, the average wholesale energy price for 2013 of £49.68 per megawatt hour and a load factor of 85%.

¹² WRAP data

with other sectors of the economy. In 2012, the aGVA per hour worked was approximately £31 per hour, above the UK whole economy average of £27.8 per hour. The labour productivity of the waste sector was also above the national average for each of the 4 years preceding 2012.

- Within the core waste sector, material recovery jobs appear the most productive (£39 aGVA/hour in 2012) with waste treatment and disposal (£27.30 aGVA/hour in 2012) and collection (£28 aGVA/hour in 2012) showing variation above and below the national average since 2008.
- **Investment in infrastructure across the waste hierarchy plays an important role in enabling the extraction of value from waste** - Its direct contribution to wider economic growth is dependent on: whether capacity is required (i.e. will not result in over capacity); whether the investment is in the most productive technologies; whether the capital could have been put to better use elsewhere in the economy; and whether investment in the waste infrastructure displaces or substitutes for jobs and investment elsewhere in the economy (e.g. in energy generation).
- Decisions on investment in new infrastructure are made by market participants based on their assessment of future demand and supply and financial viability. Expectations about future Government policy, including in relation to waste and resource management, affects these assessments and therefore influence investment decisions. A key source of policy uncertainty concerns the framework for policy determined at European Union level. In July 2014, The European Commission published their Communication on a Circular Economy, containing a package of proposed amendments to waste directives. On 16 December 2014, the Commission announced its intention to withdraw the waste proposals within this package and publish more ambitious proposals on the whole circular economy in 2015. Defra looks forward to working with the Commission, the European Parliament and other Member States to ensure a balanced package of proposals which has ambition, is evidence based and feasible for all Member States.
- **Domestic reprocessing, where commercially viable, could add further value in the UK, supporting jobs and growth, and contribute to improving the UK trade balance** – Where commercially viable domestic reprocessing allows value to be added to recovered material in the UK. This provides a source of jobs and investment; improves the UKs trade balance (compared to not collecting/recycling the material) by reducing the need to import raw and recovered materials from overseas; and contributes to UK resource security. The tight economic climate in the recycling sector at present highlights some of the challenges faced by domestic reprocessors, but also the value of supply chain collaboration, which gives industry the confidence to invest. The case studies presented below demonstrate the value of this collaboration.
- Defra statisticians are compiling a dataset for the tonnages of materials recovered in the UK. When complete in spring 2015 and considered alongside recovered material

export, we will have a better understanding of the extent to which the domestic use of recovered material has changed over time.

Case study 1 - Coca Cola Enterprises and UK recycled plastic.

In 2010, Coca-Cola Enterprises Ltd sourced recycled plastic from Europe, while at the same time most of the UK's used plastic packaging was exported for reprocessing. Coca-Cola Enterprises worked with ECO Plastics to increase domestic supply of plastic for use in packaging for products sold in the UK. This allowed Coca-Cola Enterprises to achieve their target of including 25% recycled plastic in all their plastic packaging by 2012, and between 2010 and 2013, UK reprocessing of PET (polyethylene terephthalate) plastic bottles grew from 35,000 to 85,000 tonnes. ECO Plastics was recently acquired by Aurelius, and Coca-Cola Enterprises Ltd has entered into a long-term agreement to source recycled PET from the newly formed ECOPlastics Recycling.

Case study 2 - Jaguar Land Rover and recycled aluminium.

REALCAR (REcycled ALuminium CAR) is a research project based on high recycled sheet aluminium developments from closed loop sources. The Jaguar Land Rover (JLR) led project was funded by the Technology Strategy Board from 2008 to 2011 and has resulted in the development of a modified aluminium sheet alloy. The alloy accommodates higher recycling rates through closed loop recycling of high quality segregated scrap at JLR press shops and key external suppliers. To support the project, investment has been made in internal JLR press shops to upgrade scrap segregation processes to retain alloy quality. The modified alloy has been developed for application as a sheet alloy in the next generation JLR vehicle body structures.

The next innovation project REALCAR 2 was launched in February 2013 in conjunction with Innovate UK to investigate opportunities to exploit additional recycled aluminium from post-consumer sources through extraction from advanced waste separation facilities. The JLR led project is a 30 month, £1 million project to explore the business case and technology for including an additional 25% of recycled post-consumer, non-automotive scrap (including drink cans) in a new grade of aluminium alloy. The project is also evaluating the potential for aluminium sourced from End-of-Life vehicles. The challenge is to develop an alloy that can absorb the wider range of chemical variations that result from post-consumer recycled materials, and still provide the high performance required for use in car body structures.

- **Recovered material is also exported overseas, often to where it was first manufactured, and this too helps to improve the UK trade balance** - The domestic reprocessing sector is not large enough to use up all of the materials recovered in the UK. For instance, the UK recovers (for recycling) 7.9 million tonnes of the paper it

consumes a year but in comparison, manufactures 4.6m tonnes of paper a year. As a result, some of the paper the UK recovers needs an additional end market in the form of overseas markets. The UK therefore relies to varying extents on export markets to absorb the recovered materials it does not use at home. This also contributes to improving the UK trade balance compared to not collecting/recycling the material. In 2013, the UK exported 13 million tonnes of key recovered materials (metals, paper, plastics, and textiles) worth £4.35bn. This accounted for 8% by weight of all UK exports of goods, supporting economic activity in the shipping and ports sector and providing a source of revenue for vessels that might otherwise be leaving the UK empty. Given the UK imports relatively few recovered materials (0.8 million tonnes), the direct net positive contribution to the UK trade balance is worth £3.9bn.

- **New Bio-economy technologies and approaches may also present opportunities to extract value, particularly from residual waste** – Bio-technology offers the potential to extract new, high value petro-chemical, pharmaceutical and agricultural inputs from residual waste. The Department for Business Innovation and Skills (BIS) and Defra are developing a Bio-economy roadmap to explore these opportunities further with the industry.
- **While recovered material prices fell during the 2008-09 recession, they have now broadly recovered. In the short to medium term, there remains downward pressure for some materials such as plastic, as a result of falls in related primary commodities such as oil. In the longer term global resource pressures are projected to rise and this may result in increased recovered material and energy prices** - The UN Environment Programme (UNEP) project that under a business as usual scenario, global demand for raw resources could treble from 2000 to 2050¹³. Under UNEPs' moderate contraction and convergence' scenario, which the report concludes would require a 'significant decoupling' of raw material consumption, resource extraction would still be 40%¹⁴ higher in 2050 compared to 2000 levels. This would require a 2 fold reduction in raw resource consumption in developed economies and convergence to the same rate in emerging economies. This would suggest that as the global economy recovers there will be a strong economic driver to increase resource efficiency and substitute raw for recovered material consumption.

¹³ Page 73 of UNEP Decoupling Natural Resource Use and Environmental Impacts from Economic Growth - http://www.unep.org/resourcepanel/decoupling/files/pdf/decoupling_report_english.pdf

¹⁴ Calculated using data from table 2.1 on page 31 of the UNEP report 'Decoupling Natural Resource Use and Environmental Impacts from Economic Growth'

2. Increasing Resource Efficiency

You've told us that:

"Materials and resources are the lifeblood of the sector and account for around 40% of manufacturers' costs. Over recent years, UK manufacturers have highlighted that high and volatile material prices and security of supply pose a threat to growth. How we obtain, use and reuse the materials that flow and circulate within the economy matters to manufacturing". – EEF The Manufacturers Association

"Opportunities to improve non-labour resource productivity in the UK could enable £10bn p.a. in additional profits for manufacturers – a 12% increase in average annual profits; 314,000 new manufacturing jobs – a 12% increase in manufacturing employment; and 27 million tonnes of CO2e p.a. reduction in GHG emissions – 4.5% of the UK's total GHG emissions in 2010". – Next Manufacturing Revolution

"Even the most conservative estimates suggest that the potential of remanufacturing in the UK is £5.6billion" – Triple Win – The Social, Economic and Environmental Case for Remanufacturing

Economic theory suggests:

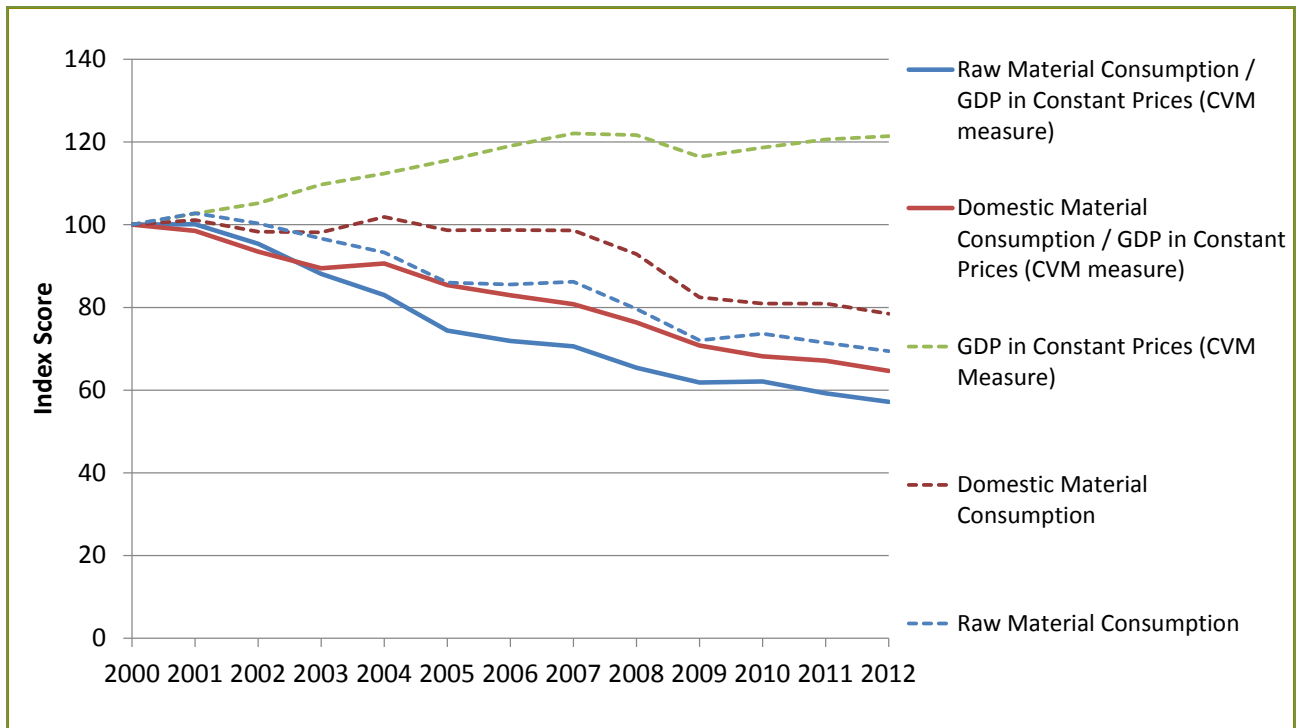
- Growth throughout the economy is driven by several factors, including increases in the efficiency with which inputs are used to make outputs, which includes the resources they use and the waste they generate. Therefore, this section looks at the wider economy and its use of resources.
- Reducing raw material consumption reduces a country's exposure to volatile commodity prices increasing resilience. Reducing raw material usage intensity, per unit of GVA, means the economy's exposure to input prices is lower.
- Reducing the burden of regulation of managing waste reduces cost to businesses, and thereby frees up resource for other uses in the economy. This can be estimated in terms of the efficiency savings to business generated by changes to Government legislation.
- Much economic output does not go through the waste sector but still contributes to the circular economy and resource efficiency. Therefore it may be relevant to look at a wider measure of GVA than simply the waste sector.

We've noticed:

- **Raw material resource efficiency appears to be improving across the economy -** Since 2000, raw material resource consumption, as measured by both Domestic

Material Consumption (DMC) and Raw Material Consumption (RMC)¹⁵, per unit of GDP has reduced. This suggests that there has been some decoupling of resource use and income generation across the economy. It does not however provide a direct measure of the extent to which UK manufacturers are becoming more resource efficient or using recycled materials in place of raw materials.

Figure 3 – Index values of Raw Material Consumption and Domestic Material Consumption per unit of GDP in constant prices.

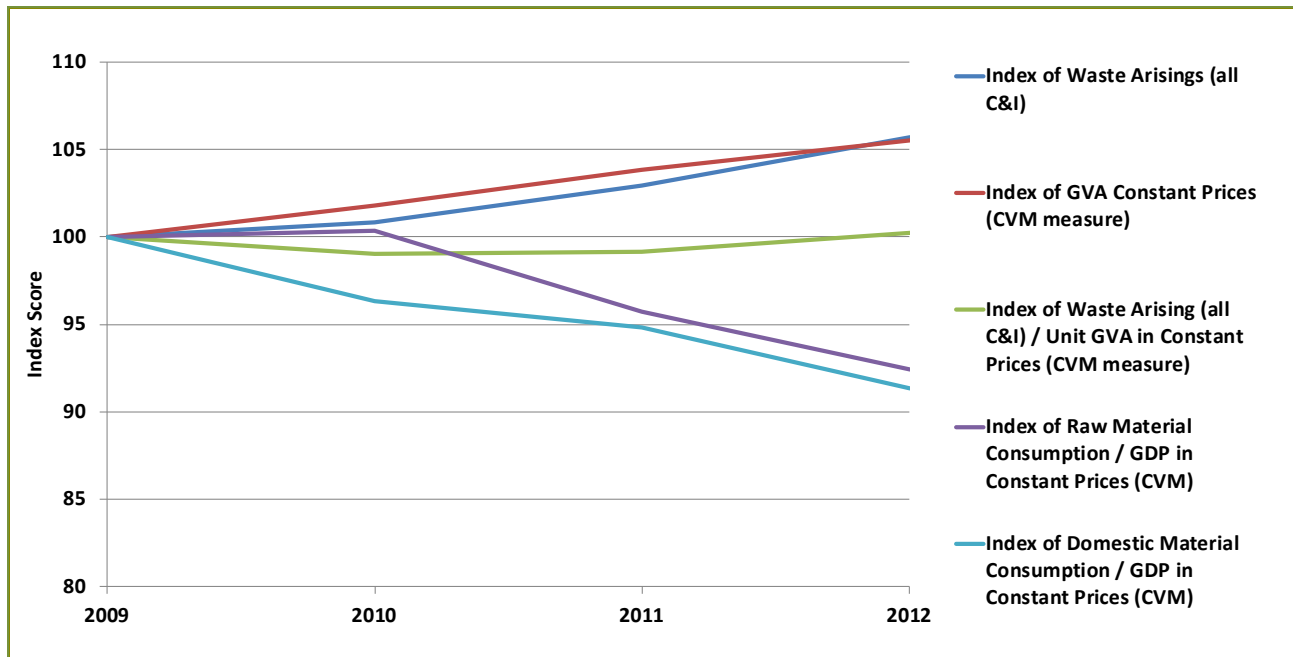


- **Within the Commercial and Industrial sectors between 2009 and 2012 there appears to have been little change in waste efficiency per unit of output. This would suggest that other actions have driven the resource efficiency improvements over that period** - A Defra report previously estimated that in 2009 there were potential material resource efficiency savings worth up to £18bn per annum available to businesses in commercial and industrial sectors through low and no cost actions.
- To assess the extent to which businesses are acting upon these savings we have sought to establish a measure of waste efficiency per unit of output (figure 4 below). Between 2009 and 2012 both GVA and waste arisings for commercial and industrial

¹⁵ **DMC** measures the domestic extraction of material resources in tonnes of gross harvest and ore, plus the weight of goods imported, minus the weight of goods exported. One limitation of DMC is that it doesn't account for material inputs to imported products that are incurred in the production process but do not end up in the final product. **RMC** is designed to overcome some of this issue by converting imports into their Raw Material Equivalents (RME).

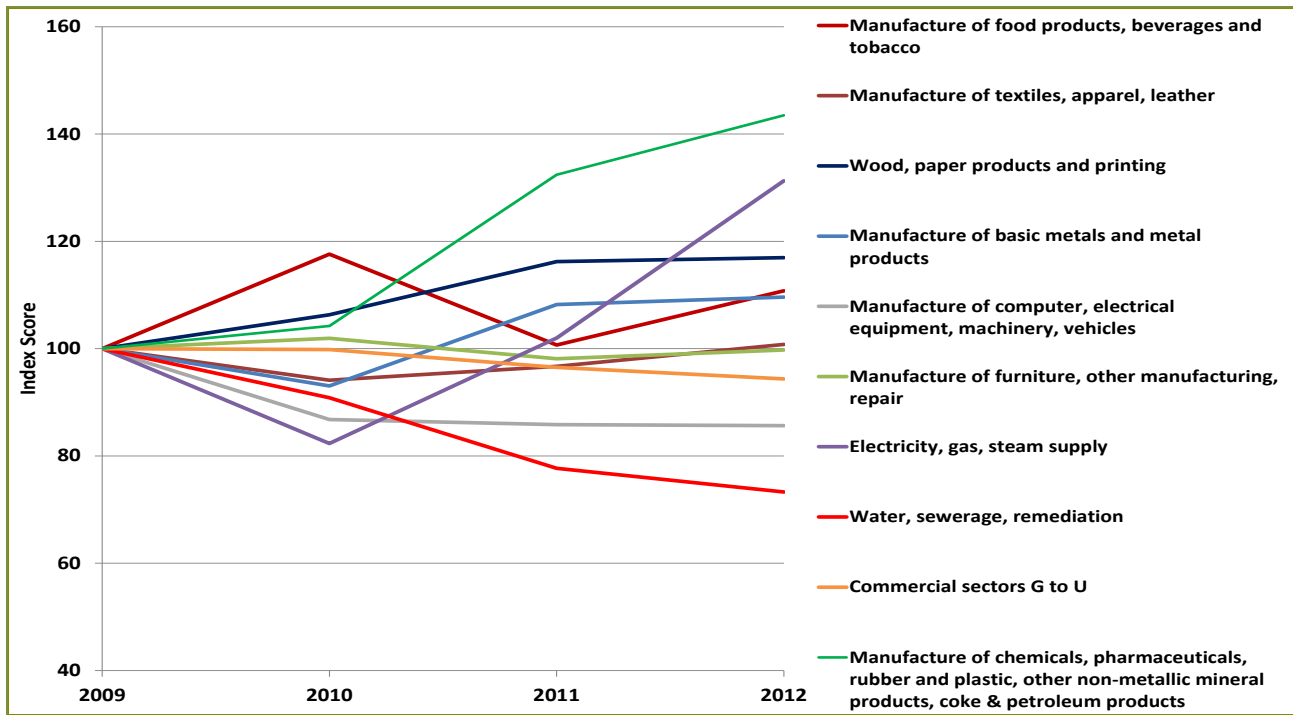
sectors as a whole increased. Initially GVA increased at a faster rate than waste arisings, but by 2012 waste arisings had caught up resulting in no net change in waste per unit of GVA. Over the same period both RMC and DMC per unit of GDP decreased suggesting that other actions, such as more resource efficient goods and services and increased use of recycled materials substituting for virgin materials, have made a greater contribution to resource efficiency.

Figure 4 – Graph comparing index trends in growth of the economy, waste arisings, tonnes of waste per £GVA of the UKs commercial and industrial sectors, and raw material consumed per £GDP generated.



- At a sector level waste efficiency appears to vary significantly, particularly within the chemical and pharmaceutical, energy, coke and petroleum, and water sectors. It is unclear whether this is the result of issues in the calculation methodology, the impact of the recession, or other contributing factors. We would like to explore the value of this metric with the sector further.

Figure 5 – Index of waste per unit of GVA for Commercial and Industrial (C&I) waste¹⁶



Case Study 3 - British Gypsum – Recycling and zero waste to landfill.

In 2014, [British Gypsum](#) recycled 43,809 tonnes of used plasterboard to make new products and recovered 244,796 pallets from customers for re-use. It is currently working towards a target to increase recycling of new construction plasterboard waste to 50% by 2015. In 2013, 25.5% was being recycled.

To help achieve the 50% target, waste plasterboard is collected and returned to site, reprocessed and reintroduced into the plasterboard production cycle. In turn, this significantly reduces the need for raw gypsum from other sources. The initiative has been combined with a zero-waste to landfill target and the application of world class manufacturing production techniques.

2014 was the fourth anniversary of the company achieving zero gypsum waste to landfill. As a result, British Gypsum has avoided paying an estimated £45m in the 4 year period in landfill costs, closed and restored three in-house landfills, and placed plasterboard on a much stronger sustainable footing.

¹⁶ The metric is based on Defra C&I data and UK National Statistics National Accounts Chain Value Metric GVA. Combining the two provides a measure of waste intensity per unit of output at a sectoral level. The Chain Value Metric for GVA has been used as it is adjusted to remove the effects of commodity price inflation, therefore providing a more accurate measure of output.

Case Study 4 - Veolia - Helping businesses understand the value of 'closing the loop'.

Veolia have set up the #livingcircular hub on their website to showcase the very best in circular ideas, projects and innovations. From their work with business, they have produced a range of case studies which demonstrate that by adopting processes which focus on the recovery and transformation of waste, the circular economy delivers value producing quality materials and products that are competitively priced and have a smaller environmental footprint than those made with virgin materials.

- **Through better regulation Defra hopes to help business make further progress on waste prevention by allowing business reduce costs and generate revenue from their waste where it can be used to create quality new products** - By 2014 the Environment Agency had launched 11 new End of Waste Quality Criteria that, by 2020, could help businesses save £139m a year through reduced waste management costs and generate a further £355m a year through the sale of 'new' resource that would otherwise have needed to be disposed of. In total, between 2014/15 and 2020/21, these changes are projected to be worth £3.58bn to businesses.
- **Activities such as repair, re-use and service based consumption that seek to extend the life of products also increase resource efficiency and already make a significant contribution to the economy** – In 2013 repair, resale and leasing activity contributed £35.3bn approximate GVA to the economy¹⁷. The majority of this value was generated through high value products such as motor vehicles (£18.9bn GVA) and machinery and equipment (£13.4bn GVA) where leasing allows easier access or regular upgrades, and where maintenance, repair and eventual resale are anticipated at purchase¹⁸.
- While these markets are relatively mature, new business models are starting to emerge that seek to meet demand in more resource efficient ways. Such approaches include: service based business models that lead to products designed for durability; standardisation of components; ease of disassembly to facilitate upgrading and remanufacture; and low toxicity to allow for biodegradation. For other areas such as repair of personal and household goods (£0.5bn) and the sale of second hand goods in stores (£0.8bn) the contribution was smaller.

¹⁷ UK National Statistics Annual Business Survey. Values quoted are in basic prices. Estimate based on SIC codes 47.79, 95.2, 77.2, 95.1, 33.1, 77.1, 77.3, 45.11/2, 45.2.

¹⁸ In some instances, such as leasing, it is difficult to determine exactly how much of the GVA directly relates to activity that extends the life of products and reduces waste, however it does provide a useful indication of the potential scale of existing activity.

Case study 5 - Rolls Royce – Service based consumption.

Rolls Royce's civil aviation division employs a "Total Care" programme which encourages customers to pay a fee, under a contract, for every hour an engine runs for. In return the company maintains it and replaces it if it breaks down. Services and long-term service agreements account for 47% of total revenues. It provides Rolls Royce with a competitive edge by providing real time data on the functioning of their engines and extending customer relationships as well as adding a powerful incentive on the company to produce durable and efficient engines.

Alongside this Rolls Royce also operates its Revert programme. Over 20,000 tonnes of alloys using materials such as Rhenium, hafnium, tantalum, and titanium are needed to make today's advanced aero engines. Over the past decade, Rolls Royce has developed processes to remove coatings, separate alloys and clean up waste metal so that which can't be remanufactured, can be melted and turned into new aerospace alloys. Through Revert, the company has reduced its demand for raw material, saved energy and avoided emissions of carbon dioxide.

- **Remanufacture presents opportunities for manufacturers and third parties to increase their profits, contribute to GVA and increase resource security.** In 2009 it was estimated that remanufacturing activity in the UK generated approximately £5bn in turnover for UK manufacturers¹⁹, remaining relatively unchanged since 2004²⁰, and accounting for about 1%²¹ of total manufacturing turnover, with some companies, such as Caterpillar, having a well-established operation.
- 'The Next Manufacturing Revolution' report²² estimates suggest that the potential benefit of remanufacturing for 3 key sectors²³ in terms of increased profitability²⁴ could be in the region of £5.6bn-£8bn a year, excluding the initial capital expense required to establish their remanufacturing capability.

¹⁹ Remanufacturing in the UK: A snapshot of the UK remanufacturing industry – 2009 – Page 6. Figure includes the aerospace sector, which accounts for about half of the turnover generated by remanufacturing.

²⁰ Resource Recovery Forum – Remanufacturing in the UK: a significant contributor to sustainable development? - 2004

²¹ Lavery/Pennell - The next Manufacturing Revolution – Non-Labour Resource Productivity and its Potential for UK Manufacturing – Page 78 – based on a turnover of UK manufacturing in 2011 of £512bn.

²² Lavery/Pennell - The next Manufacturing Revolution – Non-Labour Resource Productivity and its Potential for UK Manufacturing – Page 73

²³ Electrical, electronic and optical products; machinery and equipment; transport equipment

²⁴ Measured through EBITA (Earnings before interest, tax, depreciation and amortisation)

- A recent joint report by the All Party Parliamentary Groups for Sustainable Resource and for Manufacturing also identified electrical appliances and white goods, paints and chemicals, post-industrial and pre-consumer textiles, and carpet flooring as additional under developed sectors.

Case study 6 - CAT Reman – Remanufacturing.

Caterpillar is a global company which established its first major facility outside the United States in the UK more than 60 years ago. It now employs 10,000 people in the UK in 20 major facilities. Much of what is produced here is exported to overseas customers. The company has been providing Remanufacturing services for more than 40 years. Last year, worldwide, Cat Reman took back over 2.2 million end-of-life units and remanufactured over 73,000 tonnes of material.

The UK is home to the European headquarters for Cat Reman – its remanufacturing operation – in Shrewsbury where it employs 360 people at its 27,800m² facility. Using extensive remanufacturing technologies, the facility receives engines, transmissions and components from customers and cleans, refurbishes, reassembles and updates them in compliance with exacting quality standards. The site remanufactures thousands of items each year and returns products to the latest performance specification, with a warranty to match.

- **The progression to a more circular economy has the potential to create new jobs that make a net contribution to UK employment** – Economic theory and scenarios developed by WRAP and the Green Alliance show that under a specific set of assumptions, a more circular economy could reduce unemployment by creating jobs in regions at pay grades where there is spare capacity²⁵. There are clearly no guarantees, and new technology or ways of working in the industry could change this, but it is useful to know that jobs in the circular economy need not necessarily crowd out jobs in other parts of the economy.
- Estimates of labour productivity for different repair, re-use and leasing sectors show considerably variation between sectors and between years (2008 to 2012). Some trends are however apparent:
 - The renting and leasing of motor vehicles and the renting and leasing of machinery, equipment and tangible goods have consistently performed above the UK average for labour productivity.
 - The repair of fabricated metal products, machinery and equipment consistently performed close to or above the UK average for labour productivity.

²⁵ Employment and the Circular Economy (2015) - <http://www.wrap.org.uk/content/employment-and-circular-economy>

- The repair of computers and communication equipment and the renting and leasing of personal and household goods varied considerably but in most years perform below the UK average for labour productivity.
- The maintenance and repair of motor vehicles, and the repair of personal and household goods consistently performed below the UK average for labour productivity.
- Labour productivity data specifically for the reprocessing sector was not available, however, the manufacture of plastic products and the manufacture of articles of paper and paperboard sectors consistently performed above the UK average.
- Labour productivity data was also not available for remanufacturing, however, those sectors where remanufacturing has been identified as a potential opportunity for the UK²⁶ appear to consistently perform significantly above the UK average. These include:
 - the manufacture of machinery and equipment; the manufacture of computer, electronic and optical products; and the manufacture of motor vehicles, trailers and semi-trailers; which were significantly above the UK average for labour productivity in most years.
 - the manufacture of electrical equipment which remained close to the national average for labour productivity in most years.

3. Export of goods and services

You've told us that:

"Rapid urbanisation across the globe is representing a real opportunity for waste management companies" - Tom Kenning – MRW - 3 May 2014.

"In the past 10 years, the UK has been the most dynamic marketplace for waste infrastructure across the world". "Our skills are relevant across the world in terms of providing advisory support, business planning and providing technical solutions for improving waste management. The export value for this home grown expertise is enormous – in the many billions of pounds during the next few decades, and one that we should capitalise on". "We are still going through a transition from being landfill-led to infrastructure-led, and I think the skills developed in these transition years are highly

²⁶ Lavery/Pennell - The next Manufacturing Revolution – Non-Labour Resource Productivity and its Potential for UK Manufacturing – Electrical, electronic and optical products; machinery and equipment; transport equipment

relevant and highly exportable" - Alban Forster, Board Director, SLR Consulting – MRW – 3 May 2014

"Foreign spending on recycling equipment is likely to be one of the three fastest growing areas of overseas procurement by 2030, increasing 250%" - Confederation of British Industry.

Economic theory suggests:

- Where a country has a comparative advantage in the production of particular goods or services, exporting those goods/services provides an opportunity to grow the economy in several ways. Exports increase demand into the UK, and help to grow the sector and the economy overall. It also provides resilience against future domestic shocks. In the longer-term exports allow a country to specialise and gain expertise in particular sectors, thereby reaping productivity gains which are one of the major sources of growth.

We've noticed that:

- **Global municipal solid waste is projected to increase by 70% between 2010 and 2025²⁷.** In economic terms, the global market is projected to grow from \$161bn in 2013 to \$297bn in 2020, a compound annual growth rate (CAGR) of 9.2%²⁸.
- **At the same time, globally the scale and pace of progress towards sustainable urbanisation and smart cities is increasing.** Focus is shifting to extracting greater value from resource the development of infrastructure and more efficient and responsive waste management systems.
- Growth in waste arisings are projected to be highest in lower middle income countries with 44% of total increase in global municipal waste arisings occurring in the East Asia and the Pacific region between 2010 and 2025²⁹. Separately, Frost and Sullivan³⁰ also anticipate growth of the Municipal Solid Waste (MSW) service market to be greatest in the Asia-Pacific region where they project a 15.8% compound annual growth rate from 2013 to 2020.

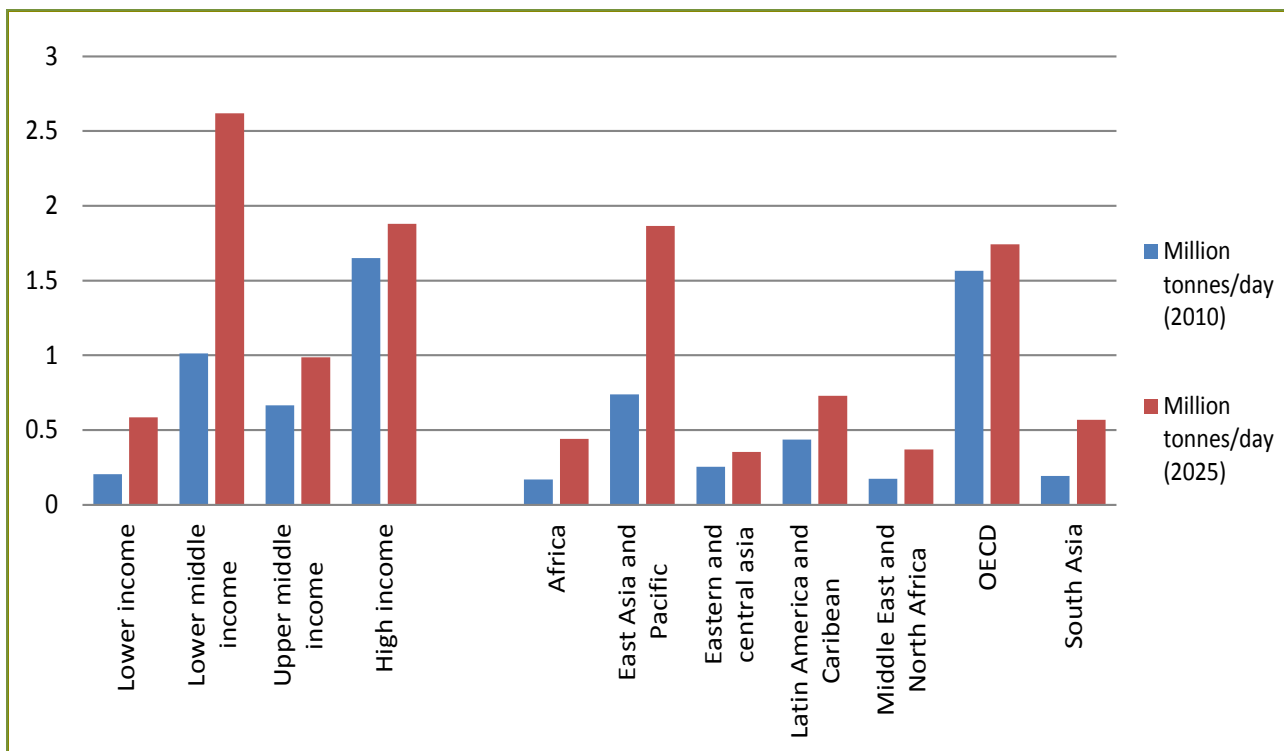
²⁷ World Bank: What a Waste: A Global Review of Solid Waste management

²⁸ Frost and Sullivan – Global Municipal Solid Waste Management Services Market

²⁹ Calculated using data from the 'World Bank: What a Waste: A Global Review of Solid Waste management' report

³⁰ 'Global Municipal Solid Waste Management Services Market' report - 2013

Figure 6 – Growth in Global MSW Arisings³¹ - Data from World Bank report “What a Waste: A Global Review of Solid Waste Management”

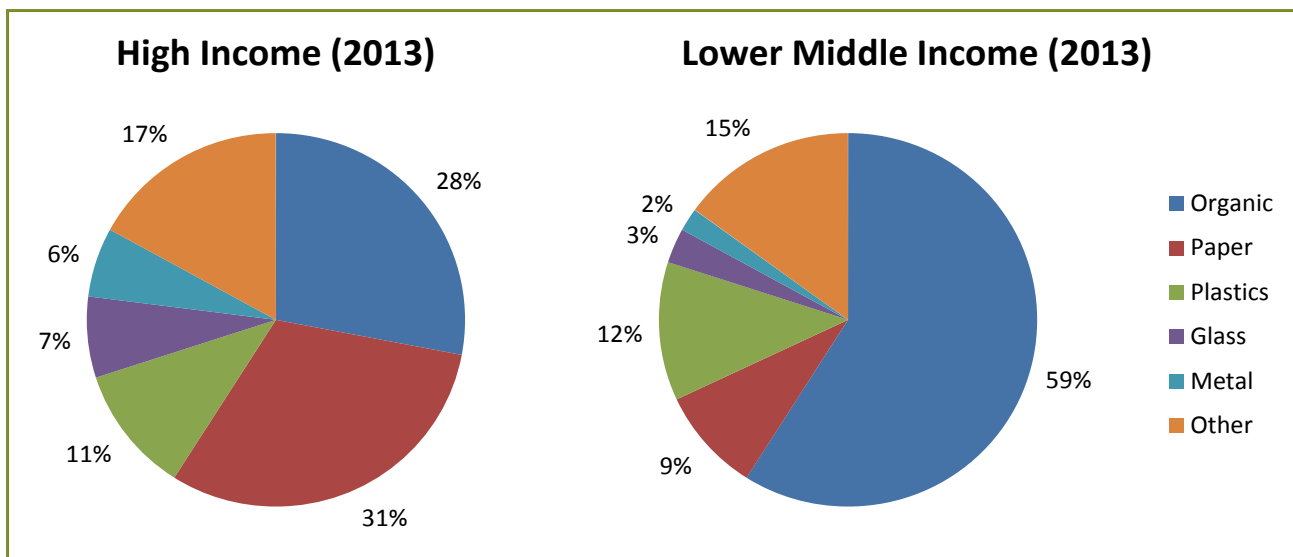


- Lower middle income countries face substantial waste management challenges as they rapidly urbanise. For instance, in China in 2009 it was estimated that only 49% of MSW was collected and that 70% of the waste that was collected was disposed of or burnt in open dump sites³².
- There are also significant differences between the composition of waste in high income and lower middle income economies, with organic waste accounting for a far higher fraction of MSW in lower middle income countries.

³¹ - Data from World Bank report “What a Waste: A Global Review of Solid Waste Management”

³² Waste Atlas – D-Waste – China Country Profile (www.atlas.d-waste.com/index.php?view=country_report&country_id=8)

Figure 7 – Waste composition of High Income and Lower Middle Income Countries³³



- The global market for managing commercial and industrial waste** is also projected to grow significantly from \$387bn in 2013 to \$750bn in 2020, a Compound Annual Growth Rate (CAGR) of 9.9%³⁴. Collection and sorting is projected to remain the largest market segment by 2020 worth \$278.10 billion (CAGR of 9.3%). Strongest growth is projected in the recycling market which is projected to be worth \$173.57 by 2020 (CAGR of 10.8%), overtaking landfill (8.3% CAGR) as the second largest sector (by value) by 2020
- UK expertise appears well matched to these growth opportunities** - The UK already exports a range of waste goods and services with provisional estimates suggesting these to be worth several hundreds of millions of pounds³⁵. With UK expertise in policy and strategy development, civil engineering, landfill remediation and management and our recent advances in anaerobic digestion and mixed recycling sorting technologies there would appear to be a good match between UK capability and global opportunities. Increasing UK exports further is part of the 2020 export drive, a partnership between Government and Business.
- Defra and government partners such as UK Trade and Investment (UKTI) get regular requests from both developed countries interested in UK innovation and lower middle income countries keen to learn about the UK's rapid transition from landfill to recycling and energy recovery and the capability of UK business to help them in their own transition.

³³ Data from World Bank report - What a Waste: A Global Review of Solid Waste Management, Page 20

³⁴ Frost and Sullivan – Global Industrial Waste Management Services Market - 2014

³⁵ BIS will publish a report assessing the size and performance of the low carbon economy, including exports, early in 2015.

Case study 7 - SLR Group - Export of waste resource management consultancy services.

The SLR Group is a UK owned company operating globally across the environmental sector. SLR has 350 UK based consultants working with another 750 staff: operating in Africa; the Americas; Asia-Pacific; and, Europe. Their international revenue has grown proportionally from 25% of their business in 2006 to 75% today. Within the waste resource management sector SLR UK has a number of active international projects including: supporting Durban, South Africa in the design, procurement and construction of landfill extraction systems with 7.5MW electricity generation; supporting the European Bank for Reconstruction and Development (EBRD) in reviewing the Al Glabawi landfill site in Amman, Jordan, one of the largest engineered containment landfills in Africa with remaining capacity to 2032, and undertaking a financial and economic appraisal of the investment; and supporting the procurement of Malaysia's first modern 350ktpa EFW in Kuala Lumpur, delivered through Public Private Partnership.

Case study 8 - Ricardo AEA - Export of waste resource management consultancy services.

Ricardo-AEA is an environmental consultancy with more than 400 employees headquartered in Oxfordshire, specialising in waste and resource management, air quality, climate change, sustainable transportation and energy. The international market has been key to Ricardo-AEA's growth in the last three years with projects in more than 40 countries - including India, China, Vietnam, Saudi Arabia, Turkey, South Africa, Kenya, Ethiopia and Latin America - and international revenues in 2014 up by more than 100% year on year.

Examples of Ricardo-AEA's international waste resource management projects include: development of a comprehensive waste management strategy for Saudi Arabia's capital city Riyadh; transaction advisor to the City of Johannesburg on Waste to Energy Public Private Partnership; and an energy from waste technology and policy review for Zero Waste South Australia.

Next steps

Developing this analysis has prompted us to take a fresh look at the sectors contribution to wider economic growth, now and in the future. It highlights that key figures and trends suggest:

- 1) The sector already makes a significant contribution to the economy and is finding new ways to extract greater value from waste;
- 2) The wider economy is becoming increasingly resource efficient; and,
- 3) Significant opportunities remain for businesses and the wider economy as we transition to a more circular economy.

We intend to discuss this analysis with key sector bodies to hear their views on:

- Whether this analysis captures the breadth of the sectors current contribution and the opportunities moving forward.
- Whether other evidence exists that strengthens the case for further action.
- The actions that sector bodies and their members are planning to capitalise on these developments.

We also propose working with key sector bodies to:

- Raise awareness of global export opportunities, better understand the extent to which UK companies with waste and resource management solutions are looking to act upon them, and discuss the respective roles of sector bodies, UKTI, BIS and Defra in helping them do so.
- Explore the drivers of value creation at each rung of the hierarchy and how these are likely to change over time to help strengthen our understanding of the extent to which the market is likely to continue to deliver increases in productivity.
- Explore the opportunities presented by emerging technologies (e.g. bio-economy), how these compare to established technology and approaches, and the timescales within which the technology may become commercially viable.