

# Wasted opportunities: Smarter systems for resource recovery

A report from the Circular Economy  
Task Force



**green  
alliance...**



# **Wasted opportunities: smarter systems for resource recovery**

## **A report from the Circular Economy Task Force**

By Dustin Benton and Jonny Hazell

### **Green Alliance**

Green Alliance is a charity and independent think tank focused on ambitious leadership for the environment. We have a 35 year track record of working with the most influential leaders from the NGO, business, and political communities. Our work generates new thinking and dialogue, and has increased political action and support for environmental solutions in the UK.

### **Acknowledgements**

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# The Circular Economy Task Force

This is the second report of the Circular Economy Task Force, a business led group convened by Green Alliance. It is a forum for policy innovation which aims to disseminate information and recommendations on the best responses to sustainable resource security.



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# Preface



**Julie Hill**

**Chair of the Circular Economy  
Task Force**

This report marks the end of year two for the Circular Economy Task Force. At the end of year one, we drew the roadmap for a circular economy in *Resource resilient UK*, giving a series of actions for businesses and the government that would yield real progress. We also explained the risks of not acting.

The past year has seen positive signals. Alongside the task force members, we have talked to businesses that are ever keener to take up the idea and make the circular economy part of their values and their business model. With them are policy makers in Brussels, Edinburgh and Cardiff, talking of ambitious targets and policy support. In Westminster, enlightened politicians from all parties are beginning to explore the concept and seeking to incorporate the ambition to be more circular into their manifestos.

But against this positive trend is the beleaguered Department for the Environment Food and Rural Affairs, with little resource or central government encouragement to be the driver of the circular economy, and the Department for Business Innovation and Skills and the Treasury have yet to fully take on board the scale of the opportunity. Local authorities are stuck in an institutional model that has them still dealing with ‘waste’ rather than empowered to reap the value of resources, and unable to return that value to their citizens in any significant way. A false separation between household and business waste, the latter being at least nine times the volume of the former, hampers effective capture of valuable products and materials. And the structure of what little recovery incentive we have allows materials to flow abroad, bypassing what could be vibrant domestic industries.

We need a shake up. In this report, we have asked ‘What if?’ What if we see all waste as potential resource, no matter who generates it? What if we approach value capture as starting, not ending, with the reprocessors: the businesses that can return products and materials to productive use? What if we design collection and sorting according to their needs, not according to the outdated system that has grown out of a public duty to dispose of unwanted items, disregarding their value? What if we set out to achieve a circular economy?

We’ve examined the mismatch between the materials systems we currently have and how a circular system of the future might work, to show how the design of our system is blocking better outcomes. And we’ve identified how better materials loops can form the basis for higher value remanufacturing and reuse. This isn’t a precise prediction about how a circular economy would work, but it sets some guidelines for business and government for redesigning the system.

Those who have already bought into the idea of a more circular future, including the task force’s members, will help to lead that effort. I am confident that, as the election approaches, these opportunities will look far more attractive than business as usual.

# Executive summary

**British recycling policy is based on outdated assumptions about resources, which reinforce an expensive, stagnating system: recycling rates were up just 0.2 per cent between 2012 and 2013. In contrast, a circular approach, focused on preserving the value of collected materials, could enable the private sector to deliver £2 billion of investment in recovery infrastructure, capturing £1.7 billion in material and reuse value each year.**

We can't ignore the poor outcomes that result from our existing recovery systems: less than half of our waste is recycled despite manufacturers' demand for recycled materials, including amongst members of the Circular Economy Task Force. Much that is recycled is downcycled into less useful, lower value products. The result is that councils are spending more on waste management than housing or planning, while valuable raw materials are lost and businesses are left frustrated by a lack of usable recycled materials.

The problem is structural. At a local level, decisions about recovery systems have been based on arbitrary political boundaries and made by councils not focused on material value. At a national level, a lack of central government strategy and common standards reinforce our wasteful system, rather than helping to resolve its inefficiencies. Pressures on council funding mean poor outcomes are likely to be entrenched, undermining existing recycling and new opportunities to reuse and remanufacture.

Addressing this structural problem requires a shift in thinking: resource recovery should be based on preserving material value so that existing demand for high value recycle and recovered parts can justify investment in reprocessing infrastructure. In practice, this means that collection and processing systems need to operate at a suitable scale to meet the needs of high quality reprocessors and remanufacturers.

We show that for some materials, like biowaste, a single council area is the right scale for operations. Central government could increase investment by raising recycling targets or implementing landfill bans with separate biowaste collections.

But for materials like plastics and waste electronics, collaboration across many local authorities, using materials from both municipal and commercial collections is needed to provide UK refurbishers and reprocessors with a secure supply of quality feedstock.

Smarter and wealthier local authorities are beginning to collaborate, but most only do so to cut administrative costs rather than to improve the value of the materials recovered. Waste companies don't have enough control over materials to create better systems, even where they can see the opportunities to do so.

Central government has a choice in how it can help. It could empower bottom-up collaboration between entrepreneurial councils by creating a £250 million challenge fund for circular infrastructure. This is the same amount found by the Department for Communities and Local Government to encourage wasteful weekly residual bin collections. A fund would enable councils to design their systems together, so that sufficient high quality materials become available to justify private sector investment in recycling and remanufacturing facilities. These could include businesses like closed loop plastics factories; AD plants, which benefit from feedstock co-ordination; and waste electronics (WEEE) refurbishers.

Alternatively, as part of its national infrastructure plans, the government could assess the infrastructure necessary to process materials like plastics and waste electronics at an economy-wide scale and set common collection standards for councils.

Either approach would address the structural factors blocking a more circular economy for materials; support businesses which are demanding recycled materials; and capture more of the billions of wasted value lost in the current system.

# Wasted opportunities

**“Just 30 per cent of plastic packaging is collected for recycling, two thirds of which is exported for reprocessing overseas.”**

Maximising resource value is best achieved by extending the useful life of products through resale, repair, and refurbishment: such high value activities underpin the transformational promise of a circular economy. These opportunities demand major shifts in business practice and governance. But the circular economy also encompasses more incremental, readily achievable gains, primarily through better collection systems and closed loop reprocessing.<sup>1</sup>

This report, the second from the Circular Economy Task Force, takes a closer look at the immediate opportunities available to the UK. It focuses on maximising the value of end of life products and materials by turning them into a useful input for manufacturing, and shows how interventions which improve the UK's recycling system can also enable higher value remanufacturing and reuse.

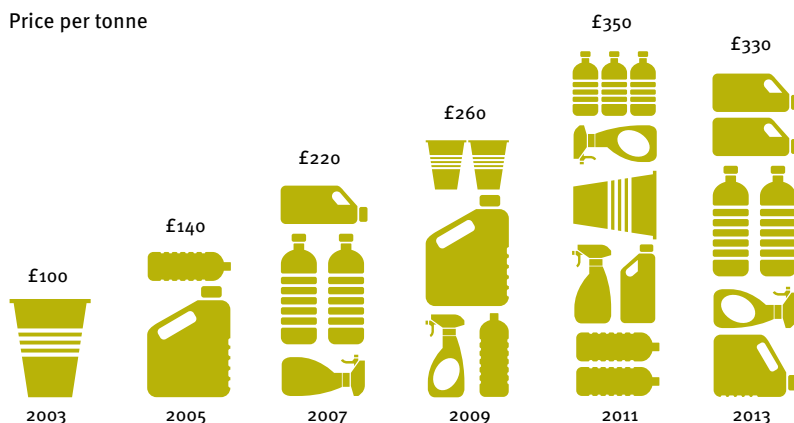
## Recycling systems are based on the wrong assumptions

The UK's resource management systems were never designed for a circular economy. Instead, they evolved from arrangements to transport waste to landfill that have two main characteristics. First, they were led by local authorities who based collections on their geography, rather than that of material flows. Second, the focus was on minimising transport costs rather than a concern for the quality of the materials transported. Retrofitting recycling onto these systems has delivered limited gains: just 30 per cent of plastic packaging is collected for recycling, two thirds of which is exported for reprocessing overseas. For waste electronics, just two per cent is reused, even though 23 per cent is suitable for reuse.<sup>2</sup>

The characteristics of landfill based systems are now impeding more circular resource flows in the UK. Unlike landfills, much of the infrastructure able to capture value from waste demands material from multiple local authorities. And maximising value is now more important than reducing collection cost: disposal to landfill costs around £100 per tonne, whilst some waste streams are now worth £300 per tonne.

## The rising value of plastic recyclate

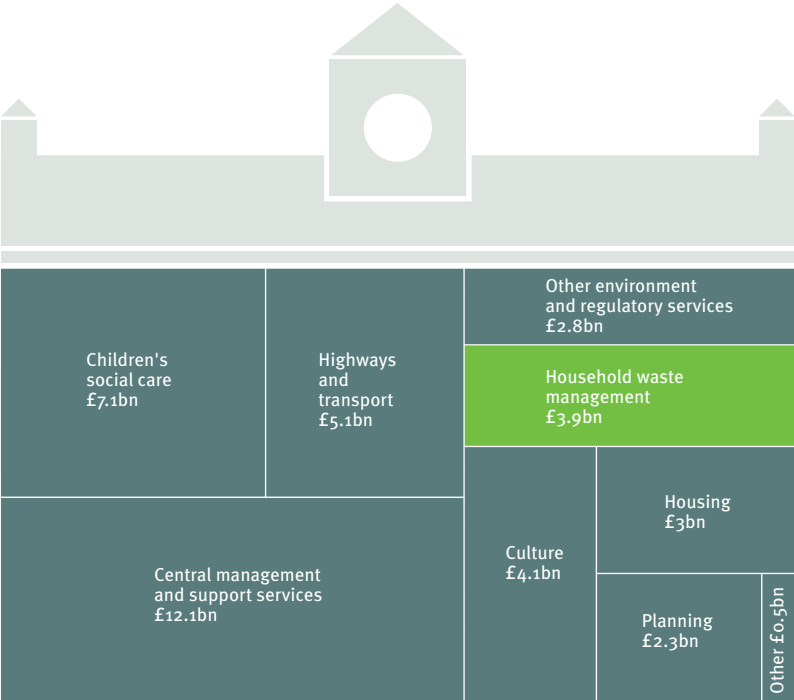
Price per tonne



“£1.7 billion worth of plastics, food and electronics is lost to the economy.”

In Wales, the value captured from redesigning collection to deliver high quality materials in three local authority areas has reduced the net cost of recycling by two thirds.<sup>3</sup> This is vitally important when the total amount spent by local authorities in the UK on waste is more than that spent on planning or housing.<sup>4</sup> Even a more modest reduction in cost, bringing the highest spending councils down to the median spending level, would save £464 million per year, according to the Audit Commission.<sup>5</sup>

Total spent on waste by local authorities compared to other areas



To capture value from waste, high quality recovered materials have to be delivered at sufficient quantity and quality to reprocessing facilities. But there are 376 waste collection authorities across the UK: the organisation and scale of their collection and management activities is almost wholly unrelated to the quality and optimal flows of the materials they manage.

Uncertainty over the availability of feedstock means fewer reprocessing facilities are built than there is feedstock for. This creates a vicious circle: reprocessors aren't building infrastructure because feedstock isn't reliably available at scale; councils and waste companies don't ensure the quality and consistency of recovered materials, because there isn't sufficient infrastructure for reprocessing; and manufacturers, which could use the recycled content, are forced to go elsewhere for raw materials.

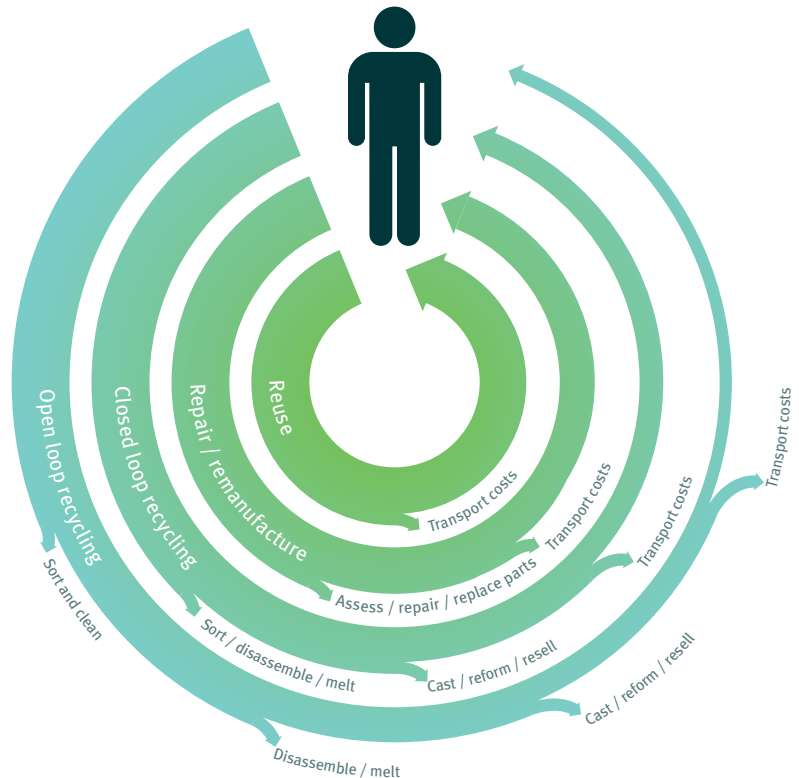
The result is that £1.7 billion worth of plastics, food and electronics is lost to the economy. If all this value could be captured by local authorities, council tax could be reduced by £61 a year per household.<sup>6</sup>



## What would a better system look like?

The goal of a better system should be to preserve the value of materials and products by capturing and managing them in such a way as to retain as much of their original function as possible.

### Where resource value is lost



Different materials need to be transported and processed at different scales to maximise their value. Capturing the most value almost always means supplying uncontaminated materials or products to reprocessing plants, which can turn them back into high quality products. Collection systems may need to vary to take account of local needs, including different housing densities, but they should deliver the same outcomes.

The following analysis of three major waste streams – electronics, plastics and food – shows how a smarter system can get the most from today's wasted resources.

# Electronics

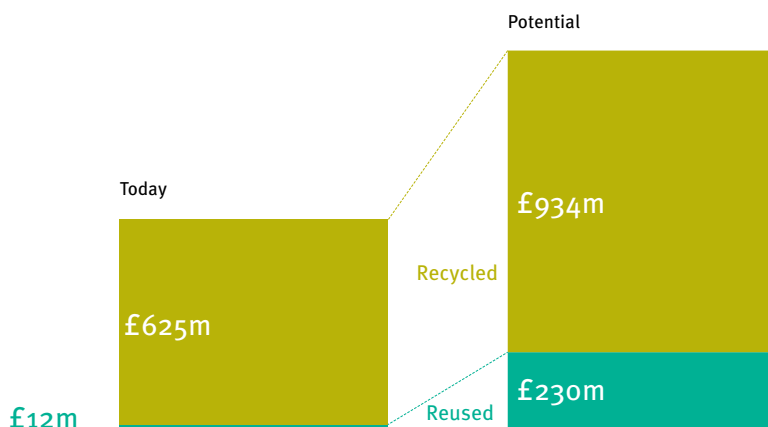
The UK could support eight to 16 generalist waste electronics (WEEE) recyclers recovering raw material value, as well as 50-200 reuse-focused reprocessors specialising in particular appliance types which would draw on a wider geographic area. This implies regional scale collaboration.

At present, the UK has plenty of capacity to shred WEEE. But the generalist recyclers we envisage would assess items for reuse potential, and separate those which are suited to reuse or disassembly to maximise recycling value, rather than simply shredding them.

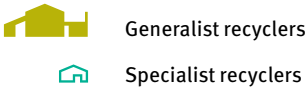
Getting this right would mean capturing £500 million more per year from better reuse and recycling of waste electronics that would otherwise end up in landfill. About half of this value is from reuse, which is where the largest increase in value can be captured.<sup>7</sup>

The biggest barrier to realising the value in discarded electronics is the current system's inability to organise careful collection and delivery to a facility that can effectively separate high value reusable or repairable products from those that must be recycled. Indeed, current systems render most electronics only suitable for recycling: the three foot fall onto the steel floor of a recycling bank destroys the reuse value of all but the most robust electricals, as does the practice of leaving them outside for collection exposed to damp and dirt.

**Better electronics recovery systems would increase the value captured**



**The UK could support eight to 16 generalist waste electronics recyclers recovering raw material value, as well as 50-200 reuse-focused reproprocessors specialising in particular appliance types**



# Plastics

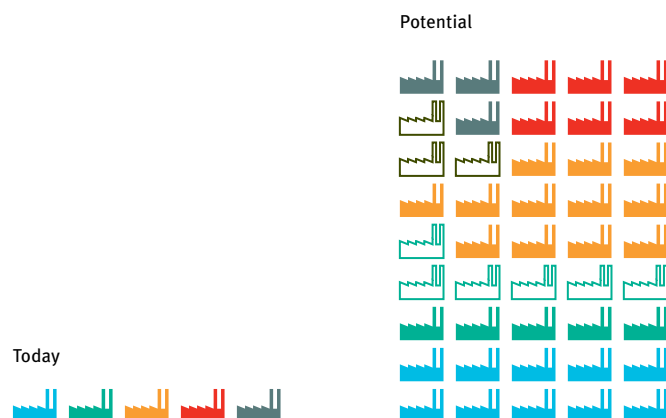
The UK could support around 45 high quality, closed loop plastics recyclers, up from the five that operate in the UK today. These would be made up of five to eight plants for each polymer type and format, eg bottles, clingfilm, trays etc, implying that each plant would have to draw on efficiently separated materials arising from a wide region. In addition to these highest quality recyclers, there is enough feedstock which is not immediately separable into pure material streams to support around 25 recyclers producing downcycled, but still valuable, plastics.

Taken together, this shift in provision would mean additional investment of around £850 million in circular economy infrastructure. This infrastructure could recover over £900 million a year in additional value from recycled plastic that would otherwise have been exported, incinerated or sent to landfill.<sup>8</sup>

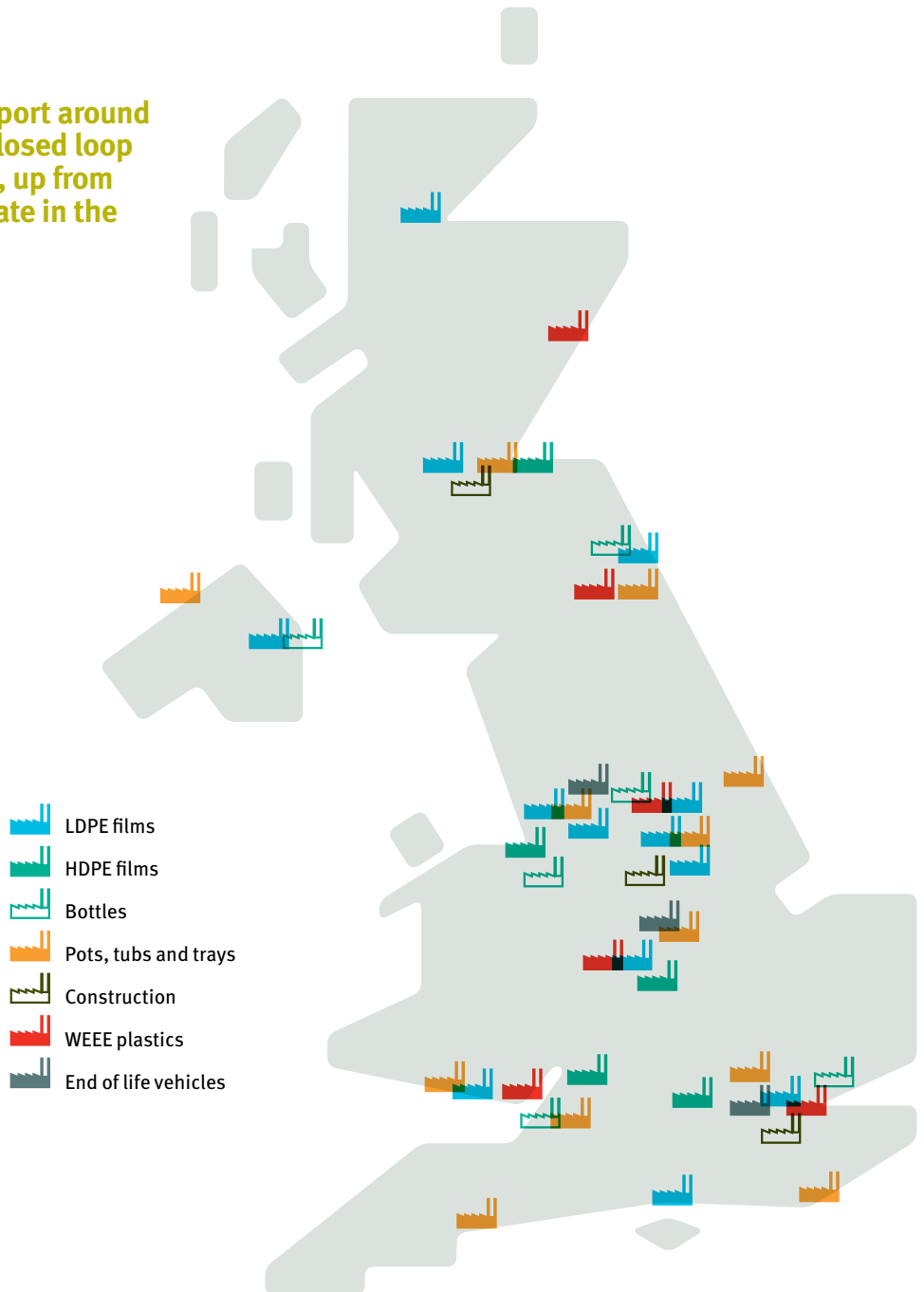
The majority of plastic feedstock flows through council organised systems, meaning that local authority decisions, particularly on which polymers are separated and to what level of purity, determine the economic viability of the whole system.

Local authorities could recover more value by helping to create recycled plastics which manufacturers can use in place of virgin plastics. Doing so would mean improving separation requirements and working across borders to ensure enough feedstock for reprocessors. Removing the artificial divide between household and commercial waste streams would also improve access to feedstock.

## Smarter policy could increase the number of UK plastics reprocessors

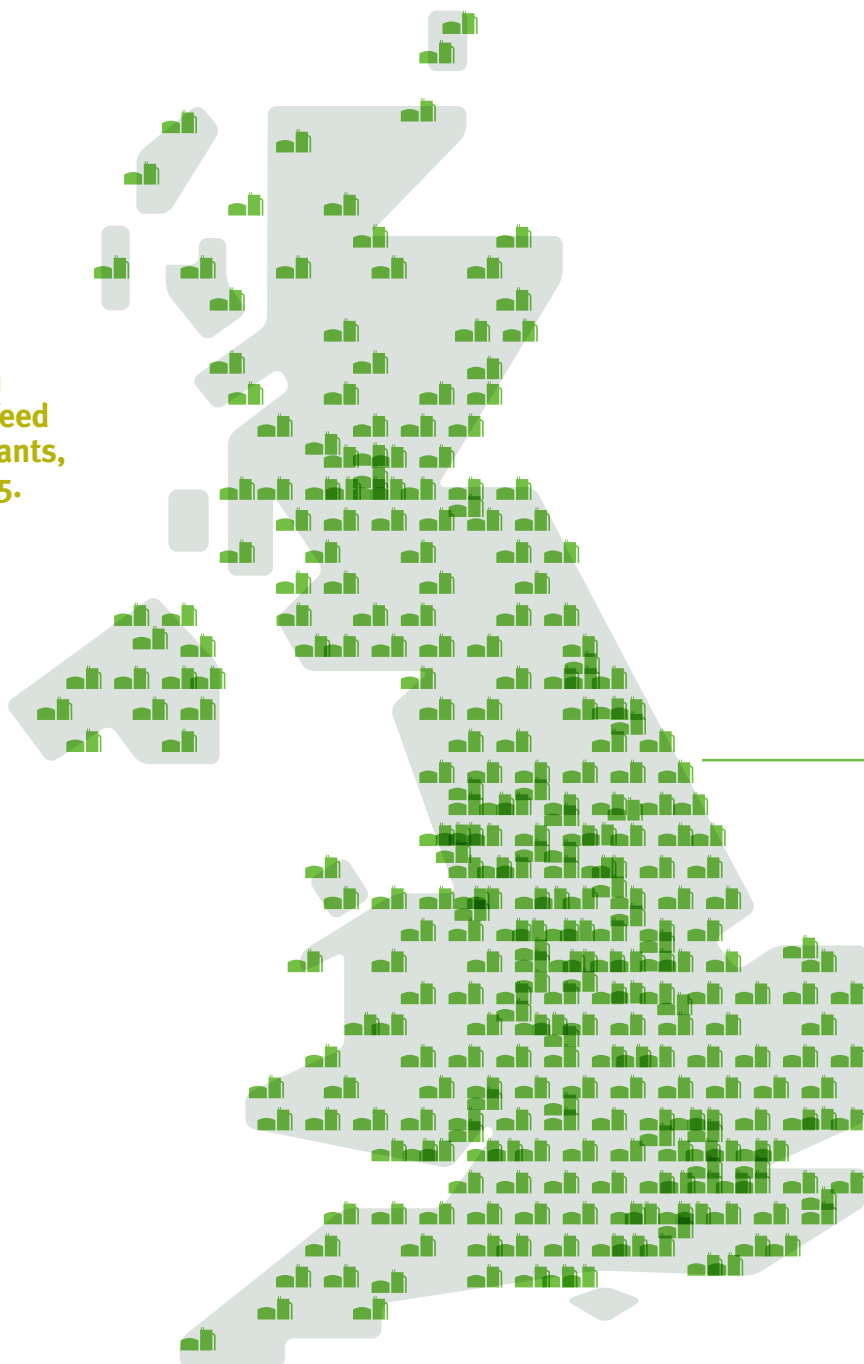


**The UK could support around 45 high quality, closed loop plastics recyclers, up from the five that operate in the UK today.**



# Food

The UK produces enough biodegradable waste to feed approximately 500 AD plants, but currently only has 135.



Unlike electronics and plastics, anaerobic digestion (AD) can be managed at the local authority scale. The UK currently has 135 AD plants but produces enough biodegradable waste to feed approximately 500.<sup>9</sup> The size of each of these plants fits well with the amount of material generated by households and businesses in each local authority, meaning that local authorities would not necessarily need to collaborate. However, local authorities need to separate biowaste from the main waste stream and prevent it from going to landfill.

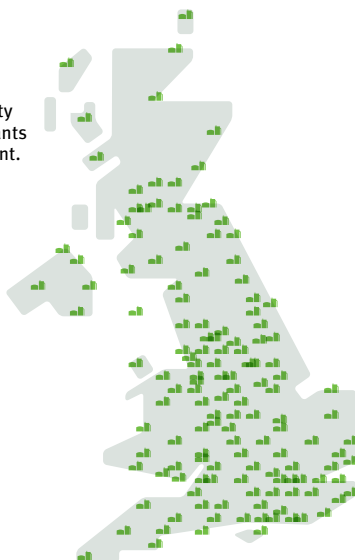
Capturing all the biodegradable waste that now goes to landfill and using it as feedstock for AD would mean the UK could hit its national AD ambitions using waste alone,<sup>10</sup> and earn at least £140 million from currently unexploited biogas each year. But, with business as usual, only 14 per cent of landfilled biowaste is being captured at a quality suitable for AD.

If the food waste collection system doesn't improve, the UK AD sector has a choice: it could just forego the opportunity to build the additional 120-280 plants which could process all the currently landfilled biowaste, accepting that there is a lack of suitable feedstock. But this would forego a potential £1.2 billion in investment.

Or the sector could build the AD facilities required to meet the target and expand the use of energy crops as feedstock instead. But, if this were the case, it would be necessary to plant an additional 60,000 to 270,000 hectares of energy crops, equivalent to up to nine times the area of Greater London. This would be a high price to pay in land use terms, given competing pressures for agricultural land and the potential for habitat loss. There is also growing evidence that maize, the preferred energy crop for AD, may significantly increase flood risk due to rainfall run off.<sup>11</sup>

The UK could forego the opportunity to build the additional 120-280 plants – and lose £1.2 billion of investment.

Or the sector could invest in more AD and expand the use of energy crops as feedstock instead. This would require an additional 60,000 to 270,000 hectares of energy crops, equivalent to up to nine times the area of Greater London.



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# Why don't we have a better system already?

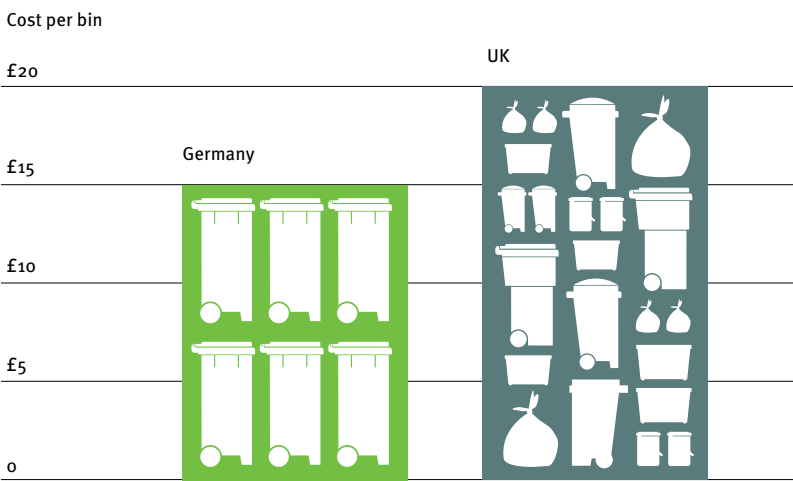
Five factors are keeping market demand for recycle and reused goods from stimulating investment in good quality reprocessing plants.

## Superficial localism

Devolving power and making councils accountable to their citizens is surely a good thing. But insisting on local difference without sufficient information about where this creates perverse outcomes means citizens cannot hold politicians to account. Two examples, outlined below, highlight where localism in resource management is problematic.

In Germany, all bins are the same. The high volume makes the unit cost cheap. In the UK, few local authorities jointly purchase bins, and many insist on expressing local preferences through bin colour, embossed logos and the like. But the lack of joint procurement means each UK bin costs £5 more than a German bin.<sup>12</sup> Across the UK, this means the UK has spent £200 million more than it needed to, just on buying bins.<sup>13</sup>

## Standardising bins and purchasing would save £5 per bin



Similarly, some local authority contracts require new processing infrastructure to be built within their local area, ignoring spare capacity in neighbouring areas.<sup>14</sup> This means that the total cost of recycling is higher as existing assets are used inefficiently.

## Split incentives

Central government policy creates two types of split incentive which impede better recovery.

First, collection authorities pay for collection, but may not benefit from the value of recovered materials. This encourages collection cost savings, even if cheaper collection means valuable materials are lost, as the costs are borne by separate disposal authorities.



Second, the separation of municipal and commercial waste creates two parallel systems dealing with the same raw materials, encouraging unnecessary duplication.

### **Lack of central government strategy**

A lack of central government strategy has sent mixed messages to local authorities, waste companies and reprocessors. The Department for Communities and Local Government has promoted and funded more expensive weekly collections for residual waste. At the same time, the Treasury has trimmed grants to councils. Alongside efforts to limit council tax rises, spending is set to fall by nearly 30 per cent in real terms between 2008 and 2015.<sup>15</sup> This has reduced the ability of industry and local government to plan effectively.

### **Misplaced competition**

Waste companies compete fiercely on projects, driving down the cost of infrastructure. But the project specification is set by authorities thinking about waste within their boundaries, not the total value of the system, including the value of materials.

A more effective approach would encourage companies to compete at the system level, rather than on individual projects. But no local authority or waste company has enough control to deliver a more systemic approach for materials which would be better processed at a larger scale. This means that the value of materials recovered through better quality recycling, remanufacturing and reuse systems is not fully factored into competing bids for resource management services.

### **Risk aversion**

Capturing the value of materials exposes councils to volatile raw and secondary material markets for long contract periods, adding uncertainty to the forecasting of council revenues and expenses. Concerns about price volatility have led councils to favour contracts with higher but known costs over contracts which should have lower costs because more material value is captured, but where resource prices fluctuate. This limits the possibility of funding shortfalls but locks in lower value recovery.

Budget cuts entrench these problems. Cuts could be a catalyst for a shake up in resource management. But on their own they are more likely to entrench a poor system. This is because they make local authorities more risk averse and don't address any of the other factors outlined above. The result is that valuable materials will continue to be lost. This means councils lose out on material value, waste companies can't recycle efficiently and manufacturers can't source recycled material reliably. To accelerate the creation of a more productive circular economy, a smarter way of organising the system is needed.

# How to create a better system

Central government can help councils to resolve many of the factors preventing a better system from emerging. The most important action would be to plan recovery systems so they feed high value reprocessing at an economic scale. There are two ways of achieving this:

## **Option 1: Create a £250 million challenge fund for recovery infrastructure**

This would support three actions:

- 1. Cross boundary assessments** of municipal, commercial and industrial waste arisings to understand the feedstock potential for high quality recovery facilities: closed loop plastics factories, AD plants, WEEE refurbishers etc. This analysis could be done by local authority officers or waste companies, with support from organisations like WRAP.
- 2. Funding staff to broker agreements** across local authority boundaries and work with waste companies to deliver quality material to reprocessors in a way that maximises value through reuse and high quality recycling. Strategy and collaboration are being squeezed as budgets are cut, leading to poor procurement and collection decisions.
- 3. A seed fund for a financial stability mechanism.** As revenue from selling better quality recyclables becomes a larger proportion of council budgets, a fund which stabilises the peaks and troughs in revenue would address market price volatility concerns.<sup>16</sup>

## **Option 2: Designate some materials and associated infrastructure as nationally significant**

As part of its infrastructure planning process, for materials like plastics and WEEE that are likely to require wider than local collaboration, the government could assess the need for reprocessing infrastructure and set associated collection standards nationally. This process might mirror the actions set out in option one above but the outcome would be more uniform. As part of this process, the government should remove the arbitrary divide between commercial and municipal waste and copy the Danish system, which collects the same materials from both commercial organisations and households.<sup>17</sup>

A less centralised version of this option could focus only on the collection of certain goods. For example, it is clear that the biggest barrier to the reuse of waste electronics is poor collection. Subjecting online retailers to the same take back requirements as shops could kickstart better quality collection, without requiring a national system for all materials. This would mean take back through doorstep collection, via services like Collect+ or Amazon Locker, or via post offices, rather than the requirement simply to fund generic collection schemes. Japan has implemented a similar system, which captures 72 per cent of WEEE, compared to the UK's 32 per cent.<sup>18</sup>

**“The government should remove the arbitrary divide between commercial and municipal waste and copy the Danish system.”**

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### **Better systems in action**

Smart local authorities are already collaborating, with over 50 waste partnerships currently in operation. But they have largely focused on cost reductions in tendering and back office functions rather than increasing the value of materials recovered for reuse and recycling. There may be limited scope for further efficiency savings as the “labour costs [of collection] have been contained well below inflation levels reflecting the freeze on local government pay.”<sup>20</sup>

#### **Hampshire is getting more value from waste**

In contrast, Hampshire’s Project Integra is trying to increase the value of recovered materials. It is a partnership between the county council, Hampshire’s 13 district, borough and unitary authorities, and the waste management contractor Veolia. The partnership assessed municipal and commercial materials arisings; it set common collection standards to ensure consistency of materials supplied to the county’s material recovery facilities. This has helped to develop economies of scale, improve the quality of the materials collected and achieve a higher price for recycle.

#### **Wales has effective collaboration**

On a larger scale, Wales, the highest performing UK country in terms of recycling, already has a set of regional waste partnerships that enable collaboration on infrastructure development and efficiencies in procurement and service delivery.

These examples show that better systems already exist. What’s needed is for more companies and local authorities to take up this approach.

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### **Reinforcing recommendations**

In addition to addressing structural problems the government could stimulate further demand for recycled, remanufactured and reused products. This would reinforce its structural reforms and enable the private sector to build on them and move on to the more transformative circular opportunities which require R&D and redesign.

#### **Encourage reprocessing and recycled content through producer responsibility reform**

For plastics, government could help to align incentives across the whole supply chain by incentivising manufacturers to use recycled content in their products. This could be achieved by offsetting the use of recycled plastic against producers’ packaging waste obligations, boosting demand for products produced by high quality recyclers. This move would also encourage the kind of supply chain collaboration that would improve the whole plastic packaging system and make it more circular, for example through investment in R&D for more recyclable materials, improved product design for recyclability and more public-private collaboration on household engagement campaigns.

### **Incentivise better design for electronic and electrical products**

Changing the way electronic and electrical products are designed would help to facilitate more high value, reuse-focused reprocessing. The government can do this in three ways:

- it could ensure electronic and electrical products are designed to be easily refurbished, to salvage parts from, or to disassemble for higher value recycling through EU ecodesign regulations;
- it should follow the advice of its own advisory group on the WEEE directive and weight manufacturers' WEEE obligations according to the reparability or recyclability of their products;<sup>19</sup>
- it could further reinforce recoverability by including design standards in government procurement requirements.

### **Conclusion**

Addressing the structural barriers to high value recycling is the first step in moving the UK to a more circular economy. Once these barriers are removed, existing technology and business practices could very rapidly raise the UK's stagnating recycling rates. Improving collection systems so reprocessors can preserve the value in materials and products would provide a path, beyond high volume but low value recycling, towards high value reuse and remanufacturing.

# Endnotes

- <sup>1</sup> By closed loop, we mean that materials of sufficient quality are recovered to be used in the same type of product they came from, or that components or whole products are recovered in a way that enables them to be reused.
- <sup>2</sup> Based on analysis by WRAP of the reuse potential of WEEE presented at Household Waste Recycling Centres, [www.wrap.org.uk/sites/files/wrap/WRAP%20WEEE%20HWRC%20summary%20report.pdf](http://www.wrap.org.uk/sites/files/wrap/WRAP%20WEEE%20HWRC%20summary%20report.pdf)
- <sup>3</sup> Based on Russell Owens' presentation, [www.brysonrecycling.org/PDFs/WheelieBoxResultsReactions2014Presentation.pdf](http://www.brysonrecycling.org/PDFs/WheelieBoxResultsReactions2014Presentation.pdf). Savings cover urban and suburban authorities, with some rural areas.
- <sup>4</sup> Data from: Audit Commission, 2014 *Local authority waste management*, [www.audit-commission.gov.uk/wp-content/uploads/2014/03/Waste-vfm-briefing-26-March-FINAL.pdf](http://www.audit-commission.gov.uk/wp-content/uploads/2014/03/Waste-vfm-briefing-26-March-FINAL.pdf)
- <sup>5</sup> Ibid
- <sup>6</sup> Derived by dividing the £1.7 billion in value by the 27,767,000 dwellings in the UK in 2012, see [www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants](http://www.gov.uk/government/statistical-data-sets/live-tables-on-dwelling-stock-including-vacants), to give a value of £61 per dwelling
- <sup>7</sup> This assumes that the UK captures all WEEE, so that maximum arisings are available to an individual local authority. If a capture rate of 85 per cent (the UK's WEEE target) is used fewer plants would be needed, which would imply even larger areas of collaboration.
- <sup>8</sup> These figures are based on estimates of annual plastic waste arisings from packaging, agriculture, electronics, vehicles and non-packaging household materials; existing examples of plants for each polymer type and application, and existing reprocessing capacity for each polymer type and application. This is explicitly an assessment of the maximum number of plants, because we wanted to assess the minimum scale for collaboration for high quality plastics reprocessing possible in a UK circular economy. A copy of the dataset from which these estimates are derived is available upon request.
- <sup>9</sup> The estimate of 500 plants is derived from the Committee on Climate Change's estimates of biodegradable waste and WRAP's and SKM Enviro's estimates of available food waste in the UK, see [www.theccc.org.uk/wp-content/uploads/2013/06/Chapter-7-Waste-and-other-non-CO2-emissions-WEB.xlsx](http://www.theccc.org.uk/wp-content/uploads/2013/06/Chapter-7-Waste-and-other-non-CO2-emissions-WEB.xlsx); [www.wrap.org.uk/sites/files/wrap/Landfill%20Bans%20Feasibility%20Research%20Final%20Report%20Updated.pdf](http://www.wrap.org.uk/sites/files/wrap/Landfill%20Bans%20Feasibility%20Research%20Final%20Report%20Updated.pdf); and [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/48166/2711-SKM-enviros-report-rhi.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48166/2711-SKM-enviros-report-rhi.pdf). Assessments were then made of the total heat potential that could be generated via biogas from this waste and the number of plants necessary to produce this quantity of heat using the following conversion factors: UK AD plant size of 35,000t per year, see [www.ows.be/wp-content/uploads/2013/02/Anaerobic-digestion-of-the-organic-fraction-of-MSW-in-Europe.pdf](http://www.ows.be/wp-content/uploads/2013/02/Anaerobic-digestion-of-the-organic-fraction-of-MSW-in-Europe.pdf); an average UK load factor of 67 per cent, see [www.teagasc.ie/energy/policies/AD-Market-Report-June-2013.pdf](http://www.teagasc.ie/energy/policies/AD-Market-Report-June-2013.pdf); the assumption that food waste produces 750kWh of heat, see [www.scotland.gov.uk/Resource/Doc/311011/0098129.pdf](http://www.scotland.gov.uk/Resource/Doc/311011/0098129.pdf); with other biodegradable waste producing 240kWh of heat [www.epa.gov/region9/organics/ad/EBMUDFinalReport.pdf](http://www.epa.gov/region9/organics/ad/EBMUDFinalReport.pdf). The figure of 135 AD plants currently in operation comes from the WRAP database of operational AD sites, see [www.wrap.org.uk/content/operational-ad-sites](http://www.wrap.org.uk/content/operational-ad-sites) (retrieved July 2014)
- <sup>10</sup> The UK government's aspirational targets for AD are set out in the government's *Anaerobic digestion strategy and action plan*, [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/69400/anaerobic-digestion-strat-action-plan.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69400/anaerobic-digestion-strat-action-plan.pdf)
- <sup>11</sup> BBC, 7 March 2014, 'Careless farming adding to floods', [www.bbc.co.uk/news/science-environment-26466653](http://www.bbc.co.uk/news/science-environment-26466653)
- <sup>12</sup> Birmingham council standardised its bin procurement, dropping costs to £15.24 per bin. See <http://birminghamnewsroom.com/2014/01/wheelie-bin-purchase-%E2%80%93-the-facts/> and <http://theconversation.com/we-need-to-talk-about-wheelie-bins-rubbish-24303>
- <sup>13</sup> 82 per cent of councils use wheelie bins, see [www.bbc.co.uk/news/uk-england-22704241](http://www.bbc.co.uk/news/uk-england-22704241). There are 26.4 million households in the

- UK, see [www.ons.gov.uk/ons/rel/family-demography/families-and-households/2012/stb-families-households.html](http://www.ons.gov.uk/ons/rel/family-demography/families-and-households/2012/stb-families-households.html). Assuming two bins per household (a probable underestimate), this gives a total cost of £216 million.
- <sup>14</sup> This is usually for sorting infrastructure, like materials recovery facilities. But local authorities have also demanded specific forms of incineration plant.
- <sup>15</sup> Joseph Rowntree Foundation, 2013, *Coping with the cuts? Local government and poorer communities*, [www.jrf.org.uk/sites/files/jrf/local-government-communities-full.pdf](http://www.jrf.org.uk/sites/files/jrf/local-government-communities-full.pdf).
- <sup>16</sup> There are numerous options for the design of a fund and alternatives which may require less direct government intervention. Local authorities could pay into a fund when recycle prices exceed a set upper threshold, and draw from it when they go below a lower threshold. Alternatively, financial markets have well established systems for mitigating volatility that could be applied in this case. These include hedging mechanisms, as used in foreign exchange markets, or futures or options, as used in commodities markets. Also, more domestic reprocessing infrastructure would make long term supply contracts possible, enabling local authorities to side step volatile global markets.
- <sup>17</sup> EEA, 2013, *Municipal waste management in Denmark*, [www.eea.europa.eu/publications/managing-municipal-solid-waste/denmark-municipal-waste-management](http://www.eea.europa.eu/publications/managing-municipal-solid-waste/denmark-municipal-waste-management)
- <sup>18</sup> According to data submitted to the Environment Agency, the collection rate for household and non-household WEEE in 2012 was 35.37, see [www.rwmexhibition.com/files/prof\\_margaret\\_bates\\_\\_university\\_of\\_northampton.pdf](http://www.rwmexhibition.com/files/prof_margaret_bates__university_of_northampton.pdf); In Japan in 2005, 17.2 million of an estimated 22 million waste home appliances were taken back by retail stores, see page 579 of V Goodship and A Stevels, 2012, *Waste electrical and electronic equipment (WEEE) handbook*, Woodhead Publishing
- <sup>19</sup> This recommendation is taken from *Waste electrical and electronic equipment (WEEE) regulations: individual producer responsibility (IPR) in a UK context*, produced by an independent working group convened by BIS, [www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/34569/12-1007-waste-electrical-and-electronic-weee-regulations-individual-producer-ipr-responsibility.pdf](http://www.gov.uk/government/uploads/system/uploads/attachment_data/file/34569/12-1007-waste-electrical-and-electronic-weee-regulations-individual-producer-ipr-responsibility.pdf)
- <sup>20</sup> Association of Public Service Excellence, *Cost and quality performance in refuse collection services*, page 5, [www.apse.org.uk/apse/index.cfm/members-area/briefings/2012/12-01-refuse-collection-trend-analysispdf/](http://www.apse.org.uk/apse/index.cfm/members-area/briefings/2012/12-01-refuse-collection-trend-analysispdf/)



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