

A large circular graphic in the center of the page. It features a white outline of a circle with various icons around its perimeter, including buildings, a factory, a car, a recycling symbol, and a tree. The background of the circle is a dark blue gradient. The text "The circular revolution" is written in white, bold, sans-serif font in the center of the circle.

# The circular revolution

An Imperial College London report  
commissioned by Veolia

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ADOPTING  
A CIRCULAR  
ECONOMY  
COULD CREATE  
**£29 BILLION (1.8%)**  
OF GDP IN THE UK

## How the circular economy will boost UK GDP

At Veolia, we know the world is facing an enormous challenge. Demand for raw materials has seen exponential growth with a fast-expanding global population and rising standards of living. Yet the resources on which we all rely are depleting fast. It's time for businesses to wake up to the reality of the throw-away economy and put more value on resources.

The circular economy is the industrial revolution for a new generation. A business model that enables the economy to grow, while minimising the amount of virgin resources that are extracted. But the focus is no longer just environmental, it's all about the bottom line. The circular economy saves resources and saves money. A catalyst for 'free growth' that requires no Government or external funding, just a change of mindset.

The World Economic Forum has forecast that the circular economy will contribute \$1 trillion per annum globally by 2025. But until now, there has been no specific analysis of the potential gains to be made in the UK.

This Imperial College London report, commissioned on our behalf, outlines the business case for adopting a circular economy. The results demonstrate that using resources in a closed loop system has the potential to contribute £29 billion (1.8%) of GDP and create 175,000 new jobs in the UK.

## Six ways that the circular economy contributes to GDP

The analysis focused on generating value from commodities from households and commercial and industrial sources, in the UK this amounts to 30% of resource flows.

The remaining 70% of all resource flows in the UK were down to sectors such as construction, mining and quarrying, agriculture, forestry and fisheries already contributing to GDP. Data was taken from Eurostat for 2012.

### UK GDP Contributions: total £29bn

\*Numbers have been rounded to the nearest decimal place

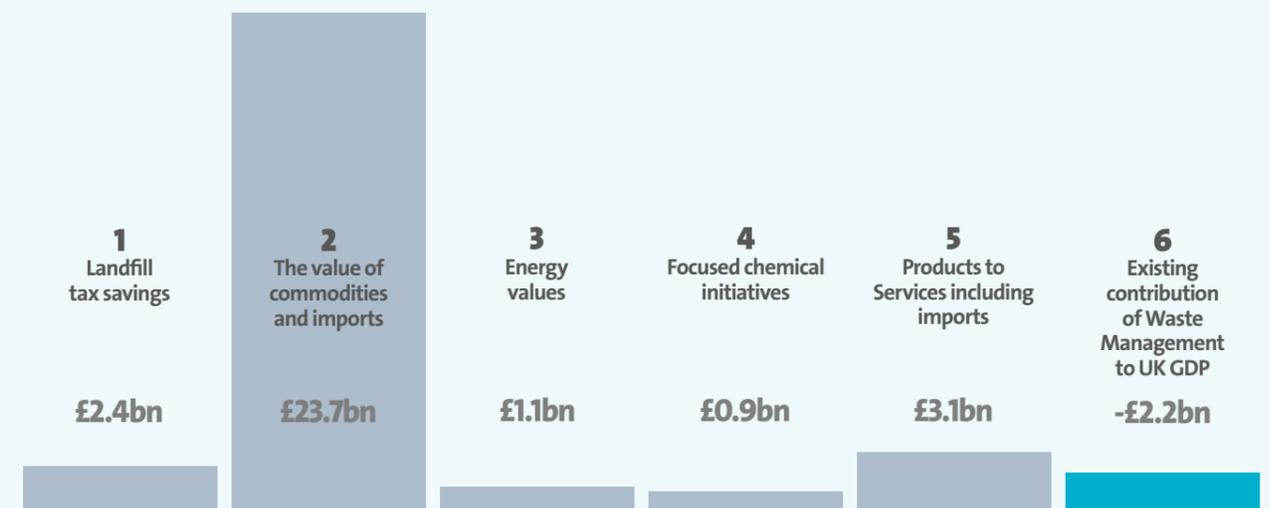


Figure 1: UK GDP Contributions

## Which resources were selected?

The report focused on the following household and commercial & industrial resources:

- Manufacture of food products; beverages and tobacco products
- Manufacture of textiles, wearing apparel, leather and related products
- Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
- Manufacture of paper and paper products; printing and reproduction of recorded media
- Manufacture of coke and refined petroleum products
- Manufacture of chemical, pharmaceutical, rubber and plastic products

- Manufacture of other non-metallic mineral products
- Manufacture of basic metals and fabricated metal products, except machinery and equipment
- Manufacture of computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment
- Services (except wholesale of waste and scrap)
- Electricity, gas, steam and air conditioning supply
- Household waste

## Calculating GDP value from the circular economy

The contribution to GDP, as a result of a transition to a circular economy, was calculated based on the following six strategies:

- 1 Landfill Tax savings**  
savings generated from landfill diversion.
- 2 The value of commodities and imports**  
commodity value of materials used again and imports replaced.
- 3 Energy Values**  
Value from materials that cannot be reprocessed into commodities, e.g. food, animal, vegetal and residual waste.
- 4 Focused chemical initiatives**  
Initiatives for deriving value from chemical by-products, steam or heat.
- 5 Products to Services including imports**  
recovering value by switching from buying and disposing of products to selling them as part of a service.
- 6 Contribution of Waste Management and Circular Economy**

## UK opportunities

The UK's total commodity resources are 244 million tonnes (mt). This is comprised of 228mt of domestic resources and 16mt of imported resources.

The 30% (72mt) included in the analysis focused on commodities from commercial, industrial and household sources. Of this, 23mt was generated from energy, 1.8mt from commercial and industrial sources and 43mt from household sources.

Imported commodities accounted for 13.7mt of household sources. These could potentially be avoided by closing the loop on material waste produced in the UK.

The value of Products to Services was also analysed and calculated at 4.9mt. The remaining 2.4mt of imported resources could be reduced by adopting products to services initiatives.



## Breakdown of circular economy potential

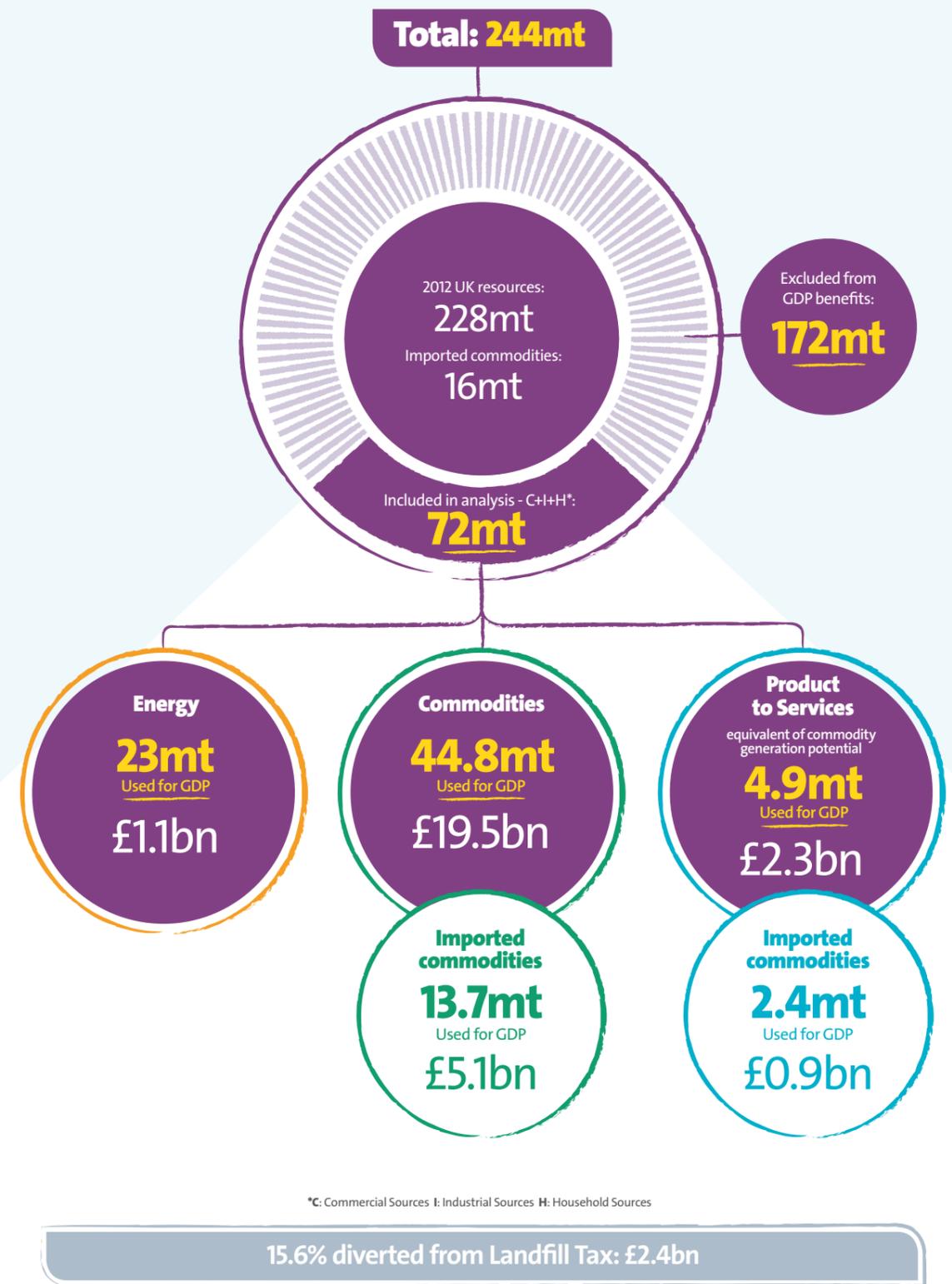


Figure 2: Total UK resources

## 1. Landfill Tax savings

The tax previously paid on resources lost to landfill can now be circulated back in the economy, boosting GDP. For the UK, the average Landfill Tax of active, inert and exempt resources was calculated as £65/tonne.

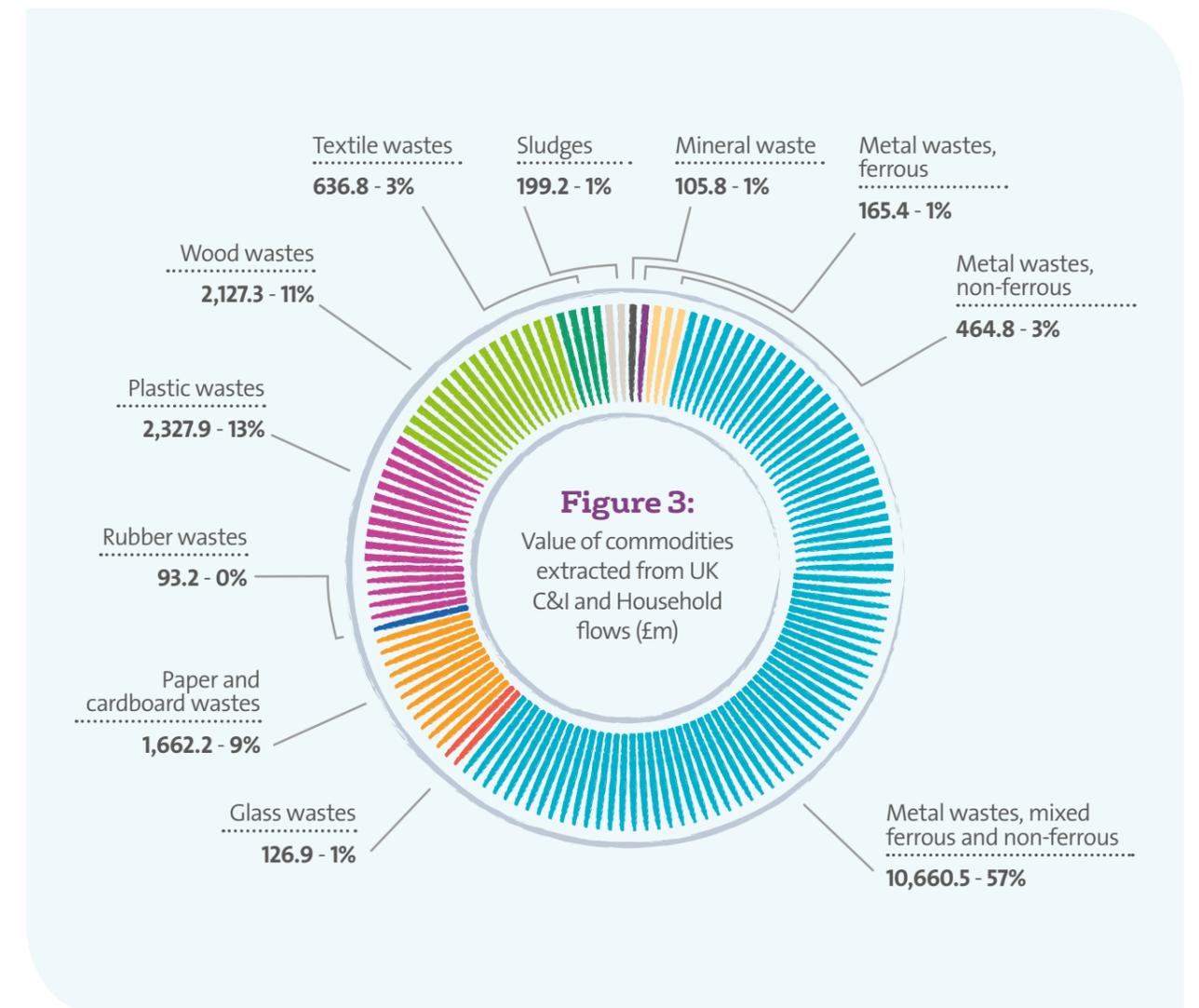
This was multiplied by the total waste flow (72mt, £4.7bn) from which the current receipts of the Landfill Tax at HMRC are deducted (£2.3bn). The final figure of £2.4bn thus represents additional Landfill Tax savings in the UK.



## 2. The value of commodities and imports

The value of materials extracted from C&I and household resources is presented below. The figures are based on manufacturing (except machinery); electricity, gas, steam, air conditioning supply and services (except wholesale of waste and scrap). This reflects the high price scenario. Mixed metals (£10.7bn), plastics (£2.3bn) and wood (£2.1bn) represent the largest material values for the UK (Figure 3).

As imports are subtracted from GDP calculations, the commodities produced from the waste streams can be used to replace imported materials. For commodities with a surplus it is assumed these can be exported to the same value. The net positive contribution to balance of payments is an additional £5.1bn based on 13.7m tonnes of materials (see Figure 2 page 5).





### 3. Energy values

The value of energy extracted from flows in the UK is calculated based on a price of 10p per kilowatt hour. It concerns materials that cannot be reprocessed into commodities such as food, animal, vegetal and residual waste. The results are presented in Table 1 below.

Flow	Tonnes (2012)	kwh/tonne	Value/tonne	Value £m
Mixed ordinary waste	16,848,761	550	55	927
Animal and mixed food waste, vegetal waste	6,925,512	300	31	215
<b>Total</b>	<b>23,774,273</b>	<b>-</b>	<b>-</b>	<b>1,142</b>

Table 1: Energy value of flows



OUR  
CALCULATIONS  
FOR THE UK  
CHEMICAL  
WASTE STREAMS  
PRODUCE  
A VALUE OF  
UP TO **£888M**

### 4. Focused chemical initiatives

In this report, deriving value from the unwanted chemicals and resources produced by an industry was included as a separate initiative. We have estimated the value of four chemical waste streams: spent solvents, acid/alkaline wastes, used oils and other chemicals. The value is based upon the price of common chemicals such as ammonia. Our calculations for the UK produce a value range of £415m to £888m. Most of this value lies in the chemical, pharmaceutical, rubber and plastics sector (£137m to £292m) and the manufacture of basic metals (£58m to £124m).

## 5. Products to Services including imports

One of the characteristics of the circular economy is changing the business models, by shifting from selling a product to offering a service. In this report, we have used this transition from products to services as another way of recovering value from commodities.

Our calculated figure consists of the remaining flows after consideration of commodity and energy values (4.9mt, value £2.3bn). Imports that can be replaced by products and services amount to 2.4mt with a net benefit to balance of payments of £0.9bn (see Figure 2).

Case studies exemplifying products to services include a diverse range of companies and products:

**Electrolux** - charging for each wash rather than a washing machine

**Castrol** - offering a lubricant service package instead of selling bottles of lubricant

**Koppert** - offering crop protection by the square metre, as opposed to barrels of pesticide

(Ellen MacArthur Foundation, Design for Sustainability [www.d4s-sbs.org](http://www.d4s-sbs.org)).



TOTAL WASTE HAS DECREASED FROM **298MT** TO **239MT**, WHILE GVA IN THE WASTE MANAGEMENT SECTOR HAS INCREASED FROM **€12.9 MILLION** TO **€13.1 MILLION**.



## 6. Existing contribution of Waste Management to the Circular Economy

Using Eurostat figures for 2004 and 2011, this report finds that the value of the Waste Management sector in the UK has increased while the volume of waste has decreased. This suggests an increase in the GVA (Gross Value Added) per tonne of waste for the waste management sector.

Total waste has decreased from 298mt to 239mt, while GVA in the waste management sector has increased from €12.9 million to €13.1 million. GVA per tonne has increased from €43.2 per tonne to €54.9 per tonne.

Comparing 2011 with 2004, the additional value is calculated to be €2.8 billion, or £2.2 billion with 2014 exchange rates.



**Table 2:** Growth of the GVA of the Waste Management Sector in the UK

## Which sectors have the most to gain from the circular economy?

Analysis of GVA and waste generation of sectors illustrates the importance of sector activity for waste generation. Certain sectors hold more value in their unutilised resources compared to others in terms of their share of the GVA pie (Table 3).

Resource flows in the economic sectors are not uniform, and thus the benefit (additional GDP) is not directly linked to the

GVA value of that sector. The manufacture of coke and refined petroleum products, electricity, gas, steam and air conditioning supply, and services sectors yield lower values based upon their actual waste generation than that of their GVA ratio.

**Table 3:** Sectoral analysis of GVA and waste generation.

Sectors UK	GVA 2011 (£m, Eurostat)	Total waste kt	Value calculated from sector share of total GVA*	Value calculated on actual flows**
Manufacture of food products; beverages and tobacco products	19,925	3,294	299	464
Manufacture of textiles, wearing apparel, leather and related products	3,685	474	55	161
Manufacture of wood, paper, printing and reproduction	9,502	2,160	143	733
Manufacture of coke and refined petroleum products	2,438	189	37	87
Manufacture of chemical, pharmaceutical, rubber and plastic products; other non-metallic mineral products	29,763	4,343	447	805
Manufacture of basic metals and fabricated metal products, except machinery and equipment	14,051	2,144	211	1,317
Manufacture of computer, electronic and optical products, electrical equipment, motor vehicles and other transport equipment	27,516	732	413	587
Electricity, gas, steam and air conditioning supply	15,719	4,965	236	64
Accommodation and food service activities	32,905	3,415	494	423
Retail & wholesale	136,634	10,528	2,053	5,599
Public administration & social work	157,015	3,303	2,359	1,757
Education	76,115	1,693	1,144	900
Transport and storage	53,271	2,502	800	1,330
Other services	586,961	6,174	8,818	3,283
<b>Totals</b>	<b>1,165,500</b>	<b>45,916</b>	<b>17,509</b>	<b>17,510</b>

\* This figure represents the value of a sector's waste resource flows if the total waste value was distributed among sectors

\*\* 'Value calculated from actual flows' is the value of Commodities, Energy and Chemical Initiatives

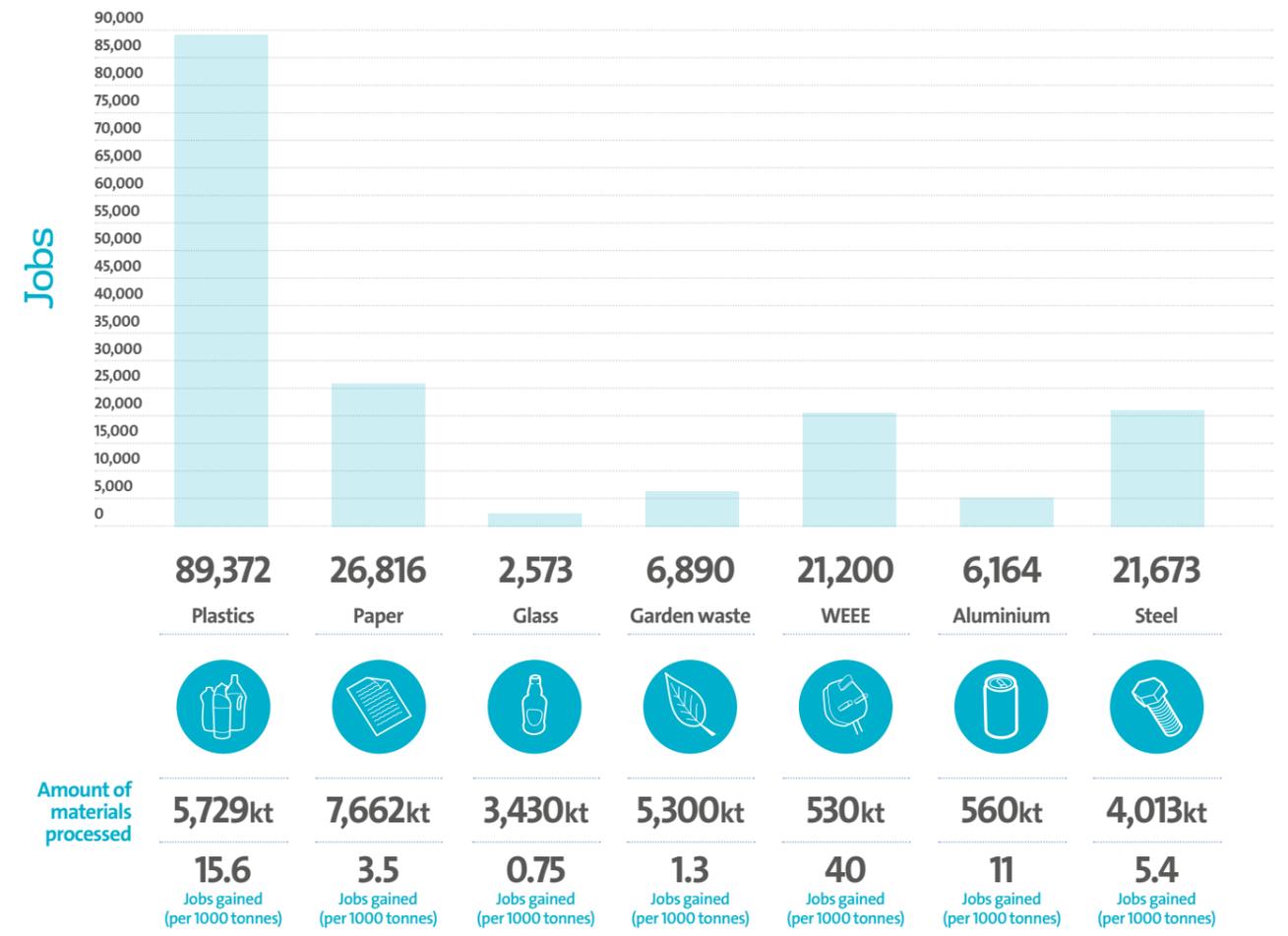


## Job creation

Using values from the report More Jobs, Less Waste (Friends of the Earth 2010\*), this report estimates that 175,000 jobs will derive from implementing circular economy principles. This is based upon recycling of certain materials, does not cover all materials or aspects of the report (such as products to services), and is thus very likely to be an underestimate. Table 4 below provides an overview of the materials and the jobs derived from their recycling.

\*Whilst using 2010 referenced data for the purposes of a calculation methodology the latest job market profiling indicates this quantum remains relevant.

## Total jobs gained: 175,000



**Table 4:** Jobs gained from recycling of materials from UK C&I and Household flows (Jobs gained figures from Friends of the Earth, More Jobs, Less waste 2010).



## Circular economy in action: Veolia case studies

### Dairy Crest biomass energy plant

#### New life for old wood

The Dairy Crest biomass energy plant is one of the largest wood pellet burning installations in its industry sector, using sustainably sourced pellets made from used or life-expired wood.

Dairy Crest is the UK's leading chilled dairy foods company. At their Davidstow site, they manufacture a range of dairy products including milk, cheese and butter – many of which are household names. In order to make the 55,000 tonnes of cheese they produce every year, they need 100,000 tonnes of steam for the pasteurisation and drying process. This was traditionally generated by burning fossil fuel.

We were commissioned by Dairy Crest to find a solution that would reduce their carbon emissions and make their factory more energy efficient. The answer was a new biomass steam plant fuelled by wood pellets. These wood pellets were produced from life-expired wood that had been thrown away by the construction and manufacturing companies as it no longer had any use.

As a country we produce a large amount of waste wood. Every year 10 million tonnes of wood is disposed of in the UK with only 1 million tonnes of it being recycled. The rest is sent to landfill. There was a clear opportunity to put some of this waste wood to good use.

After we collect the wood from commercial and domestic sources, it is sorted into grades and checked to ensure it meets sustainability requirements. Then it is chipped, shredded and any contaminants – like nails or staples – are removed and recycled. The wood is then dried and made into pellets.

As a result, Dairy Crest's carbon emissions at the site were reduced by 60%. The energy savings made also mean they will see a return on their investment early in the plant's life. By using life-expired wood, we have reduced the burden on landfill and are turning this into a valuable fuel source.

Due to the project's success, the plant has won three awards: The Lord Ezra Award, The Energy Awards – Best Renewable Energy Project and the RegenSW Best Biomass Project.



**21,900**  
tonnes of CO<sub>2</sub> emissions saved each year

### Conclusion

When Veolia commissioned this report, we were convinced that there were gains to be made from UK businesses thinking circular. However, the findings have far exceeded our expectations of the contribution that the circular economy could make in terms of GDP and employment.

£29 billion and 175,000 jobs, with particular opportunities in the plastic sector, makes a compelling business case for change. Organisations that embrace the circular revolution now will make considerable savings in the future. Quick wins that require no additional funding, just a simple change in mindset.

At Veolia we are already helping businesses to rethink their resource requirements and waste streams. There is no one size fits all solution. The best approach is one that

is tailored to individual businesses and market sectors.

The opportunity is here for business to benefit from designing products to take into account a second and third life and better supply chain pricing as the quality of secondary recycled materials becomes business critical. By promoting greater resource efficiency we can help manufacturers protect their own supply chains and stimulate a growth in the market for recovered materials.

On the following page you will find two case studies that highlight some of the ways that Veolia is helping businesses to preserve resources and grow the economy through closed-loop thinking. In short we see the circular economy as the industrial revolution for a new generation.

### Bag 2 Bag

#### Filling plastic bags with potential



**8** billion plastic bags used in England each year

Working alongside local authorities, we offer a closed-loop environmental solution by recycling used plastic bags into refuse sacks.

In England alone, over 8 billion plastic carrier bags are used each year. A large percentage end up in landfill sites where they take a long time to decompose, or can be found littering our towns, cities, coasts and countryside. Although England is due to follow in the footsteps of Ireland, Wales and Scotland when it introduces its mandatory charge for single use plastic bags in 2015, the problem is still a big one.

Our idea is to give plastic bags a new life by turning them into refuse sacks. We collect used bags from retailers and at our Materials Recovery Facilities (MRFs) and transport them to our recycling partner. The bags are then washed, processed, turned into pellets and then made into bin bags. We then deliver them back to the local authority where the used shopping bags were first collected.

We are currently trialling this closed-loop solution in Southwark. If it proves successful, we will look to extend the number of MRFs with the technology needed to remove plastic bags from the waste stream and the number of local authorities joining the programme.

# Resourcing the world

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