eunomia

A Resourceful Future – Expanding the UK Economy

A report commissioned by SUEZ recycling and recovery UK,
written by Eunomia Research & Consulting

September 2016

SUEZ

Foreword

The waste management sector has undergone a huge transformation over the past 10-15 years. Traditionally disposal-led, the sector is now geared towards recovering value from waste, with ultimate disposal a last resort. Reusable products discarded by consumers are collected for repair and refurbishment, non-reusable products and materials are recovered in the form of recyclables, and value from residual non-recyclable waste is recovered in the form of energy.

The UK's membership of the EU allowed us to rely on its policies and legislative framework to determine the direction and speed of travel for our sector. But Brexit could change that. Whether we go for a hard or a soft exit, the UK will have to define its economic future on its own terms, rather than relying on the thrust of policy at European level. This applies as much to the waste management sector as it does to the economy as a whole.

As the UK enters a new phase in its relationships with Europe and the rest of the world, nurturing a balanced and resilient economy assumes an increased urgency, along with a vision for our sector. We need a home-grown, forward-looking strategic framework for waste and resource management. We should regard Brexit as an opportunity for some fresh thinking, to extract in full measure the economic benefits we are capable of delivering.

That strategic framework could be created if the waste management sector was fully integrated into the industrial strategy that the newly formed Department for Business, Energy and Industrial Strategy has been tasked with developing.

Our sector currently recovers about £15 billion worth of value from waste, in the form of secondary materials and energy. But because of a disjoint between waste policy and industrial policy, some 50 percent of recyclates and 90 percent of waste derived fuel is exported to overseas markets, even though the UK is a net importer of primary raw materials and of energy. Re-shoring and re-integrating these streams into the UK economy will not only help future-proof the UK against resource supply risks, but also create employment in new waste-related activities.

How might the UK benefit if we used the waste and resources industry as a source of renewed economic prosperity? What might an industrial strategy look like if it was informed by circular economy principles? And what policy measures should be taken to realize the benefits of circulating value back into the UK economy?

We asked Eunomia Research & Consulting to address these questions. SUEZ thank Eunomia for undertaking this project and for recommending a set of clear policy measures that would energise and grow the UK economy. We hope that the report initiates a debate on how we can move forward, especially in relation to the integration of our sector into the industrial strategy that BEIS will be developing.

David Palmer-Jones
Chief Executive Officer - SUEZ recycling and recovery UK

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Executive Summary

E.1.0 Industrial Strategy

For some years now, politicians have lamented the decline in manufacturing industry, both in relative terms, and, for the most part, absolute terms. This decline presents a challenge: how, in an increasingly globalised world, where more and more goods and services are traded internationally, does the UK become a maker of more things? The state's intention to pursue an industrial strategy has sparked debate between those with concerns that this could descend into protectionism, and those who believe that co-investing in mission-oriented research can generate significant opportunities for growth.

Recent shifts in Departmental responsibilities under the new Prime Minister included the announcement of a new Department for Business, Energy and Industrial Strategy (BEIS). This would indicate that industrial strategy is an important priority for this Government. The exact shape of industrial strategy that will emerge from BEIS is yet to be determined. However, this report demonstrates a clear rationale for a greater appreciation of the role to be played by the waste and resource management sector than was afforded to it in the Coalition Government's 2013 industrial strategy.

The waste and resource management sector can, and in many ways already does, play an integral role in closing the loop on material flows between different actors in the economy. This report sets out to explore how the sector may become more effectively integrated within Government's industrial strategy and examines some of the horizontal policies needed to ensure that the UK can transition to a more resource efficient, circular economy. It also explores how environmentally-informed industrial and resource strategies can work in tandem to bring enhanced prosperity to the UK economy.

E.2.0 The Evolving Waste and Resource Management Sector

Alongside the re-emergence of interest in industrial strategy, environmental imperatives and the expressed interest of much of industry have driven a significant change in the waste and resource management sector. Although the transformation is only partially complete, the sector is becoming increasingly 'industrialised' as its business models move from being disposal-led to being value-led. This model is consistent with reducing primary resource use in the economy: in most cases, the use of secondary materials, and the preparation of goods for reuse also help to reduce global greenhouse gas (GHG) emissions.

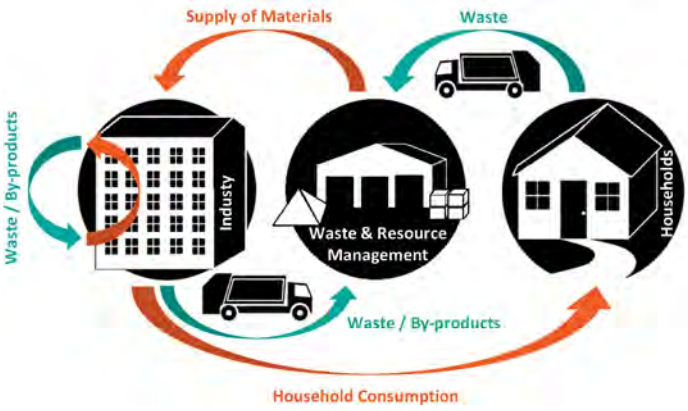
It is, perhaps, unsurprising that as industry has declined in the UK, so has the demand for materials for manufacturing. This, however, does not capture the full picture: the UK exports secondary materials to be reprocessed overseas, and then imports processed materials. Imports of ferrous metals in various forms were, in 2014, more than three times the mass of secondary materials exported. For aluminium, more than five times the mass of secondary material exported was imported.

The trade deficit associated with these movements of materials could be reduced if the UK developed systems to ensure that the quality of secondary materials was such that they could substitute for virgin materials in our industrial processes. Analysis undertaken for this study suggests that reshoring some of the currently exported materials could add significant value to the UK economy if they were processed locally. It is not being suggested that the UK should close the borders to exports of secondary materials. Rather, we propose that the UK might benefit from a closer examination of how the increasingly resource-oriented 'waste management' sector can support the rollout of an effective industrial strategy.

E.3.0 Industrial Strategy and its Symbiosis with Waste

Industrial symbiosis is generally conceived within a paradigm where one industrial producer makes use of the outputs or by-products of another industrial producer. The waste and resource management sector can play an important facilitating role in this process by enabling the flow of materials through the economy, as shown in Figure ES1. As the sector becomes more value-led, however, it will have to pay increasing attention to issues of material quality and to managing the process by which it produces commodities for industry.

Figure ES1: A Symbiotic Relationship between Industry and the Waste and Resource Management Sector



The recent discussions around the future of the Tata Steel plant in Port Talbot are a good example of potential symbiosis. This is because one of the parties seeking to rescue the plant wanted to shift away from the use of primary steel in basic oxygen furnaces to the use of steel scrap in electric arc furnaces. Such a solution could have helped reverse the outflow of steel scrap from the UK, thereby retaining value within the country's economy.

Other potential examples of how the sector could support industrial development include:

1. In the case of food waste, that which is not avoidable could be used in anaerobic digestion, which can generate energy in various forms. Other outputs can be used for soil improvers that contain minerals and nutrients which can enhance the resilience of the agricultural sector.

2. In the case of what would be, in a forward looking strategy, a declining quantity of residual waste, then processes exist to recover materials, energy products (such as synthetic fuels) and energy in the form of heat and electricity. These can supply either households or industry.

3. A more collaborative approach across the supply chain to facilitate materials being processed by the waste and resource management sector to a standard desired by domestic industry. This would be particularly important for materials that represent supply-side risks.

4. Design of new consumer products to allow for easy repair and component recovery — this presents the opportunity for new industries focused on product repair and remanufacturing.

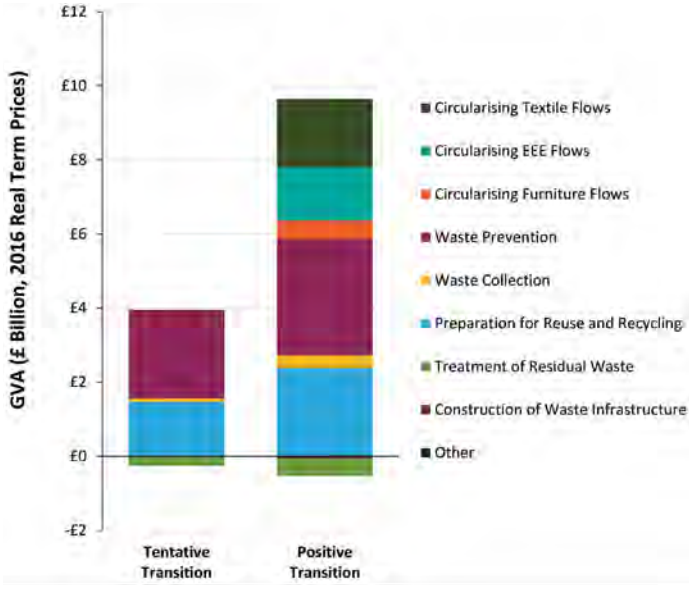
E.4.0 What is the Economic Case for Change?

This study sought to understand the impact of a range of measures on Gross Value Added (GVA) as a result of changes in waste management and broader shifts in the consumption and use of furniture, electronic equipment, and textiles. The headline results indicate that whilst a strategy emphasising more conventional waste management could generate significant benefits to the economy, further gains are likely to result from embedding waste and resource management within a wider industrial strategy.

As shown in Figure ES2, of the two core scenarios modelled against the baseline 'Business as Usual' (BaU) scenario, the more ambitious 'Positive Transition' (to a more circular industrial strategy) scenario results in a total net gain in GVA of £9.1 billion in 2030. According to the ONS, the waste and resource management sector as a whole was responsible for generating an estimated £6.5 billion of GVA in 2014.[1] The GVA uplift is, therefore, considerable, with some of the modelled benefits in 2030 also being attributable to sectors other than waste management. It is also interesting to understand what the total value of the Positive Transition scenario is over time. It is estimated that the Net Present Value (NPV) of the Positive Transition scenario (for the period 2016 to 2030) is £47 billion.[2] This shows that there are substantial benefits to be gained over time under this ambitious scenario.

The Positive Transition scenario also generates GHG emission savings. In this respect, improvement in waste management, relative to the BaU scenario, delivers reductions of around 4 million tonnes of CO_2 eq per annum by 2030. The scenario also delivers substantial savings related to waste prevention. Overall, GHG savings are estimated to be in the order of 27 million tonnes of CO_2 eq by 2030. To put this figure in context, it amounts to 3.4% of the UK's GHG emissions in 1990. They are around one and a half times the emissions reported by the UK under the Waste chapter of the inventory reported to the UN Framework Convention on Climate Change: these emissions have already fallen by 72% between 2000 and 2014.[3]

Figure ES2: Net Change in GVA Relative to BaU in 2030 (£ Billion, 2016 Real Term Prices)



E.5.0 How Do We Seize the Benefits?

Whilst the orientation of the economy to pursue a more environmentally informed industrial strategy is no longer optional, it can still appear to be a financial burden for those who seek to follow such a path. The transformation does require policy to shape the trajectory for the economy (as implicitly recognised by the creation of BEIS), for tax structures and industrial strategy within it.

Measures introduced under each of the following themes would support the delivery of the economic benefits mentioned above:

- **Completing the job of waste management policy**
  Waste management in the UK moved in leaps and bounds in the first decade of the millennium. There are, however, policies that are still missing, and ones that are simply no longer fit for purpose. The job would be 'more or less complete' if the policies described in this report were implemented. Possible measures include:
  - A revised form of extended producer responsibility to enhance effectiveness and strengthen links between producers and the waste industry.
  - A broadened scope of producer responsibility to cover other waste streams, such as furniture.
  - Setting minimum service standards for household waste collection, and mandating the separate collection of specific materials by commerce and industry, and those generating C&D waste.
- **Influencing consumer behaviour**
  The pervasive nature of litter and the problems it can create, in rivers and marine ecosystems in particular, have led to considerable emphasis on litter as an issue that needs to be tackled. Methods based on educating and informing have less to recommend them than measures that incentivise change and encourage behaviours to reduce littering. Measures of interest here include:
  - Legislate to allow pay-as-you-throw (PAYT) schemes for household residual waste (and if PAYT is not mandated, introduce targets aimed at reducing residual household waste per inhabitant).
  - Broadening the scope of taxes on single use disposable products (beyond plastic bags).
  - Introducing deposit refund schemes for beverage containers, as well as other items such as small waste electrical and electronic equipment (WEEE).
- **Influencing industry**
  An industrial strategy would seek to influence the behaviour of industry in terms of production and resource efficiency. Measures which could be used include:
  - Mandated use of extended warranties for (what should be) durable goods.
  - Requirements to ensure that products are designed to facilitate repair and recycling.
  - Target a shift in Public Procurement so that 80% of spend is 'greened' by 2035.
  - Using agri-environmental payments to encourage use of compost and digestate in agriculture.
  - Invest in R&D and collaborative research to support matching of secondary materials with demand for them.
  - Establish a commission to investigate the feasibility of a tax on raw materials, potentially linked to embodied carbon in materials.

The specific policies associated with each of the above measures are discussed further in the main report. With these measures in place, substantial progress towards the vision we have identified would be made. The benefits to the UK economy would be significant.

It is therefore crucial that Defra moves forward to implement the key waste measures that will reinvigorate the sector. BEIS, in reviewing its industrial strategy, needs to carry forward a clear view as to how the waste and resource management sector integrates with industrial strategy. It must also consider how industry can ensure that its development path is sustainable, resource efficient, and attentive to the factors that influence its products, both in the period where they are used, and at the end of their life. There can, and should be, a symbiotic relationship between the waste and resource management sector and the delivery of an industrial strategy.

Development and implementation of this strategy will require interdepartmental collaboration (across BEIS and Defra) alongside effective engagement with a key stakeholder steering group consisting of members from across the whole supply chain. If we are to realise the significant economic benefits presented by the transition to a more resource efficient, circular economy, then Government needs to start to progress this framework without further delay. Now is the time to seize this opportunity.

Acronyms

AD – Anaerobic Digestion

ACT – Advanced Conversion Technology

BaU – Business as Usual

BEIS – Department for Business, Energy and Industrial Strategy

BIS – Department of Business, Innovation and Skills

C&I – Commercial and Industrial

C&D – Construction and Demolition

CfD – Contract for Difference

DCLG – Department for Communities and Local Government

DECC – Department of Energy and Climate Change

DEFRA – Department for Environment, Food and Rural Affairs

DMC – Domestic Material Consumption

EAC – House of Commons Environmental Audit Committee

EfW – Energy from Waste

EPEAT – Electronic Product Environmental Assessment Tool

ESIF – European Structural and Investment Funds

EU-ETS – European Union Emissions Trading Scheme

GEC – Green Economy Council

GDP – Gross Domestic Product

GHG – Greenhouse Gas

GVA – Gross Value Added

IVC – In-Vessel Composting

MRF – Materials Recovery Facility

NPV – Net Present Value

OAW – Open Air Windrow composting

ONS – Office for National Statistics

PAYT – Pay-As-You-Throw

RDF – Refuse Derived Fuel

RMC – Raw Material Consumption

SRF – Solid Recovered Fuel

UNFCCC – United Nations Framework Convention on Climate Change

WEEE – Waste Electrical and Electronic Equipment

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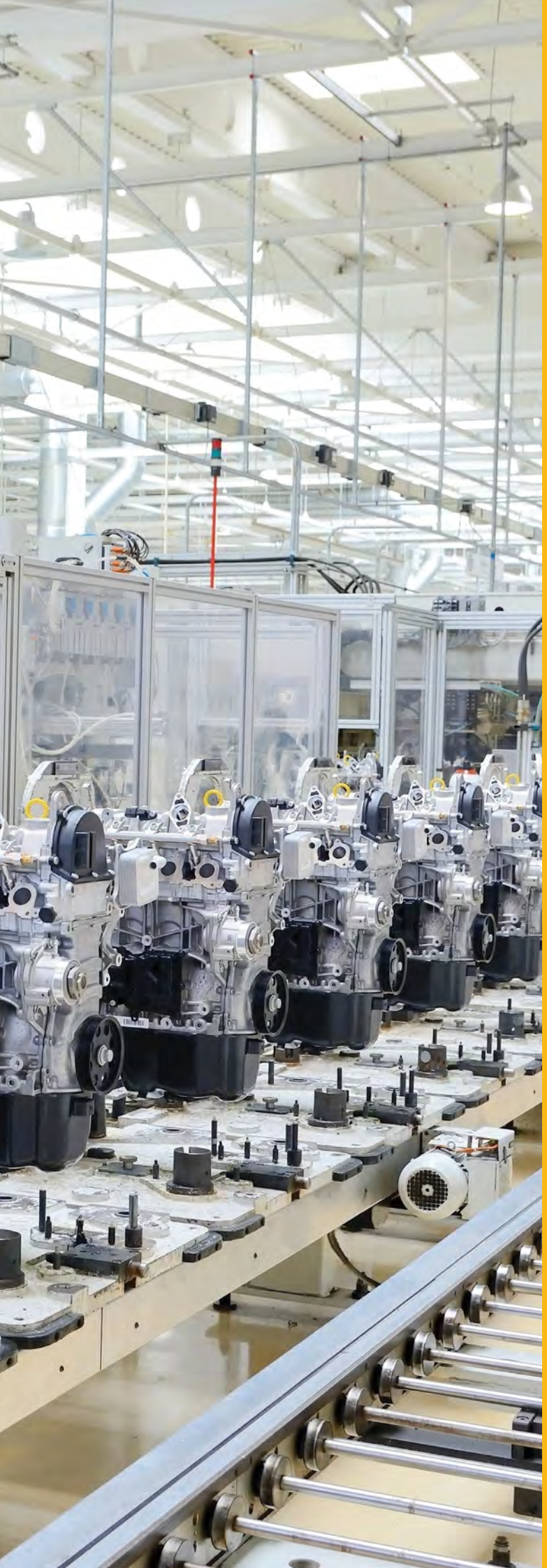


1.0

Introduction

In the first decade of the new millennium, significant strides were made in improving waste management across the UK. The recycling of municipal waste increased dramatically, and the amount of waste directed to landfill declined quite sharply. Household waste quantities had broadly stabilised, even before the effects of the financial crisis were felt, and a range of new facilities were developed to sort recyclables, treat bio-wastes and deal with the remaining residual waste. If the economy cannot yet be said to be a 'circular' one, it is much less linear than it was fifteen years ago.

Increasingly, over time, it has become obvious that waste – or rather, the resources that we discard as 'waste' – should be viewed not as a challenge, but rather, as an opportunity. What was once considered worthless is now being considered for its reuse potential, or is being transformed into materials of value, including precious metals, which are typically used in small quantities in various technical applications. Recognising the opportunity cost of discarding these valuable materials, increasing attention is now being paid to designing the things we consume with a view to ensuring that they last longer, can be more easily repaired, and once they reach the end of their first life, that they can be easily recycled. The economic up-side of the waste and resource management sector is becoming ever more apparent.

This report takes its cue from a paradox that has infected Whitehall government in recent years. Amidst growing appreciation of the economic opportunities presented by improved waste and resource management, Government seems, largely, to have absented itself from policy-making in this area, leaving the EU to dictate the course of action. This is somewhat ironic in the light of recent events, for the sector is now largely shaped by European legislation and requirements, some of which may not be achieved or applied in the UK post-Brexit. The recent lack of clear direction in domestic policy has been compounded by cuts in local authority budgets and by falling commodity prices as growth in the global economy falters. With one or two notable exceptions, the case for investment in the sector, in England in particular, looks weak.[4] The devolved administrations, notably Scotland and Wales, have sought to forge different paths, and it remains to be seen how far performance can diverge across the UK before market strains appear.

The vote in the EU referendum to leave the EU adds to the sense of uncertainty, yet it also offers the potential to reappraise where we are, and where we should be heading. What exactly our vote to leave the EU will mean for a sector that has been strongly shaped by EU-level initiatives remains to be seen. Broadly, however, the choice is likely to come down to either complying with existing and future Directives, or making our own decisions as to how we manage waste and resources. In the former case, doing nothing is no longer a viable option as proposed revisions to existing Directives are expected, so a reappraisal of policy would be required – even if it were not required, it would be merited (not least to ensure that England is not left behind by the devolved administrations).[5] In the latter case, the opportunity also arises for the UK to reassess the future of waste and resource management, and to reconsider the policies needed to harness the waste and resources industry as a source of renewed economic prosperity. All UK producers selling into the EU will also have to meet relevant EU standards, irrespective of the outcomes of Brexit.

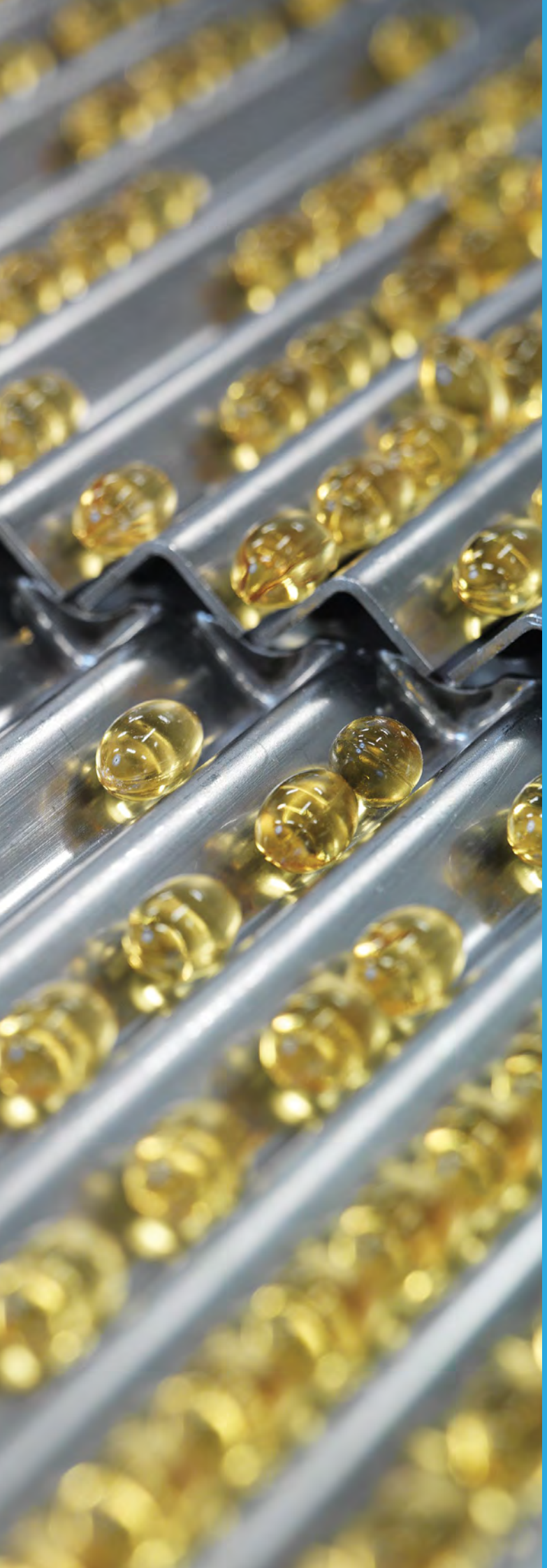
The recent decision to establish a Department for Business, Energy and Industrial Strategy (BEIS) provides another opportunity.[6] The coalition government's industrial strategy had many positive features, but its environmental credentials were lacking — a point well made by various inquiries led by the Environmental Audit Committee. A new, or revised, strategy could recognise the merit of defining a role for the waste and resources industry, both as a means to support the prosperity of other sectors and as a source of prosperity in its own right.

In short, a reassessment of conventional waste policies and an environmentally informed industrial and resource strategy could work in tandem to bring enhanced prosperity to the UK economy.

In summary, the goals of this study are to:

- Explore the role of the waste and resource management sector in industrial strategy (Section 2.0).
- Set out a vision for the future and describe the key features of this vision (Section 3.0).
- Demonstrate the economic benefits, in terms of Gross Value Added (GVA), that this vision could deliver (Section 4.0).
- Propose a concise set of Government interventions that are required to deliver the vision and associated economic benefits (Section 5.0).

Key messages from the study are summarised in Section 6.0.



2.0

The Role of Resource Management in Industrial Strategy

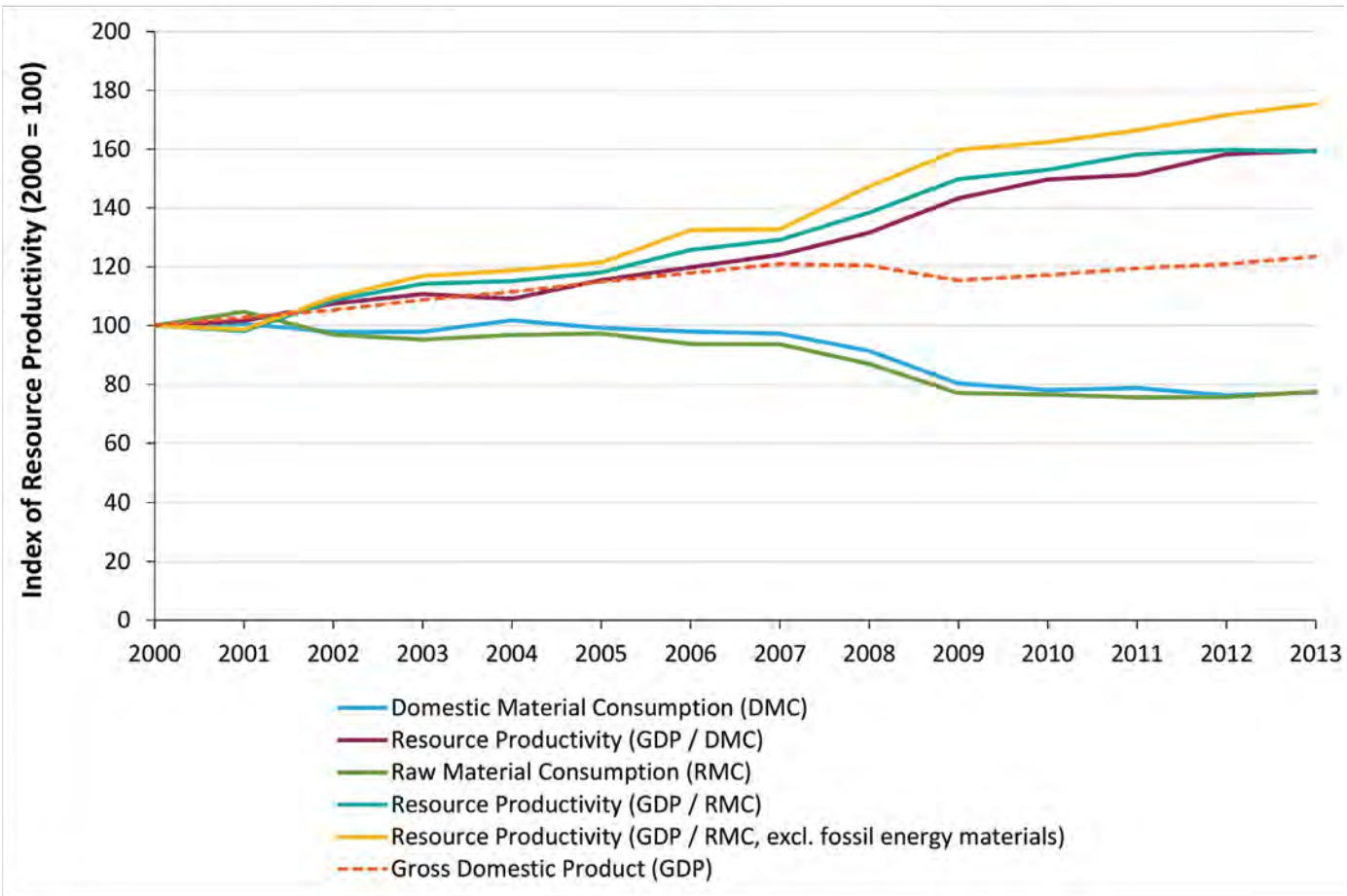
2.1. What is a Resource-Efficient and Resource-Resilient Economy?

The term 'resource efficiency' is widely used, though not often clearly defined. In principle, resource efficiency implies reducing resource use in delivering output, as measured by a given metric, relative to economic performance, measured as GDP. The concept can be applied at different levels. For example, for a given producer, resource efficiency could be considered at the level of process – that is, making the same amount of product with fewer resource inputs. However, if the product itself is not designed (within reason) for longevity, and cannot be easily repaired, then having a resource efficient process could be counterproductive if society's overall use of resources is higher than it needs to be because of the product's short lifetime. From a macro-perspective, therefore, the overall use of resources in meeting demand might be a more relevant indicator than one based on process alone.

Furthermore, we might ask whether we should consider all resources in the same way: if the intention is to reduce environmental impacts of, and demand for, primary resource extraction, then secondary materials derived from waste should be considered differently to primary raw materials. If the economy approximates to a genuinely circular one, then a growing proportion of demand for resources would be met through use of secondary materials. This would complement policies that reduce the quantity of all resources used in the production of goods.

Again taking a macro-perspective, resource efficiency might not be an issue solely of production patterns: what and how businesses and households consume also influences how productively resources are used. The measure of output matters here, since the use of measures such as GDP invalidates the question of whether the consumption is, subjectively, wasteful. Indeed, this suggests that as well as resource efficiency measures, absolute limits on resource use might usefully steer production and consumption to a level that is most welfare enhancing.

Figure 2.1: Resource Productivity Indices (real GDP per unit of resource use, by different measures, 2000=100)



At the EU level, the headline indicator used is the ratio of GDP to domestic material consumption, expressed in euros per tonne. Recent UK performance in respect of resource productivity measures, based on ONS data, is shown in Figure 2.1. These show indexed values (based on year 2000 levels) of GDP itself, as well as:

1. **Domestic material consumption (DMC)**
   This measures the amount of materials used in the economy. It is effectively domestic extraction, plus imports, minus exports. It is measured in tonnes and does not differentiate between whether materials consumed are the primary ore, or a finished product.

2. **Raw material consumption (RMC)**
   This effectively converts the domestic material consumption figures into the equivalent mass of raw materials extracted, depending upon the form in which consumption occurs.[7]

The GDP, DMC and RMC indicators are also used to calculate resource productivity indicators (units of GDP per unit of DMC, for example, for the 'Resource Productivity (GDP / DMC)' index as shown in Figure 2.1). Given the prominence of fossil energy carriers in resource use, we also present the RMC resource productivity indicator excluding these materials from the index.

Clearly, Figure 2.1 indicates an improvement in resource productivity of the economy over time, with all productivity indices being at least 60% higher in 2013 than in 2000 (a compound increase of 3.7% per annum). It might be considered, however, that the measure of output used – that is, GDP – does not reflect the full consequences of economic activity, notably excluding the environmental consequences of resource use, from the measure of output.

The discussion regarding resource productivity is of interest in the context of ongoing concerns about the low rate of productivity growth in the UK economy as a whole. The weakness of manufacturing productivity (measured as GVA per unit of labour input) since 2011 has been a defining feature of the UK's apparently stagnant labour productivity growth: in manufacturing in particular, ONS data indicate that in Q1 2016, manufacturing productivity stood only 1.8% higher than in Q1 2008. The apparent divergence in the resource productivity trends in the economy, and the labour productivity trends, raises a number of points regarding the effect of different influences on the different measures. In principle, however, they can work in the same direction, so that resource productivity in a given industry can contribute positively to GVA. Whilst some such changes may also increase labour inputs (remuneration of which is effectively a component of GVA), labour productivity may also increase (though this might not always be true). It matters also – at an economy wide level – that multipliers do not stimulate only those sectors which are stagnant in terms of productivity.

In market economies, it is 'the invisible hand' of the market that is relied upon to allocate resources. In well-functioning markets, theory suggests that resources will be allocated efficiently, yet a range of so-called market failures act to frustrate this.[8] Of particular relevance to this report are the environmental costs and benefits – the externalities – that remain outside of market transactions.

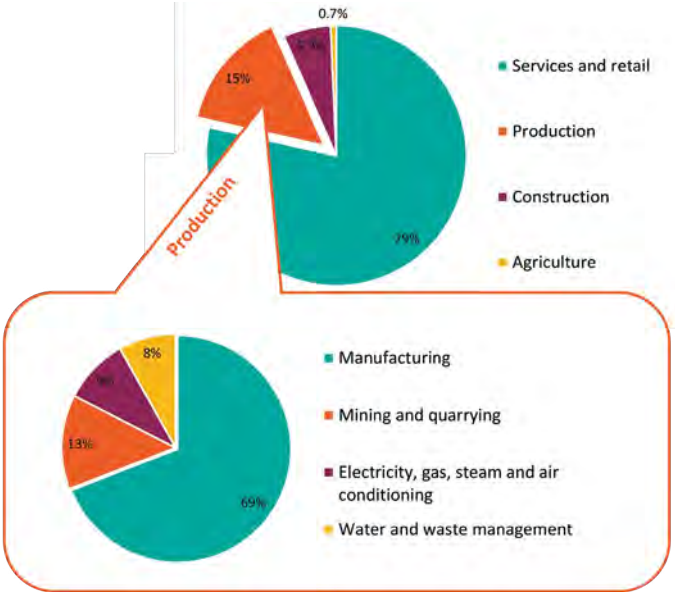
As long as the market fails to reflect the full costs, or benefits, of products and services, then there will be misallocation of resources, even in otherwise well-functioning markets. This failure of whole product costing has often been cited in studies as a major barrier to making further progress towards resource efficiency or driving the economy to become more circular. However, it is far less easy to 'get prices right' than the exhortation implies, not least since the externalities are often not well characterised and are difficult to measure.[9]

Another source of market failure is restriction on the free interplay of supply and demand. This can take various forms, but includes trade restrictions, in the form of quotas, which can have the effect of artificially raising prices for materials placed on the open market. Concerns are usually motivated by geopolitical considerations and the ease with which industries can access key resources. These concerns have given rise to discussions, and increasingly, calls for action, around the resilience of the economy to restrictions on the availability of resources.[10] At the European level, a list of so-called critical materials has been identified. Other sources of vulnerability include the supply disruptions that may be occasioned by major disasters and other catastrophic events. The question of resource resilience is one which also deserves attention: to the extent that market prices are inflated by such activities, the market may respond by calling forth additional sources of supply (effectively diminishing the vulnerability of the economy, and improving its resilience).

2.2. Characterising our Current Economy

One of the reasons for the increase in the resource productivity of the UK economy described in Section 2.0 is the reduced significance of production industries (i.e. manufacturing, mining & quarrying, energy supply and water supply & waste management) in the economy. This is because more GDP is generated per unit of resource use as the structure of the economy shifts to less resource intensive forms of wealth generation. The UK economy is dominated by the service and retail sectors, which accounted for 79% of the country's GDP in April 2016.[11] As shown in Figure 2.2, production industries accounted for 14.9% of GDP, whilst construction and agriculture accounted for 5.9% and 0.7% of GDP, respectively.

Figure 2.2: Components of the UK's GDP (April 2016)

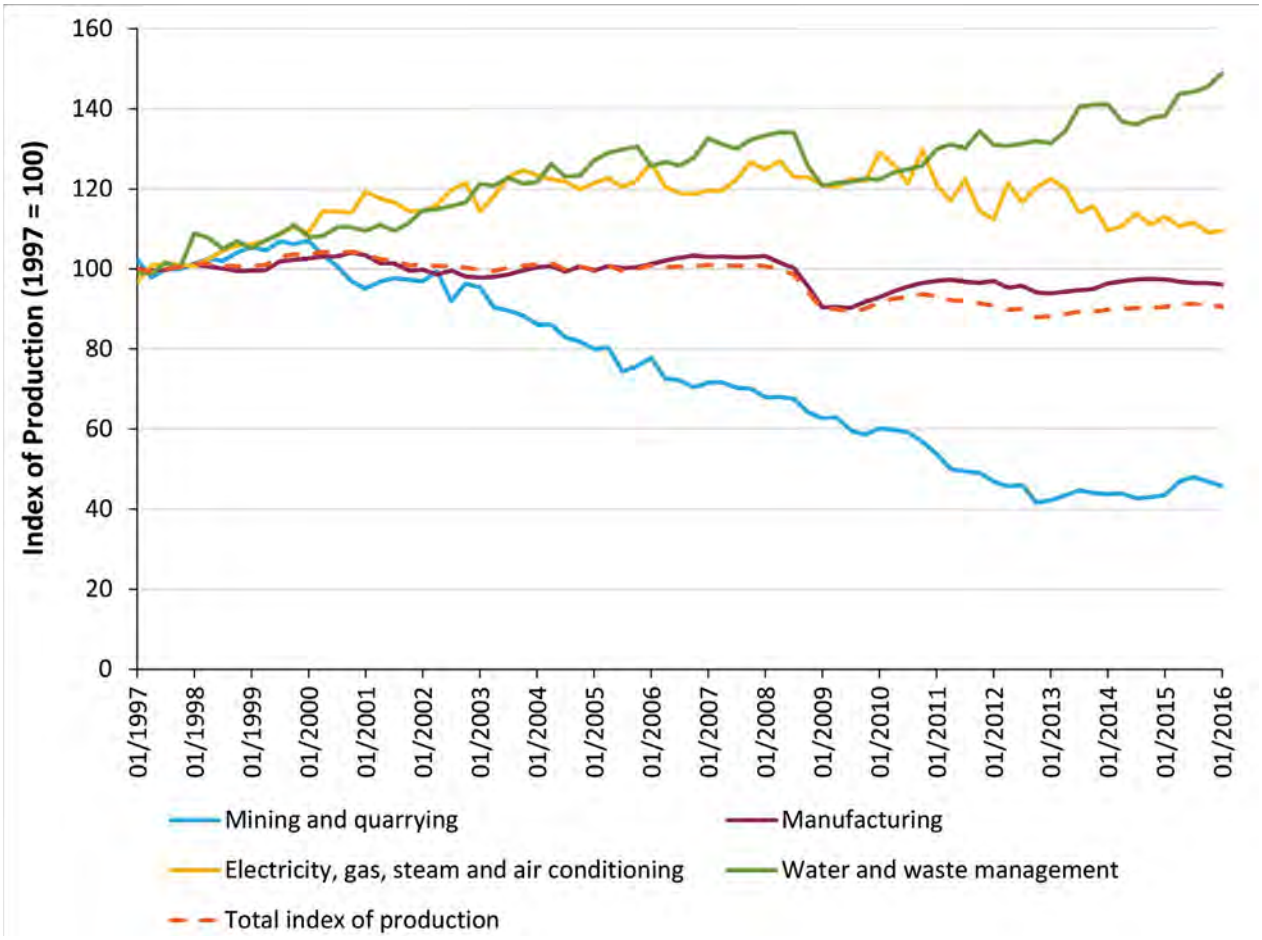


Source: Office for National Statistics

The combined index of production remained more or less constant between 1997 and the onset of the financial crisis in 2009. As shown in Figure 2.3, the financial crisis resulted in a marked decrease in production, which has not yet recovered to pre-recession levels.[12] The sub-components of production exhibit rather different trends: mining and quarrying has shown a steady long-term decline (reflecting, amongst other things, the decline of coal), whilst outputs from electricity, gas, steam and air-conditioning, as well as water and waste management, have increased; the performance of the water and waste management sector has been the strongest in relative terms. The majority of the index (69%) is accounted for by manufacturing, with water and waste management contributing 8%.

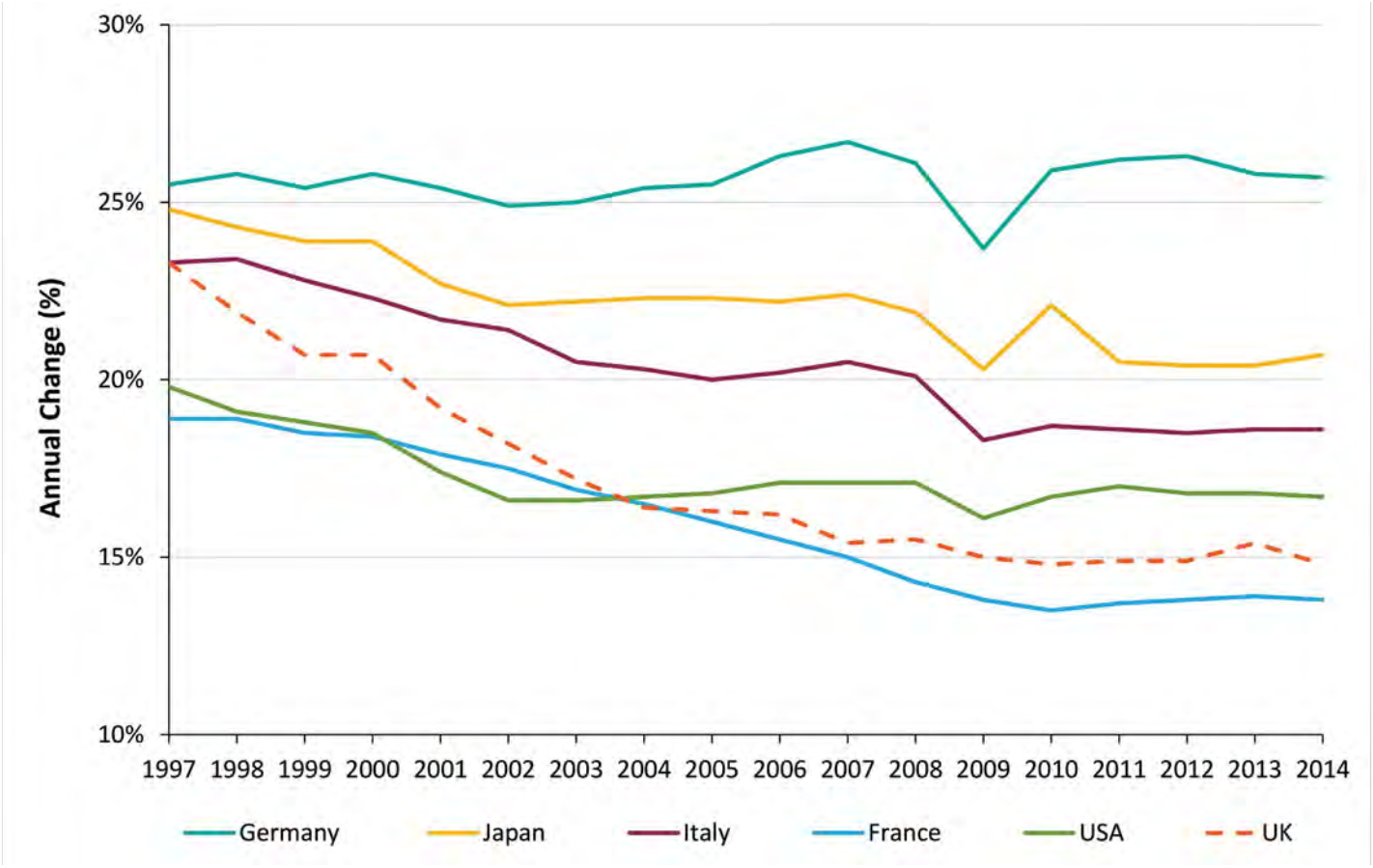
Although total production output has started to grow over recent years, the rate of growth has been outstripped by better performance in other areas of the economy. This has meant that, as a proportion of nominal GVA, production has been in decline for many years. Indeed, as shown in Figure 2.4, the UK's production output has been declining more rapidly than in other advanced economies and has stabilised

Figure 2.3: Index of Production and Sub-Components, 1997-2016



Note: The Index of production measures the volume of production at base year prices for the manufacturing, mining & quarrying, energy supply and water & waste management industries. Source: Office for National Statistics

Figure 2.4: Production as a Percentage of Nominal Gross Value Added in Comparable Economies to the UK, 1997 to 2014



Source: Office for National Statistics

at around 15% of nominal GVA since 2009. It is partly this decline in the relative (and to a lesser extent, the absolute) prominence of production activities in the economy that underpins a renewed interest in articulating an industrial strategy which can help to maintain diversity (both sectoral and spatial) in the sources of employment and earnings within the UK.

2.3. The Current Approach to Industrial Strategy

Against the backdrop of declining production activities, recent governments have sought to develop an industrial strategy to bolster the economy, and to ensure that businesses benefit from the world-class research that the UK produces. The Coalition Government committed itself to the development of an industrial strategy. This strategy, published in April 2013, identified eleven sectors (including aerospace, life sciences and professional and business services) that it believed could benefit from a long-term strategic partnership with Government and could make the most difference to the economy.[13] In addition, the strategy identified eight "great technologies" (including big data, advanced materials and agri-science) where it believed that the UK had the research expertise and business capability to become a world leader. Other key, and cross-cutting, strands of the strategy related to Skills, Government Procurement and Access to Finance.

In July 2014, an inquiry by the House of Commons Environmental Audit Committee (EAC) recommended that the circular economy must be embedded into the UK's industrial strategy and be "mainstreamed" into Departmental business plans.[14] The Government response stated that it agreed with the EAC's recommendations and that, consequently, the Green Economy Council (GEC) had been invited to independently review the sustainable elements of the industrial strategies of the Departments of Business, Innovation and Skills (BIS), Energy and Climate Change (DECC) and Environment Food and Rural Affairs (Defra). The GEC's subsequent report broadly aligned itself with the view of the EAC, including, as one of its conclusions:[15]

Industrial strategy should exploit opportunities to incorporate resource resilience, efficiency and the circular economy as key strands of its forward development.

In its draft action plan, the GEC also endorsed the EAC's proposal for the Circular Economy Task Force to conduct a government-led study into the exposure to material security, starting with sectors identified by the industrial strategy as those most able to contribute to growth. Finally, it recognised a need, in industrial strategy, to:

broaden the original vision to one which includes a strong and unequivocal commitment to environmental and social sustainability and the risks of failing to do so, e.g., in terms of disruption of supply chains due to extreme weather, raw material price shocks.

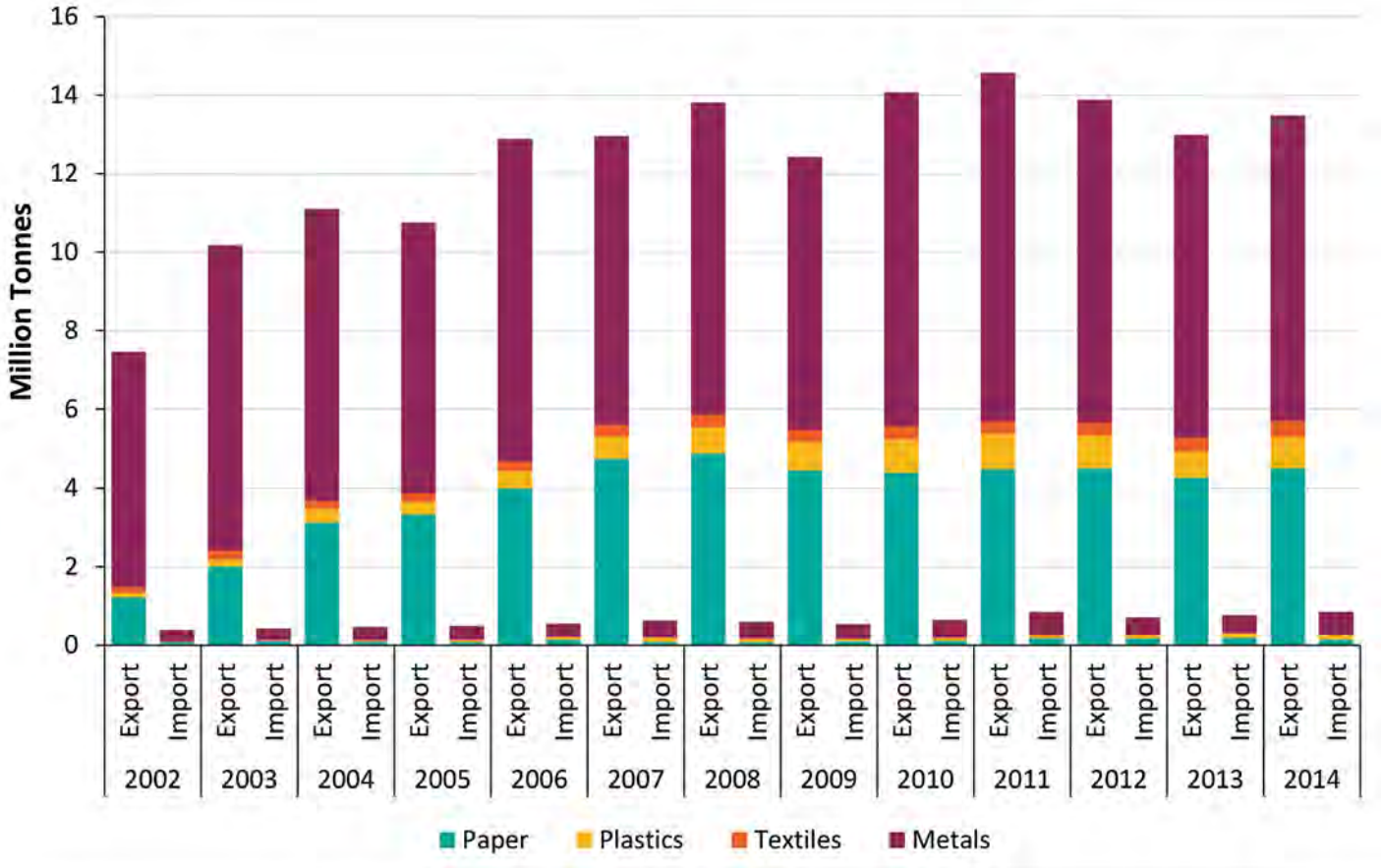
The current Conservative Government has subsequently reassigned some Departmental responsibilities, and in the new Department for BEIS, it has reaffirmed commitment to developing a comprehensive industrial strategy. The above discussion indicates, however, that under the Coalition, there was only a passing nod to the potential role that could be played by the resources and waste industry within such a strategy, and to how this could develop in future. What matters now is that BEIS builds on previous and ongoing work, but further seeks to integrate a more environmentally informed vision of an industrial strategy.

2.4 An Exported Opportunity

As shown in Figure 2.5, data published by Defra suggests that, in recent years, the UK has been a net exporter of between 12 and 14 million tonnes of secondary materials each year. The graphic indicates that over time, as recycling has progressed, there has been an increase in exports, whilst imports have remained consistently at low levels.

Whilst a situation of 'protectionism' and zero exports is not an objective in itself, the UK is effectively losing out on the opportunity to add value to those materials it exports. The challenge is to find innovative ways – for instance, through the collection of high quality material and investments in improved processing technologies – to ensure that, as far as possible, and without imposing undue costs on the economy (that might render UK manufacturing less productive), materials can be processed locally to add value to the UK's economy. In

Figure 2.5: Tonnage of Secondary Materials Exported from the UK



Source: Based on the figures published in: Defra (2016) Digest of Waste and Resource Statistics – 2016 Edition (Revised), March 2016

the context of industrial strategy, it would also make sense to consider the industries that are potential users of various secondary materials, and how their demands can be met by the secondary materials supply industry.

Jaguar Land Rover's commitments to increase the amount of recycled aluminium in vehicle manufacture to 75% provides an example of how the export of valuable secondary materials can possibly be reversed. The company has invested in developing a new alloy called 'RivAlloy' that can tolerate higher levels of impurities in aluminium scrap castings, which were previously disregarded. The company states that this not only reduces the amount of aluminium sent to landfill, but also cuts transport emissions since UK materials can be used, rather than the current imports.[16]

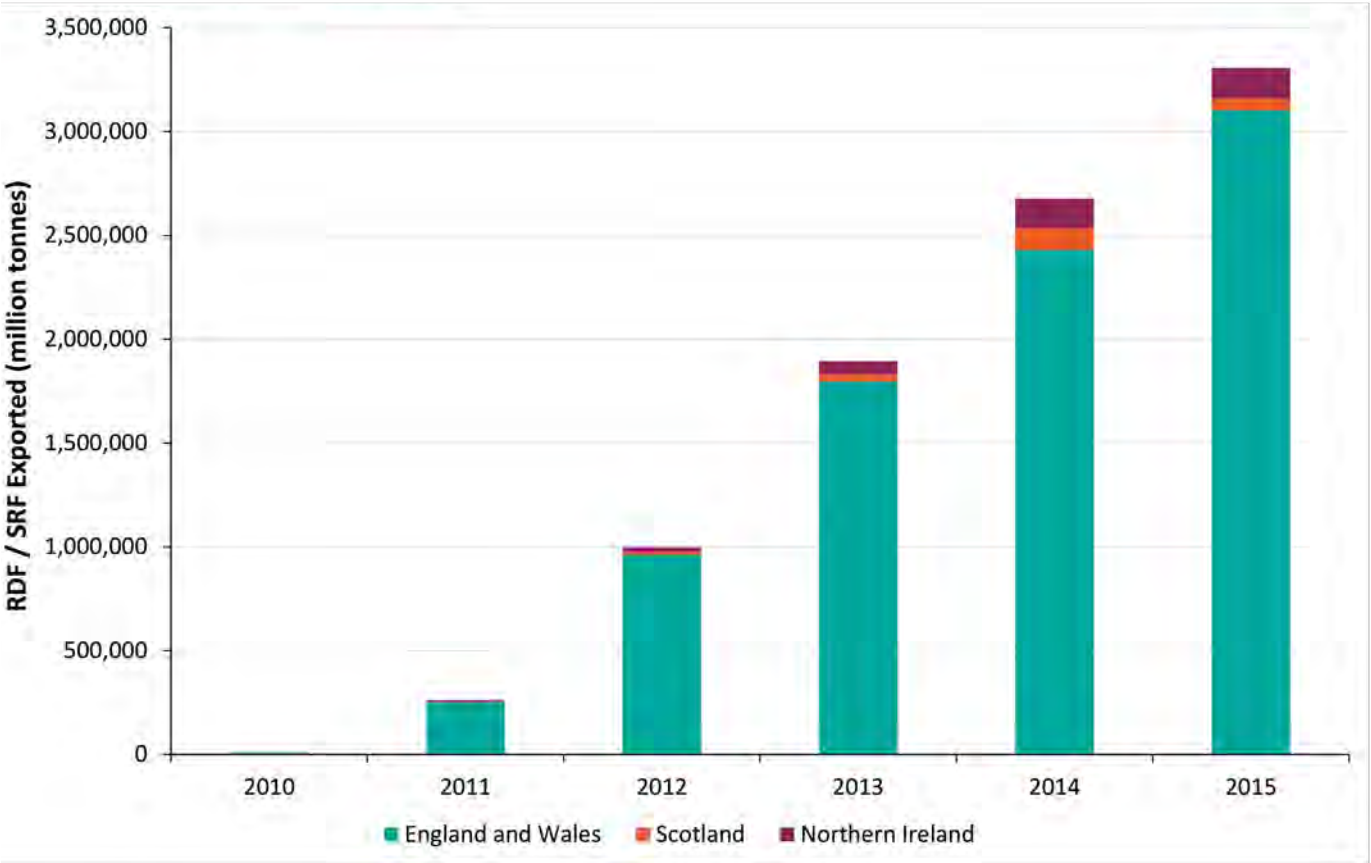
At the same time, with the revised Waste Framework Directive allowing for the export of residual processed waste to recovery facilities, there is also significant tonnage of refuse derived fuel (RDF) being exported from the UK to fill spare capacity at energy from waste (EfW) incineration facilities in other EU Member States. Furthermore, a smaller tonnage of higher quality solid recovered fuel (SRF) is being exported for processing at overseas cement kilns. Combined, this tonnage has been growing steadily during the last five years, totalling over 3 million tonnes in 2015, as presented in Figure 2.6. Monthly 'transfrontier shipments' data gathered directly from the Environment Agency also suggests that this tonnage is set to rise towards 4 million tonnes in 2016. As with the case of secondary materials described above, there are likely to be GVA benefits associated with reshoring this tonnage to be processed in the UK, along with some small benefits in relation to achieving the UK's energy policy goals, as described in Section 3.0.

2.5 The Need for a Joined-up, Circular Industrial Strategy

2.5.1 Industrial Strategy and its Symbiosis with Waste

Industrial symbiosis is generally conceived within a paradigm where one industrial producer makes use of the outputs / by-products of another industrial producer. The waste management sector can play an important facilitating role in this process as shown in Figure 2.7. As

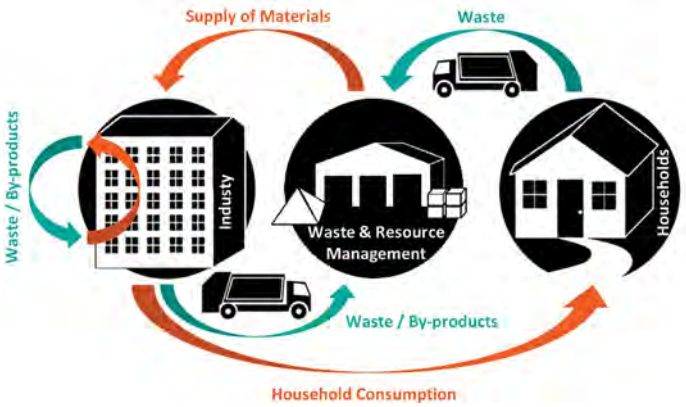
Figure 2.6: Growth of RDF (and SRF) Export from the UK



Note: Tonnage for 2015 is for England only as data from Natural Resources Wales has not yet been made available

the waste management sector becomes more value-led it will have to pay increasing attention to issues of quality and to managing the process by which it produces input materials for UK industry.

Figure 2.7: A Symbiotic Relationship between Industry and the Waste and Resource Management Sector



The waste and resource sector itself can justifiably claim to have made an important contribution to the economy over recent years (Figure 2.3). Although the sector has not bounced back as quickly as the wider economy to pre-recession GVA levels, the rate of increase in GVA from the sector has been higher than the average for the whole economy over the last fifteen years.

There is a case, both in respect of the sector's recent growth and its potential to grow further, for recognising the waste and resource management sector as being of interest in its own right. However, in the context of supporting the growth of other key sectors, the rationale for incorporating the waste and resource management sector within an overarching industrial strategy is far stronger. For instance, the recent discussions around the future of the Tata Steel plant in Port Talbot are of interest because one of the parties seeking to rescue the facility wanted to shift away from the use of primary steel in basic oxygen furnaces towards the use of steel scrap in electric arc furnaces. Such a solution could have helped reverse the outflow of steel scrap from the UK, thereby retaining value within the UK economy.

Other examples of how the sector could potentially support and complement the development of other industry sectors (apart from through multiplier effects) include the following:

1. On its current 'business as usual' trajectory, enhanced waste management performance, generated through appropriate policy, would drive further contributions to the economy by moving more waste from activities that deliver little economic benefit to those which generate more (see Section 4.0).

2. In the case of food waste, that which is not avoidable could be used in anaerobic digestion (AD) which can generate energy in various forms (gas to grid, gas to transport fuel, gas to electricity and heat) for use by households and industry. Other outputs can be used for soil improvers that contain minerals and nutrients that can enhance the resilience of the agricultural sector.

3. Using residual waste, that cannot economically or technically be reused or recycled, for the production of electricity and heat is an established and growing industry as more materials are diverted from landfill. However, technologies are increasingly being developed that can also convert residual waste into liquid fuels and chemicals that can directly be used by UK industry.

4. The value-added associated with recycling is not fully realised due to the amount of material being exported for reprocessing. This takes place for a number of reasons such as the material being of insufficient quality, incompatible specifications for UK manufacturers, or very simply the lack of UK production base. A more collaborative approach across the supply chain could facilitate mutually beneficial domestic market collaboration and value production.

5. If new consumer products introduced to the market allow repair and component recovery then there is the potential for reuse and repair activities to be developed, which would have the net effect of increasing GVA in the economy.

6. For industrial sectors that rely upon a supply of key raw materials that are of high value and / or present significant supply-side risks, then the waste and resources industry could provide solutions to recovering and supplying some of these materials. In 2013, a Foresight report for the Government Office for Science on the Future of Manufacturing highlighted that the UK has world class capabilities in key areas of research in novel material design and development.[17] It added that programmes to develop rapid recycling and recovery technologies, with 'non-destructive removal of high value parts and materials from complex end-of-life products', should complement continued support for fundamental research.

7. If the UK is keen to build on its expertise in novel materials, then it may need to consider how environmental imperatives to recover materials at end-of-life might restrict those markets (as may be the case for composites in vehicles, where the End-of-life Vehicles Directive sets minimum recycling rates for vehicles). Addressing end-of-life concerns not only opens up markets which might otherwise be constrained, but also opens up the possibility for establishing specialised reprocessing industries to import secondary materials rather than exporting them.

Such interventions are consistent with a strategy for industry which seeks to minimise dependence on primary raw materials, and which should therefore result in greater resilience to supply chain shocks in respect of raw materials. Industrial strategy would be predicated on a different premise to the one which prevailed when much of UK waste policy was being shaped (in the late 1990s and early 2000s). Back then, much of industry, and the relevant Government department for business, saw the targets for recycling principally as 'a burden'. Business support for a more circular economy, the challenge of addressing global climate change, and the pressure on ecosystems arising from ever-growing demand for primary resources, suggest that this should no longer be seen as optional, but rather, a central component of any industrial strategy. The Government has, it should be noted, committed to reducing GHG emissions by 57% relative to 1990 levels by 2030.[18] An industrial strategy informed by circular economy principles should help ensure that industry maintains and enhances its competitive advantage, and helps to address climate change (albeit that not all actions may result in improvements to the inventory that the UK currently uses as the basis for measuring its performance).[19]

Resource efficient industries and households would also reduce waste generation. Whilst it might appear that this would, at the margin, reduce the role of the waste and resources sector in the traditional sense, many waste companies are involved in delivering such services (for example, advising companies in the hospitality sector on food waste prevention), recognising that it adds value to their offering.

2.5.2 At Regional and Local Levels

The EAC's recommendations included a suggestion that the Local Enterprise Partnerships (LEPs) should also integrate circular economy principles within their Strategic Economic Plans. Government responded that these plans were the responsibility of local partners, indicating that it would not intervene. However, Government has found it difficult to give completely free rein to the LEPs in setting out, and implementing, their plans. Indeed, it has ultimately decided the pattern of funding allocated via the Local Growth Fund, and the Department for Communities and Local Government (DCLG), as the managing authority, has overseen the plans proposed for use of European Structural and Investment Funds (ESIF).[20]

The 2016 budget included a commitment to provide a further £1.8 billion of funding to LEPs during the course of 2016, on top of the £7.3 billion of Growth Deal funding that they had received by March 2016.[21] [22] There may well have been good reasons why Government was reluctant to allow LEPs to exercise more control over spending. A review by the National Audit Office in March 2016 commented that LEPs did not have an established track record of delivery, that it had "serious reservations" about their capacity to deliver. Further, it highlighted a risk that the projects on which LEPs are currently engaged will not necessarily optimise value for money.[23]

These developments are important in the context of the ongoing process of devolution of powers from Westminster. Following the then Chancellor, George Osbourne's, coining of the term 'Northern Powerhouse' in 2014, there has been much emphasis on devolution of power in the form of the current wave of City Deals, Growth Deals and Devolution Deals. Following Brexit, and the subsequent decision by council leaders to freeze discussions over devolution for the North East, this approach was reinforced by then DCLG Secretary of State, Greg Clark, in a speech in Manchester on 8th July 2016.[24] This speech was largely aimed at reassuring some cities and regions in stating that as a result of the referendum result, there would be "*a much bigger role for local leadership in our national life*".

In his new role as Secretary of State for BEIS, Greg Clark should consider how the principles of resource efficiency and the circular economy can be embedded within industrial strategy at the local/regional level as part of ongoing devolutionary activities. This is likely to require coordination between the regional and national levels, with national policy guiding on cross-cutting themes, and decision makers locally seeking to foster hubs and clusters that build on locally available skills and expertise. In respect of the waste and resource management sector, the challenge will be to aggregate materials and ensure they are supplied, at the required level of quality, to the locations where they are needed. This is a logistical challenge which the sector is well-equipped to handle.

3.0

A Vision for the Future

The amount of waste that is generated will certainly change and the approaches to managing waste that is still generated can also be significantly improved. Valuable materials are still discarded as residual waste and some products produced using valuable materials are effectively destined to be discarded because they have not been designed with any thought as to how they will be dealt with at the end of their life.

So what could the future hold? How could the future look? The answer to this question is of importance to the waste and resources sector as it currently stands. One report for CIWM noted that a shift to a more circular economy would risk the traditional waste and resource management sector operating on the periphery of a new way of working or, at worst being excluded completely if it does not adapt.[25] If it does morph to the new demands, the sector will be able to drive benefits throughout domestic industry.

We therefore propose that the future common vision of the economy should be one where, amongst other things:

> *all sectors of the economy consider how their own activities may be shaped by circular economy principles, and how they may contribute to those principles being embedded in the wider economy.*

This vision could include the following:

1. Industry recognises the value of UK-sourced secondary materials in terms of the security of supply of material inputs. Industrial strategy would reflect this, with the secondary material industries becoming integrated within it as industry seeks to ensure access to quality secondary materials, improve resource security and to consume less.

2. Industrial strategy supports efforts of industry and commerce to develop with a clear strategy in mind for reducing their environmental impact, including considering how they themselves can become 'more circular' and how they can contribute to the development of a more circular economy. As part of this, issues related to design are considered and the upstream supply chain consequences of various choices are examined more closely, both internationally and domestically.

3. Secondary material industries begin to reverse the net outflow of secondary materials to other countries through becoming sources of supply to new and existing industries.

4. Businesses undertake a range of actions to reduce waste in production, and to minimise waste at the end-of-life (for example, by enhancing product durability and extending product lifetimes, or designing for ease of repair or remanufacture). They act to reduce the problematic nature of wastes, both in respect of its potential to do harm, and the ease through which it can be prepared for reuse or be recycled. As a consequence, retailers have fewer returns of products that fail within the guarantee period, but act as points for take-back of a growing range of materials with a view to ensuring quality reverse flows of materials to original equipment manufacturers or reprocessors.

5. Producer responsibility becomes a close partnership between users of materials and the secondary materials industry. Producers take full financial responsibility for the end-of-life management of products and packaging and play a prominent role in deciding how end-of-life materials are managed with design for durability and recyclability being incentivised by the structure of producer fees.

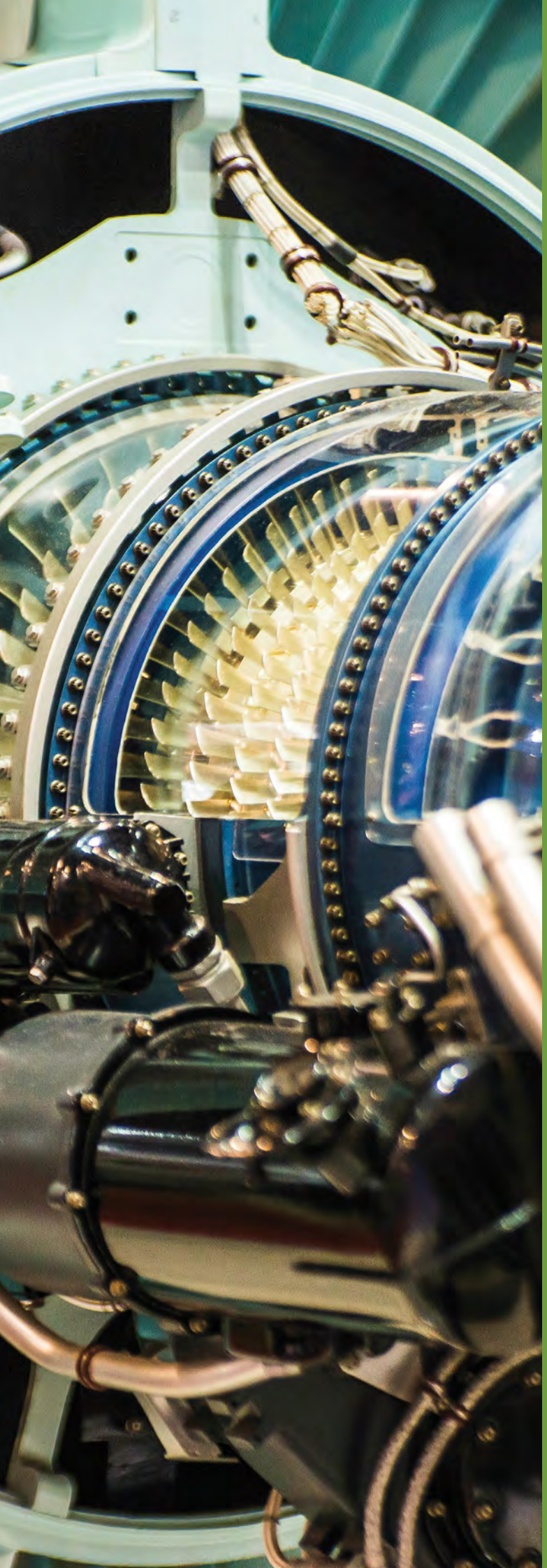
6. Household waste is managed, increasingly, in reverse logistic loops so that a diminishing share is managed through conventional bespoke collection schemes. A large proportion of the costs of household waste management moves to being funded through extended producer responsibility schemes, with 'variable' charging used to incentivise waste prevention, reuse and the use of recycling services. Our own estimates suggest that this could lead to savings in the order of £1 billion to local authorities, the costs being transferred to producers.

7. Soil organic matter is restored via the application of certified compost and digestate (from processing of food and green wastes) to land, with attendant benefits for moisture retention (and hence, resilience to changes in climate) and nutrient and mineral recycling.

8. Building on the recent new levies on plastic bags, the persistent problem of littering, and the problem of litter in rivers, estuaries and the marine environment, is tackled through a series of measures aimed at incentivising a reduction in such activities.

9. The provision of infrastructure takes full account of the services that can be provided by ecosystems. Green infrastructure therefore becomes embedded in urban projects, resulting in services, such as, water supply/catchment management and water treatment being delivered through changes in land use.

10. The number of new homes required to be built is reduced through more efficient use of existing dwellings (backed by incentives to encourage higher occupancy). Use of selective demolition techniques is more prominent, whilst additive layer manufacturing (3D printing) reduces the level of wastage of materials. Homes will be built using more recycled materials and designed to be far more energy efficient, whilst maintaining a focus on affordability.



4.0

What are the Benefits of the Vision?

4.1 Measuring Economic Benefits

Much has been written about the potential benefits of moving towards a more circular, resource efficient economy. Few studies, however, have aimed to quantify the additional value that could be generated for the UK economy by such a transition. As part of this study, a model was developed to assess the benefits that could be derived from achieving elements of the vision set out in Section 3.0. Given the broad scope of the vision set out above, the model described in Section 4.3 focuses on specific changes for which material flows, and associated economic consequences, can be quantified in a reasonably straightforward manner. It does not, therefore, aim to cover all areas of the vision. The model also does not seek to quantify the impact of individual initiatives and policies, but instead illustrates the benefits that could be derived from taking decisive steps towards achieving the outcomes consistent with the above vision. In Section 5.0, we explore the new policy mechanisms required to deliver both the vision and the associated benefits presented in Section 4.4.

GVA was selected as the economic metric by which to quantify the macroeconomic impact of a transition to a more circular, resource efficient economy. In essence, GVA is a measure of the increase in the value of the economy due to the production of goods and the delivery of services. GVA can be measured using either the 'production' or the 'income' approach. The latter approach is used by the Office for National Statistics (ONS) to estimate regional GVA figures for the UK.[26] To allow for comparability in figures the same approach was used for the analysis presented here.

The income approach to calculating GVA adds up all of the income earned by individuals or businesses involved in the production of goods and services. The main components of income-based GVA are:

- Compensation of employees.
- Gross operating surplus (includes gross trading profit and surplus, mixed income, non-market capital consumption, rental income, less holding gains).
- Taxes (less subsidies) on production. These are included, whereas unit taxes on products are not. This means that in the waste and resource management sector, landfill tax – considered as a unit tax on a 'product' – does not fall within GVA calculations.

The analysis undertaken for this study takes into account the direct, indirect and induced effects on the economy. An increase in demand for a product will result in an increase in the production of that product, as producers react to meet the increased demand. This is known as the 'direct' effect. As producers increase output there will be a corresponding increase in demand on their suppliers along the entire supply chain. This is known as the 'indirect' effect. Because of the direct and indirect effects, the level of household income throughout the economy will increase as a result of higher aggregate compensation to employees. A proportion of this increased income will be spent on final goods and services and thereby generate additional economic activity. This is known as the 'induced' effect. By accounting for the various effects across the economy, it is possible to obtain a more accurate picture of the likely impact that changes to specific sectors, such as waste and resource management, will have on the broader economy.

The assumptions and key sources of information underpinning the model have been described in a separate Technical Appendix which accompanies this report.[27]

4.2 Alternative Futures

Depending on the level of ambition among policy makers, and the rate of transition, the UK economy may look quite different in 2030 to the current situation. Three scenarios were modelled to illustrate different possible trajectories. Each scenario includes a number of 'switches' – assumed changes in the way resources will be managed within the economy (for example, switching paper out of landfill and into recycling) — depending on the level of ambition shown by the UK in relation to improved resource management, and the level of integration with an industrial strategy. Further detail on the switches included under each scenario are presented in the separate Technical Appendix that accompanies this report.

The three scenarios can be summarised as follows:

- **Business as Usual (BaU)**
  This provides a baseline against which the performance of the other two scenarios are compared. It assumes no policy change and limited progress on waste related issues outside of Scotland and Wales (where existent policies continue to affect change). Broadly speaking, there is stasis in England's waste and resource management sector, and limited engagement by industry on the circular economy.
- **Tentative Transition**
  This assumes that some early, but clear, steps are taken to improving the management of resources in the UK economy, rendering it 'more circular'. The switches include, for example, setting (and achieving) a more ambitious recycling target for England of 55% by 2030, a greater focus on waste prevention

and preparation for reuse, as well as a reduction in residual waste being disposed of at landfills. This scenario also assumes that there is a reduction in the quantity of secondary materials being exported for recycling abroad, and that some RDF that is currently exported is reshored. The effect of these is to retain the added value associated with processing these materials within the UK. Note that we have assumed no net increase in cost with either of these measures; an assumption we believe to be reasonable now, and even more so, in the medium-term.

- **Positive Transition**
  This assumes that, by 2030, significant strides have been made in integrating what industry does with what happens in the resource management sector. The UK economy becomes more circular as a result. The scenario assumes that efforts at waste prevention through, for example, the adoption of new business models and behaviour change campaigns have resulted in measurable and sustained reductions in waste arisings (most notably food waste). It assumes that 70% recycling is achieved across the UK by 2030, bringing all of the four countries in line with one another. This scenario, unlike the Tentative Transition scenario, also aims to estimate what the added value would be for a number of broader switches in the economy. This element of the analysis is not intended to be comprehensive but is intended simply to provide an illustration of the order of magnitude of the additional value that could be created by circularising the flow of textiles, furniture, and electrical and electronic equipment (EEE). As with the Tentative Transition scenario, in this scenario, higher levels of secondary materials and RDF are reshored to the UK.

4.3 Approach Taken to Estimating Financial Benefits

The structure of the model developed for this study is shown in Figure 4.1. It comprises of two key elements: the first is a waste flow module covering household waste, commercial & industrial (C&I) waste, and construction & demolition (C&D) waste. The second element is a broader circular economy module, as mentioned above, which assesses the likely impact of changes to the economy arising from improving the circular flow of three product categories. It was assumed that these broader switches would only occur under the Positive Transition scenario. The two elements are then brought together to calculate the overall change in GVA and GHG emissions.

For the waste flow element of the model individual material flows were projected forward to 2030 and these were multiplied by unit GVA values (£ per tonne) which covered the various elements of the waste management value chain (i.e. collection, preparation for reuse, recycling, treatment, and disposal). These waste flows were also multiplied by GHG impact factors (as carbon dioxide 'equivalent' - CO_2eq) to estimate the avoided emissions associated with transitioning to the Tentative Transition and Positive Transition scenarios.

Given the broad scope of the vision, the model focused on specific areas for which reasonable data exists and for which material / financial flows can readily be quantified. In light of this, the model covered the following areas:

- **Circularising product flows** – the Positive Transition scenario models a shift to repairing and maintaining furniture and EEE, and selling greater quantities of unwanted textiles via second hand retailers.

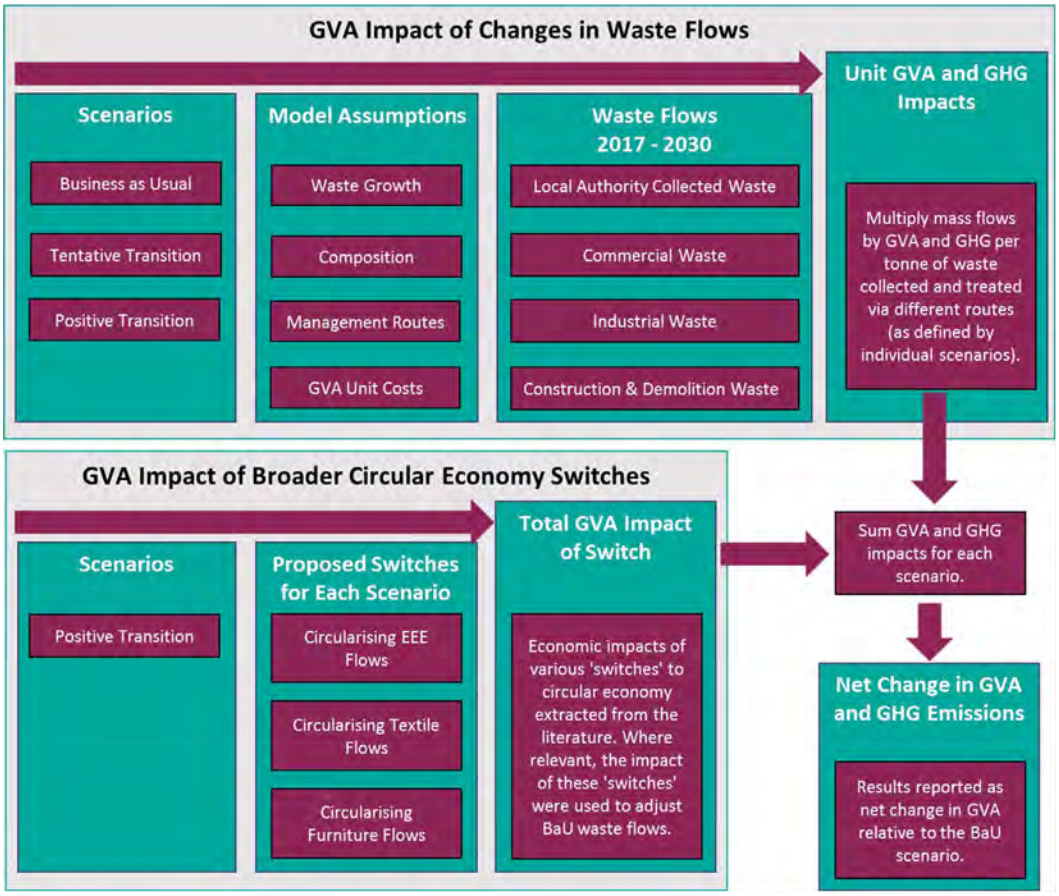
- **Waste prevention** – under more forward thinking strategies, there are likely to be effects on waste quantities (e.g. through changes in consumer habits, increasing product life and reusability / reparability, or a shift to new business models that offer services rather than encouraging the outright ownership of products).

- **Preparation for reuse and recycling** – diversion of materials away from the residual waste stream to recycling / preparation for reuse can add significant value to the UK economy due to the more labour intensive nature of recycling.

- **Residual waste treatment** – the model considers the need for residual waste treatment infrastructure. It takes account of changes in residual waste arisings and the effects of reshoring RDF/SRF.

- **Construction of waste related infrastructure** – the scenarios have implications for the type of infrastructure that may be required to deliver them. The model assesses the GVA impacts associated with building, or potentially not building, different types of facilities.

Figure 4.1: Overview of Model Structure



Note: GVA = gross value added; GHG = greenhouse gas emissions

4.3.1 Waste Prevention

As highlighted above, an important aspect of the tentative Transition and Positive Transition scenarios will be a reduction in waste arisings. Estimating the economic impact of waste prevention is challenging as one has to consider a number of possible upstream and downstream impacts. Given the importance of waste prevention in the Tentative Transition and Positive Transition scenarios, it was necessary to estimate the likely macroeconomic impacts of avoiding food and non-food waste.

The prevention / avoidance of waste through reduced consumption in various sectors is associated with a fall in the GVA in the relevant sectors. On the other hand, if the activities that lead to waste prevention are not incurring significant costs, householders will save money and businesses' profits will increase. These avoided costs may be spent by households or used in various ways by businesses. This can offset (or even exceed) any direct reduction in GVA.

Figures published by WRAP suggest that by avoiding preventable food waste, households could save around £2,604 per tonne (or about £500 per household).[28] We assume that these savings apply to the households, and are reflected in lost GVA associated with retail. We then assume a proportion of these savings will be spent, thereby offsetting the reduction in GVA from reduced retailer expenditure.

As described in the Technical Appendix, a similar approach was used to estimate the GVA impact of preventing food waste in the C&I waste stream.[29] This was to account for efforts being made by industry and manufactures to reduce food waste as part of, for example, the Courtauld Commitment 2025. The GVA impacts of non-food waste items across the household, C&I and C&D waste streams were also included in the model.

4.3.2 Preparation for Reuse and Recycling

Relative to other forms of waste management, preparing products for reuse is a labour intensive process. The GVA associated with preparing furniture, WEEE, mattresses and textiles for reuse was calculated based on the average time taken to repair products. These times were multiplied by Defra estimates of the GVA per hour worked in different repair sectors.[30]

The GVA associated with recycling different materials was calculated based on the employment intensities of different recycling processes. These figures were multiplied by the UK average salary for 'recovery of sorted materials' to estimate unit GVA impact figures.[31] These figures enabled the GVA associated with increasing recycling rates under the different scenarios to be calculated (after accounting for the impacts of waste prevention). Given that these materials are drawn from the residual waste stream, which generates lower amounts of GVA per tonne processed, the uplift in recycling tonnages is associated with an increase in GVA.

The GVA effects associated with sorting materials at material recovery facilities (MRFs), and treating bio-waste via anaerobic digestion (AD), in-vessel composting (IVC), and open-air windrow (OAW) were derived from information provided by SUEZ and from Eunomia's extensive work on modelling waste treatment processes.

4.3.3 Residual Waste Treatment

The GVA effects associated with landfilling, treating waste at energy from waste (EfW) facilities, and preparing RDF/SRF for export were obtained from SUEZ. These figures were used to estimate the GVA contribution related to disposal, treatment, and the reshoring some of the RDF/SRF that is currently being exported.

4.3.4 Construction of Waste Related Infrastructure

Moving towards the Tentative Transition and Positive Transition scenarios will result in the generation of less residual waste. This means that, relative the BaU scenario, there will be some GVA lost to the UK due to the avoided construction of residual waste infrastructure. However, this is offset, at least in part, by an increased need for MRFs, AD, IVC and OAW facilities to process recyclables. The UK derived GVA associated with building facilities was calculated based on data from SUEZ and Eunomia. The model calculates the GVA generated

through construction, based on the projected mass flows of each scenario and assuming an average capacity or each type of facility. Once the projected tonnage exceeds this threshold it is assumed that a new facility is built and that the GVA associated with construction is realised in the same year.

4.3.5 Circularising Product Flows

Improved product design would help extend product lives and facilitate reuse and repair. Assessing the macroeconomic impacts of such changes to the economy is challenging given the limited data currently available on product and resource flows within the broader economy. A simple approach was taken in which it was assumed that improved design would, on average, increase the lifetime of products by increasing their durability and making them easier to repair and maintain. Over time this would reduce the annual amount of waste related to these streams. We assumed that the unit price of each product would, on the other hand, increase relative to current levels, reflecting higher quality. Notwithstanding the higher unit values, the lower level of consumption dominates, and results in a net reduction in the expenditure on new products, reflected in the total turnover of the retail sector related to these products being reduced accordingly. GVA from the sector falls as a result.

It was assumed that net spending on retail and repair would, however, remain constant, and that the money saved from reduced sales would instead be spent (directly or indirectly) on repairing the better designed products so that they continue to flow through the economy. Repair and maintenance activities are therefore stimulated, and contribute positively to GVA. The net effect tends to be positive as the GVA benefits of additional repair activity are greater than those related to retail.

4.4 Quantifying the Benefits

The results presented below are all given relative to the BaU scenario. Positive results show a net gain in GVA, or net increase in GHG emissions, whereas negative values indicate that, relative to the baseline situation, a loss in GVA, or a decrease in emissions, is anticipated.

4.4.1 Financial Benefits

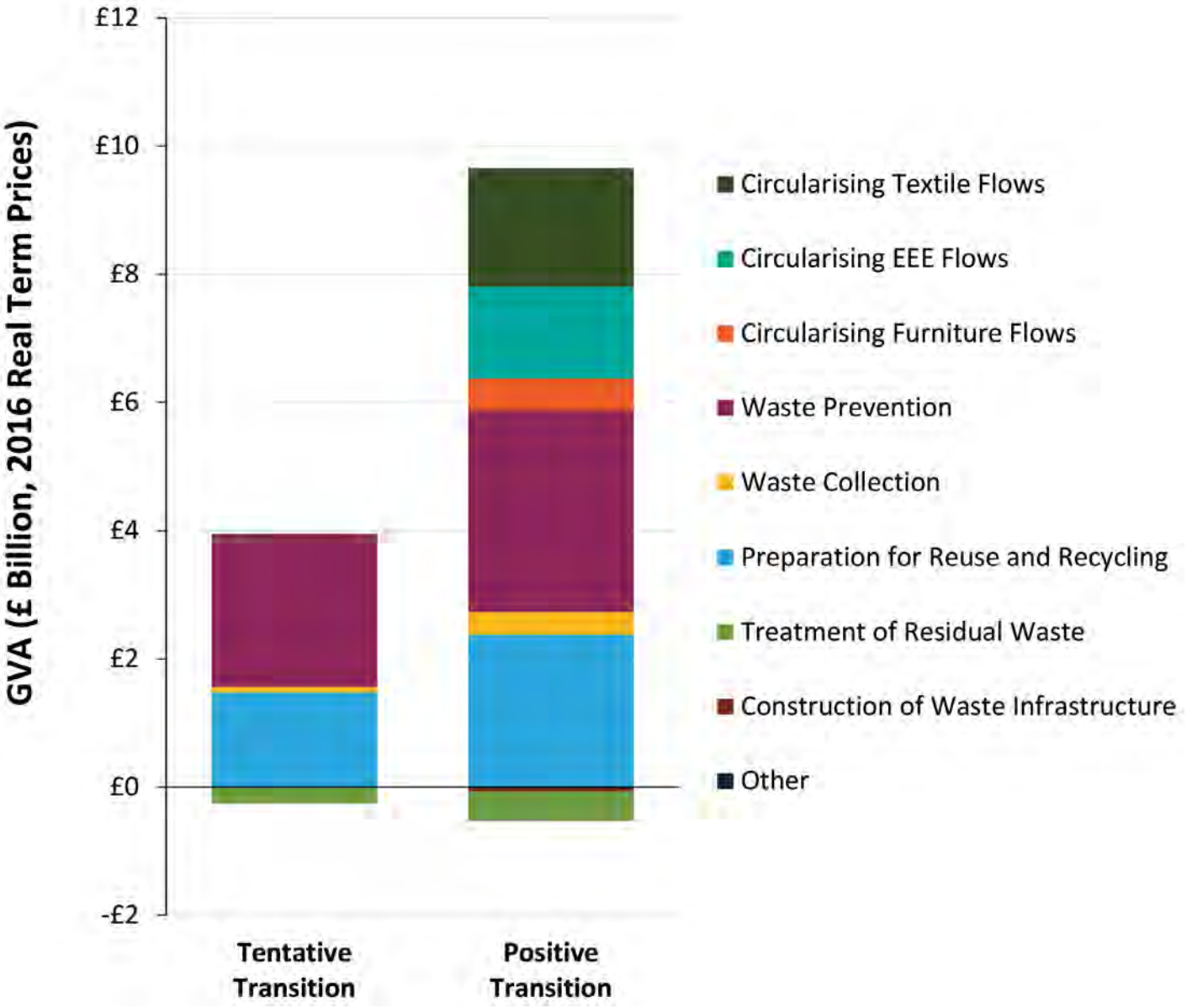
The results of the analysis demonstrate that both the circular economy scenarios will result in significant added value for the UK economy in comparison to continuing on a BaU trajectory. The GVA uplift for the Tentative Transition and Positive Transition scenarios are shown in Figure 4.2. The former delivers additional GVA of £3.7 billion per annum in 2030, whilst the latter results in far greater net benefits of £9.1 billion per annum. According to the ONS, the waste and resource management sector as a whole was responsible for generating an estimated £6.5 billion of GVA in 2014.[32] The GVA uplift is therefore considerable in this context, despite some of the modelled benefits in 2030 not being directly attributable to the sector. Put another way, the uplift is over 0.5% of the current GVA of the UK (at £1.6 trillion, according to ONS).

It is also interesting to understand what the total value of the Tentative Transition and Positive Transition scenarios are over time. Economists report the current value of a stream of future payments as a net present value (NPV).[33] It is estimated that the NPV of the Tentative Transition scenario is £18 billion (2016 prices and covering the period 2016 to 2030). For the Positive Transition scenario, the NPV rises substantially to £47 billion. This shows that there are substantial benefits to be gained when considering the additional value that could be generated over time under this ambitious scenario.

The key benefits of moving from BaU to the Positive Transition scenario are associated with the improved circular flow of textiles, EEE and furniture, as well as much higher levels of GVA generated through waste prevention, preparation for reuse, and recycling. The significant contribution of waste prevention to the overall results suggests that substantial macroeconomic benefits can be gained through focusing more efforts on driving forward waste prevention.

Under the Positive Transition scenario, as a result of the indirect and induced effects, the significant increase in waste prevention results in the largest net gain (of £3.1 billion per annum) followed by the contribution from preparation for reuse and recycling, which delivers £2.4 billion per annum. The reduction in tonnage sent for residual waste treatment results in a net drop of £0.47 billion per annum, but this is more than offset by the shift to prevention / other forms of waste management.

Figure 4.2: Net Change in GVA Relative to BaU in 2030 (£ Billion, 2016 Real Term Prices)



Notes:

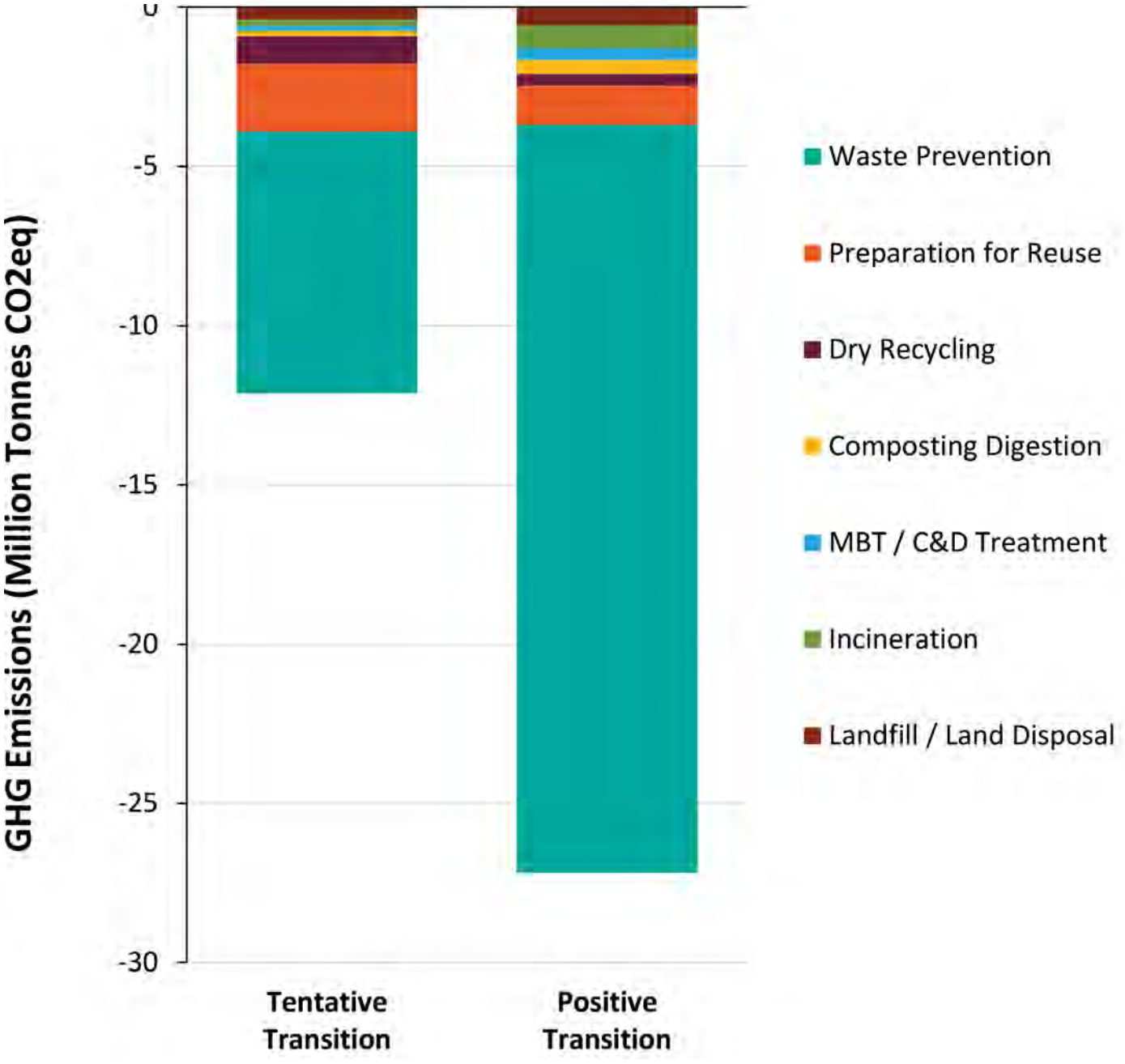
1. *Positive results show a net gain in GVA, whereas negative values denote a reduction in GVA relative to the BaU scenario.*
2. *The results make no forecasts of how waste streams may change as a result of a change in sectoral contributions to the economy.*

4.4.2 Greenhouse Gas Benefits

The scenarios also generate savings in respect of GHG emissions. Improvement in waste management delivers reductions of around 4 million tonnes per annum in each scenario by 2030, but the scenarios also deliver savings related to waste prevention, and these dominate the figures. In the Tentative Transition scenario, GHG savings are 12 million tonnes per annum in the year 2030, whilst in the Positive Transition scenario, the savings are 27 million tonnes in the same year. To set these figures in context, the fifth carbon budget has recently been approved by the Conservative Government and this sets a target for reducing UK GHG emissions by 57% by 2030 (relative to 1990 levels).[34] The reductions from the scenarios amount to 1.5% and 3.4%, respectively, of the UK's 1990 emissions.

The cumulative change in GHG emissions over the period to 2030 is estimated, for the Tentative and Positive Transitions, to be 168 and 372 million tonnes CO_2eq respectively.

Figure 4.3: Net Change in GHG Emissions Relative to BaU (tonnes CO_2eq)



4.5 Summary

It is clear that there is considerable potential for economic benefits in the modelled scenarios, and that they also have potential to reduce GHG emissions. The GVA uplift is from the Positive Transition scenario is more than 0.5% of total GVA in the UK. The GHG savings amount to one and a half times the emissions reported for the waste sector under the inventory reported to the United Nations Framework Convention on Climate Change (UNFCCC).

Not all the GHG reductions being reported here will benefit the UK in terms of what it reports to the UNFCCC.[35] Indeed, some measures, whilst reducing global emissions, might increase reported emissions under the UK's inventory, whilst some waste prevention activities might impact equally on the emissions from countries from which we import products and materials. Nonetheless, the potential for enhancement of value added in the economy is clear, and the case for considering measures that realise this potential is strong.

5.0

How can the Vision and Benefits be Realised?

5.1 Building on Brexit

The vision and economic benefits set out in the previous two sections will not be realised without action. There is a need for a range of policy interventions from Government, both to overcome the current hiatus in conventional waste and resource management, and to foster a longer-term transition to the vision set out above. Industrial strategy can have both horizontal and vertical policies. Horizontal policies are those that are applied across the whole economy – for example, skills, finance, infrastructure, energy and resource policy. Vertical policies, on the other hand, focus on helping particular sectors to achieve their broader objectives. The measures presented here are intended to provide a sound horizontal policy framework which can act as the basis for a strong, resource efficient economy.

In the context of ongoing discussions regarding Brexit, it is worth stating that the measures suggested here are consistent with the current direction of travel within European waste management policy. Some, however, are made more or less likely by different forms of Brexit. We comment on this through reference to the extremes of Brexit, which are, for the purposes of this report:

- *Soft Brexit, in which the UK remains within the Single Market, and as a result, is bound by the environmental legislation of the European Union;*

- *Hard Brexit*, in which the UK effectively delinks from the Single Market, and as a result, is left to devise its own environmental legislation independently of other countries.

A number of policy levers could help to realise the benefits described in Section 4.0. These are described below and elaborated in the Technical Appendix which accompanies this report.[36]

5.2 Completing the Job of Waste Management Policy

Waste management in the UK progressed in leaps and bounds in the first decade of the millennium. There are, however, policies that are still missing, and ones that are simply no longer fit for purpose (if, indeed, they ever were). The job would be 'more or less complete' if the following changes were made:

- **Extended producer responsibility**
  Extended producer responsibility should work for the producers, and – by helping them to access more secondary materials –should support a shift to more sustainable materials management and use. Producers should be asked to cover the full costs of end-of-life management (and should seek to recover those costs in ways that reflect the ease through which end-of-life management can take place). Bearing the full end-of-life costs would drive improvements in product design and also encourage producers to consider alternative business models, such as, offering repair and maintenance services, product leasing, and remanufacturing.

- **Broader scope of extended producer responsibility**
  Extended producer responsibility in the UK is limited to the streams covered by European Directives. There is no consideration of such a measure for furniture, for example, or pharmaceuticals such as already occurs in France. Colombia – which has no extended producer responsibility for packaging – uses the measure to address a range of hazardous wastes (for very good reasons). Wider scope, and the incorporation of targets and objectives that go beyond recycling, would be welcome.

- **Mandate recycling collections**
  One area where Defra has expressed considerable interest is in harmonising collections across England: the diversity of customer experience is beyond the level that would be justified by rational experimentation. Scotland and Northern Ireland have resorted to mandating collection of food waste at some commercial enterprises. It would make sense to introduce:

  - Minimum standards of service provision, in terms of (inter alia) the range of materials collected, and the frequency of their collection, for those collecting household waste. The requirement for this, as regards dry recyclables, could be influenced by the nature of a revised extended producer responsibility measure (in essence, producers themselves could specify this in a more enlightened model of extended producer responsibility).

  - A requirement for commerce and industry to sort specific wastes (dry recyclables and food).

  - A requirement for producers of construction and demolition waste to separate out materials for recycling.

Such measures would increase captures of suitable materials for recycling.

5.3 Influencing Consumer Behaviour

There are a number of measures that should be adopted to help influence consumer behaviour in environmentally positive ways:

- **Pay as you throw (PAYT) schemes**
  The use of such schemes is widespread across the world. The law having finally been changed to allow for this in the Climate Change Act, the Coalition Government effectively overturned that change. It makes no sense to disallow the use of PAYT given that it can bring efficiencies and improved performance to the sector.[37,38] In terms of industrial strategy, a number of UK companies are suppliers of relevant equipment and software, but the market for their use has been constrained in the UK by a lack of implementation of these measures. A target to reduce residual waste arisings per inhabitant could be coupled with the introduction of PAYT schemes. Whitehall government has set no recycling targets for municipal waste. Recycling targets can have perverse consequences if they lead to the collection of more of an easily recyclable waste as a means to increase recycling rates (this has happened, and continues to happen, with garden waste). Setting a target to reduce the amount of residual waste being generated can help to avoid this.

- **Incentivising return rates**
  The pervasive nature of litter, and the problems it can create in rivers and marine ecosystems in particular, have led to considerable emphasis on litter as an issue that needs to be tackled. Methods based on educating and informing have less to recommend them than measures that incentivise change, and encourage behaviours to reduce littering. Measures of interest here include:

  - **Broadening the scope of taxes on single use disposable products**
    The success of plastic bag levies indicates an acceptance of, and willingness to respond to, measures that seek to achieve sensible objectives. Products that are obviously disposable, and which are clearly wasteful, are legitimate targets of levies which send a strong signal for behaviour to change. Other targets could include disposable cups, disposable cutlery, and disposable take-away containers, for example. These measures would reduce littering and reduce wasteful use of resources.

  - **Deposit refund schemes**
    Deposit refund schemes for beverage containers are widely used in European Member States, provinces and states in North America, and increasingly, in states of Australia. Evidence suggests that they can lead to high return rates, delivering high quality materials, and that they reduce litter. Scotland is still considering such a

scheme. Similar measures could also be applied to small WEEE items, which are often disposed of without being presented for recycling.

5.4 Influencing Industry

An industrial strategy would seek to influence the behaviour of industry in terms of production and resource efficiency. Measures which could be used include:

- **Extended warranties**
  In order to increase longevity of products, Government could legislate for extended warranties. One option would be to require pricing of a product to reflect the period of the warranty the manufacture is prepared to offer, so that durable goods would be able to clearly demonstrate lower whole life costs than those which are more prone to failure. This outcome would also be encouraged under leasing models.

- **Green Public Procurement**
  In the UK, the Government spends around £268 billion on goods and services each year, or around 15% of GDP. [39] The spending power of public procurement is not fully utilised in a manner that allows for a shaping of delivery of the products and services which the public sector uses. The notional targets from the EU have never been meaningfully implemented (not just in the UK) but the potential remains enormous. Tactical packaging of procurements can lead to bidders shaping product or service development to respond to the demands of clients with significant collective purchasing power. Another possibility would be to use environmental rankings of products, such as Japan's top-runner programme, or EPEAT in the USA, and use these (as happens in the USA) to inform public procurement exercises.

- **Using agri-environmental payments to encourage use of compost and digestate**
  The Brexit vote could mean that the way in which financial support is offered to farmers is significantly revised. Italy has used agri-environmental schemes to encourage farmers to use compost on farmland to enhance soil structure and increase soil organic matter. Similar measures could be used in the UK, thereby enhancing demand for compost (and digestate). This could be assisted also if the UK was to revisit the limits to application of compost, in particular, in the event of a hard Brexit since in principle, nitrogen content limits use, even where the nitrogen is bound within humus.

- **Invest in R&D and collaborative research**
  We have highlighted previously the mismatch between the nature and quality of materials extracted from waste, and the requirements of end users. Support for practical, collaborative efforts to explore how such hurdles can be overcome would be welcome. In addition, support for R&D in novel processing techniques to deal with materials which are anticipated to arise in large quantities in future, and the processing of which offers a commercial opportunity, should be introduced. There are already a number of sources of funding available, such as those provided by Innovate UK, whilst the Government has committed to guarantee funding for existing EU Horizon 2020 funds, which may be due to UK companies after the UK has officially left the EU.

- **Taxes on natural resources**
  The demand for primary materials is not only excessive as a result of a lack of full internalisation of externalities, but it is excessive relative to the demand for secondary materials, for which the associated externalities are smaller than for primary materials. The difficulties in implementing a comprehensive raw material tax are not to be understated, but the measure is one that is worth pursuing. In principle, under a Hard Brexit, there might be a rationale for considering how the UK deals with carbon pricing: withdrawal from the EU-ETS may make a carbon tax attractive, with border tax adjustments used to offset any competitiveness concerns. A commission to explore the potential for a raw materials tax should be established, making recommendations as to the feasibility, and potential design options (if feasible) of a comprehensive tax of this nature.

  The commission would also investigate some important possible targets for taxation with a view to enhancing the potential for more sustainable resource management. Taxes on mineral phosphorous, or the extraction of peat, would help the market for the outputs from biological treatment through shifting demand to the untaxed products.

  An increase in the application of environmental taxes could generate significant revenue, although examples of levies such as the plastic bag levy, which have the ability to bring about major shifts in consumer behaviour, tend to erode the tax base upon which they are based. A comprehensive resource tax would, however, have the potential to generate significant revenue. This would give scope to shift the burden of taxation away from taxes on labour, thereby incentivising employment.[40]

If the above initiatives were implemented, the vision proposed in Section 3.0 could be delivered.

6.0

Key Messages

The key messages from the study can be summarised as follows:

1. In the period since the formation of the Coalition Government in 2010 (and in preceding periods), industrial strategy has been conceived with only very limited attention given to resource efficiency and its associated economic and environmental benefits. Successive reports from the EAC and the GEC have recommended that a resource efficient, circular economy should be the basis for the UK's industrial strategy. Government has broadly accepted these critical remarks and so, as a matter of priority, a revised industrial strategy should be developed by BEIS.

2. For the last decade, the UK has been a net exporter of between 12 and 14 million tonnes per annum of secondary materials. Reshoring 50% of waste paper, 30% of scrap metal, 30% of plastics, and 10% of secondary textiles, relative to the current baseline, could generate an estimated £646 million of additional GVA per annum by 2030.

3. Additional GVA in the wider economy could be delivered by waste prevention activities and 'circularisation' of flows of textiles, furniture and EEE. The ambitious 'Positive Transition' (to a more circular industrial strategy) scenario modelled for this study results in a net gain in GVA of £9.1 billion in 2030. In NPV terms, this could generate as much as £47 billion of additional GVA for the UK economy between now and 2030.

4. This would be coupled with the cumulative avoidance of an estimated 372 million tonnes of CO_2eq during the same period, which would represent a material contribution towards the UK's 2030 carbon reduction target.

5. To realise the above GVA and carbon benefits, Government needs to introduce a range of cross-cutting policy initiatives. These 'horizontal' policy measures range from EPR legislation, and mandating of recycling collections for businesses, to a range of economic instruments, such as taxes on natural resources, deposit refund schemes, and revamped Green Public Procurement.

6. Such mechanisms need to be introduced alongside the progressive industrial strategy outlined above, which helps facilitate the transition to a more resource efficient, circular economy.

7. As part of this strategy, delivering the behaviour change and associated new infrastructure required for maintaining resource flows within the UK – or even attracting materials into the UK – will require strategic, joined-up planning at all levels. While LEPs or the new bodies created as a result of City Deals, Growth Deals and Devolution Deals may be able to coordinate local efforts there is also a need for Westminster to establish a suitable framework, both in terms of policy reform, and the overarching strategy.

8. Development and implementation of this strategy will require interdepartmental collaboration (across BEIS and Defra) alongside effective engagement with a key stakeholder steering group with members from along the whole supply chain. If we are to realise the significant economic benefits presented by the transition to a more resource efficient, circular economy, then Government needs to start to progress this framework without further delay. Now is the time to seize this opportunity.

Glossary

Greenhouse Gas (GHG)
Gases which trap heat in the atmosphere are called greenhouse gases. These gases which include, for example, carbon dioxide (CO_2), methane (CH4) and nitrous oxide (N2O), are responsible for the greenhouse effect and driving climate change.

Gross Value Added (GVA)
This is a measure of the contribution to Gross Domestic Product (GDP) made by an individual producer industry or sector. The Gross Value Added generated by any unit engaged in production activity can be calculated as the residual of the unit's total output less intermediate consumption, or as the sum of the factor incomes generated by the production process. Net Value Added is shown after deducting capital consumption.

Gross Domestic Product (GDP)
The sum of all economic activity taking place in a defined economic territory. It is the primary measure of economic activity and it can be measured based on production activity, final expenditures or the sum of income generated in an economy.

Local Enterprise Partnerships (LEP)
Local enterprise partnerships are voluntary partnerships set up between local authorities and businesses. The idea was developed in 2011 by the Department for Business, Innovation and Skills to help determine local economic priorities and lead economic growth and job creation at the local level.

Net Present Value (NPV)
The discounted value of a stream of either future costs or benefits. The term Net Present Value (NPV) is used to describe the difference between the present value of a stream of costs and a stream of benefits. The UK government recommends a discount rate of 3.5% per annum be used in governmental evaluations.

Secondary Materials
Waste materials that have been identified for their potential for recycling or reprocessing to generate raw materials (potentially displacing the need to make us of primary materials).

Endnotes

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[2] At 2016 prices and using a standard 'social' discount rate of 3.5%

[3] These do not include emissions from energy generated through incineration, which are reported in the part of the inventory related to Energy, but neither do they capture the GHG benefits from recycling.

[4] The exceptions include, for example, advanced conversion technologies (ACTs) which have been supported by the renewables obligation (RO), feed in tariffs (FiT) and the renewable heat incentive (RHI) and now the Contracts for Difference (CfD) mechanism

[5] Proposals for revisions to existing Directives have been adopted by the European Commission in the context of a revised Circular Economy Package. These revisions are being discussed in the Council and the Parliament at present (see http://ec.europa.eu/environment/circular-economy/index_en.htm for the proposals adopted by the European Commission).

[6] Created through the merging of the Department of Energy and Climate Change (DECC) with the Department of Business, Innovation and Skills (BIS)

[7] So, for example, consumption of a processed product would imply the use of more raw material, on a tonne for tonne basis, than consumption of the raw ore.

[8] Market failures include, for example, imperfect competition (i.e. where market dominance affects supply / demand and pricing), imperfect / asymmetric information, absence of property rights (i.e. missing markets), and environmental externalities.

[9] One need only consider the debates – understandable given the uncertainties involved – regarding the costs incurred by increases in greenhouse gas emissions.

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