a vision for England's long-term resources and waste strategy

suez

contents

foreword

These are uncertain times for the United Kingdom, with the process of leaving the European Union raising many questions over the future direction of the many different policy areas that affect our daily lives. However, inherent within this instability is a significant and exciting opportunity to achieve positive change, by taking a lead in delivering a new and sustainable economic base.

Perhaps more than any, this is true of environmental policy, which is capturing the imagination of the British public, media and policymakers in a way and scale that we believe, as active participants and commentators in this area, has never been seen before.

Historically, UK waste and resources targets, legislation and policy have been a direct response to, or implementation of, EU law, but this will not remain the case for much longer. Although the UK government has signed up to the European Commission's Circular Economy Package governing many of these environmental policy areas, come 2020 the UK will be able to set its own policy agenda, its own targets and use its new control and agility to speed delivery.

We believe a golden opportunity therefore exists for the UK to create a policy context which not only places the UK at the forefront of environmental sustainability, but uses efficient resource management and sustainability to spur new levels of productivity and economic competitiveness within the global economy.

Under the current UK government, these policy changes have begun apace, but we believe it is important that the benefits of integrating the whole value chain and coordinating with the Clean Growth Strategy, the 25 Year Environment Plan, the National Infrastructure Commission Assessment, the UK's Industrial Strategy, and the Resources and Waste Strategy are identified and seized at the outset – with appropriate interventions, policies and funding put in place to reinforce these opportunities.

We also believe that a well-designed and delivered waste and resources plan would represent a win/win scenario for both the environment and the economy, with the potential to add up to 0.5% of total gross value added (GVA) to the UK economy – equating to an additional £9 billion a year.

SUEZ is one of the world's largest waste, water and resource management companies and we have been active in the UK market for over 30 years. We operate across the majority of sectors and throughout the complete value chain. We work alongside companies through the design, manufacturing, logistics and sale of their products and services to post-consumer collection, treatment and remanufacturing of materials, from both municipal and commercial sources. Our global scope means that we also work across a wide range of differing legislative and political environments and, as such, have rare insight into the causes of successes and failures of resource policies, as well as the intricacies and idiosyncrasies of supply chains in different environments.

More recently, as government and its various departments have become more active and dynamic in seeking to determine English waste and resources policy, and link it to development, sustainability and environmental goals for the wider country and economy, SUEZ has regularly been asked to provide assistance through advice, through data and through its experience on how the various policy, market and technical drivers and constraints might be seen more as part of an integrated system than as individual drivers for individual sectors. For the first time, in this document, we have sought to consolidate our experience into what could be considered our vision for the future of resources and waste policy in the UK.

We offer this document to policymakers, business leaders and individuals alike, and hope that it proves influential in helping to scope and shape both emerging policy at a national scale and action on an individual scale. We hope this 'manifesto' of sorts provokes some open debate, and we look forward to working with our partners, our clients, key stakeholders and government in the coming months as the Resources and Waste Strategy comes to the fore, and the policy agenda for the next 25 years becomes clearer. We want to live in a world with no more waste and believe that this can be achieved through the vision we present in this document.

David Palmer-Jones
Chief Executive Officer

SUEZ recycling and recovery UK

executive summary

We believe that a 'systems approach' is required in order to fully integrate resources and waste reduction into the UK economy and achieve circularity of resource flows. Waste extends far beyond the manifestation of materials in a bin, but also to the resource-loss and wasted time and productivity in dealing with waste. Waste often starts at the design stage, which then has negative knock-on effects throughout the various stages of the value chain.

Adopting a whole value chain approach to tackling waste and resources policy is essential, but this is often hamstrung by its own complexity, particularly as it requires participation and change throughout the value chain – many parts of which do not have the time or resources to understand the complexities of the circular economy and the role they could play to make it a reality.

Policymakers must therefore consider how policies might be communicated, implemented and regulated in a way that seeks to drive a common purpose throughout the economic value chain and the many interconnected supply chains.

In this comprehensive document, we have considered each aspect of the system within a functioning circular economy separately and set out the policy positions or interventions we believe are fundamental to achieving the desired outcomes of eliminating waste, protecting the environment and bolstering the UK economy, by returning resources back into the cycle of production and consumption.

In considering these elements of the system, we have grouped them into five overarching categories – **origins of waste, harvesting, logistics, treatment,** and **products and markets** – each with specific sub-sections and respective policy interventions.

These positions are drawn from this document and summarised here for ease of reference. However, the full document provides the relevant context for each, the linkages between them and illustrative examples, where appropriate, drawn from real-world experience.

The policy interventions proposed in this document relate principally to the UK government, which has responsibility for environmental policy strategy in England, whereas the devolved administrations in Scotland, Northern Ireland and Wales take responsibility for this within their own jurisdictions. Although Wales and Scotland have arguably outpaced England in respect of progressive policy development in this area in recent years, the population balance (and associated waste arisings) is so heavily weighted towards England that the effect of positive Welsh and Scottish performance only has a marginal effect on performance of the UK as a whole. It is therefore essential for England to take a leading role if the United Kingdom wishes to deliver substantial environmental performance gains.

We would hope that there is increasing alignment in policy, targets and interventions across all of the UK as we move forward post Brexit and believe many of our recommendations are equally applicable and appropriate in the devolved administrations.

Origins of waste

1. Design standards

Waste is often designed into products either through the materials used or the manner of their construction. To minimise waste throughout the value chain, it is essential that products are designed with their end of life in mind.

- Introduce a phased minimum recycled content in packaging, as defined by the technical requirements of each product. Adopt a target of 50% recycled content by 2025 on average for all packaging types, but allow the various types to adopt technically-achievable levels above and below this level.
- Introduce a target for 100% of the products and packaging placed on the market to be technically and affordably recyclable by 2030.
- Introduce a requirement for packaging manufacturers to construct their products from common materials and simpler compositions such that the variety on the market is reduced. This will allow consumers and the value chain to more easily identify, extract and reuse the materials. Common design standards should be adopted.
- For products and packaging where recycling is difficult, these require changes to the virgin material used in their manufacture (fossil to renewable, for instance) so that the benefit of the material in energy recovery is maximised.

2. Data generation and collection

Data is fundamental to knowledge of how the value chain works, how targets are to be derived and monitored, and to allow strategic decisions to be made on infrastructure.

- Require all waste producers and waste carriers to collect weight data for each individual container lift across the mainstream waste types – from both municipal and commercial sources. This data should be added to the normal duty of care dataset.
- Collection data is required at each point in the waste management duty of care system. Such data needs to be reported and consolidated centrally and made available (anonymised) to the market.

3. Value chain

Policy has traditionally been focused on parts of the value chain (waste policy, for instance) rather than being designed to achieve the best economic and environmental outcomes across the value chain. This needs to change if the full value of a transition to a circular economy is going to be achieved.

- Require government by 2020 to have worked with the value chain members to map the flow of materials and interactions in the chain, to deliver a commonly agreed map and to have identified all points of essential data gathering to ensure the data collection requirements are fully scoped and agreed.
- Focus new policy and revise existing policy, where necessary, to deliver change in performance across the whole value chain, and seek to avoid interventions that only focus on a particular sector or component of the value chain.
- Ensure that all government departments involved in policy across the value chain are coordinated and collaborate such that their policy interventions facilitate and promote full value chain thinking, and ensure targets or interventions support the value chain approach.

Harvesting

4. Target materials

We think it is vitally important that the resources used and consumed in products are demanded as secondary resources by customers who want and need to make new products using these recycled materials. Harvesting those target materials to recover them for recycling and other uses is the most important factor. How those materials are recovered and collected from the consumers should be left open to allow innovation.

- Target materials are likely to include ferrous and non-ferrous metals, glass, plastics, organics, card and paper, and rare and precious metals.
- Establish a department in the Department for Business, Energy and Industrial Strategy with an appropriate Junior Minister to manage a cross-sector group to identify the target materials and substances that are important to the current and future economy and environment. Empower this group to identify where these target materials are consumed and wasted in the value chain and deliver priorities for their preservation and recovery.
- Ensure that policy avoids being overly deterministic in the manner the target materials are extracted, but sets appropriate targets for recovery levels. This policy, once set, should enable innovation in the manner of extraction and collection to achieve the recovery levels specified.

5. Collection systems

The sole purpose of collection systems is to ensure that the target materials are collected and transported in an environmentally and economically-efficient manner. There are a multitude of different collection systems that can, and should, be utilised in a plethora of combinations. The weighing of all individual containers will quantify the volumes of materials being generated (an essential element of resource management) and the introduction of pay-by-weight will proportionally reward behaviour and resource recovery.

- Define the target materials to be harvested and the measurements of performance.
- Facilitate innovation in existing and new collection systems.
- Require the adoption of digital systems in collection by 2020 to drive data which, in turn, enables efficiency increases in material harvesting activities.
- Promote collaborative systems across the value chain to help create the matrix of collection solutions required.
- Require the weighing of all containers for the target materials and require the transition to pay-by-weight for residual waste and target material collections.

Logistics

6. Waste logistics infrastructure

Efficient logistics for the movement of recovered resources is essential to ensure environmental and financial costs are minimised. Using all methods of transport to move materials is fundamental to delivering a circular economy.

- Ensure that local and regional planning considers not only large waste infrastructure, but also the supporting network of depots, transfer stations and intermodal connections necessary for current and future treatment capacity needs.
- Facilitate the refurbishment and repurposing of existing logistics infrastructure and/or replace existing infrastructure with new facilities designed for the new systems of waste consolidation and movement.
- Protect essential logistical waste infrastructure especially in and around urban areas where pressure for other developments often drives their redevelopment for other purposes or their constraint in operation through developments around them.

7. Intermodal transport

Intermodal transport involves the transportation of waste in a container or vehicle that can be used for multiple modes of transport. Using the most efficient method of transportation for waste requires access to, and the use of, all available modes of transport, from road to rail and boat. The opportunity to back-haul materials on transport delivering other materials maximises efficiency and minimises cost, improving productivity throughout the economy.

- Include the current and future needs of the waste and resources sector in strategic planning of national infrastructure for roads, rail and shipping.
- Protect access to intermodal centres to ensure resilient and efficient access to nodes of uploading and offloading.
- Encourage, through the strategic planning process, new facilities at locations where intermodal transport is available and necessary to support the strategic movement and treatment of waste and resources.

Treatment

8. Capacity cooperation

Using the data captured throughout the value chain, overlain with the policy objectives and targets, will enable accurate assessments of current and future capacity requirements. These capacity assessments are essential to ensure the UK delivers the right scale of capacity for each stream of waste and secondary resource.

- Establish a waste treatment capacity review committee under the management of the Department for Environment, Food and Rural Affairs (Defra), between government, the National Infrastructure Commission and the waste and resources sector to annually review new capacity delivered, under construction and as required.
- Establish an annual review procedure with the capacity review committee to agree market requirements, delivery and forward needs. This should include representatives from Defra, the waste and resources sector and economic advisors.
- Establish common modelling and data analysis methods across the value chain, building on the work done by Defra and the National Infrastructure Commission, to allow all market participants to model and forecast against the available consensus data.

9. Long-term treatment policy visibility

To build the necessary systems and infrastructure to deliver the long-term transition to a circular economy, it is essential that policy and targets are set sufficiently far ahead in time to provide investment certainty. Building facilities which cost hundreds of millions of pounds often requires a decade or more to achieve payback and, as such, policy visibility needs to extend to a minimum of 20 years. Without firm policy over investible periods, it will be difficult to secure the finance necessary to fund the transition to a more circular economy.

- Ensure that all new policy is multi-generational. A policy timeline to 2050, mirroring the carbon law horizon is appropriate.
- Establish a process to review and measure, managed by Defra, delivery against the policy targets. This process should occur on a five-year basis and be charged with adjusting the policy interventions to ensure the long-term policy objectives are met.
- By 2020, establish new resource measurement metrics that underpin the policy objectives and which will be used to measure progress. The metrics should comprise a greenhouse gas carbon basis from 2025 to 2050, aligning with the national carbon plans and transit to a pure natural capacity basis from 2050 onwards. Carbon should be used, as it mirrors a number of natural capital drivers, but is also clearly understood by the public, by industry and by the trading markets.

10. Business waste

A circular economy requires extensive waste and resource management across both household and business waste. Helping UK business become more productive, and reduce and remove waste from its processes, will help deliver the fundaments of the Clean Growth Strategy and 25 Year Environment Plan. The current policy vista focuses more on household waste, while infrastructure development has, in the majority, targeted household waste. This has left business waste lacking much of the focus and infrastructure necessary for it to be internationally competitive and make the affordable transition to a circular economy.

- Consider and accommodate the needs of commercial and industrial wastes through collaborative approaches to new waste treatment facilities.
- Require all municipal contracts for infrastructure to consider provision for a proportion of private sector residual waste as well as the municipal waste requirement.
- Require the development of innovative support mechanisms that help residual commercial and industrial waste consolidation and management in the most efficient methods and to deliver the necessary treatment capacity.

11. Local government recycling targets

Targets are useful and necessary to give direction and measure progress. However, if their application is not responsive to individual circumstances, it can unfairly task some segments of society. A national target needs to be applied in a decentralised manner that proportionally tasks each entity.

- Adopt a 55% recycling target by 2025 based on weight, and adopt a 45% target by 2025 for the residual element of a household's waste, falling to 30% by 2030. New metrics will apply post 2030.
- Local authority recycling targets should be set for each individual authority according to their own structural opportunities and constraints, with all such targets collectively aligned to meet national objectives.
- Establish a defined process to assess each local authority's structural ability to recycle.
- Distribute national targets to local authorities in accordance with this assessment approach and task each authority individually on a proportional basis to meet national objectives.
- Establish a five-year formal review process, so that local authorities are reassessed against their respective recycling ability and their proportional targets as they change and develop.

12. Waste minimisation

SUEZ supports the continued adoption of the waste hierarchy, but recognises that some aspects, like the minimisation of waste, are essential but very difficult to measure. Ensuring that the policy targets set, like the government's intention to halve food waste, are both measurable and deliverable is essential to reducing waste and increasing productivity.

- Policy targets must recognise the importance of waste minimisation and include metrics to measure this activity alongside recycling performance and residual waste reduction.
- Use the collection of data from all parts of the value chain to both measure waste production and traditional treatments, but also to ensure that minimisation, re-use, repair and dismantling activities are measurable.
- Include discrete minimisation sub-targets within national recycling targets (for instance, to meet the food waste reduction targets in the 25 Year Environment Plan).
- Target to reduce residual waste produced per head of population from 45% in 2025 to 30% in 2030.

13. Food waste

The wastage of food not only wastes money for the consumer, but masks huge embedded costs in the production, processing and retail of those products. The government is correct in seeking to minimise food waste and should set targets beyond the 2030 headline. However, in seeking to minimise food waste at source, care needs to be taken that food waste treatment capacity is aligned to the long-term objectives.

- Confirm the target to halve food waste by 2030 and require a further target to reduce avoidable food waste to less than 20% by 2040.
- Use the treatment capacity committee to set the target for anaerobic digestion capacity, which should be set to meet the long-term market capacity requirements after food waste minimisation targets have been met.
- Stabilise and tune incentives for biogas uses (power, heat, gas, fuel) to ensure that anaerobic digestion remains commercially viable for the existing treatment capacity and remaining new capacity required.
- This direction would predicate digestible packaging is favoured against compostable for those materials that would be collected with food waste.

14. Compostable and digestible packaging

Innovation in new forms of packaging will be necessary to meet some of the government's objectives on sustainability and litter. However, if they are introduced in ways that adds to the multiplicity of all packaging, or inhibits effective recycling, or produces increased contamination of other streams, then they may make matters worse rather than better. Compostable or digestible packaging has a potentially important role in the transition, but unless their use is properly managed they may fail to deliver on their promise.

- Government should set out its position on the role of compostable and digestible packaging and ensure that any policy which seeks to support wide-scale adoptions is phased and integrated with access to suitable treatment types and available capacity.
- The use of these forms of packaging must be controlled to ensure that they are not mixed with similar packaging types that are not treatable in the same manner.
- Require clear identification of these types of packaging through unique and visible identification to ensure consumers can differentiate between them and other forms of packaging.

15. Repair and re-use

Working with the established waste hierarchy requires a focus on repair and re-use of goods and products. The ability to repair items is heavily influenced by their design, but repair often also requires skilled staff and replacement components. Policy is required to ensure that a comprehensive and effective system of repair services and component supply is available to the value chain.

- Introduce design standards which ensure that products can be easily repaired and that components can be removed, tested and reused.
- Introduce and require the use of green public procurement standards which support good design and prioritise the purchase of equipment suitable for repair and component extraction and re-use.
- Introduce a requirement for all manufacturers and retailers to provide repair services to their customers (either direct or via third parties). Cost of repair should be controlled such that costs do not exceed a target of 40% of the equivalent purchase price for a non-breakage repair and items with a minimum value of £150.
- Introduce VAT relief on the labour costs of repair and recovered component re-use.

16. Extended producer responsibility (EPR)

Extended producer responsibility is a key component of the circular economy and should be a foundation of all policy thinking and policy drivers. Extended producer responsibility clearly works across the full value chain and, when correctly applied, will drive changes from design to end of use. An expansion of extended producer responsibility is required, but not all products can have extended producer responsibility applied in the same way, so care needs to be taken that it is applied in a manner that does not induce unnecessary financial or environmental burdens.

- Establish a work programme with the value chain to assess the expansion of extended producer responsibility and the identification of all new materials streams that should form part of a truly expansive extended producer responsibility programme. Mattresses and clothing might be two such examples.
- Undertake a review of existing extended producer responsibility schemes (domestic and international) and define best in class for each target stream and then implement those that represent best in class.
- Agree and implement new extended producer responsibility schemes with the value chain by 2020.
- Implement a deposit return scheme (DRS) for England by 2020. This system should target PET plastic bottles of less than 0.75 litres in size and metal cans consumed in on-the-go environments, leaving the current collection methods to continue to harvest other materials from households and businesses. The deposit rate should be set at £0.10 per unit and myriads of deposit return points created to ensure cost-efficient and convenient access for consumers. An English scheme must align completely with any schemes being adopted in the devolved administrations.

17. End of life consumer information

Being able to make informed purchase and consumption choices is essential to drive positive consumer behaviour. This information requires a simple method of measurement of environmental performance and a clear and easily understood system of product labelling which informs at the point of sale.

- Require a standard form of environmental impact labelling on all products, aligned with the future performance metric chosen (e.g. carbon or natural capital).
- Require manufacturers and retailers to provide information as part of their normal marketing to consumers on the burden and benefits of the production of the goods, of the burden of their use and the intended route of disposal.
- Require both local authorities and the private sector to align their communications to customers / residents and adhere to the same communications standards expected of retailers and manufacturers.
- Expand the remit of the Advertising Standards Authority to work with Defra and ensure that the information used by manufacturers and retailers is both correct and in accordance with the chosen performance metric.

Products and markets

18. Energy products

The energy potential of waste is significant and should be exploited in a way that maximises the delivery of that potential. We must collectively understand the potential, and how that potential can be best and most usefully exploited to meet the requirements of the economic growth plans of the UK.

- Utilise appropriate incentives to drive development of the waste-derived (recovered or reformed) energy products government sees as important to both the UK economy and its sustainability objectives.
- Avoid supporting specific technologies and instead focus on the quantum and value of the products that can be delivered. This will allow the market to innovate in the method of production to achieve the target outputs. Incentives should only be used to support the development of commercially proven technologies, but government should support emerging but not commercially proven solutions with appropriate grants.

- Clarity of purpose of each policy is essential and the established policies should be required to continue to deliver that clarity of purpose. The Electricity Market Reform – Contracts for Difference should focus on electricity, while the Renewable Transport Fuel Obligation should focus on transport fuels and the Renewable Heat Incentive focus on gas to grid and heat. A new incentive system should be designed with the UK chemicals industry to support the production of industrial chemicals from waste.
- The Department for Business, Energy and Industrial Strategy, the Department for Transport and Defra should collectively determine the best waste-derived energy product outcomes and ensure that incentives are aligned between the different systems to make best use of the resource available.

19. Heat networks

Making best use of the energy potential of waste requires an expansion of the uses of heat produced in the generation of electricity or other products. Heat losses occur at substantial levels in all forms of power production, so heat supply and the development of heat grids should apply to all power stations – from those powered by gas, oil, coal, biomass or nuclear, as well as those powered by waste. Joining this potential together will speed the deployment of heat grids and supply of heat and creation of a network of heat offtakes.

- Require that a payment towards the development of a local heat grid is included as a condition of all new planning consents for all power stations. The payment should be a minor proportion of the total capital for the plant, but proportional to its scale. The money is held by a municipal body appointed to manage the combined fund.
- Require industrial and municipal facilities built within the curtilage of the heat network (actual or planned) to be heat sink ready through the planning permission.
- Enable all municipal bodies to facilitate and/or contribute to the funding required for the development of heat grids and facilitation of heat offtakes.

20. Recycling markets

Recycling markets need a supply of quality feedstocks, but must also match this supply with demand from secondary materials users (i.e. manufacturers). Requiring recycled content in new products, requiring high recycling potential for products sold into the market, and delivering efficient systems to harvest materials post-consumption are all essential to support the whole value chain. Further financial drivers are required to support the economic use of secondary resources against those from virgin materials.

- Implement a tax on the use of virgin materials to disincentivise the use of primary resources, while making the use of secondary resources more economically attractive.
- Introduce VAT relief on the labour involved in repair, disassembly and reinstallation of reusable, tested and warrantied components.
- Review the packaging recovery note system.

21. The packaging recovery note (PRN) system

The packaging recovery note system should be reviewed such that target materials and the infrastructure that supports their harvesting, sorting and refinement is sufficiently funded and those funds are adequately directed to support the development of new infrastructure. Furthermore, it is important to develop conditions that provide a level technical and economic playing field for domestic and exported materials credits.

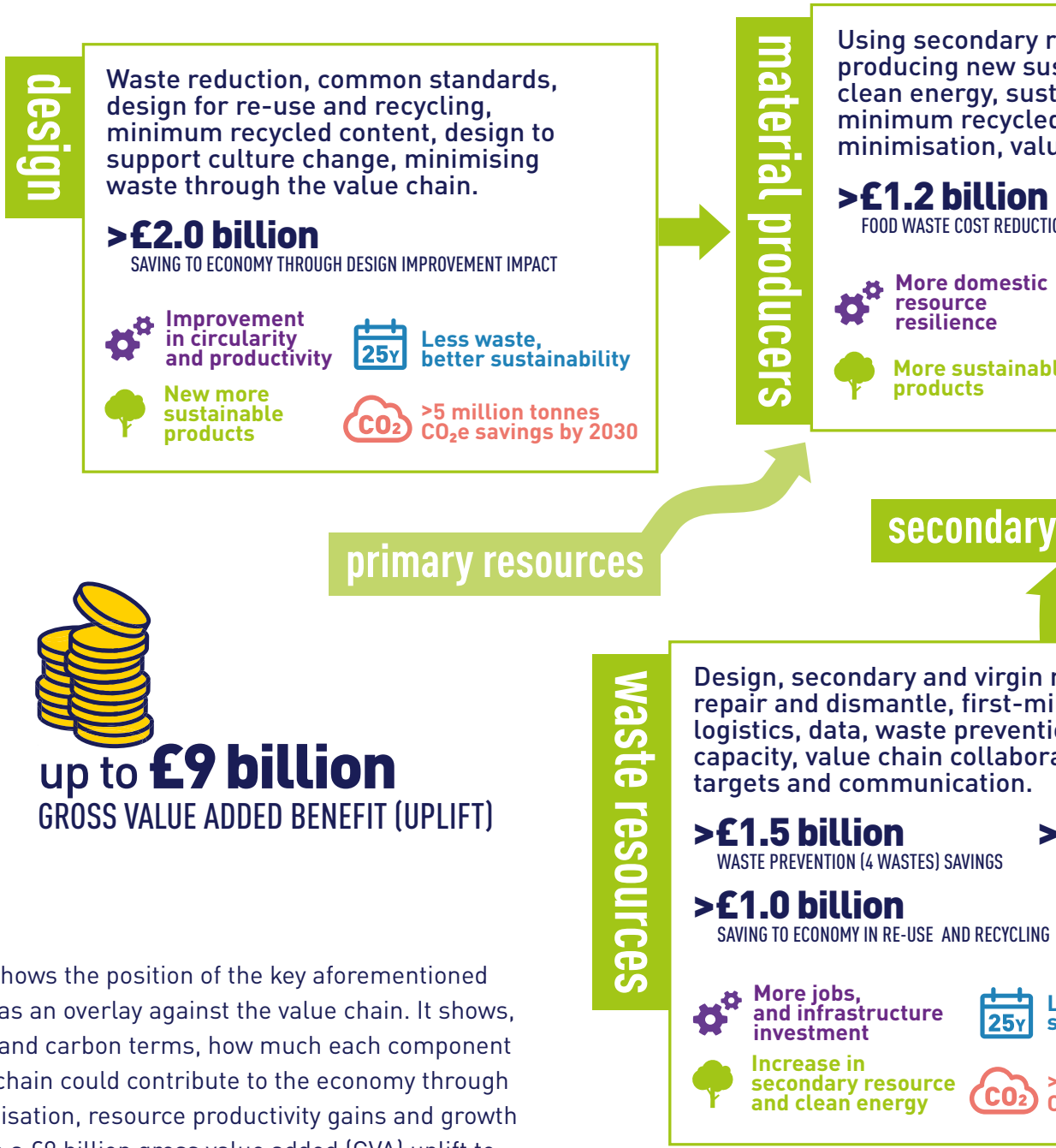
- All companies which place materials on to the market should be obligated to contribute to a packaging recovery note system.
- Make the point of data compliance at the point of sale (shop, internet or other) in a similar way that VAT is applied.
- All packaging recovery notes earned and compensated should apply to domestically-used and internationally-exported material on the same level playing field of technical standards, quality and value.
- The value in packaging recovery notes issued should contribute to the process of harvesting the materials and to the provision of recycling infrastructure.
- Materials recycled under the packaging recovery note system should, when used in new products, count towards recycled content targets and targets applied to minimise virgin material usage.

22. Empower change in local government

Local government is fundamental in the transition to a more circular economy. Local authorities should be empowered to ensure that all sectors and players in the value chain, within their geographic remit and in cooperation with their nearby equivalents, are facilitated to deliver the goals and targets of local and national policy.

- Require local government to take a role in managing and facilitating access to the resources wasted in the value chain in their respective jurisdictions.
- Require cooperation with other local government bodies and the private sector In the value chain to meet the locally and nationally set targets.
- Require local government to facilitate a network of solutions to harvest materials in the most economically and environmentally-efficient manner, recognising the skills and resources inherent in the value chain – from reverse or shared logistics to multiple modes of first-mile collection or return of target resources.
- Empower local government to be able to borrow money to invest or co-invest in waste and resources infrastructure and collection and logistical delivery systems. This will help to deliver the £20 billion or more funding required in the waste and resources sector to make the transition to a more circular economy.
- Require local government to set up the fund management of heat grid contributions from new power plants. This would enable match funding and the delivery of both the heat grid and the heat offtakes necessary to increase waste heat usage. All appropriate and significantly sized local and national government buildings should be amended to be heat network ready by 2030.

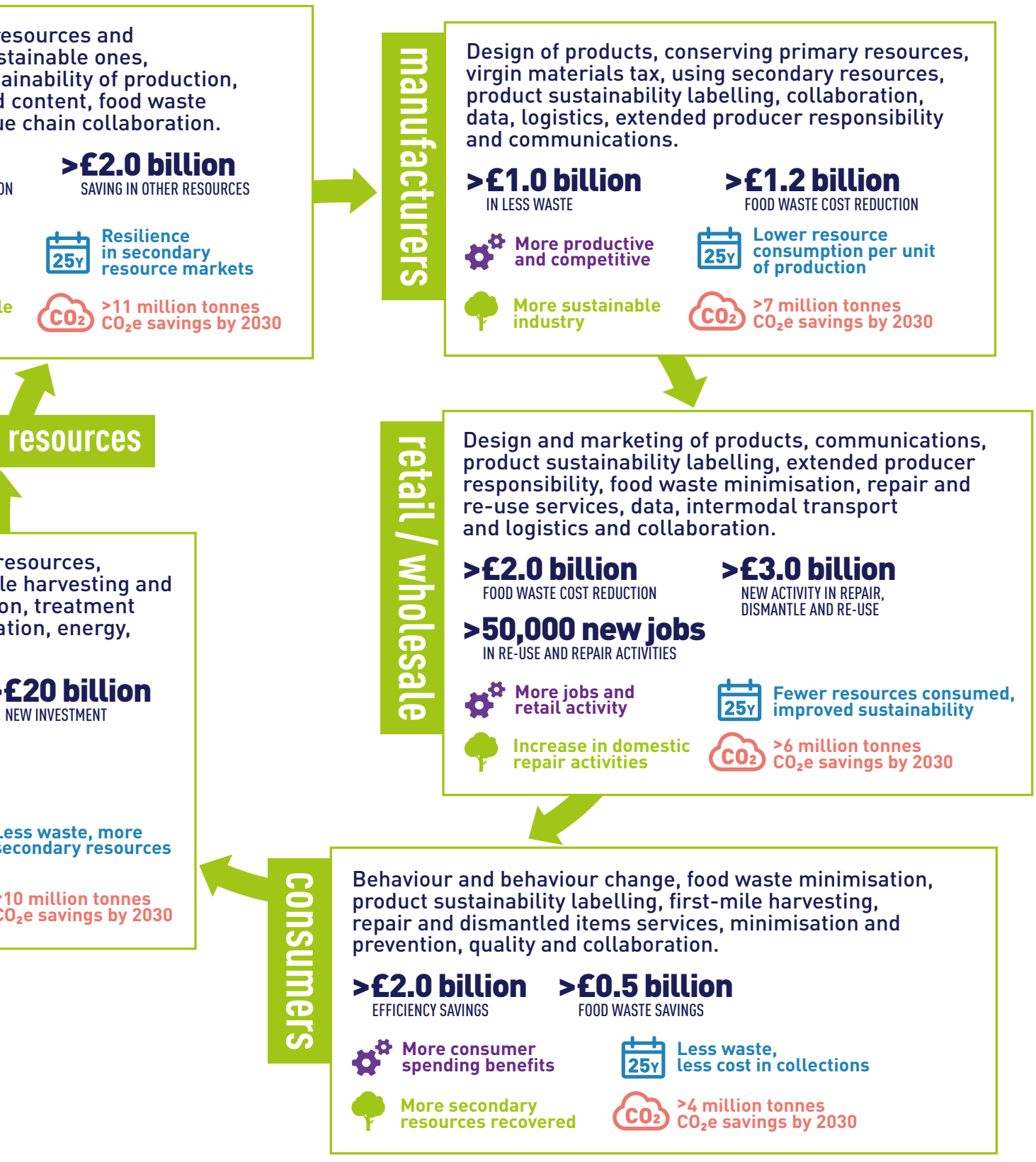
How a well-designed **resources and waste strategy** can support the **economic value chain**



This model shows the position of the key aforementioned policy areas as an overlay against the value chain. It shows, in monetary and carbon terms, how much each component of the value chain could contribute to the economy through waste minimisation, resource productivity gains and growth – resulting in a £9 billion gross value added (GVA) uplift to the economy. The model also describes how each component of the value chain could contribute towards targets for the Clean Growth Strategy, 25 Year Environment Plan, Industrial Strategy and Climate Change Act.

Document references

SUEZ reports: *A resourceful future – Expanding the UK economy, At this rate – Exploring England's recycling challenges, Driving Green Growth and Mind the Gap 2017-2030 – UK residual waste infrastructure capacity requirements.* ONS economic data sets, Green Alliance report *Less In, More Out* report, ESA report *RESOURCEFUL: Delivering a strong and competitive UK resource economy*, Defra data and report *Resource management: a catalyst for growth and productivity*, Associate Parliamentary Sustainable Resource Group report *Exporting opportunity? – Putting UK waste to work at home and abroad*, WRAP reports and data sets.



Government strategy links

Industrial Strategy · Clean Growth Strategy · 25 Year Environment Plan · Climate Change Act

introduction

Typically, legislation and target-setting around waste and resources has tended to focus attention at the 'end of the pipe', by promoting landfill diversion and recycling, rather than seeking to influence or explore the causes of waste inherent in the production and consumption of goods and services.

SUEZ believes that an alternative approach which considers resource and waste 'systems' within and across value chains is an essential foundation of a truly circular economy.

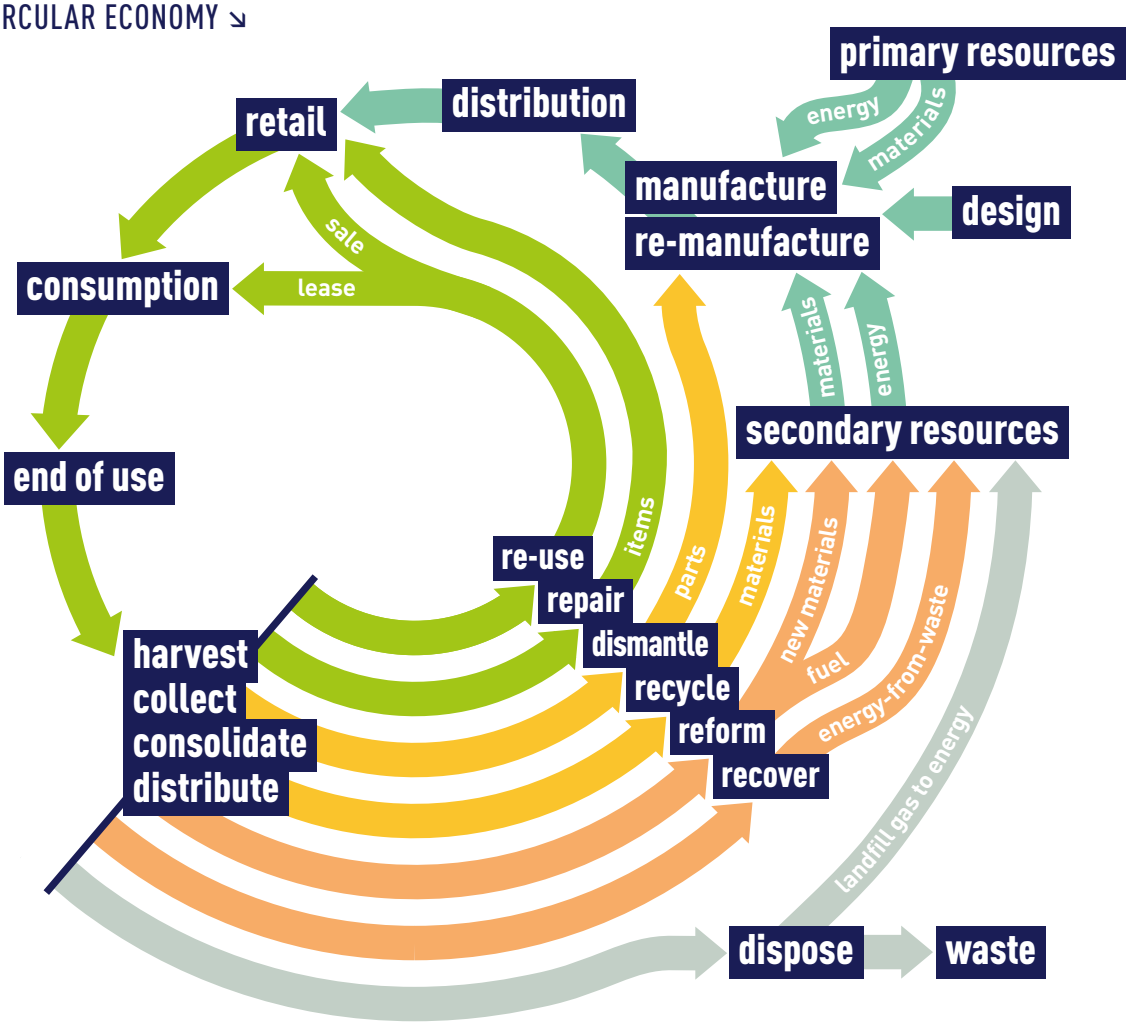
A system approach requires the full understanding and coordination of the economic value chain – from manufacture to supply, then retail, consumption and wastage. Our view of the waste and resource management sector's contribution to the circular economy is shown here. It demonstrates how we would expect each arm of activity to flow back into the economy.

It brings key terms on to the policy agenda, like 're-use', 'repair' and 'dismantle', but it also introduces less common terms like 'harvest' and 'reform'.

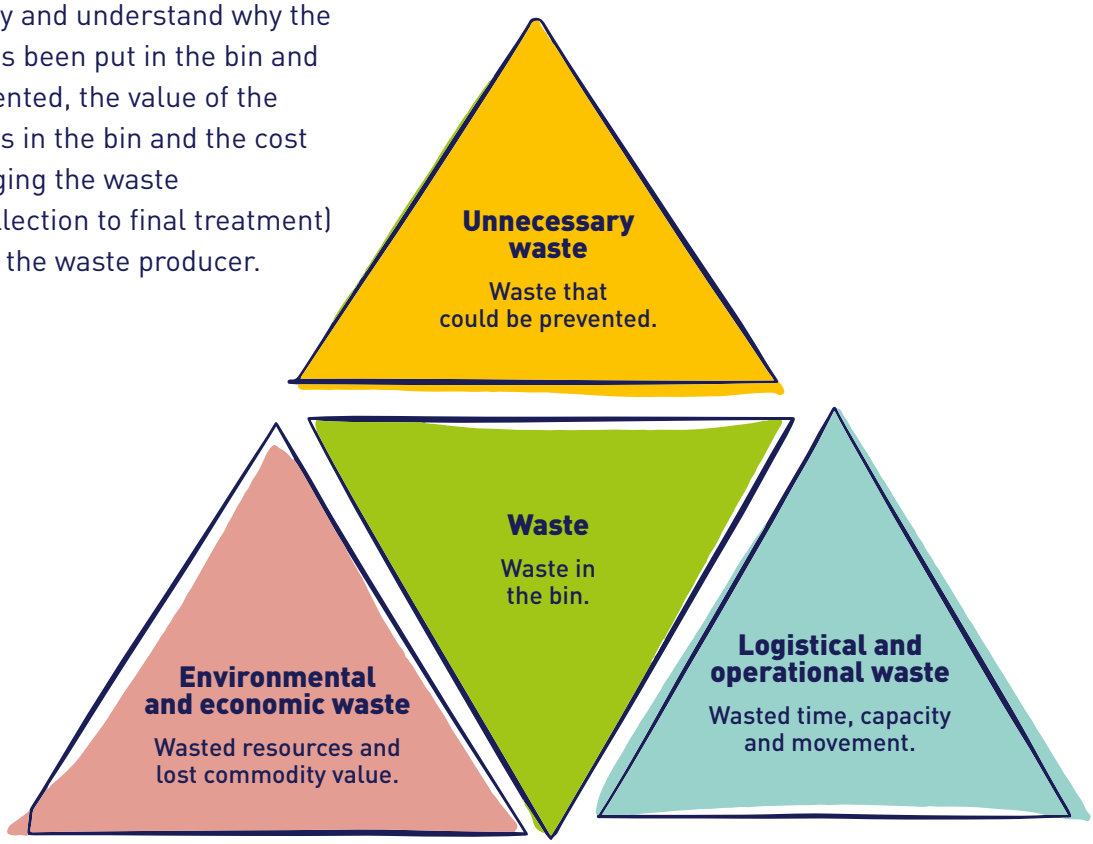
By 'harvest', we mean a designed intention to identify and extract key resources from the economy, which is fundamentally different to the more passive collection of materials from containers at customer locations. The term 'reform' sits between 'recovery' (energy-from-waste, for instance) and 'recycling' (a closed loop for materials) and seeks to accommodate processes that reform waste either into their original raw materials or to form new materials. This area covers, for example, chemical recycling, protein manufacture and fuel-replacement products.

When considering waste, we believe we must look well beyond the physical presence of waste in the bin. Waste starts in the design stage and then becomes endemic in preventing options or compounding cost and waste at later stages in the value chain. A value chain approach to waste addresses this 'designed-in' waste, but can appear complex, unachievable or just too distant to make real. Simple, effective and consistent messaging is required to make the change throughout the value chain, particularly with consumers and small and medium enterprises who often don't have the time to fully understand the complexities of recycling, of resources and of sustainability and the circular economy.

THE CIRCULAR ECONOMY ↘



SUEZ has developed a simple graphic which defines waste in its primary four forms – a model we call 'the four wastes'. This model centres around the waste that physically appears in the bin, with the surrounding elements helping to identify and understand why the waste has been put in the bin and not prevented, the value of the resources in the bin and the cost of managing the waste (from collection to final treatment) borne by the waste producer.



↑ THE FOUR WASTES

The graphic is a simple way for busy organisations and individuals to start their journey towards improved sustainability and circularity, without needing to understand the complexity of both themes. Understanding the waste in the bin, from its weight to its composition, provides essential insight to the customer and waste service provider. SUEZ considers it is not only important to define policy, but it is vitally important to understand how that policy will be communicated, implemented and regulated, so that it is effective in application.

Duty of care

The duty of care regulations have been implemented for many years and are focused on the waste producer. However, their communication, simplification and enforcement have only really fully been implemented in recent years through the Environmental Services Association's and Environment Agency's 'Right Waste, Right Place' campaign and more recent changes to the fixed penalty notice scheme. A more effective method of simplification, communication and enforcement at the time of introduction may well have delivered benefits in the quality of recycled materials and/or a reduction in fly-tipping, which would have enabled more materials to be recycled and reduced the costs of litter and fly-tipping clean-up.

Radical changes are required for our linear economy to move to a more sustainable circular one. These changes flow across the whole value chain and contain multiple dependencies, which means policy should deliver:

- Ambition that motivates individuals and organisations to participate as a value chain.
- Sufficient detail to adequately inform all of the parties within the value chain.
- Vital 'push' and 'pull' measures to establish market and cultural conditions that deliver progress on targets and performance.
- Multi-generational, long-term, social good.

Of course, policy should be reviewed on a periodic basis to ensure that it is delivering its intended benefits, but it is important that a firm direction of travel is maintained through multiple government cycles to create the right conditions for investment and innovation. Policy and regulation that captures and defines common goals across sectors, rather than polarising activity, is essential.

In this document, with these principles in mind, we consider and suggest policy interventions across the circular economy – from the origin of waste at the design state, to the products flowing back into the circular economy. For each of these aspects, we provide context and draw on existing examples. These policy areas are grouped into sections:

- Origins of waste
- Harvesting
- Logistics
- Treatment
- Products and markets

origins of waste

Waste is not a natural state, it is generated from a plethora of interwoven conditions, constraints and habits.

Having a clear understanding of why waste occurs will help define the policies necessary to prevent and minimise waste, rather than continue with policy designed just to manage it once created. In the SUEZ-sponsored report 'A Resourceful Future'[1], it was estimated that the gross value added benefit to the UK of waste prevention could range between £2 billion and £3 billion per year. These savings also delivered reductions in greenhouse gas emissions of five million to 20 million tonnes of CO_2e.

The influence of design and manufacture

Design is fundamental to good product performance. Good design should minimise resources used during manufacture and maximise the effective life of the product, but design also determines how the item, its component parts, or its constituent materials, will be repaired, reused, dismantled, recycled or used for energy recovery or disposed of.

The complexity of plastic

Virgin plastic can be made from fossil sources or renewable sources (agriculture based). Fossil based plastics have a very different climate change impact when compared to renewable ones. Some plastics can be digestible in anaerobic digestion or compostable in in-vessel composting facilities or can be biodegradable in farmers' fields. However, a digestible cup in an in-vessel composting facility will not turn to compost, nor will a compostable cup work in anaerobic digestion. Furthermore, some products which include a mix of biodegradable plastic may not be suitable for second use in building products. The design of the product and the system to manage it are intricately linked.

1 www.sita.co.uk/wp-content/uploads/2017/08/ResourcefulFutureReport-SUEZ-1609-web.pdf

Relatively simple products like food or product packaging should be designed with the principles of recyclability and minimal resource consumption throughout. Packaging producers have undertaken significant work on light-weighting their products, thereby minimising resource usage in their manufacture and resource consumption in their transportation and distribution. Many products made are technically recyclable, but the infrastructure necessary to collect, sort and actually recycle them, and/or the markets necessary to fund this process, are not commercially adequate.

The more complex or lightweight products, together with a plethora of different products and product lines, has meant for instance that flexible packaging has been one of the most difficult products to harvest and recycle, and yet they have achieved remarkable reductions in primary resource usage in production, filling and distribution. The Reflex Project[2] for flexible packaging looked at how, across the value chain, flexible packaging might be designed, collected, sorted and recycled. The project showed how complex the value chain was, but also how productive it could be when brought together and asked to work towards a common goal.

One of the key outputs of this project, and something a number of organisations have been working on for many years, is design standards[3,4]. These create the conformity that enables more common systems to be applied in the value chain for material harvesting and recycling at a later date.

The introduction of minimum recycled content in new products is a further way designers can assist in delivering products which feature the same performance standards, but which also drive 'pull' mechanism for recycled products to be used again. The Royal Society for the encouragement of Arts, Manufactures and Commerce (RSA) has provided some useful detail about how design can assist in sustainable living and how various components can be integrated.

The introduction of extended producer responsibilities for families of materials has proven a successful method for creating the right 'push' and 'pull' market conditions through design matters.

End-of-life vehicle directive

Coming into force in 2007, this extended producer responsibility scheme has driven improvements in harvesting and resource recovery from vehicles. It has driven innovation in product manufacture where recycled components are included in various new car parts. SUEZ has a venture with Renault to help recycle some of the materials from old cars into new ones, a project driven through the demands of the end-of-life vehicle directive.

2 www.reflexproject.co.uk

3 www.recoup.org/p/130/recyclability-by-design

4 www.bpf.co.uk/standards/Default.aspx

POLICY INTERVENTION

1

Design standards

Waste is often designed into products either through the materials used or the manner of their construction. To minimise waste throughout the value chain, it is essential that products are designed with their end of life in mind.

- Introduce a phased minimum recycled content in packaging, as defined by the technical requirements of each product. Adopt a target of 50% recycled content by 2025 on average for all packaging types, but allow the various types to adopt technically-achievable levels above and below this level.
- Introduce a target for 100% of the products and packaging placed on the market to be technically and affordably recyclable by 2030.
- Introduce a requirement for packaging manufacturers to construct their products from common materials and simpler compositions, such that the variety on the market is reduced. This will allow consumers and the value chain to more easily identify, extract and reuse the materials. Common design standards should be adopted.
- For products and packaging where recycling is difficult, these require changes to the virgin material used in their manufacture (fossil to renewable, for instance), so that the benefit of the material in energy recovery is maximised.

Prevention and minimisation

Achieving a sustainable, circular, economy starts with waste prevention and minimisation. To understand what waste is occurring, it is essential that the volume / weight and composition of the physical waste is recorded, that the effort expended in managing the waste is clearly quantified and the reasons why the resource loss cannot be avoided or recovered are valid (see our four wastes model in the introduction section).

Although data exists in the municipal and business waste sectors, its granularity and extent varies significantly.

Municipal waste data, as reported through Waste Data Flow, provides consistent and reasonably good coverage of collected waste streams. It works well to a local authority level, but does not provide detail to the level of individual collection rounds or, apart from an averaging process, an individual household level.

Business waste data is not widely available for central consolidation and does not have the breadth and scope of data compared with municipal waste. However, the granularity of the data available to business waste collection tends to be greater, especially where individual containers are weighed at the time of collection. Individual bin weight data provides greater opportunity to see trends, and intervene to identify the source and cause of waste. This opportunity to intervene drives many proven examples of waste prevention and minimisation. In one instance, a university customer saved nearly £60,000 a year through the analysis of bin weight data provided by SUEZ from the first three months of service operation by simply redesigning the bin systems on campus to avoid unnecessary collections.

POLICY INTERVENTION

2

Data generation and collection

Data is fundamental to knowledge of how the value chain works, how targets are to be derived and monitored, and to allow strategic decisions to be made on infrastructure.

- Require all waste producers and waste carriers to collect weight data for each individual container lift across the mainstream waste types – from both municipal and commercial sources. This data should be added to the normal duty of care dataset.
- Collection data is required at each point in the waste management duty of care system. Such data needs to be reported and consolidated centrally and made available (anonymised) to the market.

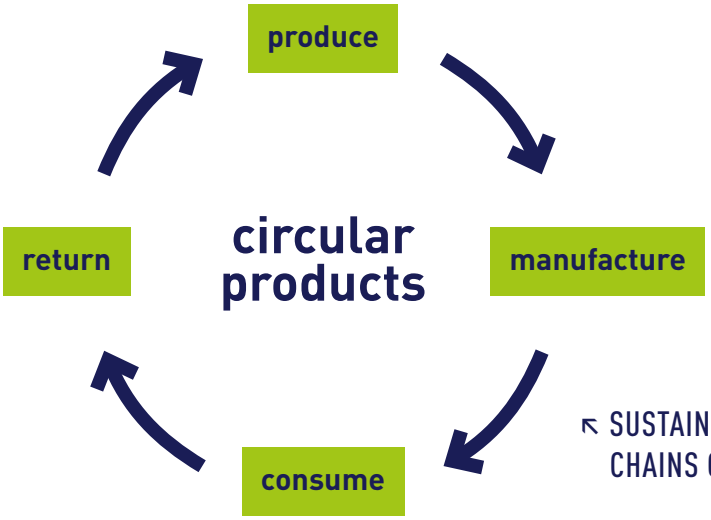
Consumption habits

Minimisation of waste also requires action at the consumer level. Helping consumers to understand the consequences of the materials used in the items they choose to purchase may have a profound impact on the composition of materials and items ultimately discarded and entering the waste management chain.

Common and consistent information for purchasers of raw materials or products is fundamental to informing choice.

Aligning the value chain through a set of common metrics, which value the materials used themselves rather than just their weight, will allow consistent purpose and measurement to flow from design standards, through purchasing and consumption, and on to waste and resource management practice. The value chain over which we believe the metrics should flow is shown here.

↑ MATERIALS AND PRODUCTS HEADLINE VALUE CHAIN



↖ SUSTAINABILITY OF CHAINS OF MATERIALS

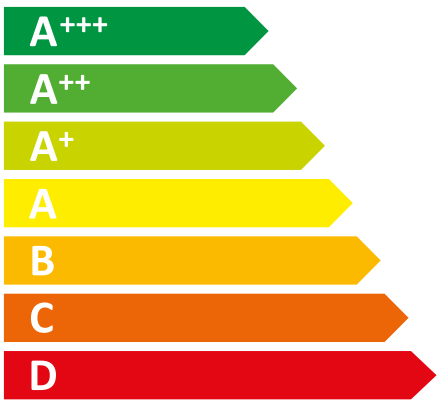
Once a common set of metrics has been adopted for each material / product moving between each compartment of the value chain, it will be possible to clearly describe and show the performance of those items (perhaps in a manner similar to the energy efficiency rating found on many white goods), which in turn informs purchasing and consumption habits at each downstream stage.

An example of a simple grading system used to follow the sustainability of chains of materials and/or items, and defined by a relative consistent grading system, is shown here.

↑ SUSTAINABILITY GRADING SYSTEM

The EU has proposed ECO labelling rules[5], which give some guidance on what should be considered, but they do not fully integrate the whole value chain with conforming and complementary metrics and, as such, should be amended and improved to better represent a full chain approach.

The EU energy rating system for white goods has proved effective since its introduction, but as the energy rating baseline has not been revised since 2009 it has two issues. Firstly, it considers power consumption rather than the full impact of the product and its use and, secondly, the rating scale should be revised to reflect the changes in technology – for example, when more than 50% of goods are classed as grade A or B.



↑ EU ENERGY LABEL

5 ECO design directive 2009/125

Re-use and dismantling

Providing an opportunity for items in the consumption chain to be repaired or dismantled, and the parts reused, has obvious environmental benefits. However, if products cannot be dismantled or opened to repair internal components, or if the cost of doing so is similar to the cost of a new replacement, then the market will not deliver its potential in this area.

Television dismantling

Dismantling studies have shown that whilst some televisions can be opened using one screw driver and nine screws, other televisions require up to nine different screw drivers to match the screw heads used in manufacture and the removal of over 30 screws. The time / labour cost of simply opening the device can create the first and most significant cost-of-repair barrier and this should be dealt with at the design stage. A supply of components that can be used in the repair would assist in minimising the cost of repair and reinforce to the consumer that there is a viable alternative to discarding the item.

To be able to repair items, it is necessary that they are designed and constructed in a manner that allows entry and replacement or repair of components. For instance, where glues are used, their properties should allow them to be melted and re-glued easily. This activity should be efficient, convenient and cost-effective for the consumer. Where mechanical attachments are used (screws, clips etc) they should be designed to allow simple and quick access and replacement to limit the cost of labour associated with the task.

Where items cannot be repaired, it should be possible for their working components to be removed, appropriately tested and then be made available to replace other broken components in other devices. This process will provide a potential low-cost solution for repair that complements the supply of new components.

Reductions in the cost of purchase of repaired items or dismantled components should be considered to equalise some of the cost inherent in repair. VAT relief on repaired items (covering the labour of repair and the reused components) and a tax on the use of virgin resources will assist in promoting both repair and the use of secondary resources recovered from the value chain in new products. All retailers should provide access to a repair service and control costs for items over a minimum value such that, on average, the labour cost of repair never exceeds 40% of the equivalent new purchase equivalent.

Discarding

When items or materials reach their end of life, it is necessary to provide simple guidance, targeted to each stage of the value chain, advising how they should be dealt with properly on disposal. This should comprise simple on-product information and access (via QR code or similar) to information about local locations for treatment or specific organisations who would benefit from the material – from aluminium waste to car manufacture, or carbon fibre to specialist recycling companies. The National Industrial Symbiosis Programme is a good example of how a system might be set up. However, this programme never achieved a level of density and activity to effectively create a marketplace.

Creating a working marketplace for discarded materials is an essential element of delivering a long-lived and vibrant circular economy. Learning from the National Industrial Symbiosis Programme[6] work, together with the many peer-to-peer sales platforms (such as eBay etc) in existence today, it should be possible for government to define the boundaries and financial conditions necessary to support a diverse set of marketplaces – ensuring that materials end up in the hands of those that need and can use them productively.

Resource usage

Understanding the net environmental burden of resources used in products throughout their life-cycle will help government to determine which streams are least, and most, burdensome and subsequently inform both policy priorities and appropriate interventions going forward.

Furthermore, understanding the import and export flows of materials could help to better inform trade negotiations with key source or destination countries.

Strategic planning for the Clean Growth Strategy and other UK-specific industrial growth and sustenance strategies will require detailed knowledge of the materials flows at each stage of the value chain such that interventions, actions and research can be targeted at the right points and their impact measured and adjusted as necessary.

6 www.nispnetwork.com

POLICY INTERVENTION

3

Value chain

Policy has traditionally been focused on parts of the value chain (waste policy, for instance) rather than being designed to achieve the best economic and environmental outcomes across the value chain. This needs to change if the full value of a transition to a circular economy is going to be achieved.

- Require government by 2020 to have worked with the value chain members to map the flow of materials and interactions in the chain, to deliver a commonly agreed map and to have identified all points of essential data gathering to ensure the data collection requirements are fully scoped and agreed.
- Focus new policy and revise existing policy, where necessary, to deliver change in performance across the whole value chain, and seek to avoid interventions that only focus on a particular sector or component of the value chain.
- Ensure that all government departments involved in policy across the value chain are coordinated and collaborate such that their policy interventions facilitate and promote full value chain thinking, and ensure targets or interventions support the value chain approach.

harvesting

SUEZ considers that the collection of wasted resources from the value chain comprises two main processes – both the physical collection of containers and other 'service' activities, like waste minimisation and data analysis.

The concept of 'harvesting' takes this forward another step and refers to a more systematic approach of understanding the nature of the discarded materials or items, designing an appropriate collection system for them (from collection to consolidation and logistical forwarding) and then on to appropriate repair, treatment or disposal points.

Harvesting materials, as opposed to more passive waste collection service solutions, delivers the most effective collection method and ensures the quality of materials is both correct to specification and is maintained through the logistical system to the point of treatment. For instance, there is no point in collecting something for repair only to find that the process of collection and onward logistics has further damaged the item.

Collecting materials in an inappropriate manner can lead to excessive cost and/or a quality loss, which can prevent the resources being extracted and conserved in the optimum manner. Understanding the resource value flows will help target the harvesting methods and systems that best apply to each stream and create the basis of appropriate targets and priorities.

Metrics

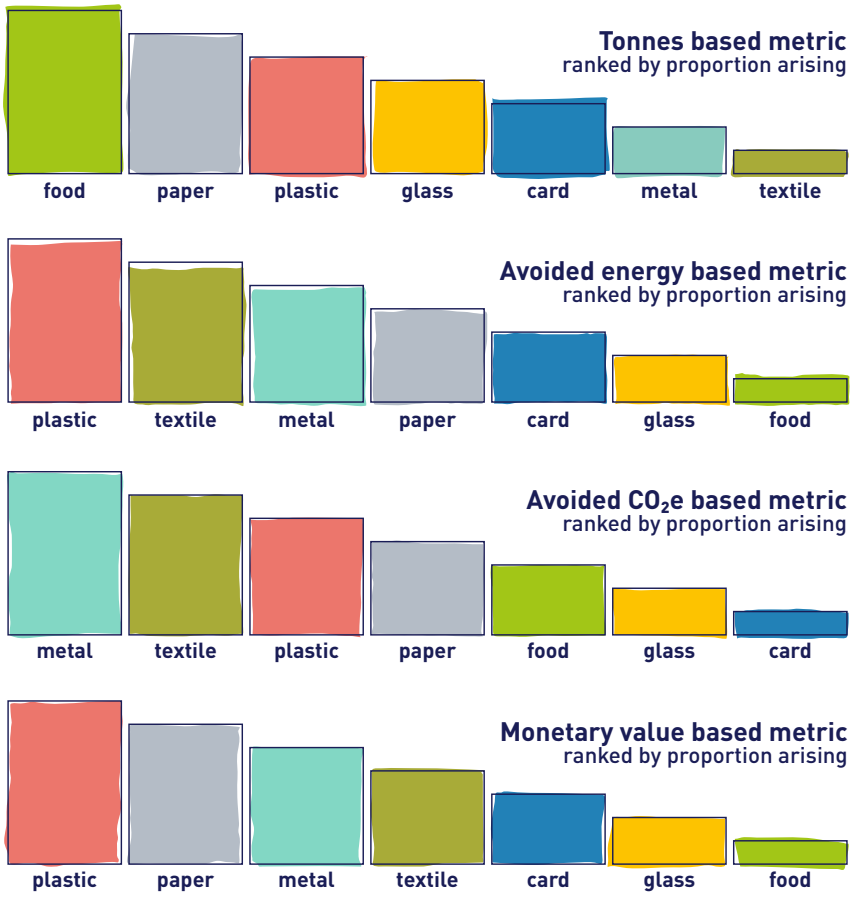
We understand that Defra is using a life-cycle approach, informed by the principle of natural capital, to inform its waste and resources plan. Natural capital is a useful manner of determining resource priority and is defined by the World Forum on Natural Capital as *"... the world's stocks of **natural** assets which include geology, soil, air, water and all living things. It is from this **natural capital** that humans derive a wide range of services, often called ecosystem services, which make human life possible."*

Natural capital is one of a number of ways of measuring resources, although it is probably the least well known among the general population. Its use as a common metric across the whole value chain of resource consumption, however, may take some time to establish and, to become truly effective, it will need consistent standards of data and reporting from international markets and communities as well as from domestic ones.

A suitable metric would allow flows to be easily measured, the burden of production and use of materials and items easily calculated, and reporting methods to be easily understood at the point of purchase and/or production.

We consider it essential that an appropriate tool is developed which helps each section of the value chain use the same fundamental information and methods of calculation to ensure consistent and robust measurement. We do not consider that it will be possible to measure all externalities, but a common method and data set, internationally accepted, will provide a good foundation.

RECYCLING METRICS → BY PROPORTION ARISING



SUEZ has considered recycling metrics in some detail and previously published a report called 'At this rate'[7]. A graphic created to provide a simple summary of some of the findings is presented here.

These charts show how a set of different standards will influence priorities and targets, and show the differing level of benefit when materials are split by weight (as is currently used), energy avoided, carbon saving and monetary value.

The results are presented in a manner that represents both the burden / benefit of the material and the average quantities of that material which arise within typical waste streams. For instance, a high-intensity material may not be the top priority if the weight of materials typically in the waste stream is low. Green waste is not included in the chart, as it is not consistently produced / collected by all local authorities and is not common in commercial and industrial waste, so it would therefore confuse the analysis.

It is clear from this graphic that the choice of metric can fundamentally alter the priority targets for material harvesting. For instance, food waste is a priority target if a weight based metric is used, but is one of the least important if carbon avoidance or energy metrics are used. Food waste would be a key target for natural capital (due more to the minerals and nutrients present rather than the energy potential in anaerobic digestion, for instance), but in the current policy context, minimising food waste should be more important than harvesting or recycling it. This supports the government's 25 Year Environment Plan focus on minimising food waste, rather than targeting it for harvesting and recycling.

7 www.sita.co.uk/wp-content/uploads/2017/08/SUEZ-AtThisRateReport-1509-web.pdf

We believe that a move away from weight is essential if the Resources and Waste Strategy is to measure the value in the resource and not just its intrinsic weight. Weight has been a useful measure of diversion from landfill, but lacks purpose and definition when considering resource value.

We also consider that a transition from weight is necessary to build the data base, value-chain relationships and consistency of purpose across those relationships required to deliver circular economic solutions.

Having considered transitionary arrangement, we would recommend the following actions from government:

2018-2020

- Agree the method of measurement with stakeholders across the value chain.
- Build the common data base and datasets necessary to inform the process.
- Build the common tool and methods of calculation.
- Maintain weight as the metric of measurement of policy delivery in the field and expand this to cover all the target flows through the value chain.

2020-2025

- Continue to use weight as the primary driver of measurement, but require parallel reporting in the new chosen metric. This will help all participants in the value chain understand how the method of measurement works relative to weight and to undertake any necessary corrections to datasets or calculation methods.
- Establish targets for future performance using the new method of measurement and ensure these are agreed across all components of the value chain.

2025-2030

- Adopt the new metric as the lead reporting item, but continue to report weight as a secondary metric.
- All targets of performance established in the prior period are implemented and success measured against them.

2030+

- Switch fully to the new measurement and reporting method and ensure all targets are set and assessed against this.

This transition will integrate well with the adoption of the EU circular economy package weight-based targets through to 2025 and the parallel reporting from 2020 to 2030 will enable a direct comparison of performance to EU standards whilst also moving beyond the expectations embodied in the package itself.

Targets for local authority contracts would also need a form of transition and we consider the following method to be practical:

- All contracts let from adoption of the waste and resource plan onwards, and through to 2025, are based on weight-based targets but include the provision for a second method of measurement to be co-reported at the correct time.
- All contracts planned to be let after 2025 would adopt proven new targets set by the new metric. Parallel reporting of weight would continue to allow a full understanding of the relative performances.
- All contracts let after 2030 would be set on the new method of measurement only. However, as part of the metric calculation, it is likely that weight will continue to be collected as part of the necessary dataset. Contracts previously let on the basis of weight would, upon extension or renewal, move to the new method of measurement and equivalent new targets.

Targets for recycling in the commercial and industrial field would also follow the same routine and sequence, but would need the policy intervention mentioned previously with regard to an increase in statutory data collection and reporting. A weight-based target would be set for 2025 and a new metric target set for 2030 and beyond.

POLICY INTERVENTION 4

Target materials

We think it is vitally important that the resources used and consumed in products are demanded as secondary resources by customers who want and need to make new products using these recycled materials. Harvesting those target materials to recover them for recycling and other uses is the most important factor. How those materials are recovered and collected from the consumers should be left open to allow innovation.

- Target materials are likely to include ferrous and non-ferrous metals, glass, plastics, organics, card and paper, and rare and precious metals.
- Establish a department in the Department for Business, Energy and Industrial Strategy with an appropriate Junior Minister to manage a cross-sector group to identify the target materials and substances that are important to the current and future economy and environment. Empower this group to identify where these target materials are consumed and wasted in the value chain and deliver priorities for their preservation and recovery.
- Ensure that policy avoids being overly deterministic in the manner the target materials are extracted, but sets appropriate targets for recovery levels. This policy, once set, should enable innovation in the manner of extraction and collection to achieve the recovery levels specified.

Conformity of systems

Much has been said recently about conformity of collection systems across local authorities and the benefits which might arise. We believe that the process of 'harvesting' targets the priority materials to be recovered from the value chain and should be the main focus of conformity. Alignment of bin colours and collections systems are less important than the target materials. However, adopting a common set of materials for harvesting would, over time, allow for the alignment of collection systems which could see a gradual replacement of waste containers coordinated by colour, which in turn is likely to help consumers form positive waste management habits. Once the new method of measurement is agreed and harvesting priorities established, this will allow a new common set of target materials to arise.

Although a set of prioritised materials is essential, not all waste producers in each stage of the value chain will be wasting all of those priority materials, or will be able to economically and efficiently support their extraction, due to, say, location or volume produced. Once the priority materials are established, it will then be necessary to undertake further work to determine the ability to practically extract those materials from each type of waste producer.

For instance, with local authorities, SUEZ utilises a system of assessment which we call 'DNA'. This system uses a range of factors to assess the likely materials that can be effectively recovered from a location. We use five classifications: very urban, urban, suburban, rural and very rural. Green waste provides a simple example of how this applies in practice. Very little green waste arises in very urban environments, as there is limited garden space and, as such, collection costs would be excessive to the value of materials recovered.

↓ LOCAL AUTHORITY DNA

In assessing the DNA of a local authority, we consider a wide range of factors which include:

Factor	Indication
Population density	Indicative of the space available for recycling.
Homes owned	Indicative of stability in homes (people in rented accommodation often move more often than those in owned homes and this disrupts their waste management habits).
First language	Indicative of the ability to communicate waste management systems clearly in all languages spoken in the local authority area.
Deprivation	Indicative of home sizes, purchasing and consumption habits.
Age profile	Indicative of the time available which individuals could potentially allocate to waste management activities.
Employment rates	Indicative of the time available which individuals could potentially allocate to waste management activities and consumption habits.
Average council tax band rates	Similarly indicative and complementary to deprivation.
Worthwhileness	Indicative of a number of potential factors around the wider benefits of waste and resources.

Categorising local authorities using these criteria helps not only to provide the foundation for targeted harvesting, but also the basis for a number of other opportunities, such as inter-authority collaboration.

Similar categorisation exists in the private sector where sector descriptions help define the types and scale of each sector's activities within geographies, which allows sector-specific solutions to be developed and utilised.

Volume and compositional data, in both the municipal and business sector, unlocks significant insights about the generation of waste to inform solutions in collection and harvesting of those materials.

Composition of dry recyclate by sector

Working with Imperial University and one of its industrial MSc students, SUEZ explored the mix of dry recyclable material composition in waste streams from a number of pre-identified industrial sectors. Data taken from sampling SUEZ undertook was used, together with customer information derived from a number of key vehicle depots and their collection route customer mix. This analysis identified common trends by sector but also some trends of difference in composition between smaller and larger companies in the same sector. A chart of the results is presented here.

		Target materials									Non-target recyclable						Non recyclable			
	INDUSTRY MATERIAL MATRIX ↘	Cardboard	News and pams	Mixed paper	Office paper	PET bottles – clear	HDPE natural	Mixed plastic bottles	Steel cans	Ali cans	PET trays	Mixed pots, tubs and trays	LDPE jazz film	LDPE clear film	Rigid plastics	Scrap metal	Liquid	Residue items	Others 1 (food)	Others 2 (WEEE)
Industry	Chemical / Non-metallic minerals					x	x		x	x		x	x	x						x
	Education	x	x												x	x			x	
	Food and drink			x		x	x			x	x	x	x				x	x		
	Hotels / Catering and pubs					x	x		x	x		x	x	x						x
	Machinery / Equipment	x	x												x	x			x	
	Metal manufacturing			x													x			
	Other	x		x	x	x	x	x		x	x	x	x				x			x
	Power / Utilities	x		x	x							x	x	x			x			
	Public admin													x				x		
	Retail / Wholesale			x		x	x			x	x	x	x				x	x		
	Textiles / Wood / Paper / Publishing					x	x			x	x	x	x					x		
	Transport								x					x				x		

Very strong correlation
(where a greater percentage of the industry, more of the input material arises)

Weak correlation (suggests that there could be a potential link between the more of the industry and greater input material type)

Very strong correlation (where a greater percentage of the industry, the more input material – visible in linear groups, suggesting an additional influence)

Very strong opposing correlation (where more of an input material is seen with the least representation of the industry)

x **Suggested relationship by comparison of top five industry rank against top suppliers of each material**

Schedule and dynamic systems

The scheduling of waste collection in both the municipal and business sectors has been refined to a high level of efficiency over many years and route planning is approaching peak efficiency for scheduled style collections. However, this measures only the efficiency of collection of the containers and not the efficiency of harvesting the materials they contain.

Where SUEZ collects commercial and industrial customer waste and weighs the containers, we accumulate accurate information on the weight of materials in the containers. Often containers are not full and, at certain times of the year (such as holidays or down times), they may be less than half full. Collecting containers that are neither full nor nearing their capacity is inefficient. We believe this represents an opportunity for the next stage of collection efficiency improvement, which will reduce the cost of harvesting the target materials.

Further, we consider that a move towards a more dynamic form of collection (defined as containers being collected when needed) or when the collection service analysis indicates a collection of a part-full container is environmentally and economically efficient (a collection vehicle is passing the location and can collect with no additional travel for instance) can significantly reduce the cost of the service of collection.

Although the inclusion of in-bin sensors and bin telemetry are not common, they are already proving robust in the field and are expected to increase in use over time. These sensors give periodic updates on the fill level of the bin and that information, together with flexible collection contracts and services, can add further benefits to customers. Transitionally, by simply adding weight measurement to bins and for some other services, a 'call off' service can be implemented that introduces some of the economic and cost benefits of dynamic collection prior to the other technologies achieving field maturity.

Dynamic collection services

Typically, a customer pays for two main components of container servicing – the collection of the container and the treatment (depending on value) of the materials being harvested. A dynamic service would require the customer to accept a more flexible collection service, rather than just a scheduled service. They would pay for all collections made, but would expect, over a year for example, to have fewer collections (for the same volume of materials) than would be expected for a scheduled service – saving some cost for them and reducing the environmental burden of collecting part-filled bins. If a bin is collected at the convenience of the collector, then a discount on the collection service charge would be implemented.

Although most likely to be introduced at scale into the commercial and industrial waste sector, this same methodology would have similar benefits to municipal waste collection. Weighing municipal household bins will help improve the efficiency of the collection rounds, especially in times of lower arisings (such as summer holidays) where round changes could release crews from scheduled work or reduce the cost of temporary staff. Further weight data alone will allow targeted interventions by recycling officers to help households change their behaviours, recycling more and wasting less.

Data, combined with the knowledge it can reveal, has significant potential to drive down costs and increase efficiency throughout the waste collection system.

Pendle Council

In moving to a paid-for green waste service, Pendle Council introduced an opt-in service for collection for the winter months. Customers signed up for a green waste service can request a collection from the authority as required and the authority 'dynamically' organises these call-off services for optimum collection efficiency. Reported savings of £13,000 per year for this small element of service provision gives a good indication of potential savings in the future.

Service quality and data collection

Ensuring that collections are made in accordance with customer expectations is a fundamental of service delivery. Over the last decade, it has been common for household bins to be electronically 'tagged' to provide a confirmatory record that the bin was collected, which in turn aids both customer service and contract management considerations. It is common in local authority collection contracts that real-time visual representations of collections underway are displayed at depot control centres, so missed bins can be identified whilst the collection vehicle and crew are still local. This data has been a positive addition to these services and the customer experience.

As noted previously, it is more common in the commercial and industrial waste sector that containers are weighed when collected. This, together with data on the materials in the bin being harvested, and customer details, provides excellent information for a number of different services, namely:

- It helps accurately measure the weight of the materials being collected.
- It helps identify part-filled containers, giving an opportunity to reduce bin collections where the bin is not full.
- It helps identify trends in waste production, informing the customer of matters that might be material to their own process and which might drive prevention in their activities.
- It drives knowledge of periodic changes in waste production that help refine and add efficiency to collection and harvesting activities.
- It delivers customer-specific pricing, replacing historic average-weight charging methods.

Service quality, data and education can significantly improve services delivered.

SUEZ municipal service improvement

As part of a major collection service change for a public sector customer, SUEZ found that a change of collection format did not initially deliver the anticipated benefits and elicit the desired response from residents.

Follow-up interventions were used to target households which hadn't responded as hoped, with communication 'tags' used to remind them of the change and explain why they were being asked to present their recycling differently. Crews logged responses against the particular properties. If a second communication tag was issued, it was also followed up with a more direct letter and, if necessary, a visit by an officer. In the first 15 months, almost 7,000 properties (8% of the population) received an information tag, letter or visit, which helped the contract to achieve a positive action response from nearly 99% of households.

This has provided service improvements by reducing non-compliant presentations, reducing contamination and increasing the volume of recyclable materials collected.

Information tags are routinely used in service changes to provide a final 'nudge' reminder to residents prior to the introduction of the change.

Although it is difficult to measure, SUEZ has seen a stark difference between changes where these have been used and where they haven't, particularly when collection days are changed. This has resulted in efficiency-savings for the contract, since crews and contract managers have to monitor the compliance of rounds for shorter periods of time following a new service introduction – instead being able to focus on persistent problem areas.

It is the SUEZ experience that container weighing generates data that gives customers a complete understanding of the waste arising from their processes and delivers an almost immediate opportunity to minimise waste by addressing both the waste in the containers and the wasted effort in their business.

Weight data from the municipal collection system has the potential to unlock a number of benefits, including:

- Targeted interventions to maximise the efficiency of education.
- Service and harvesting efficiency improvements and/or cost reductions.
- Trend analysis for future planning and budgets.
- Routing opportunities to maximise the effectiveness of each collection crew.

Building a comprehensive dataset across both municipal and business waste, implemented through a policy change on duty of care reporting, will ensure that the quantity and quality of data can deliver datasets that drive real knowledge and real tangible improvements.

Litter, fly-tipping and waste crime

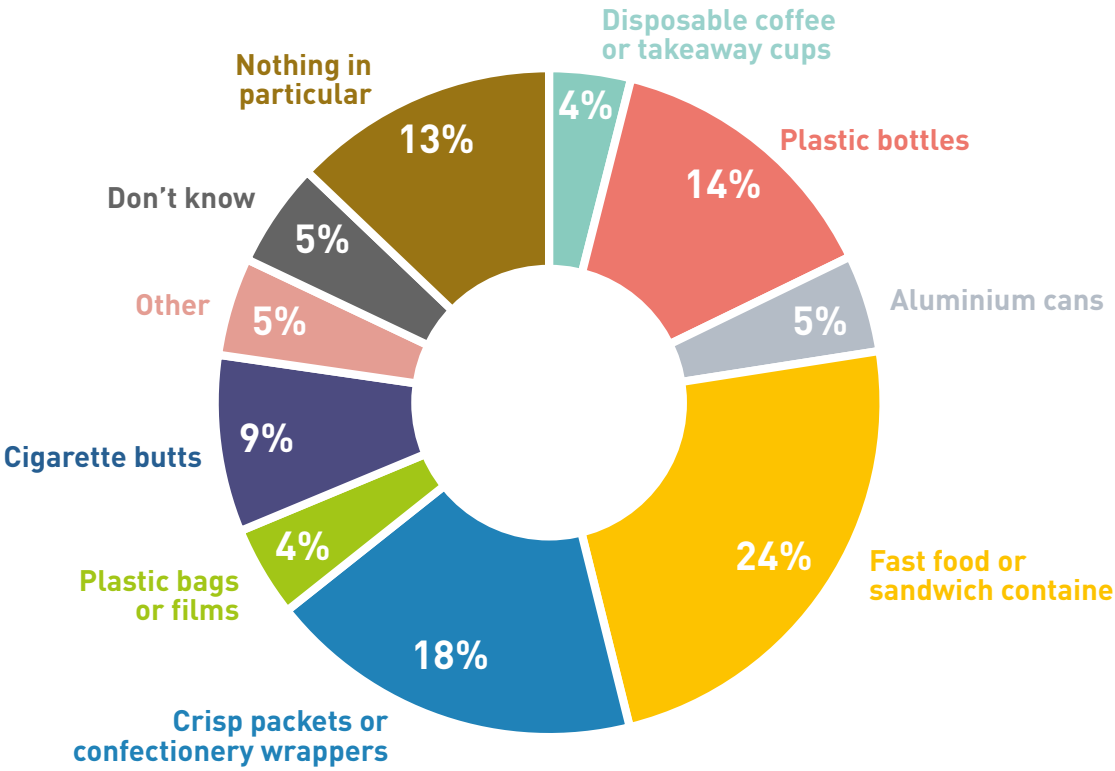
Litter, fly-tipping and waste crime represent the unacceptable and uncontrolled management of waste.

Creating a system of data generation, reporting and analysis across the value chain allows waste to be tracked through its full 'duty of care' journey. The aforementioned level of data and tracking will make the identification of losses through fly-tipping and waste crime easier to identify. We believe these activities can be minimised by adopting the currently proposed increases to fines and penalties and by providing sufficient resources to undertake tracking and enforcement.

The recently proposed fixed penalties for littering will also create a foundation of compliance which, if implemented correctly, should minimise litter habits.

Economically, if affordable and convenient solutions for the various waste streams are not available, it is likely to lead to an increase in fly-tipping and waste crime. To an extent, the continued increase in landfill tax and the lag in delivering new residual treatment capacity has promoted some of the increase in this crime over the last 10 years. Economic drivers and changes need to be carefully planned and phased, such that the delivery of replacement infrastructure and solutions become available within the affordability envelopes of waste producers.

Other interventions, such as deposit return schemes, offer the opportunity to 'pull' materials used 'on-the-go' (such as plastic bottles and aluminium cans), which are often littered, into a system of refunded deposit. This will not only reduce the volume of those deposit return scheme targeted materials littered, but also help drive the associated education and habit change.



↑ PUBLIC PERCEPTION OF THE BIGGEST CAUSE OF LITTER

Finally, and most importantly, education is a fundamental requirement to foster positive participation across the value chain. This should focus on simple and clear guidance on the benefits of the resources being conserved and the burden of litter and fly-tipping crime. Current public interest, built through the focus on plastics, provides a solid foundation for future education, but plastics are only one element of illegal losses. In a YouGov survey undertaken for SUEZ in March 2018, public perceptions on litter identified certain items as a concern, shown in the chart here.

Dealing with litter, fly-tipping and other waste crime requires a combination of actions targeting different push and pull measures, good data controls and visibility and an environment of education and context-setting that helps all parties understand the rationale behind these various activities.

Inter-authority collaboration

North East Derbyshire Council and Bolsover District Council formed a strategic alliance in 2011, resulting in sharing of senior and middle management posts and delivering shared efficiency savings of approximately £750,000. This joint working extended to establishing joint Streetscene Services management and administrative arrangements, delivering further shared savings of approximately £200,000. To achieve this, services have been jointly reviewed across parks and grounds maintenance, waste collection and street cleansing, resulting in harmonised service delivery policies and performance management systems.

Inter-local authority and industry collaboration

The process of local authority contracting has led to a variety of different and very specific services, which we are seeing often reduces the opportunity for cooperation between different (often neighbouring) authorities. Scotland and Wales have made some efforts to bring forward a coordinated approach, but this relates more to service design than creating an integrated and collaborative set of services.

Understanding and comparing key contextual factors for local authorities, such as some of those described in the aforementioned DNA approach, helps identify commonalities that might provide the opportunity to collaborate. For instance, where two adjoining authorities have mutual areas of high-density multiple-occupancy housing and suburban-style housing, they have the opportunity to consider aligning their collection systems and perhaps sharing resources to enable them each to deploy two types of collection (one for each type of housing) and share the purchasing and service provision that avoids duplication or the inefficiency of keeping spare materials or crews.

Cooperation between local authorities and other service providers has the potential to increase efficiency and reduce costs. Preliminary modelling undertaken by SUEZ of the full implementation of collaboration, resource sharing etc and new technologies and techniques, saved upwards of £500 million and, in some scenarios, over £1 billion in operational costs across the municipal waste collection and treatment service.

New systems and solutions

The very notion of the circular economy dictates that efficiency comes from collaboration and cooperation, and that silo working misses many of these potentials. Moving away from a traditional methods of harvesting materials from households and businesses is essential in facilitating the extraction of more materials in efficient and affordable ways. Many of these are covered elsewhere, but they represent only a small set of exemplars of cooperation across the value chain. New systems and solutions introduced through value chain collaboration offer even greater potential benefits.

The arrival of new digital solutions provides new opportunities for waste tracking, for informed customer choice and for more efficient methods of separation and identification of materials.

Digital watermarking and recycling

Various technologies for marking products are available, from simple bar codes through to hidden but machine-readable digital watermarks. If digital watermarking was introduced for products passing through the consumer value chain, they could open a completely new way of recovering materials. Households would not be required to separate materials beyond keeping them in a dry materials container. At the recycling centre, separation into individual streams can simply be done by reading the digital watermark, allowing a more granular method of material identification and extraction. The digital watermark can present information related to composition and use which would allow separation of food contact from non-food contact plastics for instance.

Bin sensors are placed in containers and measure the volume of material present. They can communicate how full each waste container is, allowing collectors to collect when required and not just on a fixed schedule. This, combined with customer context data (type of waste historically put in the container, for instance), can release efficiencies in collection, maximised where service activities are undertaken collaboratively. Datasets that support bin sensors, such as weight data for each type of waste stream, can enable vehicle loading prediction and harvesting strategies that target materials in a more 'just in time' basis, increasing asset utilisation, decreasing the costs of inefficiency and contributing to the productivity and profitability of the full value chain.

Vodafone trials in Paris with connected bins saved a reported 17% of the collection costs and clearly show the potential benefits of embracing digital technologies in the waste and resources sector of the future.

POLICY INTERVENTION 5

Collection systems

The sole purpose of collection systems is to ensure that the target materials are collected and transported in an environmentally and economically-efficient manner. There are a multitude of different collection systems that can, and should, be utilised in a plethora of combinations. The weighing of all individual containers will quantify the volumes of materials being generated (an essential element of resource management) and the introduction of pay-by-weight will proportionally reward behaviour and resource recovery.

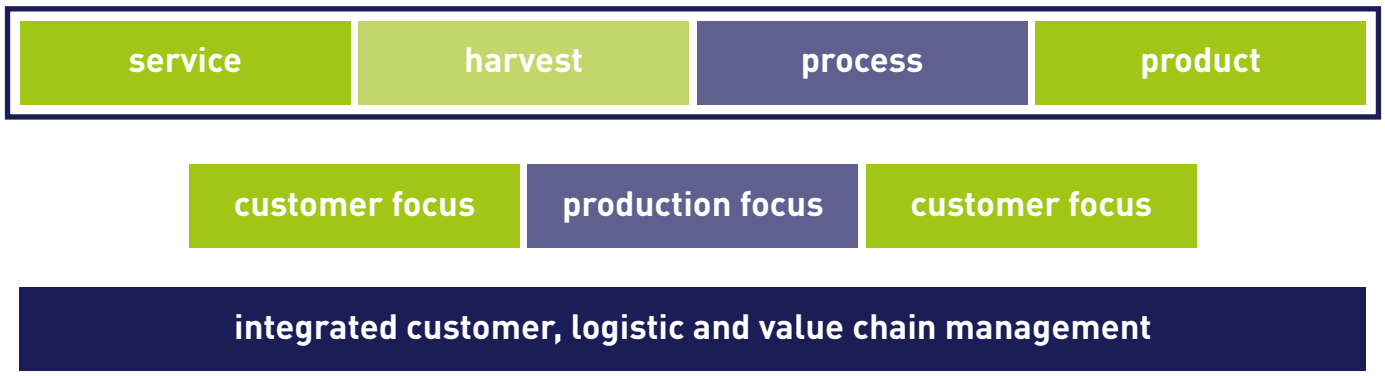
- Define the target materials to be harvested and the measurements of performance.
- Facilitate innovation in existing and new collection systems.
- Require the adoption of digital systems in collection by 2020 to drive data which, in turn, enables efficiency increases in material harvesting activities.
- Promote collaborative systems across the value chain to help create the matrix of collection solutions required.
- Require the weighing of all containers for the target materials and require the transition to pay-by-weight for residual waste and target material collections.

logistics

The waste and resources sector undertakes many logistical services – from the simple collection of waste from households and businesses, through to the consolidation and onwards transport to treatment facilities.
In many instances, the collection of waste from households and businesses involves a vehicle leaving empty and arriving back near full. Onwards transport between the initial consolidation points (transfer stations) and the factories or facilities that then recover the resources, or undertake the final disposal, often involves bulk transport and more frequent back-loading. In essence, whether through passive service delivery or active 'harvesting', these activities are designed to feed materials into the processing facilities that transform them into new products for existing markets.
Responding to these changes requires a clear understanding of how a resource business runs and is structured.
An example used by SUEZ in its own development is shown here.

However, the traditional model of waste logistics is gradually being replaced or complemented by other ways of harvesting materials that involve multiple methods and participants. For example, these might be charity collections for things like textiles, or 'bring-back' schemes like those used for small batteries, or new-for-old replacement services for white goods and mattresses.

RESOURCE BUSINESS STRUCTURE ↘



Hub and spoke models

Waste collection has, in many ways, remained a constant and consistent activity for decades. Improvements in bin design (dustbins to wheelie bins, for example), collection vehicles, routing and other elements of waste collection have increased efficiencies and reduced costs.

Supporting this infrastructure is a network of depots where the vehicles park and are often maintained, and a series of transfer stations where field collections are consolidated before being bulked up and moved to treatment. Some materials are direct-delivered for treatment in instances where the collection round is near to the treatment facility, but the majority of materials pass through transfer stations. The current network of transfer stations were, in the majority, constructed to serve a landfill model and these facilities were therefore located to fit with a distribution model where landfills were numerous and local and served in the majority by road based transport. As we have moved away from landfill disposal, the number of residual waste and recycling treatment locations that have replaced them has been significantly smaller in number.

In the 1990's, there were many thousands of landfill sites available for disposal, but this number has eroded and is currently only a few hundred. The number of energy-from-waste facilities built to replace these sites is measured in the dozens and, as such, the role of the transfer station has and will continue to change and become more important. Many of the existing sites are now not fit for purpose and are in the process of being redeveloped or replaced to accommodate the changing need and their changing role.

In the future, they will need to support multiple streams of materials, longer-distance bulk logistics systems and elements of backhaul for waste or other materials that are concordant with the logistical systems themselves. Refreshing and/or replacing the existing network of transfer stations is an essential element of providing the basis of the performance increases and efficiency gains necessary to deliver the systems of the future.

Reverse logistics

Making sure that vehicles are full on both their inward and outward journeys is a key element of efficient logistics. If this is maximised, it can produce significant savings and, in SUEZ's report 'A resourceful future[8]', we identified potential savings across the economy of over £1 billion through an extensive and efficient integration of logistics.

Reverse logistics moves beyond filling waste trucks with materials on their empty journey legs and extends to combined full-integration of the complete set of services. For example, supermarkets use their delivery vehicles to backhaul stores' wastes to their distribution centres, from where they are sent on. Amsterdam has a system where some delivery trucks haul back suitable wastes to city perimeter locations while some internet companies are increasingly offering to recover packaging or other items from their customers. These and many other systems will need to be utilised to deliver the efficient logistical systems required of the sector.

8 www.sita.co.uk/wp-content/uploads/2017/08/ResourcefulFutureReport-SUEZ-1609-web.pdf

POLICY INTERVENTION

6

Waste logistics infrastructure

Efficient logistics for the movement of recovered resources is essential to ensure environmental and financial costs are minimised. Using all methods of transport to move materials is fundamental to delivering a circular economy.

- Ensure that local and regional planning considers not only large waste infrastructure, but also the supporting network of depots, transfer stations and intermodal connections necessary for current and future treatment capacity needs.
- Facilitate the refurbishment and repurposing of existing logistics infrastructure and/or replace existing infrastructure with new facilities designed for the new systems of waste consolidation and movement.
- Protect essential logistical waste infrastructure especially in and around urban areas where pressure for other developments often drives their redevelopment for other purposes or their constraint in operation through developments around them.

Value chain niche extractions

Small streams of materials, when included in the mainstream systems of collection and treatment, can often be lost, or are difficult to extract, or pose risks of fire or contamination. Also, some of these materials may only be consumed and discarded periodically or may not be widely used and prove difficult to capture in traditional systems.

Black plastic meat trays are a good example of a niche stream, amounting to only 35,000 tonnes of material annually in the UK. However, although they are plastic and often arise in recycling streams, they are difficult to extract from 'mainstream' materials in recycling centres and can add significantly to contamination of non-pigmented plastic streams. Small batteries, as a further example, can contain hazardous materials like mercury or, if combined in certain ways, can pose a risk of fire – particularly in the case of lithium batteries. Extracting these niche streams in ways that are economic, practicable and environmentally sustainable is key to realising the next stage of improvement in recycling and in the quality control for residual waste going to energy-from-waste.

Flexible plastic recycling project – REFLEX

SUEZ, together with a number of value chain partners – including Dow Chemicals, Axion, Amcor, Interflex, Nestle, Tomra and Unilever – has undertaken a project to improve the recyclability of laminate packaging. The trials sought to identify design standards, material volumes in the system, volumes being harvested, separation methods and secondary product specifications, and end uses for the materials.

The project concluded:

- 80% of the materials were already technically recyclable.
- Investment in the collection and recycling infrastructure was required to harvest the material.
- Two new reprocessing centres would be required to reprocess the material into new products.
- This value chain solution was estimated to cost around £100 million, would take 7-10 years to implement (due to local authority contractual rotation and infrastructure investment) and would have a marginal payback while adding less than 1% to the UK weight-based recycling rate.

The project showed the value chain the need for a resource-based set of target metrics, a whole value chain solution and the need for a managed transition.

SUEZ has undertaken a number of studies and projects looking at systems for flexible plastic packaging extraction, design and recycling. The Defra project entitled 'Flexible aluminium packaging collection trials'[9], the Innovate UK REFLEX project[10] and currently ongoing CEFLEX project[11] are three such examples.

Furthermore, SUEZ has been working with brands that want to find ways for their products to be recovered from their customers and deliver a more sustainable solution and more engaging experience. For example, SUEZ has undertaken trials for the collection of coffee pods and pouches, with two of the major brands looking at how the items can be harvested through different collection methods – including existing local authority systems.

It is clear from these trials that multiple methods of collection are required to meet the convenience expectations of customers and that this will need to involve multiple collaborative partnerships to deliver a workable solution.

Working with brands and leveraging their experience in customer engagement adds new skills and experience to the waste and resources sector, increasing the likelihood of success.

Collaborative working across the value chain is essential to the success of a waste and resources strategy. The waste and resources sector intersects activities right across the value chain and, if correctly and ambitiously integrated, can deliver significant economic and environmental gains – not only for the value chain as a whole, but for the individual components within it too.

9 randd.defra.gov.uk/default.aspx?menu=menu&module=more&location=none&completed=1&projectid=19045

10 www.reflexproject.co.uk/about

11 www.ceflex.eu

First-mile collection

Harvesting small amounts of materials from a large number of locations in small quantities is always going to be relatively expensive and thus the smaller and more niche materials generated in households or businesses have proven the more difficult to capture. In many cases, the cost and burden of collection exceeds the natural value in the materials themselves.

Cracking the 'first-mile' harvesting of all materials will require multiple partnerships to ensure that the value-to-cost ratio is maintained at an appropriate level. SUEZ has been exploring and testing multiple methods of first-mile harvesting to understand what methods might work and where they might best be applied. Methods considered and available for potential use include:

1. **Standard container collection** – household and commercial business collections.
2. **Post back** – allows users to send used capsules in the post to a consolidation point, as practised by brands like Nespresso.
3. **Take-back** – old tyres are disposed of upon the supply and fitting of new ones, as practised by tyre replacement companies.
4. **'Parasitic' collections to municipal services** – additional niche streams are collected alongside existing kerbside collections, as being trialled by Nestlé and JDE through trials with SUEZ.
5. **Survival bag** – holds some recycled materials, is collected in the residual waste collection and then the bag is separated for treatment at the reception facility, as practised in East London and more extensively overseas.
6. **New for old swaps** – items are exchanged at consumers' premises when a new one is delivered, as practised by Appliances Online (AO) for electrical items.
7. **Store bring back** – packaging items may be brought back without requiring an additional purchase, as practised by many stores for some recycled products.
8. **Charity donations** – books and clothes are donated, as practised by many charities.
9. **Charity doorstep collection** – items are collected from residents' doorsteps, as practised by many charities for textiles in particular.
10. **Business takeback** – an agreement between manufacturers and their customers that requires a manufacturer to take back a product for recycling at the end of its useful life.

11 **Takeback for schools** – an environmentally-friendly way to raise funds for a school by recycling items such as toner cartridges, ink cartridges, mobile phones or other items commonly used in schools.

12 **Reverse vending / deposit return schemes** – systems such as reverse vending machines, where the consumer inserts plastic or glass bottles or cans and the machine returns money, or deposit return schemes, which see consumers pay an up-front deposit which is redeemed on return of the empty drink container are practised for various recyclable containers in many countries.

13 **Household waste recycling centres** – facilities where members of the public can dispose of household waste and also often containing recycling points, run by the local authority in a given area. They are now commonly used for old, small items of furniture, DIY waste and other materials.

14 **Supermarket internet delivery bring back** – a scheme where items such as unwanted plastic shopping bags can be returned with the driver making your weekly shopping delivery.

15 **Courier collection** – a method of delivery whereby a courier comes to a specified location to pick up a parcel, or multiple parcels, before taking them back to the depot to be sorted and sent to the recipient. It is now being more regularly used with purchases made on eBay or other sales mechanisms.

We believe it is necessary, however, for a range of solutions to be available for each material or product type.

Many of the trials that have either concluded, or are underway, are brand-driven and have explored multiple extraction methods. Indeed, many brands are well aware of the opportunity to make the recycling and recovery solution, and subsequent sustainability benefits, a core element of their brand identity and associated marketing. This complements local authority communications and helps to embed positive recycling habits in consumers and other waste producers.

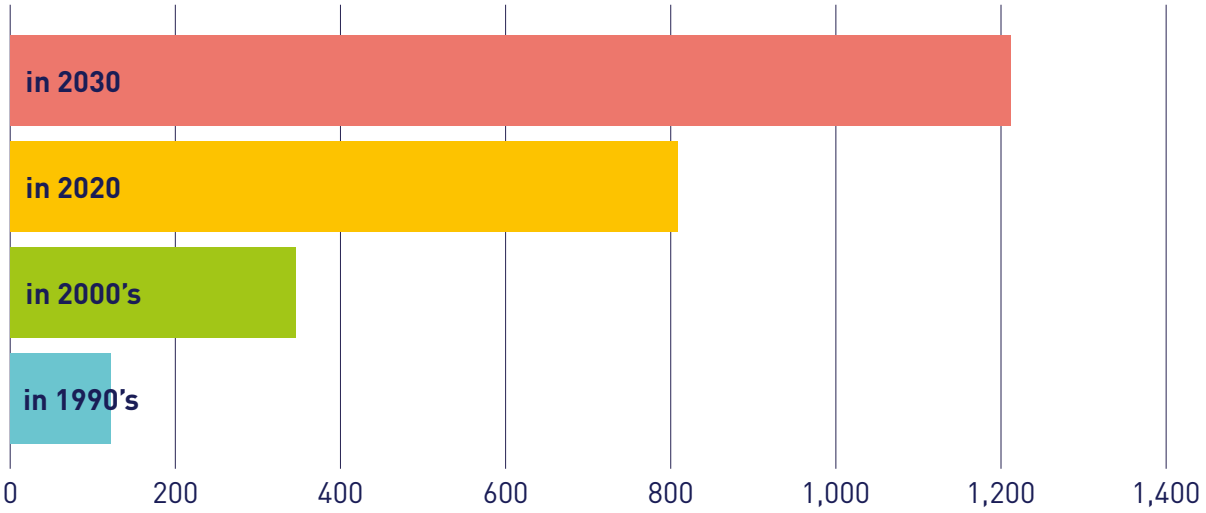
Using all the assets and skills available in the value chain will improve efficiency, increase harvesting and minimise the environmental and financial burdens of recovering discard items and materials.

Intermodal distribution

As the logistics systems for waste and resource movement mature, they have increasingly utilised more than just road transport. Some examples of sea and rail movements have existed for decades, but they tend to be linked to specific contracts and outlets. Increasingly, rail and ships are being used to supplement road transport and bring the full benefits of multi modal transport to the sector.

Given the distributed nature of the first-mile harvesting (many locations with small volumes of materials) and the increasingly concentrated and far less numerous presence of treatment facilities, waste is being moved greater distances than has historically been the case. The graph here shows the change in the area covered by a residual treatment facility from the 1990's and 2000's through to estimates for 2020 and 2030. It is clear that waste movement is likely to substantially increase in future.

↓ AREA COVERAGE FOR RESIDUAL TREATMENT FACILITIES – 1990'S TO 2030



Average area covered by each residual treatment facility in the UK (km^2)

Making best use of all the modes of transport is essential to delivering an effective and resilient treatment infrastructure in the future.

POLICY INTERVENTION

7

Intermodal transport

Intermodal transport involves the transportation of waste in a container or vehicle that can be used for multiple modes of transport. Using the most efficient method of transportation for waste requires access to, and the use of, all available modes of transport, from road to rail and boat. The opportunity to back-haul materials on transport delivering other materials maximises efficiency and minimises cost, improving productivity throughout the economy.

- Include the current and future needs of the waste and resources sector in strategic planning of national infrastructure for roads, rail and shipping.
- Protect access to intermodal centres to ensure resilient and efficient access to nodes of uploading and offloading.
- Encourage, through the strategic planning process, new facilities at locations where intermodal transport is available and necessary to support the strategic movement and treatment of waste and resources.

treatment

Treatment capacity must match the volume of materials requiring treatment in the market at any one time to avoid either over or under-supply and the associated negative consequences of either scenario. Having access to accurate market data is essential to understanding current capacity provision and future needs.

The waste and resources industry has worked with Defra to help establish consensus on available treatment capacity data and the subsequent analysis of this data.

This work has also identified data gaps, particularly in the range and extent of commercial and industrial waste data, in the depth of municipal data and in data consistency across all sectors.

We believe that, if the proposals regarding data detailed in our data generation and collection policy intervention were implemented, including the weighing of waste containers in both business and household environments, the quality of data available to underpin treatment capacity assessment would be massively increased and, within three years of implementation, would provide a far more reliable dataset than exists today.

Reviewing this data through a joint standing committee with government will ensure the UK is able to deliver the correct type, capacity and timing of infrastructure.

POLICY INTERVENTION 8

Capacity cooperation

Using the data captured throughout the value chain, overlain with the policy objectives and targets, will enable accurate assessments of current and future capacity requirements. These capacity assessments are essential to ensure the UK delivers the right scale of capacity for each stream of waste and secondary resource.

- Establish a waste treatment capacity review committee under the management of the Department for Environment, Food and Rural Affairs (Defra), between government, the National Infrastructure Commission and the waste and resources sector to annually review new capacity delivered, under construction and as required.
- Establish an annual review procedure with the capacity review committee to agree market requirements, delivery and forward needs. This should include representatives from Defra, the waste and resources sector and economic advisors.
- Establish common modelling and data analysis methods across the value chain, building on the work done by Defra and the National Infrastructure Commission, to allow all market participants to model and forecast against the available consensus data.

Residual waste

Residual waste is the waste left over after other reusable or recyclable materials are recovered. Its composition is therefore subject to variation based on consumption habits, recycling services and the habits of those discarding the waste – together with seasonal and regional variations in waste production. Residual waste properties and its benefits / burdens cannot therefore be dealt with as an amorphous mass, but must be considered in a series of individual streams.

In the past, when residual waste was typically sent to landfill, quality was of limited interest, although in later years the landfill gas potential became more interesting as landfill gas-to-energy projects became common on most sites. However, residual waste quality is far more important to the range of technologies which now treat residual waste in place of landfill.

The ultimate destruction of residual waste tends to occur through thermal processes, but other processes – like mechanical and biological treatment, mechanical treatment and mechanical thermal treatment – can be used to reduce residual waste volumes, extract some materials and deliver a specified grade of fuel for energy recovery. These three processes do not deliver full residual waste treatment.

For thermal treatment, the vast majority of capacity is delivered through 'moving grate' energy-from-waste facilities which use heat generated from the combustion of residual waste to raise steam, which in turn drives turbines that generate electricity.

Heat can be taken before the turbine, for high heat demand customers, or after the turbine for lower heat requirements – although heat taken before the turbine reduces electrical generation. Some residual waste is pre-treated prior to the process, normally through mechanical means, and classed as refuse derived fuel or, if made to a defined specification, as solid recovered fuel.

Refuse derived fuel is used in some energy-from-waste facilities, but is most often exported for use in 'spare' European energy-from-waste capacity. Solid recovered fuel is most often used to power cement kilns, both domestically and internationally. Refuse derived fuel tends to have a higher energy value than untreated residual waste and solid recovered fuel has a higher energy value than both residual waste and refuse derived fuel.

Gasification and pyrolysis have been explored for a number of years and in 2018 it is expected that approximately seven facilities utilising these technologies will be commissioned in the UK. All of the facilities being commissioned take the syngas produced in the gasification process and combust it to raise steam that then drives a steam turbine to generate electricity. Gasification and pyrolysis can produce a syngas that, by further synthesis, can be converted into chemicals and liquid fuels.

SUEZ built and operated a pyrolysis facility near Bristol, converting end-of-life plastic (that which was too contaminated or poor quality for recycling) into fuels, such as diesel and kerosene. In 2017, the facility was mothballed due to the uneconomic position of the oil price at the time. Gasification and pyrolysis facilities often require a more processed residual waste feedstock to operate efficiently (refuse derived fuel or solid recovered fuel quality) and their robustness in full scale operation will be proven over the next few years.

The volume of residual waste requiring treatment each year is a function of the volume of total waste produced minus the volume of materials reused, repaired or recycled.

The volume is also a function of population and population growth, business activity and the habits and economics of repair, re-use and recycling. As such, forecasting likely capacity can be difficult and prone to assumption-influence, which can significantly skew estimates. SUEZ has published a series of reports on its view of the residual capacity gap, one in 2014 named 'Mind the Gap 2015-2025'[12] and one in 2017 named 'Mind the Gap 2017-2030'[13] which sought to predict, based on policy mix and market economic conditions, the requirements for residual waste treatment 10 to 15 years ahead.

In 2017, the Environmental Services Association published a consolidation of various reports from across the sector. This report, entitled 'UK Residual Waste 2030 Market Review'[14] was written by Tolvik Consultancy and sought elements of consistency between the various reports considered.

In summary of these reports, under almost all scenario assumptions, more residual treatment capacity was required in the UK. If Brexit delivers additional barriers (administrative or tariff based) to the export of goods from the UK, then the ~3.5 million tonnes per annum of refuse derived fuel and solid recovered fuel exported to the continent may also need to be treated domestically.

Typically, an energy-from-waste facility takes four to seven years from planning to operation, which means that the sector cannot respond to short-term volume swings without resorting to the use of landfill. In addition, an energy-from-waste facility will typically operate for a period of 20-30 years and so the investment and replacement cycle needs a policy horizon that stretches to at least the same longevity as the facilities themselves.

The government has a stated aim to reduce waste to landfill and is intending to ban biological waste to landfill by 2030. A landfill ban date of 2021 for municipal-style wastes is already in place in Scotland.

SUEZ supports the reduction in use of landfill and the promotion of solutions that recover more value from the wastes being discarded. However, we also recognise that landfill has provided a flexible, quality-insensitive solution for the sanitary treatment of residual waste for many years. A landfill can often be flexible in accommodating inbound waste volumes, within the boundaries of its regulatory permissions, and can react to changes in demand quickly.

12 www.sita.co.uk/wp-content/uploads/2017/08/MindTheGapReport-SITAUK-1402-web.pdf

13 www.sita.co.uk/wp-content/uploads/2017/09/MindTheGap20172030-1709-web.pdf

14 www.esauk.org/esa_reports/UK_Residual_Waste_Capacity_Gap_Analysis.pdf

With the decline in landfill that has occurred over the last 30 years (from a number of thousands of operating facilities to a few hundred) and with the continuing trend of more closures, landfill will be less and less able to accommodate treatment fluctuations or short-term economic or policy interventions.

Process facilities such as energy-from-waste facilities seek to operate at their maximum throughputs almost continuously, maximising their efficiency and profitability. Operational availability in excess of 90% of all available hours is a normal target – with planned downtime making up the majority of the difference to 100%. This means that they have very little flexibility to accommodate unexpected tonnages and this raises the question of residual treatment resilience for the domestic energy-from-waste network.

Currently, this issue of treatment resilience is managed either through accommodating the excess waste in landfill or by stopping access to some waste streams to allow capacity catch-up for key and core customers. Although stopping some inbound waste helps with the management of the facility, it does not solve the treatment issue for that displaced waste, particularly if local landfill is not available or desirable. This creates a knock-on problem for other infrastructure in the region, and possibly beyond, with greater transport times and costs being incurred.

As access to landfill declines and the residual waste treatment becomes reliant on processing facilities, government and the waste and resources sector need to consider how resilience for residual waste treatment can be provided.

To give scale to this point, a network of energy-from-waste facilities in the UK with a nominal capacity of 25 million tonnes per annum of residual waste treatment would require resilience for planned down-times of around two million tonnes per annum and 5% additional unplanned downtime would require a further 1.25 million tonnes per annum of resilience capacity.

Many energy-from-waste facilities have been built to serve a municipal primary customer and, as a result, it is likely that business waste will be unduly impacted by the resilience issues described.

The funding of large-scale residual waste treatment infrastructure often involves investment of hundreds of millions of pounds and payback periods exceeding 10 to 15 years. Although some facilities undergo refinance within those periods, it is necessary to underpin the investment with feedstock and offtake contracts that mirror the scale of investment and the pay-back periods. Feedstock contracts are a vital element of facility investment and operation.

Typically, a residual waste treatment facility will require over half of the feedstock (and often up to 80%) to be contracted for a period in excess of 10 years and that the supplying parties provide financial surety. This requirement has, for the majority of facilities, led to a natural municipal bias in the development of facilities. Local authority contracts are often let with timelines in excess of 10 years and can reach 20 to 30 years where projects are integral to the municipal service provision. Typically, business waste contracts last one to three years and are therefore insufficient on their own, in both length of term and feedstock volume, to support typical facility development.

POLICY INTERVENTION

9

Long-term treatment policy visibility

To build the necessary systems and infrastructure to deliver the long-term transition to a circular economy, it is essential that policy and targets are set sufficiently far ahead in time to provide investment certainty. Building facilities which cost hundreds of millions of pounds often requires a decade or more to achieve payback and, as such, policy visibility needs to extend to a minimum of 20 years. Without firm policy over investible periods, it will be difficult to secure the finance necessary to fund the transition to a more circular economy.

- Ensure that all new policy is multi-generational. A policy timeline to 2050, mirroring the carbon law horizon is appropriate.
- Establish a process to review and measure, managed by Defra, delivery against the policy targets. This process should occur on a five-year basis and be charged with adjusting the policy interventions to ensure the long-term policy objectives are met.
- By 2020, establish new resource measurement metrics that underpin the policy objectives and which will be used to measure progress. The metrics should comprise a greenhouse gas carbon basis from 2025 to 2050, aligning with the national carbon plans and transit to a pure natural capacity basis from 2050 onwards. Carbon should be used, as it mirrors a number of natural capital drivers, but is also clearly understood by the public, by industry and by the trading markets.

More recently, a limited number of 'merchant' facilities have been developed where the feedstock is consolidated through commercial waste management companies and those companies provide the long-term commercial feedstock certainty. Policy certainty is vitally important if residual waste volumes from the private sector (which almost equal those from municipal sources) are to be provided with non-landfill treatment solutions.

POLICY INTERVENTION

10

Business waste

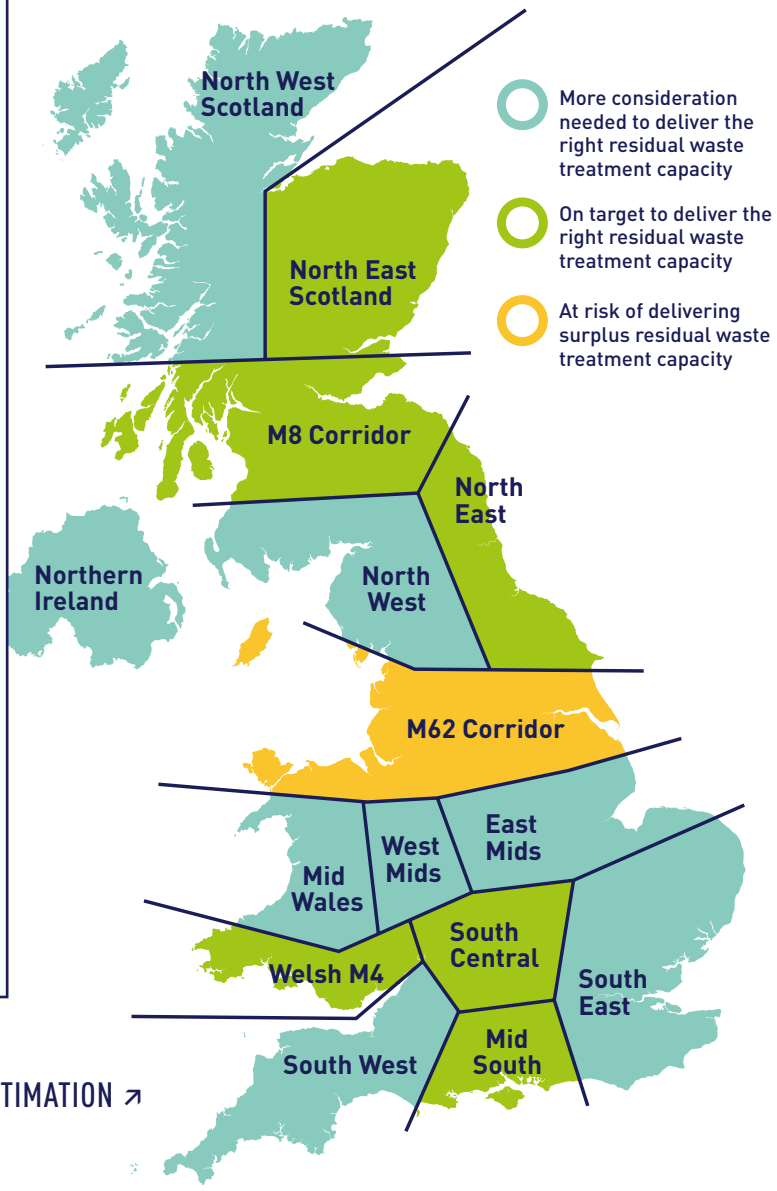
A circular economy requires extensive waste and resource management across both household and business waste. Helping UK business become more productive, and reduce and remove waste from its processes, will help deliver the fundaments of the Clean Growth Strategy and 25 Year Environment Plan. The current policy vista focuses more on household waste, while infrastructure development has, in the majority, targeted household waste. This has left business waste lacking much of the focus and infrastructure necessary for it to be internationally competitive and make the affordable transition to a circular economy.

- Consider and accommodate the needs of commercial and industrial wastes through collaborative approaches to new waste treatment facilities.
- Require all municipal contracts for infrastructure to consider provision for a proportion of private sector residual waste as well as the municipal waste requirement.
- Require the development of innovative support mechanisms that help residual commercial and industrial waste consolidation and management in the most efficient methods and to deliver the necessary treatment capacity.

Furthermore, residual waste is generally treated in a regional manner and so capacity targets and waste arisings should also be considered in a regional manner. In the most recent Mind the Gap report, SUEZ published a map of the UK divided by 'waste region' (with each region defined by a range of factors). The map also shows whether each region is trending towards an over or under-capacity situation.

When the proposed standing committee meets, its remit should be to consider the regional capacity requirements and not just national ones.

The map showing the SUEZ regions and estimates of capacity gap trends is presented here.



WASTE REGION MAP WITH CAPACITY ESTIMATION ↗

Current recycling

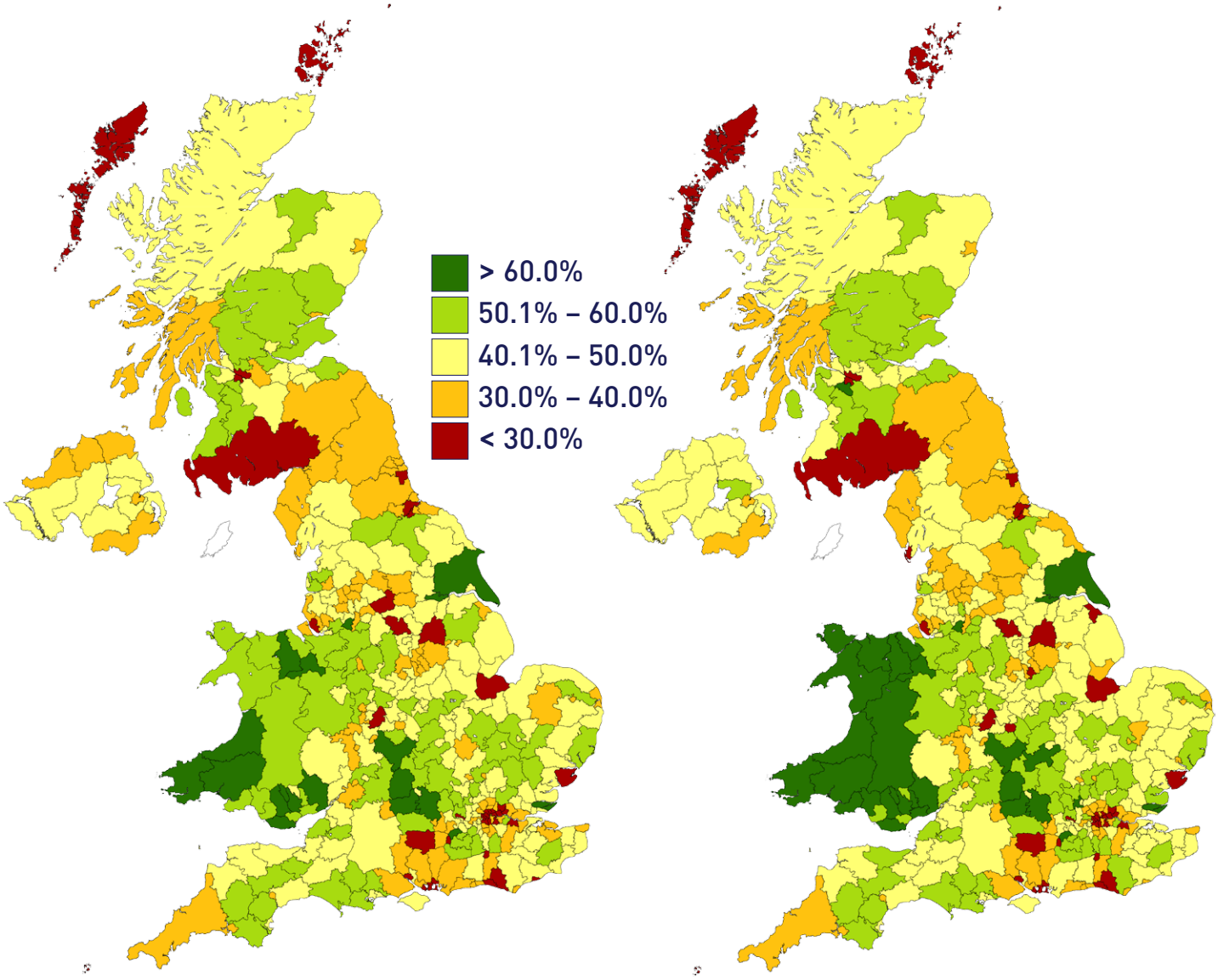
Recycling systems in the UK are fundamentally based around the weight of materials and diversion from landfill. Although collection systems vary between authorities, and between commercial operators, they target a key set of materials while inhibiting those that either:

1. Don't contribute significantly to the weight-based targets (flexible plastics, for instance).
2. Don't have viable end markets for the materials themselves (multi-laminated plastic packaging, for instance).
3. Are not universally consumed and discarded, particularly in household collections (used nappies, for instance).
4. Add unduly to contamination if they are collected with other materials (single-use cups, for instance).

These constraints have naturally developed through markets, targets and quality considerations, but show that policy interventions must work across all of these considerations and that getting the materials is more important than the method of recovery.

Myriad factors influence the collection and harvesting routes chosen by local authorities. Many of these are individual and reflect local factors, such as the impact of tourism, traffic implications of collections or changing demographics. These multiple influences are shown in the graphic here.

↓ MUNICIPAL COLLECTION AND HARVESTING ROUTES INFLUENCING FACTORS



↑ % OF HOUSEHOLD WASTE SENT FOR RE-USE, RECYCLING OR COMPOSTING BY LOCAL AUTHORITY AREA

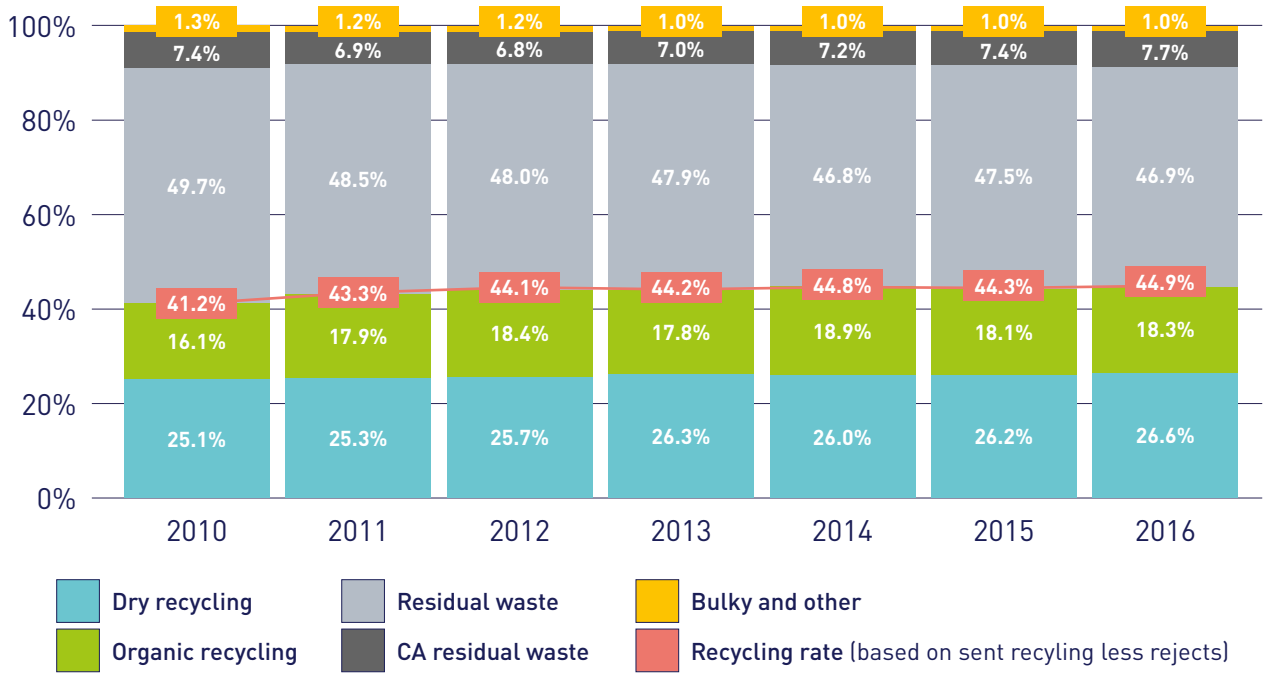
This document previously discussed SUEZ's DNA approach to local authority service factors – how issues such as deprivation or housing density can impact the efficacy of recycling services and how this influences the design of services and variability of performance. This variability in performance is shown in the two maps here that present recycling performance by individual authorities and the change in performance over a year.

Over a longer period of time, as shown in the graph here, it is clear that recycling performance has increased markedly – but that rate of progress has slowed in the last few years.

Once collected, recyclable materials are often sorted by a range of simple to complex materials recycling facilities located around the country. The materials recycling facility outputs are often then sent direct to customers as secondary resources or for further processing to refine their quality at a product enhancing recycling facility first.

Materials most commonly targeted from households include green waste, paper and card, plastic bottles, metal cans, and glass bottles and jars. The proportions of these materials collected since 2010 (as dry and organic recycling) are shown here, together with the recycling rate achieved.

↓ PROPORTION OF MATERIALS COLLECTED IN ENGLAND BY STREAM 2010-2016



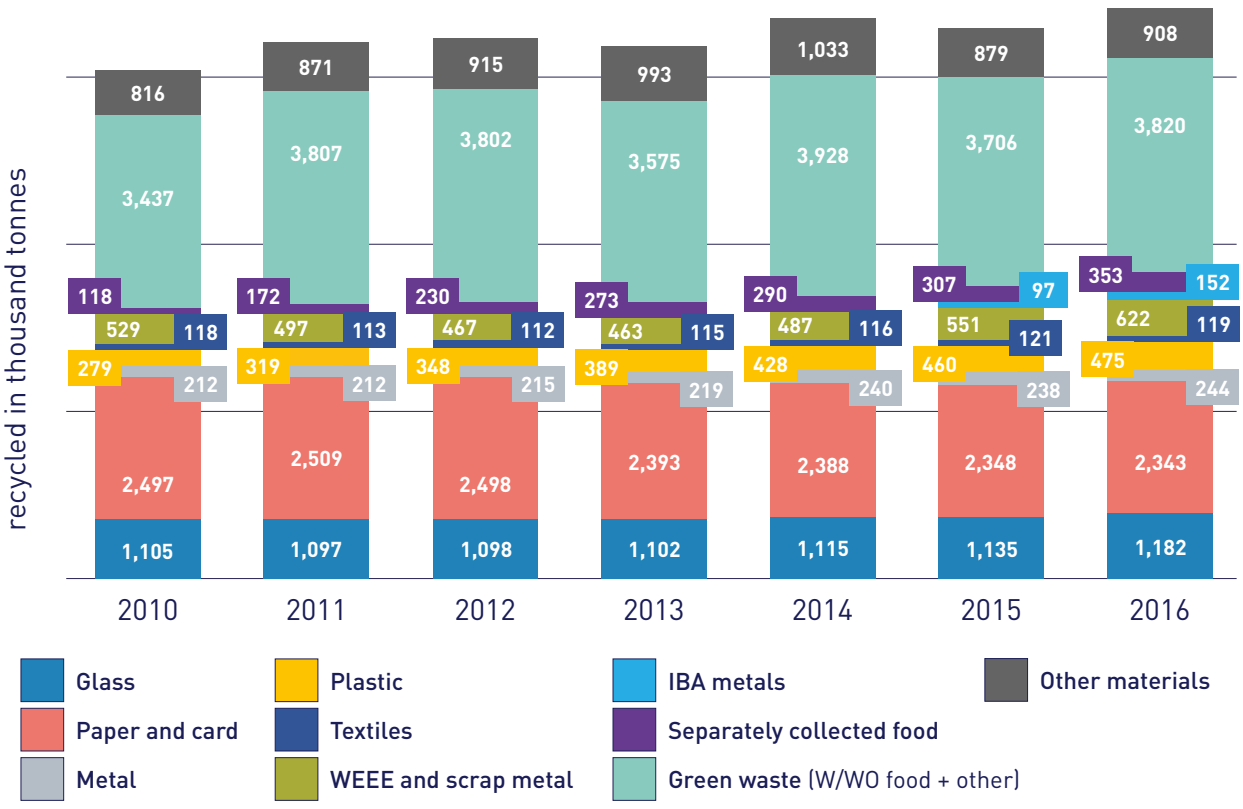
This next chart shows the split of recyclable materials from the total amount collected by local authorities. Green waste, which is not a legally-obligated collection stream for authorities, makes up nearly 38% of the materials recycled in 2016, but fluctuates for reasons as simple as having a 'good' growing season or a 'poor' one. The remainder consists of the dry materials (paper, glass, metals etc.) amounting to 59%, and separately collected food waste at 3% of the total. In some areas, green waste may not be generated (a very urban environment where gardens are rare) or will be composted at home, as may be the case in very rural areas. Including green waste in the weight-based recycling targets can unfairly skew the recycling performance in favour of those authorities whose residents have gardens and generate significant volumes of green waste. The same can be true of municipal DNAs that find food and other materials difficult to extract, for instance in areas of high multi-occupancy dwellings.

A number of authorities collect other materials from the doorstep, such as plastic pots, tubs and trays, plastic films, textiles and other materials.

Some of these materials are collected in separated streams (source separated) and others are mingled together into defined streams, such as food and green or metal and glass. This mingled form of collection is often referred to as dry mixed recycling collection. The basic default collection style is, by law, a series of source-separated streams for plastic, paper and card, glass and metals. However, if it is assessed by an authority or customer/waste carrier as technically, environmentally or economically impracticable (known as a TEEP test) to undertake source separation, then other forms of collection method may be used.

For instance, a corner shop with room for only two waste containers cannot accommodate the four separate recycling streams and a residual waste container, so may choose a single residual waste bin and a dry mixed recycling container.

↓ ENGLAND RECYCLING BY MATERIAL TYPE 2010-2016



When setting performance metrics and targets for municipal, it is essential that government takes into account their natural structural propensity (DNA) for recycling and apportions any new national target based on this assessment.

In practice, each authority within a DNA band would be given recycling targets based on their ability to perform against the target. In some ways, this is similar to the council tax structure, where those identified as having the ability to pay more (i.e. by the value of their property holdings) are required to contribute more than those with less valuable holdings.

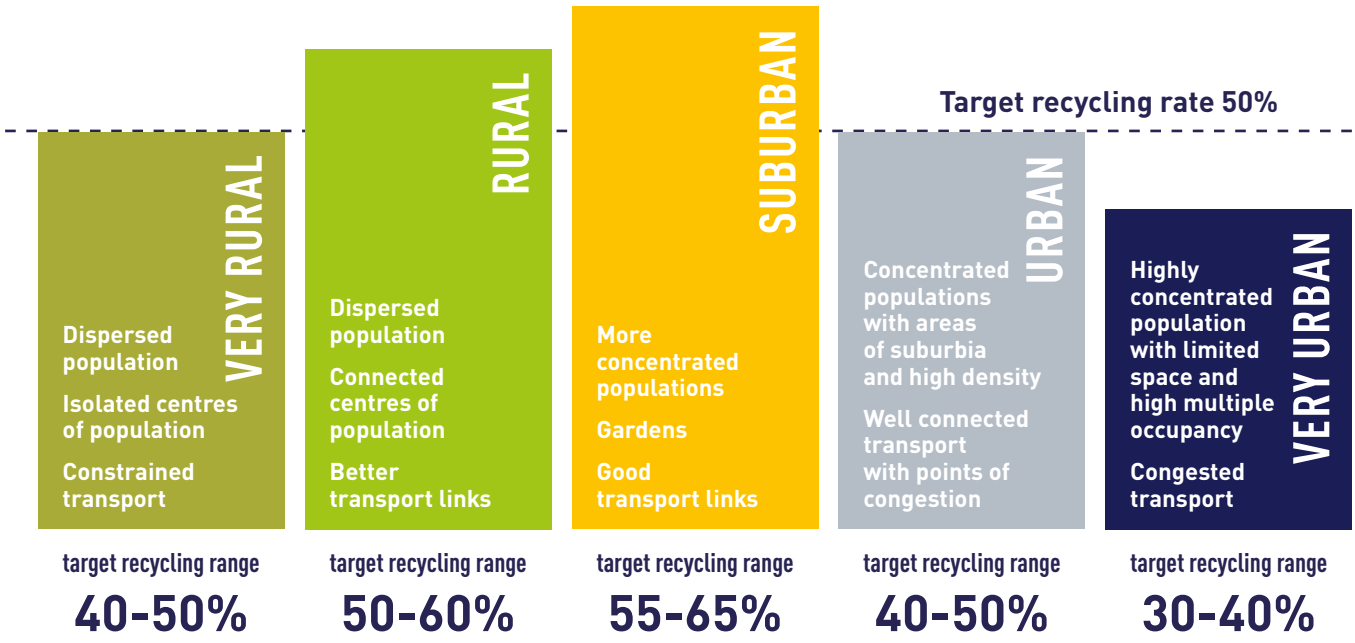
Differential targeting is essential to ensure that the burden of performance is equitably applied and the affordability to each local authority is fully taken into account. The next chart provides an example of how this might work in practice.

Materials recycling facility capacity is often difficult to assess. Unlike energy-from-waste facilities, which cost more to build and run continuously with relatively light labour loads, materials recycling facilities tend to operate with higher labour proportions, per tonne of waste treated, and will often operate a shift basis that can allow the facility to upscale and downscale its operations.

Materials recycling facilities across the current UK network have been individually constructed to meet either contractual specifications determined by recyclate collection system, or to process generic incoming material mixes such as dry mixed recycling.

If new materials are added, such as flexible laminated packaging, or new combinations of collected materials are introduced, this may necessitate operational changes to materials recycling facilities or, in some instances, expensive structural changes. It is therefore necessary to coordinate the addition of new target materials with the technical ability of the materials recycling facilities to sort them.

↓ EXAMPLE OF LOCAL AUTHORITY DNA POTENTIAL DIFFERENTIAL RECYCLING TARGET APPLICATION



Finally, while it is important to have targets for materials collection and recycling, it is just as important to ensure that the costs of their collection, consolidation, sorting and refinement are aligned both to the fees available for performing such a service and the value of the materials in the marketplace.

Given that the cost of collection to refinement can be calculated with some degree of certainty, the two variables that define whether the service is economic or non-economic are the collection fee and the commodity sale revenue.

'Gate fees' at materials recycling facilities for recyclable materials need to be attractive by being competitive against other forms of treatment.

Creating stability in the market for materials recycling facility outputs therefore becomes essential to ensure that the service remains attractive, by being profitable, for all.

POLICY INTERVENTION 11

Local government recycling targets

Targets are useful and necessary to give direction and measure progress. However, if their application is not responsive to individual circumstances, it can unfairly task some segments of society. A national target needs to be applied in a decentralised manner that proportionally tasks each entity.

- Adopt a 55% recycling target by 2025 based on weight, and adopt a 45% target by 2025 for the residual element of a household's waste, falling to 30% by 2030. New metrics will apply post 2030.
- Local authority recycling targets should be set for each individual authority according to their own structural opportunities and constraints, with all such targets collectively aligned to meet national objectives.
- Establish a defined process to assess each local authority's structural ability to recycle.
- Distribute national targets to local authorities in accordance with this assessment approach and task each authority individually on a proportional basis to meet national objectives.
- Establish a five-year formal review process, so that local authorities are reassessed against their respective recycling ability and their proportional targets as they change and develop.

Future recycling

Future recycling will require huge innovation in system designs and collaboration across the value chain to ensure that materials not currently entering the recycling chain can be harvested and the resources within them returned to productive use. To do so needs a full value chain approach, good quality and extensive data and a set of measurement metrics that support resource value and not just the intrinsic weight of the materials.

Given that the UK government aspires to increase recycling performance and intends to adopt the EU circular economy weight-based targets for at least a short period, there will be a requirement to increase the volume of materials being harvested for recycling. This can be achieved in a number of ways:

1. Capture more of the materials currently targeted by increasing the capture rates of existing collection systems.

- Currently only 58% of plastic bottles are recovered for recycling in the UK and government is proposing to introduce a deposit return scheme to drive more successful harvesting of these materials. SUEZ has recently produced a report on the potential adoption of a deposit return scheme for 'on-the-go' recycling entitled 'How a deposit return scheme for 'on-the-go' could be designed for the UK'[15] which calculates that, with a £0.10 per unit charge at sale, plastic bottle recycling could increase up to nearly 83% for the target PET bottles, recovering commodity with a value in excess of £20 million per year.
- Education and information campaigns will also benefit the harvesting of target materials, but must be consistent, well conceived and well executed to really drive habitual change within households and businesses.
- Gradually reducing the range of different local authority collection styles will assist recycling habit-forming within households. We believe that this could be consolidated to five main collection systems, for each of the five DNA profiles, but that the consolidation must extend beyond just the colour and size of bins.

15 www.sita.co.uk/wp-content/uploads/2018/03/DRS-OnTheGo-Report-UK-1803.pdf

2. Capture all commonly recycled materials everywhere.

Increasing the consistency of materials being captured across all participants in the municipal and business sectors will help increase the recycling rate.

- There has been an ongoing debate around conformity of collection systems and much work has been done by WRAP in defining solutions for harvesting materials in different environments. SUEZ does not believe that one system of collection can work equitably for all and, as has been mentioned previously in this document, considers that targets for priority materials should be set – allowing innovation and variation in the methods of collection applied.
- Restricting container size or collection frequencies for residual waste at household level will drive more materials from the residual stream into the recycling streams, but many also induce increased levels of contamination if the transition is not well managed. Contamination in recycled material loads can cross-contaminate other materials – resulting in the possibility that they are excluded from secondary material markets.
- Not all waste materials are common across all local authorities and business sectors and, as such, it may not be practicable to attempt to recycle everything across all sectors. Targeting materials by weight can also drive heavy efforts for materials with little intrinsic resource value or, perversely, might work against the minimisation of food waste for instance. Aligning new target metrics which value resource, with the timeframes of recycling targets and new collection systems, will ensure that no effort is wasted chasing lower-priority materials.

3. Capture new materials not currently targeted for recycling.

Capturing materials not currently recycled – for example, used nappies or laminated pouches – will increase the recycling rate.

- The types of materials targeted here will be determined by the adoption of new target metrics which favour materials that are intrinsically light weight or not universally consumed and discarded.
- Many of these materials will require innovative solutions of collection to allow them to be harvested. For instance, the coffee pouch and pods collection trials SUEZ has been undertaking have identified the need to deal with the liquid residues left in the items after use and which, if not controlled, can leak and contaminate other materials when they are stored.
- Many of these new materials will also require new treatment solutions, so they can be reformed into products. Used nappies, for example, would require a cleaning process prior to other processes to extract the plastics, the fibres and the super-absorbents for use in new alternative products. Connection across the value chain, from design to final treatment, is essential to give confidence to investors, operators and consumers that materials being harvested are being productively recycled and reformed.

4. Account for minimisation in recycling.

As has been recognised earlier in this document, there is a need for improved measurement of re-use, repair and dismantling, but there is no easy way to measure waste minimisation. There is some evidence that the introduction of source-separated food waste collections does, over time, reduce the volume of food being wasted, but this is not well proven and not universally the case. Furthermore, the measurement of minimisation relies upon being able to calculate the reduction from a known wastage level, which relies upon a service having been introduced before formal minimisation activities can be applied and their impacts measured. The minimisation of waste should count towards recycling figures as it both supports the waste hierarchy and saves the most resources.

- Monitor and measure the inflows of materials into the value chain to understand the quantities of materials and the flows within it.

- Set and accommodate targets within each element of the value chain and understand their context and value throughout the value chain. For instance, many food packaging forms have been light-weighted over the years, often reducing resource consumption in the packaging itself, but also reducing the resources necessary to move and transport them from manufacture to retail and consumption. Although some of these packaging types are more difficult to recycle than others, they often consume far less resource and protect and preserve the product – minimising waste through their existence, to an extent that this outweighs their environmental burden as waste in themselves.

Materials recycling facility capacity flexibility

A 120,000 tonnes per annum materials recycling facility targeting comingled materials may operate on a three shift basis. This could mean that each shift in a year will treat 40,000 tonnes per annum. However, day shifts are often cheaper to operate and the split might be skewed to more throughput during the day. In addition, different streams of material might be processed at higher or lower rates within the facility depending on the exact compositional mix. As such, certain shifts might operate throughputs of 10-12 tonnes per hour, whereas others may operate at 16-18 tonnes per hour. If the input compositional mix needed an operation mostly at the lower rate per hour, the facility capacity would be limited to less than 100,000 tonnes per annum.

Organics

Both green waste and food waste are not consistently produced and/or collected across municipal and business sectors and, for green waste particularly, volumes fluctuate significantly with the seasons.

Only around half of local authorities have local access to an anaerobic digestion or in-vessel composting facility, although most will have access to open windrow composting facilities. Open windrow composting facilities can treat green waste, but cannot treat food waste from households and commercial and industrial sources.

Food waste from these sources can, however, be comingled with green waste and sent to in-vessel composting to make compost, or collected on its own and sent to anaerobic digestion, where it is used to make biogas for energy and liquid digestate, which is returned (as is compost) to the land and contributes nutrients and minerals to the soil.

Post-industrial organic materials are often returned to farmers for use as animal feed and in many cases recover a positive value. Some supermarkets donate or sell food waste from their stores (bread, for instance) to farmers for use in animal feed.

Food waste collections from households and businesses have grown significantly over the last 10 years, but only a minority of authorities or businesses make financial savings by adopting separate food collection alone. Some authorities which have reduced their residual waste collection frequency in conjunction with new food waste collections have saved money overall, but it is a marginal calculation around the volume of food waste diverted (saving a gate fee delta of >£50 per tonne against residual waste costs) and the increased cost of a weekly food waste collection – which typically only amounts to a few kilos per household.

For businesses, the calculation is generally simpler. Those that generate significant volumes of food waste benefit financially from separate food collections, while those that don't produce significant food waste tend to incur additional cost and therefore opt out.

For all food waste producers, adopting minimisation techniques (such as individual portion control) can significantly reduce the volume of food waste and reduce costs accordingly.

POLICY INTERVENTION 12

Waste minimisation

SUEZ supports the continued adoption of the waste hierarchy, but recognises that some aspects, like the minimisation of waste, are essential but very difficult to measure. Ensuring that the policy targets set, like the government's intention to halve food waste, are both measurable and deliverable is essential to reducing waste and increasing productivity.

- Policy targets must recognise the importance of waste minimisation and include metrics to measure this activity alongside recycling performance and residual waste reduction.
- Use the collection of data from all parts of the value chain to both measure waste production and traditional treatments, but also to ensure that minimisation, re-use, repair and dismantling activities are measurable.
- Include discrete minimisation sub-targets within national recycling targets (for instance, to meet the food waste reduction targets in the 25 Year Environment Plan).
- Target to reduce residual waste produced per head of population from 45% in 2025 to 30% in 2030.

Minimisation can, however, make food waste collection more financially challenging – since it reduces the cost benefit in waste diversion.

The provision of treatment capacity is therefore highly dependent on policy and its approach towards minimisation. Scotland has implemented a policy-driven mandatory food waste collection for most local authorities and businesses and therefore created increased volumes which subsequently require more treatment capacity. To date, England has taken an economic 'market' approach and food waste is collected separately where it is economically viable to do so.

Incentives exist for the biogas produced in anaerobic digestion, such as the (now replaced) Renewables Obligation, Renewable Heat Incentive, and feed-in tariffs. This increases revenue for the facilities and helps subsidise the cost of treatment – allowing the facilities to offer a lower gate fee.

SUEZ believes anaerobic digestion treatment capacity in England is currently balanced against supply of available feedstock, although a slight softening of gate fees in some areas suggests it might be marginally over-capacity in certain regions. Certainly, significant new capacity is only going to become available if market conditions or policy drivers change. The proposed ban on food waste to landfill in 2030 will have little impact on markets today or, bearing in mind the role of energy-from-waste is unlikely to result in major change, closer to 2030 either.

Current feedstocks within the market for anaerobic digestion are estimated at around 2.45 million tonnes of source-separated food, with a likely maximum of 3.5-4 million tonnes. Care must be taken when planning new capacity to take into account food waste minimisation activities, as this could quickly lead to over-capacity and commercial failures.

As it is not a legally-obligated collection stream, a number of local authorities have implemented charging schemes for the collection and treatment of green waste.

Switching to a chargeable scheme typically requires a change from in-vessel composting (where food and green is mixed) to a combination of anaerobic digestion and open windrow composting (treating green waste via open windrow composting is significantly cheaper than treating it mixed in an in-vessel composting facility). If this trends continues, it will likely change the capacity requirements between the various treatment types and necessitate infrastructure / investment adjustments.

Similarly, any efforts to encourage home-composting, as has been the case in some authorities for many years, will also have an impact on the infrastructure balance, which will need to be better understood at both a local and regional scale.

POLICY INTERVENTION **13**

Food waste

The wastage of food not only wastes money for the consumer, but masks huge embedded costs in the production, processing and retail of those products. The government is correct in seeking to minimise food waste and should set targets beyond the 2030 headline. However, in seeking to minimise food waste at source, care needs to be taken that food waste treatment capacity is aligned to the long-term objectives.

- Confirm the target to halve food waste by 2030 and require a further target to reduce avoidable food waste to less than 20% by 2040.
- Use the treatment capacity committee to set the target for anaerobic digestion capacity, which should be set to meet the long-term market capacity requirements after food waste minimisation targets have been met.
- Stabilise and tune incentives for biogas uses (power, heat, gas, fuel) to ensure that anaerobic digestion remains commercially viable for the existing treatment capacity and remaining new capacity required.
- This direction would predicate digestible packaging is favoured against compostable for those materials that would be collected with food waste.

Given recent public attention towards to the role of plastics in society, there has been a rise in discussion around the opportunities and challenges inherent in compostable or digestible packaging. Any significant change in this area could pose significant problems for authorities and the resources and waste management sector, unless the transition is properly managed and controlled.

The issues that need to be addressed include:

1. Not all authorities have access to both anaerobic digestion and in-vessel composting facilities, which would be required to treat the materials.
2. Compostable products do not function well in anaerobic digestion facilities and digestible materials are not suitably treated in in-vessel composting facilities. As such, alignment of product usage to available treatment infrastructure presents significant challenge.
3. At the feedstock reception points for both anaerobic digestion and in-vessel composting facilities, operators undertake contamination removal. It is likely that any packaging delivered as part of mixed loads (as opposed to source-separated) will be contaminated by incorrect feedstock and it would be impossible to identify and separate – for example, non-biodegradable cups from compostable ones.

If biodegradable packaging, and other organic items, form part of England's waste and resource management solutions, careful consideration must be given to ensure complete system change and not just a move to alternative packaging that many authorities will be unable to process due to a lack of sufficient appropriate infrastructure.

Furthermore, if compostable materials are favoured, consideration must be given to the lack of green waste during the winter period, which will likely inhibit effective processing of the materials.

POLICY INTERVENTION **14**

Compostable and digestible packaging

Innovation in new forms of packaging will be necessary to meet some of the government's objectives on sustainability and litter. However, if they are introduced in ways that adds to the multiplicity of all packaging, or inhibits effective recycling, or produces increased contamination of other streams, then they may make matters worse rather than better. Compostable or digestible packaging has a potentially important role in the transition, but unless their use is properly managed they may fail to deliver on their promise.

- Government should set out its position on the role of compostable and digestible packaging and ensure that any policy which seeks to support wide-scale adoptions is phased and integrated with access to suitable treatment types and available capacity.
- The use of these forms of packaging must be controlled to ensure that they are not mixed with similar packaging types that are not treatable in the same manner.
- Require clear identification of these types of packaging through unique and visible identification to ensure consumers can differentiate between them and other forms of packaging.

Repair and dismantle

Access to capacity for repair and dismantling of goods is not universally available and many items are designed in such a way that they are too difficult or expensive to repair. The role of design in enabling easy repair and dismantling was covered earlier in this document, but here we consider how capacity for these activities can be delivered.

Repairing items ad hoc requires high levels of skills, knowledge and equipment, since each item will have different constructions and require different tools for access.

Design standards have the potential to provide more commonality in design, which could reduce this burden, but it is not the only option. Encouraging manufacturers and retailers to offer affordable repair services for their products is essential. Some retailers provide repair services already or are experimenting with their introduction[16]. The cost of repair should be targeted as a percentage of the replacement costs of a new, similar specification item.

Repair services that can also upgrade equipment, if necessary, will add further benefits to extending the life of goods. Supporting the use of dismantled components in repair will help further encourage this activity and allow greater access to affordable repair.

We believe government should require manufactures to adopt design standards that allow efficient repair and component extraction. Furthermore, all manufactures and retailers should be required to provide their customers with access to a repair service (either in-house of subcontracted) and for many common areas where repair is an option, those repair services should offer costs that are proportionally less than the cost of a new replacement item.

Repair services should be proportional to the items and might require on-site service (washing machines, for instance) or drop-off in store or at a repair centre (computers and mobile phones, for instance).

Procurement policy can also provide a foundation to support repair and dismantling services and can be especially effective if undertaken by municipal authorities.

Often, large organisations buy multiple items of the same type and brand. Promoting repair within procurement policy for governmental bodies, particularly targeting reparability and component-removal from broken items, will support good design practices. It will also support the infrastructure required to provide repair services and will reduce the cost of repair by creating a supply of component parts. A foundation network, based on municipal procurement, will support the development of the skills necessary to create repair services in the wider market.

Finally, we believe it is necessary for government to support these repair services and component re-use via instruments designed to reduce their cost relative to the cost of the replacing broken items with new ones. Introducing a lower VAT charge for the labour involved in repair, and for components that are reused, will help to create this pricing differential.

16 http://uk.fashionnetwork.com/news/H-M-launches-pilot-project-on-sustainable-fashion-in-Hamburg,967997.html#.WwJXWinrszW

POLICY INTERVENTION

15

Repair and re-use

Working with the established waste hierarchy requires a focus on repair and re-use of goods and products. The ability to repair items is heavily influenced by their design, but repair often also requires skilled staff and replacement components. Policy is required to ensure that a comprehensive and effective system of repair services and component supply is available to the value chain.

- Introduce design standards which ensure that products can be easily repaired and that components can be removed, tested and reused.
- Introduce and require the use of green public procurement standards which support good design and prioritise the purchase of equipment suitable for repair and component extraction and re-use.
- Introduce a requirement for all manufacturers and retailers to provide repair services to their customers (either direct or via third parties). Cost of repair should be controlled such that costs do not exceed a target of 40% of the equivalent purchase price for a non-breakage repair and items with a minimum value of £150.
- Introduce VAT relief on the labour costs of repair and recovered component re-use.

Extended producer responsibility

In addressing the various components of the value chain, it is essential that material flows are monitored and managed through each stage of the chain and that each component takes responsibility for the elements under their control.

Extended producer responsibility was defined by the EU as *"... an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle."*

We have discussed the role of deposit return schemes in delivering additional materials for recycling and helping change consumer behaviour, and a deposit return scheme is a form of extended producer responsibility.

England currently has four main forms of extended producer responsibility scheme in operation through the Producer Responsibility Obligations regulations. They target:

1. End-of-life vehicles
2. Waste electrical and electronic equipment
3. Batteries
4. Packaging

Each scheme is set up differently and targets materials with differing complexities, but each sets targets for delivery that are periodically reviewed and reset to reflect performance and expectations.

An expansion of extended producer responsibility over a wider range of products would help link the value chain together more often, and ensure the final use and wastage of products and packaging are considered at all stages from design onwards.

However, inefficient extended producer responsibility schemes can drive unnecessary financial and environmental costs, which ultimately costs consumers, so this must be avoided. Lessons should be learnt from the existing extended producer responsibility schemes in the UK, and those abroad, so that the best examples can be copied and the failures avoided. Extended producer responsibility schemes must be designed with the whole value chain in mind and not just part of it. They should consider and reflect the roles, opportunities and constraints inherent in their delivery at each stage in the chain.

POLICY INTERVENTION **16**

Extended producer responsibility (EPR)

Extended producer responsibility is a key component of the circular economy and should be a foundation of all policy thinking and policy drivers. Extended producer responsibility clearly works across the full value chain and, when correctly applied, will drive changes from design to end of use. An expansion of extended producer responsibility is required, but not all products can have extended producer responsibility applied in the same way, so care needs to be taken that it is applied in a manner that does not induce unnecessary financial or environmental burdens.

- Establish a work programme with the value chain to assess the expansion of extended producer responsibility and the identification of all new materials streams that should form part of a truly expansive extended producer responsibility programme. Mattresses and clothing might be two such examples.
- Undertake a review of existing extended producer responsibility schemes (domestic and international) and define best in class for each target stream and then implement those that represent best in class.
- Agree and implement new extended producer responsibility schemes with the value chain by 2020.
- Implement a deposit return scheme for England by 2020. This system should target PET plastic bottles of less than 0.75 litres in size and metal cans consumed in on-the-go environments, leaving the current collection methods to continue to harvest other materials from households and businesses. The deposit rate should be set at £0.10 per unit and myriads of deposit return points created to ensure cost-efficient and convenient access for consumers. An English scheme must align completely with any schemes being adopted in the devolved administrations.

Consumer responsibility

The consumer forms a vital part of the value chain for products and services. Although resources are invariably consumed at all other stages in the value chain too, common business practices are applied and each compartment of the chain typically records usage and wastage of resources.

For the public though, as consumers, the systems of control and management are less overt, yet the performance of this stage in the chain is pivotal in determining the extent to which resources and materials are ultimately recovered.

Influencing consumer attitudes and behaviour is a complicated process and the waste and resources sector has, in general, only shown modest success. Comparatively, manufacturers and retailers are highly adept at influencing their customers' behaviour. Given this relative success it is important that recycling and resources management communications become a fundamental consideration for the whole value chain, and that retailers and manufacturers reinforce this messaging through the sale of their products – providing clear guidance to the next stage in the chain (their customers) about what should happen to the product at the end of its life.

Moving the system towards a harvesting model will facilitate the adoption of more consistent messaging (for example, plastic bottles can be recycled and should be placed in a deposit return scheme deposit point or designated local authority container), which should reduce the risk of confusion around what can and cannot be recycled.

As local authorities work together in accordance with their DNA structures, they should be able to reduce the variation in collection systems and, over time, align container types and colourations. This will further assist the provision of clear and consistent information by the value chain about what to do with various materials.

POLICY INTERVENTION **17**

End of life consumer information

Being able to make informed purchase and consumption choices is essential to drive positive consumer behaviour. This information requires a simple method of measurement of environmental performance and a clear and easily understood system of product labelling which informs at the point of sale.

- Require a standard form of environmental impact labelling on all products, aligned with the future performance metric chosen (e.g. carbon or natural capital).
- Require manufacturers and retailers to provide information as part of their normal marketing to consumers on the burden and benefits of the production of the goods, of the burden of their use and the intended route of disposal.
- Require both local authorities and the private sector to align their communications to customers / residents and adhere to the same communications standards expected of retailers and manufacturers.
- Expand the remit of the Advertising Standards Authority to work with Defra and ensure that the information used by manufacturers and retailers is both correct and in accordance with the chosen performance metric.

products and markets

Electricity

Electricity is generated from waste in a number of ways which includes:

1. The combustion of gases produced from the degradation of waste in landfill.
2. The combustion of gases produced from the digestion process in anaerobic digestion.
3. The heat produced from the combustion of waste in energy-from-waste facilities.
4. The combustion of syngas[17] produced from gasification or pyrolysis processes.

The electricity generated is most often exported to the National Grid and forms part of a very liquid market that easily and efficiently connects multiple power stations with many electricity consumers, be they industrial or domestic. The power generated is most often sold via a range of licensed suppliers through a range of different price mechanisms.

The price paid typically reflects the scale of the facility and related export quantity and, where applicable, the sustainability of the fuel. Landfill gas and anaerobic digestion gas is treated as 100% renewable, whereas power from energy-from-waste and the combustion of syngas will often be between 40% and 65% renewable depending on the composition of the feedstock.

The efficiency of the conversion of the fuel into electricity can vary significantly depending on the type of power plant used, for instance:

- Reciprocating engines can typically vary from 35% to 45% efficiency.
- Modern moving grate energy-from-waste facilities using steam typically vary from 21% to 30% efficiency.
- Gasification facilities that use their syngas to generate steam (in a manner similar to energy-from-waste) typically vary from 16% to 25% efficiency.
- Gasification and pyrolysis facilities that produce syngas and use gas turbines, or put the gas into reciprocating engines, typically report efficiencies in the range of 30% to 45%. However, there are very few of these types of facilities operating at scale in the world and as such real data is difficult to determine.

In electricity-generating facilities of all types, the majority of the missing energy is lost as heat and this is no different to coal or gas fired plants. Coal fuelled power plants often report electrical efficiencies of 32%-44% and combined cycle gas fired power stations report electrical conversion efficiencies of 50%-60%.

17 Syngas is a combination of gases produced through the thermal conversion of materials in limited or starved oxygen conditions in gasification or pyrolysis facilities.

However, when comparing solid waste-fuelled power stations with traditional power stations, fired through the combustion of coal, biomass or gas, it is worth considering that:

1. Residual waste composition is less homogeneous than either coal, biomass or gas and the technologies used to accommodate these variations suffer relative inefficiencies as a result.
2. The energy content of residual waste per tonne is significantly lower than that for coal or wood biomass fired power stations by factors of 3 to 1.5 respectively and this can induce a relatively inefficiency in the manner of the fuel conversion.

These factors, together with the role that energy-from-waste undertakes in the sanitary aspect of waste management, means that it is not correct to compare the performance of power stations designed using a consistent fuel and whose sole purpose is the production of power against an energy-from-waste facility which has a dual purpose linking the safe destruction of residual waste (therefore avoiding landfill) with the generation of power from the waste being destructed. Much has been said about the comparison of the carbon intensity of electricity from energy-from-waste to the average (marginal) of UK supply, but this often unfairly compares power stations with an energy-from-waste facility which also undertakes the important role of sanitation.

The UK electricity market is mature and there are multiple routes to market for the sale of power generated from waste, from simple day-trading through to long-term power purchase agreements, which can provide a secure power price for a number of years. As is normal with all markets, the price point recovered for a long-term contract with price security is often lower than that in the merchant market.

Incentives for the production of 'green' power have been used by government to promote market development or encourage transitions to greener and more renewable feedstocks. In the waste sector, a number of different incentives mechanisms have been utilised, including:

- Non-Fossil Fuel Obligation
- Renewables Obligation
- Contracts for Difference
- Feed-in tariffs
- Levy exemption certificates (as part of the climate change levy system)

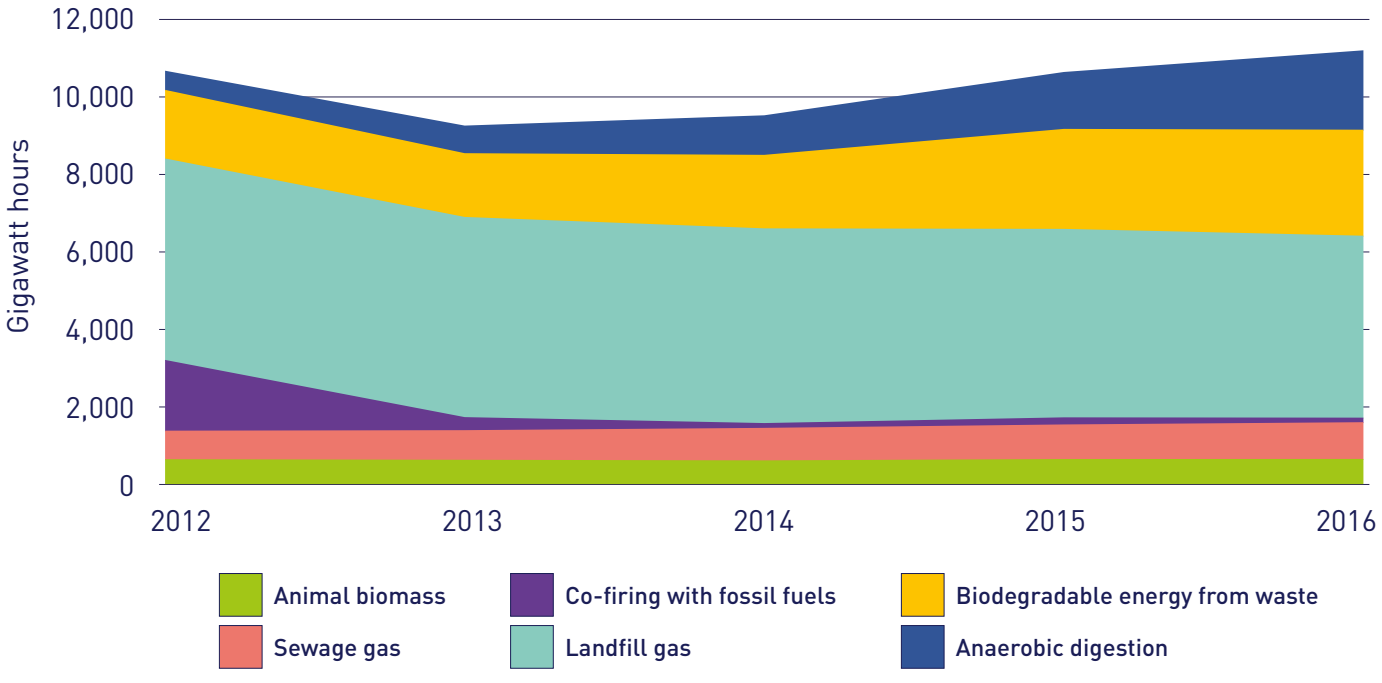
Each system has been conditioned to support certain types of electricity generation from specific fuels sources. For instance, the Non-Fossil Fuel Obligation scheme supported landfill gas to electricity and energy-from-waste, whereas the Renewables Obligation supported anaerobic digestion, landfill gas to electricity and some energy-from-waste facilities where certain criteria on heat were achieved.

Furthermore, the original Renewables Obligation scheme supported two forms of gasification or pyrolysis, giving more support to those technologies that were able to produce a syngas for synthesis into fuels or chemicals, while offering 50% less to the same technologies if they produced a syngas that could only be immediately combusted to produce steam to drive a steam turbine. At the time, this was intended to support those technologies that could produce products deemed more valuable than electricity and heat. Strangely, gasification or pyrolysis processes that made steam were no more efficient (and often less efficient) in their conversion of residual waste to electricity than conventional energy-from-waste – yet they were not required to meet the same heat export requirements as energy-from-waste to qualify for Renewables Obligation incentive support. The same technology influence has carried through somewhat to the Contracts for Difference incentive that replaced the Renewables Obligation.

Since the introduction of the Renewables Obligation and Contracts for Difference, almost all of the gasification and pyrolysis facilities built or in construction in the UK (amounting to around 5% of the total new facility delivery since the inception of the support through the Renewables Obligation) have not shown they can operate profitably whilst using residual waste, refuse derived fuel or solid recovered fuel and meet the dual requirement of reliable waste destruction and consistent power production. All those built at a commercial scale combust the syngas to make steam and then electricity, while only small or pilot plants exist which produce syngas for other purposes.

The success of the delivery of waste-based electricity generation is shown in this chart. The growth in energy-from-waste capacity (the actual electricity generated from energy-from-waste being almost twice that shown, if the full renewable and fossil export is included) is almost wholly from technologies that did not benefit from the aforementioned electricity-based incentive support.

↓ ELECTRICITY GENERATED FROM RENEWABLE WASTE-BASED SOURCES



Energy-from-waste only includes biorganic fraction

Commercial failure of immature technologies

Air Products sought to develop two large process lines of gasification facilities in the Tees Valley area. Each line was subject to Renewables Obligation' support and developed in series in an attempt to meet commissioning deadlines defined within the incentive. The technology used was subject to a significant upscale and, during commissioning, failed to operate in a successful manner. Ultimately, the project failed and the company wrote off around $1 billion of capital investment. The outcome anticipated from the incentive allocated to these two lines was ultimately not delivered, leaving a gap in anticipated volumes of UK renewable power.

There has been a recent consultation to consider amendments to the Contracts for Difference, looking at how support might be used to develop more facilities that produce syngas for other purposes (gas to grid, liquid fuel or chemicals). Given that the Contracts for Difference is part of a wider scheme designed to deliver electricity as an outcome, SUEZ considers that any nonaligned products should be subject to more focused and separate incentives, such as the Renewable Transport Fuel Obligation. The production of syngas to grid should be supported by the Renewable Heat Incentive and industrial chemicals should be supported (if required) by a specific incentive system for that outcome.

In a similar manner as has been proposed for recycling (i.e. focus on the type of product desired rather than trying to dictate a form of collection), we believe that incentives to support the generation of electricity or other materials from solid residual waste should focus on the product and be technology neutral.

Further incentives should only be used to support the development of technologies that are already proven at commercial scale and can deliver reliably their quantum of products. There are numerous examples where incentives have failed to deliver technology solutions at a commercial scale where the technology is insufficiently mature and this should be avoided where possible[18].

The incentives discussed apply to the organic (biogenic) fraction of residual waste. Analysis undertaken by SUEZ on the residual waste it has treated since 2010 indicates current biogenic fractions vary from around 50% up to 68% depending on geographic location. Government focus on minimising food waste, collecting food waste arising after minimisation and increasing recycling is likely to impact the composition of residual waste through to the policy horizon of 2050. This change in composition will change the contribution of renewable power from waste-based feedstocks

This means that the level of work required to manufacture refuse derived fuel and solid recovered fuel to the required specifications for some of the incentives (Renewable Transport Fuel Obligation, for example), or technology solutions, will also likely increase. However, if all policy interventions are undertaken in a planned and progressive manner, we would expect that the biogenic fraction and calorific value experience would remain within historic ranges.

18 www.bioenergy-news.com/display_news/10380/air_products_to_scrap_gasification_project_in_uk

Of course, if improved waste prevention, re-use and recycling performance is achieved, there will be a reduction in the volume of residual waste generated – but existing populations and businesses in the UK still place over 10 million tonnes of waste in landfill each year and, as populations are expected to continue to grow (and business activity with them), there is still a proven need for more energy-from-waste capacity in the UK. Furthermore, during the period from current day to 2050, almost all residual treatment facilities and contracts will reach their end of life. In fact, by 2030 at least five to seven million tonnes per annum of long-term residual waste contracts are likely to have come back to market and adjustments to installed capacity can be undertaken, if required, on an ongoing basis.

Given the above, it is expected that there is a continued and growing role for energy-from-waste and other thermal technologies over the period to 2050. The products made by those facilities will continue to have significant renewable content and will continue to make a contribution to locally-embedded electricity base load and green power.

Over time, there is a natural and significant opportunity to switch an increasing proportion of the outstanding landfill tonnage to energy generation and to allow materials returning to market, from facilities or contracts at their end of life, to be repurposed for products such as fuel, gas to grid or chemicals.

Finally, either as a natural reaction to the market or as a result of Brexit, the further 3.5 million tonnes of residual waste currently exported to energy-from-waste and cement works overseas can be returned and used to feed domestic solutions.

Benefits of solid recovered fuel production for use in cement manufacture

SUEZ operates a solid recovered fuel facility in Rugby which supplies solid recovered fuel to the adjoining Rugby cement works operated by CEMEX. The facility accepts municipal residual waste, which was previously destined for landfill, under a contract with Northamptonshire County Council.

SUEZ calculated the carbon intensity of the full solid recovered fuel solution through transport, production and usage in the cement kiln. We found that this solution resulted in a 90% carbon saving compared with the previous landfill solution.

18

POLICY INTERVENTION

Energy products

The energy potential of waste is significant and should be exploited in a way that maximises the delivery of that potential. We must collectively understand the potential, and how that potential can be best and most usefully exploited to meet the requirements of the economic growth plans of the UK.

- Utilise appropriate incentives to drive development of the waste-derived (recovered or reformed) energy products government sees as important to both the UK economy and its sustainability objectives.
- Avoid supporting specific technologies and instead focus on the quantum and value of the products that can be delivered. This will allow the market to innovate in the method of production to achieve the target outputs. Incentives should only be used to support the development of commercially proven technologies, but government should support emerging but not commercially proven solutions with appropriate grants.
- Clarity of purpose of each policy is essential and the established policies should be required to continue to deliver that clarity of purpose. The Electricity Market Reform – Contracts for Difference should focus on electricity, while the Renewable Transport Fuel Obligation should focus on transport fuels and the Renewable Heat Incentive focus on gas to grid and heat. A new incentive system should be designed with the UK chemicals industry to support the production of industrial chemicals from waste.
- The Department for Business, Energy and Industrial Strategy, the Department for Transport and Defra should collectively determine the best waste-derived energy product outcomes and ensure that incentives are aligned between the different systems to make best use of the resource available.

Heat

Heat can be directly supplied to heat grids or heat consumers, or can be recovered after the generation of electricity by drawing it from the process waste heat flows. Heat is released into the atmosphere by almost all power stations in proportions from as little as 30% of the energy potential up towards 80% in low efficiency gasification or similar facilities. Most electricity power stations in the UK, be they coal, gas, oil, biomass or waste-fired, do not supply heat to heat grids.

Where heat grids have been developed – such as Sheffield, Nottingham, or Coventry – they have been connected to energy-from-waste facilities, but often represent the only source of heat input to the system. In Birmingham, a heat grid has been built, but it is not connected to any of the three energy-from-waste facilities in the city and is instead powered by conventional dedicated power stations despite years of effort by the municipal authorities.

Heat grids often extend to tens of kilometres at best from their sources and link a limited number of heat inputs to heat offtakes. This is a far more vulnerable contractual position than exists in the highly liquid supply and demand side of electricity, where there are hundreds, if not thousands, of inputs and millions of offtakes. In the very fixed nature of heat grids and heat supply, there is a strong interdependency between the two component parts of supply and demand and the uniqueness and limited extent of the heat grid means there is little opportunity to add new customers.

Domestic heat demand also cannot be used as an underpinning supply to heat offtake, which requires a high level of consistent usage to justify the high capital investment in heat grids, especially when retrofitted in urban environments. As such a key component of any heat supply contract is a large scale industrial heat user who operates most of the year around with a high heat demand.

Wilton energy-from-waste facility

SUEZ, in partnership with Sembcorp and the Merseyside Waste Disposal Authority, developed an energy-from-waste facility at the Wilton International site taking waste from the Merseyside conurbation by rail under contract. The Wilton site has an existing heat grid and facilities that already supply heat into the system. The existing grid and multiple heat inputs and offtakes from it created a very robust commercial model that helped underpin the contract requirements and £250 million of capital investment into the facility. The power station supplies enough electricity to power 63,000 homes and significant quantities of industrial heat.

Where a facility is constructed with a heat connection to only one or a small number of industrial offtakes, the operator can be very vulnerable to the commercial viability of the heat user. For instance, the Coventry energy-from-waste facility was originally connected to a heat grid supplying Peugeot, but when that car plant closed, there was no other significant user and the heat grid became redundant. The same occurred with the Markinch waste wood biomass plant in Fife, Scotland, which had a heat supply to a local paper processing plant that subsequently shut for economic reasons, with no replacement immediately available. Coventry City, however, was able to reconstitute heat supply a number of years later through a new heat grid and by offering heat offtakes from their municipal operations.

Where a power plant is constructed with the hope of heat supply, it can take considerable time to develop the heat grid and will most often require the involvement of a municipal authority to facilitate not only the development of the network, but also the facilitation of heat offtakes and future connections.

POLICY INTERVENTION **19**

Heat networks

Making best use of the energy potential of waste requires an expansion of the uses of heat produced in the generation of electricity or other products. Heat losses occur at substantial levels in all forms of power production, so heat supply and the development of heat grids should apply to all power stations – from those powered by gas, oil, coal, biomass or nuclear, as well as those powered by waste. Joining this potential together will speed the deployment of heat grids and supply of heat and creation of a network of heat offtakes.

- Require that a payment towards the development of a local heat grid is included as a condition of all new planning consents for all power stations. The payment should be a minor proportion of the total capital for the plant, but proportional to its scale. The money is held by a municipal body appointed to manage the combined fund.
- Require industrial and municipal facilities built within the curtilage of the heat network (actual or planned) to be heat sink ready through the planning permission.
- Enable all municipal bodies to facilitate and/or contribute to the funding required for the development of heat grids and facilitation of heat offtakes.

Chemicals and fuels

The ability to extract chemicals from waste streams for use in the UK chemical industry is proven technically, but has yet to develop on a commercial basis. Substances like polyphenols can be extracted from organic wastes, while naptha and other chemicals can be generated from gasification and pyrolysis of wastes – with the synthesis of those substances into fuels or chemicals.

These chemicals can be wholly or partially renewable and could potentially assist with the decarbonisation of the chemicals industry in the UK. It has been technically proven that chemicals of the correct qualities can be made, but it has yet to be proven that they can be made at industrial scales and whether there is sufficient feedstock to make these materials in enough quantity to make a positive difference.

British Airways has an ongoing range of projects seeking to produce jet fuel from renewable sources and has announced a project using up to 575,000 tonnes of refuse derived fuel to make 120,000 tonnes of liquid fuel, of which 50,000 tonnes would be jet fuel. The UK airline industry uses approximately 34,000 tonnes of jet fuel per day which, on the same proportion, would require more residual waste than is available in the UK. For such a technology solution to make 10% of the annual UK jet fuel requirement, it would require in excess of 14 million tonnes per annum of refuse derived fuel.

Similar issues of scale exist for the chemical industry, which would suggest that the thermal or biological generation of industrial chemicals should focus on relatively small-scale specialist chemicals, rather than those used on mass in an industrial scale. After identifying these potential chemicals, and whether they can be manufactured at sufficient scale to be interesting to the chemicals industry, it will be necessary to fund some pilot or first commercial plants to prove the economic case. It will then take a further number of years before the technical and business case is sufficiently proven to deliver a potential market scale sector solution.

Government support for the transitional proving phase and, if necessary, the development of the sector solution will be required, as will, if commercially proven, the ring-fencing of sufficient feedstock to support such a transition.

Strategic planning for the use of available waste feedstocks at points in the future should sit within the industrial strategy planning group of government and industry.

Given the timescales, it is likely that any feedstock ring-fencing will occur after waste has been diverted from landfill, and will require strategic direction of residual energy-from-waste facility waste tonnages coming back to market at their end of their contracts or their facilities' operational lives.

Government has a policy intervention in the Renewable Transport Fuel Obligation introduced in 2017, which targets a level of 12.4% of renewable fuels by 2032 – two years after the Defra target to ban biological wastes from landfill. Furthermore, government wishes to limit the volume of renewable fuels that can be generated from agricultural sources and has identified waste-based sources as a target feedstock.

In addition, government has a target of decarbonising the gas grid such that 12% of the supply is from renewable sources by 2020. To meet this target will require a significant increase in the biomethane to grid from anaerobic digestion, such that it would form the dominant future use of such gases, impacting and inhibiting the growth of anaerobic digestion gas to electricity. Significant contributions will be required from the gasification gas to grid sector, which from statements made to date, might amount to 100 terrawatt hours of BioSNG (a substitute natural gas produced from biofuels) or hydrogen and require many tens of millions of tonnes of refuse derived fuel per year to generate sufficient quantities.

Given the commentary already noted within this document regarding the time to market of the appropriate technologies, it is important that government coordinates its departments to ensure that interdepartmental targets and aspirations of waste feedstock occur at the right time in the technology development and in the feedstock availability. Current targets suggested for fuels and green gas may far exceed the UK total residual and organic waste feedstock irrespective of the benefits that may arise from using such wastes to generate electricity, heat and chemicals.

These conversions of waste to fuels and chemicals fall uncomfortably between the waste hierarchy element of recovery and recycling. SUEZ suggests that a new level of the waste hierarchy is introduced that is termed 'reformation' and will include processes that produce new virgin materials that can be used for secondary purposes. For example, re-polymerisation of plastics to make new 'virgin' plastics would be a reformation process.

The EU is currently discussing as part of the Renewable Energy Directive whether fuels and chemicals that can be made from waste materials, irrespective of their renewable content, should be reclassified. The process they are considering is part of our 'reformation' description and would allow fuels and chemicals made from waste to be supported.

Minerals and nutrients

Compost from open windrow composting and in-vessel composting, and liquid digestate from anaerobic digestion, contain a range of nutrients and minerals that are essential to soil health and vitality. Anaerobic digestion digestate supplies a range of valuable components including nitrogen, phosphorus and potassium. Phosphorus is a vital nutrient for farming and its worldwide reserves have shown a continued and marked decrease in availability of supply over recent years, so should appear high in any metrics of measurement based on the foundation of natural capital.

Compost adds similar minerals and nutrients, but also assists soil health, water retention, cation exchange capacity and reduces bulk density. Currently the benefits of these minerals and nutrients, and the benefits the products provide to soil quality, are not commercially valued to any great degree compared with their finite and/or less sustainable alternatives.

The value of these products to the long-term sustainability of soil quality for agricultural purposes is important and government should recognise their value to future agricultural production in the UK. Addressing the non-sustainable or less sustainable alternatives (such as those derived from fossil sources or extracted unsustainably) through appropriate policy interventions, such as taxation, would raise an appropriate price differential and encourage greater use of waste-derived nutrients.

Biological waste materials can also be used as a substrate for the production of new materials, such as protein, algae for the production of protein and fine chemicals, or through the fermentation of the materials to distil further products.

Post-farm and post-food production wastes can be used to grow protein by growing maggots and then processing their larvae into protein feed for chickens and other farm-based livestock. The use of biological waste to grow protein for animals reduces the load on agricultural land and allows redistribution of activity back towards growing food for humans. It also has the potential to significantly reduce the environmental burden of meat production.

Post-consumer food cannot currently be used for the production of animal feed and other regulations, such as the EU fertiliser regulations, prevent certain outcomes for protein return to husbandry. Consideration should be given to the controls necessary to not only protect human health and animal health, but also the opportunity to progressively use waste feedstocks for the displacement of less sustainable farming practice.

Fibres to sugar as a foundation chemical

Low value fibres, such as those unsuitable for recycling into new paper products, can be fermented into sugar as a foundation chemical for other purposes in yeast production, in bio-ethanol production and in bio-chemicals production. The yeast markets exceed 800,000 tonnes per annum, bio-ethanol 3.5 million tonnes per annum and bio-chemicals 120,000 tonnes per annum and, as such, the potential exists to make highly valued chemical products from low value fibre products that have achieved their end of life in traditional production lines. This may provide outcomes that replace the markets capacity currently constrained by the export market restrictions in China.

Components

Serviceable components recovered from broken items can be reused in other items in need of repair. Their extraction and the supporting policy for repair and re-use were covered earlier, but the market into which they are returned requires some attention.

The extraction and testing of components, to ensure they are functional and fit for purpose, needs to be regulated such that consumers can have confidence in the repairs undertaken using previously used components, or their purchase of such items, through testing and relevant warranties.

Creating the basis of a marketplace where there are sufficient agencies for repair and a secondary marketplace for tested and warrantied products is essential to allow this marketplace to flourish in the UK. Establishing testing and warranty guidelines for components is fundamental and should be a key delivery for the waste and resource plan.

Secondary materials

The output of recycling centres is sold into commodity markets that wish to use the materials. These secondary products therefore often displace the use of virgin materials, saving both resources and carbon. Depending on the quality of the secondary materials produced, and the available offtake markets, these materials can be recycled into similar products (plastic bottle to plastic bottle) or 'downcycled' into lower grade materials (high-quality paper to tissues, for instance).

The UK has operated a goods trade imbalance for many years, with the majority of items produced overseas and imported into the UK. This imbalance means that the domestic use of resources (both primary and secondary) in manufacturing is less than the total volume consumed.

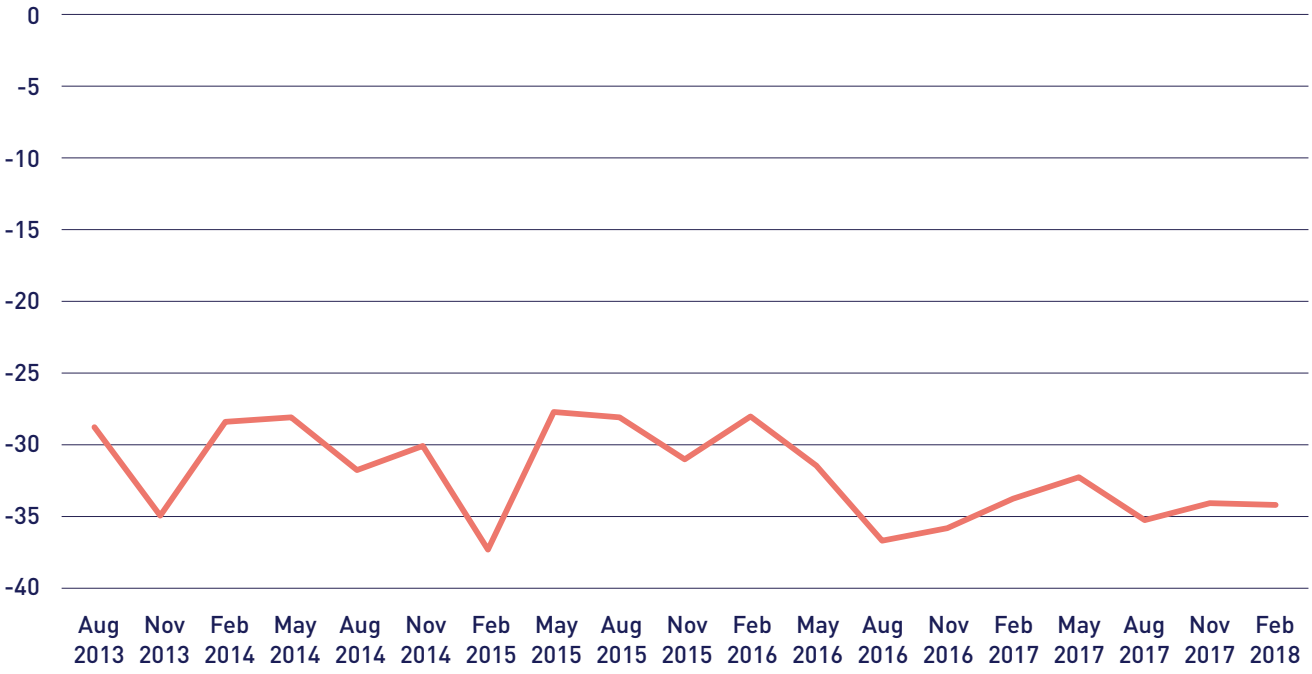
It would be possible to match the usage of primary resources (whether domestic or imported) with levels of domestic consumption, but the market for secondary raw materials is a function of the level of domestic consumption of goods (not just production) – hence the balance of trade position for secondary raw materials.

Given this imbalance, it is not surprising that many of the secondary resources produced in the UK have been shipped back to the origin production markets. This 'return to sender' market condition is exemplified by the export of secondary resources to China, which historically have amounted to around 494,000 tonnes of plastic and 1.4 million tonnes of recovered paper per annum. The UK contribution of secondary plastic amounts to around 7%, and recovered paper to around 5%, of total Chinese imports of these materials from around the world.

Recent changes to the import quality requirements of China have meant that severe restrictions have been imposed on most secondary plastic grades and, to a slightly lesser extent, the import of recovered paper. Many recycling companies have found it difficult to place material with alternative domestic and other international markets due to existing infrastructure capacity issues and due to the balance of goods traded.

New markets have provided some replacement capacity (such as Vietnam, Malaysia and Turkey), but their ongoing capacity is limited and likely, in the short to medium term, to be less than is required. EU markets have provided some additional capacity but, in a number of areas, the quality requirements have required changes in the operation of materials recycling facilities and product enhancing recycling facilities.

↓ UK GOODS TRADE BALANCE 2013-2018 (£BILLION)



Creating offtake markets for domestic secondary resources in the UK will require three main actions:

1. The construction of more recycled materials processing capacity to produce secondary resources at the quantities required to match consumption and wastage in the value chain.
2. To manage the feedstock quality at recycling centres to ensure the quality of products made is aligned to the quality needs of manufacturing industries (domestic and international).
3. To ensure that the UK manufacturing sectors are scaled and supported to match the supply. Current UK manufacturing capacity is insufficient to make use of all of the potentially available secondary resources consumed in the country.

The use of domestically produced secondary resources in manufacturing in the UK will require the development of more manufacturing plants and requires government intervention across the manufacturing sector, as well as drivers for those manufacturing companies to use secondary resources.

POLICY INTERVENTION

20

Recycling markets

Recycling markets need a supply of quality feedstocks, but must also match this supply with demand from secondary materials users (i.e. manufacturers). Requiring recycled content in new products, requiring high recycling potential for products sold into the market, and delivering efficient systems to harvest materials post-consumption are all essential to support the whole value chain. Further financial drivers are required to support the economic use of secondary resources against those from virgin materials.

- Implement a tax on the use of virgin materials to disincentivise the use of primary resources, while making the use of secondary resources more economically attractive.
- Introduce VAT relief on the labour involved in repair, disassembly and reinstallation of reusable, tested and warrantied components.
- Review the packaging recovery note system.

POLICY INTERVENTION

21

The packaging recovery note (PRN) system

The packaging recovery note system should be reviewed such that target materials and the infrastructure that supports their harvesting, sorting and refinement is sufficiently funded and those funds are adequately directed to support the development of new infrastructure. Furthermore, it is important to develop conditions that provide a level technical and economic playing field for domestic and exported materials credits.

- All companies which place materials on to the market should be obligated to contribute to a packaging recovery note system.
- Make the point of data compliance at the point of sale (shop, internet or other) in a similar way that VAT is applied.
- All packaging recovery notes earned and compensated should apply to domestically-used and internationally-exported material on the same level playing field of technical standards, quality and value.
- The value in packaging recovery notes issued should contribute to the process of harvesting the materials and to the provision of recycling infrastructure.
- Materials recycled under the packaging recovery note system should, when used in new products, count towards recycled content targets and targets applied to minimise virgin material usage.

The packaging recovery note system has operated for a number of years and was designed as a market mechanism to improve recycling infrastructure for packaging materials. Not all companies that place packaging into the market are obligated by the packaging recovery note system, with around 15% of the supply falling below the minimum level of activity defined in the regulations. The system is administered by the Environment Agency in England and by their counterparts in the devolved administrations.

Evidence is issued from accredited reprocessors and exporters of qualifying materials to prove that a certain amount of recycling has taken place. Targets for the obligated types of packaging are set on a periodic basis and amended to ensure they remain continually ambitious to drive performance improvements.

A review of the packaging recovery note system has commenced with a series of workshops held early in 2018 with the intention to define the details and conditions commonly understood to be necessary to reform the system.

summary

This document sets out the components and policy interventions that SUEZ considers necessary to achieve a circular economy in the UK. It focuses on strategies to minimise and prevent waste and to make best use of those waste materials that cannot be avoided. Given this context, we have not considered the details of circular economy business models, such as leasing of products replacing capital purchase, or the plethora of other topics that need careful consideration and application beyond the focus of a waste and resources plan.

This document does not intend to provide answers to every question or challenge raised by the concept of a circular economy, but instead aims to help its reader understand the scope and scale of opportunity that is available, while promoting actions that could deliver on each opportunity. We believe that if the fundamental components of this plan were enacted, they would not only significantly increase the sustainability of the UK, but they would add significantly to the financial productivity of the sector[19] and the UK economy as a whole – allowing the country to be at the forefront of the next industrial revolution.

The changing role of local government

Collaboration across the economic value chain is the most essential foundation of sustainability success, but throughout this document we have repeatedly referred to the role of local government in helping to promote and facilitate key elements of the transition to a circular economy. Given the repeated reference to the roles and remits of local government within these proposals, we have defined one final set of policy interventions which seek to enable local authorities to fulfil their potential in this area.

We believe local authorities should consider the whole value chain, rather than to try and deliver results in isolation, and also consider business waste arising in their political jurisdictions rather than just municipal wastes. In doing this, we also believe they should utilise the skills of the private and third sectors, in addition to their own, and use their financial standing to help fund some of the transitions and new infrastructure required by the circular economy.

19 www.sita.co.uk/wp-content/uploads/2017/08/DrivingGreenGrowth-SITAUK-120423.pdf

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POLICY INTERVENTION

Empower change in local government

Local government is fundamental in the transition to a more circular economy. Local authorities should be empowered to ensure that all sectors and players in the value chain, within their geographic remit and in cooperation with their nearby equivalents, are facilitated to deliver the goals and targets of local and national policy.

- Require local government to take a role in managing and facilitating access to the resources wasted in the value chain in their respective jurisdictions.
- Require cooperation with other local government bodies and the private sector in the value chain to meet the locally and nationally set targets.
- Require local government to facilitate a network of solutions to harvest materials in the most economically and environmentally-efficient manner, recognising the skills and resources inherent in the value chain – from reverse or shared logistics to multiple modes of first-mile collection or return of target resources.
- Empower local government to be able to borrow money to invest or co-invest in waste and resources infrastructure and collection and logistical delivery systems. This will help to deliver the £20 billion or more funding required in the waste and resources sector to make the transition to a more circular economy.
- Require local government to set up the fund management of heat grid contributions from new power plants. This would enable match funding and the delivery of both the heat grid and the heat offtakes necessary to increase waste heat usage. All appropriate and significantly sized local and national government buildings should be amended to be heat network ready by 2030.

about SUEZ

SUEZ recycling and recovery UK is part of the SUEZ group, a French-owned multinational business that manages water, waste and resources around the world. The group has revenues in excess of €16 billion and employs over 80,000 people worldwide.

SUEZ recycling and recovery UK (SUEZ) is the operating business in the UK that deals with solid waste. We handle over 10 million tonnes of material per year, have 30,000 customers and collect many millions of bins per year. We operate nine energy-from-waste facilities (three of which were commissioned in 2017) and are currently building our 10th facility in Surrey as part of a combined development involving gasification, anaerobic digestion, bulk logistics and a household waste recycling centre. We operate multiple simple and complex recycling facilities, from dry recyclate to green waste and mechanical biological treatment, and more niche waste streams, like street sweepings, solid recovered fuel and fuel from waste wood.

About the author

Stuart Hayward-Higham is Technical Development Director at SUEZ recycling and recovery UK. His role includes delivering market knowledge and strategy and understanding policy implications to the sector through negotiating offtake contracts, advising customers, research, development and innovation and implementing new solutions or making successful niche activities mainstream.

Main activity themes for Stuart include harnessing waste as a resource, energy and bio-fuels manufacture, sorting, extraction and value enhancement for waste mix resources and the increasing introduction of circular economy based products and solutions.

Stuart is currently working with government and policymakers through a number of different programmes which will contribute to the emerging waste and resources plan due to be published in October 2018. He is a member of the Defra Advisory Committee on Packaging, a member of the steering board for Recoup, a member of the Renewable Energy Association – Organics Recycling Group and a member of the Environmental Services Association, the Renewable Energy Association, the Energy Industries Council and other industry association groups. He is a director of TerraCycle in the UK and was a director of the Anaerobic Digestion and Bioresources Association for over seven years. He has been an expert advisor to the EU on circular economy and been an EU Horizon 2020 projects assessor.

We hope our vision for the future of England's resources and waste strategy has provided a useful catalyst for further thought and debate.

If you have any questions or feedback about the contents of this report, please email communications.uk@suez.com or call 01628 513288.

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