environmental services association

Ricardo Energy & Environment

Why Wait? Weight isn't working

Smarter measures for the circular economy

Report for the Environmental Services Association

Customer:
Environmental Services Association

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Contact:

SarahJane Widdowson
Ricardo Energy & Environment
Gemini Building, Harwell, Didcot, OX11 0QR, United Kingdom

t: +44 (0) 1235 753 000
e: Sarajane.Widdowson@ricardo.com

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Author:
Josephine Brown, Jamie Warmington, John Woodruff

Approved by
SarahJane Widdowson

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Executive Summary

Executive Summary – Why Wait? Weight isn't working

- The current weight-based recycling targets for municipal waste have been useful in driving performance to date, but their lack of sophistication can create unforeseen behaviours such as the collection of heavy materials like garden waste to increase performance. In the transition to a circular economy we need to think differently about what we need to do to improve environmental performance across the value chain and not just at the kerbside, and how we can measure success. Weight just isn't working anymore and with the development of a new waste and resources strategy we now have the perfect opportunity to transition away from blunt weight-based targets to smarter indicators for the circular economy.
- The ESA has commissioned research to explore the potential benefits of using alternate metrics / measures for different materials and the development of management models that would demonstrate and drive environmental performance. This summary provides an overview of the key recommendations from the research.

Why should we move away from weight-based Recycling Targets?

- Weight based recycling targets have served us well to date, but we have reached a stage where the race to improve perceived performance can drive unforeseen behaviours. The waste prevention message can get lost amongst messaging that recycling is the right thing to do. Heavier materials such as garden waste can be targeted for collection whereas the better environmental option could be home composting. For garden waste in particular this can create a performance divide between urban and rural authorities, making performance comparison unreliable. The focus on quantity can mean that quality is compromised, with low quality / contaminated materials sent to be recycled. Importantly, end of life targets also fail to create any drive for producers to design products that are more durable or easier to reuse or recycle. Our understanding of product lifecycles has become more sophisticated, and we need to update our approach to ensure that our actions and priorities are geared towards achieving the best environmental outcomes and that all stakeholders are involved in the process.
- We need parity of approach across all stakeholders to identify and incentivise the recovery of the valuable materials rather than the heavy. The development of the forthcoming waste and resource strategy along with increasing consumer interest in materials such as plastics provides the perfect opportunity to rethink the what behaviours we're trying to achieve and what metrics and measures we need to monitor performance

Everyone has a responsibility to improve our environment, from the producers of the goods we purchase to the local residents, businesses and public-sector organisations that consume them and the local authorities and environmental service providers that manage them at end of use and end of life.

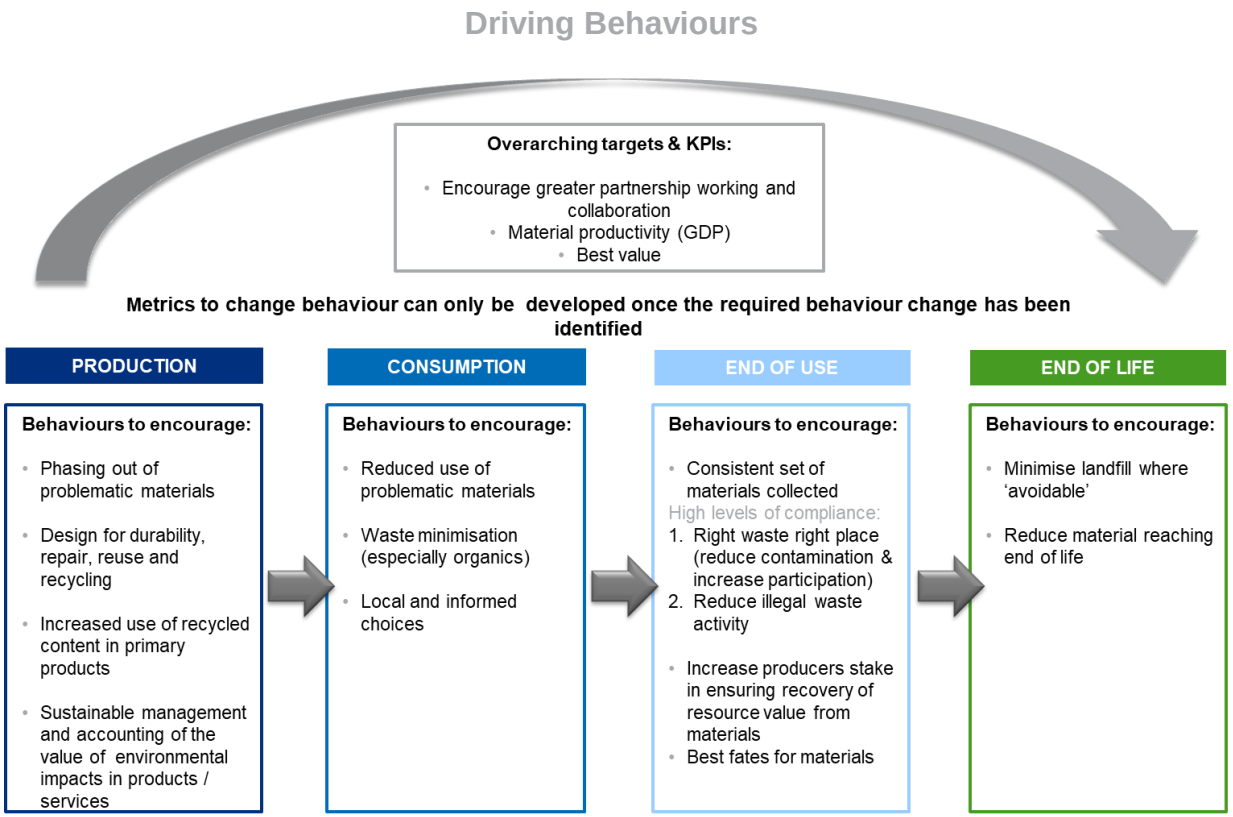
Executive Summary

What should replace weight-based targets?

- We will need to continue reporting performance against weight-based targets in line with the requirements of the Circular Economy Package; however, there is an opportunity to think differently. Our waste management system is and will continue to be weight based – we record the weight of waste and recycling collected and our materials are bought and sold by weight. But we can add sophistication by using this weight data in a smarter manner by combining it with other data and information.

- The first step in the process is to understand what behaviours we're trying to achieve. The figure provides an overview of behaviours which need to be encouraged at each stage of the value chain. It's important that the focus for new metrics isn't just at end of use and end of life. Many environmental impacts can be avoided by designing products in the right way and it's important that producers take responsibility for the products that they create and sell (producer responsibility).

- From mapping behaviours across the value chain (Production, Consumption, End of Use and End of Life) it becomes clear that no one metric will fully illustrate environmental performance improvement. Therefore, a dashboard approach has been recommended with a number of complementary metrics, targeted at different stakeholders but providing a coherent life-cycle approach.



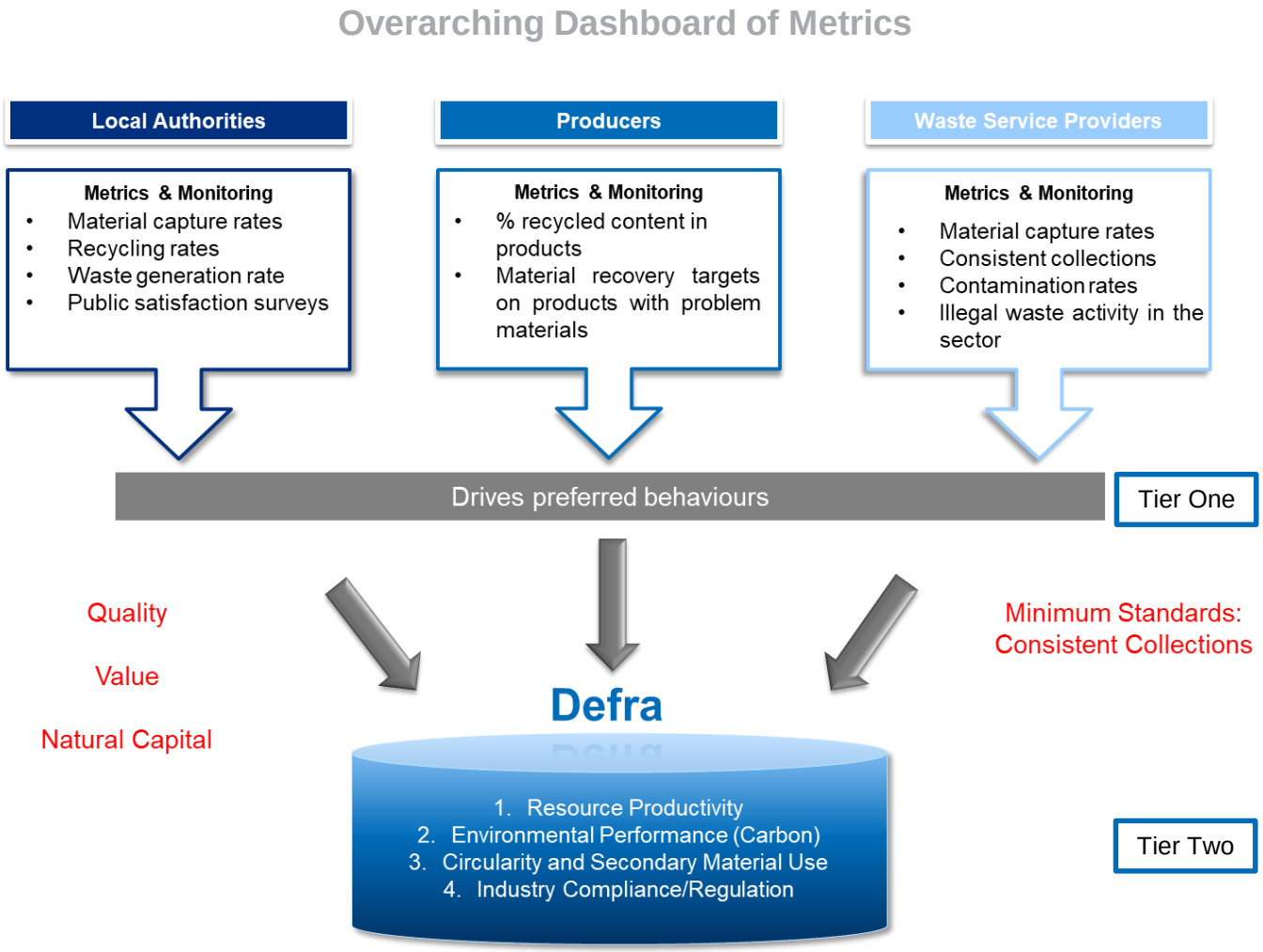
Executive Summary

When and How could this happen?

At a national level a number of metrics will need to be reported including:

- Resource productivity
  - An economic target
- Environmental performance
  - Carbon – as part of the Global Warming Reduction Targets
- Circularity and Secondary Material Use
  - To what extent we use materials more than once
- Industry Compliance / Regulation
  - Monitored by the Environment Agency and Local Authorities

These country-wide 'tier one' targets require a number of different interventions from different stakeholders to improve performance. Because they're measured at a country level they don't necessarily create an incentive to change for individual stakeholders, so metrics need to be implemented at a tier below (tier two) to drive the right behaviours and encourage individual stakeholder responsibility.



Executive Summary

Transition

Local Authorities and Waste Service Providers:

- In the first instance, Local Authorities will need to continue to report against weight for the Circular Economy Package targets using the existing Waste Data Flow system. Waste Data Flow reporting can provide the basis for carbon analysis, which currently provides the most robust and easily communicable alternative metric, and is already used for national climate change mitigation.
- In the short term, indicators from the Scottish Carbon Metric could be used alongside weight data to develop a performance rating in terms of carbon. In the medium term, waste composition analysis would need to be undertaken to provide material specific monitoring data, which would be reported centrally. This level of granularity would allow a material specific focus and provide data for potential material stream capture targets in the future. This data would also enable monitoring of any producer compliance systems and/or systems such as Deposit Return Schemes.

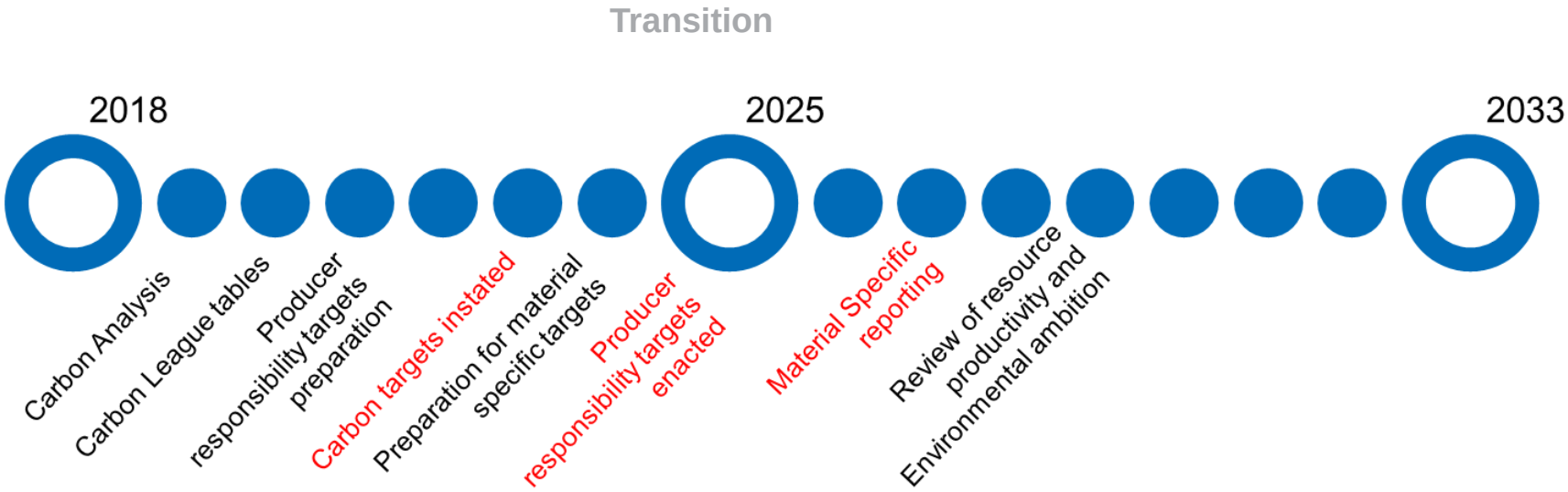
Producers:

- As part of a producer responsibility framework, metrics to monitor producer environmental performance could include percentage of recycled content within products and material recovery targets for problem materials. This would provide an incentive for producers to ensure the capture of quality materials at end of life and drive product redesign so that items placed onto the market maximised recycled content, and were designed for reuse / recycling and to limit environmental harm. Time would also be required to ensure there is sufficient capacity for the capture and reprocessing of materials (preferably through increasing domestic reprocessing).
- These steps would take some time and it's estimated that the preparation required would mean metrics would not be introduced for at least five years..
- **National Government and Regulators:**
- Post Brexit, regardless of the targets utilised, there will need to be significant extra resource invested in the waste management sector. This will be enhanced by the need to feed down national analysis into industry target setting.

Executive Summary

What are the benefits?

- These recommendations provide a whole system approach which should encourage better design of products, an increased focus on quality of materials and higher rates of capture and reprocessing. A framework which provides both a push and pull for materials across the value chain and requires participation from everyone. Smarter measures for the transition to a circular economy which will support domestic material markets (stimulated by material recycling recovery targets for producers) and economically viable recycling solutions for collectors.
- Environmental performance should be measured across the whole value chain. A systems approach should be used, as each activity does not happen in isolation. A dashboard of metrics would allow different actors across the value chain to play their part in protecting the environment, maximising resource productivity and supporting the transition to the circular economy
- In the short term, reporting performance against weight-based targets would continue, in line with the requirements of the CEP; however, there is an opportunity to think differently, and utilise additional metrics to better demonstrate better resource productivity. Our system has become more sophisticated and we need to update our approach to ensure that we're nurturing a high performing and sustainable waste management sector



ESA Alternative Metrics Report

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- **Stakeholder Feedback**
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Introduction and Context

1. Introduction

Purpose of the report

- This report examines the options for the introduction of alternative metrics, focussing on the environmental outcomes envisaged by current and emerging policies, including the Government's 25 Year Environment Plan, the EU's Circular Economy Package and current proposals for Extended Producer Responsibility and Deposit Return Schemes.
- Evidence has been gathered through literature review, case studies, stakeholder engagement and analysis of existing alternative metric approaches
- The potential benefits of moving to alternative metrics, and evidence regarding what metrics could potentially replace our current weight based target system are explored
- Focus is maintained on identifying the environmentally best options for managing different material streams. The output also considers how we could transition to this over time.

2. Context

Current Policy

It is becoming increasingly accepted that the current methodology for assessing environmental performance through weight-based indicators for municipal waste does not take full account of the over-arching environmental benefits or impact of the activities driven by this approach.

Currently, recycling performance is based solely on the measurement of the weight of waste diverted from the residual stream through reuse, recycling or composting, expressed as a percentage of the total weight of waste collected. This system encourages the “chasing” of the heavier recyclable materials, regardless of the overall environmental benefit involved in their collection and reprocessing.

The focus on weight can lead to the collection of materials for which more beneficial treatment options are available; this effect is most clearly seen in the expansion of garden waste collections by Local Authorities to boost their recycling rates.

This report thus explores methodologies for assessing recycling activities through the prioritisation of the capture of resources which represent the best environmental outcome. Utilising alternative metrics such as carbon impact or residual waste production would enable a focus on those materials whose recycling represents the maximum environmental benefit, rather than simply collecting the heaviest elements of the waste stream.

Reviewing the carbon contribution of a total waste service could become an appropriate measure of environmental benefit. Carbon is often used as a proxy for environmental impact, particularly because materials and processes that have a high carbon footprint often involve wider environmental impacts due to high energy consumption, e.g. mining, processing, transport, etc. Thus measuring the carbon impact of waste collection methodologies would provide a more informative reflection of environmental performance, and the setting of more appropriate targets.

Under this approach, instead of an absolute target for recycling, individual material streams could have their own targets, linked to the best environmental option for that particular material. The use of alternative metrics would allow more holistic decisions to be made regarding the prioritisation of materials for recycling and reuse. It would also enable a value chain approach to be utilised where specific measures could be applied at each stage in the chain rather than just focussing on local authorities and municipal waste.

2. Context

Post-Brexit

The Department for Exiting the European Union (DEXEU) has confirmed that all EU legislation which has not already been transposed into UK law will be transferred to UK statute, including current regulations governing waste, packaging, waste electrical and electronic equipment (WEEE) and landfill. However, DEXEU has also stated that 'Following integration into UK law upon departure, all EU environmental laws will be open to being "amended, repealed or improved"'. The UK is thus free to decide the future of its waste policy and laws.

This freedom has given rise to uncertainty over the future of environmental legislation and policy post-Brexit. This is due to the methodology which will be utilised to "amend, repeal or improve" the current Regulations, with Ministers, utilising secondary legislation to amend or repeal primary legislation without parliamentary scrutiny. This may limit the ability of the wider waste sector to influence policy decisions, and may also lead to politically motivated policies being introduced which impact on local authorities' municipal waste activities and the ability of private sector partners to support them in their activities.

A further concern is that at present, the UK is reliant on enforcement from both the European Commission and the European Court of Justice (through the threat of heavy fines) to ensure that environmental standards and targets are met. The Government will thus need to consider the means by which environmental commitments are given effect in domestic law, and the scope and scale of the regulatory and accountability systems by which the UK is held, to adhere to the standards set. Environment Secretary Michael Gove has recently announced plans to consult on a proposal for a new, independent body for environmental standards. The proposed consultation regarding this suggest this will be a new, independent body that will hold Government to account for upholding environmental standards post-Brexit.

This provides an opportunity for the UK to introduce a more ambitious approach to the setting of environmental targets. Whilst this would require a two-stream set of indicators to be maintained for a transitionary period, this would provide a wealth of information regarding the relative benefits of utilising alternative metrics, and may be instrumental in introducing the concept of 'best environmental outcome' as a practically realistic improvement to the current weight-based approach.

2. Context

25 Year Environment Plan

Key actions from 'A Green Future: Our 25 Year Plan to Improve the Environment' (January 2018)

PRODUCTION

- Producer responsibility
  - Environmental impacts of products
  - Review of the plastics in use
- Make more plastics easily recyclable and improve the quality
- Reform PR systems (incentivise)
  - explore EPR requirements
- Ban other problematic materials if there are better alternatives
- Encourage bio-based, biodegradable plastic through the bio-economy

CONSUMPTION

- Reduce the amount of plastic in circulation through reducing demand for single use plastic:
  - Extend uptake and range of plastic bag charge
  - Remove all consumption of single use plastic from central government estate offices
  - Introduce water bottles top-up schemes
  - Explore plastic free store aisles (loose food)

END OF USE

- Make it easier for people to recycle by:
  - Support labelling
  - Litter strategy to reduce littering
  - Introduction of DRS options

END OF LIFE

- We will improve the rate of recycling by:
- Framework for greater consistency: collaborate with WRAP + Industry + LAs to explore the opportunity for consistent materials collected by all authorities
- supporting comprehensive and frequent waste and recycling collections ….and, returning high quality materials back to the economy.
- Working with the waste industry and reprocessors to increase the proportion of plastic packaging collected & recycled.

WASTE CRIME

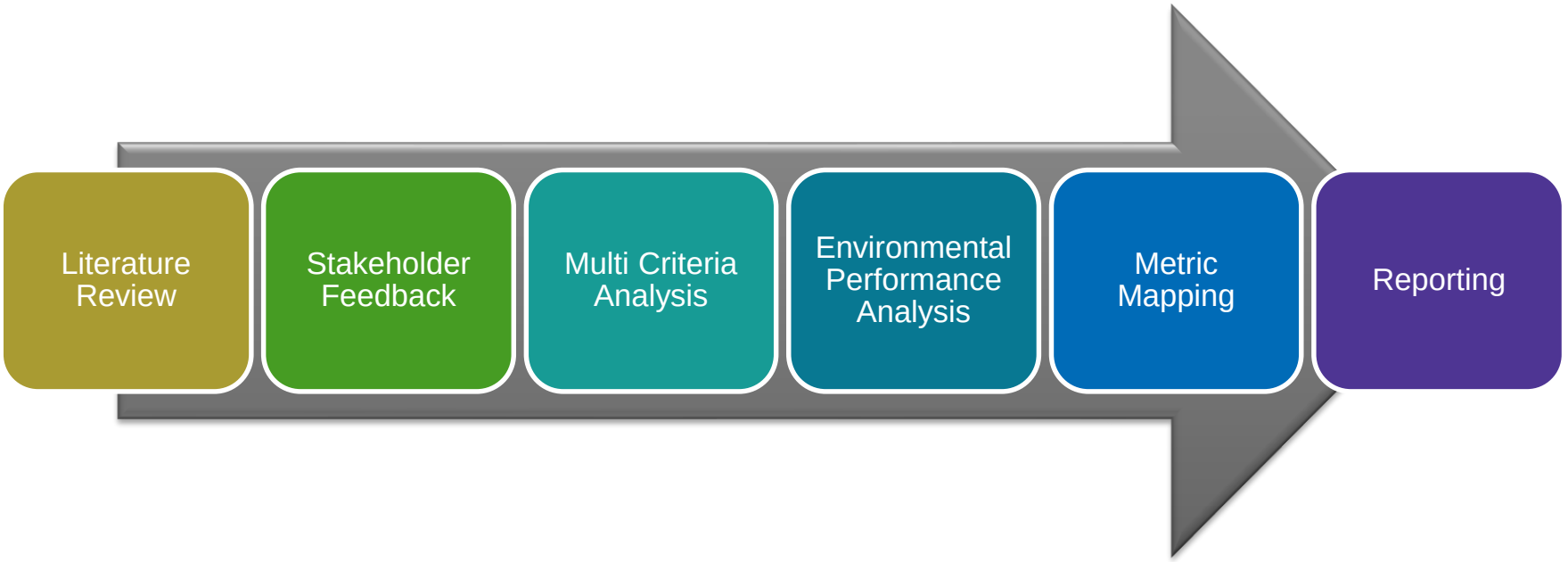
Cracking down on fly-tippers and waste criminals

- Seeking to eliminate waste crime and illegal waste sites
- Explore options to introduce electronic tracking of waste
- Strategic approach to prevent, detect, and deter waste crime
- Partnership approach

3. Project Methodology

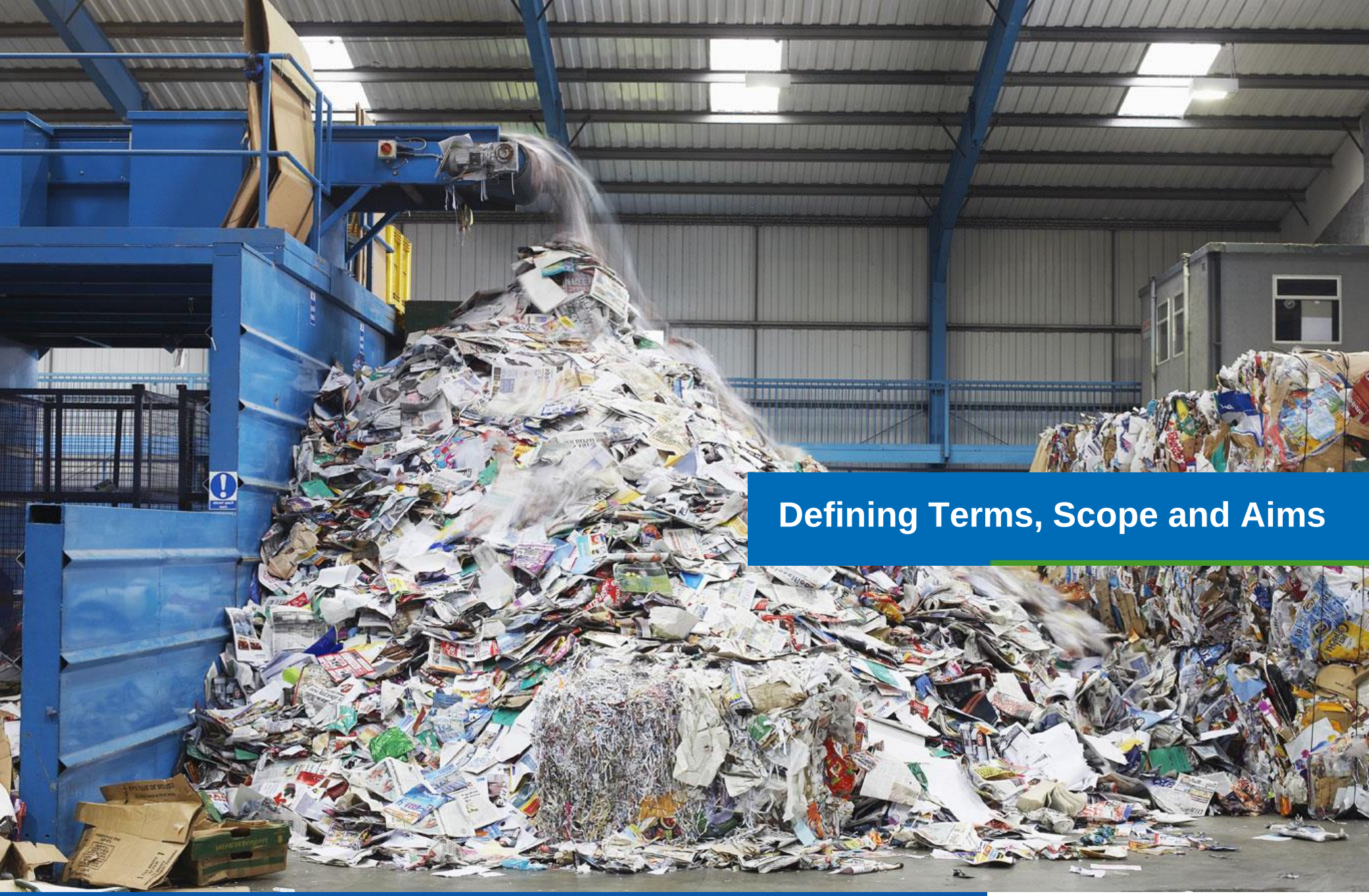
Our Approach

To ensure the Project approach represents a comprehensive assessment of the available options and the wide range of proposed methodologies, the methodology was designed to enable comprehensive consideration of existing research, followed by engagement with stakeholders.



Following stakeholder engagement, an analysis of the relative benefits and drawback of each methodology was carried out, followed by the identification of the methodologies required to assess environmental performance. This ensured that the metric mapping exercise was fully informed by existing research, stakeholder input and scientific evidence.

The annex to this report provides full details of the methodology including the findings of the literature review, stakeholder feedback and behaviour mapping.



Defining Terms, Scope and Aims

4. Defining Terms and Scope

Who are the main stakeholders?

In terms of the remit of the Project, the key stakeholders have been identified as those responsible for each material stream from the initial placing of the material on the market, through its purchase and consumption to its discarding and subsequent collection and transportation to an appropriate disposal or reprocessing facility. Key stakeholders:

- Producers – organisations that produce goods
- Householders / Consumers – individuals and organisations that consume goods
- Local Authorities – organisations with a statutory responsibility to manage municipal waste
- Environmental service Providers – organisations that provide services for the management of waste including collection, treatment and disposal in compliance with the waste hierarchy

This effectively limits the remit of the Project to those who have a direct involvement on the composition of both residual waste and recyclate material streams. These stakeholders will design their activities based on targets set by regulators/legislators, and will look to achieve them as effectively and efficiently as possible.

The key remit of the Project is to explore whether more effective, informative metrics would facilitate the adaptation of each stakeholder's actions in a manner which more effectively reflects the environmental cost or benefit of their methodology. The key stakeholders are thus those who have the greatest ability to refine their activities to reflect the revised priorities identified by the use of alternative metrics.

Definitions:

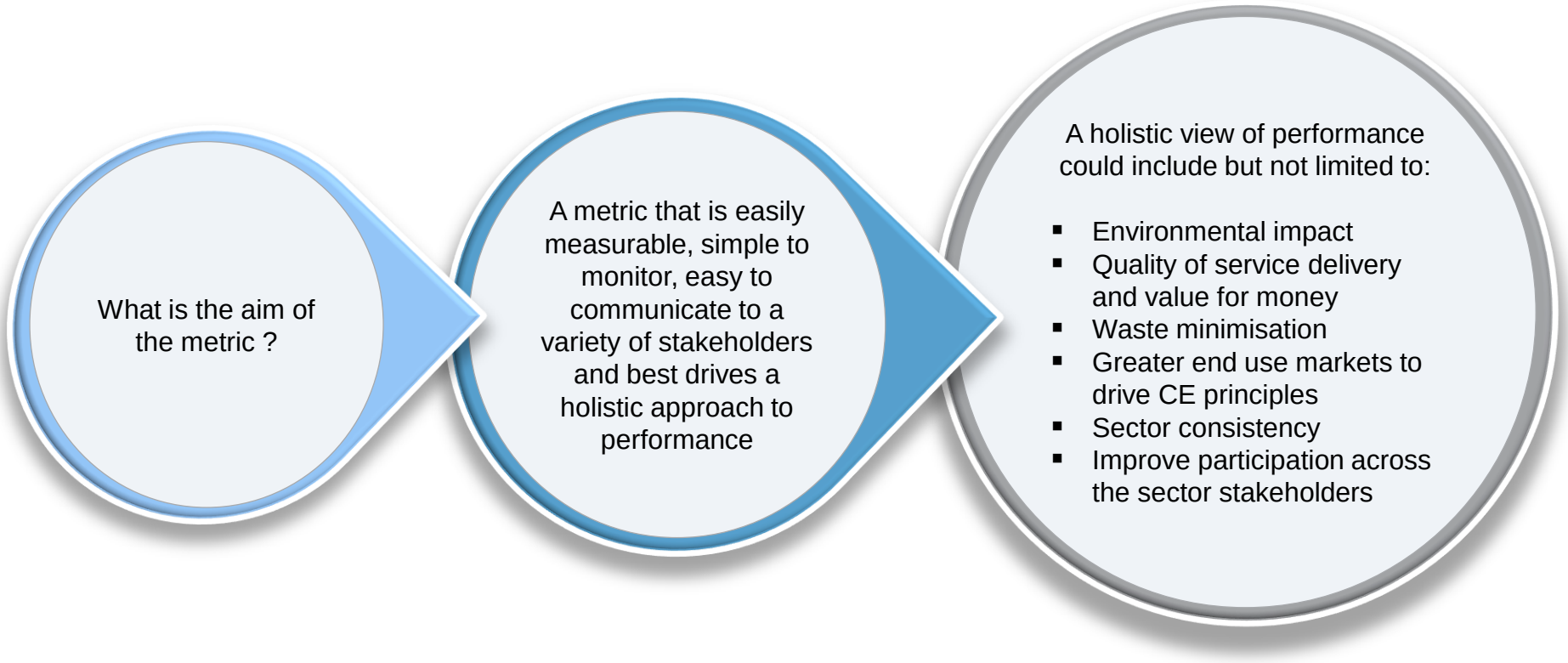
Waste – the waste streams included in the scope of this study are MSW like waste, including household and MSW like commercial waste.

Metric – a set means and approach to continually monitor the change in activity data by an industry stakeholder(s) holistically.

KPI – A KPI or key performance indicator is the process of utilising a consistently reported metric to identify and set and enforce changes in progression of activity towards a defined target or threshold which is deemed appropriate.

Standards and minimum standards - can be either metric based using defined thresholds or similarly they can be more descriptive In nature, such as setting a minimum standard for the range of materials that must be collected as part of a kerbside collection service.

5. Purpose and Aims



6. Driving Behaviour Change

Overarching targets & KPIs:

- Encourage greater partnership working and collaboration
- Material productivity (GDP)
- Best value

Metrics to change behaviour can only be developed once the required behaviour change has been identified

PRODUCTION

Behaviours to encourage:

- Phasing out of problematic materials
- Design for durability, repair, reuse and recycling
- Increased use of recycled content in primary products
- Sustainable management and accounting of the value of environmental impacts in products / services

CONSUMPTION

Behaviours to encourage:

- Reduced use of problematic materials
- Waste minimisation (especially organics)
- Local and informed choices

END OF USE

Behaviours to encourage:

- Consistent set of materials collected

High levels of compliance:

1. Right waste right place (reduce contamination & increase participation)
2. Reduce illegal waste activity

- Increase producers stake in ensuring recovery of resource value from materials
- Best fates for materials

END OF LIFE

Behaviours to encourage:

- Minimise landfill where 'avoidable'
- Reduce material reaching end of life

Environmental Performance Analysis

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7. Environmental Performance Analysis

Methodology

Environmental analysis results

SimaPro LCA Software

- A LCA-based environmental assessment has been carried out in order to investigate potential changes in the ranking of preferability between recycling and conventional disposal options (i.e., incineration) due to the quality of MRF's outputs.
- The analysis includes 6 mid-point environmental impact categories based on CML 2013 method (V3.05 / EU25).

Threshold for recycling vs EfW

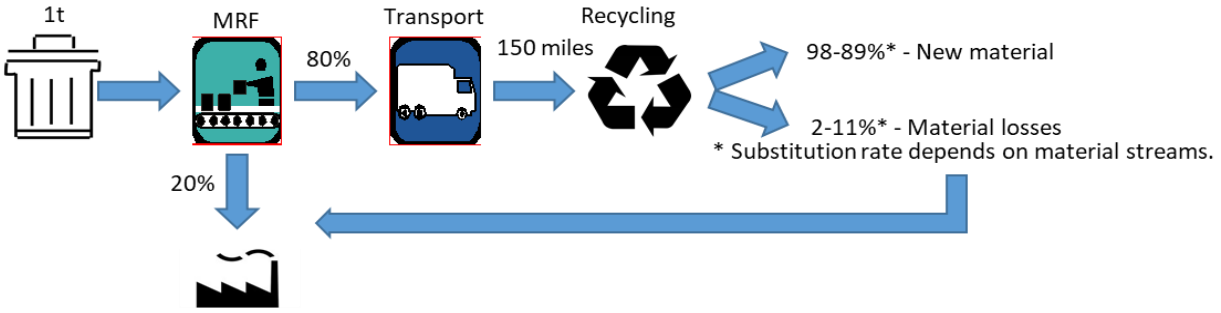
- In this analysis, we assume that poor-quality MRF's outputs will lead to substantial increase in MRF reject which is sent to an energy recovery facility. Poor-quality outputs will also lead to a significantly low substitution rate of virgin materials. For example, 1t of paper waste, sent from a MRF to a paper mill, will offset the production of 0.99t in the baseline scenario, 0.8t of virgin paper in Option 1, and 0.75t in Option 2.

Results

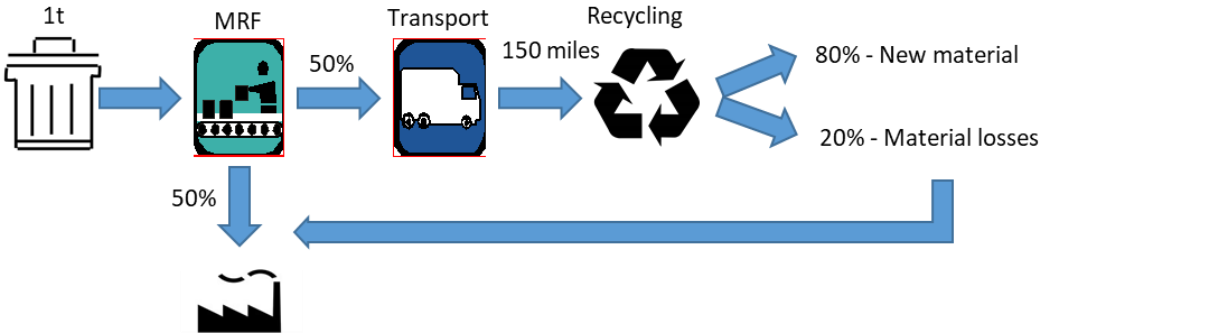
7. Environmental Performance Analysis

Scenarios

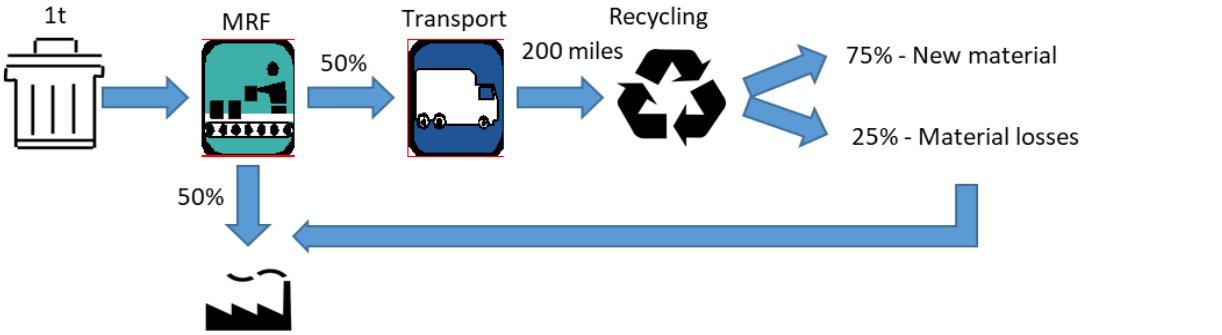
Baseline Scenario



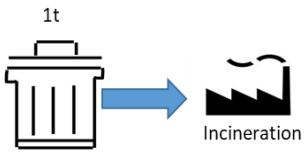
Option 1 (Medium Quality)



Option 2 Low Quality

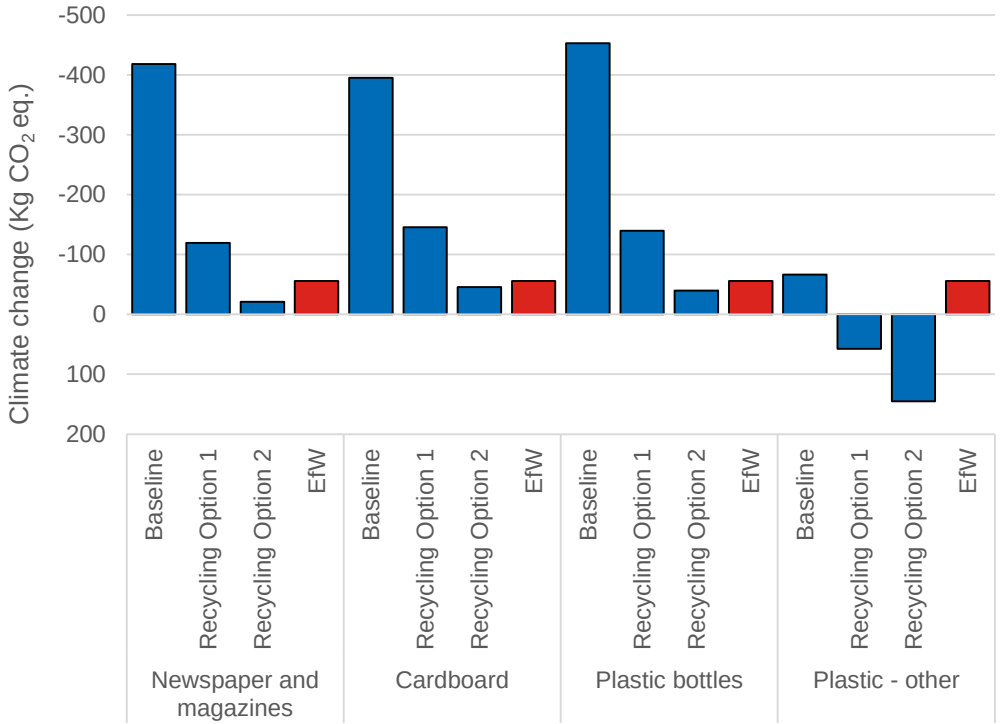


Option EfW



7. Environmental Performance Analysis

Findings



Results

The results show that EfW tends to have higher environmental benefits than recycling for paper, cardboard and plastic PET due to the poor quality of MRF's outputs (50% contamination and 25% material losses).

Limitations of the analysis

- Environmental impacts of processing MRF's outputs at the re-processing stage is assumed to be 10% of the MRF total environmental burden.
- Distances between the MRF and final destinations of different outputs are constant across all materials (i.e., 150 miles for Baseline and Option 1 and 200 miles for Option 2).
- A pre-defined WRATE incineration process, used in this analysis, assigns the same environmental burden to all waste streams. In reality, energy recovered and environmental impacts of incinerating waste materials vary significantly based on caloric value .
- The percentage of reject material is assumed to be the same across all waste streams.
- The substitution rate of virgin materials in the baseline scenario are based on WRATE. With regards to Option 1 and 2, we used fixed substitution rates: 80% for Option 1 and 75% for Option 2.
- Environmental benefits of avoided production is based on pre-defined processes in Ecoinvent v3.4 (2017).
- MRF glass output is assumed to substitute the production of gravel.

Material stream	Option	Climate change (kg CO2-Eq)	Acidification potential (kg SO2-Eq)	Eutrophication potential (kg PO4-Eq)	Freshwater aquatic ecotoxicity (kg 1,4-DCB-Eq)	Human toxicity (kg 1,4-DCB-Eq)	Depletion of abiotic resources (kg Sb Eq)
Newspaper and magazines	Baseline	-293	-1	-2	-740	-216	3
	Option 1	-119	0	-1	-372	-83	1
	Option 2	-20	0	-1	-344	-52	1
	EfW	-56	1	0	-5	21	-3
Cardboard	Baseline	-270	0	-1	-863	-278	3
	Option 1	-145	0	-1	-486	-137	1
	Option 2	-45	1	0	-451	-103	1
	EfW	-56	1	0	-5	21	-3
Plastic bottles	Baseline	-328	0	-2	-2846	-540	3
	Option 1	-139	0	-1	-1449	-249	1
	Option 2	-39	1	-1	-1354	-208	1
	EfW	-56	1	0	-5	21	-3
Plastic - other	Baseline	59	1	-1	-770	-151	3
	Option 1	58	1	0	-390	-51	1
	Option 2	146	1	0	-361	-22	1
	EfW	-56	1	0	-5	21	-3

7. Environmental Performance Analysis

Literature

WRAP's 'Environmental benefits of recycling – 2010 update'

Looks at the impact of landfilling, recycling or incinerating materials by analysing over 200 LCAs of waste material disposal to consider which route would give the most preferred benefits based on 4 impact categories:

1. Resource depletion
2. Cumulative Energy demand
3. Climate Change potential
4. Water consumption

Waste management options including; recycling, composting, incineration, landfill, anaerobic digestion (AD), pyrolysis, gasification, were considered in the assessment.

Paper & Cardboard

That landfilling is the least preferred option, particularly from a climate change potential and energy demand perspective, however the data shows that whilst recycling is preferable for energy demand and water consumption, it is comparable with incineration in regards to climate change potential. Stresses that the **quality** of paper being recycled diminishes each time it is recycled- once it is of too low quality to be recycled further, it is important to find appropriate outlets.

Plastics

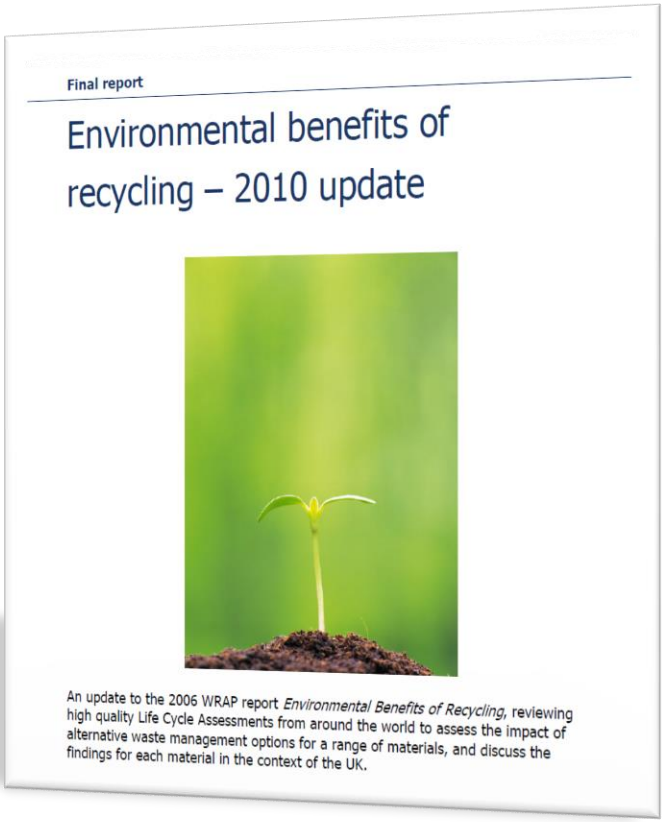
The results confirm that recycling is the best waste management option in respect of the climate change potential, depletion of natural resources and energy demand impacts. The benefits of recycling are mainly achieved by avoiding production of virgin plastics. Indeed quality of the material is key to achieving the best environmental benefit whereby there is a limited reject fraction and the replacement of virgin plastics on a ratio of 1 to 1.

Food & Garden waste

Finds that AD probably qualifies as the most preferable option, especially for climate change potential and depletion of natural resources (only tested on half of the studies). Additionally, composting brings benefits as a result of the compost that can be used as a substitute for products such as peat or fertilisers. Since composting is not associated with energy recovery, it generally does not perform well compared to the other options for depletion of natural resources and energy demand. Incineration with energy recovery also does well for all four indicators despite the relatively low heating value. The benefits of incineration are greater if the energy produced substitutes fossil energies.

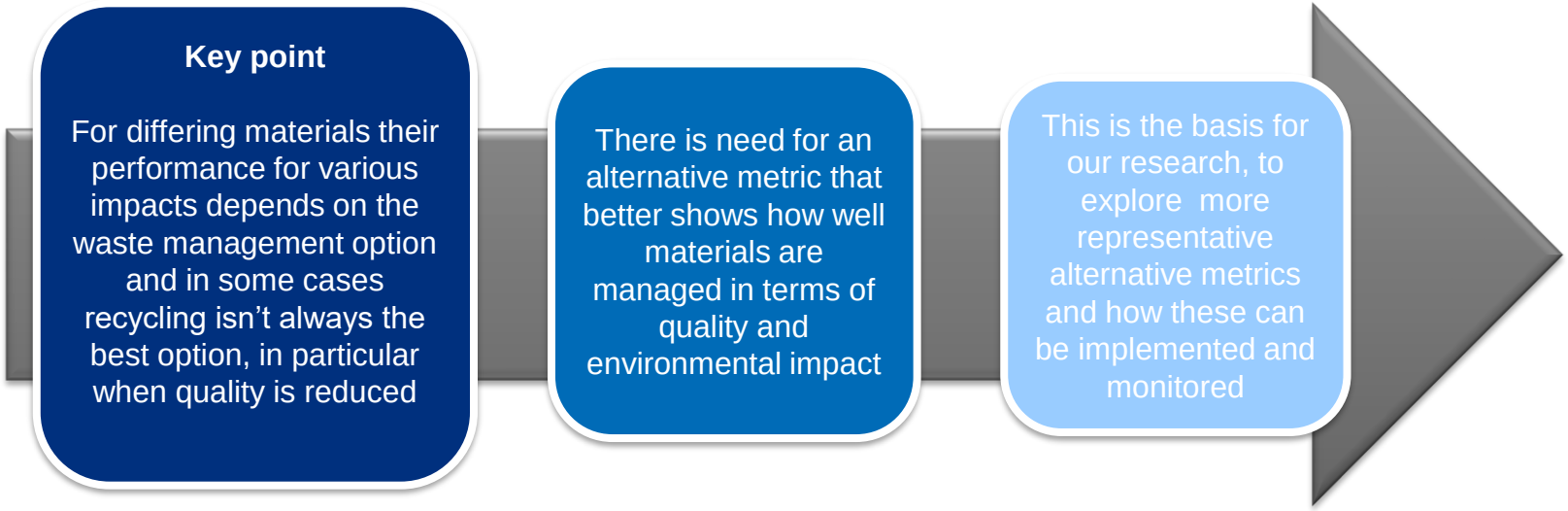
Data

Due to gaps in data about specific materials and the impacts of waste management options, the study identifies a need for a stronger evidence base on materials and innovative EfW technologies.



7. Environmental Performance Analysis

Summary



Multi-Criteria Analysis

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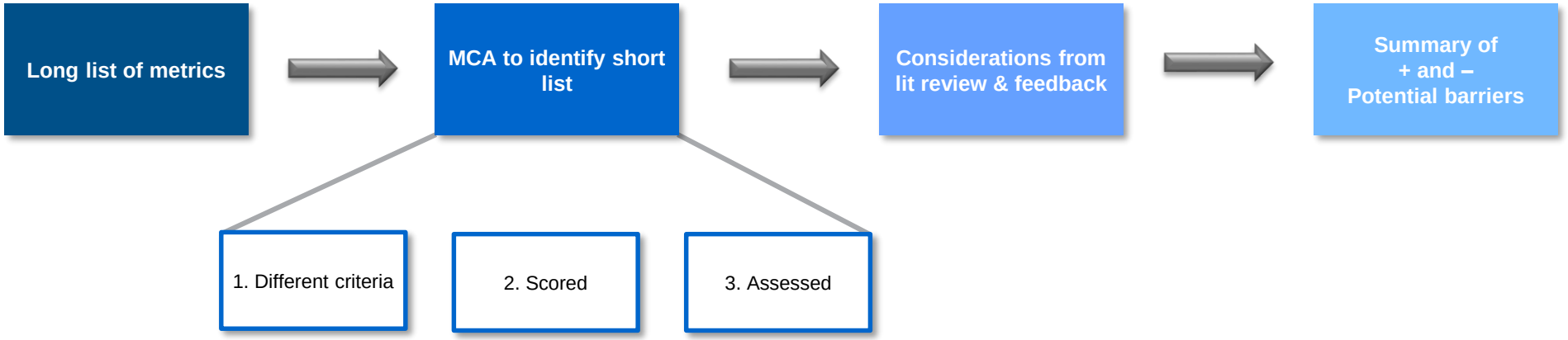
8. Multi-Criteria Analysis

Long list of metrics and indicators

Long List of metrics/indicators

1. Recycling rate
2. Scottish carbon
3. Recycling Carbon Index
4. Total waste generated per capita per year
5. Total waste generated per household per year
6. Residual waste per capita per year
7. Residual waste per household per year
8. % of waste diverted from landfill
9. GDP per unit of resource
10. Material flows (inputs and outputs)
11. Circular economy (circular material use rate or MCI)
12. % of recycled content
13. Material recovery rates
14. Environmental Protection Expenditure
15. Air emissions
16. Avoided energy use
17. Avoided water use
18. Illegal waste sites

MCA Process



8. Multi-Criteria Analysis

Criteria

Criteria – What makes a good metric ?

1. Easy to measure / data availability
Is the data needed to monitor the metric readily available, does it require updating regularly, is it easy to measure or are complex programs and technical experience needed

2. Easy to implement at minimum cost
What are the extent of costs associated to implement the metric, it's monitoring and reporting. Do infrastructure or systems need to change if so what are the costs? **Who bears the cost?**
2 stages of cost – cost to implement the metric and cost of best practice

3. Easy to understand & communicate
Is the metric simple to understand as a concept and can it be communicate to all stakeholders easily

4. Does not create perverse impacts or behaviour
Check that the metric does not cause negative impacts on other sectors such as air pollution, water. Does not encourage biased prioritisation of materials.

5. Equitable

6. Offers consistency over time
A metric that can be messaged long-term and possibly adapted to reflect future changes

7. Compatible with other benchmarks and other markets
Is the metric compatible and comparable with other targets and goals in the waste sector as well as other sectors such as air, water, transport etc.

Variable metric

8. Good indicator of performance
This is metric that assesses whether it best shows a measure of performance- need to define what our perspective on performance is ?

Scored

The criteria will be evaluated using scoring system that may range from 1-10 or a 3 tiered system (0 ,2 ,3). The criteria may be given a weighting if needed and this should give a total score to compare each of the metrics against

8. Multi-Criteria Analysis

Approach

- Each of the long list of potential alternate metrics has been appraised and scored individually using the consistent scoring matrix.
- The scoring has been conducted first by the project team then independently reviewed by other waste management specialists within the Ricardo Energy & environment team. Following this appraisal results are open for review by the ESA steering group with comments accepted to feed into the second iteration of the reporting.
- Importantly, when criteria of perverse impacts have been appraised this is not relative to recycling rates as the status quo, instead based on setting targets which result in the best environmental results in moving the industry to a more circular economy.
- Criteria have been set to identify “what makes a good metric” thus allowing for a shortlisting of metrics that could potentially be easy to implement and easy to interpret whilst monitoring key criteria of the industry that could be used to set targets or design policy to implement behavioural or market change within the waste management sector.
- No weighting of criteria has currently been applied so score are criteria based only with the idea of allowing differentiation between similar or competing metrics.
- The findings from this multi criteria analysis are presented in the next slides with rationale provided for the scoring. A summary of the findings are then presented.

8. Multi-Criteria Analysis

Findings

Metric	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8
	Easy to measure / accurate data available	Cost to implement	Easy to understand & communicate	Does not create perverse impacts or behaviour	Equitable	Offers consistency over time	Compatible with other benchmarks	Good indicator of performance (variable)
Recycling rate	**9**	**10**	**9**	**6**	**6**	**9**	**4**	**7**
	Recycling rate is a simple weight based measure which is well recognised, having been utilised for national and EU level reporting for many years.	Recycling rate reporting is based upon data already collected, so no additional expenditure required.	Easy to communicate to the full range of stakeholders including households/consumers, producers, LA's and at a national scale.	As this is the baseline metric, it will not effect the status quo activities within the sector, but creates the perverse incentive of chasing heavy materials rather than those that have the highest environmental benefit in recovery.	Could be argued it favours certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	A good measure of weight based diversion but is better when supplemented with waste minimisation targets.
Scottish Carbon	**6**	**7**	**7**	**8**	**8**	**6**	**9**	**9**
	The Scottish measure requires additional steps, to multiply weight throughout the system by a set of factors for avoided carbon production. As such this requires not only weight based data, but regularly updated carbon factors.	The current Scottish carbon metric is not reported quarterly or annually, (with the last published in 2015/16), more regular calculation reporting and updates to methodology will require investment. Also pursuing carbon targets as opposed to recycling targets could lead to investment in service change.	A more difficult concept to communicate to all stakeholders, people understand weight but tonnes of CO2 more difficult to grasp as benefits are tied to the factors utilised.	Carbon metrics are still a better measure of environmental performance but could generate a change in activities in the market incentivising different materials and processes.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Research is ongoing with alternate processing methodologies meaning environmental burdens could be constantly shifting, therefore the most intensive materials now could be reduced with alternate processed in the future.	Carbon has emerged as the proxy for environmental performance across multiple sectors with GWP reduction targets set at national level. Scottish carbon more transferable as the range of carbon factors used encompass a broader coverage of the waste management sector.	Carbon metrics are probably the best proxy for environmental performance and the Scottish carbon metric takes into account a broad range of the waste management sectors activities as well as virgin material offset.
Recycling Carbon Index	**7**	**8**	**7**	**7**	**8**	**6**	**8**	**6**
	The Recycling Carbon Index is similar to that of the Scottish assessment methodology, albeit it is less rigorous due to its focus on recycling and composting and not disposal.	The current Welsh carbon metric is currently reported as a KPI (comparison of authorities), more regular calculation reporting and updates to methodology will require investment. Also pursuing carbon targets as opposed to recycling targets could lead to investment in service change.	A more difficult concept to communicate to all stakeholders, people understand weight but tonnes of CO2 more difficult to grasp as benefits are tied to the factors utilised.	Carbon metrics are still a better measure of environmental performance but could generate a change in activities in the market incentivising different materials and processes.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Research is ongoing with alternate processing methodologies meaning environmental burdens could be constantly shifting, therefore the most intensive materials now could be reduced with alternate processed in the future.	Much like the Scottish carbon metric, but does not cover the range of waste management activities	Carbon metrics are probably the best proxy for environmental performance, unlike the Scottish carbon metric has a narrower system boundary in terms of the waste management sectors activities.

8. Multi-Criteria Analysis

Findings

Metric	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8
	Easy to measure / accurate data available	Cost to implement	Easy to understand & communicate	Does not create perverse impacts or behaviour	Equitable	Offers consistency over time	Compatible with other benchmarks	Good indicator of performance (variable)
Total waste generated per capita per year	**9**	**10**	**9**	**7**	**8**	**9**	**4**	**7**
	Accounting for waste generated per capita is a relatively simple assessment requiring already existing weight based data and population statistics.	Weight based KPI's already reported so could easily transferred into targets	Easy to communicate to the full range of stakeholders including households/consumers, producers, LA's and at a national scale.	As this is the baseline metric, it will not effect the status quo activities within the sector. Albeit this is currently only a benchmark, making this a target could negatively influence recycling performance should it be non recyclable material that is "unavoidable".	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	In isolation waste generation per capita is good in incentivising waste minimisation, but should be supplemented by recycling reuse and recovery data. Per capita is a better normalising factor than household.
Total waste generated per household per year	**9**	**10**	**9**	**7**	**8**	**9**	**4**	**6**
	Accounting for waste generated per household is a relatively simple assessment requiring already existing weight based data and population statistics.	Weight based KPI's already reported so could easily transferred into targets	Easy to communicate to the full range of stakeholders including households/consumers, producers, LA's and at a national scale.	As this is the baseline metric, it will not effect the status quo activities within the sector. Albeit this is currently only a benchmark, making this a target could negatively influence recycling performance should it be non recyclable material that is "unavoidable".	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	In isolation waste generation per capita is good in incentivising waste minimisation, but should be supplemented by recycling reuse and recovery data. Per capita is a better normalising factor than household.
Residual waste per capita per year	**9**	**10**	**9**	**6**	**8**	**9**	**4**	**7**
	Accounting for residual waste arisings per capita is a relatively simple assessment requiring already existing weight based data and population statistics.	Weight based KPI's already reported so could easily transferred into targets	Easy to communicate to the full range of stakeholders including households/consumers, producers, LA's and at a national scale.	As this is the baseline metric, will not effect the status quo activities within the sector and would support recycling performance.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	In isolation residual waste generation per capita is good in incentivising waste minimisation, but should be supplemented by recycling reuse and recovery data. Per capita is a better normalising factor than household.

8. Multi-Criteria Analysis

Findings

Metric	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8
	Easy to measure / accurate data available	Cost to implement	Easy to understand & communicate	Does not create perverse impacts or behaviour	Equitable	Offers consistency over time	Compatible with other benchmarks	Good indicator of performance (variable)
Residual waste per household per year	**9**	**10**	**9**	**6**	**8**	**9**	**4**	**6**
	Accounting for residual waste arisings per household is a relatively simple assessment requiring already existing weight based data and population statistics.	Weight based KPI's already reported so could easily transferred into targets	Easy to communicate to the full range of stakeholders including households/consumers, producers, LA's and at a national scale.	As this is the baseline metric, it will not effect the status quo activities within the sector and would support recycling performance.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	In isolation residual waste generation per capita is good in incentivising waste minimisation, but should be supplemented by recycling reuse and recovery data. Per capita is a better normalising factor than household.
% of waste diverted from landfill	**9**	**10**	**8**	**6**	**8**	**9**	**4**	**4**
	Existing metric which is already easy to measure based on aggregated tonnages to end destinations.	Weight based KPI's already reported so could easily transferred into targets	Easy to communicate to the full range of stakeholders including , producers, LA's and at a national scale. Householders and consumers can feel separated from this reporting which is predicated on treatment activity.	Does not necessarily cause perverse incentives but focus on landfill diversion rather than capture for recycling or reuse is not supportive.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	Waste diverted from landfill is increasingly a backward looking metric with waste having already been moved up the waste hierarchy away from landfill activities.
GDP per unit of resource	**7**	**7**	**5**	**9**	**8**	**9**	**9**	**7**
	National databases for economic development allow this to be reported fairly easily at a national scale, but sub national / regional will be more difficult.	Already utilised as national indicators reported into the European Union, however greater understanding of these will be required, in particular more regional reporting, by material typologies etc.	The concept of material productivity itself is not a difficult concept, but understanding the wide range of influencing factors makes communications of causal benefits more difficult.	As a national indicator this support greater material reuse recycling and recovery with maintain the value in materials key in achieving greater material productivity.	A national or regional indicator so does not benefit or cost any individual stakeholder.	As long as GDP is normalised (i.e. accounting for base inflation) then this metric will provide a consistent indicator of material productivity over time	National indicators which encompass all sectors of the economy, by nature all sectors contribute to hitting these targets	At a national level a good metric to monitor material productivity, but should be cautious as can be improve either by higher value goods or reducing material consumption. Also every sector contributes so not a waste sector specific target

8. Multi-Criteria Analysis

Findings

Metric	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8
	Easy to measure / accurate data available	Cost to implement	Easy to understand & communicate	Does not create perverse impacts or behaviour	Equitable	Offers consistency over time	Compatible with other benchmarks	Good indicator of performance (variable)
Material flows (inputs and outputs)	**7**	**6**	**5**	**7**	**8**	**9**	**9**	**7**
	National databases for economic development allow this to be reported fairly easily at a national scale, but sub national / regional will be more difficult.	Already utilised as national indicators reported into the European Union, however greater understanding of these will be required, in particular more regional reporting, by material typologies etc.	Undertaken at regional and national scale these are simple to report and communicate. Problem is stakeholders feel removed from very aggregated targets with multiple influences.	This indicator needs carful interpretation as although gives an indication of materials consumed in country needs to be mentored so that we are not causing environmental difficulties further afield.	A national or regional indicator so does not benefit or cost any individual stakeholder.	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	National indicators which encompass all sectors of the economy, by nature all sectors contribute to hitting these targets	At a national level a good metric to monitor material productivity, but should be cautious as can be improved either by higher value goods or reducing material consumption. Also every sector contributes so not a waste sector specific target
Circular economy (Circular material use rate or MCI)	**5**	**4**	**5**	**9**	**6**	**7**	**7**	**8**
	Is currently only used at company or product level and needs a thorough understanding of material pathways through the supply chain. Would be difficult to measure for all companies and at regional or national scale.	To be implemented in a more wide spread manner, would require additional investment for every business or product. In addition targets to be set based on this metric would require significant auditing as per energy efficiency and CCA's etc.	Circular economy is still a difficult concept to communicate to a all stakeholders. Also at either a product or business level this will require some way of scoring or labelling such as energy efficiency for electronic products.	Material recovery and reuse with for secondary purposes is a key component of the circular economy. This is in line with both environmental goals and recycling	Could negatively impact smaller business or market entries providing barrier to competition In product markets.	A focus on secondary material use based on weight based metrics will provide a consistent measure over time, however it should be noted that the quality of this secondary material use should also be consistent but not explicitly measured in this metric.	The circular economy is a cross cutting concept so well translatable to all sectors of the supply chain and economy.	A good metric to utilise targeting specific stakeholders (e.g. as per energy labelling or eco label) would incentivise consumers to think in terms of efficiency material use in production
% of recycled content	**4**	**3**	**9**	**9**	**5**	**7**	**5**	**7**
	Applying targets on recycled content in products will be easy to do in theory but require regular auditing to ensure a level playing field for all product manufactures.	This will require significant change to market structures with investment required in material recovery infrastructure as well as product design, licensing and monitoring.	Recycled content is already understood by all stakeholders and supports the use of secondary materials and the circular economy.	Material recovery and reuse with for secondary purposes is a key component of the circular economy. This is in line with both environmental goals and recycling	Could negatively impact smaller business or market entries providing barrier to competition In product markets.	As per a consistent metric this could easily be achieved using a recycled content factor. However it could also be variable influenced by public opinion (e.g. Attenborough effect on plastic) which could confuse stakeholders on problem materials.	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	A good target in measuring progress towards secondary material use, should be combined with targets on sectors to recover materials on the market.

8. Multi-Criteria Analysis

Findings

	Easy to measure / accurate data available	Cost to implement	Easy to understand & communicate	Does not create perverse impacts or behaviour	Equitable	Offers consistency over time	Compatible with other benchmarks	Good indicator of performance (variable)
Material recovery rates	**6**	**7**	**6**	**9**	**8**	**9**	**5**	**7**
	Material recovery rates at the kerbside are more difficult to measure with accuracy due to the reliance on regular updated composition studies.	To a certain extent material recovery rates are already monitored from an LA an packaging perspective, but great accuracy of reporting will require increased investment in reporting as well as regular waste composition studies.	Material recovery rates (capture rates) are currently well understood by LA's and environmental service providers. However, it will require education on the concept to get households on board for material specific targets.	Material recovery and reuse for secondary purposes is a key component of the circular economy. This is in line with both environmental goals and recycling	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Weight based targets offer consistency over time as despite further research into carbon intensity or other metrics, a tonne is still a tonne	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	A good measure in mentoring the performance of local authority collection schemes on a material basis.
Environmental Protection Expenditure	**5**	**8**	**7**	**5**	**6**	**5**	**9**	**4**
	Company returns should stipulate spend on environmental protection but would need to be made mandatory requirement.	Environmental expenditure will already be available in company accounting implementing targets to report against will require minimal investment.	Already something well understood as part of broader environmental sustainability. Issue will be around avoiding "green wash".	Making this a target would be perverse if it incentivised paying for environmental protection activities rather than investing in processes to reduced environmental damages at source of production, consumption and disposal.	Could negatively impact smaller business or market entries providing barrier to competition In product markets.	A consistent metric could be established which is relative to revenue generation, or environmental burdens. Could be influenced by other economic factors however	As its based on company reporting of sustainability transferable across all sectors	A superficial target with many ways in firms can green wash and diverts the focus away from the source pollutant activity.
Air emissions	**5**	**6**	**5**	**6**	**8**	**6**	**9**	**6**
	Similar to carbon metrics in that it needs additional calculation processes with regularly updated emission factors. The evidence base for air emissions as opposed to Carbon is much less well developed.	As with carbon metrics additional research and development will be required to develop factors for all materials and processes, air emissions to some extent further ahead in this than energy and water, but still behind carbon.	Alternate environmental metrics are emerging in importance, but will seem perverse in use as they will incentivise different activities to those of standard recycling rates.	As with carbon metrics alternate measure of environmental performance but could generate a change in activities in the market incentivising different materials and processes.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Research is ongoing with alternate processing methodologies meaning environmental burdens could be constantly shifting, therefore the most intensive materials now could be reduced with alternate processed in the future.	Air emissions are increasingly a cross cutting metric with air emissions inventories for all sectors of the economy.	Not as holistic as carbon targets in relation to an environmental metric

8. Multi-Criteria Analysis

Findings

Metric	Criteria 1	Criteria 2	Criteria 3	Criteria 4	Criteria 5	Criteria 6	Criteria 7	Criteria 8
	Easy to measure / accurate data available	Cost to implement	Easy to understand & communicate	Does not create perverse impacts or behaviour	Equitable	Offers consistency over time	Compatible with other benchmarks	Good indicator of performance (variable)
Avoided energy use	5	5	5	6	8	6	7	5
	Similar to carbon metrics in that it needs additional calculation processes with regularly updated factors these will change regularly with material types, processing methodologies and product development. The evidence base for embedded energy as opposed to Carbon is much less well developed.	As with carbon metrics additional research and development will be required to develop factors for all materials and processes, air emissions to some extent further ahead in this than energy and water, but still behind carbon.	Alternate environmental metrics are emerging in importance, but will seem perverse in use as they will incentivise different activities to those of standard recycling rates.	As with carbon metrics alternate measure of environmental performance but could generate a change in activities in the market incentivising different materials and processes.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Research is ongoing with alternate processing methodologies meaning environmental burdens could be constantly shifting, therefore the most intensive materials now could be reduced with alternate processes in the future.	Avoided energy use is transferable to product markets directly with energy efficiency a core target at national and EU level	Not as holistic as carbon targets in relation to an environmental metric
Avoided water use	5	5	5	6	8	6	6	5
	Similar to carbon metrics in that it needs additional calculation processes with regularly updated factors these will change regularly with material types, processing methodologies and product development. The evidence base for embedded water consumption as opposed to Carbon is much less well developed.	As with carbon metrics additional research and development will be required to develop factors for all materials and processes, air emissions to some extent further ahead in this than energy and water, but still behind carbon.	Alternate environmental metrics are emerging in importance, but will seem perverse in use as they will incentivise different activities to those of standard recycling rates.	As with carbon metrics alternate measure of environmental performance but could generate a change in activities in the market incentivising different materials and processes.	Could be argued favour certain demographics and ruralities but otherwise is a consistent target for all stakeholders	Research is ongoing with alternate processing methodologies meaning environmental burdens could be constantly shifting, therefore the most intensive materials now could be reduced with alternate processed in the future.	Unlike energy and carbon, water not necessarily as well monitored metric in alternate sectors.	Not as holistic as carbon targets in relation to an environmental metric
Illegal waste sites	5	7	4	7	10	8	5	4
	The environment agency are only just getting to grips with this as a metric themselves and have a good grasp of the activity they see, but cannot account for what they do not. So easy to measure, but needs to be interpreted carefully.	As with carbon metrics additional research and development will be required to develop factors for all materials and processes, air emissions to some extent further ahead in this than energy and water, but still behind carbon	Illegal waste activity is currently really understood by those it influences, i.e. business operators and the EA. The EA have data on the activity they see, but the concept of how much of the illegal activity occurring and therefore success is difficult to convey.	Greater regulation of the waste management sector will support a level playing field, but should not be overly cumbersome to restrict innovation	Monitoring illegal waste activity actively improves equity within the sector levelling the playing field for legal operators.	Similar to weight based targets, it would be difficult to see how reducing illegal activity within the waste sector would ever be the targets focus and results in consistent emphasis over time.	Really these are waste sector specific targets which do not compare to broader targets either environmental or material productivity.	A good measure of industry regulation, but should be broadened for illegal events such as dumping and fly tipping

8. Multi-Criteria Analysis

Summary of Findings

- A range of environmental focused metrics have been appraised ranging from carbon, through to air quality, avoided energy and water consumption. Recycling rate performance has historically been labelled as an environmentally focused metric, but on review against metrics such as the Scottish carbon metric, it can be seen to be a poorer reference for environmental performance, with the incentive focussing on chasing heavy materials rather than those with the highest embedded environmental cost. In addition recycling rate targets are waste specific and do not translate well to broader sector environmental or economic targets of GHG mitigation or resource productivity.

- Despite recycling rates being easy to measure and communicate based on the appraisal undertaken, a carbon metric such as that of the Scottish carbon metric (although at additional cost to implement) would be a preferred environmental measure and link better with the natural capital approach being pursued by Defra.

- Weight based metrics should still have a place within the ongoing monitoring and performance of the UK waste industry, but less as an indicator of environmental performance but more as a measure of the industry's performance as a collection, re-use, recycling and waste minimisation entity. As such they may be better placed as tier 1 targets to monitor the performance of environmental service providers and local authorities in fulfilling their role as agents for material recovery.

- Additional targets on producers, such as % recycled content, or material recovery rates will be costly in changing the market dynamics of product design, as well as monitoring and auditing. However, their impact on securing secondary material markets will be a pivotal element in the holistic approach to greater resource efficiency and productivity.

- Circular metrics currently available are extremely useful for business or product specific aims, but are not yet suitable for national targets. A better approach is as in the EU, using a range of metrics which monitor progression to the circular economy.

Mapping Metrics

9. Mapping metrics to stakeholders and behavioural change

- A final approach used in this assessment of alternate metrics has been to reconsider the types of behaviour which the proposed targets will need to influence as part of the waste strategy.

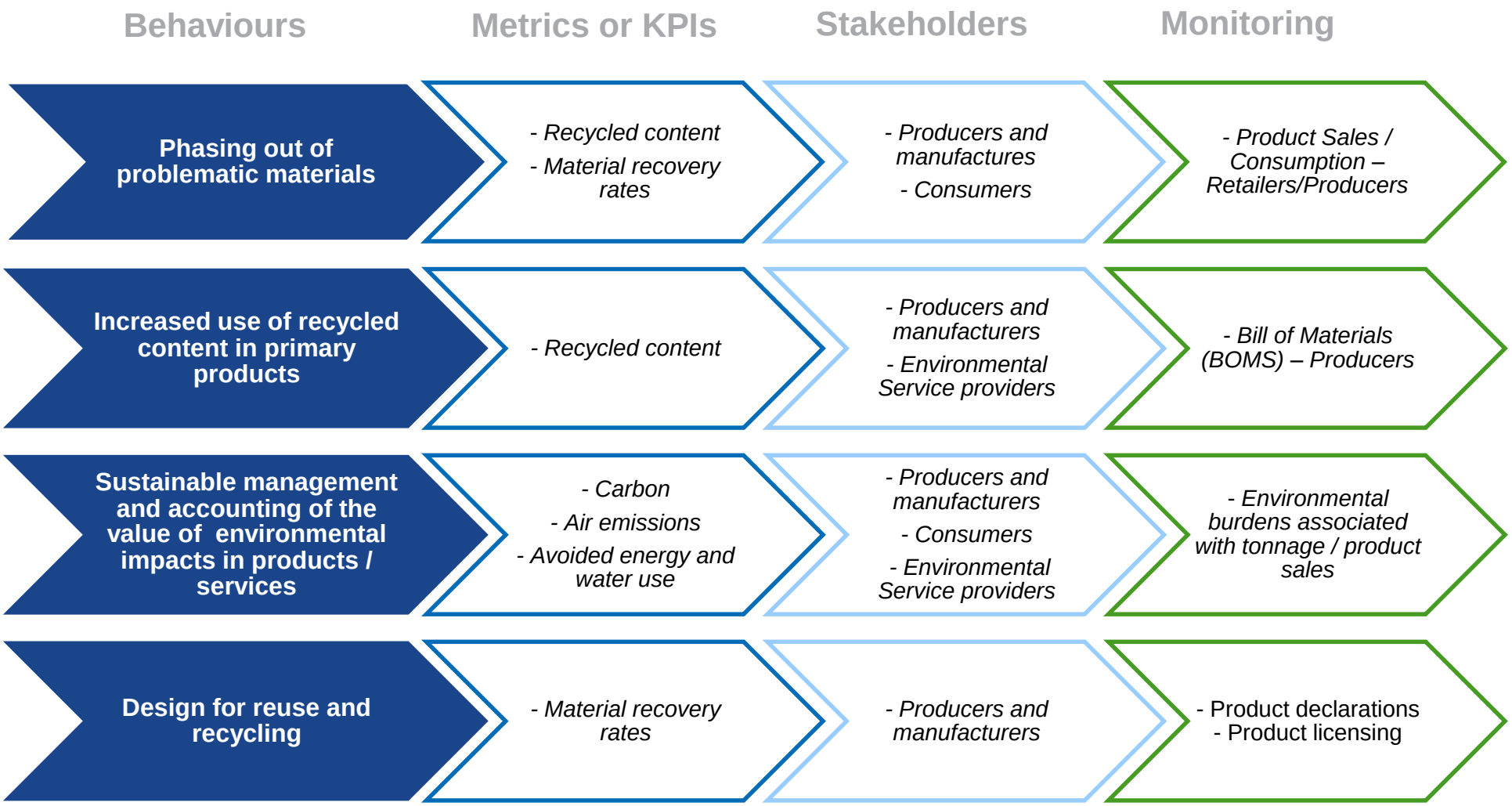
- Each of the behaviours has been identified alongside metrics that could be utilised to best incentivise a change in a stakeholders activities, thus leading to market or behavioural change.

- Each behaviour and metric has also then been paired against the key stakeholder group which it will influence, and the types of monitoring activity which will be required for its utilisation, and where this burden of monitoring is likely to lie. Some of the monitoring highlighted will need to be supported by adequate levels of funding e.g. waste crime activities.

- The results of this analysis have been presented in the following slides followed by a summary.

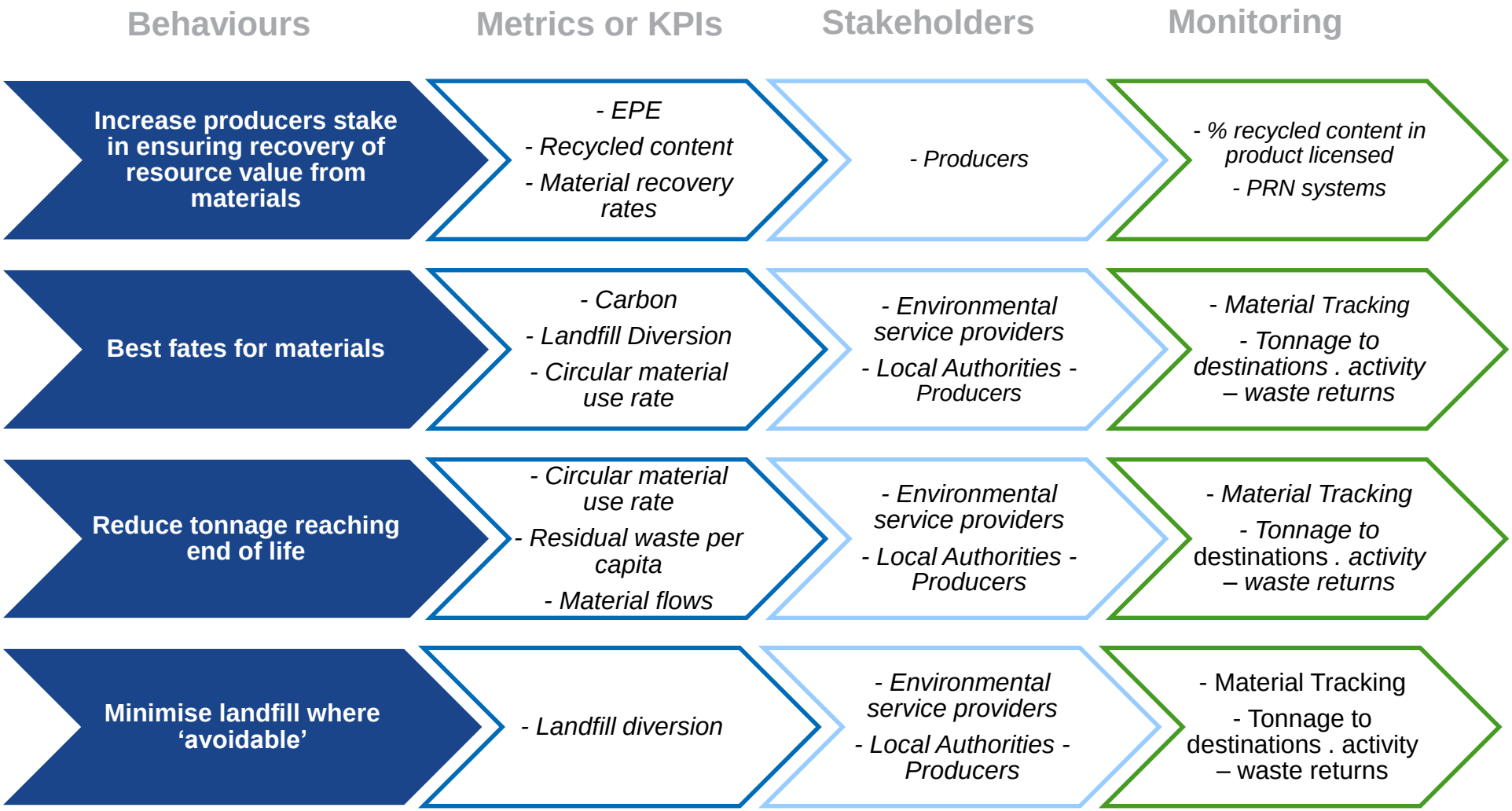
9. Mapping metrics to stakeholders and behavioural change

Impacts and monitoring



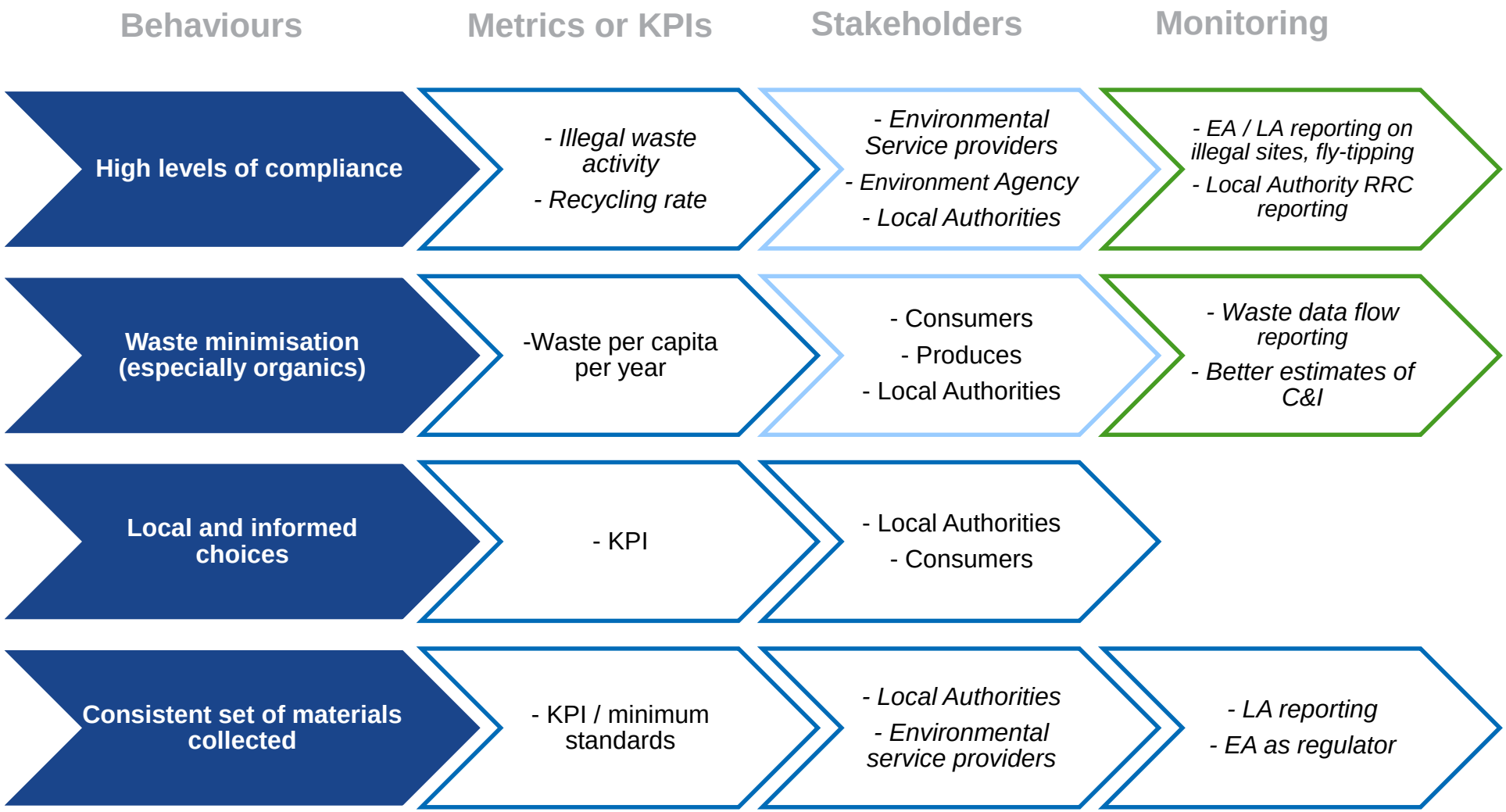
9. Mapping metrics to stakeholders and behavioural change

Impacts and monitoring



9. Mapping metrics to stakeholders and behavioural change

Impacts and monitoring



9. Mapping metrics to stakeholders and behavioural change

Summary of findings

- Based on the behaviour change targeted within the industry to maximise resource efficiency and a shift to a circular economy, **a range of metrics** are required to monitor and incentivise certain behaviours.

- These will need to be targeted at different stakeholders in the industry to ensure **consistent messaging** and direction of travel for the sector as a whole. These targets for individual stakeholders will also need to be designed to be mutually beneficial rather than produce perverse incentives.

- A single weight based metric has done this to a certain extent over the last 15 - 20 years and has been highly successful in diverting waste from landfill and up the waste hierarchy, but **may no longer be the best measure of environmental performance**.

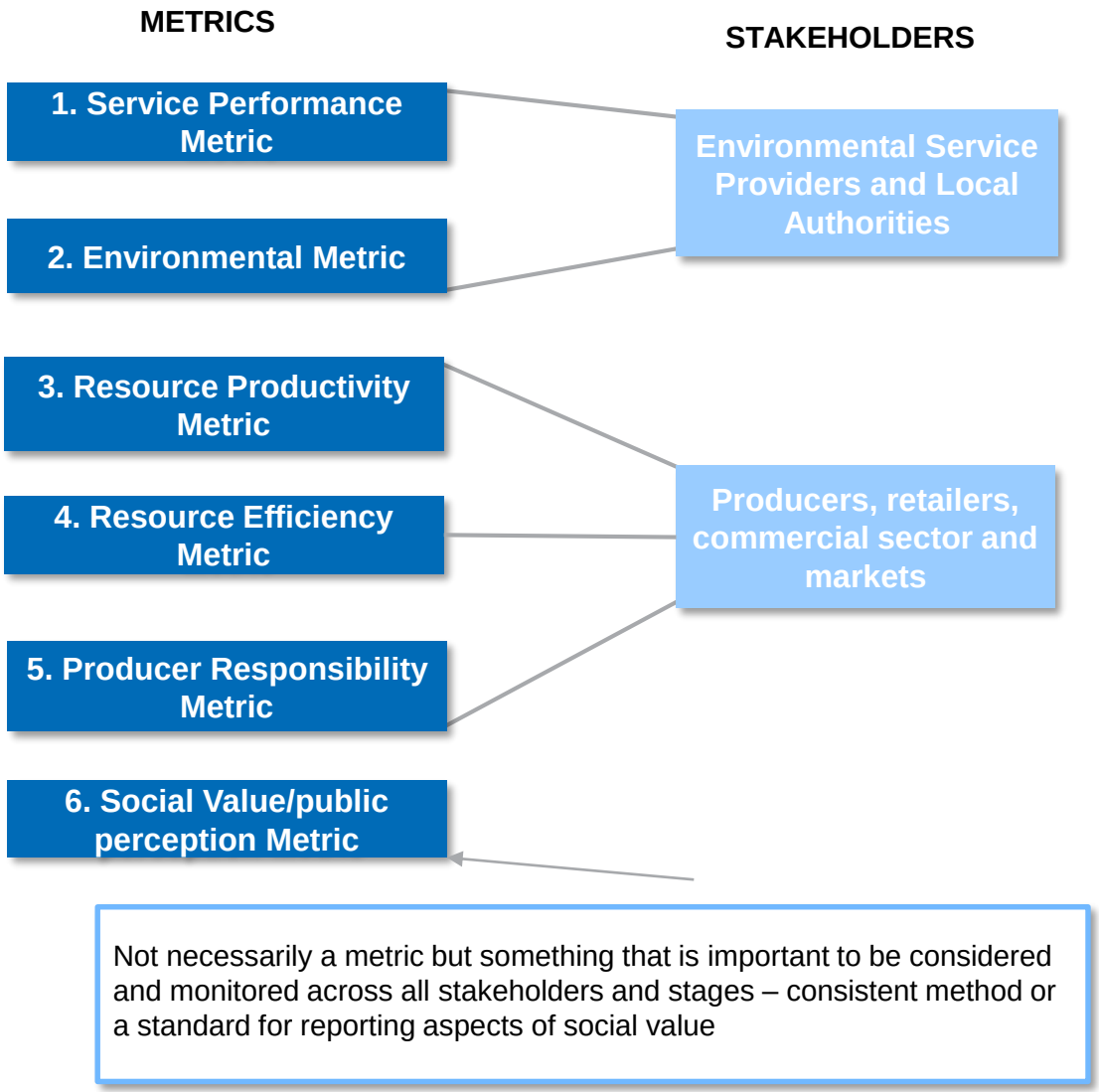
- In addition simple weight based recycling targets **do not help tackle more current issues** of secondary material markets (providing push but not pull forces for the materials markets) whereas a wider set of targets for different stakeholders will help **meet environmental and economic goals** whilst helping to tackle industry barriers, such as ensuring healthy secondary materials markets and increasing the quality of materials used in production.

- Three sets of stakeholders will be key in supporting behavioural changes as well as monitoring performance of specific activities to provide a **whole system solution**. **Local Authorities and Environmental Service Providers** will remain the custodians of collecting valuable resource (in the most environmentally sound way), but this will be aided by greater targets placed on **producers** to design for re-use and recovery with use of recycled content key to securing the value of recycled materials.

- As a result it is anticipated that a dashboard of metrics will be required to provide this whole system approach, such as that already part used by the European Commission for circularity and resource efficiency. This will have **tier 1 targets for stakeholders which will support tier 2 national targets**.

Dashboard Approach

10. Dashboard Approach



MONITORING

- The metrics are measured and reported by the relevant stakeholders and these can have individual targets or standards for differing materials. The environment Agency or "new" environmental regulator could be tasked with ensuring industry compliance with these tier 1 targets and reporting to Defra.
- Collectively the metrics create a holistic dashboard and they can be monitored on a national scale as overall 'performance' by Defra for example. This would not need to be all tier 1 targets monitored individually but rather holistic targets of:
  - Environmental
  - Resource productivity
  - Industry circularity
  - Industry compliance and regulation

11. Short listing of metrics

- Although a wide range of alternate metrics have been researched and appraised as part of the multi-criteria analysis, not all of these will be feasible or best placed to be implemented in the UK.
- A shortlist of both target areas and associated metrics have been selected to generate a streamlined approach to individual target setting at a stakeholder level, but in a way that will lead holistically to a dashboard which will stimulate high level ambitions which Defra and UK government have committed to within the Environment 25 year plan and Industry / Green Growth Strategy.
- Key in developing this dashboard of metrics is not only selecting the best available metrics to support targeted behavioural change, but also the right mix of targets which spread the burden throughout the supply chain and waste management sector in a manner which avoids creating conflicting priorities.
- As such the following slide represents a suggested mix of metrics which could be utilised and how they should be applied in the context of a national dashboard approach.

12. Dashboard of metrics

1. System Performance

- Material capture rates at point of collection
- Residual waste per person per year
- Illegal waste activity using a proxy of illegal waste sites active
- Minimum standards:
  - Consistent collections
  - Contamination rates

Environmental Service Providers
Local Authorities

2. Environmental

- Carbon
- Avoided energy & water use

Environmental Service Providers
Local Authorities

3. Resource Productivity

- GDP per unit of resource (KPI)

Producers (retailers, commercial sector and markets)

5. Producer Responsibility

- % Recycled content aimed at increased producer responsibility
- Material recovery targets on product ranges with problem or scarce materials

Producers (retailers, commercial sector and markets)

4. Resource Efficiency

- Circularity and secondary material use
- Current recycling target

Producers (retailers, commercial sector and markets)

6. Social Value/public perception

- Public satisfaction surveys
- Social justice / equality

Not necessarily a metric but important to consider across the value chain

12. Dashboard of metrics

A dashboard of metrics however, d**oes not necessarily mean a dashboard of binding targets**. To have a range of binding targets is unlikely to provide the direction required, particularly given there may be conflicting pressures between existing CEP targets and new environmental metrics.

But equally the current recycling rate position represents a single binding target, which **does not provide flexibility** over time to tackle emerging market trends or concerns.

As such, use of a dashboard of metrics should allow **monitoring of behaviours** with the ability to either set binding targets to change behaviour, provide KPI's for performance improvement, or set minimum standards which feed into the achievement of more holistic targets national led targets (see slide "overarching monitoring approach").

For example, Material capture rates and recycling performance could be a set of **guidelines backed up by KPI's and league tables** to **incentivise performance** but not conflicting with binding targets of overall environmental performance.

In this regard Local authority burdens in particular are not hugely different to how they are now in monitoring and reporting on a weight based approach, but importantly, represent **moving away from the ethos of overall recycling targets**, to **material specific** monitoring and environmental performance.

12. Dashboard of metrics

The dashboard of metrics also allows for the **spreading of behavioural change throughout the supply chain** with the potential to set additional KPI's on producers and environmental service providers alike.

The addition of producer responsibility related **targets**, such as minimum recycled content and material recovery rates, will not only ensure their appropriate contribution to resource recovery, but also help develop secondary material markets, and secure aims of resource productivity are sustainable. In particular producers placing any products onto the market which contain problem materials that cannot easily be recycled could attract targets to reduce these materials, with a sliding scale of costs applied to enable suitable resource recovery. Material substitution activities would help to support transition to a circular economy.

Conversely to current recycle at all costs targets, a dashboard approach should be developed with **flow down from national targets**. For example,

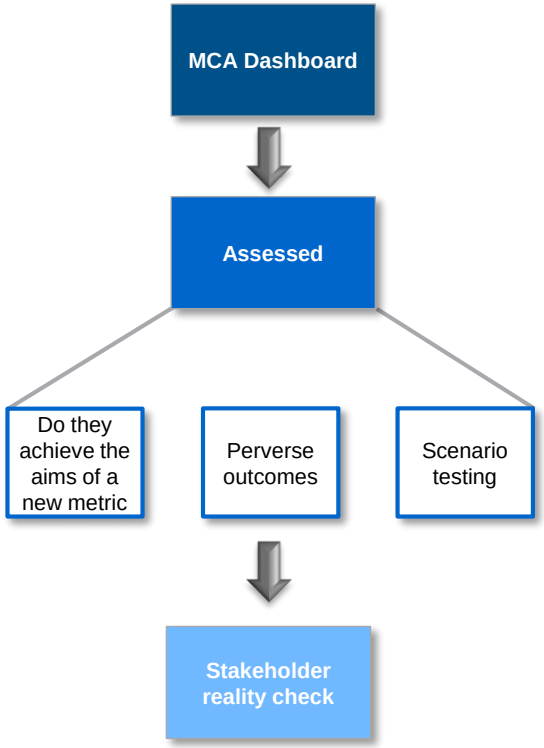
- Do we have a carbon reduction ambition for the waste management sector?,
- Double our resource productivity by 2050

The burden of this would flow down to local authorities and throughout the supply change to help incentivise development towards these key targets across all elements of the supply chain.

Targets therefore could represent **a 2% carbon reduction per year** for Local Authorities (*burden on Local Authorities and their service providers*), Material specific capture rates for plastics and metals would aid material productivity, supported by minimum recycled content targets (a push and pull through the value chain).

13. Dashboard Feasibility

Metric Mapping



Are multiple metrics compatible?

- Environmental metrics based on carbon may not always be directly compatible with legacy weight based targets but can be effectively monitored concurrently.
- Likewise targeting effective collection services alongside improved producer responsibility should lead to both greater environmental and recycling benefits.
- Other metrics will be better monitored in isolation, such as the effective regulation of the waste management sector, but this is not to say it Is not compatible with a broader dashboard, with the combined influence of the targets leading to the best environmental and economic outcomes.

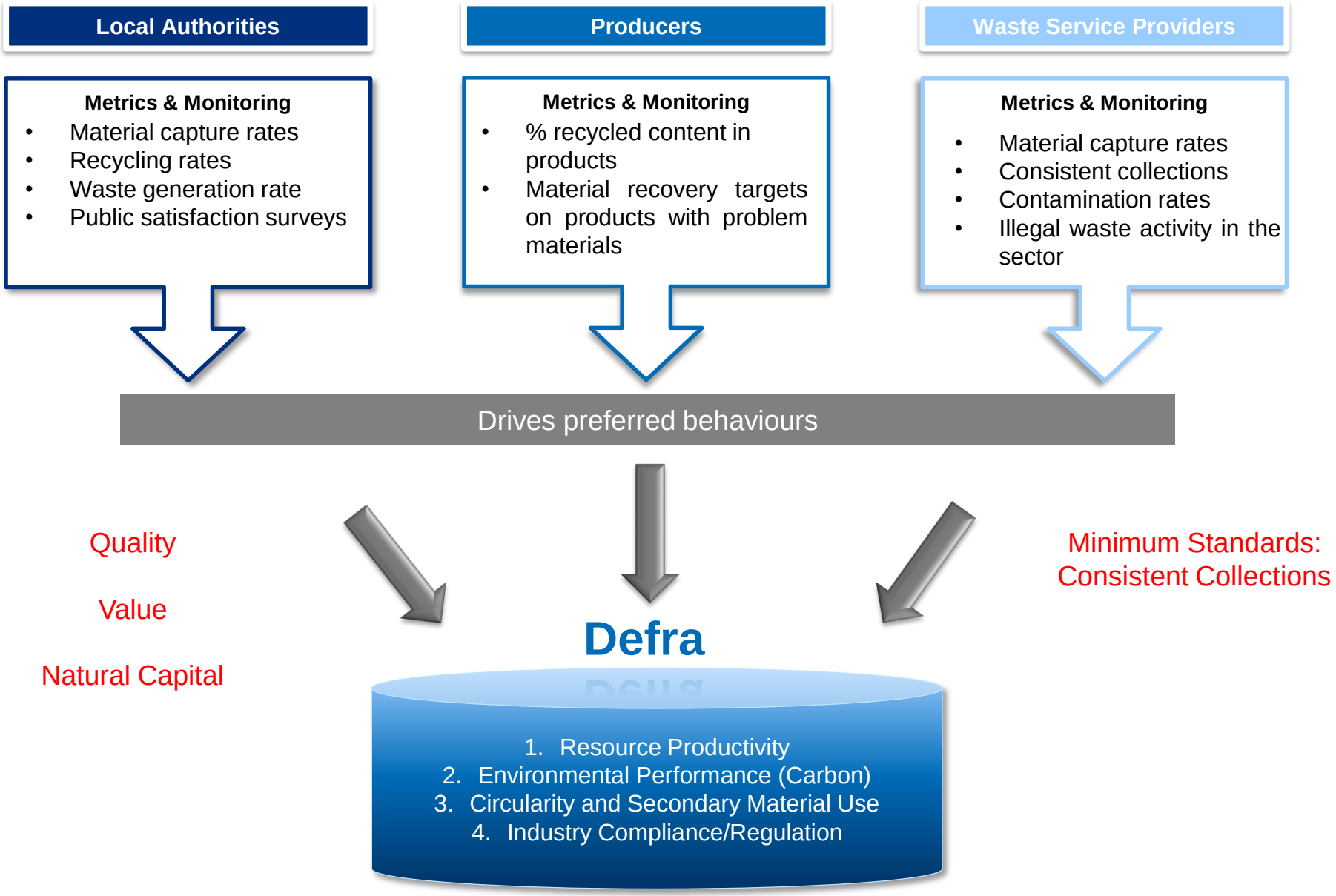
Do they achieve the aims?

- Targeting a range of stakeholders with bespoke targets should result in a holistic approach to achieving goals.
- Development of alternate metrics for different stakeholders should also be mutually beneficial in achieving a combined set of targets rather than isolating individual responsibilities.
- For example, recycled content targets for products, combined with targets for arisings and capture rates at the kerbside should lead to both improved environmental performance, greater circularity and higher resource productivity.

Are there perverse outcomes?

- Other than a need to re-align capture rates and recycling targets with those of environmental performance (to stop chasing the weight), there appears to be be limited perverse incentives created by the set of metrics proposed, however the metrics should be kept clearly under review to ensure that the targets drive the right behaviour and minimise unintended consequences.
- This possibility of perverse incentives could be remedied by making recycling targets and capture rates material specific, with the proportion captured (and therefore prioritisation of materials recycled) aligned with the environmental burdens of specific material streams.

14. Overarching Monitoring Approach



15. Transition to a new approach

Just as important as having an overarching framework for monitoring of performance towards overarching sector goals is maintaining a coherent reporting methodology.

In the immediate future the majority of the metrics proposed can be reported using **existing systems,** as fundamentally the driving force behind them is weight driven.

For recycling targets the focus should be **splitting reporting of dry recyclates** and **organics**, with food waste reported separately where possible. This will allow decisions to be made on the fate of materials against the best environmental outcome. Landfill diversion (zero MSW to landfill) would remain a priority. Decisions around food waste collection and treatment could be based on local circumstances which may include Energy from Waste, Anaerobic Digestion or use as a feedstock or added value chemical within a biological loop system as part of a circular economy approach.

Secondary levels of analysis can be overlaid to understand the carbon embedded in the existing schemes, enabling these to work alongside inventories at a national level for carbon management.

It is likely to take longer however to progress to both the materials specific monitoring and the additional burdens on producers, as these will require fundamental changes in reporting frameworks and product design.

This extension should still be a key priority within the **5-10 year timeframe**, as the links between understanding material flows, rather than waste flows, is key to the circular economy transition.

15. Costs of transition and Additional Burdens

Local Authorities and Environmental Service Providers:

- Short-Term – Metrics and Monitoring will remain fundamentally weight based with additional analysis applied as a secondary step (carbon analysis)
- Medium to Long-Term - There is a need for additional material specific monitoring which will need a methodology for more regular waste composition analysis and reporting of this into a central system. This will come at additional cost in order to conduct the analysis and analyse and report the data

Producers

- In the short / medium / Long term – additional producer responsibility metrics may not be introduced until 5 – 10 years however, there will need to be significant investment in preparation with the need for product redesign and capacity for capture and recovery of materials.
- Products containing problem materials should attract a cost of recovery charge which will support management and reprocessing. The charge should also drive investment into product redesign and methods to recover and reuse key components
- Increasing domestic reprocessing should be a priority. We currently export much of our low quality materials but the best treatment route for this may be EfW depending on composition. We need to drive manufacturing within the UK by demanding recycled content so that we can capture high quality materials for reuse and recycling.

National Government and Regulators

- Post Brexit, regardless of the targets utilised there will need to be significant extra resource invested in the waste management sector. This will be enhanced by the need to feed down national analysis into industry target setting.

16. Summary

- For many years, weight-based targets have been utilised both to set targets for the diversion of waste from landfill, to judge and compare the performance of local authorities and to identify best practice examples for ‘low-performing’ authorities to aspire to.
- However, it has become apparent that this methodology fails to measure the true environmental impact of the waste services provided by Local Authorities and their private sector Environmental Service Providers.
- A further limitation of weight-based targets is the lack of analysis of the nature of the materials collected and the true impact of diverting them from the residual waste stream. The bluntness of the ‘recycling target’ approach has led to councils to "chasing" the heavier waste materials with little consideration of the actual environmental benefits of collecting some of those wastes.
- A moments thought suggests that home composting is more beneficial than collecting garden waste in a fleet of HGVs and transporting it to a reprocessing facility. This is one simple example of the perverse behaviour weight-based targets can engender. If we are to move to a more sophisticated approach to identifying beneficial methods of waste management, we need to understand the full implications of our actions.
- The first step is to widen the examination to encompass the ‘whole product life’ approach to product management. Weight-based targets have encouraged a simplistic approach based on collecting materials from householders once they have become waste, with little consideration of the relative impact of each element of the waste stream, other than how much it weighs or what value it has as a secondary material.
- The increasing drive towards both a circular and a low carbon economy provides an opportunity to develop a more modern approach to assessing the environmental performance of waste management solutions whilst also exploring the ‘waste’ material that requires collection.

16. Summary

- From a waste collection perspective, the waste to be managed is presented by householders or businesses. But where does this waste come from, and what decides its relative value (positive or negative)? Ultimately, the value of a product, item or material is defined at the point of manufacture. If the item is created from recyclable material, a process can be developed to return the item to a process which enables its remanufacture into further useful products
- A simple example is the glass bottle; the nature of its manufacture means, provided it can be collected in a manner which keeps it free from contamination, it can be recycled into more glass bottles. A circular process. The Dairy Roadmap (http://www.dairyuk.org/images/publications/The-Dairy-Roadmap-2018.pdf) also provides a good example of supply chain collaboration and driving both a push and pull through the value chain through the utilisation of recycled content within HDPE milk bottles.
- However, the growth of consumer expectation, logistic chain savings, product protection and life extension and sophisticated marketing over the last half-century has led to the design and manufacture of consumer goods becoming increasingly complex; goods are manufactured from a range of materials, with plastic containers containing multiple polymers, ‘wood’ actually containing a variety of board-based contents, and goods and packaging containing an exotic, but inseparable, mix of materials to ensure their marketability.
- If the waste industry can only collect what is presented to it, then the manufacturing (and retail, packing, filling and marketing) sector must bear responsibility for maximising the beneficial use of post-consumer waste.
- A circular economy requires product design and manufacture to facilitate and maximise the maintenance of the usability of product. This means that Producer Responsibility is a key aspect of any move to a more sophisticated metric for environmental performance. We have thus defined Key Stakeholders as those who have the greatest ability to refine their activities to reflect the revised priorities identified by the use of alternative metrics.

16. Summary

- The literature review carried out for this Project has identified a range of potential metrics, which can identify differing environmental behaviours and have the potential to enable a clear understanding of the over-arching environmental impacts of differing approaches to the waste life-cycle (from manufacture to ultimate recycling, reuse or disposal). This research was combined with the outcomes from both the Stakeholder meeting and discussions with stakeholders currently involved in data recording and reporting.
- A Multi Criteria Analysis (MCA) was conducted to filter the long list and identify a short list (dashboard) of appropriate metrics to be assessed and compared against the current weight based target approach. Each metric was scored against several different criteria, as identified by stakeholder feedback and weighted to indicate its importance from stakeholder's perspective.
- The results of this exercise were summarised, with a focus on a methodology which enables the identification of the environmentally best options for managing different material streams. The output also considers the practicalities of how we could transition to this over time.
- The metrics chosen are specific to the role played by the stakeholders who will be responsible for them. In themselves, each metric identifies environmental performance; this provides the opportunity for targets to be set against each metric, providing a tool to incentivise environmental impact.
- Whilst this approach focusses on the development of an overarching framework for the monitoring of performance towards individual (but co-dependant) sector goals, the majority of the metrics proposed can be reported using **existing systems**, ensuring that a coherent reporting methodology can be maintained, with secondary levels of analysis able to be overlaid to provide a greater depth of understanding of the carbon embedded in the existing schemes.

16. Summary

- This provides the opportunity for a staged transition to the use of the new metrics. However, whilst central Government appears to recognise the limitations of the current weight-based indicators, it will need to develop a range of policies and legislative levers to enable the over-arching environmental benefits or impact of the alternative metric approach to be effective.
- The Government's current focus on the environmental outcomes envisaged by current and emerging policies, including the Government's 25 Year Environment Plan, the EU's Circular Economy Package and current proposals for Extended Producer Responsibility and Deposit Return Schemes are encouraging, but thus far rely on consultation and voluntary agreements rather than the introduction of statutory methodologies or targets.
- The evidence-based nature of this Report, and the support of the Waste industry may assist in driving this agenda forward in a manner which encourages a policy approach which recognises the need to identify and prioritise the best environmental option for each material stream, enabling more holistic decisions to be made regarding the prioritisation of materials for recycling and reuse. With further appropriate policies and targets for the manufacturing industry, the inherently circular nature of municipal recycling can be enhanced and incentivised.
- Ultimately, this will result in better informed consumption decisions by consumers, joining the circle of product life-cycle through a clear, easy to understand set of indicators which empower their purchasing decisions.

17. Our Recommendations

The ESA has commissioned this report to explore the potential benefits of using metrics other than our current weight based measures for municipal waste. The report explores the evidence for alternative metrics and proposes metrics for different materials and/or management models which could potentially replace our existing system, and the timeframe over which this could be introduced.
The current weight based targets for municipal waste have been useful in driving performance to date but can create perverse behaviours. Recycling isn't necessarily the best environmental option for each material stream.

- Environmental performance should be measured across the whole value chain. A systems approach should be used, as each activity does not happen in isolation. Carbon analysis currently provides the most robust and easily communicable alternative, and is already used for national climate change mitigation policy planning.
- A **dashboard of metrics** would allow different actors across the value chain to play their part in improving the environment. This allows for additional metrics monitoring manufacturers' and producers' contributions to the transition to the circular economy.
- A dashboard approach does not necessarily mean a dashboard of binding targets. It should allow monitoring of behaviours with the ability to either set binding targets to change behaviour, provide KPI's for performance improvement or set minimum standards which feed into the achievement of more holistic national targets.
- Any metrics implemented should be regularly reviewed to understand whether they remain 'fit for purpose', are easy to measure and report and have not created any perverse outcomes in behaviour such as utilising a less favourable environmental outcome or criminal behaviour.

Everyone has a responsibility to improve environmental performance, from the producers of the goods we purchase to the local residents, businesses and public-sector organisations that consume them and the waste management professionals that manage them at end of use and end of life.

We need to establish smarter measures for our transition to a circular economy and understand what behaviours are required across the value chain (production, consumption, end of use and end of life) to drive this transition

17. Our Recommendations

Proposed Dashboard of Metrics

1. System Performance

- Material capture rates at point of collection
- Residual waste per person per year
- Illegal waste activity using a proxy of illegal waste sites active
- Minimum standards:
  - Consistent collections
  - Contamination rates

Environmental Service Providers
Local Authorities

2. Environmental

- Carbon
- Avoided energy & water use

Environmental Service Providers
Local Authorities

3. Resource Productivity

- GDP per unit of resource (KPI)

Producers (retailers, commercial sector and markets)

5. Producer Responsibility

- % Recycled content aimed at increased producer responsibility
- Material recovery targets on product ranges with problem or scarce materials

Producers (retailers, commercial sector and markets)

4. Resource Efficiency

- Circularity and secondary material use
- Current recycling target

Producers (retailers, commercial sector and markets)

6. Social Value/public perception

- Public satisfaction surveys
- Social justice / equality

Not necessarily a metric but important to consider across the value chain

17. Our Recommendations

Transition

Local Authorities and Environmental Service Providers:

Short-Term – Metrics and Monitoring will remain fundamentally weight based with additional analysis applied as a secondary step (carbon analysis)

Medium to Long-Term - Additional material specific monitoring – waste composition analysis, results to be reported centrally. This will come at additional cost in order to conduct the analysis and analyse and report the data.

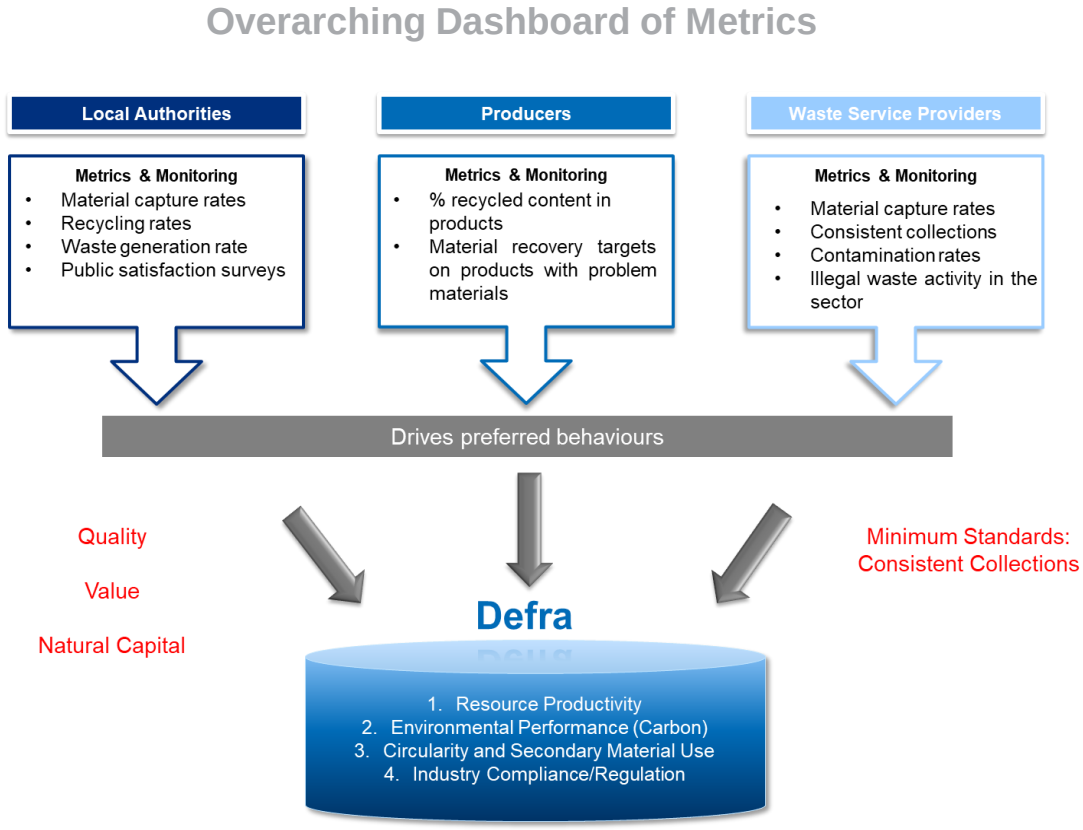
Producers:

In the short / medium / long term – additional producer responsibility metrics may not be introduced for 5 – 10 years; however, there will need to be significant investment in preparation, with the need for product redesign and capacity for capture and recovery of materials.

- Products containing problem materials should attract a cost of recovery charge which will support management and reprocessing. The charge should also drive investment into product redesign and methods to recover and reuse key components
- Increasing domestic reprocessing should be a priority. We need to drive manufacturing within the UK by demanding recycled content.

National Government and Regulators:

- Post Brexit, regardless of the targets utilised, there will need to be significant extra resource invested in the waste management sector. This will be enhanced by the need to feed down national analysis into industry target setting.



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London, EC3N 2LB
Telephone: 020 7977 4800
www.milessmith.co.uk
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Why Wait? Weight isn't working

Smarter measures for the circular economy

Annex

- Methodology
- Literature Review
- Stakeholder Feedback
- Behaviour Mapping

Methodology

3. Project Methodology

Literature Review

Our Approach

Ricardo's team reviewed the impact of the current waste based targets, and have provided a commentary on the material streams for which they drive irrational or poorly researched actions that do not support the best environmental impacts. Following this, available alternative options were reviewed i.e. carbon-based metrics or life cycle approaches. Recommendations were made regarding how these could be best applied for all or potentially a small number of material streams. This includes feedback and findings of a local authority workshop Ricardo Energy and Environment ran at the North London Waste Authority Waste Prevention Exchange which looked at the potential for alternative metrics in a post Brexit environment.

Following the literature review, a list of potential alternative metrics that could be considered was identified.

Key things to consider

- Impact of current waste based targets?
- Review of alternative options
- List of metrics to assess

3. Project Methodology

Stakeholder Feedback

Our Approach

As recommended, consultation with stakeholders for their views on alternate metrics took place during the afternoon of Monday 26th February, in a workshop format. The feedback also consists of planned stakeholder interviews, along with existing feedback from Local Authorities concerning potential metrics. We have also drawn discussion points from projects with organisations such as Zero Waste Scotland where we have worked extensively to develop alternate metrics such as a carbon metric. Furthermore, we have considered and reflected on feedback from both Local Authority officers and their private sector partners, as they are responsible for collating, recording and reporting data to comply with current reporting requirements.

Key things to consider

- Feedback from workshop
- Feedback from interviews
- Feedback and knowledge from project work
- Feedback from stakeholders who work with data and reporting
- Answers to the questions we set out to ask?

Key questions for stakeholders included:

- What metrics they're aware of that are currently in use?
- What their preferred metric might be and what makes a 'good' metric?
- What practicalities need to be considered if an alternate metric were to be considered including ease of implementation?
- What's important in a metric both in terms of driving performance and the cost and resource requirements for gathering and reporting data?
- Whether they would still gather and report data using a weight based approach if an alternate non-weight based metric were in place?
- What unintended consequences might result from introducing new metrics?
- What influence will the CEP have and how will the move towards a Circular Economy change the metrics we measure over time?
- Should metrics such as social value be considered?
- Over what timescales should the transition to a new metric be considered?

3. Project Methodology

Environmental Performance Analysis

Our Approach

To understand what the best environmental outcome for each material is, we have measured environmental performance using a Life Cycle Analysis approach, utilising the WRATE analysis tool. WRATE operates on a systems basis. It has set parameters for each potential treatment and disposal option. It will indicate what the environmental outcome will be of treating an amount of waste using a certain treatment option. We have used the tool to assess, for each material stream, what the best environmental option is for dealing with it.

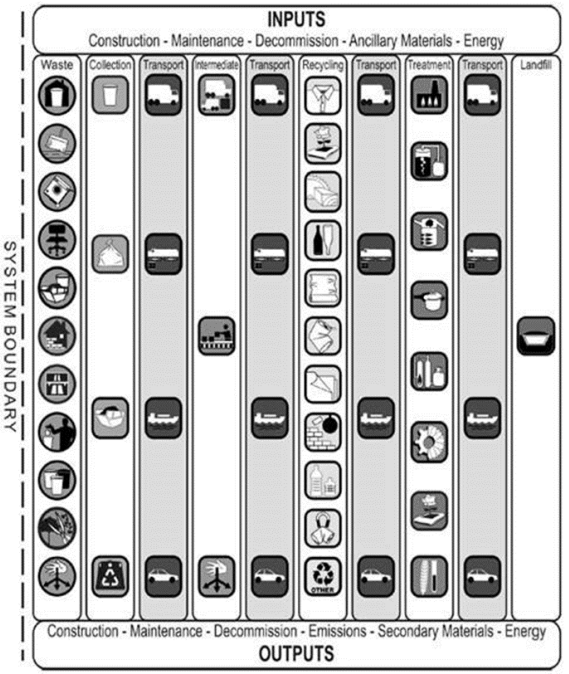
Common materials (recyclates) will be measured against the following metrics:

- ARD (abiotic resource depletion)
- Carbon metric (GWP)
- Acidification
- Eutrophication

Other metrics that have be considered include local air pollution (particulates), natural capital (in line with the 25yr Environment plan), water use and energy (although this could be a proxy for carbon).

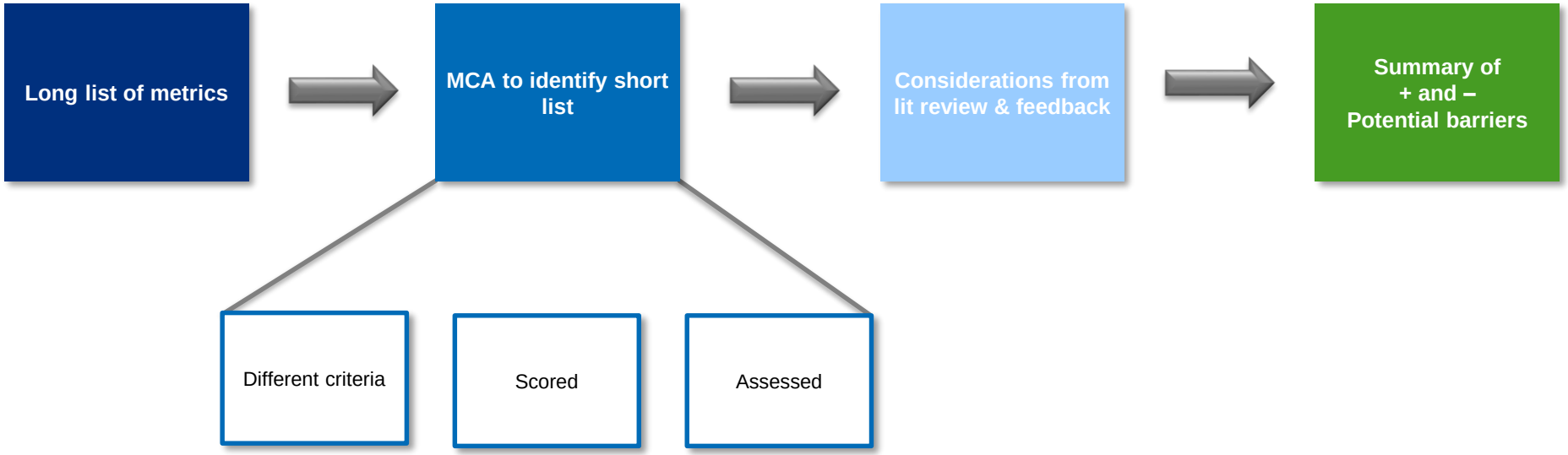
This analysis will only consider what arises and will assume that waste prevention is the best environmental option for all materials.

The output of the Environmental Performance Analysis is in the form of a summary table, which provides the results by material stream against each of the chosen metrics.



Multi-Criteria Analysis – the methodology

From the literature review and the stakeholder feedback we developed a long list of potential metrics to consider. A Multi Criteria Analysis (MCA) was conducted to filter the long list and identify a short list which will be assessed and compared against the current weight based target approach. Each metric is scored (1-10) against several different criteria, as identified by stakeholder feedback. Each criterion is weighted to indicate its importance. For example, ease of implementation may be weighted more highly than frequency of reporting. The shortlisting process is a qualitative approach that considers criteria that have been developed from the feedback and literature review. The results have been summarised to present the overall positives and negatives of each of the proposed alternative metrics and any potential barriers to adoption.



3. Project Methodology

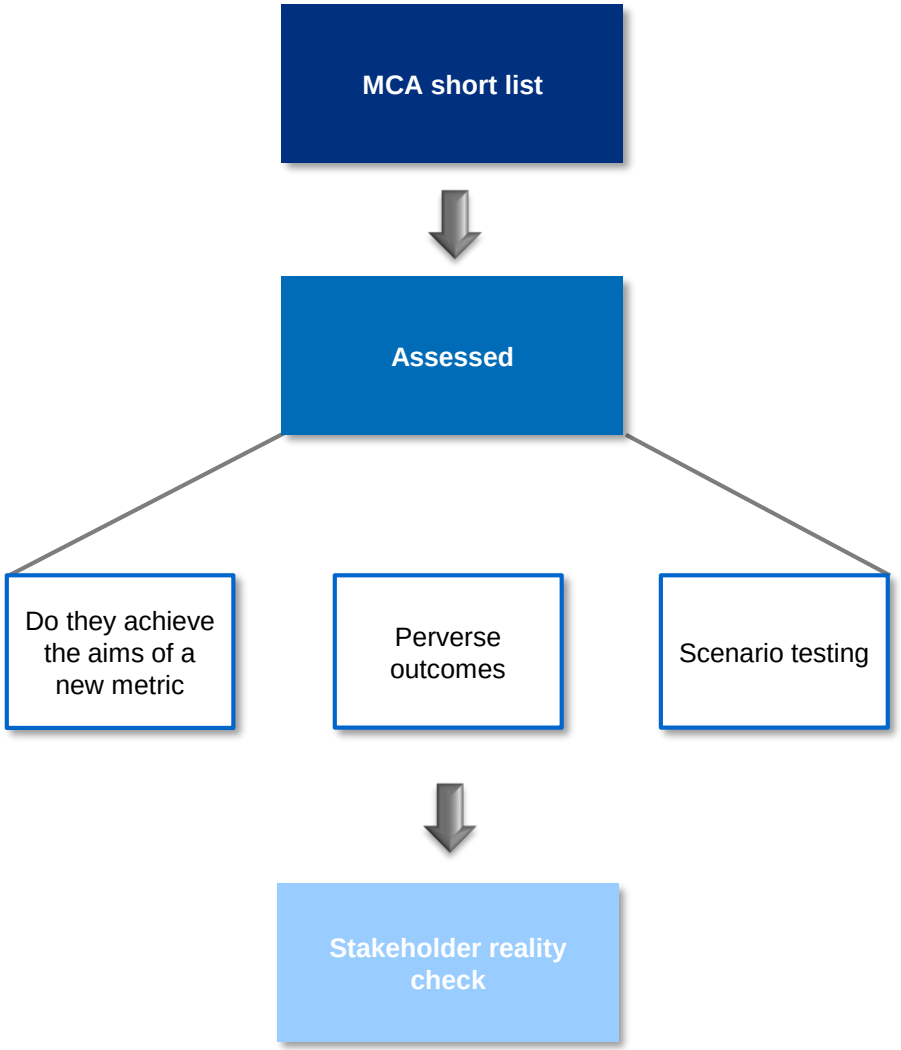
Metric Mapping

Evaluation of metrics against EPA

As part of the evaluation process the potential alternate metrics that have been shortlisted and assessed as part of the MCA, are mapped against the results of the Environmental Performance Analysis to check whether they achieve the headline aims for a metric.

This mapping process helps to identify whether there are any potentially perverse outcomes associated with the adoption of a metric e.g. do the high scoring metrics enhance environmental performance? Simple scenarios isolating individual materials streams are reviewed to 'test' the results, accompanied by discussion with relevant stakeholders to reality check our assumptions.

Metric Mapping



Literature Review

Literature Review

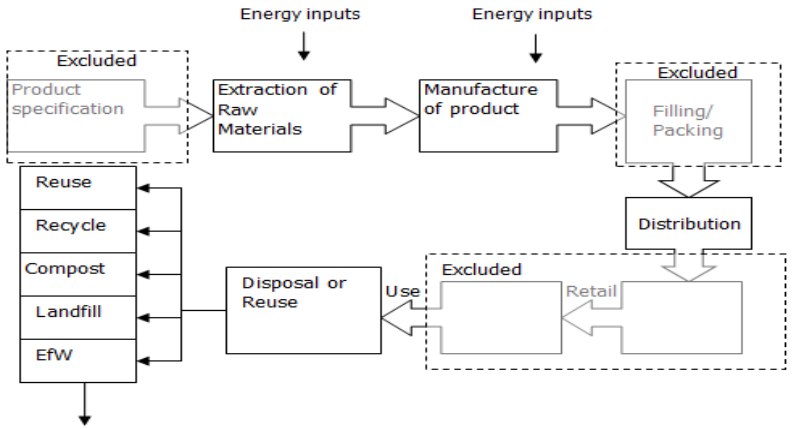
Carbon Metrics

The Scottish Carbon Metric

The Scottish Carbon Metric Final Report (2011)

1. Purpose of the Indicator or Metric

- A tool developed by Zero Waste Scotland (ZWS) in 2013 to support the requirement to reduce the environmental impact of waste through the application of the waste hierarchy, as set out in the Scottish Zero Waste Plan in 2010.
- Intended to be used to assess recycling performance in Scotland and to be used alongside the tonnage metric as a performance measure.
- Measures the whole-life carbon impacts of Scotland's waste, considering the environmental impact of a range of emissions from extraction, processing, manufacturing, transport and disposal.
- Allows the environmental impacts of alternative waste management options for materials and products to be considered alongside tonnage.



'No single indicator can holistically cover environmental impact, and for different materials, different environmental factors will be the dominant concern.' (p12)

2. Method

- Comprises a ranked list of weightings for materials and products that is based on the relative environmental impact, created using Carbon factors for relevant life cycle stages or each material.
- Life Cycle Analysis (LCA) is used to quantify the environmental impacts associated with over 30 different materials.
- The overall approach is based on Life Cycle Thinking which incorporates the basic approach of LCA without requiring a detailed assessment of each product or process.
- Relies on climate change as an indicator of environmental impact, climate change is a proxy for other environmental indicators.
- Reported as kilograms of carbon dioxide equivalent per tonne (kg CO2eq/tonne)

Benefits	Cons & Costs
1. Covers the whole supply chain	1. Not as translatable to LAs or the general households
2. Carbon is a well established proxy for environmental impacts	2. Requires an additional step beyond weight-based reporting
3. Simply measured using weight x carbon factor	3. Requires regular updates to carbon factors
4. Can compare and equate carbon to other equivalents i.e. trees/cars/flights etc.	

Literature Review

Carbon Metrics

Recycling Carbon Index

1. Purpose of the Indicator or Metric

- Analysis to monitor environmental performance of recycling and separately collected organics from local authorities.
- Intended to be used to assess recycling performance on a carbon basis and used alongside the tonnage metric as a additional performance measure.
- Considers the potential environmental savings achieved through greater recycling of MSW.
- Allows the environmental impacts of recycling each material o be considered against each other and against tonnage.

2. Method

- It takes the quantity of dry recyclables and separately collected organic materials, alongside their end destination (just recycling and composting) generating the carbon savings resulting from avoided disposal. This is communicated in tonnes or kg of CO2 equivalent, savings being expressed as a negative.
- Unlike the Scottish metric however this does not include carbon associated with residual waste and end disposal i.e. landfill, EfW, or other residual treatment. As such this does not present the whole picture of how an authority can aim to reduced carbon associated with their solid waste management system.

League tables

A number of league tables using this approach have been developed and presented, including analysis on geographical and social profiles.

Local Authority feedback has been encouraging about the approach but the lack of detail has left some Authorities wanting to understand why they are performing/ranked in such a manner.

Benefits	Cons & Costs
1. Carbon is a well established proxy for environmental impacts	1. Not as translatable to LAs or the general households as recycling rate but carbon is well understood
2. Simply measured using weight x carbon factor	2. Does not cover waste disposal
	3. Requires an additional step beyond weight-based reporting
	4. Requires regular updates to carbon factors

Literature Review

Carbon Metrics

Ricardo Carbon League

Ricardo-AEA launches new comprehensive carbon league tables *(article at R&WW Article)*

- Ricardo Energy & Environment developed the first full UK Local Authority Waste Management Carbon League Table, in 2015.
- The article highlights that the weight-based targets encourage councils to 'chase' the heavier waste materials such as garden waste, despite the arguably marginal environmental benefits of collecting some of these wastes.
- As shown in the table below, the rankings based on carbon and recycling, in many cases vary significantly. This shows that an authority's ranking does not reflect the true 'environmental strength' of its waste management services. It is suggested that a better reflection of any environmental benefit is better represented if tonnages are converted into Global Warming Potentials according to fates of materials.

Local Authority	Country	UK carbon rank	UK recycling rank	Difference
South Oxfordshire	England	1	2	1
Vale of White Horse	England	2	3	1
Denbighshire	Wales	3	4	1
Bexley	England	4	107	103
Wigan	England	5	102	97
East Hampshire	England	6	315	309
Northumberland	England	7	222	215
Barnsley	England	8	230	222
Calderdale	England	9	177	168
Milton Keynes	England	10	66	56

Method

- The carbon tool uses tonnage data from WasteDataFlow and National reports, the weight of waste by material going to each fate (reuse, recycling, composting, energy recovery and landfill) is recorded.
- Each weight is multiplied by the relevant carbon emission factor for that specific material and waste management options (derived from primary sources such as the Scottish Carbon Metric or using specialist lifecycle software).
- The contributions from each material fate are summed and divided by the total tonnage handled thus providing an overall Average Emission Factor (AEF) for each council.
- In summary the AEF is an indicator of how much CO_2 has been produced for each tonne of waste handled expressed as kg CO_2e per tonne of waste.
- The main difference between this method and other carbon tables is that this method included the fate of residual waste.

Key points learned

- *Reuse is important and makes a big difference, for example the emission factor for reusing textiles is nearly twice that of reusing aluminium.*
- *Avoiding landfill is also important as the majority of UK authority waste is sent for recovery of landfill, additionally the residual treatment options need to be considered as in this case energy from waste has savings in CO_2e in comparison with landfill which contributes significantly to CO_2e kg/t.*
- *It is suggested that carbon is a sound measurement method given that carbon is often a proxy for wider environmental impacts..*

Literature Review

Carbon Metrics

National Indicators

NI186 per capita reduction in CO2 emissions in LA area

Rationale:

- Local authorities (LA) are uniquely placed to provide vision and leadership to local communities by raising awareness and to influence behaviours.
- Indicator relies on centrally produced stats to measure end user CO2 emissions in the Local area

Descriptor:

Authority Area: An annual amount of end user CO2 emissions across a set of sectors (housing, road transport and business) that is measured as % reduction (or increase) of the per capita CO2 emission from the 2005 baseline year.

*End user: The C*alculations allocate emissions from fuel producers to fuel users. Therefore it allows estimates to be made of emissions for a consumer of fuel, which also include the emissions from producing the fuel the consumer has used.

*Domestic Housing: This includes a*ll housing in the LA area, including Arms Length Management Organisation (ALMOs), privately owned and leased housing.

*Business: I*ndustry and commercial emissions, including public sector, but not those included in the EU Emissions trading scheme

Road Traffic: All road traffic, (but excluding motorways).

Commentary

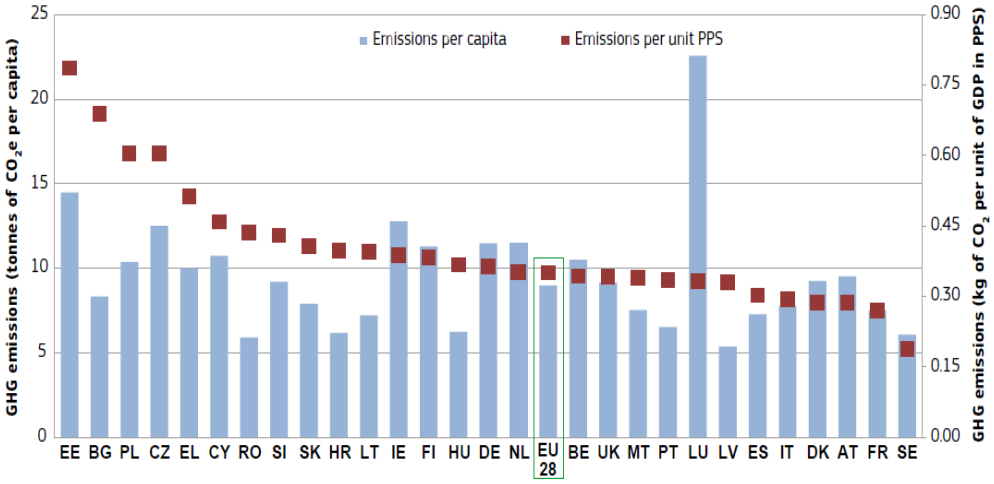
Not centred on waste management activities and level of detail insufficient to allow appropriate metric for waste activities.

EU Resource Efficiency Scoreboard 2015

Within the second-tier dashboard of indicators for resource efficiency, carbon is a sub theme of which an indicator is GHG per capita. This indicator shows the man-made emissions of the 6 GHGs defined by the Kyoto protocol. These include 1) carbon dioxide 2) nitrous oxide 3) methane 4) and the F-gases.

The indicator includes the emissions released during production of products for export, however it does not include those emissions associated with goods manufactured and imported into the EU. Also excluded are emissions from international aviation, maritime transport, land use, land-use change and forestry, use of biomass. The figure shows the emissions per capita and emissions per unit of GDP as a comparison between EU countries.

GHG emissions per capita and GHG emissions per unit of GDP PPS, 2012



Literature Review

Avoided Use

At this rate… exploring England's recycling challenges - SUEZ

The report identifies a shift from legislation that was designed to avoid harm (e.g. the Landfill Directive) towards that which is designed to extract value and realises both economic and environmental benefits i.e. waste as a secondary resource.

Given this, alternative metrics/approaches were considered including; climate change impact, energy use and monetary value.

Avoided Carbon

- The report looks at alternative metrics such as Climate change impact which is measured in terms of carbon dioxide equivalent.
- This is calculated as a weighted combination of all GHGs, with a metric of CO_2e saving per tonne of material recycled (CO_2e/tonne), and CO_2 saving per tonne of household waste, accounting for material content (tonnes CO_2e).
- The figure below shows how different materials are prioritised based on the avoided carbon metric.
- The Greater London Authority has embraced this approach through Emissions Performance Standards (EPS), this is in the form of an overall target for CO2e generated by waste management as well as a carbon intensity floor setting minimum carbon standards for EfW.

Prioritisation metric		Paper	Plastics	Glass	Card	Metals	Textiles	Food waste
Avoided CO_2e	CO_2e saving per tonne of material recycled (CO_2e/tonne)	0.30	0.92	0.16	0.06	3.44	4.37	0.16
	CO_2 saving per tonne of household waste, accounting for material content (tonnes CO_2e)	0.05	0.09	0.01	0.003	0.15	0.13	0.03
	Rank based on CO_2e saving	4	3	6	7	1	2	5

Avoided Energy Use

- The method for 'avoided energy use,' considers the energy savings that are achieved by recycling, this is calculated as the energy saving associated with recycling of material present in one tonne of household waste. The report explains that avoided energy use is also a primary factor in avoiding carbon emissions and are thus closely correlated. Further to this an energy based metric could also account for energy recovery such as that which is from residual waste via incineration. The figure below shows how materials are prioritised using this method.

Prioritisation metric		Paper	Plastics	Glass	Card	Metals	Textiles	Food waste
Avoided energy use	Energy saving per tonne of material recycled (GJ/tonne)	11	63	3	18	67	123	0.001
	Energy saving per tonne of household waste, accounting for material content (GJ)	1.8	6.0	0.2	0.9	2.9	3.6	0.0
	Rank based on energy saving	4	1	6	5	3	2	7

Monetary Value

- The value of one tonne of household waste is estimated based on current median material prices. The report suggests that it could be argued that this is a straightforward metric based on the fact that that monetary value is a significant motivator and enabler for recycling. There is some uncertainty in regard to price volatility that may be counter-intuitive form year to year.

Prioritisation metric		Paper	Plastics	Glass	Card	Metals	Textiles	Food waste
Monetary value	Price per tonne of material recycled (£/tonne)	74	145	14	64	239	275	-28*
	Revenue per tonne of household waste, accounting for material content (£)	12	14	1	3	10	8	-5
	Rank based on monetary value	2	1	6	5	3	4	7

* Excluding energy and nutrient value

Literature Review

Weight Based

Waste per capita per year

1. Purpose of the Indicator or Metric

- Several sources suggest using a metric of waste per capita per year: Wrap, Zero Waste Europe, Welsh Gov, Eurostat, Waste data flow (BVPI84a & NI 191)
- Different forms of this metric vary slightly in their purpose, however in general it is to monitor performance for reducing the amount of waste sent to landfill, incineration or energy recovery
- Some sources suggest this is best used in conjunction with the recycling target.

2. Method

Examples:

1. Total waste generated per person, including that which is recycled/composted and disposed

See case study

2. Residual waste per capita per year or per household

Calculated just for residual waste in terms of total kilograms of household waste less any sent for reuse, recycling, composting or AD, over the number of households as given by the dwelling stock figures from the Council tax base.

Case Study - *Zero Waste Europe*

Using Eurostat statistics, the article compares European countries in terms of kg per person generated, the recycling rate and thus the kg per person disposed.

The article further explains that those countries with a high recycling rate may still generate a high amount of waste (Germany), and conversely those that don't generate much waste per capita (Slovakia) but have low recycling similarly perform poorly.

In reality a balance between low waste generation and high recycling rates are needed such as in Estonia, Slovenia and Belgium.

Benefits	Cons & Costs
1. Allows monitoring of performance around waste minimisation	1. Per household data is less transparent with additional variables of household size, vacant properties etc.
2. Allows assessment of consumption habits to differentiate from waste growth due to population growth or increased per capita consumption	2. Doesn't tell you what the materials are
3. Supports the waste hierarchy with waste prevention being top of the list	3. Doesn't provide the holistic picture as a metric on its own (what type of waste, is it avoidable or not etc.)

Literature Review

Weight Based

% of waste diverted from landfill

1. Purpose of the Indicator or Metric

- Landfill is essentially the worst waste management solution for final disposal of all municipal waste materials. As it represents the lowest end of the waste hierarchy (see diagram to right) with no recovery of value, energy or resource.
- The purpose of the metric is therefore to monitor performance of Local Authorities in utilising treatment or disposal routes, be that recycling, composting, or alternative disposal (e.g. EfW)

2. Method / Data

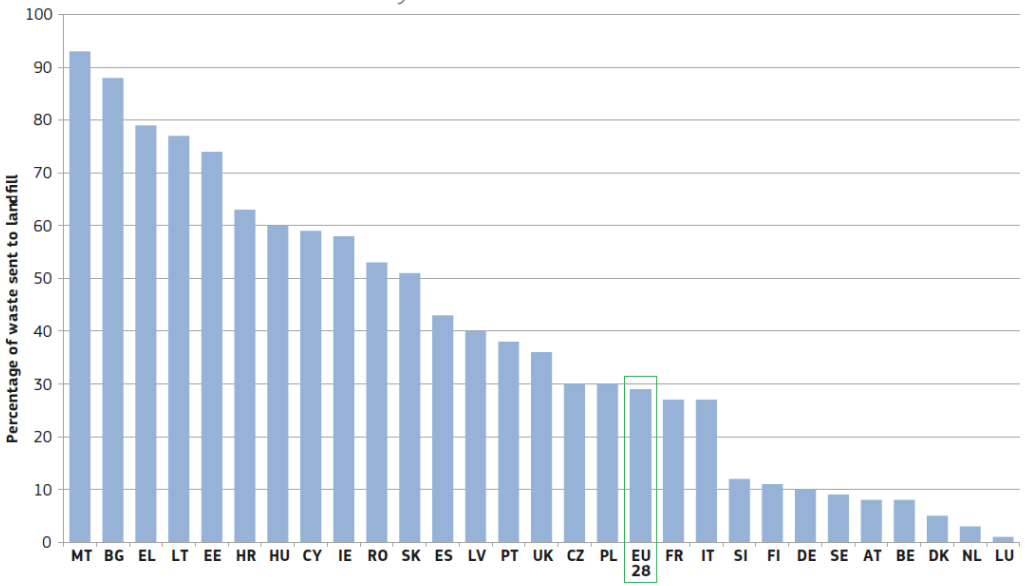
- Waste Data Flow National Indicators (NI):
  - **NI 192 Percentage of household waste sent for reuse, recycling and composting**
  - **NI 193 Percentage of municipal waste land filled**

  Includes residual waste sent directly to landfill and that which was collected for other management routes (recycling, reuse etc) but was rejected and ended in landfill. This is presented as a percentage of the total waste collected.

- The figure shows landfill rate as reported by the EC and Eurostat as a thematic indicator that focuses on the theme 'turning waste into a resource.'

Landfill rate of waste (excluding major mineral wastes), 2012

Source: EU Resource Efficiency Scoreboard 2015



Benefits	Cons & Costs
1. Diversion from landfill to reuse, recycling or composting, is recognised as environmentally beneficial	1. Not very forward thinking as it focuses on the end (lower end of waste hierarchy) rather than encouraging higher value recovery
2. Allows tracking of waste to end fates (links to infrastructure planning)	
3. A target would help to incentivise CE if combined with another CE specific target	

Literature Review

Resource Productivity

GDP per unit of resource

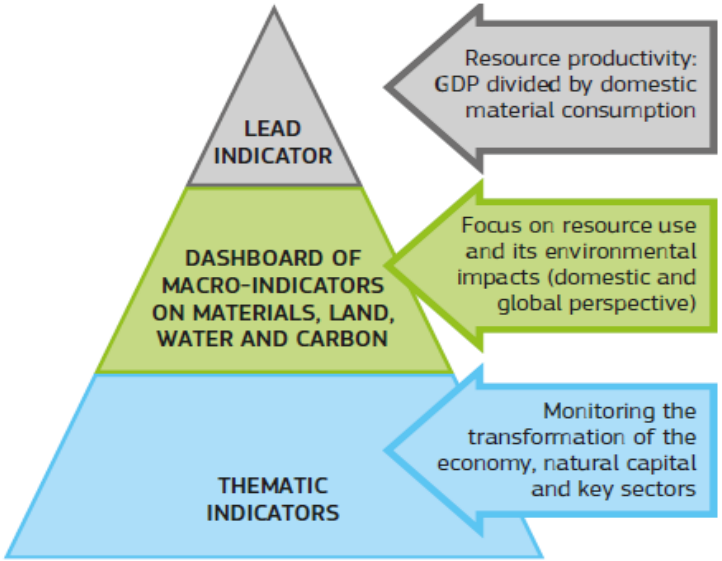
1. Purpose of the Indicator or Metric

- Resource productivity is a measure of the economic value a country or region generates in relation to the quantity of material it consumes. Therefore higher value per tonne of material consumed equates to a more productive and more efficient use of materials.

EU Resource Efficiency Scoreboard 2015

The scoreboard was developed using a 3-tiered approach which combines 32 different indicators:

1. An overall lead indicator for resource productivity
2. A second-tier dashboard of complementary macro indicators for materials, land, water and carbon
3. a third tier of theme-specific indicators to measure progress towards key thematic objectives



2. Method

- Eurostat & European Environment Agency (EEA) are the main sources for information for the indicators.

For the Resource Productivity indicator GDP is used in 2 ways:

1. **GDP in purchasing power standards:**

To compare countries at the same moment in time, GDP is converted into an artificial currency unit via purchasing power parities. The GDP in PPS represents pure output volumes, after subtracting price-level differences between countries.

2. **GDP in market exchange rates using 2005 reference year market exchange rates (EUR) with chain-linked changes in volume:**

GDP in chain-linked volumes measures the variation in the quantity of output (rather than the variation in prices) and allows productivity trends in a single geographic area to be tracked over time.

Benefits	Cons & Costs
1. It can be presented alongside labour or capital productivity 2. National indicator of economic performance (value produced per unit of resource) 3. Simple and communicable (industry plan to double resource productivity by 2050 ?) 4. Links to resource efficiency / sustainable growth 5. Based on national known factors	1. Much bigger scope than the waste sector, which only has a contributing factor 2. Doesn't relate to LAs or consumers (only a national indicator)

Literature Review

Resource Productivity

Material Flows

1. Purpose of the Indicator or Metric

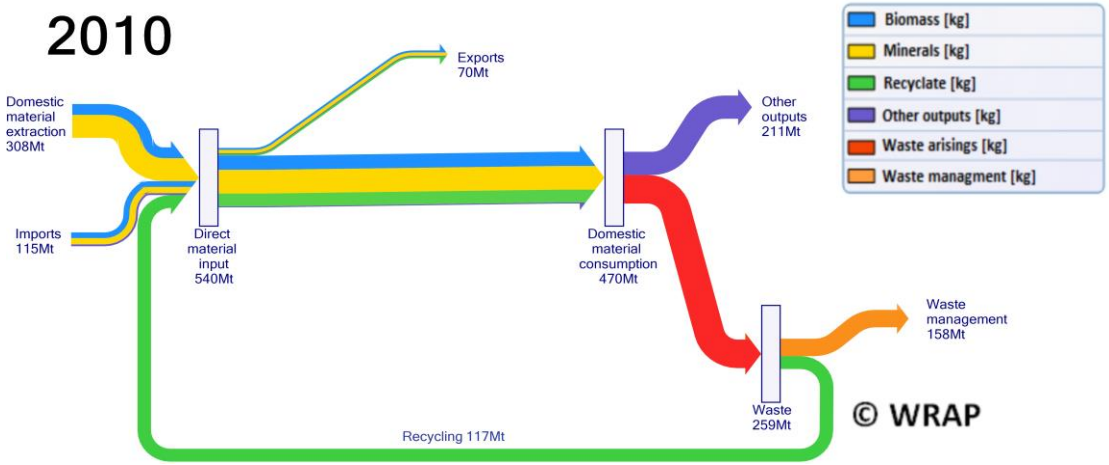
- Eurostat has several different material flow accounts that show input flows and outputs that can be used to inform a metric or minimum standards.
- Importantly it will track/document differences between materials generated, those imported and those exported for external uses.
- Hypothetically, this could be used to show a benchmark for self-sufficiency based on reduced imports, but also in the most local form it is a proxy for circularity.

2. Method

- Datasets include:
  - Material input flows, in thousand tonnes per year, into (domestic extraction & physical imports) and out (physical exports) of an economy
  - Material flow of domestic processed output from an economy to the environment in thousand tonnes per year
  - Balancing items which are required to articulate a consistent material input-output balance of a national economy in thousand tonnes per year.
  - Main indicators which provides highly aggregated economy-wide material flow accounts

- WRAP has developed Sankey diagrams that compare the material and waste flows around the UK economy in order to help visualise how circular our economy is. This is shown in the figure below.

Material Flows in the UK 2010 (WRAP)



Benefits	Cons & Costs
1. Material flows can be assessed at varying geographical scales (national, regional, local) and further analysed by sectors and individuals	1. Only shows material flows and is predominantly an economic indicator rather than for sustainable management
2. Material specific to an extent, by product/material categories	
3. Indicator of self sufficiency and Local production and consumption which is also a factor in CE	

Literature Review

Circularity

European Commission (2018):
A monitoring framework for the Circular Economy

Overview

Circular Economy- *explained as an economy where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste is minimised.* (circular economy action plan)

- The report highlights that the transition into a circular economy offers an opportunity to transform our economy and make it more sustainable, create jobs and competitive advantages, as well as contribute to climate goals and the preservation of resources.
- The circular economy action plan has committed to a simple and effective monitoring framework, the need for this is stressed as it can strengthen and assess the progress towards circular economy while minimising the administrative burden.
- Drawing upon the Resource Efficiency and Raw Materials Scoreboards, the monitoring framework uses indicators that ideally capture trends in preserving the economic value of products, materials and resources as well as trends in waste generation.

Indicators- it is highlighted that there is no one universally recognised indicator of 'circularity,' a single measure or score would not appropriately capture the complexity of the transition to the circular economy. Therefore a set of indicators is used.

- Another way of considering circular economy is to see how materials flow, in to, within and eventually leave the economy.

Criteria- other criteria the indicators are assessed on include relevance, acceptance, credibility, ease of use, and robustness.

Data- The Commission will also be improving the data availability and knowledge base for measuring the progress toward the circular economy:
- Ongoing development of methodologies and data collections that can be used as indicators on green public procurement and food waste
- Proposed to harmonise the methodologies for calculating recycling rates
- Through Horizon 2020, the Commission is funding several research projects to deliver better data

Ten indicators of the Circular economy monitoring framework

It aims to measure progress towards a circular economy in a way that encompasses its various dimensions at all stages of the lifecycle of resources, products, and services. Therefore the 10 indicators are grouped in four stages 1) production and consumption 2) waste management 3) Secondary raw materials 4) competitiveness and innovation.

Name	Description
Production and consumption	
1. EU self-sufficiency for raw materials	The share of a selection of key materials (including critical raw materials) used in the EU that are produced within the EU
2. Green public procurement	The share of major public procurements in the EU that include environmental requirements
3. Waste Generation	Generation of municipal waste per capita, total waste generation (excluding major mineral waste) per GDP unit and in relation to domestic material consumption
4. Food Waste	Amount of food waste generated
Waste management	
5. Overall Recycling rates	Recycling rate of municipal waste and all waste except major mineral waste
6. Recycling rates for specific waste streams	Recycling rate of overall packaging waste, plastic packaging, wood packaging, waste electrical and electronic equipment, recycled bio-waste per capita and recovery rate of construction and demolition waste
Secondary raw materials	
7. Contribution of recycled materials to raw materials demand	Secondary raw materials' share of overall materials demand – for specific materials and for the whole economy
8. Trade in recyclable raw materials	Imports and exports of selected recyclable raw materials
Competitiveness and innovation	
9. Private investments, jobs and gross value added	Private investments, number of persons employed and gross value added in the circular economy sectors
10. Patents	Number of patents related to waste management and recycling

Literature Review

Circularity

Circular material use rate

1. Purpose of the Indicator or Metric

- The indicator measures the share of material that is recovered and then put back into the economy.
- Therefore the higher the amount of secondary materials used equals greater circularity and thus reduces the extraction of primary raw materials in overall material use.

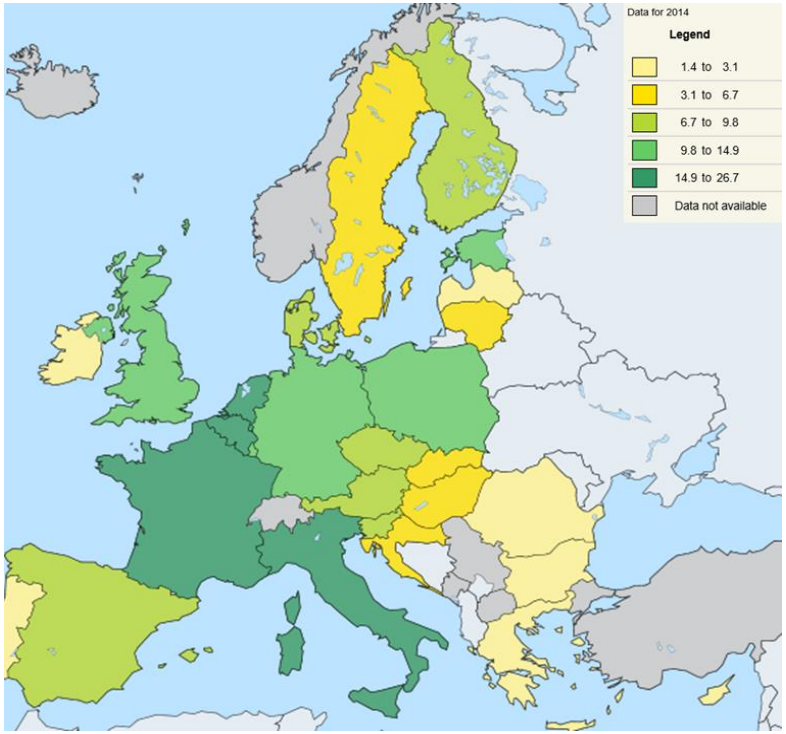
2. Method

- Eurostat defines circular material use rate (CMU rate) as the ratio of the circular use of materials to the overall material use.
- The overall material use M is measured by the aggregate DMC plus the amount of circular use of materials U (M = DMC + U). DMC is the domestic material consumption as defined in economy-wide material flow accounts.
  The circular use of materials (U) is approximated by the amount of waste recycled in domestic recovery plants, minus imported waste destined for recovery, plus exported waste destined for recovery abroad (U = RCV_O – IMPW + EXPW). RCV_O is the recovery other than energy recovery - except backfilling - as defined in the Waste Framework Directive 75/442/EEC. Eurostat's international trade in goods statistics (ITGS) are used to approximate the imports and exports of waste destined for recycling, i.e. the amount of imported waste bound for recovery (IMPW), and the amount of exported waste bound for recovery (EXPW).
  Then, the CMU rate is formalised as following:

  CMU = U/M = (RCV_O - IMPw + EXPw)/(DMC + (RCV_O - IMPw + EXPw))

  A higher CMU rate value indicates more secondary materials substituting for primary raw materials i.e. avoiding the environmental impacts of extracting primary material

2014 Circular material use rate (%) by EU Country



Benefits	Cons & Costs
1. Does try to track secondary material uses that offset virgin material extraction (principle of CE)	1. Secondary material could range in quality and standard therefore doesn't directly relate to maintaining the highest value materials in supply chain.
2. Helps demonstrate extent of local secondary markets for materials	

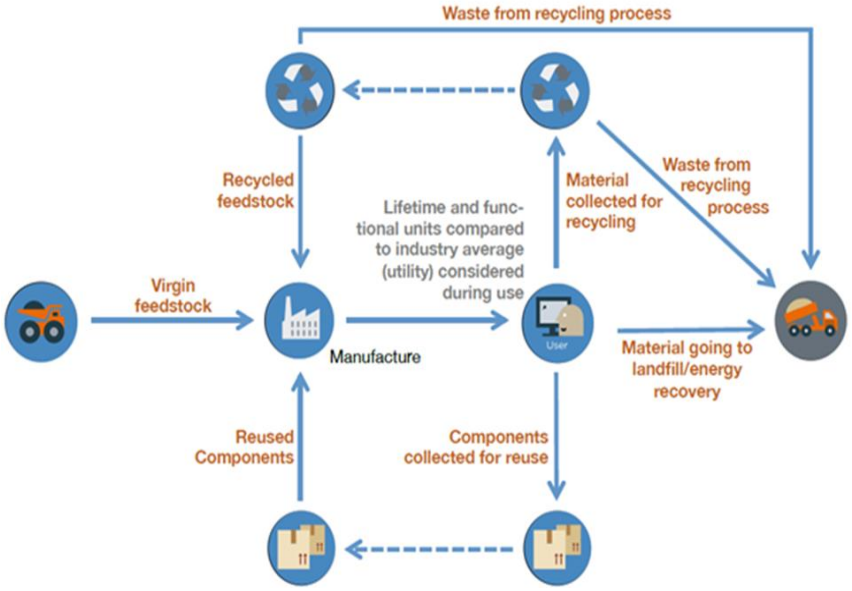
Literature Review

Circularity

Material Circularity Indicator (MCI)

1. Purpose of the Indicator or Metric

- The Material Circularity Indicator (MCI) by the Ellen Macarthur Foundation provides a method to assess how well a product or company performs in the circular economy
- The indicator was designed after there was previously no recognised way of estimating how effective a product or company is in making the transition from a linear to a circular operations
- Alongside the MCI there are complementary indicators for additional impacts and risks to be considered
- The indicators focus on technical cycles and materials from non-renewable sources as generally their circularity strategies and Business benefits are better understood



2. Method

Product level

The figure shows the material flows accounted in the MCI of a product. *Input in the production process:* how much input is coming from virgin and recycled materials and reused components?

Utility during use phases: how long and intensely is the product used compared to an industry average product of similar type? (takes into account increased durability of products, repair/maintenance and shared consumption business models).

Destination after use: How much material goes into landfill (or energy recovery), collected for recycling, and which components are collected for reuse?

Efficiency of recycling: how efficient are the recycling processes used to produce recycled input and to recycle material after use?

A bill of materials is needed listing the above data for all components and materials.

Company level

Based on the hypothesis that the material circularity of a company can be built up from the material circularity of the company's products. Seeing as it would not be practical for businesses to undertake an MCI assessment for every product, therefore this methodology takes a reference product approach, whereby a list of reference products represent a range of similar products. Therefore the overall MCI of a company is taken as a weighted average of reference products, using either mass or revenue as a normalising factor. The company level assessment also includes a de minimis rule allowing departments or products below a contribution certain threshold, to be disregarded.

Benefits	Cons & Costs
1. Holistic approach to CE assessment	1. Doesn't relate to LAs or consumers
2. Enables assessment of product sustainability by consumers	2. Requires an additional step beyond weight-based reporting
	3. Not linked to the waste sector directly does not tie in with material usage or flows

Literature Review

Circularity

Green Alliance (2018):
Completing the Circle, creating effective UK markets for recovered resources

Overview

Insufficient Recycling Targets: The report highlights the many issues with the current approach to waste and resource management via recycling targets, mainly that this approach does not encourage the recovery of valuable materials or supporting clean jobs because it focuses almost purely on recycling targets.

By only considering one stage of the material cycle it pushes recyclables into the waste collection system but doesn't does not give incentives for quality and design. Collecting materials for recycling does not guarantee they will be used again.

Contamination: Reprocessors often face challenges in obtaining high quality material from the UK recycling system, this is especially the case when they cannot be sure of the end markets for their products.

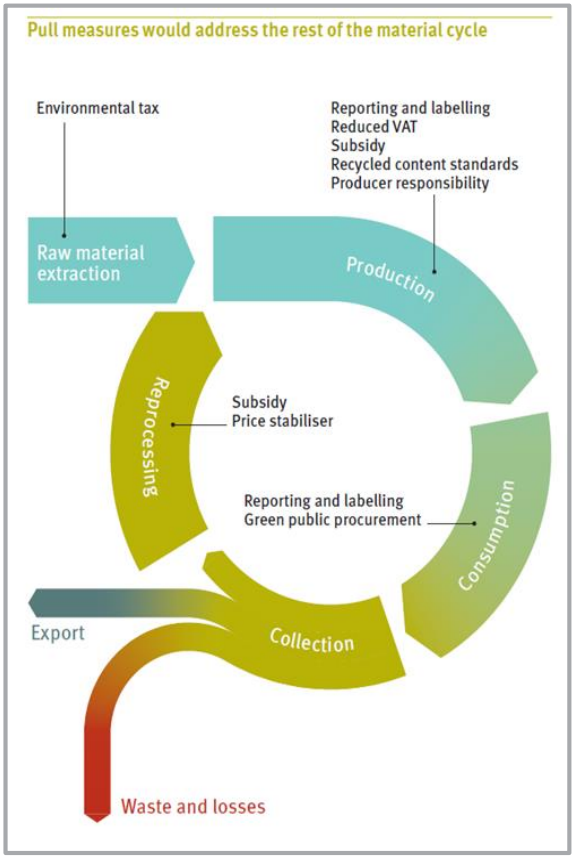
Limited Materials: For the UK companies wishing to used recycled content in their products, there are difficulties in sourcing these products. For example if the UK continues to lose rare earth elements (which are currently 100% imported), then businesses will face supply chain risks.

Missed opportunities: Previous research by Green Alliance with WRAP, shows that shifting towards a circular economy may help to reduce unemployment by creating +54,000 net jobs in sectors like recycling and remanufacturing. The report also highlights that amongst plastics, food and electronics, dome £1.7 billion is lost to the UK economy due to collection systems that do not enable domestic reuse or recycling. The reports also suggests that in the future businesses will be competing in a low carbon and resource efficient market therefore establishing circular economy now can help the UK to become competitive in this global market.

Voluntary agreements not enough: It is suggested that voluntary agreements such as the UK Plastic Pact show that businesses want to use recycled materials, yet these initiatives only succeed if supported by government regulation. For example the Dairy Road Map which committed milk producers to use 30% recycled content in HDPE milk containers by 2015, saw companies renege on the agreement. This was as a result of both Defra's decision to step back from recycling policy and the rapid fall in oil prices.

Pull Measures: The report describes how various pull measures could be used to create and shape demand for recycled material, this is focused on the stages of raw material extraction, production, consumption and reprocessing. These pull measures include, taxing the use of virgin material, using purchasing power, introduce a price stabiliser, and phase in recycled content standards.

Secondary Material Markets: It is also discussed that effective secondary materials markets could offer benefits. A key issue mentioned is the quality of materials, for example the current issues seen with China's National Sword and low quality waste, could be reused productively by the UK if we establish a secondary plastic market.



Plastic:

A secondary plastic market supported by pull measures could recycle an additional 2 million tonnes, fulfilling 71% of UK manufacturing's raw material demand.

Critical Raw Materials:

Introducing pull measures now critical raw materials in discarded products could supply over a third of domestic rare earth element demand and half of domestic cobalt demand, by 2035.

Steel:

Creating domestic markets for steel would generate more value added economic activity in the UK, reduce iron ore imports by 40% and reduce carbon emissions by ~30%.

Literature Review

Extended Producer Responsibility

Recycled content

1. Purpose of the Indicator or Metric

- EPR is the idea that the detrimental and economic costs associated with the treatment and disposal of products is a responsibility that producers (at least partly) should be accountable for.
- This broadly falls in line with the Polluter Pays Principle, whereby stakeholders involved with the production or consumption of goods, should pay towards the appropriate treatment and recovery fates.

Implementation of EPR

1. Minimum recycled content in products produced
2. Minimum recycling targets for sectors or products (e.g. ELV)
3. Material standardisation (e.g. set range of high quality/recyclable plastics that can be used)
4. Design for reuse

2. Method

How they are measured

1. Minimum recycled content in products produced

   % of product in kg which is recycled content

2. Minimum recycling targets for sectors or products (e.g. ELV)

   Proportion of all products produced which is recycled (%)

2. Material standardisation (e.g. set range of high quality/recyclable plastics that can be used)
3. Design for reuse

Benefits	Cons & Costs
1. It transfer a portion of the accountability for negative environmental impacts of waste to the producers i.e. polluter pays	1. Additional costs can be passed on to consumers
2. It incentivises investment from producers in material recovery and treatment markets	2. Will require much investment in material recovery infrastructure to provide feedstock
3. It supports material recovery rather than virgin material use	3. It will require potential changes in supply chain management and greater material standardisation (polymer grades)

Literature Review

Extended Producer Responsibility

Recycled content

UK Plastics Pact

https://www.letsrecycle.com/news/latest-news/uk-plastics-pact-largely-welcomed-by-industry/

- In April 2018 WRAP launched the 'UK Plastics Pact' which aims to eliminate 'problematic or unnecessary' single-use plastic packaging by 2025.

The voluntary targets aims include:

- Ensure that 100% of plastic is recyclable
- Include a 70% rate of plastic packaging 'effectively' recycled or composted
- A 30% rate of average recycled content across all plastic packaging

Material recovery/capture rates

Purpose of the Indicator or Metric

- Local Authority target which is material specific with designated minimum capture rates, for each material stream
- E.g. 60% capture rate of plastics which must be attainable

Benefits	Cons & Costs
1. Allows you to target particular materials which could be problematic e.g. current plastic concern	1. Requires regular composition studies or a defined methodology to which all LAs can participate in
2. Additionally it is flexible over time	
3. Also it's a proxy for the effectiveness of kerbside collection systems and public awareness	

Literature Review

Producer Responsibility

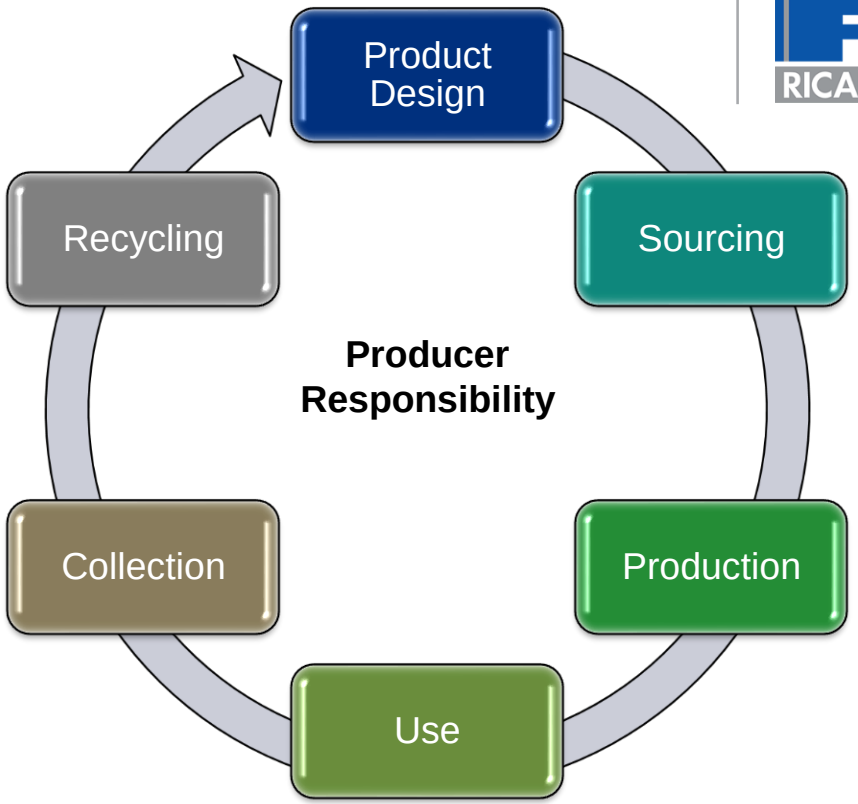
Environmental Protection Expenditure

1. Purpose of the Indicator or Metric

- To indicate the level or monetary value different sectors invest in to Environmental protection (EP) activities.
- EP being defined as the activities aimed at the prevention, reduction and elimination of pollution or any other degradation of the environment.

2. Method

- For every land rover = 50 trees
- Or at each site invest in negative environmental mitigation activities



Benefits	Cons & Costs
1. Supports the polluter pays principle (PR &EPR) (could be linked to natural capital)	1. Not linked to the waste sector directly does not tie in with material usage or flows
2. Easier to monitor than a natural capital metric which is multi-faceted with unknowns	

Air emissions

1. Purpose of the Indicator or Metric

- NI194 air quality- % reduction in NOx and primary PM10 emissions through LA estate and operations
- **Emissions Standards?**
- **Local air quality plans**

Taking this further, with emissions from waste services contributing in the region of 35% of an authority's total carbon emissions, reviewing the carbon contribution of a total waste service could become an appropriate measure of environmental benefit. However, whilst carbon is often used as a proxy for environmental impact, NOx and PM10 emissions are directly related to collection methodologies, and have a direct impact on local air quality. This metric would thus incentivise the adoption of improved collection methodologies, incentivising the use of low-carbon vehicles powered by electricity, gas or other technological solutions.

Report: ***The Impact on Health of Emissions to Air from Municipal Waste Incinerators (HPA,2009)***

The Health Protection Agency (HPA) has a statutory responsibility to advise Government and Local Authorities on possible health impacts of air pollutants. The HPA has reviewed research undertaken to examine the suggested links between emissions from municipal waste incinerators and effects on health. While it is not possible to rule out adverse health effects from modern, well regulated municipal waste incinerators with complete certainty, any potential damage to the health of those living close-by is likely to be very small, if detectable. This view is based on detailed assessments of the effects of air pollutants on health and on the fact that modern and well managed municipal waste incinerators make only a very small contribution to local concentrations of air pollutants.

Literature Review

Illegal Waste

1. Purpose of the Indicator or Metric

- Monitor compliance of the sector in appropriately transporting, treating and disposing of waste materials in line with regulatory and legal frameworks. This ensures that material is treated in compliance with guidelines to protect human and environmental health. Additionally this supports a level playing field for operators in the waste management sector. Monitoring of Illegal activity includes:

- Illegal waste sites (EA)
- Misdescription of waste
- Illegal waste exports
- Fly tipping (LA)
- NI195- Improved street and environmental cleanliness (levels of litter, detritus, graffiti, and fly posting)
- NI196 – Improved street and environmental cleanliness – fly tipping

2. Method

- Collaboration with the environmental regulator and enforcement agencies to identify, monitor and progressively stop illegal activity with the waste sector.
- Metrics for monitoring include:
- Number of illegal waste sites and time to close or regulate
- Tonnage of waste illegal exported
- Occurrence and severity of fly tipping as well as associated expenditures to remediate

Stakeholder Feedback

8. Stakeholder Feedback

ESA Workshop 26th February 2018

A Stakeholder Workshop was held at Ricardo's offices; Attendees included representatives from Environmental Service Providers, Local Authorities, the ESA, The Environment Agency and the wider Ricardo Team. The Workshop focussed on exploring;

- The environmentally best options for managing different materials streams
- How any new approach could be transitioned to over time)
- Current reporting requirements
- Policy constraints and requirements
- CEP requirements
- Resource efficiency and productivity
- Alternative metric options and compatibility
- Material Quality
- EPR implications
- Alternate indicators

Key things to consider

- Feedback from workshop
- Feedback from interviews
- Feedback and knowledge from project work
- Feedback from stakeholders who work with data and reporting
- Answers to the questions we set out to ask?

Stakeholder Feedback

ESA Workshop – Conclusions and Considerations

General points
• Targets that drive the waste hierarchy
• Best end use/ end of life for each specific material
• Need to focus on material quality, reusability and longevity
• We have the infrastructure and schemes therefore easiest option is to maximise participation and reduce contamination
• Key issues: single use items, quality, capture rates
• Need to understand the true LCA impacts and benefits as well as the costs for recycling vs recovery
• Introduce license agreements and business rates – this does have issues over shared facilities / ownership in regard to identifying responsibility
• How to tackle internet shopping – Amazon 2 box effect and vehicle use
• Need to define terms such as reuse, avoidable etc.

Key considerations for Metrics
• Give metrics priorities / weighting
• Quantify the benefits and costs of dealing with each material
• If we can get good weight based data then this can be applied to many metrics, but data is limited, inconsistent and ideally need to know or agree a composition
• Target the ‘avoidable’ materials
• Considerations for what if nothing else better can be done with a material other than landfill or if recycling is not the best option

Key considerations for Policies
• Extended MRF regulations to sample what’s going to EfW, this will provide info on available material, to make realistic targets
• Make products more valuable in the supply chain so it’s uneconomical to send to lower end uses (front end approach rather than targeting the end perspective)
• Key issues: single use items, quality, capture rates so need policies to address these

Behaviour Mapping

ee.ricardo.com

Behaviour mapping

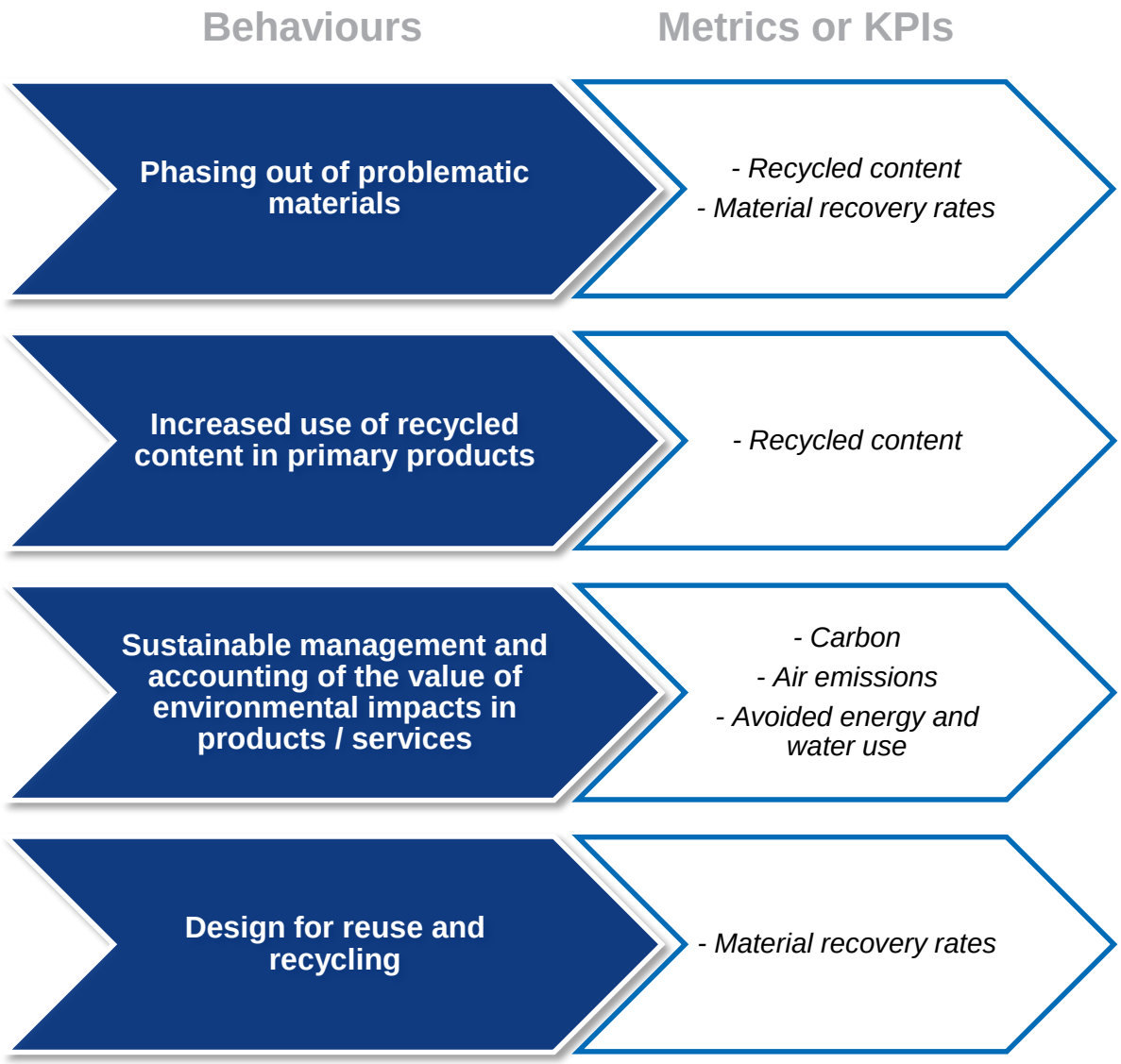
- As a second step in the identification of potential metrics a set of targeted behaviours has been set out which should underpin any effective change in the waste management sector.

- The researched alternate metrics have then been mapped against these behaviours to identify those which could be beneficial in tackling the route of the problems identified.

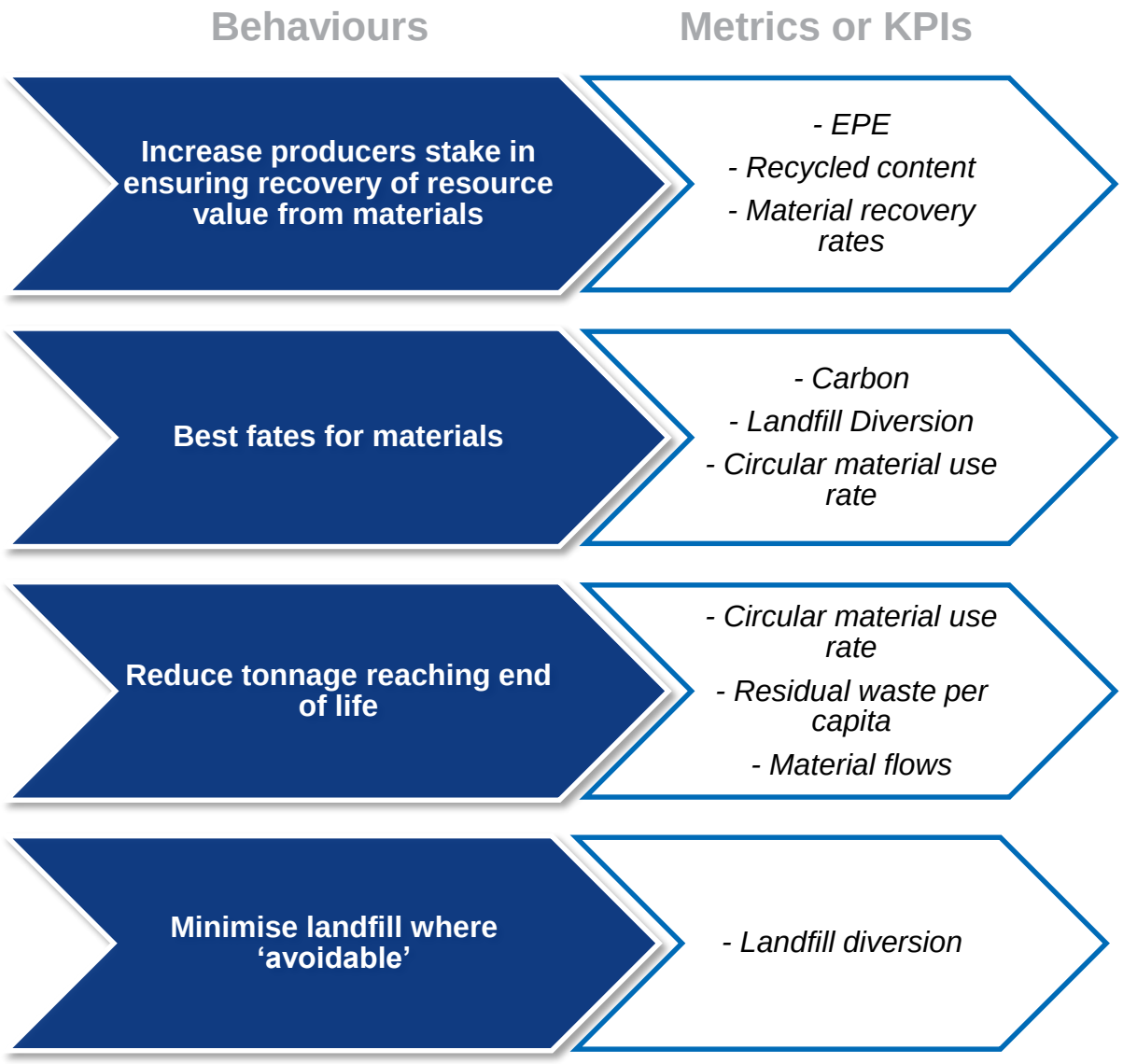
- For example, “phasing out of problem materials” with the example of plastics has been identified as a huge environmental concern as a result of media coverage and public perception. To tackle this behavioural change, targets on producers such as setting minimum recycled content in products, or imposing material recovery rates (similar to that of the ELV policy) have been identified as plausible means to impose market change.

- A similar approach has been taken to a full range of targeted behavioural change in the following slides.

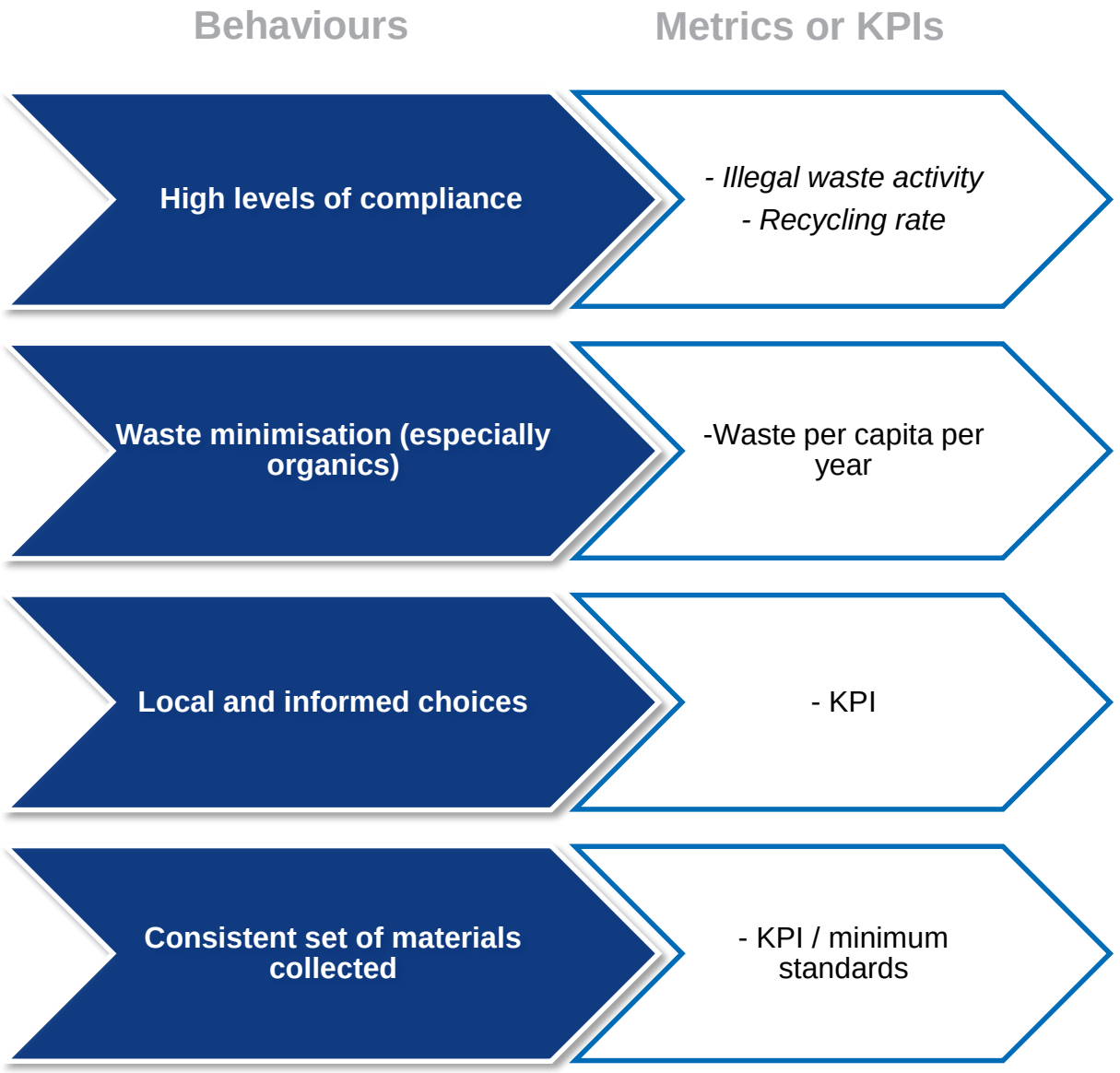
Behaviour mapping



Behaviour mapping



Behaviour mapping



environmental services association

RICARDO

Miles Smith Insurance Group is the appointed broker to the Environmental Services Association. For enquiries, please contact: enquiries@milessmith.co.uk

MILES SMITH INSURANCE GROUP

Miles Smith Insurance Group
One America Square, 17 Crosswall
London, EC3N 2LB
Telephone: 020 7977 4800
www.milessmith.co.uk
Twitter: @MilesSmithIns LinkedIn: Miles Smith Insurance Group

Why Wait? Weight isn't working

Smarter measures for the circular economy