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part of the Useful Simple Trust

Metro Dynamics

SOENECS
Innovative Sustainable Solutions

GLLEP Circular Economy Evidence Base

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V1.1	09/13/2024	Useful Projects, SOENECS, Metro Dynamics	Claire Brady David Greenfield
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Glossary

This glossary covers fundamental terms of the circular economy, offering insights into its strategies and practices

1. Circular Economy (CE)
A sustainable economic system aimed at minimizing waste and making the most of resources. It contrasts with the traditional linear economy (take, make, dispose) by closing material loops through repair, reuse, remanufacture, and recycling.

2. Closed-Loop System
A system where products and materials are continuously cycled back into production processes after use, minimizing the need for virgin materials and reducing waste.

3. Cradle-to-Cradle (C2C)
A design philosophy where all materials used in production can be fully recycled or safely returned to nature, allowing products to be part of an ongoing cycle of use without generating waste.

4. Design for Disassembly (DfD)
A design strategy that enables easy recovery of components and materials from a product at the end of its life cycle, promoting reuse and recycling.

5. Eco-Design
An approach to designing products with special consideration for the environmental impacts of the product throughout its entire lifecycle, including energy use, resource consumption, and waste generation.

6. Extended Producer Responsibility (EPR)
A policy approach in which producers are held responsible for the entire lifecycle of their products, especially for take-back, recycling, and final disposal, encouraging more sustainable product design.

7. Industrial Symbiosis
A concept where waste or by-products of one industrial process become the input for another, promoting resource efficiency and reducing environmental impact.

8. Life Cycle Assessment (LCA)
A methodological tool used to evaluate the environmental impacts associated with all stages of a product's life, from raw material extraction through production, use, and disposal.

9. Material Flow Analysis (MFA)
A tool used to track the flow of materials within an economy or industrial system to assess resource use, waste generation, and opportunities for circularity.

10. Product-as-a-Service (PaaS)
A business model where consumers lease or pay for temporary access to a product rather than owning it outright, incentivizing manufacturers to design durable, long-lasting products.

11. Regenerative Design
A design approach that restores, renews, or revitalizes energy and materials used in the production process, enhancing environmental health rather than depleting it.

12. Remanufacturing
A process of restoring used products or components to a like-new condition through refurbishment, replacing worn-out parts, and testing for quality and functionality.

13. Renewable Resources
Natural resources that can be replenished naturally at a rate that allows for continuous use, such as solar energy, wind, and biomass.

14. Repair Economy
An economic system that encourages the repair and maintenance of products to extend their lifespan and reduce waste.

15. Resource Efficiency
The practice of using natural resources more efficiently, aiming to reduce resource input and environmental impact while maintaining economic growth and development.

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The practice of using natural resources more efficiently, aiming to reduce resource input and environmental impact while maintaining economic growth and development.

16. Reverse Logistics
The process of moving products and materials back through the supply chain to recover value through recycling, remanufacturing, or refurbishing.

17. Sharing Economy
An economic model that encourages the sharing of goods and services among individuals and organizations, reducing the need for new product creation and fostering resource efficiency.

18. Supply Chain Circularity
A practice in supply chain management focused on integrating circular principles into the supply chain by optimizing resource use, reducing waste, and recovering materials for reuse or recycling.

19. Sustainable Consumption
The use of products and services that meet basic needs and improve quality of life while minimizing resource use and environmental damage over the product's lifecycle.

20. Urban Mining
The process of reclaiming raw materials from urban waste, such as electronics or infrastructure, to be reused or recycled.

21. Waste Hierarchy
A ranking system for waste management strategies that prioritizes waste prevention, followed by reuse, recycling, recovery, and finally disposal.

22. Zero Waste
A philosophy that aims to eliminate the generation of waste by redesigning products, materials, and systems to maximize the recycling and reuse of all resources.

1/ Introduction

Introduction
Purpose and Scope

Purpose
Useful Projects, SOENECS, and Metro Dynamics were appointed by the Greater Lincolnshire Local Enterprise Partnership (GLLEP) to develop a circular economy evidence base for the region. The region and the GLLEP's activities span across the local authorities of Lincolnshire, Northeast Lincolnshire, North Lincolnshire, and Rutland.

The overarching aim of this evidence base is to assess the scale and potential of circular economy activity within the region. It forms the first step in developing a regional strategic framework to facilitate the transition to a circular economy.

By evidencing the economic benefits of adopting circular economy principles, this report ultimately supports the region's objectives of economic growth, Net Zero, and environmental sustainability.

Key outputs include a mapping exercise of existing activity, a high-level resource flow of key sectors, economic impact assessments of potential opportunities, and qualitative research that helped identify barriers and opportunities for the region.

These outputs are an essential first step, but further work will need to be undertaken to identify possible interventions and priority areas of focus, which would then allow the region to develop a regional strategic framework to facilitate the transition to a circular economy.

Scope

The evidence presented is focused on commercial, industrial, and academic activity with a view of demonstrating the economic benefits of adopting circular economy principles. It presents five priority sectors with the greatest potential to transition to a circular economy to focus the analysis.

While the benefits of a circular economy are far reaching, the focus of this report is on the economic and resource savings, rather than carbon and energy.

Methodology
Overview

To evidence the scale and potential for a circular economy in Greater Lincolnshire and Rutland, various research and data collection methods were employed across two phases.

The first phase used a mix of qualitative research and quantitative economic analysis to understand and map the ongoing circular economy activities in the region with the aim of identifying potential clusters of activity. These included interviews, a policy review, desk research, surveys, a workshop, and an economic analysis. Multiple stakeholders from the different sectors were involved in each activity. This culminated in an interim findings presentation which aimed to identify emerging case studies of best practice, confirm priority sectors for the next phase, and identify potential clusters of activity.

Phase two focused on building the evidence base to understand the potential for a circular economy to develop in the region. This included identifying barriers and opportunities, a material flow analysis of the resource inputs and outputs for the key sectors, and interviews with businesses who are already adopting circular practices. The opportunities were further evidenced by understanding the scale of selected opportunities through estimates of their environmental and economic impact.

The methods used across each phase are set out in brief in the tables to the right, with detailed methodologies included the Appendix.

1) The Scale of the Circular Economy

Method	Description
Questionnaire	A short online form that asked early adopters to identify themselves and how their activities or business models support a circular economy. 37 organisations responded.
Policy Review	A review of relevant national and regional policies and strategies, and how they support the transition to a circular economy.
Survey	As a follow-up to the questionnaire, the survey gathered more detailed insights on organisations' current activities and the challenges they face in adopting circular economy principles in practice.
Workshop	Interested survey respondents attended an interactive workshop focused on discussing current business models and exploring the enablers and barriers to transitioning towards a more circular approach.
Desk Research	Online research to supplement the questionnaire and survey, identifying organisations, research institutions, waste management infrastructure and assets.
Interviews	Interviews with key stakeholders within the GLLEP to build the contextual understanding of the region.
Economic context	Economic analysis detailing economic value, jobs, business count and composition using GLLEP's definitions of key sectors.

2) The Potential of the Circular Economy

Method	Description
Interviews	Interviews with research institutions, sector experts, and businesses to identify opportunities, barriers, and develop case studies.
Material Flow Analysis	A static material flow analysis (MFA) for Greater Lincolnshire and Rutland, describing raw material inputs, waste generation and handling in the agri-food, visitor economy, construction and manufacturing sectors.
Economic Impact	'Size of the prize' – industry reports and research covering the business potential of circular economy interventions at a large scale were gathered. Relevant figures were then scaled down to the GLLEP geography to illustrate the potential impact in Greater Lincolnshire and Rutland.

2/ The scale of the circular economy in Greater Lincolnshire and Rutland

Regional Context
Economic Overview

Greater Lincolnshire
Greater Lincolnshire and Rutland has a population of 1.1 million, with 49,000 businesses contributing to a £26bn economy, which has grown by 25% in the past 10 years. It boasts a mix of manufacturing and engineering, a comprehensive agri-food sector, energy and services, and large health & social care and visitor economy sector.

The area benefits from a large number of small businesses – a distinctive feature of the economy. This is a place with strong identities and significant assets including strategically important industries. From the world-leading offshore wind energy sector and manufacturers, ports and petro-chemicals in the north, to the centre of the UK's agricultural heartland in the south.

Covering an area nearly five times larger than Greater London, Greater Lincolnshire and Rutland is a large and polycentric place made up of industrial, urban, rural and coastal areas, with over 50 miles of coastline and one of the lowest population densities of any LEP area. Industrial centres like Immingham and Scunthorpe, clusters of chemical and energy production companies on the South Humber Bank, the heritage city of Lincoln, and market towns such as Sleaford all contribute to the economy as drivers of growth and innovation, housing residents, and providing vital services.

'Game changing' sectors
Greater Lincolnshire and Rutland holds comparative advantages in key sectors that are well-placed to 'catch the wave' of future economic activity, from the UK's net zero transformation to advancements in agri-tech and supply chain logistics. Regional partners have identified four Game Changing opportunities that could transform the long-term trajectory of the region's economy: the UK Food Valley, the Humber Freeport, Clean energy, and Defense and cybersecurity

Strengths
- At the heart of UK food production and innovation potential
- Important location for UK trade
- An economy based on micro and small businesses bringing agility and diversity
- Well established offshore wind operations
- Extensive natural assets with national and international designations
- Strong visitor economy
- Significant defence assets (RAF) and recognised as a regional defence and security cluster
- 2 Universities, including University of Lincoln locations across Greater Lincolnshire
- Low business churn, indicating a stable economic base (also a weakness)

Weaknesses
- Low productivity
- Slower growth than UK average
- Significant spatial inequalities
- Constrained energy grid capacity
- Very low investment in innovation, with R&D concentrated in a small number of companies
- High number of employees paid below the living wage
- Poor connectivity, with a reliance on car use
- Low take-up of digital; and pockets of poor connectivity
- Limited access to HE and FE provision in many areas – driving low skill base within the population
- A rapidly ageing population with increasing health needs

Opportunities
- Green and low carbon economy across the area including bioenergy, circular economy, natural services and nuclear supply chain
- Carbon capture and storage innovation, particularly on the Humber Bank on a huge scale
- Continued growth of Humber Freeport as a nationally significant hub for renewable energy and associated supply chains
- Transformation of low productivity sectors by stimulating automation and technology investment
- Affordable for enterprises and start ups
- National demand for domestic food production
- Freight and supply chains
- Innovations in healthcare
- Pay gap to UK is closing
- Multiple industrial parks with potential for investment
- Expanding Research capabilities can be harnessed to support innovative circular growth
- Cross sectorial collaboration opportunities
- Agri and marine tech innovation through the UKRI and DEFRA regional cluster programme

Regional Context
Sector Composition

Examining the sector composition of the business base, manufacturing is by far the biggest of the region's priority sectors in terms of both GVA and employees. Although key enabling sectors of energy and ports and logistics are the smallest, they comprise some major businesses which are important customers for local supply chains.

Sector	GVA (in £bn)	GVA growth (5-year CAGR)	GVA per employee	Employees	Employee growth	Percentage of total employees	Businesses	Business Growth	Percentage of total businesses
Manufacturing	5.1	10%	£121,024	42300	0.1%	9.2%	2125	-1.8%	5.2%
Visitor Economy	3.2	1.8%	£64,260	50000	4.7%	10.9%	4730	12.2%	11.5%
Agri-food	2.7	2.8%	£57,561	46820	4.1%	10.2%	4730	-8.8%	11.5%
Construction	1.9	0.0%	£73,615	26000	23.8%	5.7%	6275	17.0%	15.2%
Energy	1.3	5.2%	£215,471	6205	-13.8%	1.4%	270	1.9%	0.7%
Ports and Logistics	1.1	-0.2%	£63,727	17575	-16.2%	3.8%	2880	11.4%	7.0%

Regional Context
Business Composition

Review of the business size composition helps to contextualise our understanding of the types of circular economy activities that have strong potential in various sectors. Manufacturing has a higher proportion of large businesses than other sectors, whilst construction and ports and logistics predominantly comprise microbusinesses.

Sector	Employees	Businesses	Average employees per business	Microbusiness %	Micro (0-9 employees)	Small (10-49 employees)	Medium (50-249 employees)	Large (250+ employees)
Manufacturing	42300	2125	28	81%	1725	300	95	5
Visitor Economy	50000	4730	11	83%	3925	715	55	0
Agri-food	46820	4730	10	91%	4320	310	60	5
Construction	26000	6275	4	94%	5920	315	40	0
Energy	6205	270	23	83%	225	35	5	0
Port and Logistics	17575	2880	6	92%	2640	175	40	5

Regional Context
Regional strategies

Document	Description	Impacts on the Circular Economy
Local Industrial Strategy, GLLEP (2021)	This strategy contributes to the LEP's strategic ambition to add £3.2bn to GVA by 2030 and future-proof Greater Lincolnshire and Rutland's economy, creating a productive, resilient and low carbon economic base. Based on a robust evidence base, it identifies the area's strengths, opportunities and challenges across the following key strategic sectors: agri-food, visitor economy, energy, defence, health and care, and ports and logistics. The Strategy then sets out several priorities to deliver greater productivity, earnings power and levelling up within the region through a focus on increasing innovation in sectoral clusters and increasing human capital.	– Supports a transition to a circular economy and the application of circular economy principles at a high level to the agrifood, energy and manufacturing sectors. Identifies industrial symbiosis as an opportunity to strengthen the industrial cluster and the need to integrate SMEs into the energy sector's circular economy. – Does not include specific policies or measures to lead the transition to a circular economy. – Aims to capitalise on the dispersed economy to create a leading polycentric, productive economy
Protecting, Progressing, Prospering: Economic Plan for Growth, GLLEP (2021)	A Plan that sets out how the LEP will support all parts of the region to thrive, aligned to the ambitions of the Local Industrial Stategy (LIS) and developed from the same evidence base. It builds on the framework from the LIS, focusing on the same strategic sectors to set out a roadmap to revival that aims to Protect businesses and people from pandemic impacts, Progress plans which are already underway and implement funding and opportunities, and Prosper with new programmes and ideas to transport and grow the economy.	– Opportunities for driving economic revival are linked to the circular economy but there are no policies or specific actions that drive the transition to a circular economy directly.
Greater Lincolnshire and Rutland's Strategic Infrastructure Delivery Framework (2023)	This framework sets out how the infrastructure opportunities in the LEP can facilitate its central aim of growth and levelling up through three priorities: driving economic recovery and growth, addressing levelling-up challenges, and delivering decarbonisation and climate adaptation. Rather than setting out a list of priority projects, the SIDF focuses on seven priority economic sectors where Greater Lincolnshire and Rutland have economic strengths.	– The circular economy is a key theme throughout the document, mainly as a driver for green economic growth. It identifies the agrifood, ports and logistics, visitor economy, advanced manufacturing, and energy sectors as priorities for investment. It identifies agrifood and energy as sectors ripe for advancing the circular economy through industrial symbiosis, energy from waste, anaerobic digestion, as well as using Enterprise Zones and market towns to innovate. – The Framework links the transition to a circular economy to the development of social infrastructure, human capital, and the decarbonization agenda.

Circular activities

A combination of engagement and desk-based research was done to map the scale of the existing current circular economy in Greater Lincolnshire and Rutland. This began with a short questionnaire which asked businesses and research organisations to identify what type of circular activity or circular business model they were using and was supplemented with desk-based research.

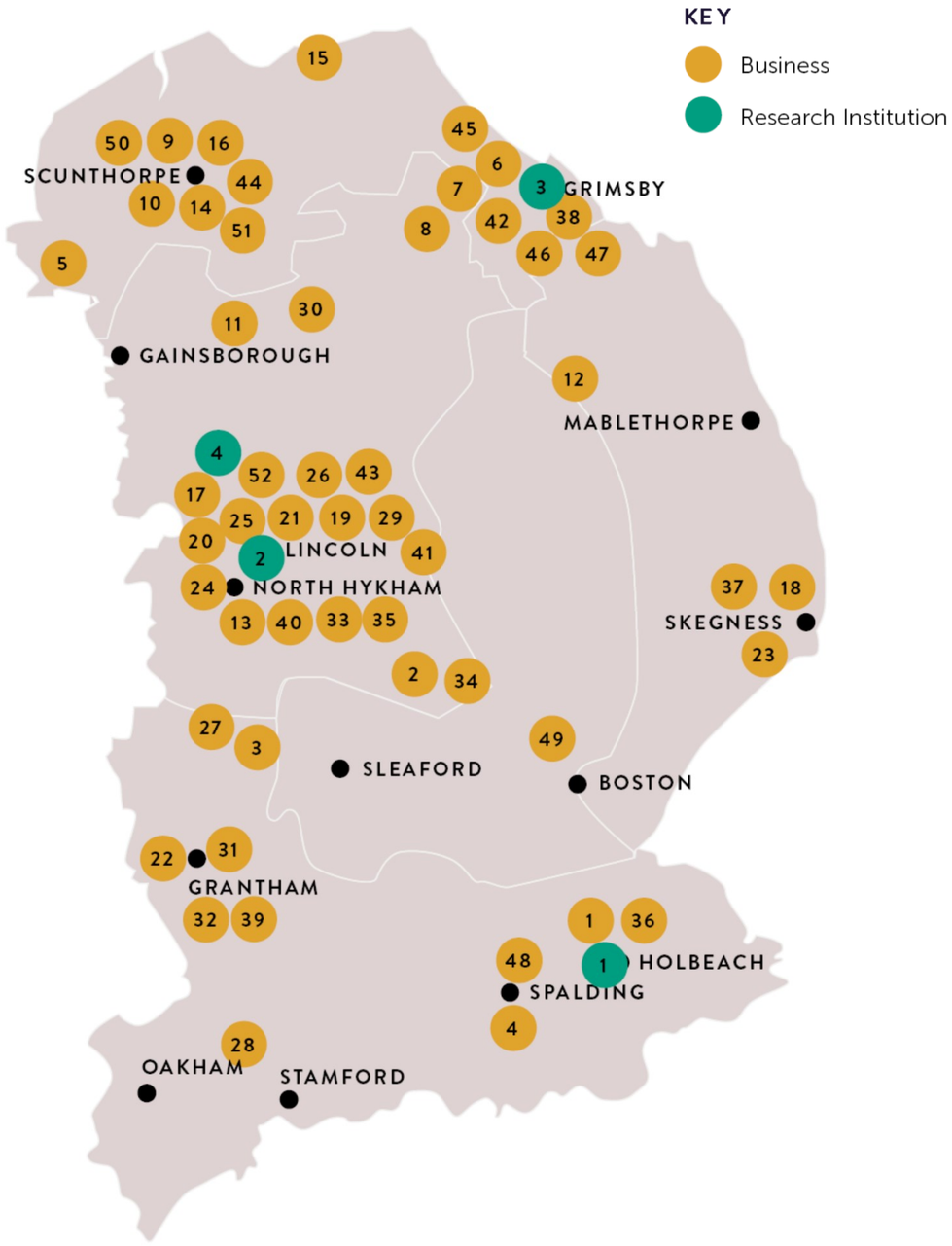
The pins on the map represent existing circular activity across two categories: research institutions and early business adopters. The locations of each organisation are not exact, and the map is for visual representation purposes only.

Research Institutions

1. National Centre for Food Manufacturing (NCFM)
2. Lincoln institute for Agri-Food Technology (LIAT)
3. Offshore Renewable Energy Catapult (ORE)
4. The Bridge Advanced Engineering R&D Centre

Businesses with Circular Models or Activities

1. Naylor Nutrition
2. Branston Ltd
3. Fairman Knight and Sons UK Ltd
4. Bridge Farm
5. Reverse Coal, the Lapwing Estate
6. PPS Group
7. Pelagia
8. Three Oceans
9. CorrBoard
10. British Steel
11. Clean Tech
12. Coveris
13. Lindum Group
14. Overhall Contractors
15. Baysgarth School
16. The Dancing Tiger Scrapstore CIC
17. Yesway Communications
18. Hildreds Shopping Centre
19. Stokes Tea and Coffee
20. Destination Lincolnshire
21. APk Industries
22. Returnal
23. Micronclean Ltd
24. Dynex Semiconductor
25. Forage & Fill
26. Smartfert Ltd
27. Reuseabox
28. Alltech
29. Annabel & Co Property Staging
30. BioteCH4
31. Viking Signs Ltd
32. Pentangle Engineering Services Ltd
33. Lincoln Eco Pantry
34. Dyson Farming
35. Lincolnshire Cloth Nappy Library
36. Manor Fresh Ltd
37. Ramco UK
38. Recurring Life
39. Autocraft Solutions Ltd
40. Filcom UK
41. Tri-Pack
42. Lenzing
43. ProAmPac
44. 2 Sister Food Group
45. Hilton Seafood
46. Samskip UK
47. DFDS UK
48. Bakkavor
49. Moy Park
50. Rockscape Energy Ltd
51. Omni-Pac Group
52. Carbon Focus Engineering



Waste and resource management infrastructure

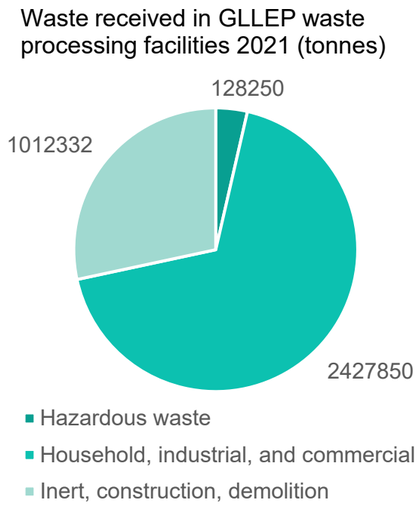
Another key aspect of the mapping exercise was to plot waste and resource management infrastructure in Greater Lincolnshire and Rutland. The circular economy requires waste and resource management to help facilitate greater re-use, recycling, and repurposing of resources, and keeping them as valuable materials in the region.

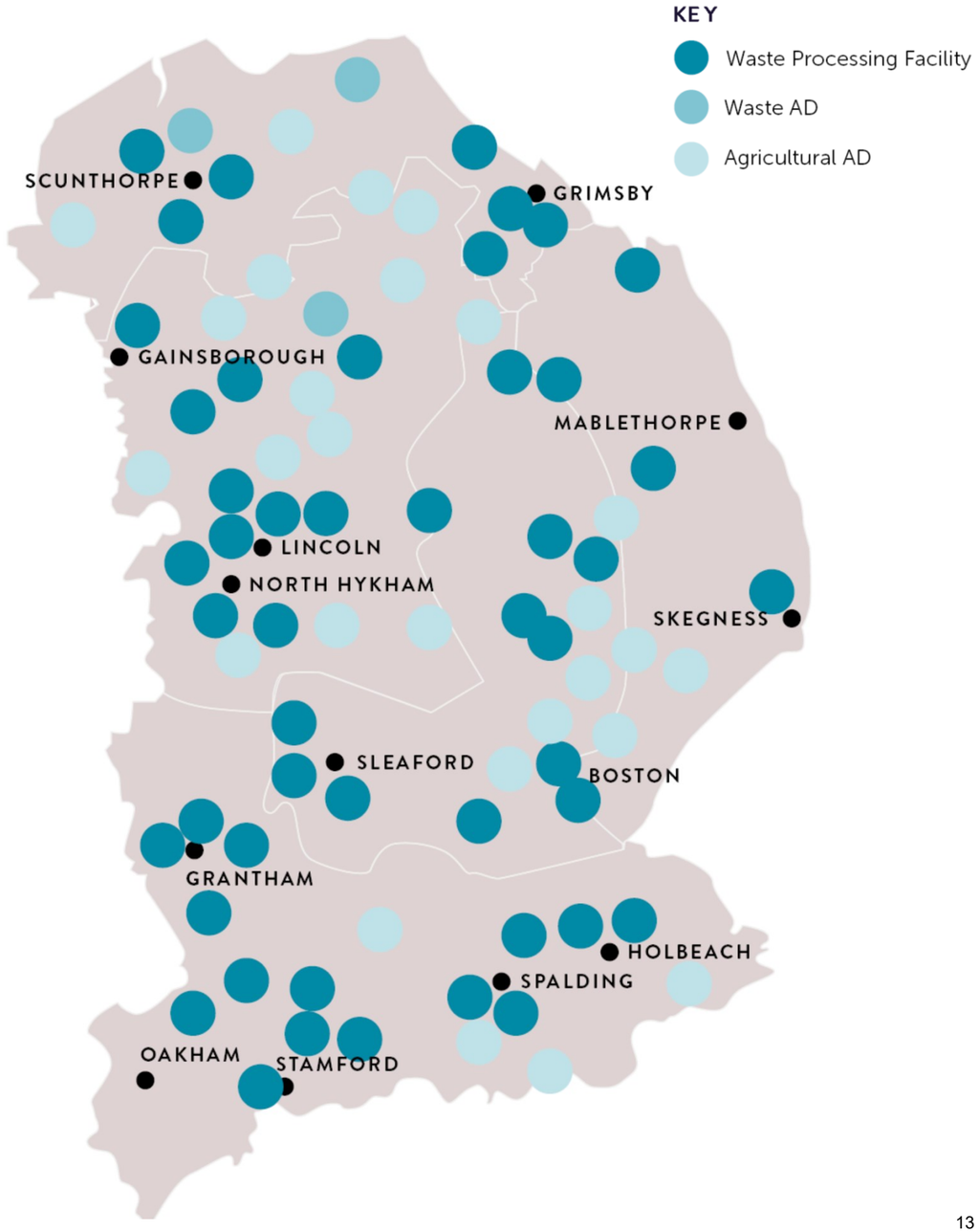
The map to the right displays the 59 waste processing facilities, 34 agricultural Anaerobic Digestors (ADs), and 3 waste ADs* across the region that can be utilised to transition to a circular economy.

The 59 waste processing facilities plotted on the map include the following types of facilities, some with multiple purposes:

- 2 materials recovery facilities
- 11 household waste recycling centres
- 48 commercial and industrial waste recycling centres
- 23 landfill sites

In 2021, the waste processing facilities in Greater Lincolnshire and Rutland received a total of 3,568,432 tonnes of waste. The pie chart on the right shows the proportion of this waste by category to demonstrate the amount of waste that is processed in the region, excluding ADs.





*Agricultural ADs are distinguished from waste AD facilities as they tend to circulate the inputs and outputs on the same farm, using agricultural by-products like manures, crop residues, and slurries as fuel, and heating their facilities on site. Waste ADs use municipal, commercial and industrial waste as fuel.

Priority Sector Clusters

The map displays the five priority sectors, with key assets, identified for the circular economy transition in Greater Lincolnshire and Rutland:

1. Manufacturing
2. Construction
3. Energy Ports, logistics and seafood
4. Visitor economy
5. Agri-food

The clusters have been created where significant existing economic activity and momentum can be leveraged to transition to a circular economy. The clusters present an opportunity for businesses, research institutions, public authorities, and residents to coordinate and share resources, and provide a useful way to understand where opportunities may lie.

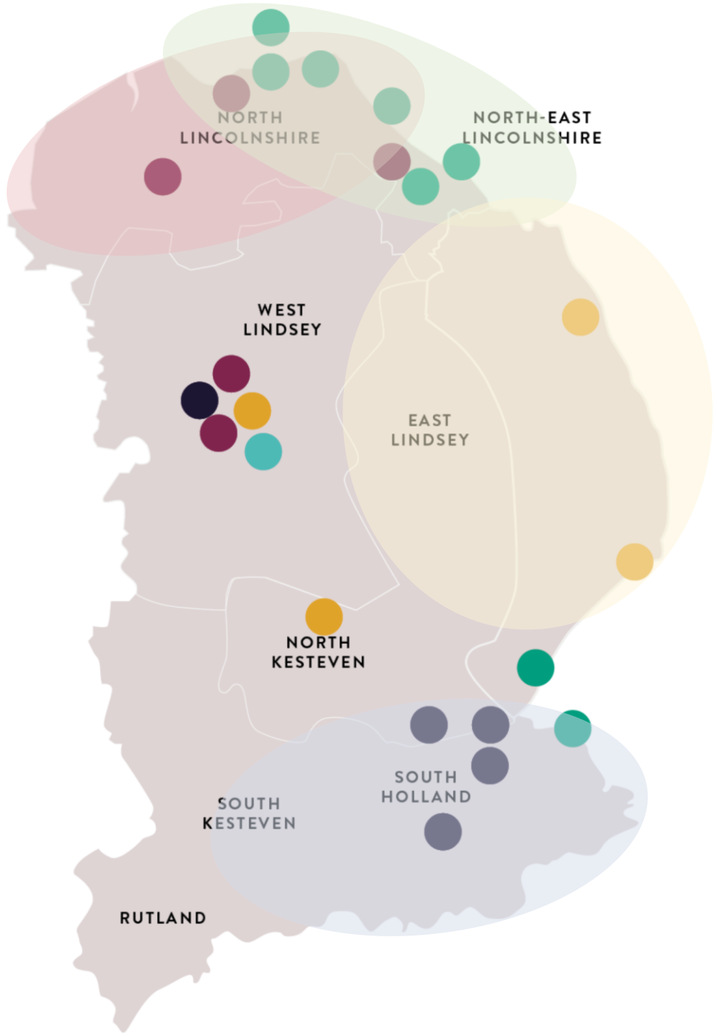
Due to the sparse geography of the region, most business headquarters are located around employment centres; major towns and cities that spread across several small economic centres. This mapping exercise has therefore used the region's strategic assets such as Enterprise Zones, ports, research institution, etc. to identify zones of activity beyond the smaller economic centres.

While the visitor economy, agri-food, and energy, ports & logistics, and manufacturing sectors are more geographically concentrated around key assets, the construction sector is spread across the wider region.

The following sections of the evidence base are structured around each of the five key sectors and their zones. This will show the potential for transitioning to a circular economy and identify how the existing assets and cluster strengths can be leveraged to support it.

MANUFACTURING
- Advanced Manufacturing Park
- The Humber Freeport
- The Bridge Advanced Engineering R&D Centre
- University of Lincoln Engineering School

CONSTRUCTION
- Lincoln School of Design and Architecture



ENERGY, PORTS & LOGISTICS, AND SEAFOOD
- Humber Freeport
- Offshore Renewable Energy Catapult (ORE)
- Yorkshire Energy Park (Humber north bank)
- AURA innovation centre (Humber north bank)
- Northeast Lincolnshire Enterprise Zones
- Seafood processing cluster
- Ports of Boston and Sutton Bridge
- Humber Industrial Cluster

VISITOR ECONOMY
- Heart of Sleaford (town regeneration project aiming to create a new destination in centre)
- Major coastal resorts such as Cleethorpes, Mablethorpe and Skegness
- The Lincolnshire Wolds
- City of Lincoln and historical and cultural assets

AGRI-FOOD
- National Centre for Food Manufacturing (NCFM)
- Lincoln institute for Agri-Food Technology (LIAT)
- Holbeach Food Enterprise Zone
- Spalding cluster of agri-food businesses
- Port of Boston
- Fresh produce and glasshouse cluster
- Boston College's Engineering, Manufacturing and Technology Centre (EMAT)

Material flow analysis
Summary

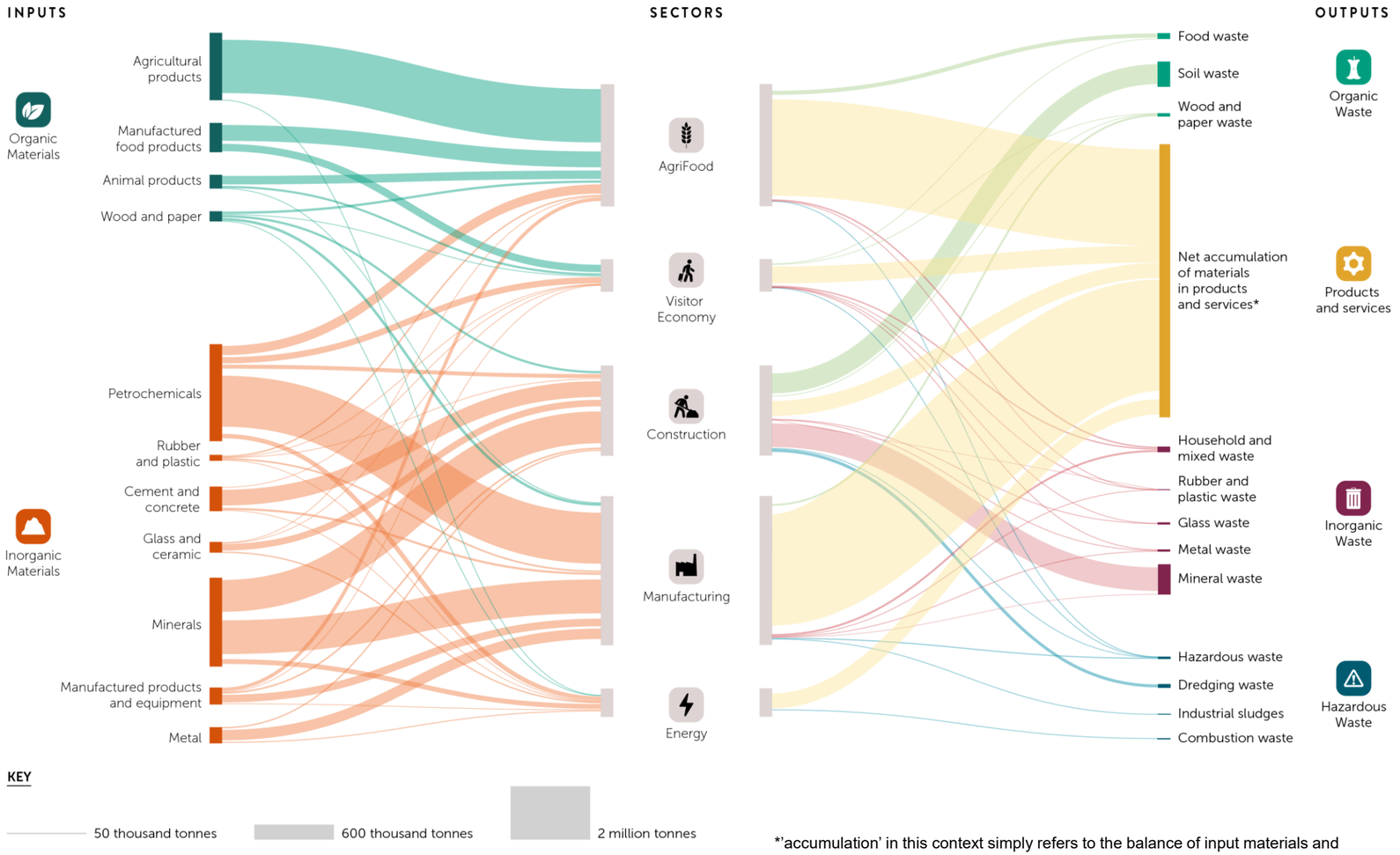
A mapping of material inputs and waste generation in Greater Lincolnshire and Rutland
A material flow analysis (MFA) was carried out to identify opportunities to redesign product systems and processes with the aim of minimising minimise waste and capture economic value in a circular economy for Greater Lincolnshire and Rutland.

In mapping the raw material inputs and waste material outputs for priority sectors, potential opportunities emerge to recirculate waste materials. The flows are presented in terms of mass of material (see key below diagram for an indication of scale). The full MFA methodology can be found in the Appendix.

The Sankey diagram opposite illustrates a summary of the MFA output, grouped by material classification. The distinction between organic and inorganic materials is based on the classification of material flows into ‘biological nutrients’ and ‘technical nutrients’. Separating the biological and technical cycles aims to prevent contamination of natural materials with man-made chemicals, additives or products which prevent decomposition.

In terms of raw material consumption, the Manufacturing and Agri-food sectors are the most resource-intensive in Greater Lincolnshire and Rutland, consuming around 4 and 3.5 million tonnes of material per year, respectively. The construction sector generates the most waste in the region, primarily mineral waste (concrete, cement and stone) and soils.

The following sections explore circular economy opportunities in each sector in greater detail.



*’accumulation’ in this context simply refers to the balance of input materials and waste arisings within the defined system boundary – this flow does not directly represent the mass of material used to manufacture products or deliver services in these sectors.

3/ The potential for a circular economy in Greater Lincolnshire and Rutland

How can we estimate the potential of the circular economy?

According to the Ellen MacArthur Foundation, a circular economy favours activities that preserve value in the form of energy, labour, and materials. This means designing for durability, reuse, remanufacturing, and recycling to keep products, components, and materials circulating in the economy. Fundamentally then, it represents a net increase in the flow of productive resources as opposed to a ‘business-as usual-version’ of the economy that loses economic value via waste. This preservation of resources creates business opportunities for firms to undergo innovative processes and sell to new markets.

Existing research and literature does not indicate any dominant method of quantifying the size of the circular economy in economic terms. In many respects, this is likely because the field is relatively new – but also because the all-encompassing nature of the circular economy presents difficulties in applying traditional data methods of economic and environmental evaluation, that may be suited to more linear 'cause and effect’ types of measurement. As such, it may not be useful to attempt to calculate a solitary figure estimating ‘how big’ the circular economy is or could be.

This report looks to give insight into the potential size and scale of the circular economy in the context of various economic opportunities that GLLEP is well poised to take advantage of. These are told through some of Lincolnshire’s game-changing sectors, which have the most potential for innovative activities that represent a more circular management of resources flowing through supply chains – from resource extraction, to production, packaging and distribution, consumption, then undertaking processes or ‘interventions’ that enable resources to be injected back into productive economy rather than wasted.

The following slide gives a variety of estimates that indicate the growing size of markets enabled by circular economy innovations. Followed by analysis and case studies demonstrating the scope for specific circular economy interventions in key sectors, this report builds a picture of the opportunity that the circular economy presents for GLLEP to achieve its economic and environmental priorities.

Potential geographical dispersion of jobs by circular economy activity

Activity	Job concentration	Areas of concentration
Reuse		Dispersed throughout the country
Closed loop recycling		Near manufacturing sites, logistics and supply chains
Open loop recycling		Near feedstock and markets, close to major ports
Biorefining		Near major ports, consuming industries, manufacturing sites, population centres and sources of domestic feedstock
Remanufacturing		Near manufacturing sites, transport hubs and population centres, with some overseas plants
Servitisation		Head office jobs may be in South East and London; back office and servicing jobs may go abroad

Scale from low to high concentration

WRAP, Employment and the circular economy (2021)

The table above indicates Greater Lincolnshire and Rutland could be well positioned to lead the growth of the many circular activities possible in the UK. Just as with non-circular practices, several of these interventions (such as biorefining, remanufacturing, and recycling) are economic activities that are highly geographically concentred, as they require co-location with specific skills, infrastructure, and existing supply chains and markets. As shown via the case study in this report on the remanufacturing of steel from wind farms, Lincolnshire’s existing strengths mean that these activities are likely to be concentred towards Lincolnshire.

In numbers – the potential scale of the circular economy

Boosting innovation and jobs

- At least **£417 million** worth of innovation funding contracts have been awarded by organisations such as UKRI to circular economy-related projects in the past 3-4 years across the UK, in the agriculture, construction and manufacturing sectors. This presents a significant and growing opportunity for firms in Greater Lincolnshire.

- Research estimates that increasing the remanufacturing rate to 50% would create **9,400** manufacturing jobs in Greater Lincolnshire by 2035, equal to an increase of the size of the manufacturing sector in Greater Lincolnshire by **22%**[1].

Building crucial infrastructure

- **20,000**[2] jobs are estimated to be in the circular supply chain for UK wind farms by 2030, including refurbishment, remanufacture and recycling.
- Based on the current proportion of UK offshore wind generated in Greater Lincolnshire, **6,000** of these jobs could be in GL.
- Refurbishing wind turbine parts is estimated to add **£10bn**[3] to the UK economy between 2025-2035. Based on the current proportion of UK offshore wind generated in Greater Lincolnshire, **£3bn** of this would be generated in GL.

- Greater Lincolnshire will require **36,000** homes by 2050[8].
- Under current construction practices, this could generate demand for up to **106,000 tonnes** of demand for reused and recycled construction materials each year to 2050[4].
- If this demand is met by locally recycled products, this is equivalent to **£10.6 million**[5] additional turnover for recycling operations in Lincolnshire each year to 2050, or **£265 million** over 25 years.

Accessing investment capital

- There was **£2bn**[6] capital invested by private equity and venture capital into the UK circular economy in 2023 – the average disclosed deal was worth **£10.7m**.
- In 2023, **£416m** was invested in Industrials & Manufacturing, compared to **£70m** in 2018. This included **£120m** of investment into Materials recovery.
- In 2023, there was **£114m** invested in Food & Drink firms, involving sustainable food systems and ingredients.
- Projecting 5-year growth rates into the future, the total volume of investment will grow annually to **£10.6bn**[7] **in** 2028, with around 600 deals a year worth an average of **£17m** by 2028.
- If firms in Greater Lincolnshire received 5%[9] of total forecasted investment in 2028, they would receive **£530m** across 30 deals in 2028.
- If this were the case, firms in Greater Lincolnshire would have received a total of **£1.8bn** investment between 2024-2028.

1 Metro Dynamics analysis based on ‘Levelling up through circular economy jobs’, Green Alliance, 2021.
2 Metro Dynamics analysis based on ‘End of Life Materials Mapping for Offshore Win in Scotland’, Catapult, 2022.
3 Coalition for Wind Industry Circularity, University of Strathclyde.
4 Metro Dynamics analysis based on 2050 materials and Business Waste
5 Metro Dynamics analysis based on UK Recycling and Waste Market Overview
6 ‘Investment in to the UK Circular Economy’, BDO, 2024
7 Metro Dynamics analysis of ‘Investment in to the UK Circular Economy’, BDO, 2024
8 As referenced in the Strategic Infrastructure Delivery Framework (slide 52)
9 Example value. Represents a growth scenario for Lincolnshire’s specialisation in Circular Economy activities.

The potential for a circular economy by sector clusters

The transition to a circular economy presents several significant economic opportunities for Greater Lincolnshire and Rutland's economy as demonstrated on the previous page.

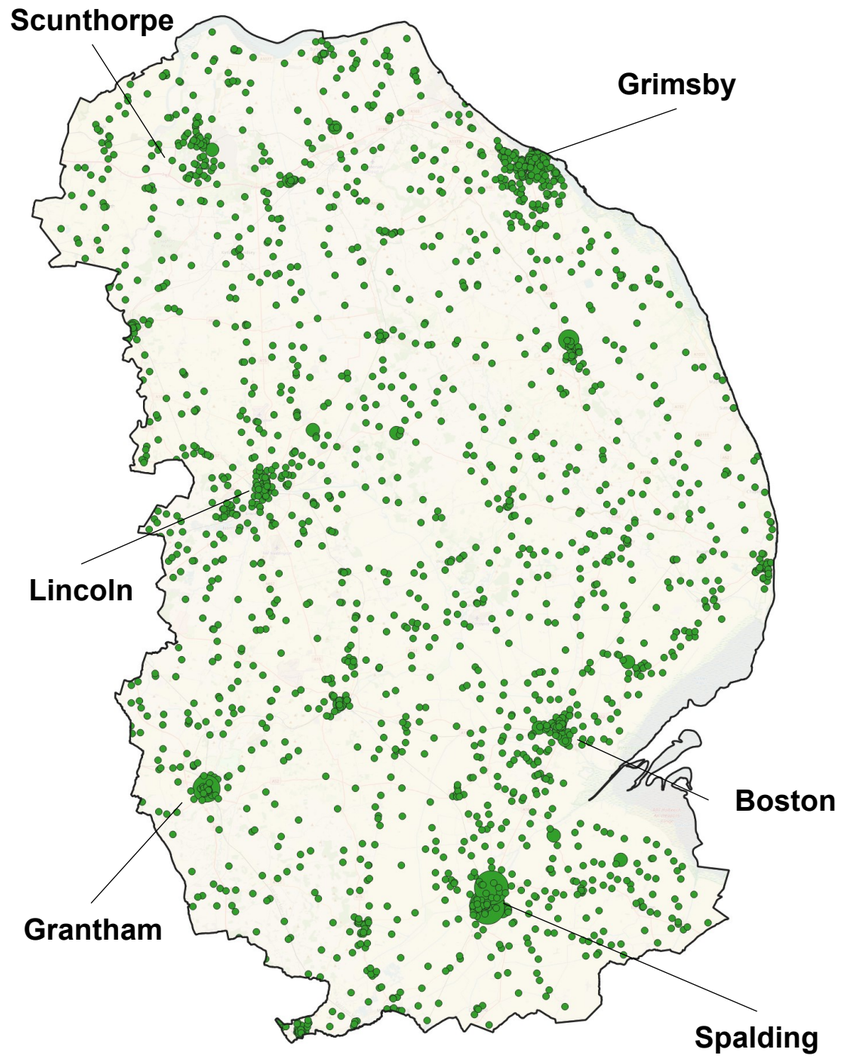
To further understand the potential for a circular economy to develop in the region, the following sub-sections explore the five priority sectors in greater detail. Each sub-section presents key findings from the research across the following components:

- *Economic sector overview* – map of the sector's business locations and an overview of key economic indicators (GVA, number of employees and businesses, and location quotients) to understand the baseline economic activity from which a circular economy could develop.
- *Map of current activities* – focusing on one zone where existing assets and demonstrator projects are clustered, this page summarises existing circular economy activity related to the sectors.
- *Material flow analysis* – a static MFA for each sector at the regional scale describing raw material inputs, waste generation and handling to help identify opportunities for circular economy interventions.
- *Case study* – deep dive into current or future circular economy projects and business models to understand how they implemented their circular approach, and an estimate of the environmental and economic benefits from doing so.
- *Opportunities* – presents opportunities identified through surveys, interviews, the workshop with businesses, and desk-research that could be undertaken to transition to a circular economy.
- *Barriers* – describes the barriers of transitioning to a circular economy for organisations in the sector, gathered from surveys, workshops and interviews.

The final sub-section *Regional Opportunities* describes the regional cross-sector opportunities that could be harnessed to develop a circular economy in Greater Lincolnshire and Rutland.

Agri-food

Agri-food: economic sector overview



Agri-food business clusters

◯ Size of the bubble = Concentration of businesses

£2.7 bn GVA

2.8% 5-year CAGR

2.5% 10-year CAGR

1.3% 5-year national CAGR

1.3% 10-year national CAGR

46,820 employees

10.2% of total employees

4.1% growth between 2018-2022

7.4% growth nationally

4,730 businesses

11.5% of total businesses

-8.8% business growth between 2018-2023

LQ of 2.95

Agri-food is around 3x more specialised in Greater Lincolnshire compared to nationally.

ONS, Regional gross value added (balanced) by industry: local authorities by ITL3 region, 2023; ONS, BRES, 2023
Metro Dynamics analysis of Data City businesses using SIC codes

Agri-food: map of current activities
Assets and demonstrator projects

Comprised of agriculture, food processing, and specialist storage, the agri-food sector is one of the most significant in the region, and crucial for the transition to the circular economy.

Greater Lincolnshire is home to the UK Food Valley, with one of the largest concentrations of agriculture, food manufacturing, research, distribution and storage in Europe. The region is home to 25% of England's Grade 1 agricultural land, supplies 1/8th of the UK's food, and 30% of its vegetables with a significant fresh produce and glasshouse cluster. It is also home to three Food Enterprise Zones and an Agricultural Growth Zone.

As an important sector with strong regional assets to support innovation and research, there are already significant existing clusters in the South of the region around Holbeach, Boston, South Holland, and Spalding. About 30% of national food shipments pass through South Lincolnshire, and South Holland has the 2nd highest concentration of logistics in the UK.

There are also key projects which demonstrate the maturity of this sector regarding the circular economy, as several businesses have saved costs and created new income streams by applying circular principles to their operating models.

Assets

1. National Centre for Food Manufacturing (NCFM)
2. Lincoln institute for Agri-Food Technology (LIAT)
3. Holbeach Food Enterprise Zone
4. Port of Boston
5. Boston College's Engineering, Manufacturing and Technology Centre (EMAT)

Branston Ltd, Branston:
One of its facilities extracts high-grade plant protein from low-value potatoes to create a clean-label functional protein to be used in vegetarian and vegan foods.

Bridge Farm, Lincoln
As the UK's largest protected crop producer, Bridge Farm grows over 70 million plants in 60 acres of glasshouses. Crops are heated using biomass fuelled by the waste wood of other industries and watered using rainwater collected on the roof of which the excess is re-used.

Fairman Knight and Sons UK Limited, Grantham
This business is building the UK's first commercial insect farm, co-located next to a broiler farm. The insect farm will feed its black soldier fly larvae with food waste. These insects will then be fed to the broiler to replace traditional soya feedstock.

Naylor Nutrition, Spalding:
The company is building the world's first brassica plant-based cold extraction facility. The process will extract high-value protein products from surplus cabbages to fill growing UK demand for plant-based proteins.

Agri-food: material flow analysis

In the Greater Lincolnshire and Rutland agri-food sector, the primary waste streams are food waste (~119,000 tonnes per year), household and mixed waste (~49,000 tonnes per year), and rubber and plastic waste (~8,000 tonnes per year). Most of the food waste and rubber and plastic waste is recycled (this includes recovery of food waste through anaerobic digestion), along with a small portion of the household and mixed waste. However, due to losses from all waste streams to incineration and/or landfill, there is an opportunity to increase the volume of material being recycled, and to capitalise on the economic value of these secondary materials.

From Greater Lincolnshire and Rutland's agri-food sector in 2019:

- 1,000 tonnes of rubber and plastic waste was incinerated.
- 20,000 tonnes of food waste was incinerated.
- 5,0000 tonnes of food waste was sent to landfill.
- Around 24,000 tonnes of household and mixed waste was sent to landfill, with most of the remainder incinerated or used in energy recovery processes.

Based on these findings, the primary opportunities for circular economy interventions in the Agri-food sector concern the incinerated rubber and plastics wastes, and food waste sent for incineration and landfill. If 25% of these waste streams could be diverted to recycling, an estimated £6.6 million in Gross Value Added (GVA) could be created by the sector each year. Also, with the mandatory collection of household food waste across England in 2026, there will be more food waste recovered through anaerobic digestion.

There are further opportunities to intervene earlier in the process and find novel uses for waste materials that could provide valuable inputs for other parts of the food industry. One example being the partnership between Branston Farms and B-Hive innovations, with their Roots Extracts product that extracts the protein from out grade potatoes so that it can be used in food processing such as binding, gelation, emulsification, foaming and solubility.

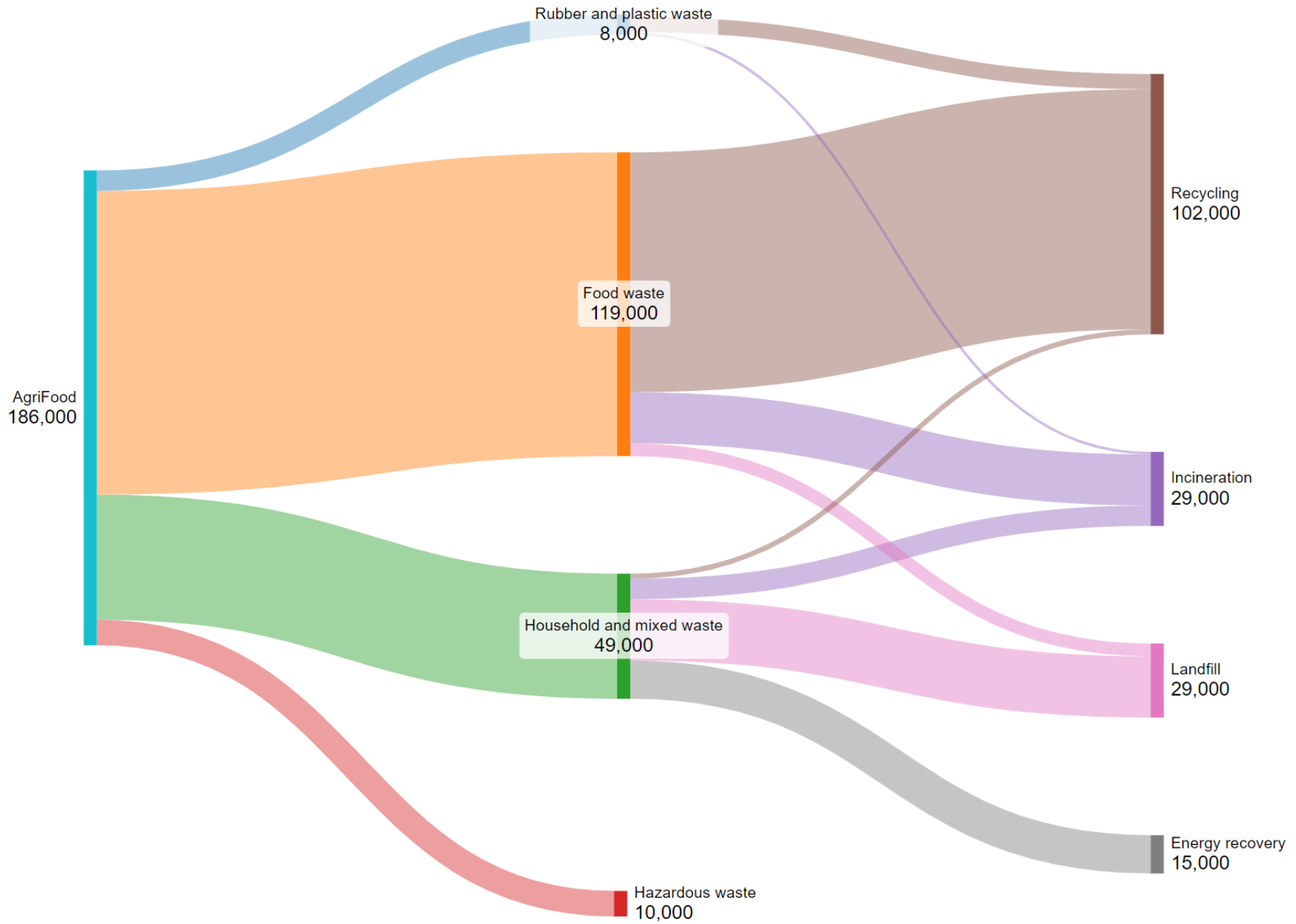


Figure. Agri-food waste stream material flow analysis

Case study - SmartFert

SmartFert is an innovative company committed to sustainability, focusing on the transformation of low-value agricultural, horticultural, aquaculture, and bio-energy residues into high-performing fertiliser products. Their approach not only reduces waste but also creates value from materials that would otherwise be discarded, addressing both environmental and economic challenges in the agricultural sector.

SmartFert are currently working alongside the University of Lincoln to develop a containerised drying system using surplus heat to transform ungraded vegetables into valuable flakes and powder products for use in food production and for animal feed. Their innovative processes include the development of granular and pelleted products derived from ashes, digestate, and solid residues. These products not only provide essential nutrients to crops but also promote a circular economy by reintroducing valuable materials back into the food chain.

SmartFert's collaboration with British Gypsum is a prime example of their innovative approach. The partnership focuses on repurposing materials from a mine in Staffordshire that are unsuitable for plasterboard production. SmartFert identified that these materials, rich in sulphur, could be repurposed as a fertiliser additive, which has been shown to be highly beneficial for crop growth. They are currently assisting in the construction of a granulating plant where these materials will be crushed, milled, and granulated, enhancing their usability and value.

By reducing waste, decreasing reliance on imported fertilisers, and repurposing low-value residues, they are contributing to a more sustainable and resilient agricultural system. As the demand for sustainable fertilisers grows, SmartFert is well-positioned to lead the market, driving further innovation in waste-to-value processes.

Figure. SmartFert produces precision fertilisers

Figure. Image of SmartFert's granular fertiliser

Case study - SmartFert

In one example of their activity, SmartFert were able to transform 18,000 tonnes of waste fish material to 6,000 tonnes of dried fish pellets. The analysis below sets out how an upcycling of this quantity creates cost savings for firms in both the handling of landfill waste and imported fertiliser, creates and retains economic value in the Lincolnshire supply chain, and reduces the emissions embedded in the waste disposal process.

Landfill and disposal

Business as usual processes

Sending excess fish parts from the fishing and food production process to landfill for incineration or exporting to other countries for handling

Impact

- Emissions generated during disposal and incineration process
- **£1.9m** landfill fees for 18,000 tonnes of fish waste
- Supply chain loses all economic value of the resource

Low-value recycling

Business as usual processes

Fish waste is used largely in the fish meal industry, as it contains proteins present in fish meat

Impact

- Average productivity of fish processing jobs is lower than in the development of drying technology

High-value upcycling

Circular economy innovation

SmartFert are using a high-tech drying process, granulating and pelleting fish waste and other agricultural waste and turning it in to nutrient-rich fertiliser

Impact

- 10-fold increase in product value from waste fish (£400/tonne) to dried fish (£4000/tonne) boosts local supply chain value by **£16.8m**
- Biofertiliser increases agricultural yields for local farmers – studies suggest by up to **10-40%**
- Combats rise in imported fertiliser prices - UK spent around £1bn on imported fertiliser in 2023, rising from £500m in 2020. Lincolnshire spend in 2023 likely around **£40m.**
- Creation of innovation jobs and investment into agri-tech in pelleting and drying processes, increasing the productivity of the agrifood sector

Key Findings – Agri-food
Opportunities

Creating value from waste material

The agri-food cluster in greater Lincolnshire is crucial to both the regional and national economy, providing 24% of jobs and contributing 21% of the area's economic output. Waste and by-products from the agri-food sector can be converted into higher-value products such as fertiliser and energy through anaerobic digestion.

Waste products

The agri-food sector creates a large quantity of waste by-products, however, there is an opportunity to convert this back into high-quality products for reuse or re-purposing.

For example**,** Branston potatoes have been given the go-ahead to launch a new £6 million extraction facility alongside partners, Rootextracts Ltd. In Branston's Lincoln headquarters, the factory will convert secondary grade low-value potatoes into functional plant-based protein, as well as, generating starch-based products for a range of manufacturing applications.

Recyclate

There is an opportunity to utilise wastewater and sewage recyclate in the farming industry through crop irrigation and fertiliser production. In the context of greater Lincolnshire, Smartfert take low-value residues from the biosolids and bioenergy sector to produce the formulation of high-value granular and micronised fertiliser.

Anaerobic digestion

2050 group ltd are developing, building and operating 10 biorefineries across the UK, with the first biorefinery set-up near to Louth, Lincolnshire. This factory - named Manby BGE facility - processes waste and residues from agriculture, specifically straw, hen and broiler manure, as well as cattle manure.

The biorefinery will in turn produce

- ~7,100nm3/hr of bio-cng (enough to refuel 1,000 hgv's daily)
- ~70,000tpa of liquid bio-co2 (10% of UK demand)
- ~160,000tpa of bio-based fertiliser

Highlighting the potential to produce a high-quality fertiliser output in addition to energy outputs.

Insect farming

Fairman knight and sons are one of Lincolnshire's first net zero farming businesses. They are building the first commercial insect farm in-situ with a broiler farm. The farm will produce thousands of tonnes of black soldier flies each year by bio-converting organic waste. This will provide a local, sustainable protein source and eco-friendly fertiliser, substantially reducing the carbon footprint and repurposing food waste into valuable resources at the farm level.

Industrial symbiosis

Industrial symbiosis exhibits the collaboration between companies that share resources to minimise waste and maximise resource use.

Enterprise zones

Located within Lincolnshire, the Holbeach enterprise zone is a hub for the food-tech and food manufacturing sectors. It holds the potential to become a centre for collaboration and innovation, intersecting food, port, logistics and energy. The enterprise zone aims to bring together researchers, farmers, manufacturers, distributors and retailers so they can improve productivity, supporting both existing agri-food businesses as well as those looking to invest and relocate

Backloading

Utilising the maximum amount of space in a vehicle to transport the most material possible. Therefore, transport trucks come back to Lincoln full, lowering fuel consumption and transportation costs.

Key Findings – Agri-food
Barriers

Regulation

Many participants in the workshop expressed their frustrations concerning regulations and standards. Businesses, particularly SMEs, in the Agri-food industry must abide to strict water extraction limits from the government, potentially impacting or limiting production. Yet, larger, more authoritative companies do not abide by these laws, creating a sense of double standards.

Moreover, one participant from the workshop highlighted a case study where ash output was extracted from a power station to go into road construction, which could provide phosphate and potash for agriculture, however, this could not be implemented due to environmental legislation.

Planning

Planning regulations play a significant role in a business's quest to becoming more circular. For example, a workshop participant revealed that they planned on installing 3 wind turbines to power their facilities, however, planning permissions only allowed for one.

Transport and logistics

The diversity and fragmentation of the supply chain make it difficult to implement coordinated circular practices, such as shared waste management systems or resource recovery networks. Collaboration between farmers, food processors, and logistics providers is essential but logistically challenging

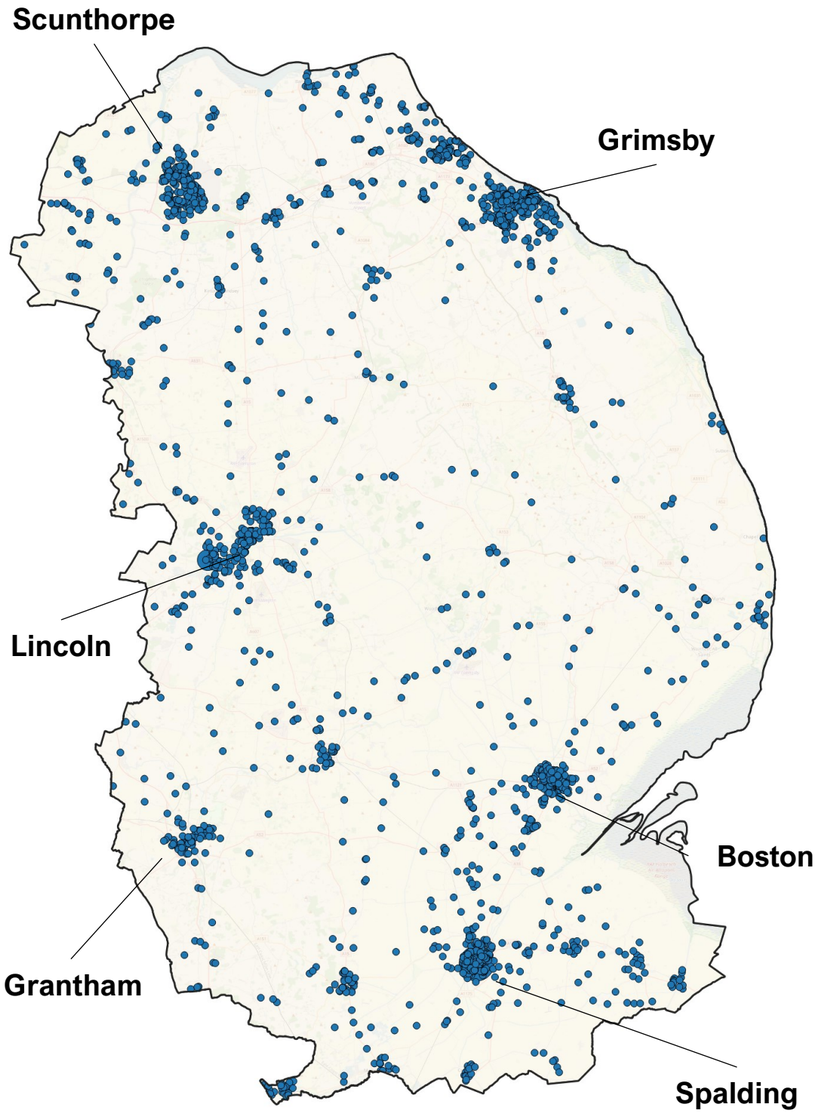
Furthermore, Lincolnshire is a rural region, and the transportation of waste or by-products for reuse in different sectors may be costly and inefficient due to the distance between farms, processing facilities, and recycling centers.

Cost/investment

For many producers in Greater Lincolnshire, the financial investment required to adopt circular practices can be prohibitive. These practices often entail upfront costs in technology, infrastructure, and training that may not provide immediate returns. Moreover, the price sensitivity of agricultural products can make it difficult to pass these costs on to consumers

Energy, Ports & Logistics, and Seafood

Ports and Logistics: economic sector overview



Port and logistics business clusters

◯ Size of the bubble = Concentration of businesses

£1.1 bn GVA

-0.2% 5-year CAGR

0.2% 10-year CAGR

1.3% 5-year national CAGR

1.3% 10-year national CAGR

17,575 employees

3.8% of total employees

-16.2% growth between 2018-2022

11.9% growth nationally

2,880 businesses

7% of total businesses

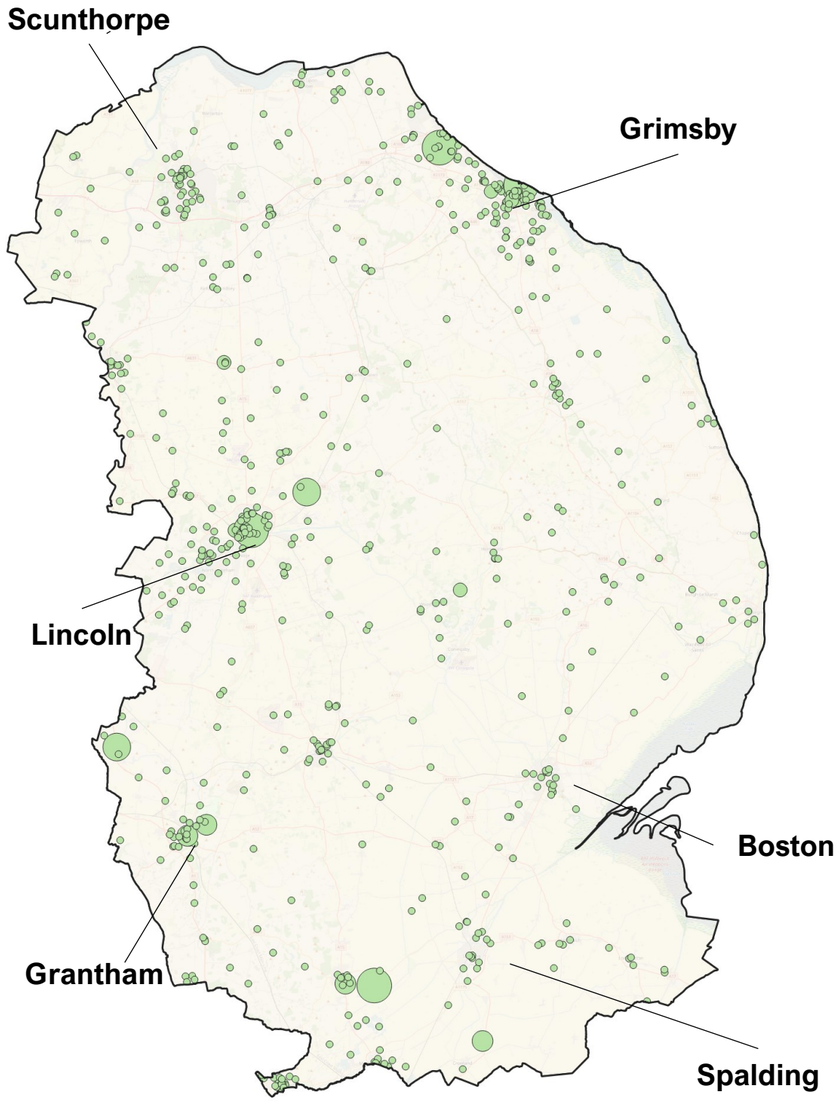
11.4% business growth between 2018-2023

LQ of 1.1

Port and Logistics is slightly more specialised in Greater Lincolnshire compared to nationally

ONS, Regional gross value added (balanced) by industry: local authorities by ITL3 region, 2023; ONS, BRES, 2023
Metro Dynamics analysis of Data City businesses using SIC codes

Energy: economic sector overview



Energy business clusters

Size of the bubble = Concentration of businesses

£1.3 bn GVA

5.2% 5-year CAGR

6.3% 10-year CAGR

-3.1% 5-year national CAGR

-0.3% 10-year national CAGR

6,205 employees

1.4% of total employees

-13.8% growth between 2018-2022

2.9% growth nationally

270 businesses

0.7% of total businesses

1.89% business growth between 2018-2023

LQ of 0.9

Energy is less specialised in Greater Lincolnshire compared to nationally

ONS, Regional gross value added (balanced) by industry: local authorities by ITL3 region, 2023; ONS, BRES, 2023
Metro Dynamics analysis of Data City businesses using SIC codes

Energy, ports & logistics & seafood: map of current activities
Assets and demonstrator projects

South of the Humber is home to a cluster of businesses from a few key sub-sectors including renewable energy, logistics and seafood processing, concentrated around the Humber Freeport.

The Humber Freeports' four ports handle 12% of the UK's cargo, exporting and importing agri-food and manufactured products internationally. Two of these ports (The Ports of Grimsby and Immingham) are in North Lincolnshire and are the second largest in terms of handled tonnage in the UK. The other two ports are on the northern side of the estuary. Transport and storage growth in North Lincolnshire has been faster than any other sector since 2011.

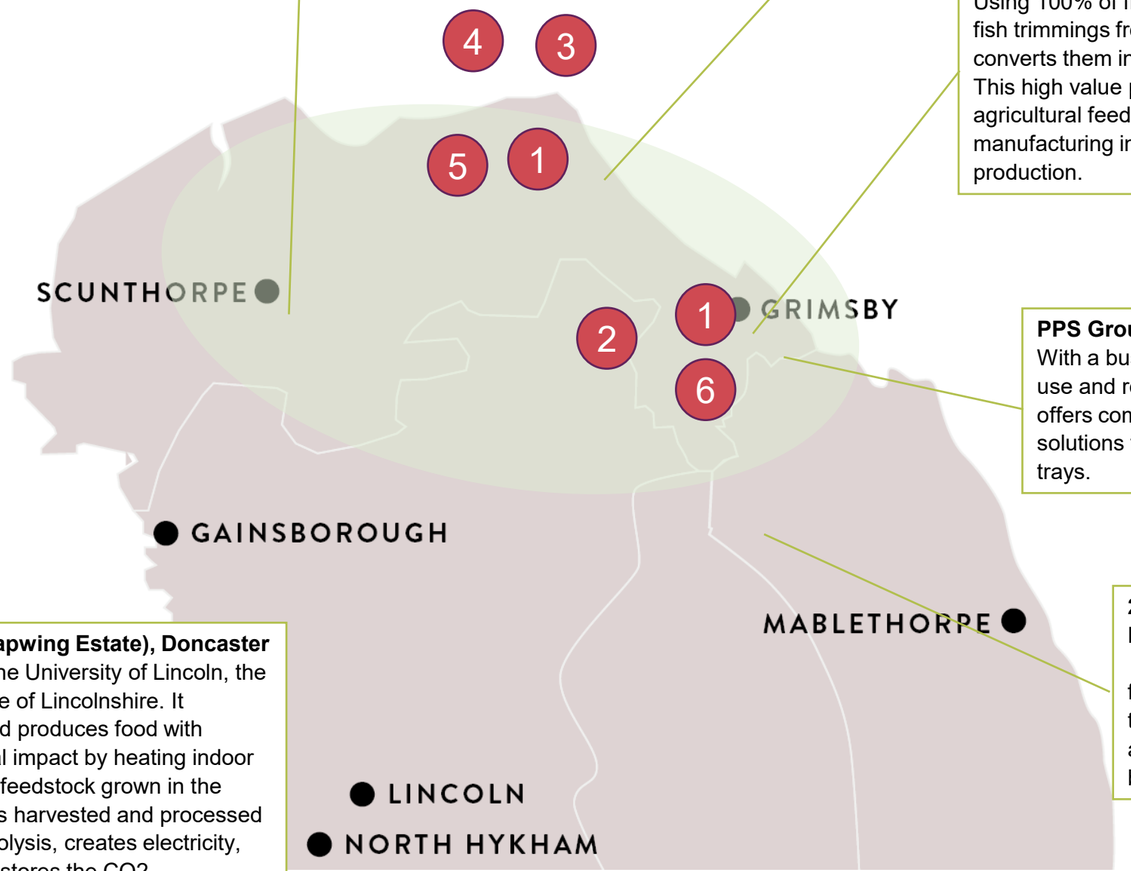
Over 50 seafood processing businesses are in Grimsby, processing 70% of the UK's seafood. The Port of Grimsby also handles all the offshore wind disassembly on the Humber. There are 10 windfarms operational or in construction, constituting 27% of UK offshore wind.

Several key assets are located on the north bank of the Humber Estuary, such as AURA innovation centre and the future Yorkshire Energy Park. They are included in this map as they bolster the potential for the transition to the circular economy by promoting innovation and sharing resources through clusters of activity.

This zone's economic activity will continue to grow as the South Humber Industrial Investment Plan supports economic growth with £42million over 15 years.

Assets

1. The Humber Freeport (Ports of Grimsby and Immingham)
2. Offshore Renewable Energy Catapult (ORE)
3. Yorkshire Energy Park (Humber north bank)
4. AURA innovation centre (Humber north bank)
5. Northeast Lincolnshire Enterprise Zones (Able Immingham Energy Park, Pioneer Business Park, Port link, Humber Gate, Grimsby Future Park)
6. Grimsby seafood processing cluster



Three Oceans and CorrBoard Bioenergy, Grimsby/Scunthorpe
Three Oceans is the first company in the world to use packaging powered by its own fish waste. CorrBoard BioEnergy collects fish waste from Three Oceans and processes it in their anaerobic digestor which powers their factory. This factory then produces corrugated board for transit packaging for customers like Three Oceans.

Shell, BA and Velocys Altato, Immingham
Operational in 2027, this project will convert municipal and commercial solid waste that is left over from traditional recycling and otherwise destined for landfill or incineration. The process will produce 60 million litres of sustainable aviation fuel per year, equivalent to 1000 flights from London to New York annually. The project expects to employ 100 people during long-term operation.

Pelagia, Grimsby
Using 100% of fish, Pelagia processes the fish trimmings from across the UK and converts them into fish oil and fish meal. This high value product is then used for agricultural feed and feedstock for other manufacturing industries such as leather production.

PPS Group, Grimsby:
With a business model based around re-use and rental for the logistics sector, PPS offers complete returnable equipment solutions from plastic crates, pallets to trays.

2050 Group & Manby BGE, Louth
2050 Group plan to build their first UK biorefinery in Louth. It will take local cattle manure, straw and poultry manures to produce biofuel and bio-based fertiliser.

Reverse Coal (the Lapwing Estate), Doncaster
In collaboration with the University of Lincoln, the project sits just outside of Lincolnshire. It sequesters carbon and produces food with positive environmental impact by heating indoor farming with biomass feedstock grown in the estate. The biomass is harvested and processed on site, and using pyrolysis, creates electricity, heat and biochar that stores the CO_2.

Case study – ORE Catapult
Decommissioned Offshore Wind and Steel Manufacturing

ORE Catapult (Offshore Renewable Energy Catapult) is the UK's leading technology innovation and research centre for offshore renewable energy, particularly focussing on offshore wind, wave and tidal energy.

ORE Catapult has eight leading technology and innovation centres, delivering impact across the UK economy. Within the Greater Lincolnshire region, Grimsby serves as a base for the Operations & Maintenance Centre of Excellence. Here, the centre works to develop new technologies, innovative strategies and best practices to increase the performance of offshore wind assets. Equally, the port functions as a centre for vessels to transport equipment to and from offshore wind farms for maintenance and repairs, and eventually disassembly.

Importantly, steel contributes to at least 70% of the mass of a wind turbine, with research predicting this to increase to 90%. Currently, steel is transported and handled abroad due to a range of factors such as cost, demonstrating a loss of valuable materials from the domestic market. ORE Catapult have identified an opportunity to work with Scunthorpe based company, British Steel, to recycle deconstructed steel from Grimsby. This partnership would create high skilled green jobs, reduce GHG emissions and retain valuable materials in Greater Lincolnshire.

Crucially, ORE Catapult currently work with key stakeholders to:

- Employ better material specifications for new builds in order to **extend product life cycles**
- Divert 'failed' parts from landfill through **repair and refurbishing**
- Capturing end-of-life materials from decommissioning for **resource recovery**
- Develop a component database and materials route map for **end-of-life** assets
- Discontinue the use of marine gas oil and switch to alternative fuels.

A significant opportunity exists to implement circular economy principles into ORE Catapult's business model to retain material value, reduce waste and generate economic opportunities with significant positive environmental impacts.

Figure 1. ORE Catapult's Grimsby facility.

Figure. Offshore wind innovation

Case study – ORE Catapult
Decommissioned Offshore Wind and Steel Manufacturing

The recycling of scrap steel from decommissioned windfarms presents a major economic and environmental opportunity that builds on the unique strengths and assets of Lincolnshire – both in green energy and manufacturing. Under the current industry standard process, economic value is lost through the exporting of scrap steel for handling once a windfarm is decommissioned. There is potential to leverage existing local expertise in steel to develop a remanufacturing plant in Scunthorpe once the steel has been deconstructed in Grimsby.

Stylised economic potential

Lifecycle of a wind turbine
25 years

Turbines in Lincolnshire to be decommissioned by 2052
1,088

Proportion of each turbine made of steel
90%

Total tonnes of recycled steel kept in Lincolnshire
160,000

Jobs that could be created at a potential Scunthorpe remanufacturing centre
1,500

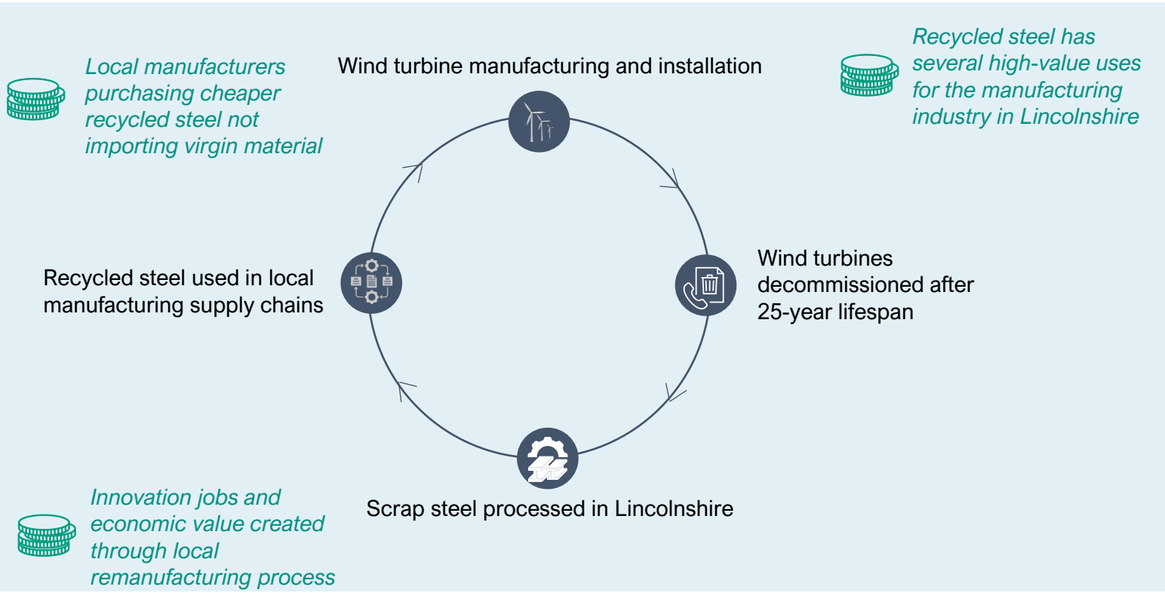
Supply chain value of recycled steel retained in Lincolnshire economy
£37m

Includes only existing turbines – current pipeline presents significant additional economic opportunity

Current standard industry practise

Steel imported → Wind turbine manufacturing and installation → Wind turbines decommissioned after 25-year lifespan → Steel exported for handling

Innovative process circular product lifespan



Key Findings - Energy, Ports & Logistics, and Seafood
Opportunities

Heat networks

Heat networks offer carbon emissions savings by supplying heat to buildings from a central source, avoiding the need for households and workplaces to rely on individual, energy-intensive heating solutions - such as gas boilers. There is a potential for areas of Lincolnshire to adopt a heat network plan through the 'Green Heat Network Fund', a £288 million government fund opened, with funding supporting the uptake of low-carbon technologies such as heat pumps, solar, and geothermal energy.

Infrastructure projects

The large scale of Nationally Significant Infrastructure Project (NSIP) applications in Greater Lincolnshire presents an opportunity for them to act as powerful catalysts for advancing circular economy projects. NSIPs are large-scale infrastructure projects that are considered to be of national importance. There are currently 35 Solar NSIP projects designated for Lincolnshire and listed on the National Grid Transmission Entry Capacity Register (TEC), including Cottam Solar Project – generation capacity of 600MW, West Burton Solar Project – generation capacity of 480MW, and Gate Burton Energy Park – a 500MW project. Solar NSIPs can promote circular approaches in energy use by reducing reliance on finite resources and fossil fuels.

NSIPs could also finance future circular economy projects through their Community Benefit Agreements, which aim to bring benefits to local residents who are impacted by the projects.

Retrofitting

Retrofitting buildings can improve their ability to retain heat and replacing their energy sources with renewable alternatives. The University of Lincoln has deployed state-of-the-art LED and fluorescent lighting from County Durham based company, 'Thorn', in 17 student halls, reducing lighting energy consumption and costs by 25%. Significantly, based on a combination of efficient LED and fluorescent technology and integrated controls, the University of Lincoln will achieve rapid returns on its investments in Thorn products. Based on lighting energy savings of 25% and total energy savings in student blocks of more than 20%, the University will save nearly £10,000 in energy savings per academic year, paying off the initial investment in just five years.

Solar Panel Recycling

Recycled materials and components from waste solar panels can be used for the manufacturing of new panels or sold into the global resource material industry. A report from The International Renewable Energy Agency demonstrated that the solar panel industry will benefit significantly from the recycling of end-of-life panels.

Considering Greater Lincolnshire have a long list of solar farm developments in the pipeline (such as the NSIPs mentioned), this is a great opportunity to recover valuable materials and divert waste from landfill. Scunthorpe based company, RECYCLE SOLAR, offer a recycling service for solar panels where materials are separated, shredded and sent off for processing where it can be processed into semiconductor grade raw material for use in new solar modules. This recycling process recovers 90% of the glass and 95% of the semiconductor materials that can be extracted for use in new solar PV panels.

Logistics

For logistics companies, potential opportunities exist to partner with low carbon energy and industrial businesses for services including the transportation and storage of feedstocks and products, and offshore logistics. Direct access to renewable energy (from offshore wind), and low carbon hydrogen, will enable logistics businesses to develop net zero supply chains, including food cool chains. The area’s low carbon energy proposition is also potentially attractive to low carbon manufacturers in sectors including sustainable transport, creating further potential growth opportunities for logistics companies.

Rural innovation test-bed

Opportunity to become a rural innovation testbed for new energy technologies and their application in rural areas, consequently, serving as an energy disruptor through this testbed approach. Already established as a leader in offshore renewable energy, Greater Lincolnshire can unlock the economic potential of the Humber Estuary and stimulate growth in the area through these developments.

Key Findings - Energy, Ports & Logistics, and Seafood
Barriers

Sparsity

Rural areas often lack the robust grid infrastructure needed to support renewable energy generation and distribution. The existing electrical grid in sparsely populated regions may not be able to handle the variability of renewable energy sources, such as wind or solar. Rural areas may also lack the skilled workforce necessary to install, operate, and maintain renewable energy projects. This shortage of local expertise can lead to delays, increased costs, and the need to bring in outside workers, which further complicates implementation

Cost

One of the biggest barriers identified was the capital upfront cost of investing in renewable energy. Renewable energy projects, such as wind farms or solar installations, often require significant upfront investment. In areas with sparse populations, the lower energy demand means less economic return on investment.

Similarly, many of the workshop participants highlighted that they did not have enough capital to make the initial investment, and thus, could not justify over lifetime costs.

Solar farms

Agricultural stakeholders may oppose large solar developments using land allocations. For example, the proposal of the Mallard Pass Solar Farm has faced heavy criticism from opposition. The 4.2-mile-long development is said to produce enough energy to power 92,000 homes across a 30-year period, however, opposition expressed concerns over damage to the wildlife, taking away productive agricultural land and being a visible eye sore.

Politics

Political shifts can lead to inconsistent energy policies and discourage long term investment. Top-down political position can potentially maintain conventional energy, whereas renewables are less of a political drive

Planning

Integration of renewable energy sources requires careful planning to ensure reliability. The University of Lincoln had an incentive to change all non-efficient lighting, yet the planning process was extremely long which served as a major barrier.

National grid

The capacity of the National Grid is heavily strained. As renewables connect to the network, power flows change and circuits become unequally loaded, causing the strained circuit to overload. And, as power naturally flows through the path of least impedance, when even one circuit reaches capacity, the entire network is unable to absorb any more power.

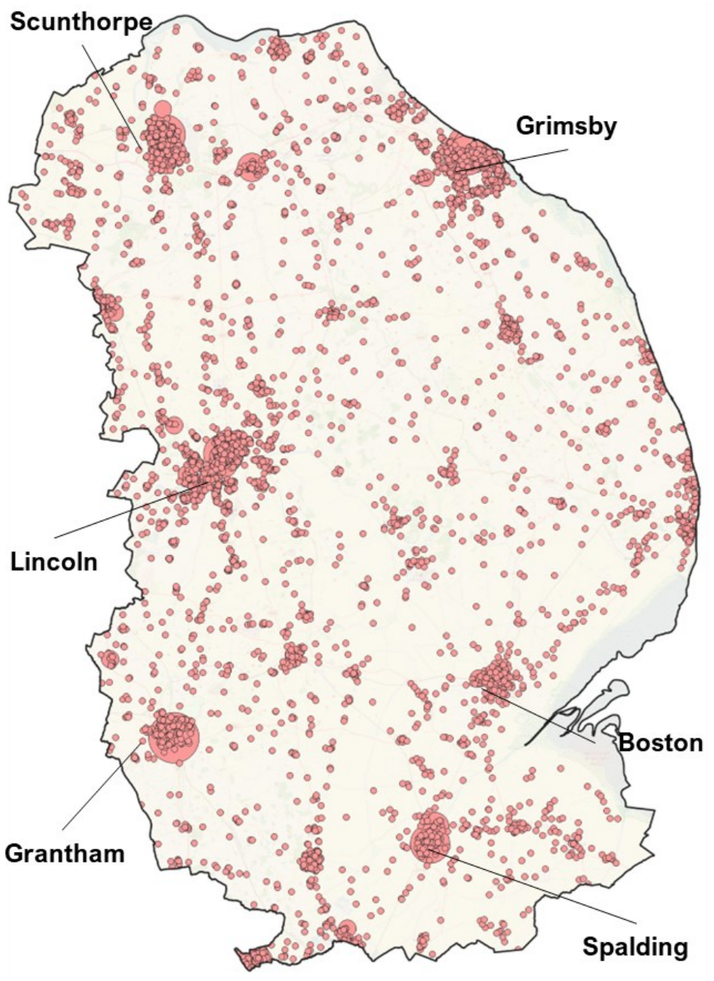
It is not yet clear that the scale of energy storage facilities which are likely to be required, or the actions necessary to secure long-term storage, is well understood. The energy sector needs clear strategic direction to secure the private investment required and delivery of grid-scale energy storage, which will otherwise be delayed. The energy sector has called on the Government to set out an energy storage strategy, establishing the short and long-term energy storage needed to deliver the UK’s net zero goals.

Decarbonisation / Low carbon fuels

To achieve Net Zero emissions by 2050, the ports and logistics sector must reduce its emissions by around 15% by 2030 vs. 2022 levels. Among the available decarbonisation options, zero-emission fuels such as methanol and ammonia are an important focus area. However, there are many barriers to implementing this. Firstly, finding sources of funding to develop zero-emission fuel projects remains a challenge due to the high price of electricity in the UK currently. Similarly, storage and transport infrastructure for zero emission fuels are currently underdeveloped and the responsibility for last-mile logistics is uncertain. A further cause of uncertainty among carriers and investors is the lack of industry-standard definitions for the resulting zero-emission fuels.

Visitor Economy

Visitor Economy: economic sector overview



Visitor Economy business clusters

£3.2 bn GVA

1.8% 5-year CAGR

1.3% 10-year CAGR

-0.8% 5-year national CAGR

0.7% 10-year national CAGR

50,000 employees

10.9% of total employees

4.7% growth between 2018-2022

7% growth nationally

4,730 businesses

11.5% of total businesses

12.2% business growth between 2018-2023

LQ of 0.95

Visitor Economy is less specialised in Greater Lincolnshire compared to nationally

ONS, Regional gross value added (balanced) by industry: local authorities by ITL3 region, 2023; ONS, BRES, 2023
Metro Dynamics analysis of Data City businesses using SIC codes

◯ Size of the bubble = Concentration of businesses

Visitor Economy: map of current activities
Assets and demonstrator projects

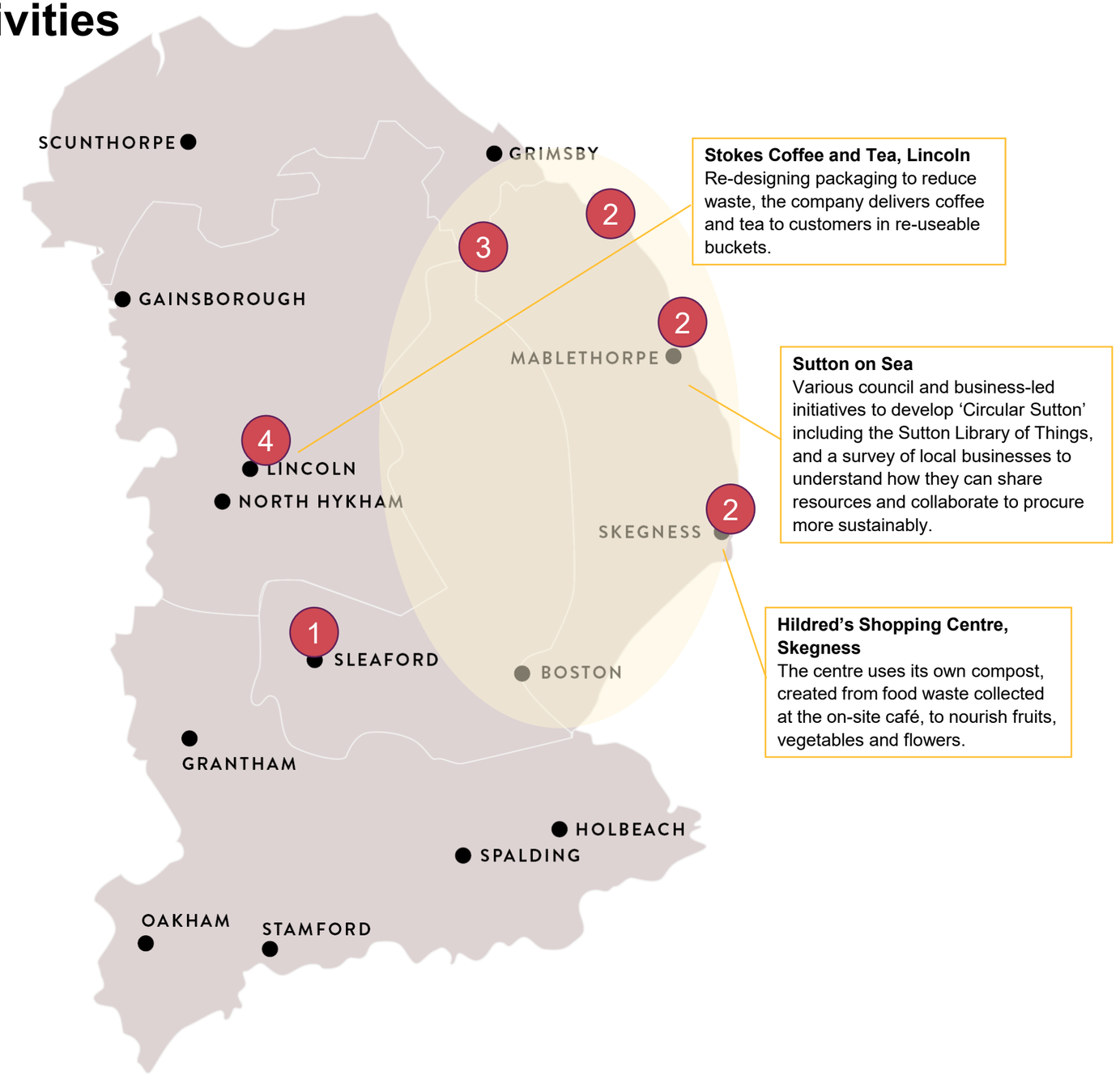
With 25.4 million visitors to Greater Lincolnshire and Rutland in 2021 and the second highest GVA of the sectors in this report, the visitor economy is a strategic sector of importance for Greater Lincolnshire and Rutland. The sector has a regional concentration on the East Coast as it is home to several assets that appeal to visitors, particularly in the summer months.

The sector is comprised of venues, accommodation attractions and hospitality. Transitioning to a circular economy model faces the challenge of seasonality with increased visitor traffic in the summer months, bringing high concentrations of economic activity and resource flows relative to the winter months.

There was very little engagement from organisations in this sector. As a result, the understanding of its potential for a circular economy is limited, and the barriers and opportunities are not place-specific.

Assets

1. Heart of Sleaford (town regeneration project aiming to create a new destination in centre)
2. Major coastal resorts such as Cleethorpes, Mablethorpe and Skegness
3. The Lincolnshire Wolds
4. City of Lincoln and historical and cultural assets



Stokes Coffee and Tea, Lincoln
Re-designing packaging to reduce waste, the company delivers coffee and tea to customers in re-useable buckets.

Sutton on Sea
Various council and business-led initiatives to develop 'Circular Sutton' including the Sutton Library of Things, and a survey of local businesses to understand how they can share resources and collaborate to procure more sustainably.

Hildred's Shopping Centre, Skegness
The centre uses its own compost, created from food waste collected at the on-site café, to nourish fruits, vegetables and flowers.

Visitor economy: material flow analysis

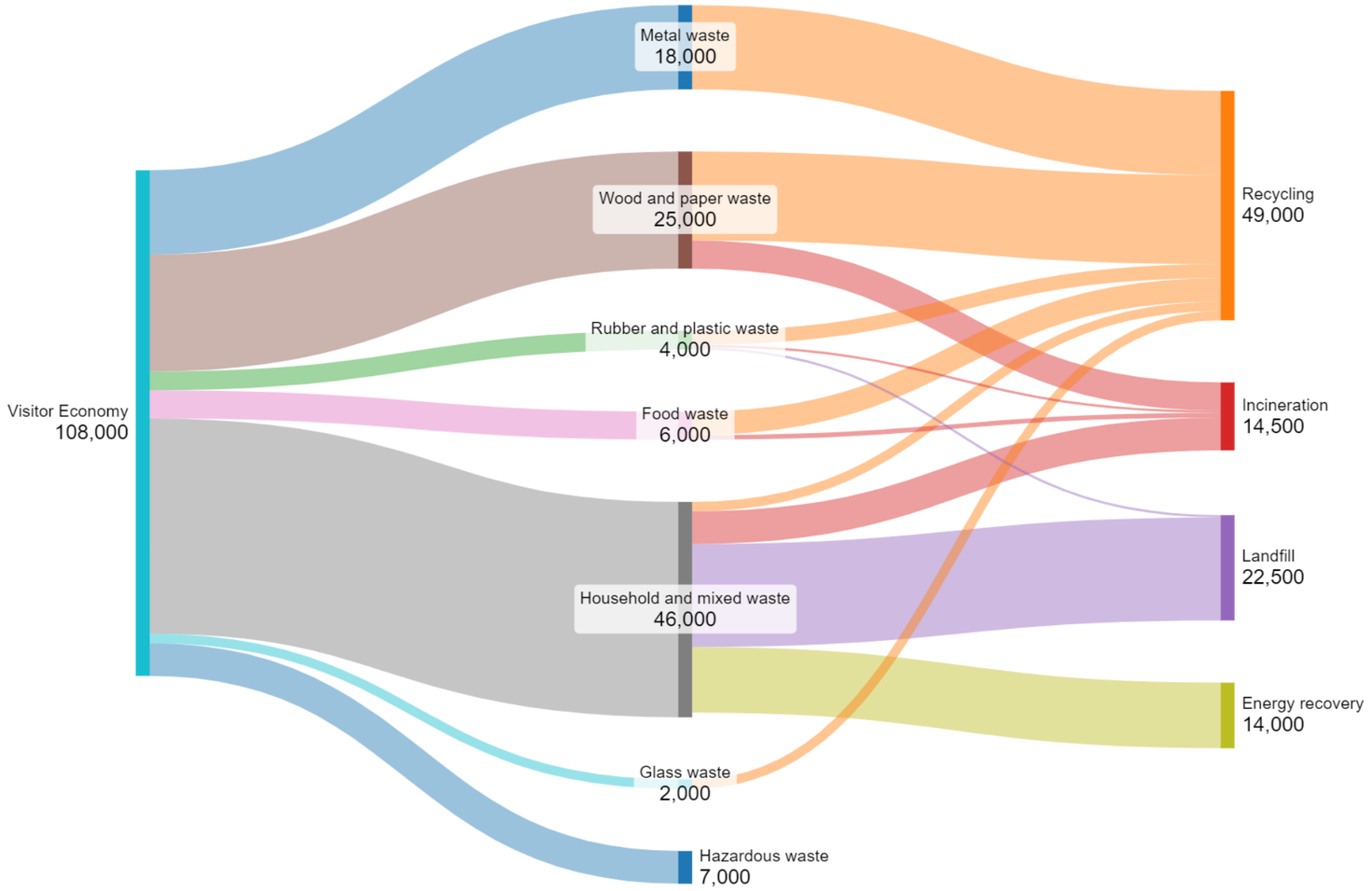
In Greater Lincolnshire and Rutland's visitor economy sector, the primary waste streams are household and mixed waste (~46,000 tonnes per year), wood and paper waste (~25,000 tonnes per year), and metal waste (~18,000 tonnes per year). Almost all the metal waste is recycled, while a significant portion of the wood and paper waste and household waste is incinerated or sent to landfill.

From Greater Lincolnshire and Rutland's visitor economy sector in 2019:

- 6,000 tonnes of wood and paper waste was incinerated.
- 1,000 tonnes of food waste was incinerated.
- Around 22,000 tonnes of household and mixed waste was sent to landfill, with most of the remainder incinerated or used in energy recovery processes.

Based on these findings, the primary opportunities for circular economy interventions in the visitor economy sector concern the incinerated wood and paper wastes, food waste sent for incineration and household and mixed waste sent to landfill.

There are further opportunities to intervene in the waste generation from the visitor economy earlier and repurpose waste materials in higher-value uses. For example, reuse of wood waste as an input to the manufacturing or construction sectors, as is being explored by UK CLT in London.



Key Findings – Visitor economy
Opportunities

Bulk buying

Bulk purchasing allows businesses in the visitor economy, such as hotels, restaurants, and attractions, to reduce packaging waste, whilst achieving lower costs. By collaborating with suppliers for sustainable products or opting for reusable packaging, they can minimise single-use items and reduce the environmental impact of sourcing materials.

Research shows that bulk dispensers and larger pump bottles can reduce up to 95% of toiletry-related plastics from hotel waste streams, with cost savings of up to 70%.

There is also an opportunity for potential shared procurement strategies ”buying clubs”, where multiple organisations club together to order in bulk, to get a better deal, but it also reduces purchasing as club members can share when stocks are low.

Water recycling

Grey water is the term used to describe wastewater from activities such as bathing, showering, laundry, dishwashers. Grey water may be collected and reused for non-potable water applications such as toilet flushing and irrigation by the installation of separate wastewater drainage systems for toilets and grey water sources. For instance, Wolds View Country Park in Lincolnshire undertake rainwater harvesting at their site, collecting and storing rainwater for future use.

Importantly, water recycling systems can be installed at relatively low-cost during construction, and at reasonable cost during major renovation

Food

In a circular economy, food is designed to cycle, so the by-products from one enterprise provides input for the next. Cities can make the most of food by redistributing surplus edible food, while turning the remaining inedible by-products into new products, ranging from organic fertilisers for regenerative peri-urban farming, to biomaterials, medicine, and bioenergy. Moreover, the visitor economy can initiate a range of food waste prevention interventions. From better matching supply with fluctuating demand for different food types, to discounting soon-to-expire products, and using overripe produce for in-store food outlets, retailers can reduce their food waste.

Lincoln has become the first community in the county to launch a strategy to tackle food poverty and reduce retail food waste. The initiative by the Soil Association for Sustainable Food Cities has been the inspiration for the Lincoln Food Partnership which brings together local charities, businesses, the city and county councils and local residents

Sustainable tourism

By integrating circular economy practices such as sustainable sourcing, waste reduction, and energy-efficient operations, businesses can attract this growing segment of eco-minded visitors. Offering eco-friendly experiences, zero-waste accommodations, and supporting local, sustainable enterprises can enhance the visitor experience while fostering responsible tourism. This not only meets demand but builds brand loyalty and reputation in the competitive travel industry

Travel

Opportunity to collaborate with local governments or businesses to create seamless, green mobility options helps create a circular transportation system that is resource-efficient. Visitors are more likely to choose sustainable travel options when they are easily accessible and well-integrated into their overall experience.

Developing frameworks

At the international level, UN Tourism identifies the circular economy as a strategic approach for the tourism sector. UN Tourism have developed two key initiatives in their agenda:

The Global Roadmap for Food Waste Reduction in Tourism is a new framework that aims at promoting the uptake of food waste reduction strategies by tourism stakeholders to enhance the contribution of the sector to sustainable food systems.

Global Tourism Plastics Initiatives, led by the United Nation’s (UN) Environment Program and the UN World Tourism Organization, in collaboration with the Ellen MacArthur Foundation, unites the sector through a vision to address the root causes of plastic pollution17. It enables businesses, governments, and other tourism stakeholders to lead by example in shifting towards a circular economy in plastics.

Key Findings – Visitor economy
Barriers

Seasonality

The tourism industry in Lincolnshire can be highly seasonal, with peaks during summer and a lot less visitors in the off-season. In peak tourist seasons, destinations can experience overtourism, which puts significant strain on local resources (water, waste management, energy). This can hinder circular practices as the focus shifts to managing the immediate influx of tourists.

Furthermore, due to fluctuations in demand and resource consumption, long-term planning and investment in circular solutions can become challenging and unpredictable.

Coordination

The visitor economy is extremely diverse, consisting of accommodation, attractions and travel to name a few. this complexity makes it difficult to achieve a coordination as there is barely any cross-sectoral collaboration. For instance, it is possible to find solutions for the circularity of food, circularity of plastics, but not necessarily within the entire sector.

Public transport

A lack of efficient public transport options forces visitors to rely on private cars, taxis, or flights, which often have higher carbon emissions – going against the principles of a circular economy. Furthermore, tourists who lack access to affordable and convenient transport are less likely to visit local markets, eco-friendly accommodations, or participate in local experiences that support the circular economy. Instead, they might opt for mass-produced goods, chain restaurants, or large resorts

Awareness and education

Tourists may not fully understand the environmental impact of their actions, such as carbon emissions from flights or the waste generated by single-use products. On the other hand, employees in the tourism sector have low levels of awareness and understanding on the opportunities and benefits that circularity can bring in tourism and how it can be implemented. There is a perception of added complexity when looking to implement circular actions within a business model.

Cost

Smaller businesses, which make up a large portion of the tourism industry, may find it difficult to bear the costs of investing in sustainable infrastructure and technology.

Attitudes

Attitude and behaviours can hinder transitioning to a circular on both a business and consumer level. On one hand, businesses, especially those in highly competitive markets, tend to focus on maximising short-term profits rather than long-term sustainability. Hotels may oppose to purchasing second hand furniture as they demand specific colours, aesthetics etc.

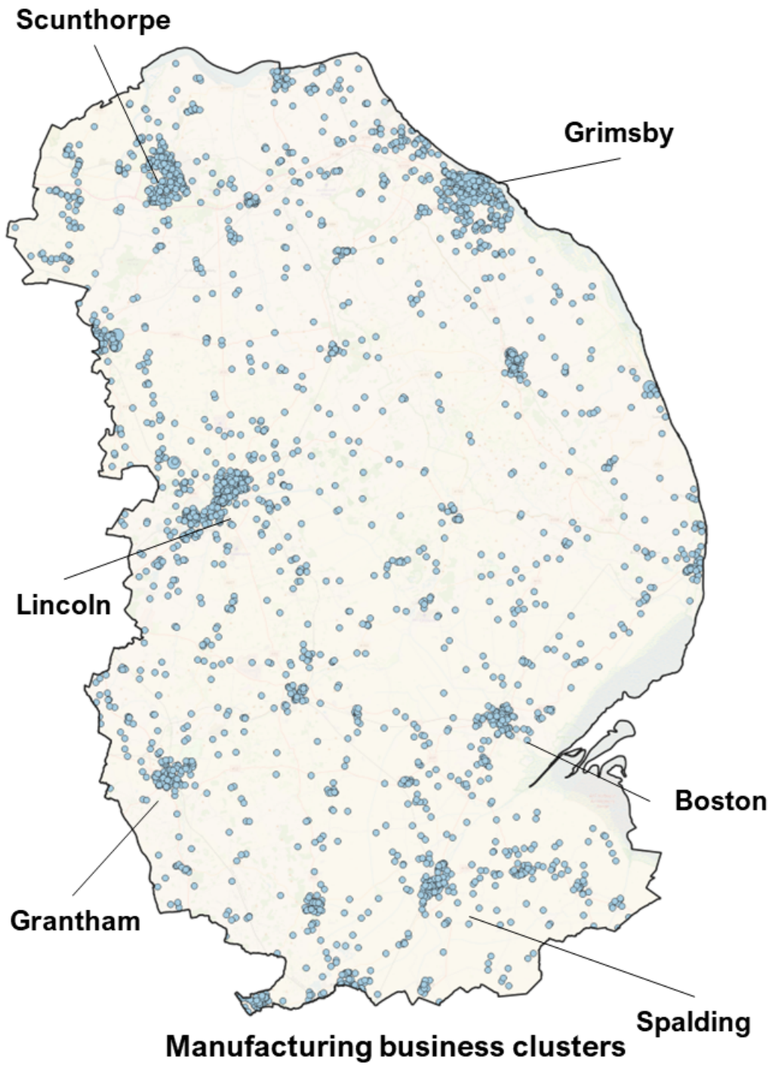
On the other hand, tourists often prioritise comfort, convenience, and experience over sustainability. Many prefer disposable items, like plastic water bottles, over reusable alternatives.

Recycling

Visitors to holiday parks may place materials in the wrong bin, leaving small businesses vulnerable to hefty financial penalties from waste management companies. Since many smaller businesses lack the capacity to sort waste themselves, contamination becomes a significant issue. These penalties can be a heavy burden, prompting some businesses to forgo recycling efforts and instead send all waste to landfill or incineration.

Manufacturing

Manufacturing: economic sector overview



Manufacturing business clusters

£5.1 bn GVA

10% 5-year CAGR

7% 10-year CAGR

42,300 employees

9.2% of total employees

0.1% growth between 2018-2022

-2.6% growth nationally

2,125 businesses

5.2% of total businesses

-1.8% business growth between 2018-2023

LQ of 1.2

Manufacturing is around 1.2x more specialised in Greater Lincolnshire compared to nationally.

Manufacturing businesses are scattered across Greater Lincolnshire, with higher concentration of businesses in Lincoln, Scunthorpe and Grimsby.

ONS, Regional gross value added (balanced) by industry: local authorities by ITL3 region, 2023; ONS, BRES, 2023

Size of the bubble = Concentration of businesses

Metro Dynamics analysis of Data City businesses using SIC codes

Manufacturing: map of current activities
Assets and demonstrator projects

Concentrated primarily in North and Northeast Lincolnshire, the region's advanced manufacturing cluster benefits from its proximity to the UK's largest ports, a high skilled workforce, and partnerships with research and higher education institutions. The sector is primarily made up of specialist engineering, chemical, metal and polymer manufacturers.

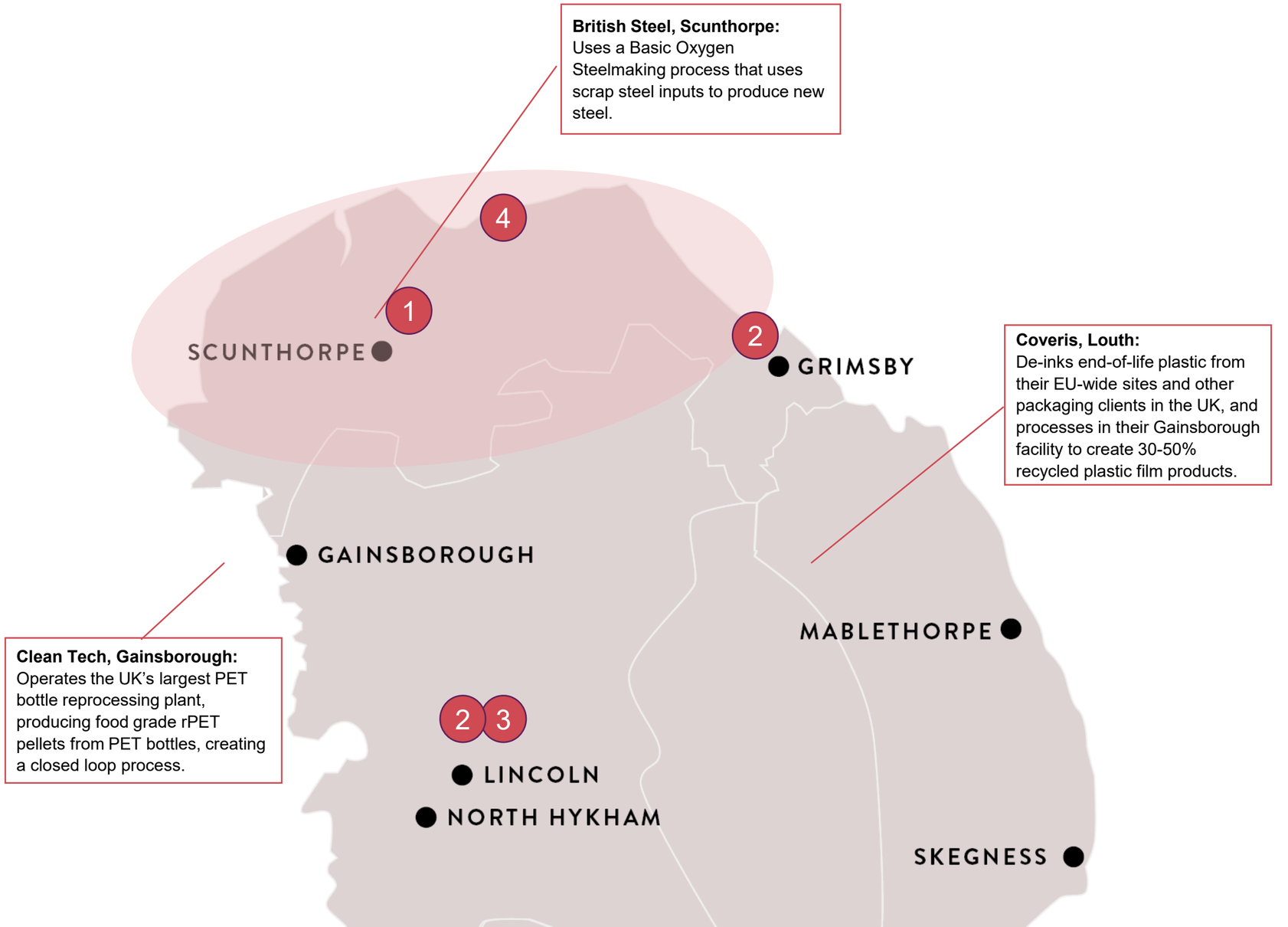
With the highest GVA, employment, and proportion of large businesses relative to the other sectors in this report, manufacturing is an important sector for driving the regional transition to a circular economy.

As a sector that processes inputs into products, there are several points in the products' lifecycle that can benefit from circular economy interventions. These also tend to bring cost savings for manufacturing businesses by reducing the need for raw materials and extending the lifespan of traditional end-of-life resources and goods.

This understanding of economic benefits is also growing among manufacturing businesses. A 2024 Make UK survey of 200 SMEs in the manufacturing sector across the UK, 26% said they believe their businesses would fail if they did not transition to a circular economy, and 40% believe a circular business model would be more profitable than a linear one.

Assets

1. Advanced Manufacturing Park (65-acre site in planning near Scunthorpe)
2. The Humber Freeport (Ports of Grimsby and Immingham)
3. The Bridge Advanced Engineering R&D Centre
4. University of Lincoln Engineering School



Manufacturing: material flow analysis

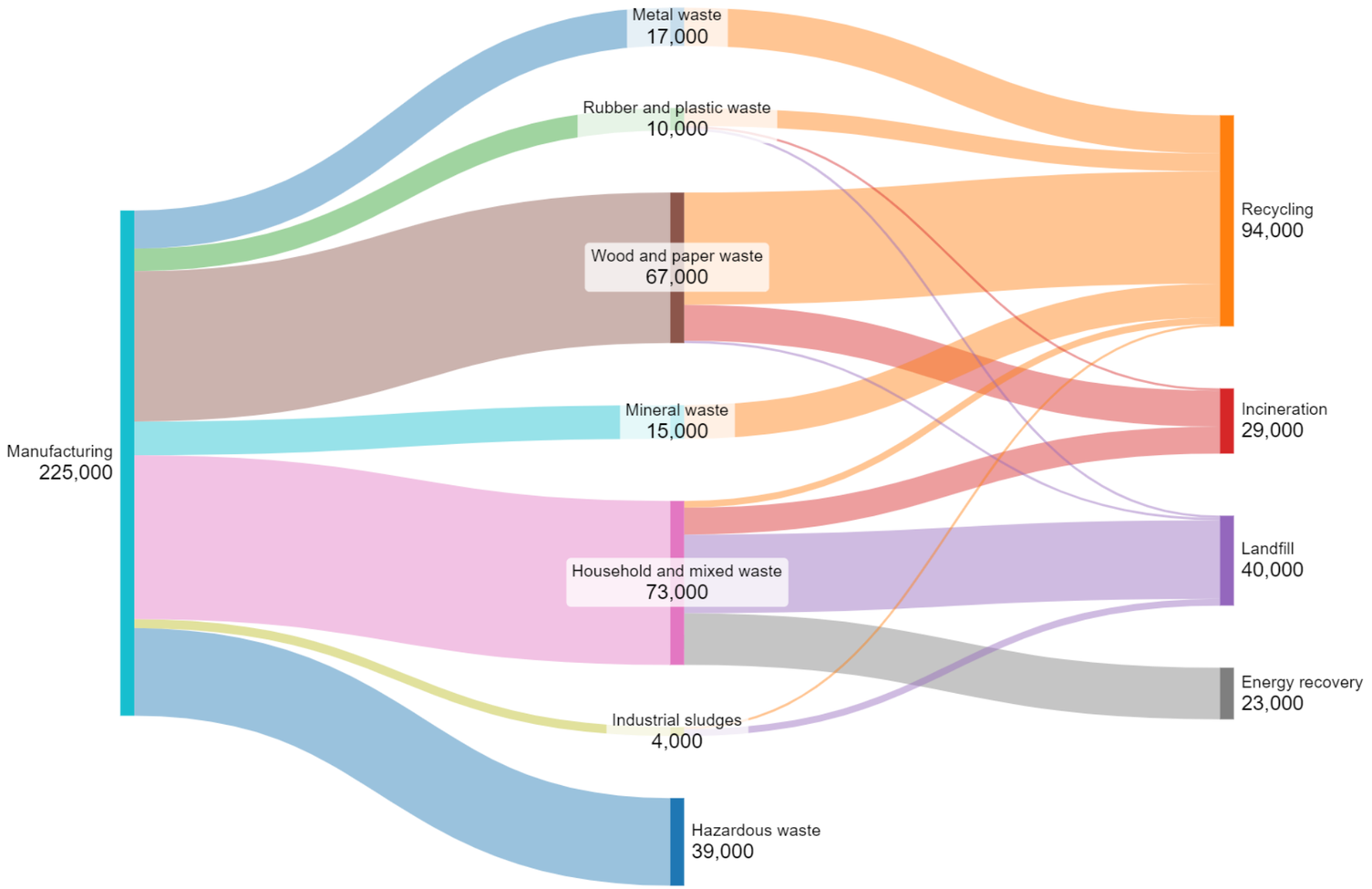
In the Greater Lincolnshire and Rutland manufacturing sector, the primary waste streams are household and mixed waste (~73,000 tonnes per year), wood and paper waste (~67,000 tonnes per year), and hazardous waste (~39,000 tonnes per year). Most of the metal waste is recycled

From Greater Lincolnshire and Rutland's manufacturing sector in 2019:

- 16,000 tonnes of wood and paper waste was incinerated.
- Around 35,000 tonnes of household and mixed waste was sent to landfill, with most of the remainder incinerated or used in energy recovery processes.

Based on these findings, the primary opportunities for circular economy interventions in the manufacturing sector concern the incinerated wood and paper wastes, food waste sent for incineration and household and mixed waste sent to landfill.

There are further opportunities to intervene earlier in the process and find novel uses for waste materials that could provide valuable inputs for other sectors. One example being in the rubber and plastic waste stream - Coveris' ReCover process removes ink from recovered packaging films for recycling into high-quality polymer resin.



Case study
Coveris

Coveris stands as a leading force in European packaging, renowned for its innovative and sustainable flexible packaging solutions. With 31 manufacturing sites across Europe, including 18 in the UK alone, Coveris is deeply committed to minimizing waste, both within its operations and for its customers. Each site is working towards a zero-waste goal by 2025, striving to process more waste than they send off-site. Notably, the Louth site in Greater Lincolnshire has become a benchmark for this ambition, being the first to achieve net-zero waste status.

Louth is also at the forefront of Coveris' sustainability efforts, housing the groundbreaking ReCover recycling business segment. Utilising advanced technology, ReCover specializes in recycling printed polyethylene (PE) films through a process known as "de-inking." This method removes ink from printed film packaging waste, which is then re-granulated into high quality recycled PE resin, ReGen. Currently, 3,500 tonnes of printed PE film are being de-inked annually, with plans to increase this capacity to 5,000 tonnes. This initiative significantly reduces the reliance on virgin raw materials, eliminates waste, and ensures plastic remains within a circular economy.

In addition, there is substantial value in returning waste to Coveris. Typically, such waste would be downgraded into lower-quality products or incinerated. By encouraging clients to collect and segregate their waste, Coveris ensures that it can be reprocessed into valuable materials, fostering a more sustainable cycle.

However, Coveris acknowledges the challenges associated with water usage in their processes. The company aims to recirculate water as much as possible, but after nine cycles, the water becomes too contaminated for further use. This dirty water is then transported off site, which is not ideal from both a cost and environmental perspective. To address this, Coveris is collaborating with a German partner to design a cutting-edge water treatment plant, enabling more extensive water recirculation and further enhancing their sustainability efforts.

Figure. An example of Coveris packaging solutions.

Figure. The ReCover facility.

Case study – Coveris

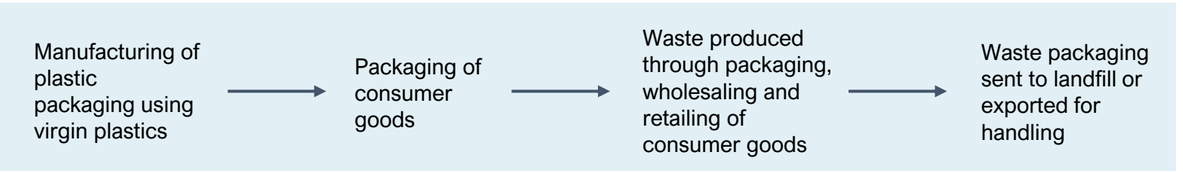
Plastic packaging recycling

With the introduction of the Plastic Packaging Tax rebate be UK government, there is an incentive for businesses to use recycled plastic in their production and packaging processes. The increase in demand from businesses for this recycled product also boosts the market for recycled plastic, which boosts the viability of Coveris' circular business model, removing the ink off plastic film and selling it back as clear recycled plastic. This illustrates how changes to industry regulation to boost environmental sustainability can increase the potential for innovation, which businesses in Lincolnshire are already doing. The below analysis is based only off Coveris' business base and does not represent the economic potential of scaling this up across Lincolnshire.

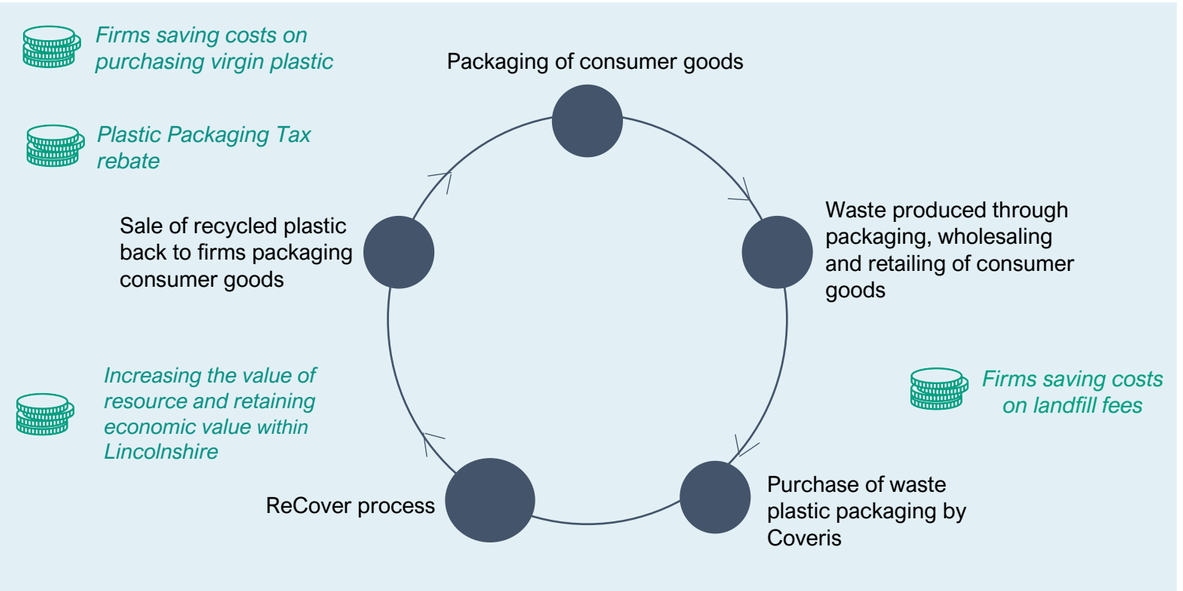
Stylised economic potential

- Recycled plastic film per annum at full capacity
  5000 tonnes
- Total Plastic Packaging Tax rebate across packaging businesses in Lincolnshire
  £1.25m
- Estimated cost saving for businesses purchasing recycled plastic over virgin plastic
  £700 per tonne
- Total cost saving on purchasing and landfill costs created for firms across Lincolnshire
  £4m
- Added supply chain value of recycled plastic packaging retained in Lincolnshire economy
  £1.5m

Current standard industry practise



Coveris innovative process circular product lifespan



Key Findings - Manufacturing
Opportunities

Feedback loops

Feedback loops refer to the process of using a systems outputs as inputs, subsequently reducing the need for virgin resources and unnecessary waste. Within Greater Lincolnshire, there are many examples of this process, however, Newark based company Reuseabox, are a strong case study. Reuseabox diverts cardboard from landfill and incineration through reusing and reselling. It is a form of feedback loop because the "output" (used boxes) of one system (businesses that no longer need them) becomes the "input" for another (businesses that can reuse them). In this model, the waste (or output) is reintegrated into the supply chain as an input, reducing the need for producing new materials.

Technology

Opportunity to invest in innovative technology to boost resource recovery and re-circulation of materials. For example, OMNI-PAC group uses a Wet Pressing Technology to combine recycled cardboard with water to create a slurry, which is then formed into a desired shape using moulds. By using a surplus of cardboard, they are giving new life to materials that would otherwise end up in the waste stream. Plus, the moulded pulp packaging can be easily recycled or composted at the end of its use, reducing the environmental impact even further.

Innovation

Innovation in circular manufacturing can gain a competitive edge by offering sustainable products, attracting environmentally-conscious consumers. For instance, Louth based company, Luxus Limited, extends its commitment to recycling with the Tray2Tray™ scheme, redefining the life cycle of end-of-first-life transit containers. These containers are transformed into quality-assured compounds, offering a second life and the flexibility of alternative colours if desired. Tray2Tray™ plays a crucial role in advancing sustainability in the manufacturing and logistics industry, contributing to a circular economy.

Logistics

One workshop participant revealed that they found a company in Scunthorpe that would take their plastic waste and use it in their business to replace OSB boards. However, the transport/logistics was too complicated to organise, and this exchange did not happen. Therefore, there is an opportunity to optimise logistics for distribution, which can be achieved through Reverse Logistics.

This is the process of moving products from consumers back to manufacturers for reuse, recycling, or disposal. It is essential in creating closed-loop systems where resources are recovered and reintegrated. Reverse logistics is operational in various companies, such as XPO Logistics. XPO's First Mile and Last Mile logistics services streamline this process, ensuring seamless pickup and transportation of returned items.

Enterprise zones

Enterprise zones can be used as testbeds for industrial symbiosis and innovations. For instance, the North-East Lincolnshire enterprise zone is a large-scale site used by industrial, manufacturing, logistics and renewable energy companies.

Enterprise zones could include a framework agreement offering:

- Knowledge sharing
- Sharing resources
- Sharing platforms
- Circular hubs
- Library of things / repair cafes.

Product-as-a-service

Product-as-a-service (PaaS) business models extend the lifetime of current assets and components and ultimately reduce the need to extract, process and produce new equipment. Business' can offer a service for their products, including rental, subscription, sharing and leasing, creating long-term relationships and recurring revenue streams. The move towards PaaS can foster knowledge sharing between businesses and academic institutions, positioning Greater Lincolnshire as a hub for innovation and cutting-edge service-based models.

Key Findings- Manufacturing
Barriers

Scale

For smaller manufacturers, the volume of waste generated might be too low to justify or attract third-party waste collection services or recycling providers. Recycling firms often require a minimum quantity of materials to make collection and processing financially viable. Furthermore, manufacturers can adopt closed-loop systems, where by-products or waste materials are reused or repurposed. For smaller manufacturers, integrating into these closed-loop systems can be challenging. Their lower production volumes may not be sufficient to create a consistent stream of reusable materials, making it difficult to partner with other businesses or industries to share or exchange by-product.

Terminology

Terminology is a key barrier to implementing circular activities in the manufacturing sector, with many misinterpreting the term. For example, one participant at the workshop did not think their business was part of the circular economy and was sceptical to attend. Similarly, another participant believed that 'circular economy' was about keeping money in Lincolnshire. There is a case to broaden the term and potentially using terms that are better understood, such as “sustainability”, or “green growth”.

Infrastructure

Collecting, sorting, and processing infrastructure is often underdeveloped or fragmented. This can Include recycling facilities, reverse logistics systems, and technologies to recover high-quality materials from waste products.

Demand

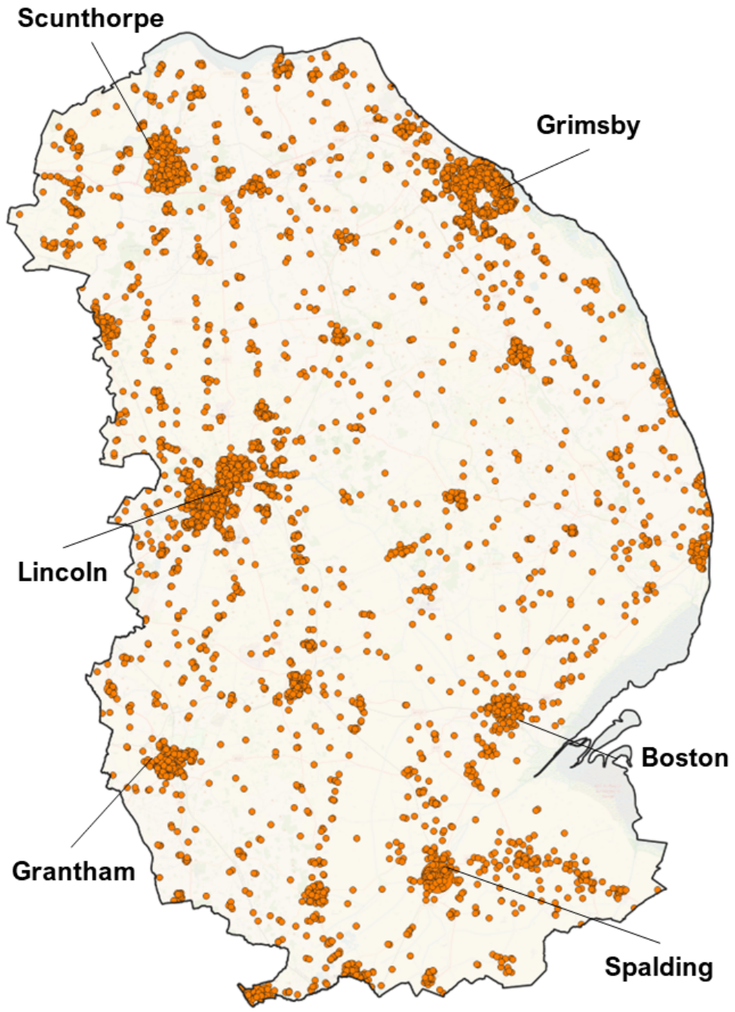
Low demand for circular products can discourage manufacturers from investing in sustainable models. Shifting consumer behaviour towards a circular mindset is essential but challenging.

Policy/legislation

Within the manufacturing sector, current policies and regulations are not fully aligned with circular economy principles, making it difficult to shift away from a linear business model. Legislations such as obligations and norms must be clear, formal, coherent, compulsory, and necessary in order to adopt a circular economy.

Construction

Construction: economic sector overview



Construction business clusters

Size of the bubble = Concentration of businesses

£1.9 bn GVA

0% 5-year CAGR

1.8% 10-year CAGR

0.1% 5-year national CAGR

1.6% 10-year national CAGR

26,000 employees

5.7% of total employees

23.8% growth between 2018-2022

8.2% growth nationally

6,275 businesses

15.2% of total businesses

17% business growth between 2018-2023

LQ of 1.2

Construction is around 1.2x more specialised in Greater Lincolnshire compared to nationally.

ONS, Regional gross value added (balanced) by industry: local authorities by ITL3 region, 2023; ONS, BRES, 2023
Metro Dynamics analysis of Data City businesses using SIC codes

Construction: map of current activities
Assets and demonstrator projects

The built environment is responsible for using over half of the materials extracted globally every year. With 36,036 new homes planned to be built by 2050 (see table below compiled from the SIDF) and several significant infrastructure projects planned across Greater Lincolnshire and Rutland in the future, the region's economy and environment will benefit from circular economy interventions.

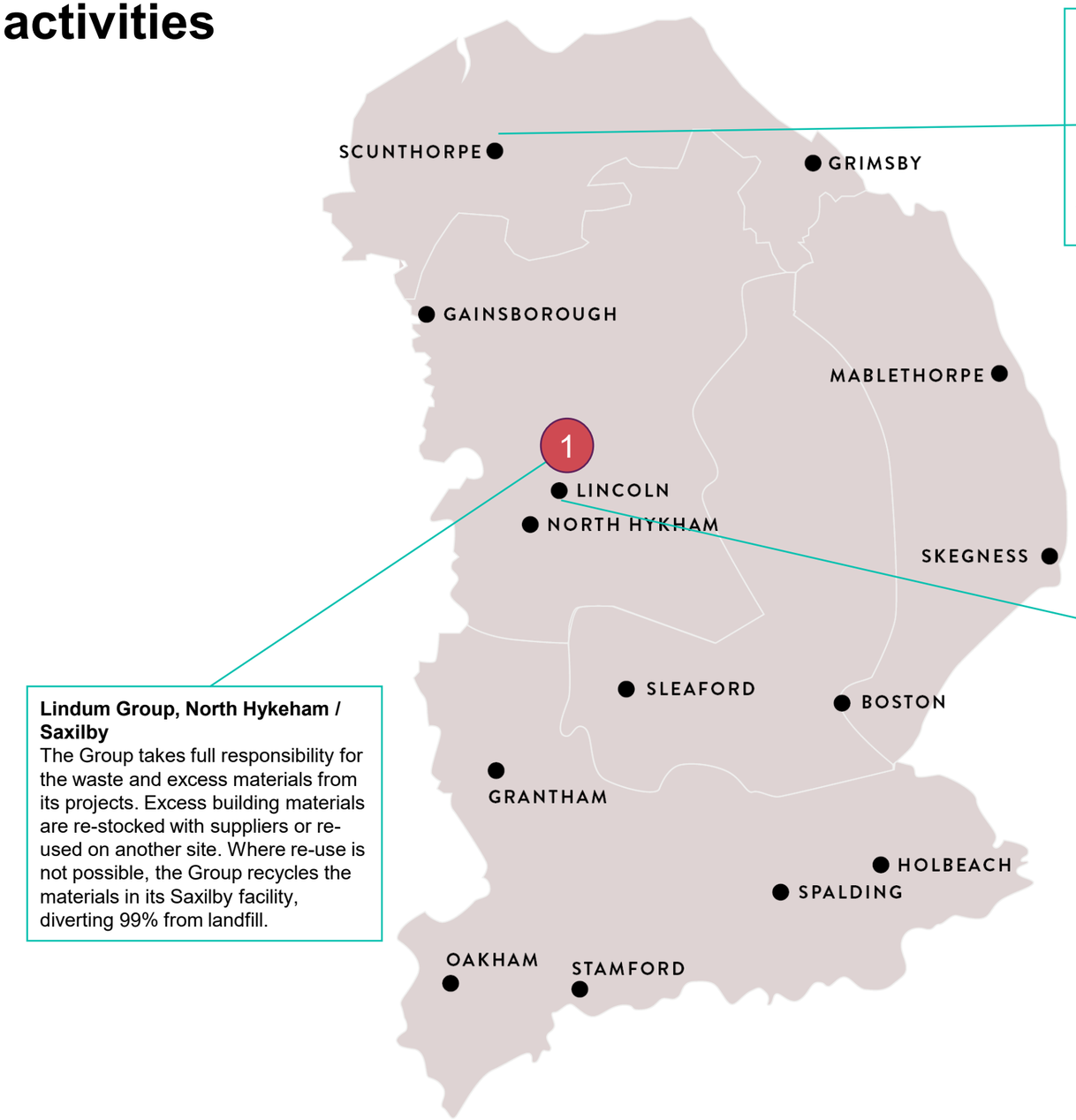
The product lifecycle of built assets and the processes to create them provides opportunities for embedding circular economy principles; from design to transportation, to deconstruction. A few businesses have already used circular business models to generate cost savings and new income streams, but many face challenges related to the sparse geography of the region, financing innovative solutions, and regulations.

While construction businesses operate across the entire region, planned housing construction compiled from the Local Plans in the SIDF have been included below to understand where construction activities will take place. These figures may increase under new government proposals.

Local Plan	No. of homes	Timescales
Boston	2,653	by 2036
Central Lincs	20,450	by 2050 for most, earlier for some
East Lindsey	1,933	by 2031
North Lincolnshire	6,000	2,150 by 2028, the remainder by 2050
Northeast Lincolnshire	5,000	by 2032

Assets

1. Lincoln School of Design and Architecture



Overhall Contractors, Scunthorpe
Overhall recycles waste from steel and construction industries into aggregates. The business produces its concrete for its projects in-house, using locally sourced recycled aggregates from recycling centres as its inputs.

Lincolnshire County Council, Lincoln
Adapted Council specifications for road infrastructure to allow the use of recycled asphalt as a building material.

Lindum Group, North Hykeham / Saxilby
The Group takes full responsibility for the waste and excess materials from its projects. Excess building materials are re-stocked with suppliers or re-used on another site. Where re-use is not possible, the Group recycles the materials in its Saxilby facility, diverting 99% from landfill.

Construction: material flow analysis

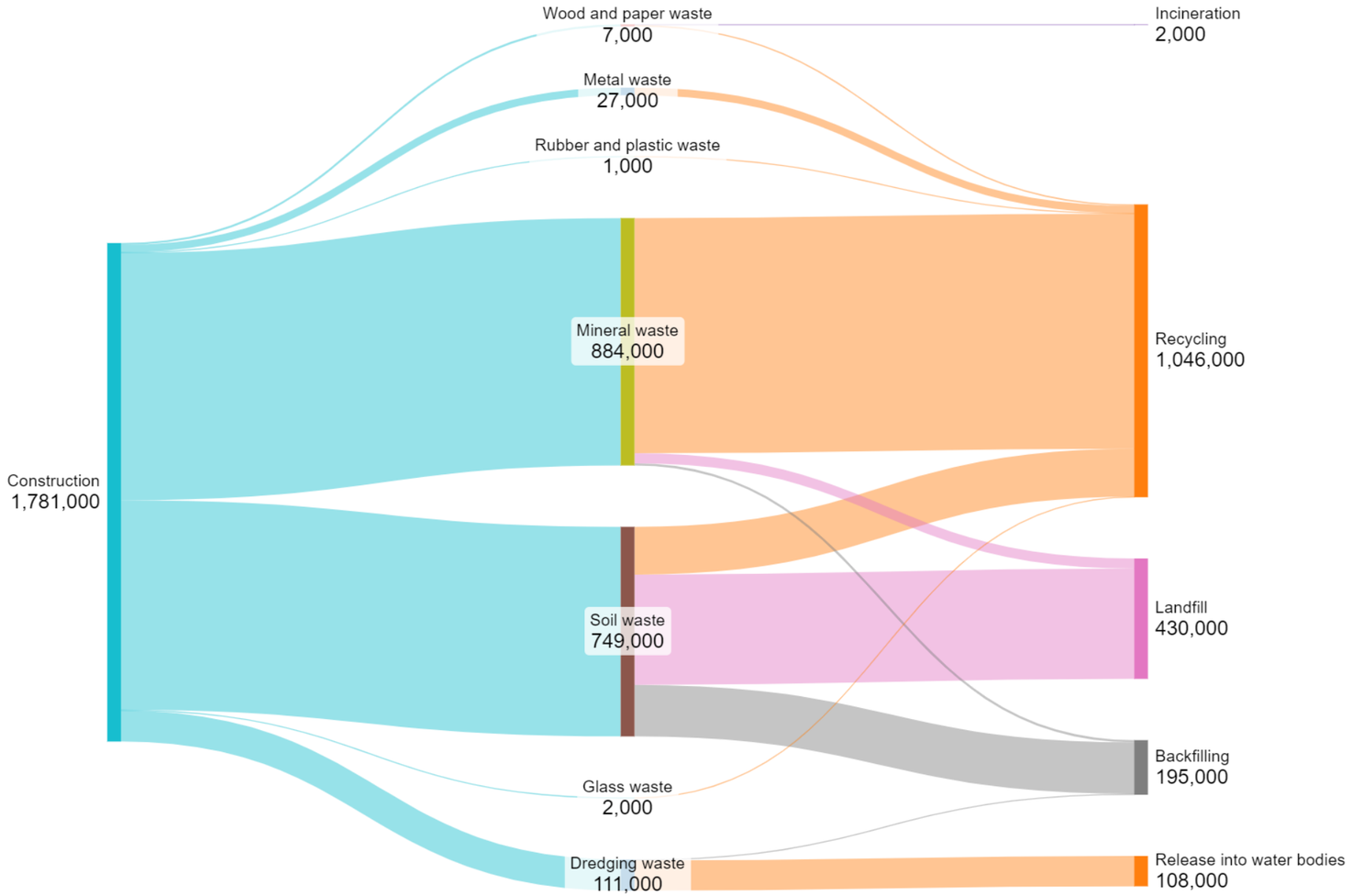
In the Greater Lincolnshire and Rutland construction sector, the primary waste streams are mineral waste (~884,000 tonnes per year), soil waste (~749,000 tonnes per year), and dredging waste (~111,000 tonnes per year).

From Greater Lincolnshire and Rutland's construction sector in 2019:

- 2,000 tonnes of wood and paper waste was incinerated.
- 36,000 tonnes of mineral waste was sent to landfill.
- 394,000 tonnes of soil waste was sent to landfill.
- 108,000 tonnes of dredging waste was released back into water bodies.

Based on these findings, the primary opportunities for circular economy interventions in the construction sector concern the incinerated wood and paper wastes, mineral and soil wastes sent to landfill, and dredging wastes returned to water bodies.

There are further opportunities to intervene earlier in the process and find novel uses for waste materials that could provide valuable inputs for other sectors. For example, dredging wastes could be assessed for their suitability for use in concrete manufacture or road-building as aggregate.



Key Findings - Construction
Opportunities

Sharing economy

Sharing platforms facilitate efficient resource allocation where equipment can be located and rented based on precise project needs, eliminating underutilisation and wasted resources.

There are a wide range of platforms out there for construction companies to use, however, “Enviromate", serves as a great example. This software allows users to buy, sell and discover left over building materials, ranging from painting & decorating, carpentry, building and plumbing.

Circular design

Design must consciously facilitate the longer functional use and ease of maintenance of building products and parts to keep them at a high value over multiple lifetimes.

The World's first strawbale council houses are in Waddington, Lincolnshire. The foundations are gravel trenches with a brick plinth wall laid with lime mortar, and foam glass blocks to the interior. Double glazed timber windows, FSC accredited timber throughout, lime plaster internally and externally and sheep's wool insulation to the roof and ground floor, all add up to a house made entirely of natural materials

Furthermore, the Fossdyke paddock project in Saxilby consists of six bespoke eco homes built by chisel wood ltd and concept design by SGA architects. The main roofs of the houses were finished in Protan EX-A. Protan membranes has a proven durability with a service life in excess of 40 years, as well as a low carbon footprint compared to other roofing solutions.

Reuse hubs

Look to have a network of construction materials reuse hubs across the region. Taking inspiration from ‘The Reuse Hub Wolverhampton', this hub is working with the regional construction industry and associated organisations to divert surplus materials from construction sites, builders’ merchants, wholesalers and others in the supply chain operating in the west midlands and sell them on giving local communities and businesses access to low-cost building materials.

Building reuse

There is huge momentum at the moment to avoid demolition for new builds. Rather, there is a growing list of examples where reuse of the building with improvements have reduced carbon emissions, reduced costs of development, and reduced time scales. See RIBA Re-Use Atlas Vol 2: D Baker-Brown.

Planning permission/zoning laws

Planning permissions can encourage sustainable development by requiring green building practices. These practices could include using renewable energy sources, using reclaimed materials and designing buildings to be energy-efficient. Planning permissions can also be used to limit the amount of development that can occur in a given area. See tower hamlets reuse, recycling and waste SPD

Standards

There are currently several standardisation gaps hindering the construction sector's transition to be more sustainable, including the lack of widespread definitions, indicators, and quality assurance procedures for reused and recycled materials. Opportunities exist to clarify clear end-of-waste criteria and establish responsible end-of-life management for construction materials.

Deconstruction vs. demolition

Deconstruction implies the dismantling of buildings with the goal of maximising the reuse potential of its components. In contrast, demolition is the process of bringing down a building in such a way that the components are fit for nothing more than recycling and landfill.

A good case study demonstrating the potential of deconstruction compared to demolition of a company owner in Lincolnshire: a dedicated service deconstructed a private asset for less money (£20k), than a demolition construction quoted (£40k). The owner then found specialist buyers for all the different components which earned them a further £40k.

Key Findings
Barriers

Electric Vehicles (EVs)

There are many questions and uncertainties around the practicality of using EV’s in transportation/construction due to weight and mileage limits. Moreover, a workshop participant revealed that they looked to purchase an electric skip lorry, yet it cost 4 times the amount of a petrol lorry. They also highlighted that it is not good for the battery to be doing several small journeys on and off.

Regulations

Stringent building regulations, such as The Building Regulations 2010 (England), may not necessarily hinder circular practices, but their focus on traditional building methods, safety standards, and compliance issues can create challenges for adopting more sustainable, resource-efficient approaches. Structural integrity, fire resistance, and thermal performance are often subject to stringent rules, which might make it difficult for recycled materials to be used without extensive testing or certification. This can add costs and delays to projects that aim to implement circular practices.

Furthermore, BS EN 1090 (Execution of Steel Structures and Aluminium Structures) requires structural steel and aluminium components used in buildings to meet specific quality and safety requirements. The difficulty of certifying recycled steel to these standards, especially when the material comes from varied sources, discourages its use, leading to a reliance on virgin steel.

Coordination

There may be a tendency for different contractors or teams to prioritise their own interests over the project as a whole. This can lead to a lack of cooperation and create silos

Stakeholder engagement

With conflicting interests, inadequate understanding and training, stakeholders may resist change or be reluctant to engage with circular methods, fearing higher costs, complexity, or risks associated with new techniques

Markets

Reclaimed products need to out-compete new products and must find secondary marketplaces, however, the market for these materials are currently limited.

Classifications

Construction and demolition waste is often classified in ways that make reuse difficult. Regulations around the handling, storage, and transportation of waste can be strict, with materials being classified as "waste" even when they are still reusable

Composite materials

Prejudices related to the circularity of composites materials still exist and make the current technical, market, and regulatory barriers even more difficult to overcome.

Regional Opportunities

Regional Opportunities

Wind turbine and Solar panel decommissioning

There is a current and potential opportunity to create inward investment into the south Humber Port area, by the scoping and creation of a materials processing industry. The decommissioning of thousands of wind turbines and dismantling of solar panels over the coming decades could create multiple green jobs and produce a highly necessary source of secondary raw materials.

Task: explore business case for sub and cross-regional collaboration

Strategic funding

There is an opportunity to harness investment from Innovate UK, Greater Lincolnshire Combined Authority Mayor's Investment Fund, and Midlands Engine Investment Fund (MEIF). The MEIF has helped deliver £400m of investment to boost small and medium business growth. Furthermore, the Greater Lincolnshire Combined Authority Mayor's Investment Fund will deliver £720m to priority areas, offering an opportunity for longer-term programmes to be developed.

With a focus on sustainable economic growth and support for innovation, this fund could potentially be utilised to create a network of Circular businesses and links to academia.

Development of a Public Circular procurement strategy

The following slide highlights some of the forthcoming procurements where circularity business models could be incorporated at a specification stage. So far, some large projects have been missed, but there are many in the pipeline that could be influenced.

Task: Undertake a detailed forward pipeline review and establish a circular Public Buyers' network (this could also focus on joint procurement and standardised specifications).

Regional centre for Circular development

There is a huge amount of expertise and examples of Circular economy within the region. As a strategy to develop CE Champions, a centre for expertise and education programme for businesses could elevate Lincolnshire to be a CE business development and innovation leader. The opportunities are:

Network of business champions

The engagement by businesses in the region in undertaking this baseline exercise has created a cohort of business and academic champions that should be formally recognised and used to spread the circular economy mantra.

Task: Explore the creation of a CE champions programme.

University centre of excellence

There is a huge amount of Circular Expertise across the region, establishing a centre of excellence that could be dovetailed to the CE Champions and an investment strategy could create huge green jobs opportunities.

Educational resources for businesses

There is currently a lack of information on the business models and practical applications of circular economy. By creating a programme with partners such as the Circular Economy Institute, fast and deep learning could be achieved.

Industrial symbiosis – at industrial park level

The region is characterised by multiple industrial parks that are in many cases source of manufacturing, many with virgin raw materials. The industrial sites have multiple waste companies picking up waste and then processing at a distant location. There is scope to undertake a waste analysis of a pilot estate with a view to determining if there is local manufacturer that could replace virgin feedstock with secondary resources form a that industrial park or nearby.

Task: undertake a waste generation and industrial symbiosis audit

Physical reuse and repair hub

In many cases industrial symbiosis is only possible if there is storage and repair facilities for materials and equipment, until they become needed. The business case for developing a physical site is being demonstrated in the West Midlands, London and Manchester and could be a way of providing businesses with more affordable circular feed stock. A site like this could be beneficial for construction and deconstruction materials, arts and culture, and householders.

Online materials exchange

A lot of materials can be exchanged through virtual exchange, sites like Freegle, excess material exchange, Globe Chain and Enviromate already provide facilities for this, alongside a physical site for large and bulky items.

Procurement Opportunities

Public procurement can play a pivotal role in facilitating a circular economy by leveraging the purchasing power of governments and public institutions to drive sustainable practices across industries.

1. Total Cost of Ownership (TCO):

Circular procurement can focus on the total cost of ownership rather than just the upfront cost, considering factors like longevity, maintenance, and end-of-life disposal. This can result in cost savings over the long term and promote the selection of products that are more sustainable. This is especially relevant for large scale public sector developments, or local authority housing.

2. Encouraging Innovation and Market Development

- **Incentivizing Circular Business Models**: Public tenders can be designed to favour companies that implement circular business models, such as product-as-a-service, leasing, or sharing platforms. This encourages innovation in these areas and helps develop markets for circular economy solutions.
- **Support for SMEs and Startups**: By including criteria that support small and medium enterprises (SMEs) and startups focused on circular economy innovations, public procurement can help these businesses scale and integrate into larger supply chains.

3. Setting a Standard for Industry

- **Leading by Example**: When public bodies adopt circular procurement practices, they set a precedent for the private sector to follow. This can create a ripple effect, where businesses adopt similar practices to stay competitive in bids or to align with emerging industry standards.
- **Benchmarking and Best Practices:** Public procurement can establish benchmarks for circular economy practices that other sectors can adopt. Sharing best practices and results from circular procurement projects helps to spread these methods more widely.

4. Circular Disposal Strategies

- **Keeping Equipment in Use:** Before disposing of equipment, assess its condition to determine if it can be reused or refurbished. This can keep perfectly useable equipment in use for longer, minimising waste and need for raw materials.
- **Redistribution: U**nwanted or old equipment can be refurbished and distributed out to those in need. For example, refurbished tech devices can be donated to disadvantaged families with children who require a laptop for school-work. Additionally, a program could be introduced allowing staff to donate or receive refurbished equipment, which would not only reduce waste but also promote positive individual behaviour change.

5. Reducing Environmental Impact

- **Minimising Waste**: By procuring products and services designed with circular principles, public entities can significantly reduce the waste generated throughout the product lifecycle, from production to disposal.
- **Lowering Carbon Footprint**: Circular procurement often prioritises local sourcing, energy efficiency, and low-emission products, contributing to reduced carbon emissions and a smaller environmental footprint.

6. Promoting Sustainable Products and Services

- **Criteria for Circularity**: Public procurement can prioritize goods and services that are designed for longevity, reparability, and recyclability. By setting criteria that favour products made from recycled materials, designed for disassembly, or that come with take-back schemes, procurement can stimulate demand for circular products.
- **Supplier Requirements**: Governments can require suppliers to adopt circular practices, such as reducing waste in production, using sustainable materials, or offering maintenance and repair services instead of just selling products.

7. Facilitating Collaboration and Partnerships

- **Public-Private Partnerships**: Public procurement can foster collaboration between governments, businesses, and civil society to develop and implement circular economy projects. These partnerships can enhance resource efficiency and innovation.
- **Cross-Sectoral Collaboration:** Procurement processes can bring together different sectors (e.g., construction, waste management, manufacturing) to create integrated solutions that promote circularity across supply chains.

In summary, public procurement can drive the transition to a circular economy by prioritising sustainability, fostering innovation, setting industry standards, reducing environmental impact, considering lifecycle costs, and encouraging collaboration. Through strategic procurement, public bodies can significantly influence markets and help build a more circular and sustainable economy.

Lincolnshire Procurement Pipeline Opportunities

A review of the Lincolnshire Public Procurement Pipeline has highlighted a number of missed opportunities where Circularity business model interventions could be used to influence the specification.

In total there is nearly £80 million of public procurement that will be commissioned in the next 18 months that could have circular interventions incorporated into their specifications (if they are not already including Circularity).

Opportunities to incoorprate Circularity into specifications that may still be able to be changed	What is it?	Procurement Start Date	Contract Start Date	Value £
Agriculture and environment:	The Lincolnshire Grounds Maintenance Framework	01/09/2025	30/11/2025	£ 3,000,000
Visitor economy:	Transport / Taxi	29/12/2024	29/03/2025	£ 4,803,000
	Local Bus Transportation in Lincolnshire	31/12/2024	31/03/2025	£ 1,228,245
Construction:	Refurbishment of Spalding Day Care Centre	03/10/2024	01/01/2025	£ 500,000
	Framework contract for highway works	02/06/2025	31/08/2025	£ 60,000,000
	Framework agreement for the provision of works with disabled facilities	01/10/2026	01/04/2027	£ 9,453,589

Potential missed opportunities to incorporate Circular economy practices in specification (review needed to determine circularity of specification)	What is it?	Procurement Start Date	Contract Start Date	Value £
	Supply of Electricity (Property & Street Lighting)	02/07/2024	30/09/2024	£ 14,000,000
	To Supply various Fuels to various locations within the Lincolnshire area	02/07/2024	30/09/2024	£ 173,000
	Five-year procurement of storage, maintenance, transportation and installation	02/09/2023	01/12/2023	£ 87,157
	One off procurement of key assets to facilitate Lincoln Castle Illuminated event	02/09/2023	01/12/2023	£ 33,246
	Provision of a new SEMH School, Sleaford	03/08/2024	01/11/2024	£ 15,000,000
	Construction contract to build approximately 220 metres of new adoptable highway within Horncastle Industrial Estate.	01/06/2024	01/08/2024	£ 1,900,000

4/ Conclusion and Next Steps

Next Steps

As the first step in the development of a regional circular economy framework, this reports provides evidence on the potential economic and environmental benefits of transitioning to a circular economy. Below are the recommended next steps for the LEP to develop a regional framework:

- Identify priority areas and themes of focus based on common barriers and opportunities
- Prioritise the ‘long list’ of opportunities identified in this report through selection criteria and based on a deeper understanding of their environmental, economic, and social benefits vis a vis their cost
- Identify possible interventions for the prioritised opportunities and create an action plan
- Define stakeholder roles in facilitating the transition to a circular economy and their actions to do so
- Continue to engage with stakeholders and groups engaged during this evidence base to develop a network of circular economy champions
- Look beyond commercial, industrial and research into grassroots circular economy activity as it was not within the scope of this evidence base

5/ Appendices

- Policy review
- Material flow analysis detailed methodology
- Sector definitions by SIC code
- Questionnaire key findings
- Survey key findings
- Workshop key takeaways

Policy Analysis
National

Policy	Description	Impact on the Circular Economy
Clean Growth Strategy, BEIS (2017)	This strategy sets out the government's proposal for decarbonising all sectors of the UK economy through the 2020s. The strategy aims to develop world-leading green finance capabilities, develop a package of measures to support businesses in improving their energy productivity by at least 20% by 2030, improve the energy efficiency of homes, roll out low carbon heating, accelerate the shift to low-carbon transport, deliver clean smart and flexible power, and enhance the benefits and value of our natural resources. The latter includes exploring new and innovative ways to manage emissions from landfill and invest £99 million in innovative technology and research for agri-technology, land use, greenhouse gas removal technologies, waste and resource efficiency.	– Allocates investments, supports innovation and mentions programmes of work that support a transition to the circular economy. – It aims to support industries in transitioning to cleaner systems.
25 Year Environment Plan, DEFRA (2018)	The Environment Plan sets out the UK's vision to improve air and water quality, and protect threatened plants, trees and wildlife species. Targets are set around using resources from nature more sustainably and efficiently as well as minimising waste. Targets include doubling resource productivity by 2050, improving approaches to soil management, ensuring that food is produced sustainably and profitably, working towards zero avoidable waste by 2050, and eliminating avoidable plastic waste by end of 2042	– Provides specific targets that are aligned with circular economy principles.
Resources and Waste Strategy for England, DEFRA and EA (2018)	The strategy sets out how the UK will preserve material resources by minimising waste, promoting resource efficiency and moving towards a circular economy. It provides steps to encourage more sustainable production, to help consumers in choosing and using more sustainable products, to maximise resource recovery and waste management, to tackle waste-related criminal activity, to cut down on food waste, and to encourage innovation.	– Provides specific steps and guidance to maximise resource use and minimise waste but does not set clear targets.
Sixth Carbon Budget, Climate Change Committee (2020)	The report recommends that the UK sets a Sixth Carbon Budget to require a reduction in GHG of 78% by 2035 relative to 1990. The report recommends that the national government supports a shift towards a circular economy. It also encourages more circular processes within manufacturing in order to reduce demand on natural resources and rare minerals. The report also recommends moving towards a circular economy by ensuring that product design maximises re-use of materials and minimises waste over products' lifetime.	– Recommends a transition to the circular economy without specific policies or measures to kickstart the transition or scale up circular economy activities.

Policy Analysis
National

Policy	Description	Impacts on the Circular Economy
Industrial Decarbonisation Strategy, HM Government (2021)	The Industrial Decarbonisation Strategy covers the full range of UK industry sectors and aims to show how the UK can have a thriving industrial sector aligned with the net zero target. One of the key themes of the strategy is to improve efficiency. The strategy supports increased resource efficiency and material substitution within industry by driving the transition towards a circular economy model and increasing reuse, repair and re-manufacturing. The strategy also supports industrial symbiosis and the acceleration of low-carbon technology innovations.	– Encourages industrial symbiosis, and provides incentives for industries to transition to circular, net zero business models and operations. Encourages industrial symbiosis, and provides incentives for industries to transition to circular, net zero business models and operations.
Net Zero Strategy: Build Back Greener (2021)	Sets out policies and proposals for decarbonising all sectors of the UK economy to meet the UK's net zero target by 2050 under the Johnson government. It sets out an indicative net zero delivery pathways and allocates a total of £26 billion of government capital invvestment for the transition, and how the Strategy will deliver the Prime Minister's Ten Point Plan. Mentioned the circular economy as a way of reforming the resources and waste systems, and sets the vision for goods to be "designed to last longer and be more efficient, while being used, repaired and remanufactured within a circular economy".	– Relevant targets: near elimination of biodegradable municipal waste to landfill from 2028, reduced emissions from landfill and incineration, saving an estimated 35 million tonnes of CO2 equivalent by 2050.
Environment Act 2021	Part of a new legal framework post-Brexit, the Environment Act establishes the provision of targets, plans and policies for improving the natural enviroment across four priortiy areas: air quality, water, biodiversity, resource efficiency and waste reduction. The waste and resource efficiency section is in line with the 25 Year Environment Plan, providing DEFRA with the powers to implement mandatory extended producer responsibility schemes and require environmental information be provided for consumers, or product passports for use in value chains.	– Introduces the standardisation of waste and recycling across local authorities. – Introduces deposit return schemes and electronic waste tracking

Policy Analysis
National

Policy	Description	Impacts on the Circular Economy
Waste prevention programme for England: Maximising Resources, Minimising Waste, DEFRA (2023)	Cross-departmental Plan to maximise resources and minimise waste in England, setting out the government's priorities for managing resourcing and waste, in line with the Resources and Waste Strategy for England. The programme supports the shift to a circular economy by setting out policy actions that aim to keep goods in circulation for as long as possible, and at their highest value. This includes increasing the reuse, repair and remanufacture of goods. The Plan takes a policy approach with key actions under each of the three themes: designing out waste, systems and services, and data and information.	– Actions related to designing out waste focus on product policy, including supporting the development of industry standards and eco-design standards, and exploring extended producer responsibility and guarantees and warranties in the future. – Actions related to systems and services actions are focused on setting clear expectations for the waste hierarchy, exploring changes to waste legislation, developing best practice guidance on reuse for local authorities, and consulting proposals to remove fees on consumers for bulky furniture waste collection by 2025. – Actions related to data and information include a facilitated industrial symbiosis model, digital waste tracking system, increasing accessibility to data, and product passport requirements.
Environmental Improvement Plan, DEFRA (2023)	This is the delivery plan for the 25 Year Environment Plan. As such, it sets out the progress made to date around the Plan's 10 goals and their plan to deliver the targets in the future. Two goals are centred around improving use of resources, focusing on maximising resources and minimising waste, and using resources from nature sustainably.. Progress has declined against these goals since they were set in 2018 due in part from the Covid-19 pandemic. However, future targets are centred primarily around waste processing and packaging. The resource use targets and actions are centred around sustainable timber supply, soil health, and due diligence.	– Relevant targets: zero supply of single use plastic from October 2023, bring at least 40% of England's agricultural soil into sustainable management by 2028. – Upcoming policy: deposit return scheme being introduced from October 2025 for plastic and metal drinks containers, consistent recycling between councils, work with businesses to implement packaging extended producer responsibility from 2024.

Material Flow Analysis
Detailed Methodology

Background
Material Flow Analysis (MFA) is a field of study dedicated to mapping the flow of resources within a defined system boundary. Defined by Brunner and Rechberger in the *Practical Handbook of Material Flow Analysis* (2005) as “a systematic assessment of the flows and stocks of materials within a system defined in space and time”, MFA can be used to identify opportunities for more efficient material use, including reuse and recycling.

The results of MFA can be used to describe the ‘metabolism’ of businesses, or regional / national economies, in other words the efficiency of a system in its use of energy and material resources. Efficiency can be described as the ratio between the material or energy utilised in the system and the total material or energy input into that system.

In general, MFA can be thought of in similar terms to a ‘mass balance’ calculation, characteristic of engineering or chemistry, although MFA is applicable to a broad range of systems. The general equation for MFA mass balance can be expressed as **Accumulation = inputs – outputs**, where zero accumulation indicates a steady-state system.

Such analysis has been used by Hass, Krausmann et al. to assess ‘*How circular is the global economy?’* by mapping material flows, waste production, and recycling in the European Union and the world in 2005. MFA is routinely used by businesses to develop resilience strategy in response to predicted supply shocks, by investors to inform funding decisions based on supply and demand, and by governments to enhance national or regional material sovereignty.

Generalised process

1) Define goal and scope
    - What is the purpose of the analysis? What should it include? Who is the intended audience? How will the analysis be carried out?
2) Define system boundary
    - Reference space (spatial locale of the mass balance)
    - Reference timeframe (temporal definition of the system)
    - Reference material (resource flows in and out of scope)
3) Define relevant processes, stocks, flows
4) Quantify stocks and flows by gathering data
5) Solve for a balanced system
6) Illustrate and interpret results

UK and Greater Lincolnshire context
In the UK, the Office for National Statistics (ONS) publishes data on economic trade flows (in terms of monetary value) as ‘input-output’ tables and ‘supply and use’ data. These data are arranged by Standard Industry Classification (SIC) codes and the statistical classification of products by activity (CPA), tabulated on page 76 onwards. The data describes the economic value of materials and products consumed by subsectors of the UK economy.

The ONS also publishes waste handling data, which describes the quantities of waste material generated by the SIC sectors, including their end-of-life processing (recycling, incineration, landfill).

Since these data are available only at a national level, a scaling process is necessary to estimate the Greater Lincolnshire and Rutland region’s contribution. This step is detailed in the data processing methodology, overleaf.

Material Flow Analysis
Detailed Methodology

System boundary
The reference location for the MFA is the Greater Lincolnshire and Rutland region of the United Kingdom.

6 sectors were identified as priorities for the evidence base: Agrifood, Manufacturing, Energy, Visitor Economy, Construction, and Ports and Logistics. Due to some overlap between Visitor Economy and Ports and Logistics, the Ports and Logistics sector was excluded from the MFA.

The most recent year for which all material input data requirements could be fulfilled from the ONS and relevant literature was 2019. Waste handling data from 2018 is the latest and has been used to derive scale factors as described opposite.

For all sectors, input flows of less than 10,000 tonnes were excluded to simplify the diagrams. Groupings of materials have been used to further simplify the model, as follows:

- Organic materials (agricultural products, manufactured food products, animal products, wood and paper)
- Inorganic materials (petrochemicals, rubber and plastic, cement and concrete, glass and ceramic, minerals, manufactured products and equipment, metals)
- Organic waste (food waste, soil waste, wood and paper waste)
- Inorganic waste (household and mixed waste, rubber and plastic waste, glass waste, metal waste, mineral waste)
- Hazardous waste (hazardous waste, dredging waste, industrial sludges, combustion waste)

Data sources

Source 1: UK input-output analytical tables: product by product (2019 edition) – Domestic use table at basic prices (product by industry), £ million (ONS)

Source 2: Analysing and Visualizing Material Flows within the Circular Economy – Delahaye et al.

Source 3: Regional gross value added (balanced) by industry – Table 1b: ITL1 & UK chained volume measures in 2019 money value, pounds million (ONS)

Source 4: UK Statistics on Waste: Total generation of waste by NACE and EWC_STAT 2010-18 UK (DEFRA)

Source 5: UK Statistics on Waste: Total waste sent to final treatment by EWC-STAT 2010-2018 UK (DEFRA)

MFA vs. Economic Sector Definitions

The data inputs for the MFA are only available at the 2 digit SIC code-level. As a consequence, the sector definitions used in the MFA differ from those used in the economic analysis. This means the MFA sector definitions for agri-food, visitor economy, and energy either exclude or include some of the 5-digit code activities that could not be separated-out from the 2-digit code activities. Most of the activities that were excluded from the MFA sector definitions are still included in the resource and waste flows depicted in the MFA diagrams and findings. The only difference is that they flow into or out of a different sectors compared to the economic sector definition. The MFAs for the visitor economy and energy sectors however do ‘over-include’ activities which could not be separated-out. These activities are detailed on page 77.

Data processing

The UK domestic use table (Source 1) was used to determine the economic value of raw materials and products used by the sectors of interest in 2019.

A set of unit costs were determined from the literature (Source 2), to convert economic value of materials into physical mass. A report from the Netherlands was chosen as it had the most comprehensive data from which to derive unit costs. The Netherlands has been assumed to have a relatively similar economic landscape to the UK – better data on the physical quantities of materials and goods consumed by the UK economy would enable the derivation of more accurate unit costs. These unit costs were then converted from kg/€ to kg/£ with a conversion factor of 0.86 £/€. The unit costs are tabulated on page 67. These unit costs were then applied to the top 50 resource flows by value for each sector, and the flows were reordered in terms of physical mass.

A set of scale factors were derived from the regional GVA statistics included in this report, to scale the UK-level data to Greater Lincolnshire and Rutland. These factors are the scale of the region’s GVA as a proportion of the UK’s GVA (Source 3) and are included on page 78.

The data on total waste generation (Source 4) was used to determine the outputs of the MFA. For each sector, the waste streams by European Waste Code (EWC) were classified into categories as tabulated on page 83 onwards.

Material Flow Analysis
Detailed Methodology

Data on the final treatment of waste generation in the UK (Source 5) was used to derive factors to determine the end-of-life treatments depicted in the sector-specific MFA diagrams. For each EWC stream, the portion of waste sent to recycling/recovery, incineration, energy recovery, landfill and backfilling were determined and applied to the waste output streams calculated from Source 4.

Model construction

Following the quantification of all physical material input flows over 10,000 tonnes, quantification of waste flows and estimation of their end-of life handling routes, the model was balanced by subtracting the waste output streams for each sector from their total material inputs, to find the net accumulation of materials in products and services for that sector.

Since this MFA approach is static rather than dynamic (the data is a snapshot in time from 2019), the ‘net accumulation of materials in products and services’ is a balancing term in the model, rather than a direct representation of the mass of material used to produce products and services in 2019. For example, for the construction sector, most of the waste outputs come from demolition of existing buildings and from excavation, while the inputs are primarily used for construction of new buildings. Therefore, the net flow to products and services for construction does not represent the total mass of new buildings constructed in the Greater Lincolnshire region in 2019, it is simply the difference between the mass of materials used and the mass of waste generated.

A dynamic MFA could iterate on this model taking data from multiple years to address this ‘time-lag’ on accumulation of materials.

Illustration

To illustrate the MFA results, Sankey diagrams have been produced using sankey-matic.com. Material groupings have been clustered by their classification as organic or inorganic materials, to reflect the separation of ‘biological and technical nutrients’ as defined by Braungart and McDonough in Cradle to Cradle.

The summary diagram (page 15) has been redrawn by a graphic designer for this report, while the sector-specific waste diagrams have been exported directly from the sankey-matic web app.

Interpretation of analysis

A visual appraisal of the Sankey diagrams enabled the identification of underutilised waste streams for the region. Materials with high recycling potential (i.e are already widely recycled) often have significant losses to landfill and incineration. By quantifying these flows from the MFA model, it has been possible to estimate the economic potential of these materials if they were diverted from landfill/incineration and recycled into valuable products. By making an assumption on the quantity of non-recycled recyclable materials, a quantity of potential recyclate was calculated, and divided by the unit cost to convert back into an economic value if that material were to re-enter the economy as a raw material.

A further economic analysis has been carried out to estimate the potential for higher-value reuse by quantifying the uplift in value if, for example, food waste was converted to fertiliser rather than downcycled into animal feed.

Material Flow Analysis
Product unit costs

Product	Unit cost (£/kg)
Products of agriculture	0.452
Products of cattle breeding	0.638
Energy carriers	0.138
Other mining products	0.029
Fish and meat products	1.982
Potato, vegetable and fruit products	2.161
Dairy products	1.250
Grain mill and starch products	1.421
Other food products	0.446
Beverages and tobacco products	1.217
Textiles, wearing apparel and leather products	4.243
Wood products, except furniture	0.837
Printing and paper products	1.275
Coke and refined petroleum products	0.203
Chemical and pharmaceutical products	0.778
Rubber and plastic products	2.601
Other non-metallic mineral products	0.194
Basic metals	0.683
Metal products, except machinery	3.131
Machinery and equipment	10.493
Transport equipment	5.619
Furniture and other manufactured goods	1.697

Economic Sector Definition: Agri-food

SIC code	Definition
1000	DEFRA/Scottish Executive Agricultural Data
1110	Growing of cereals (except rice), leguminous crops and oil seeds
1120	Growing of rice
1130	Growing of vegetables and melons, roots and tubers
1140	Growing of sugar cane
1150	Growing of tobacco
1160	Growing of fibre crops
1190	Growing of other non-perennial crops
1210	Growing of grapes
1220	Growing of tropical and subtropical fruits
1230	Growing of citrus fruits
1240	Growing of pome fruits and stone fruits
1250	Growing of other tree and bush fruits and nuts
1260	Growing of oleaginous fruits
1270	Growing of beverage crops
1280	Growing of spices, aromatic, drug and pharmaceutical crops
1290	Growing of other perennial crops

SIC code	Definition
1300	Plant propagation
1410	Raising of dairy cattle
1420	Raising of other cattle and buffaloes
1430	Raising of horses and other equines
1440	Raising of camels and camelids
1450	Raising of sheep and goats
1460	Raising of swinepigs
1470	Raising of poultry
1490	Raising of other animals
1500	Mixed farming
1610	Support activities for crop production
1621	Farm animal boarding and care
1629	Support activities for animal production (other than farm animal boarding and care) nec
1630	Post-harvest crop activities
1640	Seed processing for propagation
1700	Hunting, trapping and related service activities
2100	Silviculture and other forestry activities

SIC code	Definition
2200	Logging
2300	Gathering of wild growing non-wood products
2400	Support services to forestry
3110	Marine fishing
3120	Freshwater fishing
3210	Marine aquaculture
3220	Freshwater aquaculture
10110	Processing and preserving of meat
10120	Processing and preserving of poultry meat
10130	Production of meat and poultry meat products
10200	Processing and preserving of fish, crustaceans and molluscs
10310	Processing and preserving of potatoes
10320	Manufacture of fruit and vegetable juice
10390	Other processing and preserving of fruit and vegetables
10410	Manufacture of oils and fats
10420	Manufacture of margarine and similar edible fats
10511	Liquid milk and cream production

Economic Sector Definition: Agri-food

SIC code	Definition
10512	Butter and cheese production
10519	Manufacture of milk products (other than liquid milk and cream, butter, cheese) nec
10520	Manufacture of ice cream
10611	Grain milling
10612	Manufacture of breakfast cereals and cereals-based foods
10620	Manufacture of starches and starch products
10710	Manufacture of bread; manufacture of fresh pastry goods and cakes
10720	Manufacture of rusks and biscuits; manufacture of preserved pastry goods and cakes
10730	Manufacture of macaroni, noodles, couscous and similar farinaceous products
10810	Manufacture of sugar
10821	Manufacture of cocoa, and chocolate confectionery
10822	Manufacture of sugar confectionery
10831	Tea processing
10832	Production of coffee and coffee substitutes
10840	Manufacture of condiments and seasonings
10850	Manufacture of prepared meals and dishes
10860	Manufacture of homogenised food preparations and dietetic food

SIC code	Definition
10890	Manufacture of other food products nec
10910	Manufacture of prepared feeds for farm animals
10920	Manufacture of prepared pet foods
11010	Distilling, rectifying and blending of spirits
11020	Manufacture of wine from grape
11030	Manufacture of cider and other fruit wines
11040	Manufacture of other non-distilled fermented beverages
11050	Manufacture of beer
11060	Manufacture of malt
11070	Manufacture of soft drinks; production of mineral waters and other bottled waters
46210	Wholesale of grain, unmanufactured tobacco, seeds and animal feeds
46220	Wholesale of flowers and plants
46230	Wholesale of live animals
46310	Wholesale of fruit and vegetables
46320	Wholesale of meat and meat products
46330	Wholesale of dairy products, eggs and edible oils and fats
46341	Wholesale of fruit and vegetable juices, mineral waters and soft drinks

SIC code	Definition
46342	Wholesale of wine, beer, spirits and other alcoholic beverages
46360	Wholesale of sugar and chocolate and sugar confectionery
46370	Wholesale of coffee, tea, cocoa and spices
46380	Wholesale of other food, including fish, crustaceans and molluscs
46390	Non-specialised wholesale of food, beverages and tobacco
82920	Packaging activities

Economic Sector Definition: Construction and Manufacturing

SIC code	Definition
Section F	Construction
Section C	Manufacturing

Economic Sector Definition: Manufacturing

2-Digit SIC codes: Manufacturing subsectors

SIC code	Definition
12	Manufacture of tobacco products
13	Manufacture of textiles
14	Manufacture of wearing apparel
15	Manufacture of leather and related products
16	Manufacture of wood and of products of wood and cork, except furniture;manufacture of articles of straw and plaiting materials
17	Manufacture of paper and paper products
18	Printing and reproduction of recorded media
19	Manufacture of coke and refined petroleum products

SIC code	Definition
20	Manufacture of chemicals and chemical products
21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
22	Manufacture of rubber and plastic products
23	Manufacture of other non-metallic mineral products
24	Manufacture of basic metals
25	Manufacture of fabricated metal products, except machinery and equipment
26	Manufacture of computer, electronic and optical products
27	Manufacture of electrical equipment
28	Manufacture of machinery and equipment n.e.c.
29	Manufacture of motor vehicles, trailers and semi-trailers
30	Manufacture of other transport equipment
31	Manufacture of furniture
32	Other manufacturing
33	Repair and installation of machinery and equipment

Economic Sector Definition: Visitor Economy

SIC code	Definition
55100	Hotels and similar accommodation
55201	Holiday centres and villages
55202	Youth hostels
55209	Other holiday and other short-stay accommodation (not including holiday centres and villages or youth hostels) nec
55300	Camping grounds, recreational vehicle parks and trailer parks
55900	Other accommodation
56101	Licensed restaurants
56102	Unlicensed restaurants and cafes
56103	Take away food shops and mobile food stands
56210	Event catering activities
56290	Other food service activities
56301	Licensed clubs
56302	Public houses and bars
49100	Passenger rail transport, interurban
49320	Taxi operation
49390	Other passenger land transport nec
50100	Sea and coastal passenger water transport

SIC code	Definition
50300	Inland passenger water transport
51101	Scheduled passenger air transport
51102	Non-scheduled passenger air transport
79110	Travel agency activities
79120	Tour operator activities
79901	Activities of tourist guides
79909	Other reservation service activities (not including activities of tourist guides)
90010	Performing arts
90020	Support activities to performing arts
90030	Artistic creation
90040	Operation of arts facilities
91020	Museum activities
91030	Operation of historical sites and buildings and similar visitor attractions
91040	Botanical and zoological gardens and nature reserve activities
92000	Gambling and betting activities
93110	Operation of sports facilities
93199	Other sports activities (not including activities of racehorse owners) nec

SIC code	Definition
93210	Activities of amusement parks and theme parks
77110	Renting and leasing of cars and light motor vehicles
77210	Renting and leasing of recreational and sports goods
77341	Renting and leasing of passenger water transport equipment
77351	Renting and leasing of passenger air transport equipment
82301	Activities of exhibition and fair organizers
82302	Activities of conference organizers
68202	Letting and operating of conference and exhibition centres
68209	Letting and operating of own or leased real estate (other than Housing Association real estate and conference and exhibition services) n.e.c.
68320	Management of real estate on a fee or contract basis

Economic Sector Definition: Energy

SIC code	Definition
9100	Support activities for petroleum and natural gas extraction
9900	Support activities for other mining and quarrying
35110	Production of electricity
35120	Transmission of electricity
35130	Distribution of electricity
35140	Trade of electricity
35210	Manufacture of gas
35220	Distribution of gaseous fuels through mains
35230	Trade of gas through mains
35300	Steam and air conditioning supply
6100	Extraction of crude petroleum
6200	Extraction of natural gas
5101	Mining of hard coal from deep coal mines (underground mining)
5102	Mining of hard coal from open cast coal working (surface mining)
5200	Mining of lignite
20110	Manufacture of industrial gases
19100	Manufacture of coke oven products

SIC code	Definition
19201	Mineral oil refining
19209	Other treatment of petroleum products (excluding mineral oil refining petrochemicals manufacture)
38110	Collection of non-hazardous waste
38120	Collection of hazardous waste
38210	Treatment and disposal of non-hazardous waste
38220	Treatment and disposal of hazardous waste
38310	Dismantling of wrecks
38320	Recovery of sorted materials
39000	Remediation activities and other waste management services
72190	Other research and experimental development on natural sciences and engineering
74901	Environmental consulting activities

Economic Sector Definition: Ports and Logistics

SIC code	Definition
50100	Sea and coastal passenger water transport
50200	Sea and coastal freight water transport
51210	Freight air transport
52101	Operation of warehousing and storage facilities for water transport activities of division 50
52102	Operation of warehousing and storage facilities for air transport activities of division 51
52103	Operation of warehousing and storage facilities for land transport activities of division 49
52211	Operation of rail freight terminals
52212	Operation of rail passenger facilities at railway stations
52213	Operation of bus and coach passenger facilities at bus and coach stations
52219	Other service activities incidental to land transportation, nec (not including operation of rail freight terminals, passenger facilities at railway stations or passenger facilities at bus and coach stations)
52220	Service activities incidental to water transportation
52230	Service activities incidental to air transportation
52241	Cargo handling for water transport activities of division 50
52242	Cargo handling for air transport activities of division 51
52243	Cargo handling for land transport activities of division 49
52290	Other transportation support activities
53201	Licensed Carriers

SIC code	Definition
53202	Unlicensed Carriers
77120	Renting and leasing of trucks
77342	Renting and leasing of freight water transport equipment
77352	Renting and leasing of freight air transport equipment
49200	Freight rail transport
49311	Urban, suburban or metropolitan area passenger railway transportation by underground, metro and similar systems
49319	Urban, suburban or metropolitan area passenger land transport other than railway transportation by underground, metro and similar systems
49410	Freight transport by road
49500	Transport via pipeline

MFA vs. Economic Sector Differences

5-digit SIC code names excluded or misclassified in the MFA sector definition			5-digit SIC code names over-included in the MFA sector definition	
Agri-food	**Visitor Economy**	**Energy**	**Visitor Economy**	**Energy**
Manufacture of wine from grape	Renting and leasing of cars and light motor vehicles	Manufacture of industrial gases	Inland passenger water transport	Mining of iron ores
Manufacture of cider and other fruit wines	Renting and leasing of recreational and sports goods	Other research and experimental development on natural sciences and engineering	Inland freight water transport	Mining of uranium and thorium ores
Manufacture of other non-distilled fermented beverages	Renting and leasing of passenger water transport equipment	Environmental consulting activities	Freight air transport	Mining of other non-ferrous metal ores
Manufacture of beer	Renting and leasing of passenger air transport equipment		Space transport	Quarrying of ornamental and building stone, limestone, gypsum, chalk and slate
Wholesale of grain, unmanufactured tobacco, seeds and animal feeds	Activities of exhibition and fair organizers		Urban and suburban passenger railway transportation by underground, metro and similar systems	Operation of gravel and sand pits; mining of clays and kaolin
Wholesale of flowers and plants	Activities of conference organizers		Other urban, suburban or metropolitan passenger land transport (not underground, metro or similar)	Mining of chemical and fertilizer minerals
Wholesale of live animals	Letting and operating of conference and exhibition centres		Library activities	Extraction of peat
Wholesale of fruit and vegetables	Letting and operating of own or leased real estate (other than Housing Association real estate and conference and exhibition services) n.e.c.		Archives activities	Extraction of salt
Wholesale of meat and meat products	Management of real estate on a fee or contract basis		Activities of sport clubs	Other mining and quarrying n.e.c.
Wholesale of dairy products, eggs and edible oils and fats			Fitness facilities	
Wholesale of fruit and vegetable juices, mineral waters and soft drinks			Activities of racehorse owners	
Wholesale of wine, beer, spirits and other alcoholic beverages			Other amusement and recreation activities n.e.c.	
Wholesale of sugar and chocolate and sugar confectionery			Real estate agencies	
Wholesale of coffee, tea, cocoa and spices			Management of real estate on a fee or contract basis	
Wholesale of other food, including fish, crustaceans and molluscs				
Non-specialised wholesale of food, beverages and tobacco				
Packaging activities				
Processing and preserving of potatoes				
Manufacture of fruit and vegetable juice				
Other processing and preserving of fruit and vegetables				

Scale Factors

Sector	Scale Factor (ratio of Greater Lincs and Rutland GVA to UK)
Agri-food	0.05595
Manufacturing	0.043693165
Construction	0.014997001
Visitor Economy	0.019148
Energy	0.031382

Resource Definitions: Organic materials

CPA code	Definition
CPA_A01	Products of agriculture, hunting and related services
CPA_A02	Products of forestry, logging and related services
CPA_A03	Fish and other fishing products; aquaculture products; support services to fishing
CPA_C101	Preserved meat and meat products
CPA_C102_3	Processed and preserved fish, crustaceans, molluscs, fruit and vegetables
CPA_C104	Vegetable and animal oils and fats
CPA_C105	Dairy products
CPA_C106	Grain mill products, starches and starch products
CPA_C107	Bakery and farinaceous products
CPA_C108	Other food products
CPA_C109	Prepared animal feeds
CPA_C11.01-6 & C12	Alcoholic beverages & Tobacco products
CPA_C1107	Soft drinks
CPA_C13	Textiles
CPA_C14	Wearing apparel
CPA_C15	Leather and related products
CPA_C16	Wood and of products of wood and cork, except furniture; articles of straw and plaiting materials
CPA_C17	Paper and paper products

Resource Definitions: Inorganic materials

CPA code	Definition
CPA_C19	Coke and refined petroleum products
CPA_C203	Paints, varnishes and similar coatings, printing ink and mastics
CPA_C204	Soap and detergents, cleaning and polishing preparations, perfumes and toilet preparations
CPA_C205	Other chemical products
CPA_C20A	Industrial gases, inorganics and fertilisers (all inorganic chemicals) - 20.11/13/15
CPA_C20B	Petrochemicals - 20.14/16/17/60
CPA_C20C	Dyestuffs, agro-chemicals - 20.12/20
CPA_C21	Basic pharmaceutical products and pharmaceutical preparations
CPA_C22	Rubber and plastic products
CPA_C235_6	Cement, lime, plaster and articles of concrete, cement and plaster
CPA_C23OTHER	Glass, refractory, clay, other porcelain and ceramic, stone and abrasive products - 23.1-4/7-9
CPA_C241_3	Basic iron and steel
CPA_C244_5	Other basic metals and casting
CPA_C254	Weapons and ammunition
CPA_C25OTHER	Fabricated metal products, excl. machinery and equipment and weapons & ammunition - 25.1-3/25.5-9
CPA_C26	Computer, electronic and optical products
CPA_C27	Electrical equipment
CPA_C28	Machinery and equipment n.e.c.
CPA_C29	Motor vehicles, trailers and semi-trailers
CPA_C301	Ships and boats
CPA_C303	Air and spacecraft and related machinery
CPA_C30OTHER	Other transport equipment - 30.2/4/9
CPA_C31	Furniture
CPA_C32	Other manufactured goods

Waste Definitions: Organic waste

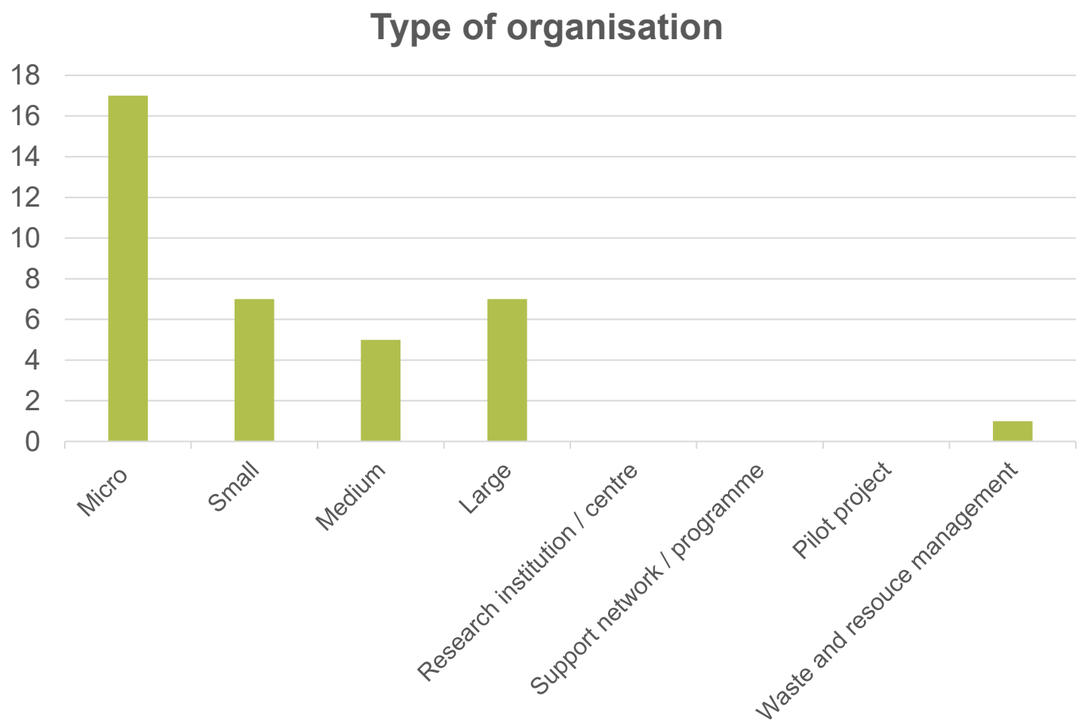
EWC code	Definition	MFA classification
7.2	Paper & cardboard waste	Wood and paper waste
7.5	Wood wastes	
9.1	Animal and mixed food waste	Food waste
9.2	Vegetal wastes	
12.6	Soils	Soil waste

Waste Definitions: Inorganic waste

EWC code	Definition	MFA classification
3.2	Industrial effluent sludges	Industrial sludges
6.1	Metallic waste, ferrous	Metal waste
6.2	Metallic waste, non-ferrous	
6.3	Metallic wastes, mixed	
7.1	Glass wastes	Glass waste
7.3	Rubber wastes	Rubber and plastic waste
7.4	Plastic wastes	
10.1	Household & undifferentiated materials	Household and mixed waste
10.2	Mixed & undifferentiated materials	
11	Common sludges	Industrial sludges
12.1	Mineral waste from construction & demolition	Mineral waste
12.2, 12.3, 12.5	Other mineral wastes	
12.4	Combustion wastes	Combustion waste
12.7	Dredging spoils	Dredging waste

Questionnaire
Key Findings

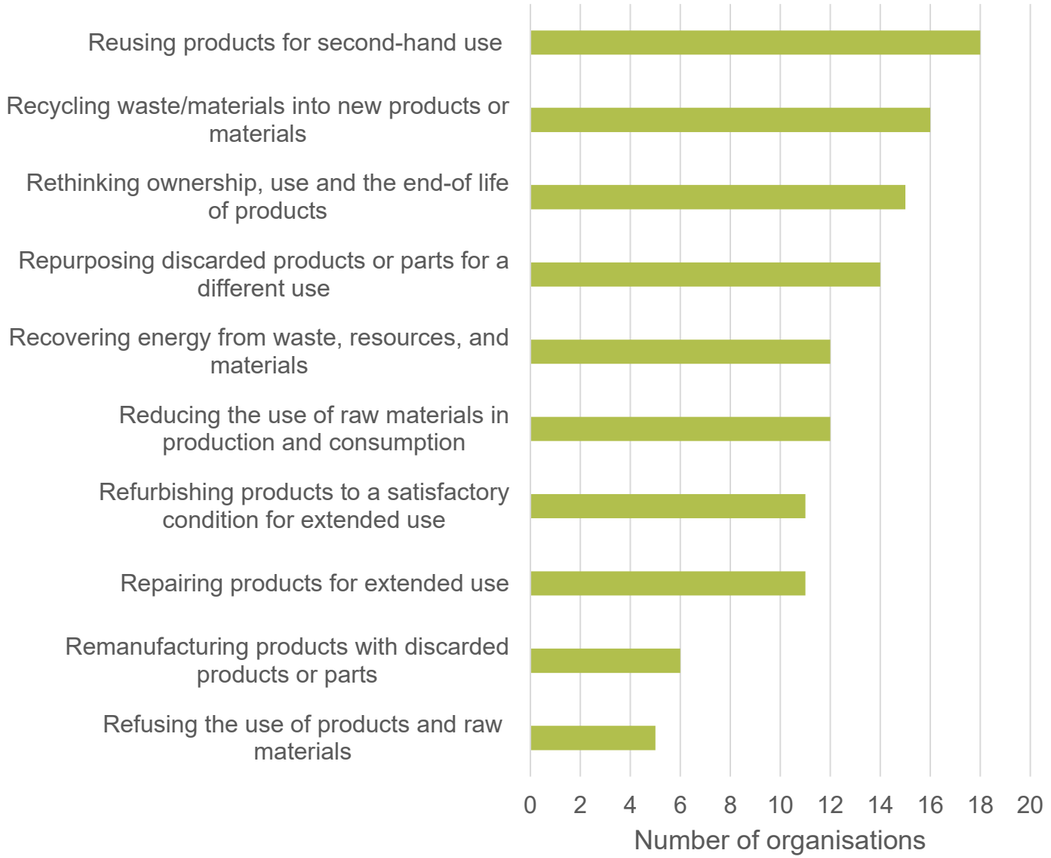
- 37 responses
- Responses came primarily from manufacturing (18%) , consumer products/retail (18%) , ‘other’ (18%) , and agri-food (16%)



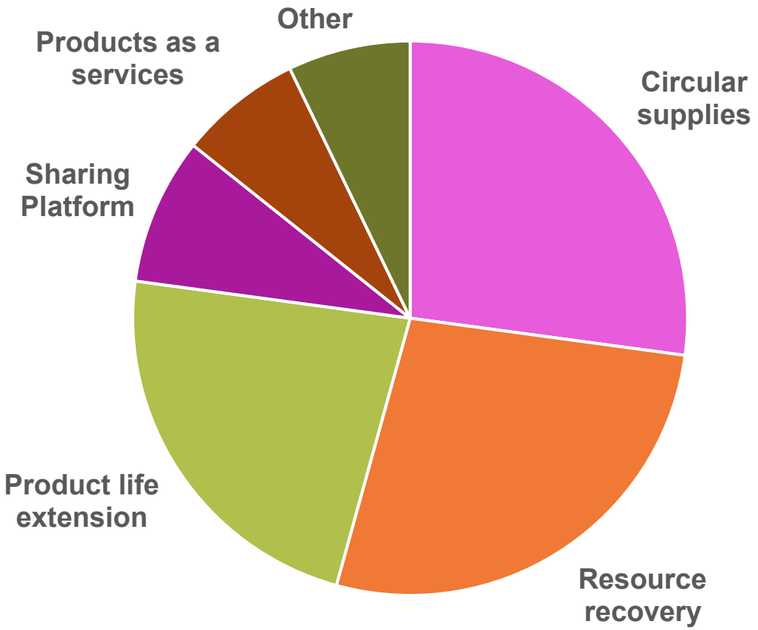
- Lincolnshire Rural Housing Association
- Phoenix Professional Development
- Baysgarth School
- The Dancing Tiger Scrapstore CIC
- Yesway limited
- Hildreds Shopping Centre
- Ellis Bros Contractors Ltd
- Destination Lincolnshire
- APk Industries
- Returnal
- Microclean Ltd
- Dynex Semiconductor
- Lindum Group
- Kurz Addison Ltd
- Liquid Mist
- Forage & Fill
- Smartfert Ltd
- Reuseabox
- Alltech
- BioteCH4
- Ellgia Limited
- Fairman Knight and Sons UK Limited
- Forage & Fill
- Viking Signs Ltd
- Pentangle Engineering Services Ltd
- Lincoln Eco Pantry
- Dyson Farming
- Lincolnshire Cloth Nappy Library
- New Earth Solutions West T/A MidUk
- Neil Gentleman-Hobbs
- The Lapwing Estate
- Yesway Communications
- Lincolnshire Wildlife Trust
- Manor Fresh Ltd
- J W Ruddock & Sons Ltd
- Rockscape Energy Ltd
- Annabel & Co Property Staging

Questionnaire
Key Findings

Circular economy activities



Business model approaches

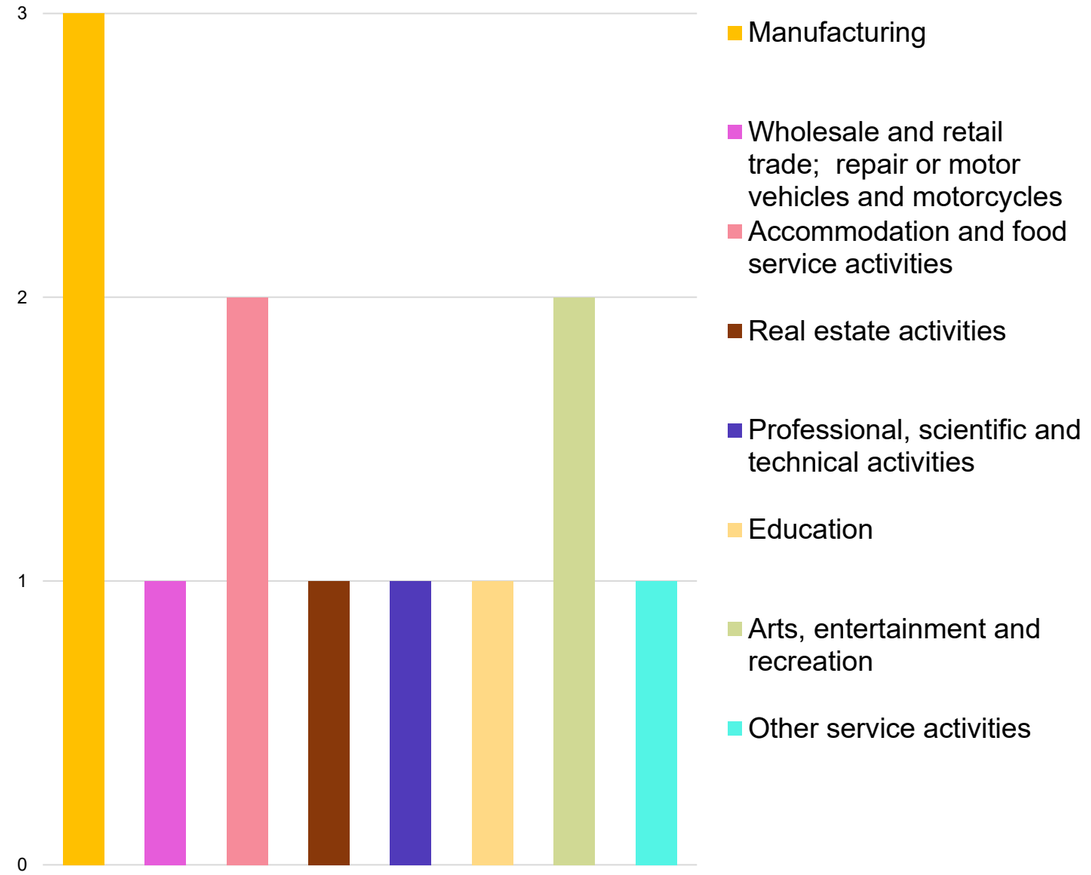


Other:

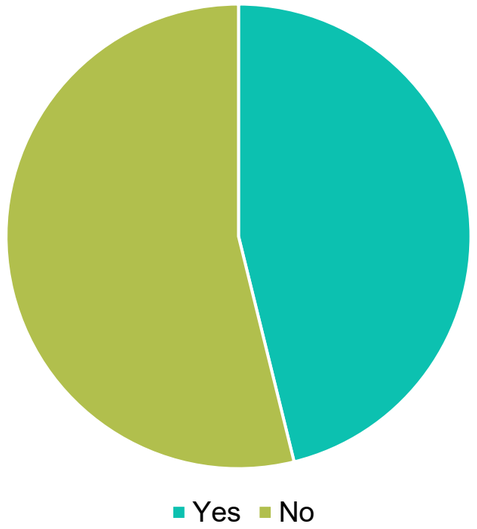
- “Don’t personally use the approach, but our suppliers do”
- Specific actions but still fit under the

Deep-dive survey
Key findings

Sector type



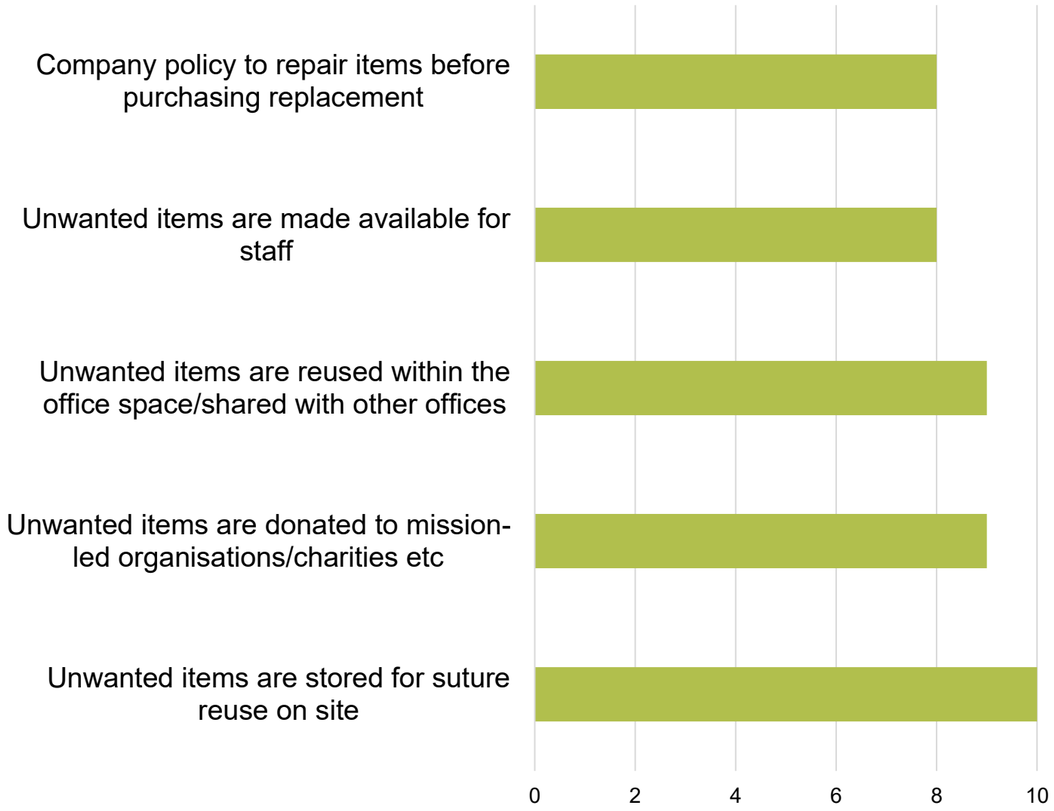
Does your organisation design or manufacture products?



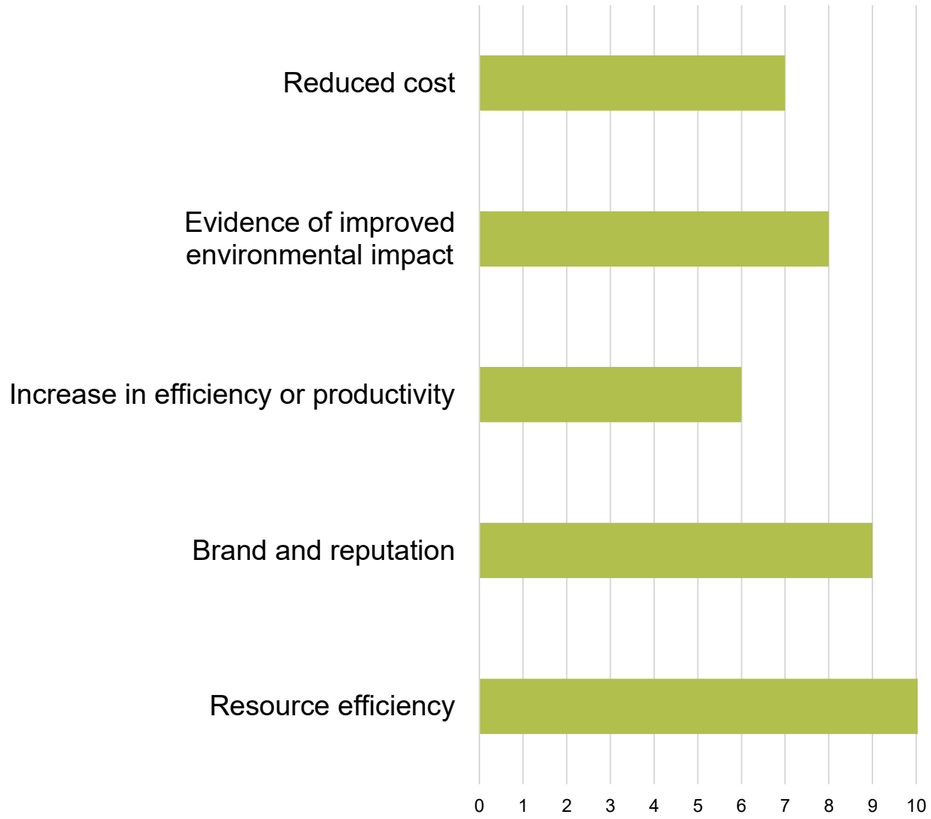
Of those that do:
50% invest in R&D for sustainability and circularity.
100% reduce waste at the manufacturing phase.
100% source recycled or bio-based material inputs

Deep-dive survey
Enablers

Top actions to keep products and materials in use for longer

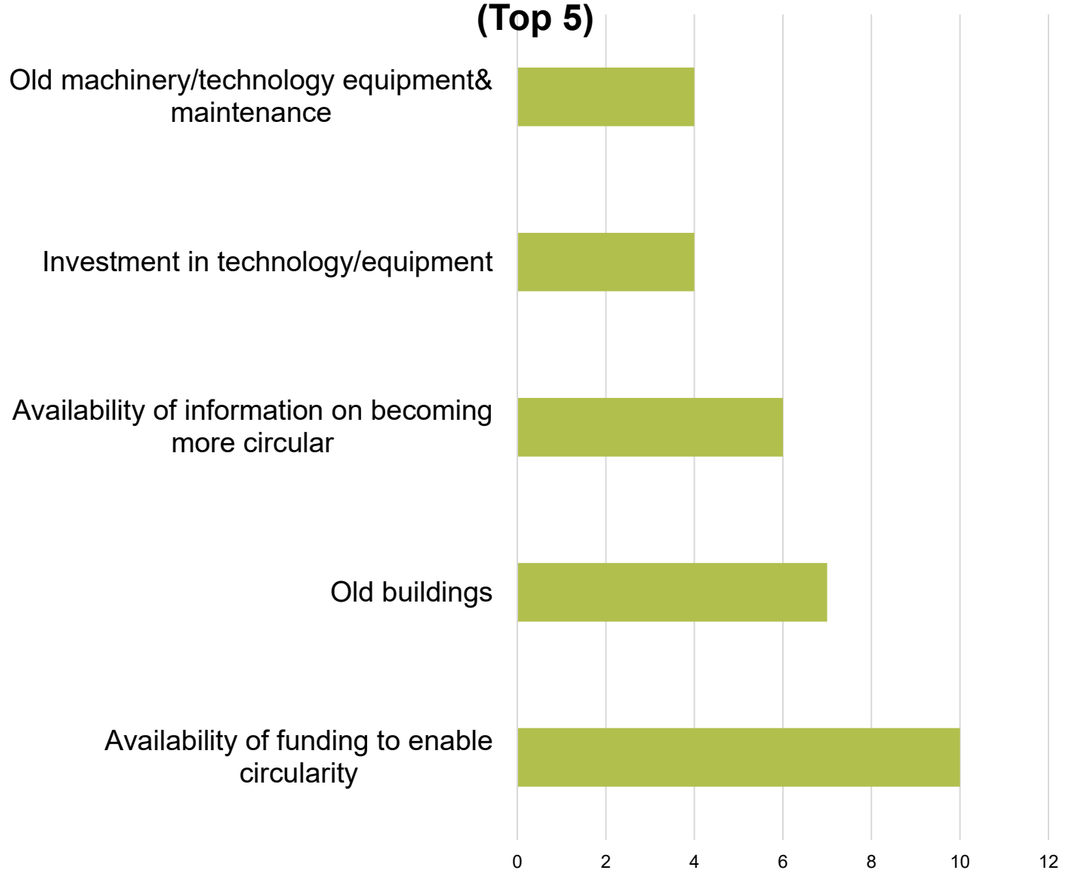


Benefits from the implementation of waste, resource or circular economy activity



Deep-dive survey
Barriers

Key barriers to adopting more circular practices (Top 5)



Considered the most challenging to address

Deep-dive survey
Recycling Ambitions

Top waste streams recycled

Waste streams recycled the least

Workshop
Key findings

Reasons for attending:

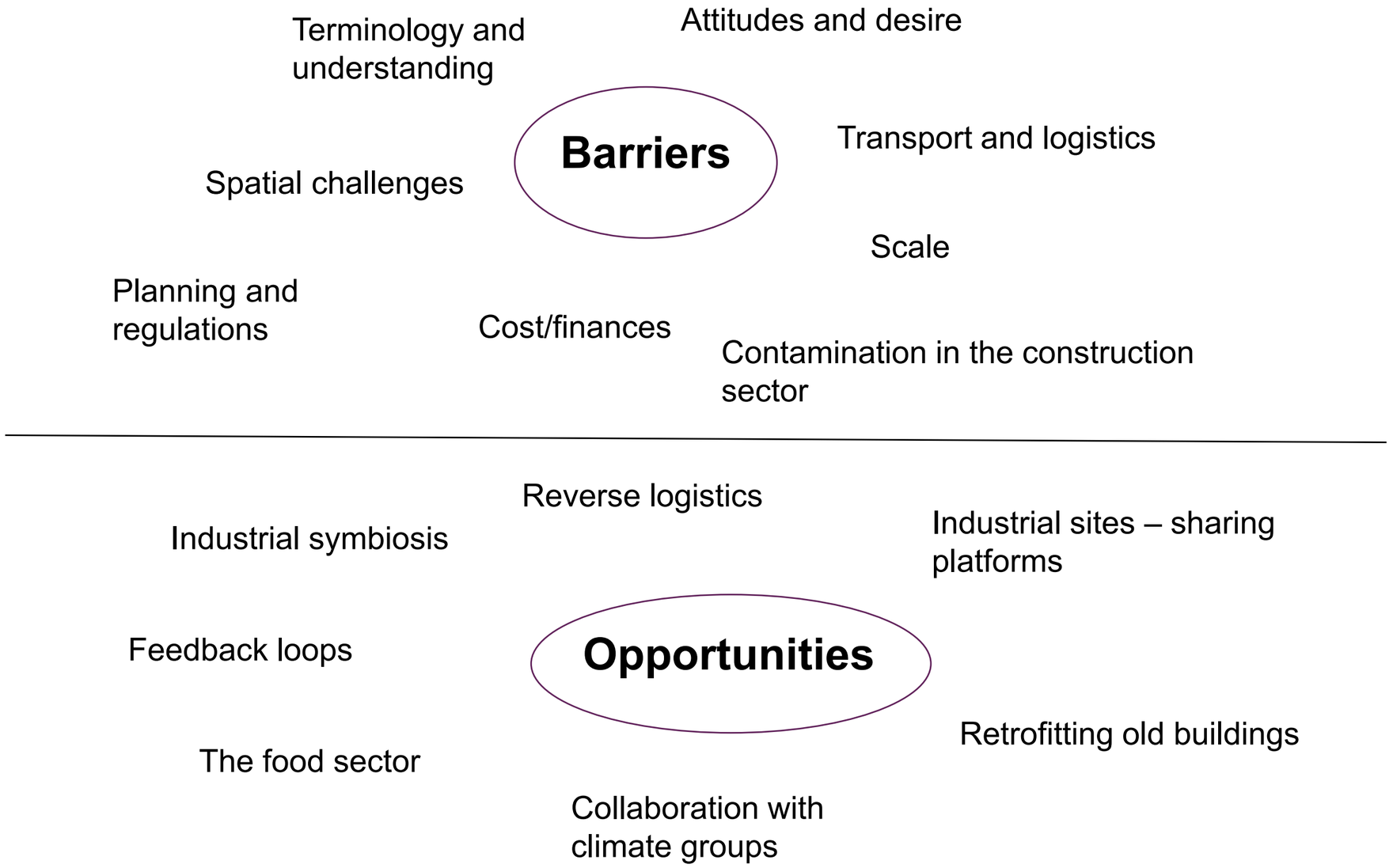
“Advice on making materials more circular and end-of-life options”

“Learning about the plans for circular economy in Lincolnshire”

“What other businesses are doing and learning from them”

“Trying to find solutions to our challenges”

“See what our company is missing and what can we pick up from others”



Workshop

Deeper look at the top barriers and opportunities..

Industrial symbiosis:
There is an opportunity for small industrial sites to work together in a “waste exchange” and joint procurement. Sharing resources, knowledge, circular hubs, energy frameworks..

Cost:
Capital upfront cost of investing in renewable energy is a massive barrier. Sparse population... there's no economy of scale - no case for initial investment

Terminology:
Opportunity to engage people through terms such as “sustainability”, “green growth”.
The definition of 'waste' is incredibly difficult, need to reclassify things as goods or materials.

Regulation:
Water extraction limits from government, alongside a differing water table.
Dual standards negatively impacting SME’s.

Electricity:
Rural areas could procure bulk electricity.
Adopt heat network plans for Lincoln to reduce reliance on imported fossil fuels and boost clean energy.

Scale:
Volume of waste streams, such as cooking oil (discussed from the survey), are not produced in large enough quantities for it to be dealt with internally.