West Midlands' Circular Economy Routemap

Kickstarting the region's journey to a green industrial revolution

West Midlands Combined Authority

usefulprojects
part of the Useful Simple Trust

SOENECS
Innovative Sustainable Solutions

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Glossary

Anaerobic Digestion: A sequence of processes by which microorganisms break down biodegradable material in the absence of oxygen. The process is used for industrial or domestic purposes to manage waste or to produce fuels.

Bio-fortification: The process by which the nutritional quality of food crops is improved through agronomic practices, conventional plant breeding, or modern biotechnology. Biofortification differs from conventional fortification in that biofortification aims to increase nutrient levels in crops during plant growth rather than through manual means during processing of the crops.

Bio-remediation: Processes that use biological systems to either restore or clean-up contaminated sites .

Brownfield: Denoting or relating to urban sites for potential building development that have had previous development on them.

Building Passports: A securely stored, online and up to date record of the physical attributes of a building through its lifecycle.

Circular Design: A design process that considers the entire lifecycle of a product and aims for flexibility, adaptability, longevity and disassembly.

Circular Economy: An economy based on the principles of designing out waste and pollution, keeping products and materials in use and regenerating natural systems.

Clean Tech: Refers to any process, product, or service that reduces negative environmental impacts through significant energy efficiency improvements, the sustainable use of resources, or environmental protection activities. It includes technologies related to recycling, renewable energy, information technology, green transportation, electric motors, green chemistry, lighting, grey water, and more.

Enabler: For this routemap, an enabler is a mechanism, process, product or infrastructure that supports a transition to the circular economy.

Environmental Product Declarations: A transparent, objective report that communicates what a product is made of and how it impacts the environment across its entire life cycle.

Extended Producer Responsibility: A policy approach under which producers are given a significant responsibility – financial and/or physical – for the treatment or disposal of post-consumer products. Assigning such responsibility could in principle provide incentives to prevent wastes at the source, promote product design for the environment and support the achievement of public recycling and materials management goals .

Industrial Symbiosis: A subset of industrial ecology, it describes how a network of diverse organizations can foster eco-innovation and long-term culture change, create and share mutually profitable transactions, and improve business and technical processes.

Material Banks: Repositories or stockpiles of valuable materials that might be recovered. If those materials replace primary resources used during the construction, operation or refurbishment of buildings and their parts, the need for primary resource mining, for example, of rare earth elements, can be eliminated.

Nutrient Loop: A nutrient loop is the movement and exchange of organic and inorganic matter back into the production of matter.

Permaculture: The development of agricultural ecosystems intended to be sustainable and self-sufficient.

Raw Material: The basic material from which a product is made.

Regenerative Agriculture: A conservation and rehabilitation approach to food and farming systems.

Sharing Economy: An economic system in which assets or services are shared between private individuals, either free or for a fee, typically by means of the internet.

Social Economy: Refers to a set of associations, cooperatives, mutual organisations, and foundations whose activity is driven by values of solidarity, by prioritising people over capital, and encouraging democratic and participative governance processes.

Social Value: The quantification of the relative importance that people place on the changes they experience in their lives. Some, but not all of this value is captured in market prices. It is important to consider and measure this social value from the perspective of those affected by an organisation's work.

Strategic Intervention: For this routemap, a strategic intervention is a sector-based project or opportunity that can accelerate a transition to a circular economy.

Virgin Material: Materials sourced directly from nature in their raw form, such as wood or metal ores. Manufacturing products using virgin materials uses much more energy and depletes more natural resources, as opposed to producing goods using recycled materials.

Executive summary

A vision for the West Midlands' circular economy

The West Midlands' circular economy will support the green industrial revolution. It will contribute to sustainable, inclusive growth, to the social economy and to a green recovery. The region's circular economy will make better use of resources, generating more value and creating new jobs.

This vision is underpinned by four principles: inclusive green growth, enabling foundations, innovation and collaboration, and resource optimization.

Why a circular economy?

The circular economy is much more than a sophisticated term for recycling. A circular economy is a different approach to the economy based on regenerative principles and business models that seeks to deliver environment and social value whilst promoting a strong economy.

For the West Midlands, transitioning to a circular economy supports the region in becoming the home of the green and circular industrial revolution. The West Midlands Circular Economy Routemap aims to kickstart the circular economy by building on existing best practice, projects, and expertise. Doing so will:

- Contribute inclusive, green growth and innovation, and create new jobs whilst safeguarding existing ones. A 2020 report by the Waste and Resources Action Programme (WRAP) found that a circular economy will help the UK build back better, bolstering the economy by £75 billion and creating over half a million jobs.
- Support the creation of a social economy and generate social value for local communities. Analysis conducted by the Ellen MacArthur Foundation shows that the average household income would increase by £2,500 a year in a circular economy.
- Reduce environmental degradation by reducing material extraction and resource consumption as well as waste generation. For example, transitioning to a circular economy could reduce global greenhouse gas emissions (GHG) by 10 billion tonnes.
- Accelerate a green, inclusive, and just recovery from COVID-19, and maximise post-Brexit opportunities that build on the region's unique characteristics and strengths.

How did we develop the routemap?

To develop this routemap, we:

- Produced a baseline analysis. This included:
  - High-level mapping of material and waste flows for five sectors. The selection of sectors was guided by the West Midlands Local Industrial Strategy.
  - Policy analysis and desk research on best practice and project case studies. It revealed a lack of robust framework and incentives to enable a circular economy at scale in the region. This analysis also demonstrated the need to put in place enabling levers that support an economy-wide transition.
  - Interviews and workshops with public, private, and academic stakeholders.
- Identified five economy-wide enabling levers and developed an implementation plan.
- Recommended that, in addition to the enabling levers, the West Midlands Combined Authority (WMCA) and its partners focus their efforts and resources on strategic interventions within three priority areas.
- Selected three priority areas and developed strategic interventions for each area. These interventions build on the region's economic and industrial strengths, capitalise on existing projects and expertise, and have a unique selling point that will drive the region's national and international competitiveness.

Enabling levers for a circular economy

Transitioning to a circular economy will be a challenging process that can generate multiple opportunities for the region. To do so, it will require a coordinated set of interventions across a wide range of sectors.

To support this economy-wide shift, five enablers are explored in this routemap:

- **Policy and regulation:** Embedding circularity in planning and design, improving regulatory and fiscal instruments to support a circular economy, and using procurement to grow new circular markets and supply chains.
- **Governance:** Implementing robust internal processes, convening experts and partners, encouraging partnerships and collaboration, developing new supply chains, and supporting a wider adoption of new, innovative circular business models.
- **Capacity-Building:** Launching a comprehensive behavioural change programme to encourage a shift in societal thinking, supporting upskilling and training, and strengthening existing business support programmes.
- **Soft infrastructure:** Supporting system-wide innovation, improving linkages between research and commercial application, using data platforms and digital infrastructure to accelerate the transition, and ensuring logistics support the movement of goods and materials.
- **Hard infrastructure:** Investing in critical energy, waste, and transport infrastructure, and in shared spaces, resource recovery hubs and storage facilities.

This routemap explores each enabler in further detail, proposing next steps and an implementation plan, identifying delivery partners and best practice.

Priority areas and strategic interventions

To accelerate the transition to a circular economy, the West Midlands must target its strongest sectors, leveraging its expertise and scaling up existing projects. To that effect, three priority areas were informed by a high-level material flow analysis and stakeholder engagement. They were selected based on the following criteria:

- Economic sectors where there are significant material and/or waste flows.
- Alignment with other corporate policies such as job creation, health improvements or environmental protection.
- Opportunity to leverage regional strengths such as existing skills, expertise and/or areas with considerable opportunity for growth.

Executive summary

The three priority areas are:

Circular Manufacturing: Industry and manufacturing consumes 3.3 million tonnes of minerals every year. With 16% of resource inputs feeding into transport manufacturing activities, the routemap focused specifically on transport manufacturing. This capitalises on the region's position as a major automotive hub and aerospace cluster. The West Midlands has a unique opportunity to drive the growth of a competitive clean tech sector, support the decarbonisation of the transport sector, and optimise the use and re-use of precious materials and metals through manufacturing.

Circular Construction: The construction sector is the largest consumer of minerals and the biggest producer of waste in the region. The waste generated by this sector represents a lost opportunity as value can be created from construction outputs. With 220,000 homes and major infrastructure projects planned, the West Midlands must reduce the impact of this sector on the natural environment. Distinctive opportunities exist in unlocking brownfield sites, embedding circular design, capitalising on new material innovations, and leveraging new delivery models, whilst building on the region's existing initiatives (such as the Zero Carbon Homes Routemap and the Advanced Methods in Construction Roadmap).

Circular Food: As the largest consumer of natural resources in the region, the food and agriculture sector was chosen because the West Midlands is a major food and drink manufacturing hub, home to giants such as Mondelez as well as a plethora of diverse community groups working on food issues. This unique landscape means the West Midlands can engage the entire food supply chain to re-design its food system. A system-wide shift in this sector would deliver socio-economic benefits, reduce environmental degradation, and contribute to the social economy.

This routemap explores 4 to 5 strategic interventions for each of the three priority areas described above. It provides detailed next steps, delivery partners and metrics for each intervention identified. The table on the right summarises each strategic intervention proposed in the routemap. To accelerate the transition to a circular economy, a mixture of large scale and smaller scale interventions were selected.

Priority Sector	Strategic Interventions	Overall Aim
Circular Manufacturing	Circular battery manufacturing	Design the first truly circular battery factory, distinguishing the West Midlands Gigafactory from other similar projects.
	Industrial symbiosis delivery programme	Implement a place-based industrial symbiosis delivery programme to cross-fertilise opportunities across the three priority areas.
	High-value fuels from waste	Use advanced processing technologies to turn residual, municipal and industrial waste into high-value fuels for aviation, logistics, heavy plant and other manufacturing sectors.
	Circular manufacturing centre of excellence	Establish a Circular Manufacturing Centre of Excellence to support circular design best practice and to develop advanced technologies (robotics, AI etc.).
Circular Construction	Circular strategies for infrastructure	Develop circular strategies and action plans for major infrastructure projects and utility providers.
	Circular building product initiative	Support the development of leading, regional circular buildings' systems, products and service offers.
	Zero waste construction hub	Launch a physical and virtual hub to recover and exchange materials, as well as share and incentivise circular design and processes.
	Circular repurposing programme	Develop and implement circular approaches for refurbishing and repurposing commercial and residential properties, as well as public buildings and spaces.
	Brownfield land reclamation	Set up a facility and associated advisory services to unlock the development potential of brownfield sites of all sizes, and to ensure brownfield reclamation adopts a circular approach to site clean-up and clearance.
Circular Food	Regenerative food production	Support regenerative agriculture and permaculture practices as well as local food growing initiatives.
	Circular food manufacturing	Develop circular strategies for food and drink processors and manufacturers, focusing on opportunity to use food waste as a productive resource.
	Circular food hubs	Create circular food hubs with optimised logistics to collect and redistribute food that would otherwise be wasted.
	Healthy consumption	Raise awareness and encourage sustainable, local food consumption, working closely with existing communities and volunteer groups.
	Circular nutrient loop	Close the nutrient loop by developing bio-technologies to recover and enhance value of food waste and other waste products (sewage etc.).

Executive summary

Next steps

A circular economy is a vital part of WMCA's overall approach to building a greener, healthier, and more inclusive region. Transitioning to a circular economy can build resilience, create new jobs, reduce environmental degradation, and support the growth of the social economy. To deliver the full potential offered by a circular economy, it will be essential for WMCA and its partners to develop shared ambitions and work closely together.

This routemap is only the first step for the region's journey towards a circular economy. Next steps proposed in the routemap include:

- Implement key actions across the enablers identified, including updating WMCA's Single Commissioning Framework and procurement rules, embedding the circular economy in the wider Net Zero Behaviour Change Campaign and the Commonwealth Games 2022 legacy work, as well as commissioning any further research and intelligence that may be required to inform future actions.
- Develop a business case for a West Midlands Industrial Symbiosis delivery programme with a focus on unlocking opportunities within and between the three priority areas identified in the routemap. The Tyseley Energy Park and the East Birmingham Corridor have been identified as hot spots for cross-sector circular activities.
- Develop a business case for a Zero Waste Construction Hub to support material recovery and exchange and to share and incentivise best practice in circular design and construction.
- Work with partners to convene a Circular Battery Partnership to create a world-leading ecosystem of circular battery manufacturing and to develop funding proposals.
- Explore innovation opportunities to transform waste into high-value fuels for hard-to-decarbonise sectors (such as aerospace).
- Accelerate a circular construction repurposing programme to implement circular approaches for refurbishing and repurposing commercial and residential properties as well as public buildings and spaces.
- Develop a network of circular community hubs based around sharing goods, food, and skills, supporting the wider Social Economy Growth Strategy and existing projects looking to re-design our food system.

The route ahead will not be simple but transitioning to a circular economy offers huge potential for the region including becoming the home of the green industrial revolution.

Structure of the routemap

1. Introduction

This chapter provides a definition of the circular economy and an overview of its key benefits. It describes the purpose, focus and scope of this routemap. It also presents the West Midlands's circular economy vision and its over-arching principles.

2. Assessing the West Midlands' Circular Economy Potential

An overview of existing circular economy best practice and expertise in the region is provided. A summary of key findings from the high-level material flow analysis conducted is presented.

3. A Focused Approach to Circularity

This chapter explains how the West Midlands needs to focus on transformative priority areas and strategic interventions that build on existing demonstrator projects and expertise. It sets out how the West Midlands Combined Authority (WMCA) can galvanise region-wide support for circularity in order to transition to a circular economy.

4. Building Enabling Foundations

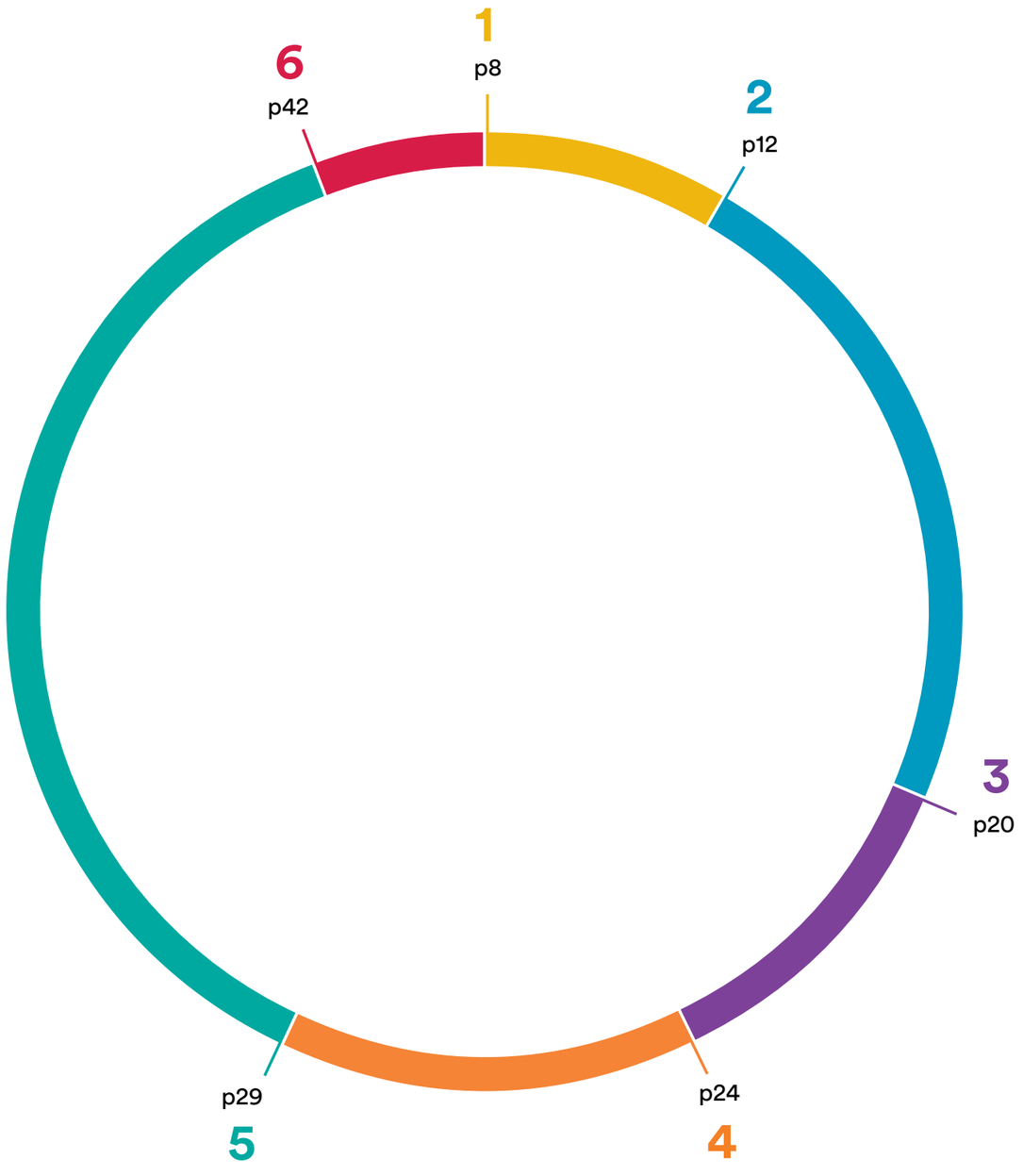
Details about the five enabling levers WMCA and its partners can use to kickstart a circular economy is mapped out. These enablers will help build a foundation that will support the delivery of strategic interventions. An analysis of the West Midlands' current enabling landscape and a detailed delivery plan are provided.

5. Selecting Strategic Interventions

The three selected priority areas are analysed, providing key findings from the high-level material flow performed and identifying strategic interventions for the region to further develop and invest in.

6. Conclusion and Next Steps

Recommended next steps for WMCA and its partners are explored. Additional resources are also provided.



1 Introduction

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Introduction

What is a circular economy?

A circular economy looks beyond the current linear take-make-waste processes to redefine growth (See Figure 1). A circular economy is based on three key principles:

1. Designing out waste and pollution.
2. Keeping products and materials in use at their highest value for as long as possible.
3. Regenerating natural systems.

A circular economy is underpinned by a transition to renewable energy sources and looks to gradually decouple economic activity from the consumption of finite resources.

Principle 1 places particular emphasis on preventing or reducing the necessity to make new products. Instead, it promotes reusing, sharing and repairing existing products as a preferred first option.

As a subset of the circular economy, the sharing economy is an economic system in which resources, products and services are shared between individuals, either for free or for a fee, often enabled through the use of digital platforms.

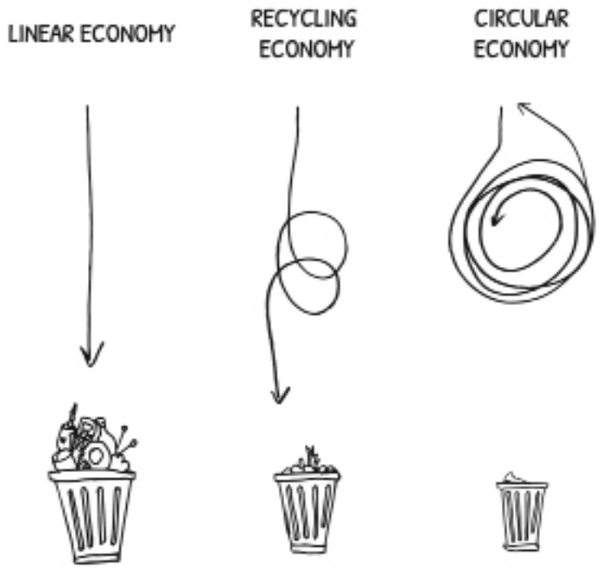


Figure 1: From a linear to a circular economy (Source: Circular Flanders, 2021)

What are the benefits of a circular economy?

Transitioning to a circular economy is an important driver of inclusive growth. It supports a wider green recovery and delivers socio-economic and environmental benefits to a wide-range of stakeholders. See Table 1 for a selection of circular economy benefits.

Economic benefits	Social benefits	Environmental benefits
New secure and long-term jobs will be created through: – Increased innovation and entrepreneurship; – A new service-based economy; and – A need to deliver new circular products. According to the Ellen MacArthur Foundation, new jobs will be required in reverse logistics, resource brokers, sales platforms, maintenance and repair as well as parts remanufacturing.	A circular economy would **increase disposable income** for manyhouseholds through: – Sharing economy approaches, – Reduced costs of products and services; – Less unproductive time (time stuck in traffic etc.). According to the Growth Within report, the average disposable income for households would increase by £2,500 by 2030.	Research by the Ellen MacArthur Foundation, suggests that a circular economy could **halve carbon emissions by 2030**. The Foundation's analysis concluded that the UK could reduce greenhouse gas emissions by 7.4 million tonnes every year simply by keeping organic waste out of landfill.
Growth in Gross Domestic Product (GDP) will be achieved through: – Increased revenues from emerging circular activities; – More productive use of economic inputs; – Lower costs of production and material cost savings by reducing the amount of raw materials used; and – Increased resilience to future, volatile raw material markets and reduced material scarcity.	**Total ownership costs for customers are reduced** by: – Overcoming premature obsolescence; – Reducing hassles associated with repairs and returns.	The shift to a circular economy leads to **resource conservation**: – Reduction in primary material extraction, processing and consumption; – Reduction in virgin and non-renewable materials used; and – Increase in use of recycled inputs.
Rethinking products and services through the lens of a circular economy drives **innovation**. A more innovative economy leads to: – Higher rates of technological development; – Improved materials, labour, energy efficiency and need for new skills; and – New business models which extend the life of an asset, improve the productivity of an asset, focus on high resource utilisation and waste reduction.	By reducing land, water and air pollution, a circular economy **improves local communities' health and wellbeing**. For example, a circular food system would reduce: – Healthcare costs associated with the use of pesticides; – Antimicrobial resistance; – Air pollution, water contamination and foodborne diseases.	A circular approach to agriculture contributes to **environmental resilience**. It will restore soil health and the productivity of the land. It also reduces food waste and the amount that goes to landfill, resulting in less GHG emissions. Such an approach has positive impacts on biodiversity and wider ecosystem services such as flood risk management.

Table 1: Benefits of a circular economy (Source: Ellen MacArthur Foundation, 2021)

Introduction

Purpose of the routemap

The West Midlands Combined Authority (WMCA) commissioned Useful Projects and SOENECS to develop a Circular Economy Routemap for the region.

Transitioning to a circular economy is a complex endeavour, involving many different parts of the economy and numerous stakeholders. It requires us to rethink all aspects of the economy at each stage of a resource's lifecycle and to understand the interplay between different material systems.

This routemap aims to kickstart the circular economy in the West Midlands by focusing initially on three priority areas that can catalyse socio-economic transformation. These priority areas build on the region's existing strengths and expertise in manufacturing, construction and food production.

This routemap purposefully focuses on practical action and was co-developed with key stakeholders, including a cross-sectorial Circular Economy Task Force. One of this document's core aims is to clearly communicate to this diverse array of stakeholders their respective role in helping the West Midlands transition to a circular economy.

Focus of the routemap

This routemap is a first, focused step for the region to transition to a circular economy. In developing the routemap, we have:

- Reviewed international best practice including enabling policies and project case studies;
- Undertaken a high-level analysis of the region's material flows;
- Identified enabling levers to develop a detailed implementation plan; and
- Identified three specific sectors and strategic interventions that respond to core regional strengths, specifically manufacturing, construction and food.

Other sectors, such as tourism, healthcare and life sciences, were also explored and offer circular economy opportunities. These will need to be explored in further detail in the subsequent phases of this routemap.

Scope of the routemap

The circular economy supports resource conservation and waste reduction. There is also a knock on benefit of reducing carbon emissions. However, the focus of this routemap is on resources and materials, rather than carbon and energy. This is to avoid duplication of work that the WMCA is already conducting as part of its climate change programme.

This routemap is purposefully not an energy, transport, carbon or waste strategy. It goes beyond recycling and advocates for a new approach to resource consumption, as seen in the resource hierarchy on the right (See Figure 2).

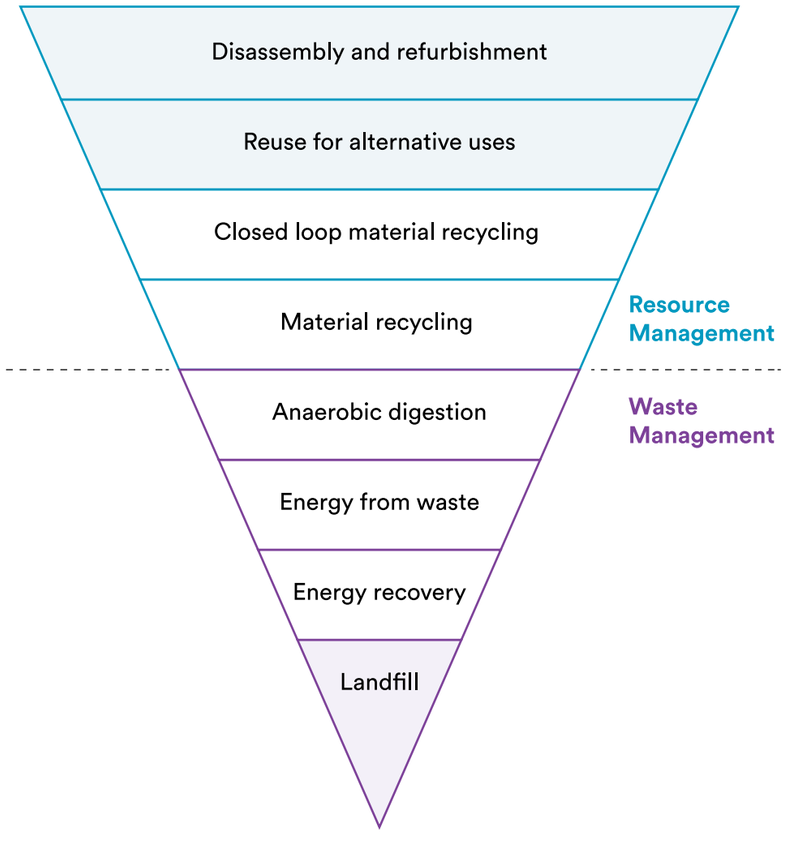


Figure 2: The resource hierarchy (Source: David Greenfield, 2013)

This routemap is central in strengthening the West Midlands' position as the home of the Green Industrial Revolution. It identifies and builds on the region's strengths and opportunities, as described in the HoGIR.

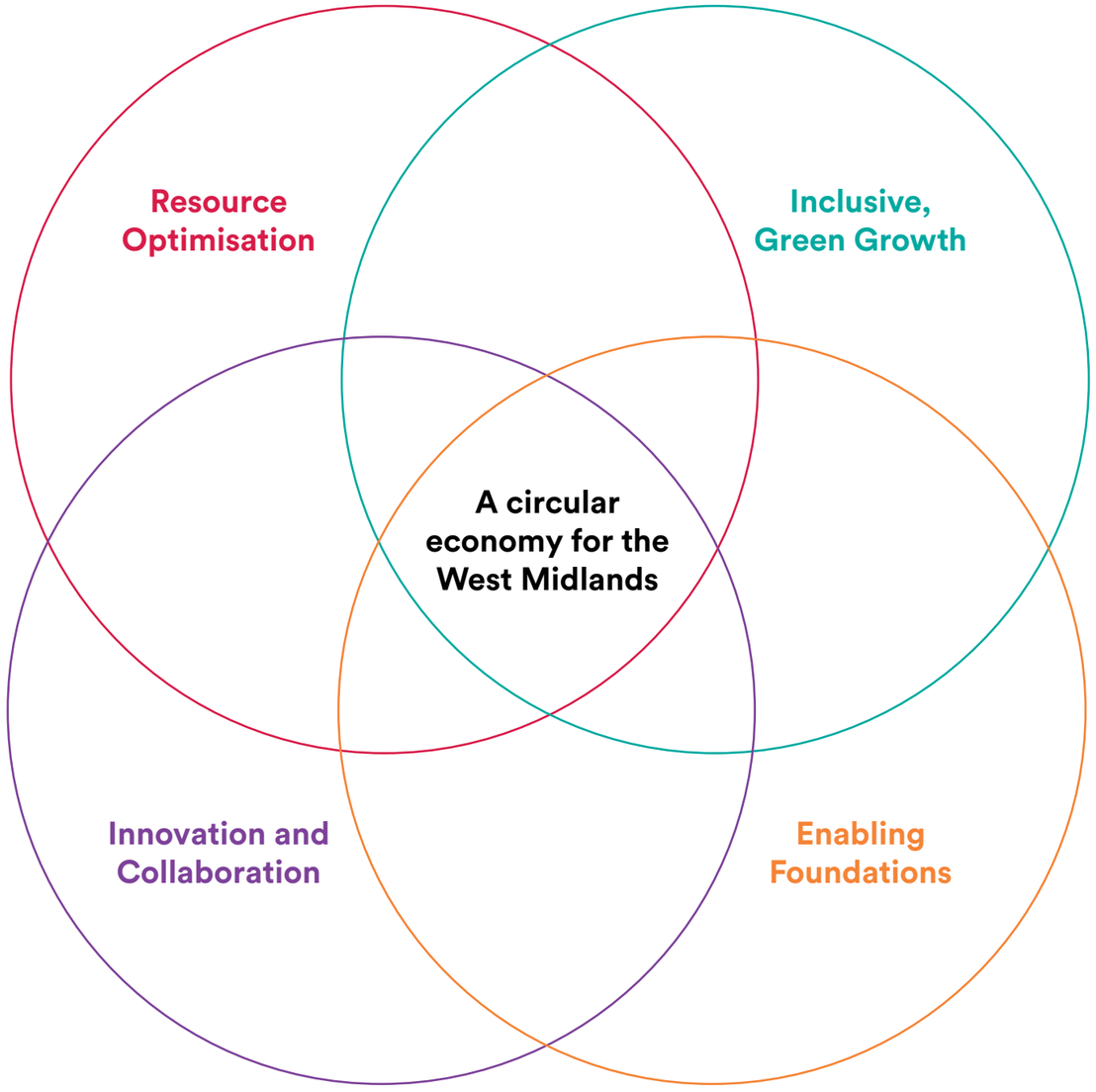
This routemap is aligned and actively supports other policy initiatives including WMCA's Five Year Plan, WM2041, Social Economy Business Plan, Transport Plans and associated policies as well as WMCA's Zero Carbon Homes and Advanced Manufacturing in Construction Routemaps.

In particular, this routemap supports WMCA's Inclusive Growth Framework and the delivery of several Sustainable Development Goals (SDGs) (See Figure 3).

Figure 3: WMCA's inclusive growth framework and SDGs

Circular economy vision & principles

The West Midlands' circular economy will support the green industrial revolution. It will contribute to sustainable, inclusive growth, to the social economy and to a green recovery. The region's circular economy will make better use of resources, generating more value and creating new jobs.



Underpinning this vision are four over-arching principles. These principles are:

1. Enabling Foundations: An enabling environment will be created to support a region-wide transition to the circular economy.
2. Resource Optimisation: Resource productivity and material recovery will be maximised, thereby increasing supply chain resilience and the West Midlands' global competitiveness.
3. Inclusive, Green Growth: An inclusive, green recovery will be supported in the region, maximising job creation, social value, decarbonisation as well as health and wellbeing.
4. Innovation and Collaboration: Innovative and collaborative processes will be encouraged and supported to unlock new business opportunities for the region.

These principles informed the selection of circular economy enablers as well as the outcomes for each proposed strategic intervention. They should continue to guide WMCA and its partners when choosing next steps and defining key outcomes.

2 Assessing the West Midlands' Circular Economy Potential

This chapter provides an overview of existing circular economy best practice and expertise in the region. It also provides a summary of key findings from the high-level material flow analysis conducted.

Regional context

The West Midlands

The West Midlands is one of the largest conurbations outside London. Its central location puts it at the heart of England's travel network and the region has strong international connections.

The region remains the manufacturing hub of the United Kingdom (UK) and was home to the industrial revolution. It saw tremendous growth until the 1970s/1980s. Although growth has slowed since, the region is seeing a resurgence in economic activity as it sets its ambition to become the hub for a green and circular industrial revolution in the country.

The West Midlands has a strong business and professional services sector, and a technology-driven manufacturing base, with key strengths in the automotive and aerospace sectors. The region will continue to see extensive city-centre construction growth and is one of the biggest educational clusters outside London (eight universities and world-class research institutions produce 55,000 graduates every year).

At the same time, the West Midlands suffers from high-levels of inequality, poverty, youth unemployment and low skills, as well as poor health and school performance. Some of these issues have been further exacerbated by the COVID-19 pandemic and Brexit.

A transition to a circular economy can help the West Midlands :

- Recover from the COVID-19 pandemic and Brexit;
- Build on its existing strengths;
- Address issues affecting its local communities; and
- Achieve its ambition to catalyse a green industrial revolution.

These regional strengths and challenges led us to develop a SWOT analysis, which was further informed by desk-based research and stakeholder engagement.

Please note: For the purpose of this report, the West Midlands refers to the geographical area covered by the combined authority's local authority members and the three Local Enterprise Partnerships (LEPs). Nevertheless, this report does also take into account strengths and opportunities for the wider West Midlands region, beyond the combined authority's reach, particularly regarding logistics, food and agriculture.

Strengths

- The West Midlands region is home to numerous circular economy businesses, exemplar projects and industrial ecology expertise. The West Midlands was home to the National Industrial Symbiosis Programme and is building on this legacy.
- Educational institutions have a strong presence in the region and are leading on several circular economy research projects.
- Strong grassroots community groups are already involved in the sharing economy, forming peer-to-peer networks to exchange and reuse resources.
- The West Midlands is part of the golden triangle of logistics in England, a position it can leverage to recover and trade resources.
- Resource flows of several economic sectors in the West Midlands generate value which can be further tapped into.

Weaknesses

- There is a lack of coordination across the region regarding policies and infrastructure. This is exacerbated by the lack of strong national policy and legislative frameworks to drive action.
- There is not enough strategic planning across the region to support large-scale circular processes.
- Existing partnerships around waste and resource flows do not neatly fit into collaborative governance structures.
- SMEs often do not have enough resources or capacity to innovate and develop circular products or services.
- High-levels of inequality, unemployment and deprivation across the region undermines a transition to an inclusive, green economy.
- Local communities and businesses still do not fully understand the circular economy, and the benefits and opportunities it presents.

Opportunities

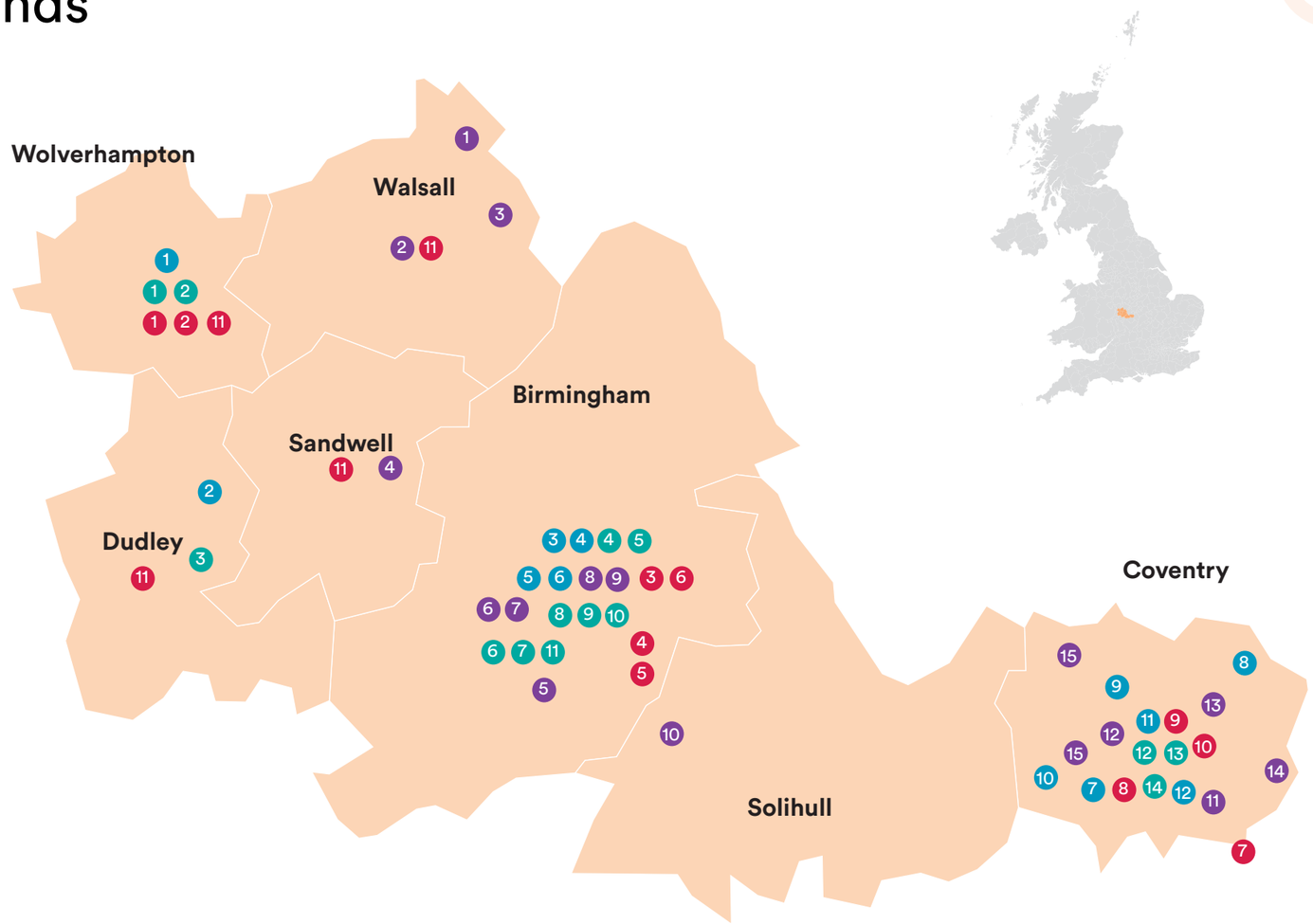
- Existing best practice examples and demonstrator projects can be scaled up and/or replicated.
- WMCA and its LEPs are well-positioned to act as a convenor of circular economy experts and key stakeholders, and be an advocate for more collaborative processes. The combined authority can also lobby for stronger national policies.
- By strengthening linkages between research institutions and businesses, the region can lead across the UK in the commercial application of innovative circular solutions.
- SMEs in the region form a large part of the economy and with the right support can significantly contribute to circular economy innovations, bringing more circular products and services to the market.
- A circular economy can build the region's economic resilience, in particular against volatile and increasing resource prices.

Threats

- Fragmentation across different local authority boundaries could slow down the transition to a circular economy.
- COVID-19 and Brexit have put a strain on resources to invest in new circular economy projects, and has disrupted supply chains. The loss of European funding is a particular threat for existing and new circular projects.
- Uncertainties over new trade rules could impact the region's economic growth and competitive advantage.
- Complexity of the circular economy and the requirement for partnerships across multiple sector could prevent creation of shared goals and shared outcomes. Path dependency and the power of the status quo can also deter transformative change.
- The region's reliance on energy from waste and the subsequent diversion of resources for incineration could restrict circular economy activity.

Place-based mapping
Circular activities in the West Midlands

A place-based mapping exercise was conducted to better understand current circular economy activities, key stakeholders and existing waste infrastructure. The first step was to research existing circular economy projects, enabling networks and early adopters. The West Midlands already hosts various circular economy activities and it must build on this existing best practice, scale up current projects and support early adopters to accelerate its transition to a circular economy. These are not exhaustive lists and the maps are for visual representation purposes only.



Circular Economy Research Centres

1. Brownfield Research and Innovation Centre (BRIC), *University of Wolverhampton*
2. Black Country and Marches Institute of Technology, *Dudley*
3. Energy and Bioproducts Research Institute (EBRI), *Aston University*
4. Centre for Circular Economy and Advanced Sustainability (CEAS), *Aston University*
5. Birmingham Energy Institute, *University of Birmingham (UoB)*
6. National Centre for Decarbonised Heat, *UoB*
7. Circular Economy Research Network (CERN), *University of Warwick*
8. Manufacturing Technology Centre, *Coventry*
9. Institute for Advanced Manufacturing and Engineering, *Coventry*
10. Warwick Manufacturing Group, *Coventry*
11. National Transport Design Centre, *Coventry*
12. Centre for Agro-Ecology, Water and Resilience, *Coventry University*

Circular Economy Support Programmes and Networks

1. Built Environment Climate Change Innovations (BECCI), *University of Wolverhampton*
2. Environmental Technologies and Resource Efficiency Support Services (EnTRESS), *University of Wolverhampton*
3. Cast Metal Federation, *Dudley*
4. UK Manufacturing Symbiosis Network Plus (UKMSN+), *Aston University*
5. Advanced Services Group (ASG), *Aston Business School*
6. ATETA, *UoB*
7. Alternative Raw Materials with Low Impacts (ARLI), *UoB*
8. STEAMhouse, *Birmingham*
9. Circular Economy Club (CEC), *Birmingham and West Midlands*
10. Sustainability West Midlands, *Birmingham and West Midlands*
11. Birmingham and Solihull Industrial Symbiosis (BASIS), *Birmingham and Solihull*
12. Midlands Aerospace Alliance, *Coventry*
13. The Enterprise Hub, *Coventry*
14. The Green Business Network, *Coventry and Warwickshire*

Circular Economy Adopters and Practitioners

1. Dunton Environment Waste Treatment Facility, *Walsall*
2. Urban Hax, *Walsall*
3. Kiondo, *Walsall*
4. Kew Technology, *Sustainable Energy Centre, Sandwell*
5. Jericho Foundation, *Birmingham*
6. Incredible Surplus, *Birmingham*
7. Eat Make Play, *Birmingham*
8. Aceleron Energy, *Birmingham*
9. International Synergies, *Birmingham and West Midlands*
10. Koolmill, *Solihull*
11. UK Battery Industrialisation Centre (BIC), *Coventry*
12. EXERGY, *Coventry*
13. Pod Cafe, *Coventry*
14. Emmaus, *Coventry*
15. Food Union Community Gardens, *Coventry*

Circular Economy Pilot Projects and Demonstrators

1. National Brownfield Institute, *University of Wolverhampton*
2. National Centre for Sustainable Construction and Circular Economy (NCCSCCE), *University of Wolverhampton*
3. Recycling Supply Chain for Luxury Cars Project, *UoB*
4. Tyseley Energy Park, *Birmingham*
5. Birmingham Energy Innovation Centre, Tyseley Energy Park, *Birmingham*
6. Food Trails, *Birmingham*
7. West Midlands Gigafactory, *Coventry*
8. RESO Project, *Coventry*
9. SIMBIO Project, *Coventry University*
10. Coventry Food Justice Network, *Coventry*
11. Repowering the Black Country Industrial Hubs, *Black Country*

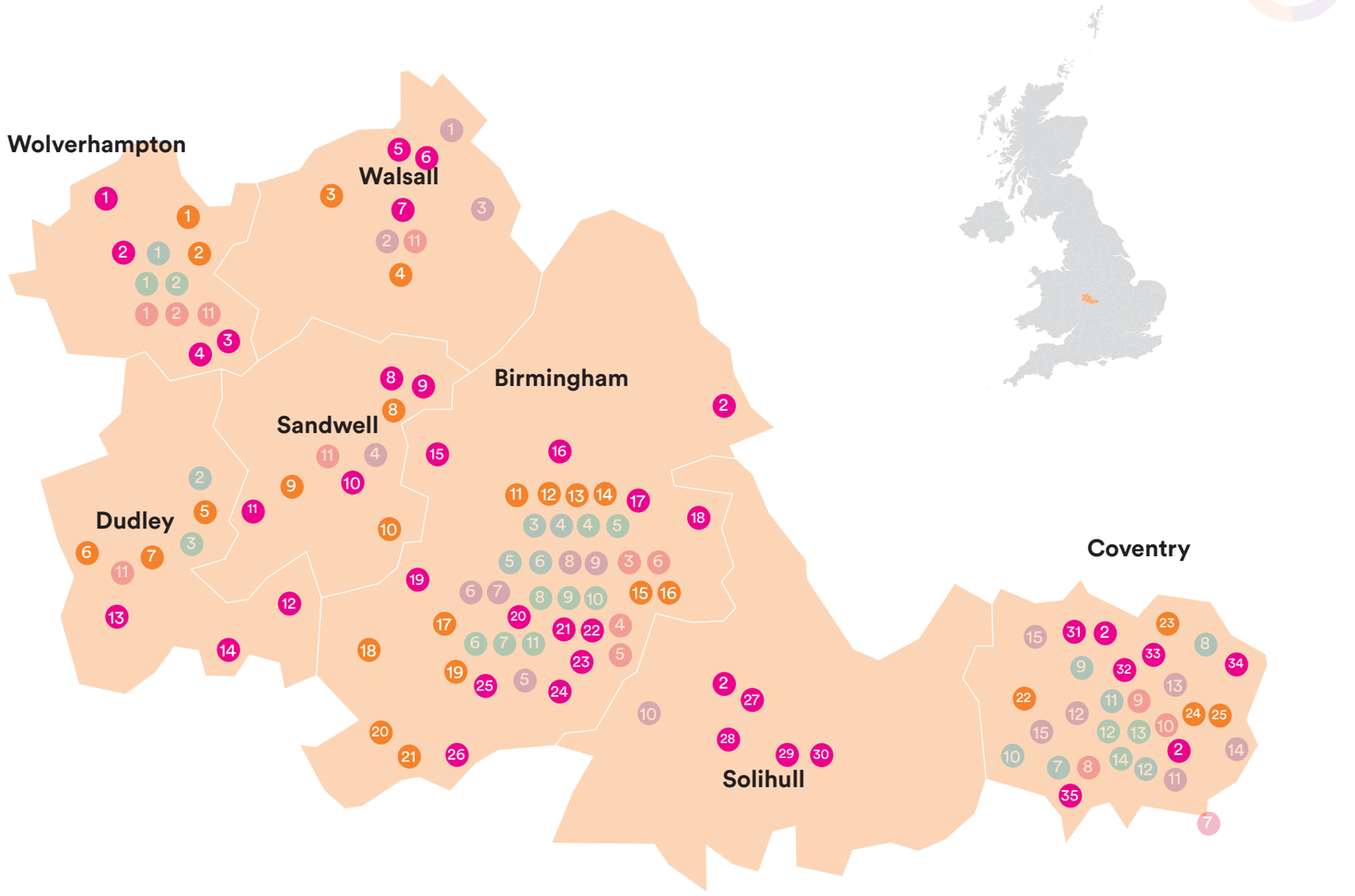
Place-based mapping
Businesses in the West Midlands

The second step in the mapping exercise was to identify large regional businesses and SMEs. All businesses identified have their headquarters and/or branch office in the West Midlands. Several of them also have a national and/or international presence.

This is not a complete list of regional businesses and more can be added over time. This represents an initial selection of principal manufacturing, construction, design, consultancy and food businesses present in the region.

The large businesses were selected based on their annual turnover and/or their number of employees. Given these businesses' size and economic power in the region, it is critical that these businesses take the opportunity and are supported in adopting circular processes.

SMEs make up a large part of the West Midlands' economy and are crucial players in supporting a circular economy transition. With appropriate support and incentives, these businesses can lead a circular economy transition, creating new jobs and social value for the region. An ecosystem that supports a circular economy needs to be created to enable SMEs to take full advantages of circular opportunities. The list of SMEs presented in this routemap was obtained through stakeholder engagement.



Selected SMEs

1. EDM Group, *Wolverhampton*
2. Jenks & Cattell, *Wolverhampton*
3. Genex, *Walsall*
4. Majestic Aluminium Anodising Ltd, *Walsall*
5. Essentia Protein Solutions, *Dudley*
6. Clamason Industries, *Dudley*
7. Marcegaglia UK, *Dudley*
8. Dalair, *Sandwell*
9. Voestalpine Metsec, *Sandwell*
10. Briggs Amasco, *Sandwell*
11. Gowling, *Birmingham*
12. Anixter, *Birmingham*
13. Slow Food, *Birmingham*
14. Edible Eastside, *Birmingham*
15. Precision Micro, *Birmingham*
16. CHEP Automotive, *Birmingham*
17. Birmingham Stopper, *Birmingham*
18. Supply Technologies, *Birmingham*
19. Barchester Healthcare, *Birmingham*
20. The Scrapstore, *Birmingham*
21. Harada Industries, *Birmingham*
22. Multimatic EU-Matic, *Coventry*
23. Circom, *Coventry*
24. Coventry & Warwickshire CDA, *Coventry*
25. Microcab Industries Limited, *Coventry*

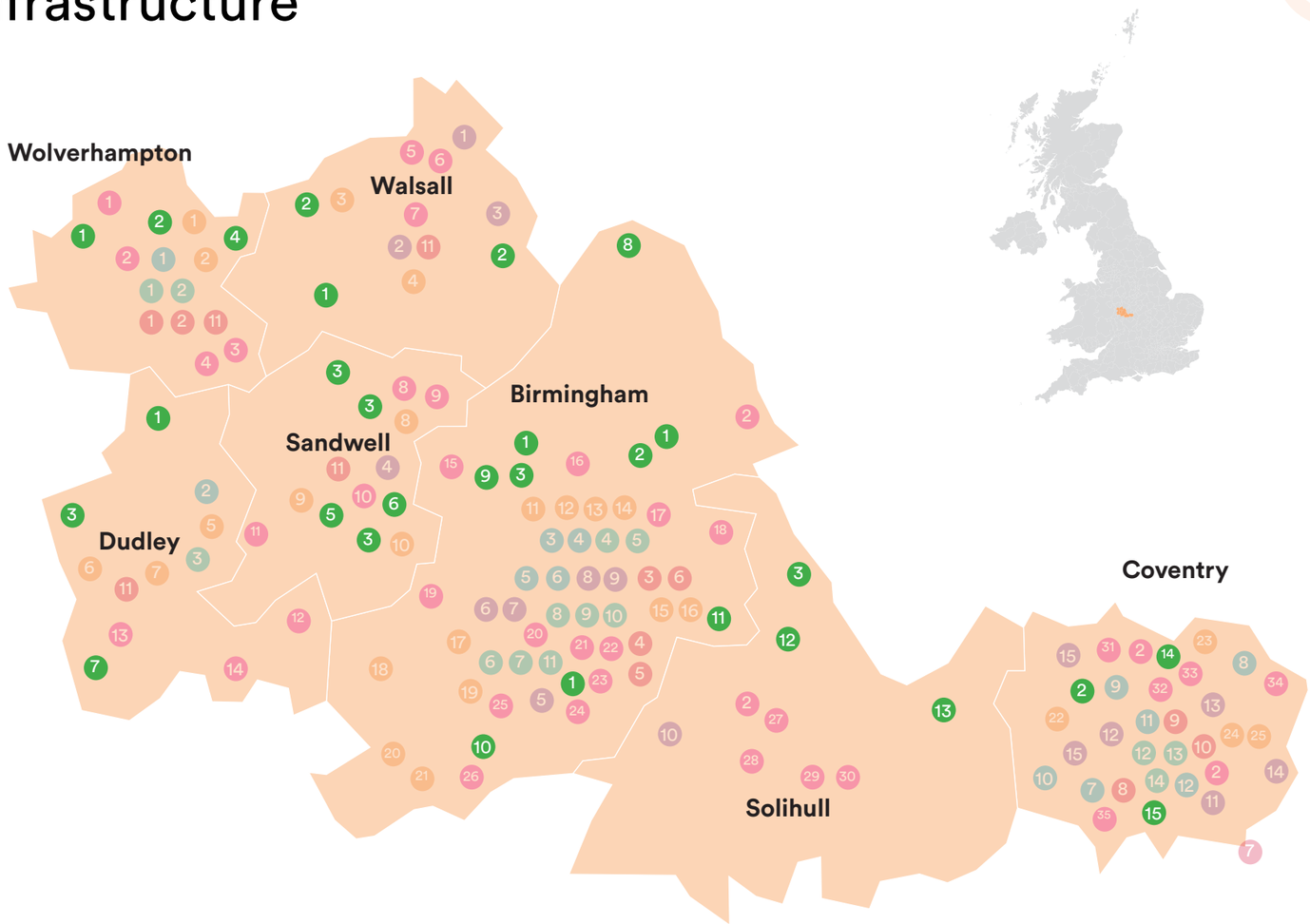
Selected Large Businesses

1. Moog Aircraft Group, *Wolverhampton*
2. Jaguar and Land Rover, *multiple locations*
3. Guardian Warehousing, *Wolverhampton*
4. ELG Carbon Fibre, *Wolverhampton*
5. Durbin Metal Industries, *Walsall*
6. Alchemy Architectural Aluminium Systems, *Walsall*
7. Urban Splash, *Walsall*
8. West Midlands Foundry Co, *Sandwell*
9. Aluminium Products Ltd, *Sandwell*
10. TRS & East End Foods, *Sandwell*
11. Doocey Group, *Sandwell*
12. Polydrain Civils, *Dudley*
13. Speller Metcalf, *Dudley*
14. Barratt Homes, *Dudley*
15. JCB, *Birmingham*
16. Make UK Technology Centre & Hub, *Birmingham*
17. Wing Yip, *Birmingham*
18. Coleman Group, *Birmingham*
19. Hadley Group, *Birmingham*
20. National Express, *Birmingham*
21. Cundall, *Birmingham*
22. 2 Sisters Food Group, *Birmingham*
23. Totally Modular, *Birmingham*
24. Gensler, *Birmingham*
25. Balfour Beatty, *Birmingham*
26. Mondelez International, *Birmingham*
27. Tarmac, *Solihull*
28. Lendlease, *Solihull*
29. Gymshark, *Solihull*
30. ARUP, *Solihull*
31. Meggit, *Coventry*
32. Spyker Cars Headquarter, *Coventry*
33. RollsRoyce, *Coventry*
34. Ford Motor Company Limited, *Coventry*
35. Tata Steel Automotive Engineering, *Coventry*

Place-based mapping
Waste and resource management infrastructure

The third step in the mapping exercise was to locate key waste and resource management infrastructure in the region. Although this is not an exhaustive list, this map shows the spatial connection between circular economy projects, key businesses and enabling infrastructure. Investment in waste and resource management infrastructure will be necessary to support a shift to a circular economy including more reprocessing facilities, anaerobic digestion plants and resource recovery hubs.

The West Midlands must have the appropriate waste, energy and transport infrastructure to support a shift to a circular economy. This is explored further in Chapter 3.



Waste and Resource Management Infrastructure

1. Veolia Recycling Centres and Reuse Shops, *Multiple locations*
2. SUEZ Recycling and Recovery Centres, *Multiple locations*
3. Biffa, *Multiple locations*
4. Lower Reule Bioenergy Recycling Centre, *Wolverhampton*
5. Hazardous Waste Recycling, *Sandwell*
6. Hazardous Industrial Services Chemical Recycling and Disposal, *Sandwell*
7. Severn Trent Green Power West Birmingham Anaerobic Digestion Facility, *Dudley*
8. Minworth Sewage Treatment, *Birmingham*
9. Metal and Waste Recycling Centre, *Birmingham*
10. Severn Trent Green Power West Birmingham Anaerobic Digestion Facility, *Birmingham*
11. Veolia Household Recycling Centre & Energy Recovery Facility, *Tyseley Energy Park, Birmingham*
12. HWRC Recycling Centre, *Solihull*
13. Veolia Wood Recycling Facility, *Solihull*
14. CSG Coventry Oil Recycling and Disposal, *Coventry*
15. Recycling and Reuse Centre, *Coventry*

Place-based mapping
Concentrations of activity

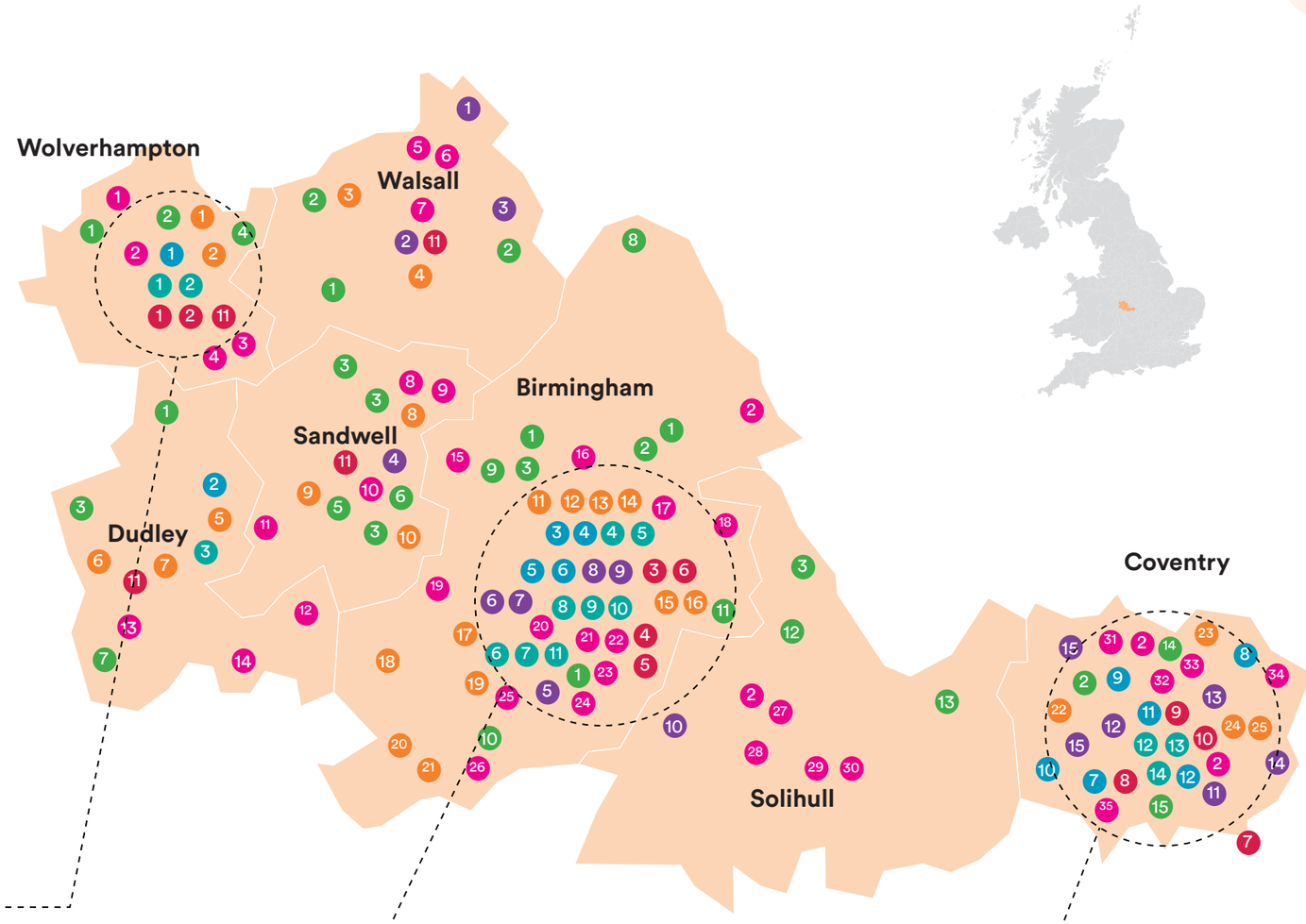
Transitioning to a circular economy will require coordinated interventions across diverse stakeholders, projects and activities. The mapping exercise provides a clear visualisation of how these different components are spatially connected and how identified concentrations of activity can be leveraged.

Three initial concentrations of activity have been identified in Wolverhampton, Birmingham and Coventry. It is worth noting that the Wolverhampton concentration of activity can be extended to the entire Black Country as strong circular economy activities have also been identified in Dudley, Sandwell and Walsall. It is also worth noting that these concentrations of activity are to be expected since cities benefit from higher density of homes, businesses and related economic activities.

The next chapters in this routemap build on these concentrations of activity, leveraging existing expertise to kickstart a circular economy in the region. These maps, concentrations of activity and themes have also informed the selection of priority areas.

We recommend that WMCA creates interactive, online maps building on the work produced in this routemap. These maps should be updated frequently to ensure they remain up-to-date and are linked with other complementary initiatives.

WMCA is also building a library of case studies, which will include examples of best practice in the region and will mention other regional companies that are already involved in the circular economy.



Concentration 1

Key themes for this concentration of activity are construction, metal manufacturing and aerospace.

- Leading in sustainable construction and brownfield remediation. This includes the National Brownfield Institute, the National Centre for Sustainable Construction and Circular Economy and the Construction Futures Research Centre.
- Wolverhampton will be the second national headquarter for the Ministry of Housing, Communities and Local Government and home to the government's Modern Methods of Construction Task Force. Wolverhampton is also the first English City to sign the European Circular Cities Declaration.
- Part of the West Midlands' aerospace cluster.
- The Repowering the Black Country project is identifying 4 industrial clusters in each local authority. Each cluster will build on regional strengths such as metal reprocessing.

Concentration 2

Key themes for this concentration of activity are enabling networks, leading research programmes, community groups and food processing.

- Leading research and development cluster with University of Birmingham, Tyseley Energy Park and Aston University.
- Rich circular economy support programme with ARLI, ASG and BASIS, and circular economy networks like the Circular Economy Club and UKMSN+.
- Presence of several community-led groups focusing on the sharing economy and on food justice and equity.
- The Greater Brimingham and Solihull LEP's Food Manufacturing Cluster is being developed in this concentration and will focus on circular economy activities.

Concentration 3

Key themes for this concentration of activity are automobile manufacturing, battery manufacturing and aerospace.

- Automobile manufacturing cluster of the region, with headquarters of Jaguar Land Rover and offices of Ford Motor, Rolls Royce and Microcab Industries.
- Part of the aerospace cluster with the Midlands Aerospace Alliance.
- Leading research and development centre with the Warwick Manufacturing Group specialising on food processing technologies, robotics and artificial intelligence.

Material flow analysis
Overview

A high-level material flow analysis was produced (see Figure 4), focusing initially on five key sectors identified in the West Midlands' Local Industrial Strategy. It sought to map the material flows within the West Midlands, including their relationships with energy systems. A complete breakdown of this material flow analysis, including data sources used, methodology followed and boundary of the analysis, is presented in the Supporting Document: Baseline Analysis.

Following extensive stakeholder engagement, the analysis was refined to three sectors which all build on the region's strengths. To inform the development of strategic interventions, more detailed material flow analysis for these sector's were carried out (See Figures 5, 6 and 7). These analyses are presented in this chapter and have informed the key findings for each priority areas. The geographical boundary for this analysis is the combined authority's three LEPs' geographical area.

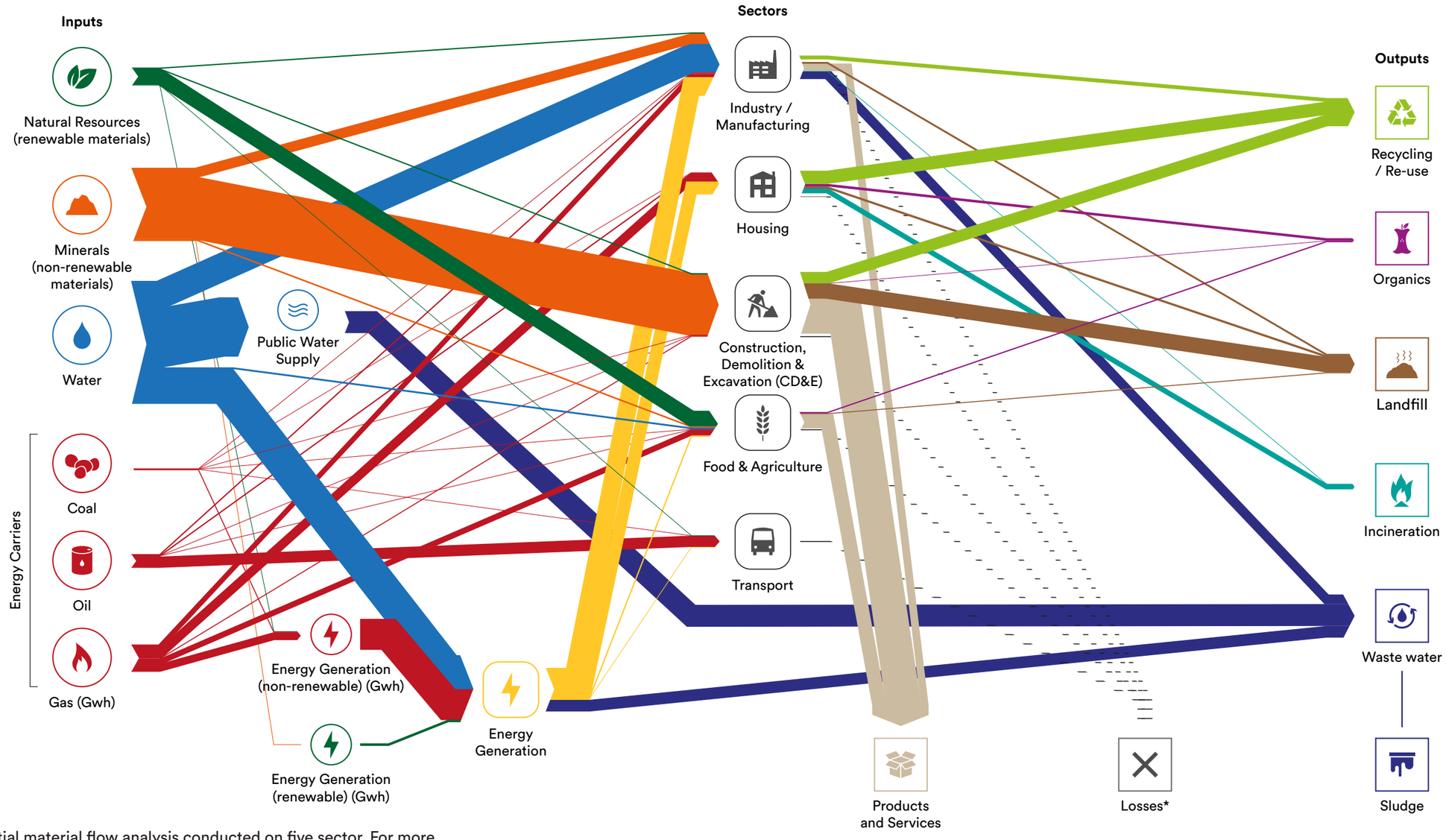


Figure 4: Initial material flow analysis conducted on five sector. For more information see Supporting Document: Baseline Analysis.

*Note: Insufficient data is available for losses, so an indicative flow has been represented by a hashed fill.

Material flow analysis
Key findings

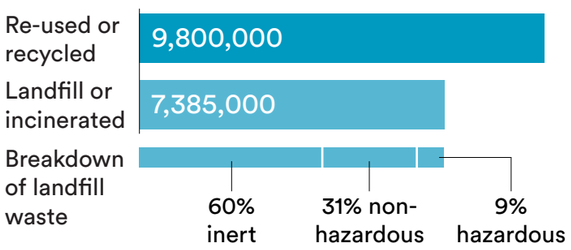
The region is
3.8 times
more reliant on non-renewable materials than renewable ones.

26.3 million tonnes of minerals
consumed in the region every year.

5.7 million tonnes of natural resources
consumed in the region every year.

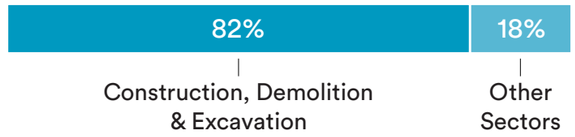
58%
of resources consumed in the West Midlands do not go to landfill or incineration each year.

7.4 million
tonnes of waste still end up in landfill or incinerated each year.



The Construction, Demolition & Excavation sector is the largest consumer of minerals in the region.

Regional mineral consumption:



72%
of waste from industry and manufacturing is re-processed, recycled or reused in some fashion every year.

Food and agriculture sector
consumes 4.5 million tonnes of natural resources per year.

Housing sector
is largest consumer of energy and water in the region.

Transport sector
consumes 800,000 tonnes of natural resources per year.

£2 billion
could be generated each year if 50% of West Midlands' population participated in reuse and sharing networks.

Re-processing and re-using resources generates
6 times
more gross value than sending them to landfill.

Data is key
Consistent collection required for in-depth analysis for key sectors. Further in-depth analysis is required.

Amsterdam Circular Strategy 2020-2025

As part of its strategy, Amsterdam mapped its main material flows from entry to processing, in order to preserve valuable raw materials. The strategy then focused on three value chains: food and organic waste streams, consumer goods, and the built environment. This approach was successful and complemented by in-depth modelling of chosen 'value chains'. You can find more information here.

Finland

Finland was the first country to publish a national roadmap to a circular economy. The first version of the roadmap included six key projects and dozens of pilots, which kick started Finland's transition to a circular economy. The updated version confirms that selecting initial sectors of focus kick starts a circular economy. You can find more information here.

Please note: A full breakdown of the data sources used is provided in Supporting Document: Baseline Analysis.

3 A Focused Approach to Circularity

This chapter explains how the West Midlands needs to focus on transformative priority areas and strategic interventions that build on existing demonstrator projects and expertise. It sets out how WMCA can galvanise region-wide support for circularity in order to transition to a circular economy.

A focused approach to a circular economy transition

Process

Based on the material flow analysis, stakeholder engagements, place-based mapping exercise and the in-depth review of existing projects and policies, it is clear that there is a strong case for circularity in the West Midlands.

Transitioning to a circular economy is a challenging process. It requires a coordinated set of interventions across a wide-range of sectors, involving various businesses and key stakeholders. To support this economy-wide shift, this routemap has identified five enabling levers: **policy and regulation, governance, capacity-building, soft infrastructure and hard infrastructure**.

Based on research of typical circular economy enablers, including those identified by the Ellen MacArthur Foundation, these five enablers will help build a region-wide eco-system focused on circularity. An implementation plan detailing actions across these five enablers has been provided in Chapter 3. WMCA, as well as its local authority constituent members and key partners (such as Chambers of Commerce and LEPs), have an important role to play in building this enabling foundation through the delivery of these actions.

However, to accelerate the transition to a circular economy, the West Midlands must move away from generic circular economy principles and target its sectors of industrial strength, leveraging its knowledge and expertise as well as scaling up existing projects, research programmes and circular activities.

Therefore, inspired by UK and international best practice, as seen in the Netherlands and Finland, the West Midlands Circular Economy Routemap follows a focused approach by initially targeting three catalyst priority areas: **Circular Manufacturing, Circular Construction and Circular Food.**

Selection criteria

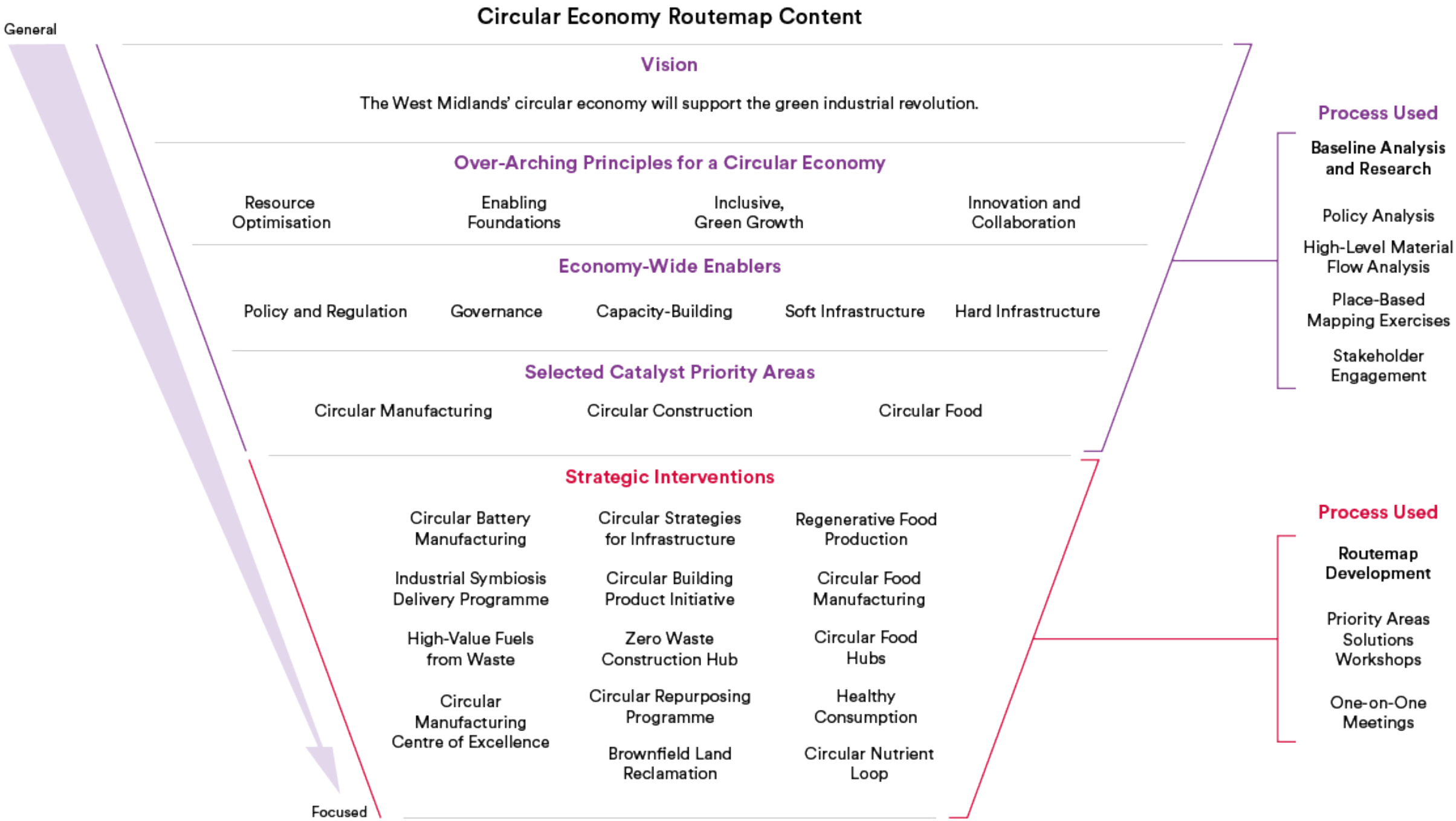
The three priority areas were selected based on the following criteria:

- Economic sectors that consume large amounts of resources and/or are large producers of waste.
- Economic sectors with existing regional circular economy expertise. For example, research and development programmes and/or projects that have already begun and can effectively be scaled up.
- Economic sectors that allow the West Midlands to build on its industrial strengths and develop a competitive advantage within the circular economy. This in turn can attract talent and resources to the region.
- Economic sectors attracting major investment where circular economy principles can be applied at scale.
- Economic sectors where circular economy interventions can contribute to job creation, can deliver social value to local communities, and can contribute to the West Midlands' decarbonisation agenda (if properly implemented).

For each of priority area, four to five high-value strategic interventions have been proposed in Chapter 4. The interventions selected are scalable opportunities that align with the region's growth plan and its industrial strategy, and can attract long-term investment and government funding. For these strategic interventions, WMCA's role will be to convene experts, encourage collaborative partnerships and facilitate the development of detailed project and funding proposals.

The methodology used for this routemap is summarised and illustrated on page 22.

A focused approach: Summary methodology diagram



Selected priority areas

Circular manufacturing

The industry and manufacturing sector was chosen as a priority area given the West Midland's strong manufacturing base and due to existing circular economy expertise and projects within this sector. Most of these projects are in their early stage of development, such as the Repowering Black Country Industrial Hubs or the regional Industrial Symbiosis Programme. These projects need to be nurtured as part of the delivery of this routemap.

Circular Manufacturing in the West Midlands will focus specifically on growing the clean tech sector, particularly to support the decarbonisation of the transport sector. This presents one of the biggest opportunities for the region since the West Midlands is already a leader in vehicle manufacturing and battery technologies, and a £2.5 billion Gigafactory is being planned in Coventry.

Circular construction

The Construction, Demolition and Excavation (CD&E) sector was chosen as a priority area since it is the largest consumer of resources and the biggest producer of waste in the region. The waste generated by this sector represents a lost opportunity as value can be created from construction outputs. The region will also be home to significant new developments, including 220,000 new homes and major infrastructure projects.

Circular Construction in the West Midlands will maximise circular design, capitalise on new material innovations and leverage new delivery models such as Modern Methods of Construction and off-site manufacturing. Opportunities also exist to unlock brownfield sites across the region, to deliver more homes whilst reducing the amount of resources used and building regional supply chains' resilience.

Circular food

The food and agricultural sector was chosen as a priority area since it is the largest consumer of natural resources in the region, and the wider West Midlands remains an agricultural hub with large agro-businesses and food processors based in the region. The region also has a strong food-based community presence, with numerous groups working on food justice issues. These groups will need to be supported as part of the delivery of this routemap.

Circular Food will see the West Midlands re-design its food system to create new jobs, improve local communities' health and reduce environmental degradation associated with modern diets and agricultural methods. Adopting circular economy principles could also significantly reduce the amount of food wasted. A system-wide shift within this sector would deliver socio-economic benefits and contribute to the growth of a social economy.

3 Building Enabling Foundations

This chapter provides details about the five enabling levers WMCA and its partners can use to kickstart a circular economy. These enablers will help build a foundation that will support the delivery of strategic interventions. An analysis of the West Midlands' current enabling landscape and a detailed delivery plan are provided.

Circular economy enablers

4

Transitioning to a circular economy requires a fundamental shift in how we operate, how we think about industrial processes and how we design our products and services. This routemap has identified five enablers that support an economy-wide transition to a circular economy. WMCA and its local authority constituent members can take a leading role in implementing these enablers. These enablers can also be applied to wider programmes of work beyond the circular economy.

Policy and Regulation

Planning & Design

- Encourage circular design and processes, particularly in planning.
- Ensure consistency and harmonisation of policies across all local authority constituent members.

Legislation & Regulation

- Introduce regulatory instruments that support the circular economy including better implementation and enforcement of existing and upcoming waste legislations.

Fiscal Incentives

- Align taxation and fiscal incentives with circular economy outcomes.

Procurement

- Develop collaborative approaches to service provision amongst public sector bodies in the region.
- Use public sector procurement to grow new circular markets and supply chains and to accelerate the introduction of circular goods and services.

Governance

Internal Processes

- Implement internal governance processes within WMCA to assign roles and responsibility, allocate resources and monitor progress.
- Plan within WMCA the delivery of circular economy strategic interventions identified in the routemap.

Partnerships

- Act as a convenor of experts and key stakeholders and encourage knowledge-sharing.
- Encourage circular economy partnerships and collaboration across synergistic sectors.

Business Models

- Encourage the adoption of new business and finance models to encourage circularity and innovation as well as increase regional businesses' competitiveness.
- Facilitate the development of circular products and services.
- Support region-wide systems-thinking and industrial symbiosis.

Capacity-Building

Behavioural Change

- Work with local communities, businesses and schools to demystify the circular economy.
- Encourage a shift in societal thinking and behaviours amongst local communities.

Upskilling & Training

- Ensure adequate training and upskilling is provided to public sector employees, regional businesses and supply chains in order to support a transition to a circular economy.

Business Support

- Streamline existing business support and ensure all businesses, including SMEs, can benefit from circular economy opportunities.

Soft Infrastructure

R&D & Innovation

- Support innovation by de-risking the use of circular processes and providing seed funding.
- Improve linkages between academic research and commercial applications.

Data & Digital

- Use digital platforms and data technologies, such as 5G, to better track movement of resources and facilitate trading of materials. This should build on WMCA's Digital Roadmap.
- Use digital platforms and data technologies to grow a regional sharing economy.
- Create a repository of information on the circular economy.

Logistics

- Ensure logistics enable easier tracking and transport of goods and materials across various sectors/businesses and to enable a sharing economy. This should include enabling reverse logistics.

Hard Infrastructure

Physical Infrastructure

- Invest in critical physical infrastructure (energy, waste and transport) to support wider transition to a circular economy.
- Ensure access to financially viable storage facilities.

Shared Infrastructure

- Invest in shared spaces for communities and businesses to encourage the growth of a sharing economy.

Circular economy enablers analysis
Key findings

Enabling levers for the circular economy identified through:

75+
documents reviewed for policy analysis.

60+ existing projects identified.

35+
stakeholder engagement workshops.

100+
people engaged across private, public and third sector.

Policy landscape in the West Midlands is fragmented.

No significant policies in the region enabling circular economy at scale.

Circular economy is often only mentioned in waste policies, which mostly focused on **recycling**.

Policies need to push for circular design especially in planning.

Changes in national policies and introduction of **New Waste Prevention Programme**, Extended Producer Responsibility and Deposit Return Scheme, bring new opportunities.

WMCA has an important role in facilitating collaboration and convening experts.

Public sector is not yet using **procurement powers** to leverage circularity.

Numerous business support programmes already exist.

Need to ensure **SMEs** can access support to adopt circular business processes and to develop circular products and services.

Insights into the **sharing economy** obtained from stakeholder engagement and household consumption patterns.

23%
of household waste still goes to the landfill or is incinerated every year.

Households also account for **42%** of gas consumption and **49%** water usage in the region each year.

Existing community and volunteer groups need further support to scale up sharing economy activities.

Still a poor understanding of what the circular economy is. Wider awareness raising and **behavioural change** is required.

High concentration of higher education institutions leading on circular economy research.

Better linkages required between research and commercial applications.

Existing innovation programmes can act as catalyst for circular economy.

West Midlands benefits from legacy of the National **Industrial Symbiosis** Programme (NISP®).

Investment in critical waste, energy and transport infrastructure required to support a wider shift.

Ongoing region-wide investment in 5G is useful to support the transition to a circular economy.

Resource recovery and material exchange hubs are required.

Logistics are key. Better tracking and transport of resources needed.

France's Anti-Waste Law (2020)

In February 2020, France signed Law No 2020-105: Circular Economy and the Fight Against Waste. The law has provided clear targets and therefore certainty for all stakeholders involved in transitioning to a circular economy. Setting clear targets for waste reduction and resource use optimisation is necessary. These must be accompanied by wider legislative and regulatory actions. You can find more information here.

Circular Economy Primer (2020)

The Primer provides guidance for built environment professionals to embed circular economy principles into their projects and design processes. The Primer provides clear guidance and requirements to increase adoption of circular design. Routemaps should focus on sectors that have the biggest impacts and should be complemented with additional policy guidance and documents targeting specific sectors or aspects of the circular economy. You can find more information here.

Enabling interventions: 2022 implementation plan

2022 will be an important year for WMCA and its partners to set the enabling foundation and map out strategic first steps required to accelerate a transition to a circular economy in the region. The table below presents the key target outcomes and potential actions WMCA and its partners should aim to achieve in 2022.

Useful Projects and SOENECS have proposed a potential implementation plan in Appendix 1, which is accompanied by a detailed matrix of the actions proposed (See Appendices 2 to 6). This implementation plan is one potential route to deliver enabling actions. Others exist based on the resources made available to deliver the routemap.

Enabler	Target Outcomes for 2022	Potential Next Steps and Actions	Delivery Partners
Policy and Regulation	– Procurement and commissioning policies and processes pro-actively support a circular economy. – Circular design is incentivised in a harmonised manner across all local authorities and key partners in the region. – The region is at the forefront of embedding and implementing new waste regulations.	– Update WMCA's Single Commissioning Framework. – Publish new procurement guidelines to support circularity. – Hold workshops with local authorities to pro-actively prepare for new waste regulations.	City of Wolverhampton Council, Walsall Council, Dudley, Sandwell, Solihull Metropolitan Borough Council, Birmingham City Council, Coventry City Council
Governance	– Sufficient internal resources have been allocated by WMCA and its Boards to deliver key actions set in this routemap. – A robust governance structure has been set up to support the delivery of key actions in this routemap. – The West Midlands becomes a first-mover in adopting innovative, circular business and finance models at a region-wide scale.	– Appoint a Circular Economy Lead. – Establish a Circular Economy Delivery Board to oversee the delivery of strategic projects. – Work with partners such as ASG to express the benefits of new business and finance models.	The Advanced Services Group, UKMSN+, CLES
Capacity-Building	– The skills supporting a transition to a circular economy have been identified. – Funding provided by WMCA and key partners supports a circular economy. – A comprehensive behavioural change programme is ready to be launched to normalise the circular economy and encourage local communities and businesses to put a higher value on circular products and services.	– Add circular economy requirements for WMCA-led grants. – Commission a forecast report to look into circular economy skills gap, working with partners like the Great Birmingham and Solihull LEP's Low Carbon Skills Team. – Include circular economy actions in the Energy and Environment Behavioural Change Strategy.	Birmingham Chamber of Commerce, Birmingham City University, Greater Birmingham & Solihull Local Enterprise Partnership, Black Country LEP, CWLEP Coventry & Warwickshire Local Enterprise Partnership
Soft Infrastructure	– Logistics are improved to support better recovery, movement and exchange of resources across the region. – Building on WMCA's Digital Roadmap, digital tools, platforms and infrastructure enable a better collection of data and sharing of resources.	– Publish recommendations to improve logistics, including the use of reverse and consolidated logistics. – Launch online repository of existing sharing platforms. – Align actions of this routemap with the Digital Roadmap.	Innovation Alliance for the West Midlands, CFRC, WM 5G
Hard Infrastructure	– Energy, transport and waste infrastructure all enable a transition to a more circular economy. – Physical locations have been selected to recover and exchange resources, as well as to support a sharing economy.	– Select location for regional Resource Recovery Hubs and financially viable storage facilities. – Launch an online repository and booking system for unused, vacant or idle spaces, whilst ensuring equal access to digital platforms.	Energy Capital, Department for Environment Food & Rural Affairs, Transport for West Midlands

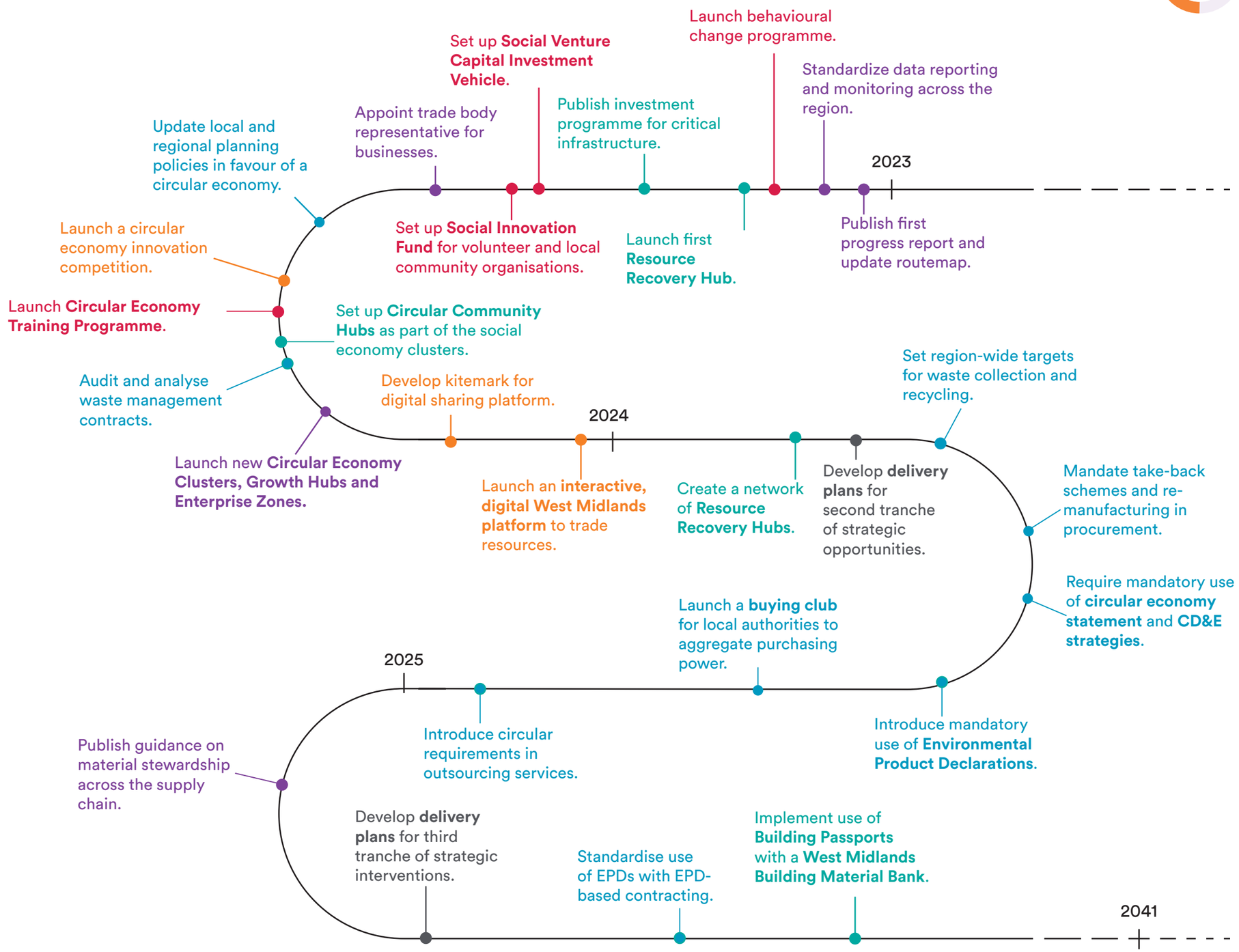
Enablers: 2023+ implementation plan

Beyond 2022, WMCA and its key partners will need to continue to support and invest in the circular economy.

We have proposed a potential 2023+ implementation plan which identifies longer-term action for WMCA and its partners to deliver. This implementation programme can be accelerated depending on the scale of resources allocated to deliver this routemap.

This page shows how selected actions, set across the five key enablers, complement one another and can help the region transition to a circular economy. It also provides key steps for the continued delivery of strategic interventions identified in Chapter 4.

The proposed actions are explored in further details in Appendices 2 to 6.



Enabler Key:

- Policy and Regulation
- Governance
- Capacity-Building
- Soft Infrastructure
- Hard Infrastructure
- Strategic Interventions

5 Focused Strategic Interventions

This chapter analyses the three selected priority areas, providing key findings from the high-level material flow analysis performed and identifying strategic interventions for the region to further develop and invest in.

Circular manufacturing

The West Midlands is a major automotive hub, with 40% of all cars exported from the UK made in the West Midlands. It is also the largest aerospace cluster in the UK, with 25% of the country's aerospace sector located in the region. Embedding circularity within the manufacturing sector will ensure these sectors continue to thrive, are resilient to future increases in material costs, and jobs are safeguarded.

The majority of employment within the West Midlands' manufacturing sector is in intermediate product supply chains to the end producers, rather than in processing of primary resources or in assembly of end products. This presents opportunities and challenges that will need to be explored further when developing specific interventions.

The manufacturing sector is a priority area for the West Midlands given the national government's support for growing the clean tech sector, particularly to support the decarbonisation of the transport sector.

The clean tech sector poses a resource challenge. This sector, which includes electric vehicle, batteries, rapid charging infrastructure, wind turbines and other smart devices, relies heavily on the supply of imported scarce materials (such as rare earth, cobalt, manganese, graphite, indium, neodymium and lithium) as well as highly refined metals (such as aluminium, composites, silver, nickel and copper).

The demand for these materials is predicted to grow by 2050, as high as 1000% for Lithium according to the World Bank. Given the rapid increase in demand and potential scarcity of these raw materials, there is a need to increase efficiency in the use of these materials and to ensure that they can be recovered and recycled at the end of their life.

To that effect, circular economy interventions that would bring the most value to the region within the manufacturing sector include:

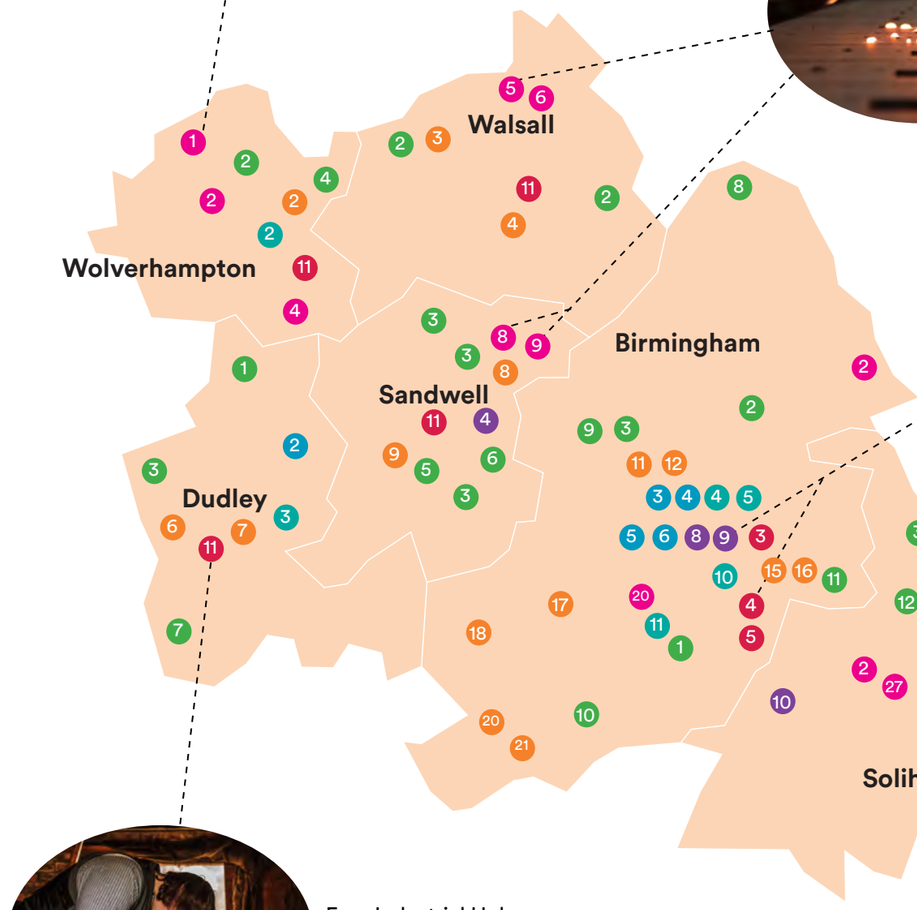
- Adopting a circular economy approach to electric vehicle, battery, and EV charging including high-value material recycling.
- Adopting circular economy approaches to metal recycling and to produce low carbon fuels from waste.
- Providing specialist circular design and development services for the manufacturing sector combined with the development of advanced material recovery technologies and facilities, including investment in robotics, robot/human interfaces and the use of artificial intelligence (AI) in resource recovery.

See Appendix 7 for more detailed information on the strategic interventions chosen for this priority area.

Part of the aerospace manufacturing hub with companies like MOOG Group.

Strong presence of metal manufacturing and reprocessing businesses like Durbin Metal Industries, West Midlands Foundry and Aluminium Products.

International Synergies and Tyseley Energy Parks can support industrial symbiosis in the region.



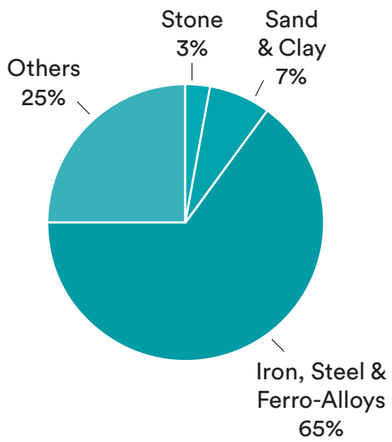
Four Industrial Hubs planned in the Black Country building on manufacturing strengths.

Automobile and battery manufacturing cluster with Jaguar Land Rover HQ, UKBIC and future Gigafactory.

Circular manufacturing
Key findings

3.3 million
tonnes of minerals consumed by the industry and manufacturing sector every year.

Iron, steel and ferro-alloys account for **65%** of mineral consumption each year. Their consumption is the most carbon intensive.



Up to
45%
reduction in **greenhouse gas** (GHG) emissions with more circular processes.

86%
of natural resource consumption is a product of forestry and logging every year.

217 million m³ of water consumed by Industry and manufacturing sector each year.

76 million m³ of wastewater produced by the sector per year.

More accurate data required on **wastewater sludge** to maximise opportunities for recovery and reuse.

400,000 tonnes of waste still go to landfill each year.

Breakdown of manufacturing outputs:

16%
of resource inputs used for **transport manufacturing** activities every year.

Supporting electrification of transport presents huge opportunities, especially with **battery manufacturing**.

Infrastructure needed to reprocess metals, rare earth and other precious materials.

Reprocessing of metals will see 15% worldwide job growth by 2030.

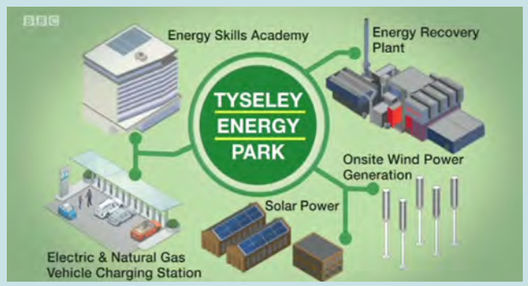
Opportunity to build **supply chains' resilience** against future volatility in material prices and availability.

Industrial symbiosis and co-location of industries within clusters are key.

NISP
NATIONAL INDUSTRIAL SYMBIOSIS PROGRAMME

Through its lifetime, NISP West Midlands has helped divert 4,250,385t of waste from landfill. It has eliminated 83,970t hazardous waste, saved 10,040,326t virgin materials and 13,339,274m³ of water, as well as 5,086,770 tCO_2e.

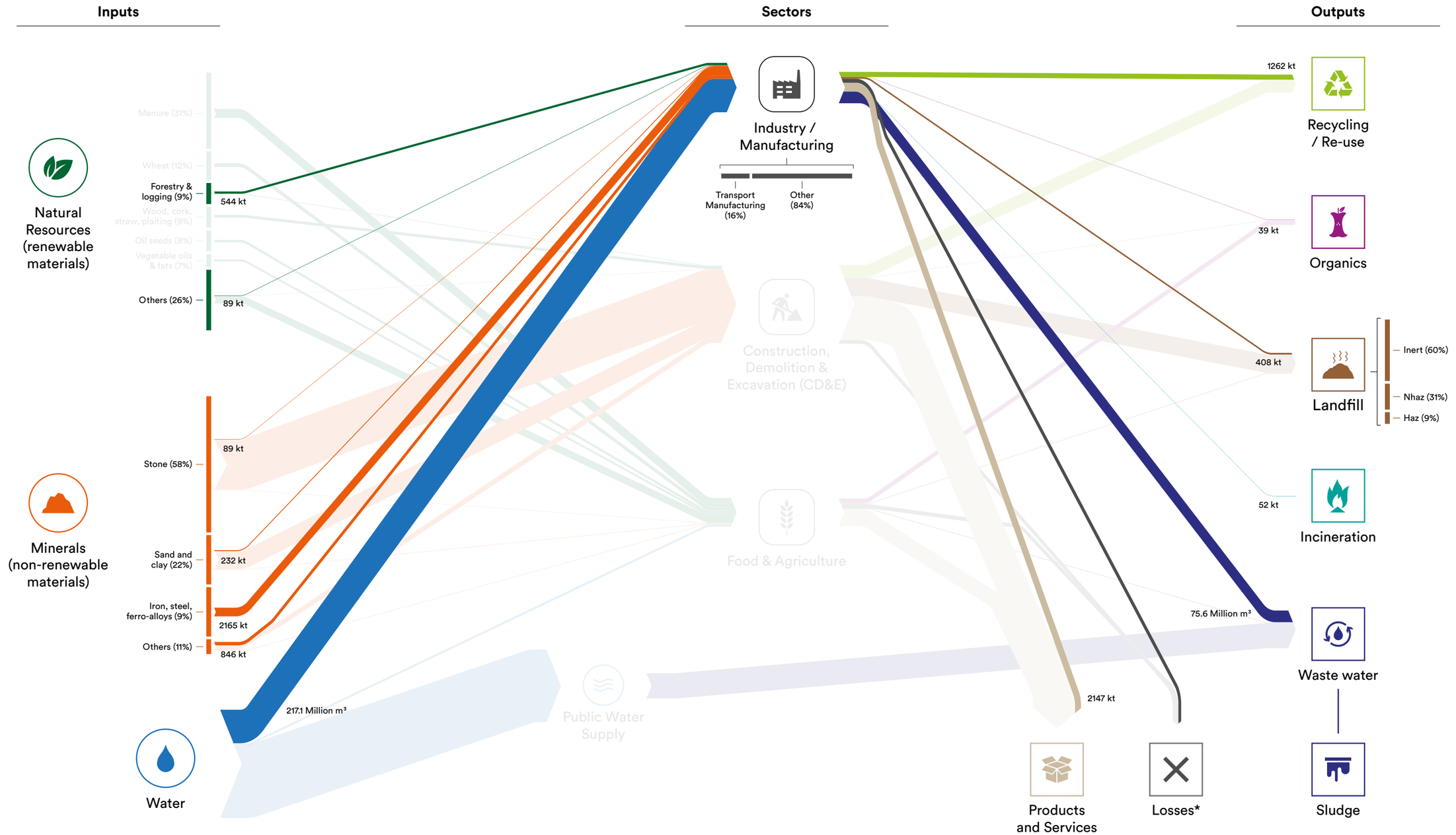
Repowering the Black Country proposes to create strategically-selected circular economy zero carbon industrial hubs. A first feasibility study for an initial hub based on aluminium re-processing at Phoenix 10 in Walsall has been completed and the hubs are currently being planned.



Tyseley Energy Park in Birmingham will be the base for the UK's first recycling plant for high-performance rare earth magnets. The plant will be based on the patented Hydrogen Processing of Magnet Scrap process.

Please note: A full breakdown of the data sources used is provided in Supporting Document: Baseline Analysis.

Circular manufacturing
Material flow analysis



Please note: The percentages represent the share of each input's broken-down components.

Please note: A full breakdown of the data sources used is provided in Supporting Document: Baseline Analysis.

*Note: Insufficient data is available for losses, so an indicative flow has been shown.

Figure 5: Material flow analysis for the industry and manufacturing sector

Circular manufacturing
Strategic interventions

Circular Battery Manufacturing

What? Design the first truly circular battery factory, distinguishing the West Midlands Gigafactory from other similar projects worldwide.

Why? To meet the growing demand for electric vehicles and batteries, to ensure that scarce materials are recovered, to secure jobs in the automobile manufacturing sector.

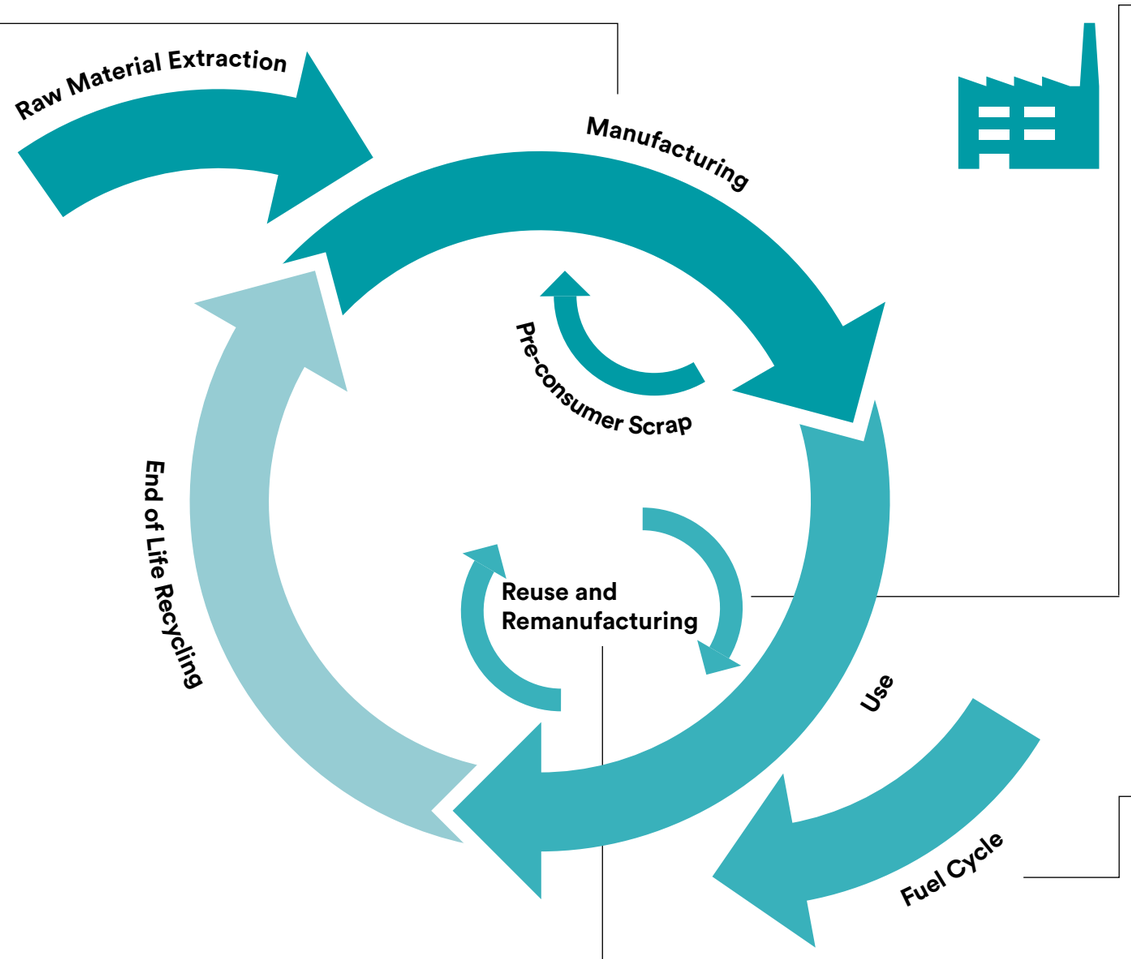
Role of WMCA? Enable.

Partners: See Appendix 7 for complete partners list.

Coventry City Council · The Faraday Institution · UK Battery Industrialisation Centre · Jaguar · Land Rover · University of Birmingham

Next Steps:

- Convene all partners to establish formal partnership and develop project and research proposals.
- Build political support and an investment prospectus.
- Develop and submit funding proposals to support a wide range of applied development projects.



Industrial Symbiosis Delivery Programme

What? Implement a place-based industrial symbiosis delivery programme to cross-fertilise opportunities across the three priority areas.

Why? To reduce resource consumption, to support SMEs in adopting circular processes, to create/save jobs, to minimise environmental degradation.

Role of WMCA? Enable and potential delivery partner.

Partners: See Appendix 7 for complete partners list.

Black Country Consortium Ltd · Department for Business, Energy & Industrial Strategy · Greater Birmingham & Solihull Local Enterprise Partnership · The Advanced Services Group · tep · Synergies industrial ecology solutions

Next Steps:

- Select location for a demonstrator project, focusing initially on high-value metal recycling (such as aluminium) and water.
- Develop a funding proposal for the selected industrial symbiosis demonstrator project.
- Convene key partners to develop a region-wide industrial symbiosis programme, aligning it with existing business support.

Circular Manufacturing Centre of Excellence

What? Establish a Circular Manufacturing Centre of Excellence to support circular design best practice and to develop advanced technologies (robotics, AI etc.).

Why? To test new technologies and processes for end of life resource recovery and circular manufacturing and to increase knowledge about circular manufacturing.

Role of WMCA? Enable.

Partners: See Appendix 7 for complete partners list.

Black Country LEP · WMG University of Warwick · International Synergies industrial ecology solutions · CATAPULT High Value Manufacturing · Cast Metals Federation · Black Country Consortium Ltd

Next Steps:

- Engage and convene identified partners to gauge support, to identify existing or potential locations for a centre of excellence and to share best practice.
- Develop and submit a major sectoral funding application for a centre of excellence and associated research/developmental projects.
- Support research into best practice for circular design in manufacturing and into advanced technologies.

High-Value Fuels from Waste

What? Use advanced processing technologies to turn residual, municipal and industrial waste into high-value fuels for aviation, logistics, heavy plant and other manufacturing sectors.

Why? To increase the volume and value of resources generated from waste, to develop new technologies that can be exported globally.

Role of WMCA? Enable.

Partners: See Appendix 7 for complete partners list.

Midlands Aerospace Alliance · Severn Trent Water · Moog Aircraft Group · Veolia · Suez · tep

Next Steps:

- Engage relevant sectors to test appetite, secure support and establish formal partnerships.
- Identify one initial focus area (sustainable aviation fuel, sewage waste, etc.) and develop detailed plan and proposal for early funding.

Circular construction

With over 220,000 new homes and major infrastructure projects like HS2 planned, embedding circularity within construction can unlock new opportunities, generate cost savings and build resilience across regional supply chains. Circular design and processes can also decrease the amount of virgin materials consumed and reduce environmental degradation associated with construction.

The West Midlands can leverage the funds it has secured to transform the construction, demolition and excavation (CD&E) sector. For example, WMCA and its constituent members have received several investment packages to support investments in infrastructure across the region. It has a £100 million Land Fund and £24 million Competitive Fund. WMCA and its constituent members have also received a £84 million investment to unlock and accelerate the region's pipeline of brownfield sites.

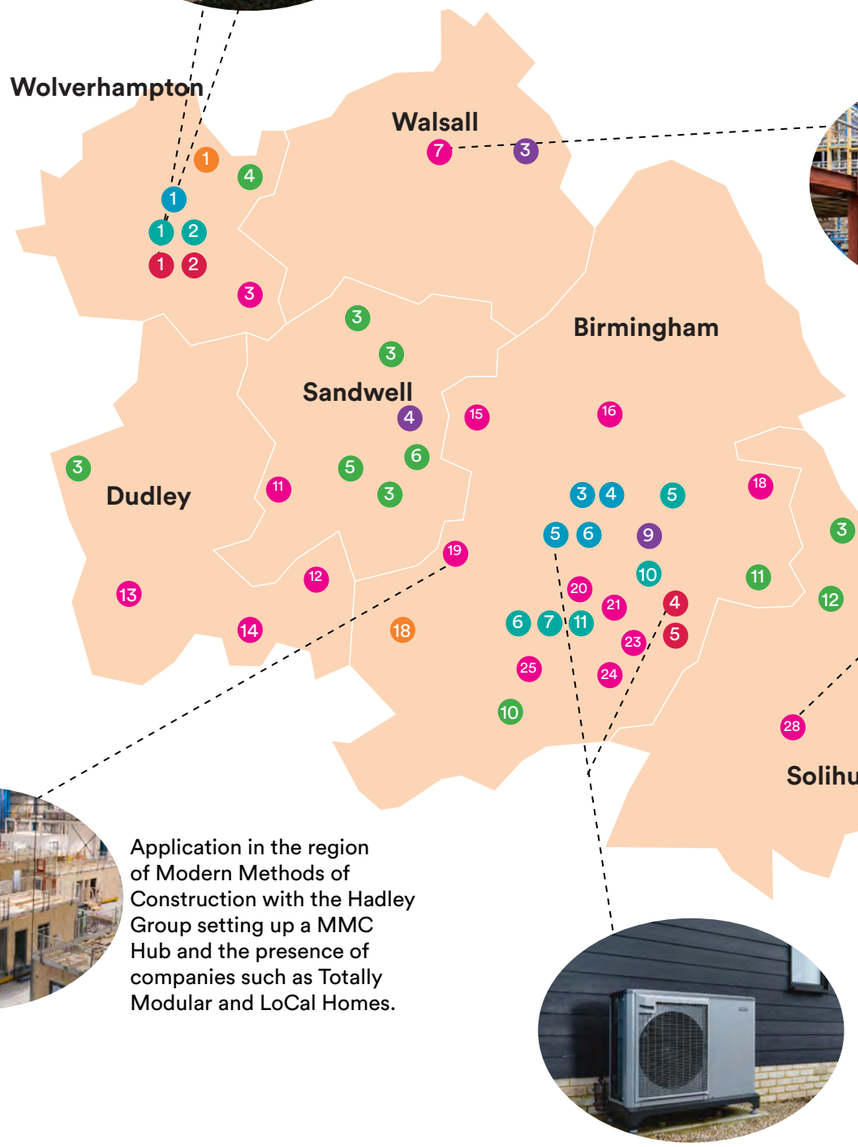
To that effect, circular economy interventions that would bring the most value to the region within the CD&E sector include:

- Adopting circular design principles and construction processes for residential, commercial and major infrastructure projects. A particular opportunity is to create a physical and virtual resource recovery and material exchange hub to make better use of material wasted in construction.
- Unlocking the value of brownfield sites with the creation of a leading facility to provide a register of sites, and incentives for developing these sites. This can be spearheaded by Wolverhampton and their National Brownfield Institute.
- Supporting the growth of regional specialist circular products and services relating to the construction industry, creating a one-stop shop to deliver all required services. Working and mobilising supply chains.

See Appendix 8 for more detailed information on the strategic interventions chosen for this priority area.

Opportunity to unlock brownfield sites with the National Brownfield Institute and the Brownfield Research and Innovation Centre.

Strong presence of developers, engineers and contractors with Urban Splash, Lendlease and ARUP, most of which have already embedded circular design principles.



Application in the region of Modern Methods of Construction with the Hadley Group setting up a MMC Hub and the presence of companies such as Totally Modular and LoCal Homes.

Leading research on decarbonising heat for buildings with the National Centre for Decarbonised Heat and the Energy Innovation Centre.

Circular construction
Key findings

The CD&E sector is the largest consumer of resources and producer of waste in the region.

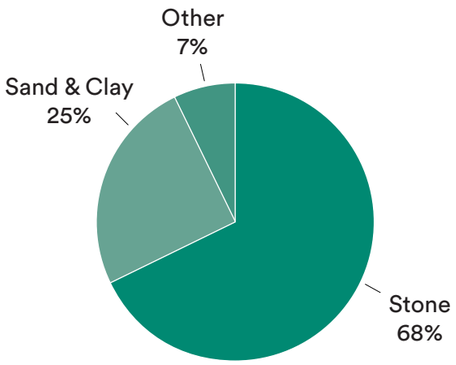
CD&E sector mineral consumption per year:

18 million

tonnes of minerals are consumed by the sector every year.

CD&E sector is the largest consumer of stone, using **1.2 million tonnes of stone** every year.

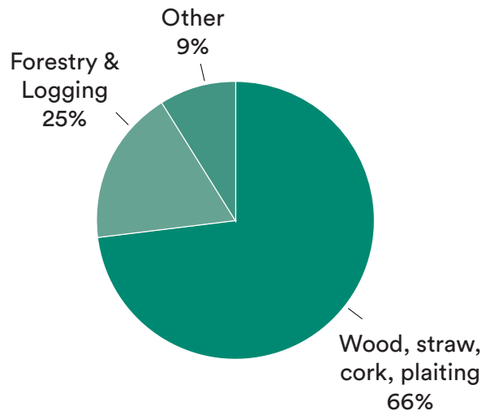
CD&E sector mineral consumption breakdown per annum:



580,000

tonnes of natural resources are consumed by the sector every year.

CD&E's natural resource consumption breakdown per annum:



169,000

tonnes of forestry and logging resources are used in CD&E each year.

3.5 million

tonnes of construction waste is re-processed, re-used or recycled every year. Further analysis on the value of these flows is required.

4.5 million

tonnes of construction waste goes to landfill every year.

Construction waste generated each year could be worth up to £5 billion.

Construction sector needs to embrace **design for adaptability, longevity, flexibility and disassembly**.

Applying circular design can reduce embodied carbon by **50%** at no additional costs.

Sourcing of materials also needs to be considered.

Lightweight structures reduce amount of materials used.

Opportunity also identified around **brownfield land reclamation**.

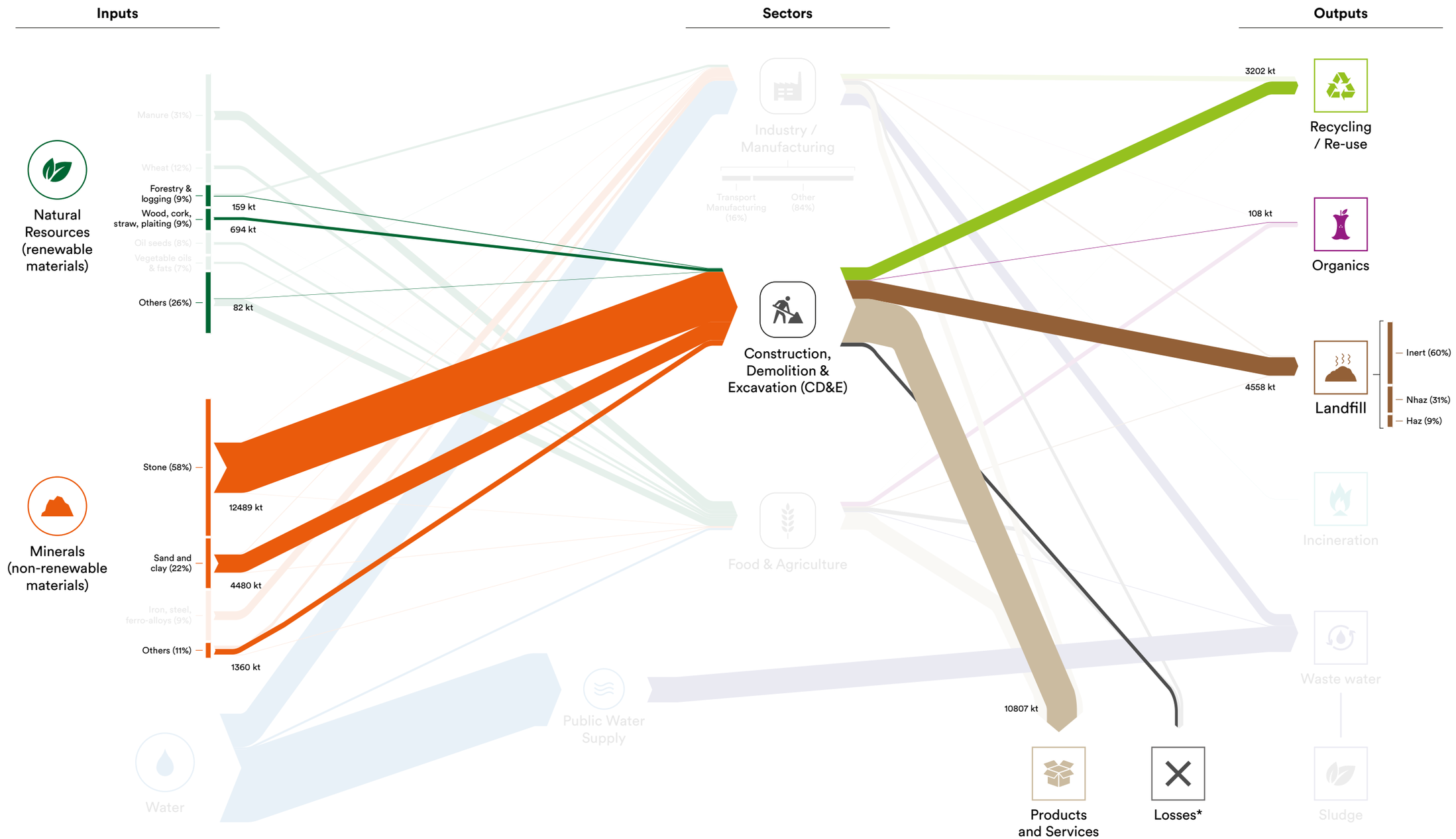
The Port Loop development in Birmingham has adopted a suite of sustainability principles for its 1,000 new homes. Of interest is its 'pick n mix' approach which ensures homes have been designed and built to be flexible and adapt to residents' changing needs.

Biohm develops bio-materials, circular construction systems and innovative business models. They are a leading pioneer in the research and development of bio-based materials including of bio-manufacturing materials for construction made from waste.

A National Brownfield Institute (NBI) is being built on the University of Wolverhampton's Springfield Campus. The NBI will focus on the practical application of future brownfield regeneration through the work of research teams, leading policy development and commercial services.

Please note: A full breakdown of the data sources used is provided in Supporting Document: Baseline Analysis.

Circular construction
Material flow analysis



Please note: The percentages represent the share of each input's broken-down components.

Please note: A full breakdown of the data sources used is provided in Supporting Document: Baseline Analysis.

*Note: Insufficient data is available for losses, so an indicative flow has been shown.

Figure 6: Material flow analysis for the CD&E sector

Circular construction
Strategic interventions

Brownfield Land Reclamation

What? Set up a facility and associated advisory services to unlock the development potential of brownfield sites of all sizes.

Why? To reduce resource consumption, wasted materials on brownfield sites, and the amount of soils and virgin materials imported.

Role of WMCA? Enable and Influence. Lead on own sites.

Partners: See Appendix 8 for complete partners list.

Next Steps:

- Explore option for the National Brownfield Institute to become leading facility.
- Convene partners to develop incentives including for smaller sites.
- Create a register of brownfield sites and develop a data-sharing platform.

Circular Repurposing Programme

What? Develop and implement circular approaches for refurbishing and repurposing commercial and residential properties, as well as public buildings and spaces.

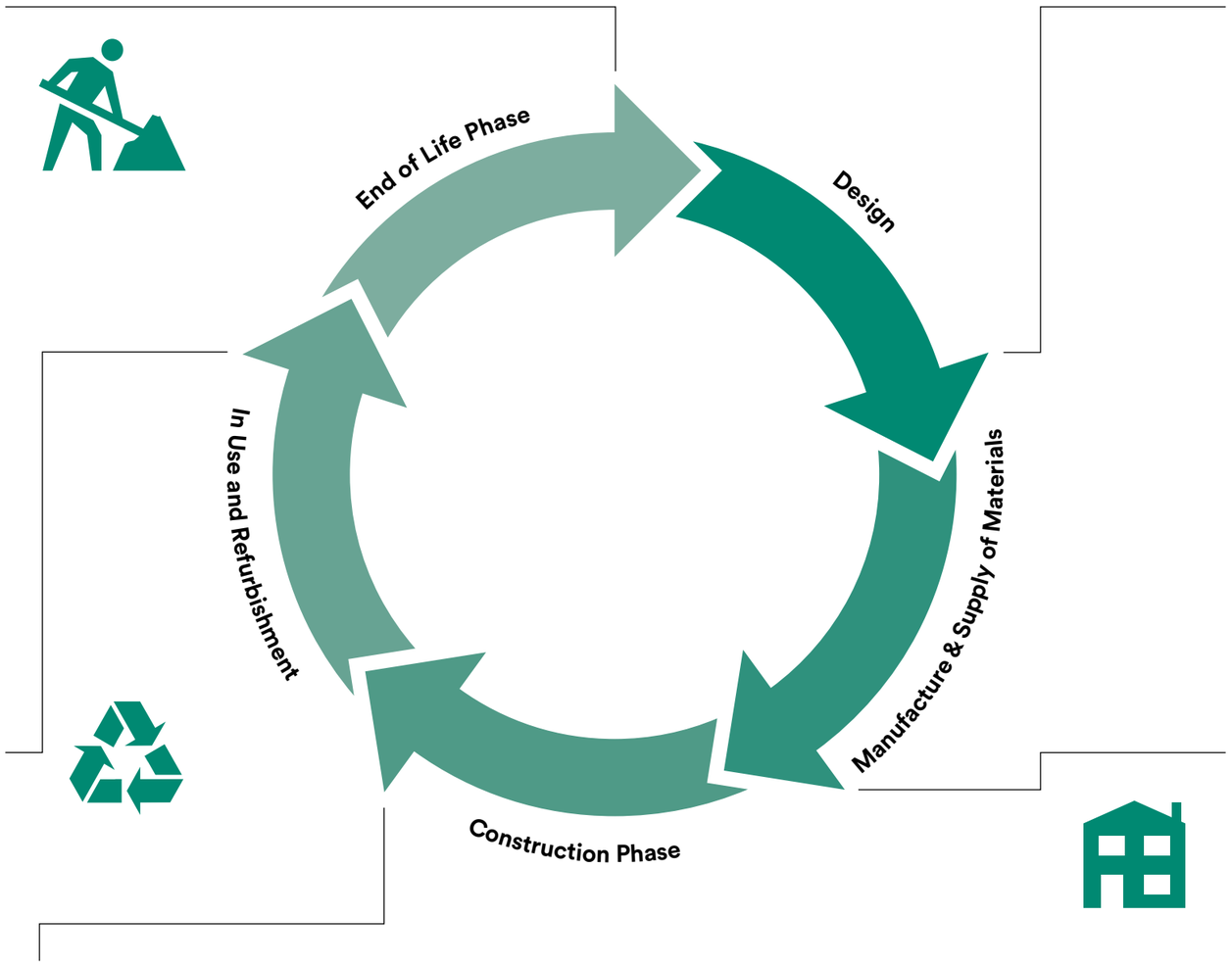
Why? To minimise construction waste, to reduce virgin material extraction and to revitalise unused space.

Role of WMCA? Enable and Influence. Lead on own sites.

Partners: See Appendix 8 for complete partners list.

Next Steps:

- Audit public spaces, high streets and unused/ vacant commercial spaces to create a region-wide revitalisation investment prospectus.
- Support R&D in circular products, services and approaches that support repurposing and refurbishing.
- Publish guidance on alternative financing and delivery models.



Zero Waste Construction Hub

What? Launch a physical and virtual hub to recover and exchange materials, as well as share and incentivise circular design and processes.

Why? To use fewer materials and reduce waste on construction sites, to encourage material exchange within the built environment.

Role of WMCA? Enable and Influence. Potential delivery partner.

Partners: See Appendix 8 for complete partners list.

Next Steps:

- Determine best location for material recovery and exchange hub(s), developing feasibility and funding proposal.
- Mobilise and convene regional supply chains around circular construction methods (including MMC and AMC).
- Launch virtual hub and share best practice guidance and incentives for circular construction processes.

Circular Strategies for Infrastructure

What? Develop circular strategies and action plans for major infrastructure projects and utility providers.

Why? To mobilise and scale up circular supply chains, to encourage innovation, and to support circular, sustainable utility provision.

Role of WMCA? Enable and Influence. Lead on own sites.

Partners: See Appendix 8 for complete partners list.

Next Steps:

- Identify and convene major infrastructure and utility companies and their supply chains to develop projects and incentives.
- Create a forum for infrastructure and utility companies to share best practice.
- Publish best practice guidance for circular strategies for infrastructure and utility companies.

Circular Building Product Initiative

What? Support the development of leading, regional circular buildings' systems, products and service offers.

Why? To create a suite of regional circular building products, to increase the number of circular products and services, to support regional job creation.

Role of WMCA? Enable and Influence. Lead on own sites.

Partners: See Appendix 8 for complete partners list.

Next Steps:

- Work with the Zero Carbon Homes Task Force and other key partners to select ten regional building product manufacturers/suppliers.
- Convene partners and experts to explore creation of a consortium of regional organisations to act as a one-stop shop for circular buildings' products, services and systems.

Circular food

Thanks to its surrounding rural areas, the West Midlands region as a whole remains one of the UK's main agricultural hubs, making the food and agricultural sector a key priority for this routemap. According to DEFRA, the biggest agricultural contributors to the region's £2.4 billion outputs are milk, poultry meat, wheat and fruit. The West Midlands is also home to several farms, with income from farming increasing by 34% between 2015 and 2019. Grazing livestock accounted for 28% of farmed area, whereas cereal farms accounted for an additional 26%.

The food and agricultural sector was chosen as a priority area given the presence of large food processors and manufacturers, local agro-ecological farms and movements, as well as numerous community-based groups focusing on food. Numerous research projects, including Food Trails, are looking to make the region's food system more circular and to eliminate food waste across the supply chain. This routemap will support such research projects.

To that effect, circular economy interventions that would bring the most value to the region within the food and agriculture sector include:

- Adopting a systems-thinking approach to redesign the food system working with leading research institutions, regional agro-businesses and farms to deliver tangible social benefits and economic growth.
- Encourage more sustainable food consumption in the region, including improving distribution and access to food and supporting existing grassroot movements to continue their work as part of a recovery. Additionally, urban agriculture and urban horticulture opportunities should be further explored, building on existing initiatives and community groups such as District Eating.
- Unlocking the value of food and drink manufacturing waste and the potential of wastewater sludge for agricultural purposes. This will help close the nutrient loops, deliver new jobs and reduce environmental degradation.

See Appendix 9 for more detailed information on the strategic interventions chosen for this priority area.

Several anaerobic digestion plants in the region producing bio-gas or compost.

Flourishing grassroots community movements involved in food justice and food equity such as Incredible Surplus, Slow Food and Edible Eastside.

Leading research on reducing the food system's impact including SIMBIO research on bio-packaging and Food Trails.

Presence of large food processors and manufacturers, including breweries. This includes companies like Mondelez and 2 Sisters Food Group.

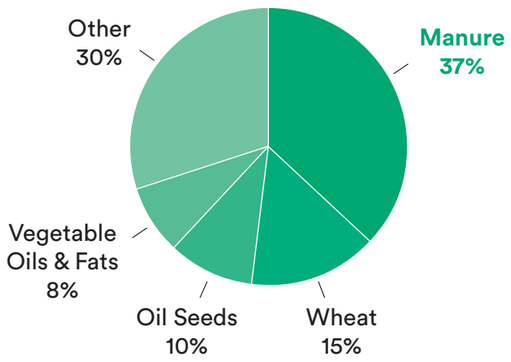
Centres of excellence on how to reduce the impact of agriculture on the environment including the Centre for Agro-Ecology, Water and Resilience.

Circular food
Key findings

Farm to gate scope used for analysis.

80%
of the region's **natural resources** consumed by the food and agriculture sector each year.

Breakdown of this sector's natural resource consumption per annum:



455,000
tonnes of minerals consumed every year.

14 million m³
of **water** used every year.

61%
of food waste does not go to landfill.

Further in-depth analysis of these waste flows required.

Amount of edible food wasted worth £700 per household.

Better **segregation of food waste** in homes and processing plants is needed.

Region benefits from strong presence of volunteer groups focusing on food access and equity.

System thinking required to develop a circular farm-to-fork food system.

Agro-ecology and **sustainable food growing methods** are required.

Logistics are key to improve access to food and reduce food miles.

Behavioural change required to shift to a more circular food system.

Circular food system brings health benefits.

Additional benefits include improved soil health and reduction in water, land and air pollution.

Please note: A full breakdown of the data sources used is provided in Supporting Document: Baseline Analysis.

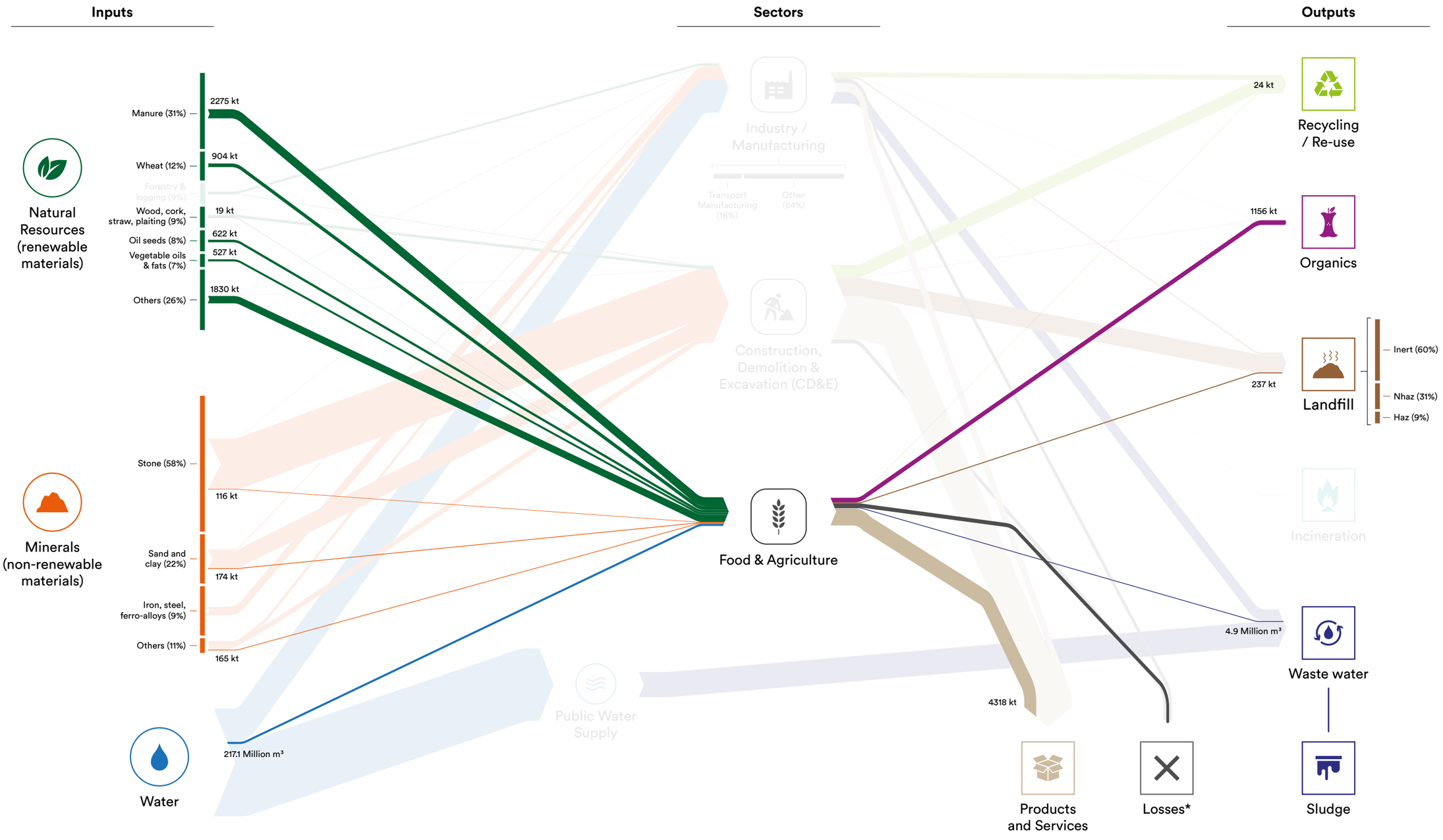
incredible surplus

Incredible Surplus collects food and other usable materials that would otherwise go to waste from supermarkets, restaurants and other sources to provide them to individuals on a 'Pay as you feel' basis. Since its inception, Incredible Surplus has redistributed over 1,800t of otherwise wasted food and has seen dozens of volunteers move to paid employment.

SIMBIO is a joint project between Canada, Brazil, Poland and the UK. In the UK, the project is led by Coventry University. SIMBIO aims to address the socio-environmental challenges of bio-plastic packaging throughout the entire supply chain from production to end of life management.

Agricultural recovery of wastewater treatment plant sludge plays a critical role in maintaining water, air and soil health. Severn Trent water is currently exploring option to use the sludge as a nitrogen-rich fertiliser. In France, Suez has rolled out sludge recovery programmes which avoid production of 6,000t of synthetic nitrogen in addition to 8,000t of phosphorus mineral extraction.

Circular food
Material flow analysis



Please note: The percentages represent the share of each input's broken-down components.

Please note: A full breakdown of the data sources used is provided in Supporting Document: Baseline Analysis.

*Note: Insufficient data is available for losses, so an indicative flow has been shown.

Figure 7: Material flow analysis for the food and agriculture sector

Circular food
Strategic interventions

Circular Nutrient Loop

What? Close the nutrient loop by developing bio-technologies to recover and enhance value of food waste and other waste products (sewage etc.).

Why? To reduce use of finite resources, to retain important nutrients in the soil, to reduce negative environmental impacts.

Role of WMCA? Enable.

Partners: See Appendix 9 for complete partners list.

Next Steps:

- Engage with wastewater and sewage companies to identify technologies to recover nutrients from sludge for agricultural use and create an online platform to facilitate exchange with farmers.
- Support local authorities in streamlining food waste collection, including producing best practice guidance for food separation.
- Determine logistics required to transport food waste to anaerobic digestion and composting plants and then distribute compost to farms and inject biogas in local gas network.

Healthy Consumption

What? Raise awareness and encourage sustainable, local food consumption, working closely with existing communities and volunteer groups.

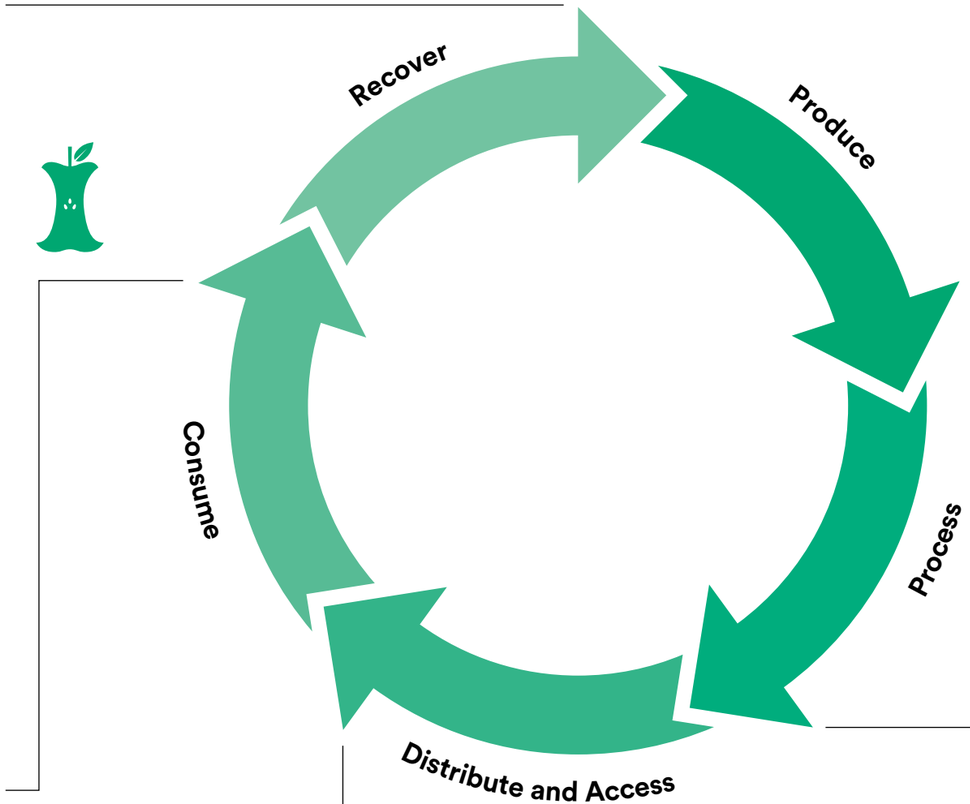
Why? To improve health of local communities, to reduce costs associated with unhealthy diets, and to reduce environmental impact of modern diets.

Role of WMCA? Enable and Influence.

Partners: See Appendix 9 for complete partners list.

Next Steps:

- Convene local authorities to launch a cohesive behavioural change programme for healthier diets.
- Lobby national government for stronger regulations on fast food advertisements (near schools etc.).
- Provide support to existing community/volunteer groups including access to finance and space.



Circular Food Hubs

What? Create circular food hubs with optimised logistics to collect and redistribute food that would otherwise be wasted.

Why? To improve local communities' access to healthy, affordable food, to reduce waste food, and to ensure better redistribution of food.

Role of WMCA? Enable and potential delivery partner.

Partners: See Appendix 9 for complete partners list.

Next Steps:

- Determine logistics requirements to bring in and redistribute food that would otherwise be wasted.
- Based on logistics requirements, determine best location for central food hubs, making best use of vacant/unused spaces or publicly-owned buildings.
- Convene existing community/volunteer groups and other key partners to develop funding proposal for hubs.

Regenerative Food Production

What? Support regenerative agriculture and permaculture practices as well as local food growing initiatives.

Why? To maintain soil health, to reduce food miles, to increase food security.

Role of WMCA? Enable and Influence.

Partners: See Appendix 9 for complete partners list.

Next Steps:

- Map existing sustainable, local food growing schemes and farms to identify best practice and gaps in provision.
- Convene key partners to develop incentives, support programmes and communal projects.
- Support local authority constituent members in implementing enabling policies, particularly in planning.

Circular Food Manufacturing

What? Develop circular strategies for food and drink processors and manufacturers, focusing on opportunity to use food waste as a productive resource.

Why? To mobilise circular food supply chains, to reduce resource consumption and pollution, to support further R&D in sustainable agro-business processes.

Role of WMCA? Enable and Influence.

Partners: See Appendix 9 for complete partners list.

Next Steps:

- Develop proposal for bio-packaging and no single-use plastic at the Commonwealth Games.
- Convene agro-businesses, food processors and other key partners to map flows of resources and identify opportunities to trade resources.
- Commission audit of existing food technologies to identify where further support into R&D and commercial application required, including bio-packaging.

5 Conclusion and Next Steps

This chapter explores next steps for WMCA and its partners.

Conclusion

6

Summary

A circular economy is a vital part of WMCA's overall approach to leading the green industrial revolution. There are many ways in which a circular economy can be developed, all of which should support a more inclusive and stronger economy, social value creation and a cleaner, greener environment.

The West Midlands already has exceptional strengths in its centres of excellence, research programmes, businesses and pilot projects focusing on circularity. These provide a fantastic springboard to accelerate the region's transition to a circular economy.

However, this transition remains a challenging, all-encompassing and demanding endeavour. It requires a set of coordinated enabling and strategic interventions across various sectors, involving multiple stakeholders and businesses as well as a radical shift in how we think about our economy.

It is why this routemap recommends that the West Midlands initially focuses on three priority areas and on builds enabling foundations to support a wider transition, based on extensive stakeholder engagement, a material flow assessment, existing circular economy expertise and aligned to the key regional and national strategies.

The priority areas selected are:

- **Circular manufacturing** with opportunities in advanced manufacturing, clean technology, vehicle and battery manufacturing, converting waste to high-value fuels.
- **Circular construction** with opportunities in brownfield land reclamation, repurposing vacant and unused spaces, circular design and construction processes and material recovery hubs.
- **Circular food** with opportunities in bio-technology R&D for agro-processing and agro-manufacturing, recovering and re-using food waste, and unlocking the potential of local social enterprises and community groups working on food issues.

Recommendations

This routemap is the first step in formalising the region's journey towards a more circular economy. We recommend that:

1. **WMCA**:

- Publishes this routemap and shares best practice across the region.
- Works with key stakeholders identified in the routemap to:
    - prioritise strategic opportunities and develop detailed project and funding proposals.
    - prioritise the enabling actions in the routemap.
    - commission in-depth material flow analysis for key sectors, when and where needed to inform future actions, as well as other sectors such as retail, tourism or health care and life science.
- Establishes appropriate internal and region-wide governance, refreshing the current Taskforce to align with priorities to support delivery of the routemap.
- Aligns the actions in this routemap with other internal programmes and strategies.
- Takes proposals on resource requirements and investment opportunities to WMCA Board, once this more detailed work has been completed.

2. **Local authorities** in the West Midlands:

- Work with WMCA on developing relevant strategic opportunities as above.
- Identify opportunities to use their enabling functions such as waste, planning, procurement and other key strategies, plans and policies, to support investment in critical waste, energy and transport infrastructure that will create the conditions for a more circular economy.

3. **National government** provides funding and policy support for industry-wide transitions to a more circular economy. This is essential since the West Midlands cannot transition to a circular economy without the support of the national government.

6 Appendices

In this section, you will find appendices and the supporting documents mentioned in this report, as well as a bibliography.

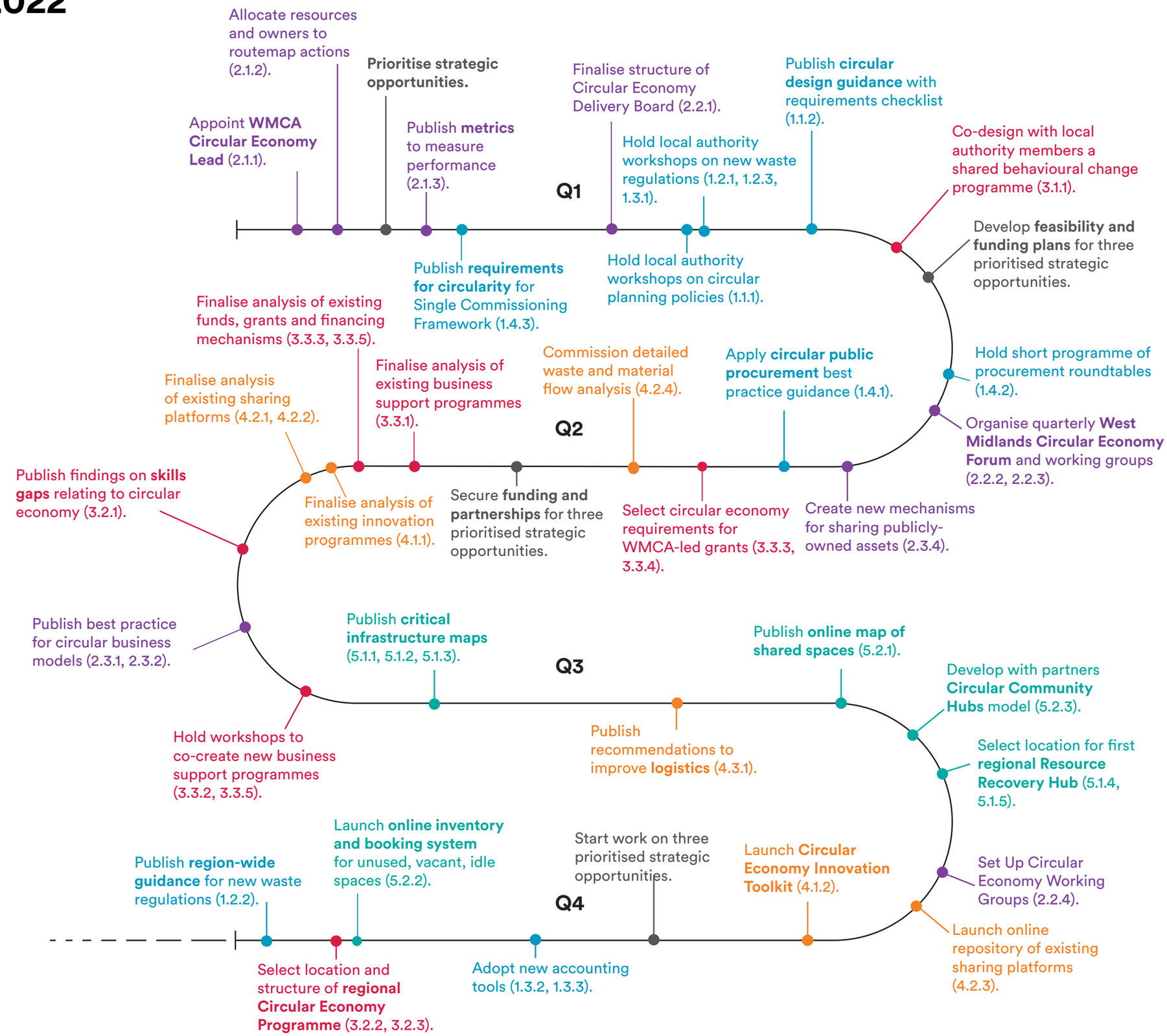
Appendix 1: Enablers: 2022 implementation plan

The 2022 implementation plan identifies quick wins and immediate next steps for WMCA and its partners to deliver over the next financial year. It purposefully builds on existing initiatives and projects.

This page shows how selected actions, set across the five key enablers, complement one another and will help the transition to a circular economy. It also provides key steps for the delivery of strategic opportunities identified in Chapter 4.

This implementation plan is a suggestion and its delivery is contingent on how much resource is allocated to the delivery of this routemap as well as the appetite and support of partners in supporting WMCA.

A detailed matrix of the actions proposed is provided in Appendices 2 to 6.



Enabler Key:

- Policy and Regulation
- Governance
- Capacity-Building
- Soft Infrastructure
- Hard Infrastructure
- Strategic Interventions

Appendix 2: Policy and Regulation

Enabler	Short Term Action (2022)	Long-Term Action (2023+)	WMCA Role	Partners	Best Practice
1.1 Planning and Design	**1.1.1** Hold workshop sessions with local authority constituent members to discuss region-wide circular requirements. **1.1.2** Publish region-wide best practice guidance for circular design and construction methods, including a design requirements checklist.	- Work with seven local authority members to update planning policies to include circular design requirements. - Work with seven local authority members to update policies on sourcing of materials and around building control. - Lobby national government in developing policies and incentives that focus on high-quality design for products, goods and packaging. - Introduce mandatory regional use of circular economy statement and CD&E strategies.	WMCA's role is to **convene partners** and **facilitate collaboration**. It will also **lead on its own projects and sites**. Local authorities are responsible for updating their policies.	- Seven local authority members. - Low-Carbon Officer Group. - National government.	- GLA's Circular Primer: Example of circular policy and design requirements. - London Plan 2021: Example of circular policies. - Build on the notion of the Triple Access System of physical mobility, spatial proximity and digital connectivity.
1.2 Legislation and Regulation	**1.2.1.** Hold workshop sessions between local authority constituent members and other partners to embed changes brought forward by the Waste Prevention Programme. **1.2.2** Publish region-wide guidance for new waste regulations, including extended producer responsibility, deposit return schemes and right to repair. **1.2.3** Lobby the national government to harmonise resource classification and definition of waste to simplify reuse, trading and transport.	- Audit and analyse existing waste management contracts to help harmonise waste collection and sorting across local authorities. - Work with seven local authority constituent members to set higher targets for waste collection and recycling which are consistent across the West Midlands. - Explore benefits of having a region-wide waste strategy. - Explore benefits of re-introducing Site Waste Management Plans legislations. - Introduce material specification requirements. - Introduce mandatory Environmental Product Declarations (EPDs).	WMCA's role is to **convene key partners and stakeholders** and **facilitate partnerships and harmonisation** across the region. Local authorities are responsible for the introduction of relevant legislation/regulation.	- DEFRA - Seven local authority members, their waste officers in particular. - National government.	- End of Life Vehicle Directive: Successful new law encouraging end of life recycling.
1.3 Fiscal Incentives	**1.3.1** Review existing regulations affecting circular economy practices and prepare a paper with proposed changes. **1.3.2** Lobby the national government to reform taxation and fiscal incentives. **1.3.3** Research and adopt accounting tools that better support transition to a circular economy.	- Lobby the national government to incrementally increase taxes on incineration and landfill. - Lobby the national government to develop purchasing standards and certifications supporting the circular economy. - Lobby national government to abolish environmentally harmful subsidies and tax breaks. - Lobby national government to introduce a tax for businesses using materials that cannot be recycled when better alternatives exist.	WMCA's role is to **lobby** the national government to change fiscal incentives in favour of the circular economy. This will require working in partnerships with various public and private partners.	- Seven local authority members. - National government. - LEPs including working with Greater Birmingham and Solihull LEP (GBSLEP) on its review of Enterprise Zone Industrial Policy.	- Paris: Example of successful introduction of participatory budgeting. - Milan's Food Policy: Introduction of a 20% municipal tax reduction for organisations donating to food banks/charities.
1.4 Procurement	**1.4.1** Apply existing best practice guidance and guidelines for circular public procurement based on ISO 20400. **1.4.2** Organise a short programme of procurement roundtable to share best practice. **1.4.3** Update WMCA single commissioning framework, grant contracts and procurement policies to align with circular economy outcomes.	- Work with local authority constituent members to introduce procurement policies that support circular economy outcomes. - Develop collaborative agreements amongst local authority constituent members and other partners to facilitate and improve service provision. - Launch a buying club for local authorities to aggregate and increase their collective purchasing powers. - Work with outsourcing services to implement circular economy requirements. - Mandate take-bake schemes and re-manufacturing in procurement. - Standardize the use of EPDs with EPD-based contracting.	WMCA's role is to **enable local authorities and key partners i**n setting up new procurement processes that support the circular economy. WMCA also needs to **lead** with its own procurement policies and processes.	- Seven local authority members. - LEPs - Black Country Consortium. - Anchor institutions including Community Wealth Building Centre of Excellence (CLES).	- The Preston Model: Using procurement to generate and retain wealth locally. - Toronto's Circular Economy Procurement Plan and Framework: Leveraging purchasing power to drive waste reduction, economic growth and social prosperity through a circular economy approach.

Appendix 3: Governance

Enabler	Short Term Action (2022)	Long-Term Action (2023+)	WMCA Role	Partners	Best Practice
2.1 Internal Processes	**2.1.1** Appoint WMCA Circular Economy Lead and map governance needs to existing groups. **2.1.2** Allocate resources and owners to routemap actions. This includes determining resources required from partners. **2.1.3** Determine and publish key metrics to measure WMCA's own performance.	- Publish first progress report and update routemap and associated documents. - Standardize data reporting and monitoring across the region. This could include a clear methodology on how to measure the value of circular economy solutions or projects.	WMCA's role is to **allocate sufficient resources** to deliver key actions set in this routemap.	- Seven local authority members. - Local Enterprise Partnerships (LEPs). - Black Country Consortium. - Anchor institutions including CLES.	- The EU Urban Agenda programme and OECD's Measuring the Circular Economy can provide information on selecting appropriate metrics. - Groups such as Business Sustain at Coventry City Council should serve as best practice example.
2.2 Partnerships	**2.2.1** Finalise the structure and Terms of Reference for the Circular Economy Delivery Board. **2.2.2** Work with Circular Economy Club and other partners to organise quarterly Circular Economy Forums for businesses to network, share knowledge and discuss challenges/ opportunities. These forums should also help create co-creation groups. **2.2.3** Encourage the creation of working groups (planning, waste etc) with members from each local authority constituent members and other key partners to encourage collaboration, partnership and harmonisation.	- Encourage setting up co-operatives and consortia between businesses (including SMEs) to improve collaboration and networking. - Encourage regional businesses to appoint a trade body representative in order to improve collaboration. - Convene WMCA's supply chains to review incentives, barriers and define roles and responsibilities. - Publish guidelines on material stewardship across WMCA's supply chains.	WMCA's role is to **convene key partners and stakeholders** and **facilitate partnerships** across the region. WMCA's role is also to **influence and enable** public and private partners to work in more collaborative ways.	- Seven local authority members. - LEPs. - Universities and colleges including Wolverhampton, Birmingham, Coventry, Warwich University, Birmingham City University, Aston Business School and Dudley College. - Warwick Manufacturing Group. - UKMSN+ and their growing networks. - International Synergies. - Circular Economy Club.	- Ellen MacArthur Foundation: Example of an organisation convening experts and influencing others by sharing knowledge and best practice. - One Public Estate: Example of collaborative partnerships agreements.
2.3 Business Models	**2.3.1** Support the development of the Advanced Services Business Routemap and introduce regional businesses to ASG's transformation roadmap and 4-quadrant advanced service business model. **2.3.2** Publish best practice guidance on the economic benefits (including cost-savings) of adopting circular business models, on co-location and on industrial symbiosis. This should include exploring the benefits of process innovation and of new finance models. **2.3.3** Develop mechanisms for public-owned equipment, machinery, vehicles and other goods to be shared amongst services, departments, organisations and neighbouring authorities.	- Launch a WMCA innovation fund in collaboration with partners to support new circular business models, products and services. This should build on existing funds such as the West Midlands Low Carbon and Circular Economy Innovation Fund. - Designate circular economy clusters with incentives for businesses to co-locate and adopt industrial symbiosis processes (where applicable). This should build on the planned Repowering Black Country hubs and the GBSLEP's existing Enterprise Zones. - Explore options to develop public-led time banking initiatives where citizens give up their time for tasks in the public interest and are given access to public resources.	WMCA's role is to **convene key partners and stakeholders** and **enable the adoption of circular business models** across the region. WMCA's role is also to **share knowledge and best practice** on circular business models in order to influence businesses in adopting them.	- Advanced Service Group at Aston Business School. - International Synergies. - Black Country Consortium. - Universities and colleges including Wolverhampton, Birmingham, Coventry, Warwich University, Birmingham City University, Aston Business School and Dudley College. - Birmingham Chamber of Commerce. - GBSLEP. - Warwick Manufacturing Group. - Innovation Alliance. - SPRING. - Circular Economy Club.	- Advanced Services Group: A primary research centre based at Aston Business School focusing on the adopting of servitization and outcome-based business models. - Examples of businesses who have adopted new business models supporting a circular economy: Frog Bikes, Pitched for You and Isla Bikes. - Rolls Royce is a good example of a company adopting a servitization model.

Appendix 4: Capacity-Building

Enabler	Short Term Action (2022)	Long-Term Action (2023+)	WMCA Role	Partners	Best Practice
3.1 Behavioural Change	**3.1.1** Convene local authority constituent members and other key partners to obtain buy-in and co-design a region-wide behavioural change programme.	- Launch a comprehensive behavioural change programme for the region aligned with other WM2041 programmes of work. - Partner with schools to launch waste prevention programmes.	WMCA's role is to **convene key partners** to harmonise behavioural change programmes and messaging.	- Universities and colleges including Wolverhampton, Birmingham, Coventry, Warwich University, Birmingham City University, Aston Business School and Dudley College. - Local primary and secondary schools. - Anchor institutions including CLES. - Seven local authority members. - LEPs. - Circular Economy Club. - Sustainability West Midlands.	- Circular Economy Club: Example of an organisation driving behavioural change. - For the sharing economy, it is worth building on existing initiatives such as Share Shacks. - Opportunity to build on the resources made available by companies such as Wastebusters.
3.2 Upskilling and Training	**3.2.1** Map skills gaps relating to the circular economy, aligning training requirements with other skills needs in the region. This should build on WMCA's Regional Skills Plan. **3.2.2** Support creation of circular economy apprenticeships in the region, working with local colleges and universities. **3.2.3** Determine best location and structure for a physical or virtual regional circular economy training hub, building on existing centres of excellence. This should build on existing initiatives and growth hubs.	- Launch a regional circular economy training programme within existing centres of excellence. This should align with existing plans for Growth Hubs. - Lobby the national government to include circular economy basics into the national curriculum.	WMCA's role is to **lead in assessing** region-wide skills gaps. WMCA's role is also to **support and enable partners in creating upskilling and training opportunities** across the region.	- Universities and colleges including Wolverhampton, Birmingham, Coventry, Warwich University, Birmingham City University, Aston Business School and Dudley College. - Dudley College and Wolverhampton University for construction-related skills and training. - Warwick University and Birmingham University for food and agriculture-related work. - LEPs including GBSLEP's Skills and Apprenticeships Hubs. - MOBIE.	- Belo Horizonte's Digital Programme: The government established an electronics remanufacturing facility and a Computer Reconditioning Centre where citizens from low-income communities receive extensive training to restore IT equipment. The refurbished equipment then goes on to support over 300 digital inclusion sites where locals have free access to computers and the internet as well as varied training opportunities in basic digital literacy.
3.3 Business Support	**3.3.1** Identify, map and review existing business support programmes to determine gaps and propose areas of improvement. **3.3.2** Organise co-creation workshops with regional businesses to develop new support programmes. **3.3.3** Identify, map and review existing funds and grants to determine gaps and inform development of new investment vehicles. **3.3.4** Select circular economy requirements for relevant WMCA funds and grants. **3.3.5** Find partners and/or sponsors to develop new funding vehicle.	- Create with partners a social innovation fund for volunteer organisations supporting local communities around the circular economy. This should align with the Social Economic Business Plan. - Create with partners a social venture capital investment vehicle to support circular economy initiatives. This should align with the Social Economic Business Plan. - Create a centralised repository to signpost available business support, fundings and grants relating to the circular economy.	WMCA's role is to l**ead in assessing existing support programmes** and mechanisms to **determine what gaps need to be addressed**. WMCA's role is also to **convene partners** and **facilitate the development** of new support programmes and mechanisms.	- Existing business support programmes such as ATETA, ARLI, BASIS, EBRI, ENTress and ASG. - Birmingham Chamber of Commerce. - Sustainability West Midlands. - Circular Economy Club. - Anchor institutions including CLES.	- ReLondon: Previously called Advance London, it was set up by LWARB and offers tailored support to SMEs. They also provide grants for businesses to trial and adopt circular business models. By the end of 2018, they had provided over 700 hours of bespoke support to 112 SMEs. - Bristol City Fund Model: Example of a collaborative model to provide funds to support inclusive, balanced growth.

Appendix 5: Soft Infrastructure

Enabler	Short Term Action (2022)	Long-Term Action (2023+)	WMCA Role	Partners	Best Practice
4.1 R&D and Innovation	**4.1.1** Identify and map existing innovation programmes, living labs and circular economy research programmes to determine gaps and inform creation of new programmes. This should build on the maps created in this routemap. **4.1.2** Create a toolkit to de-risk approach to circular economy innovations.	- Launch innovation programmes, challenges, hackathons and accelerator focusing on circular economy innovations. Build on existing competitions such as SPRING. - Designate a Circular Economy Enterprise Zone to attract investment, innovation and talent to the region. - Form robust partnerships with educational institutions to continue research and knowledge-sharing on the circular economy.	WMCA's role is to **enable R&D and innovation** in the region, **facilitating partnership** and **ensuring collaboration** and lack of duplication.	- Innovation Alliance. - WM Innovation Programme and the Virtual Innovation Team. - WMREDI. - ASG. - The Construction Futures Research Centre. - Local Enterprise Partnerships. - Sustainability West Midlands - SteamHouse. - Warwick Manufacturing Group. - Circular Economy Research Networks. - Black Country Marches Institute of Technology. - Major universities and colleges in the region.	
4.2 Data and Digital	**4.2.1** Lobby the national government to update (where necessary) digital and data regulations across the region to better support information sharing. **4.2.2** Identify and review existing online sharing platforms to determine gaps and inform potential commission of a new platform. **4.2.3** Signpost relevant sharing platform and online marketplace to facilitate material exchange (separate business-led platforms from community-led ones). **4.2.4** Commission in-depth, detailed material flow analysis for specific sectors, industries and activities.	- Develop a kitemark for digital sharing platform in order to build trust amongst users. - Launch an interactive, digital West Midlands platform to trade resources and surplus materials, as well as to share market intelligence and best practice. - Work with seven local authority constituent members and other key partners to harmonise data collection and sharing processes in the region. - Implement Building Passport with a West Midlands Building Material Bank (BAMB).	WMCA's role is to **enable better sharing of resources** across the region by identifying current mechanisms, proposing improvement and investing in digital platforms.	- WM5G Team - Local Enterprise Partnerships. - Major universities and colleges in the region. - WMREDI. - Potential to work on developing the platform as part of a SPRING competition.	- Rheaply Software: It is an asset exchange platform that drives the 'visibility on stuff' across all of a client's sites, enabling the transfer of idle equipment either within or outside an organisation.
4.3 Logistics	**4.3.1** Audit existing logistics processes to identify current issues and investment requirements and publish recommendations.	- Work with partners to enhance logistics processes (reverse logistics, mobility as a service etc.). - Launch a digital track an trace (using 5G, digital platform and BAMB) to locate resources and facilitate transport and trading.	WMCA's role is to **lead in its own operations** and improve its logistics. In doing so, WMCA will enable others to do the same and better trade resources across the region.	- Transport for the West Midlands. - Seven local authority members. - Local Enterprise Partnerships.	

Appendix 6: Hard Infrastructure

Enabler	Short Term Action (2022)	Long-Term Action (2023+)	WMCA Role	Partners	Best Practice
5.1 Physical Infrastructure	**5.1.1** Identify and map existing waste infrastructure to determine gaps and investments required to support a transition to a circular economy. **5.1.2** Identify and map existing transport infrastructure to determine gaps and investments required to support a transition to a circular economy. **5.1.3** Identify and map existing energy infrastructure to determine gaps and investments required to support a transition to a circular economy. **5.1.4** Convene partners to determine best location for a network of Resource Recovery Hubs. **5.1.5** Develop project and funding proposal for a Resource Recovery Hub and for financially viable storage facilities.	- Work with local authority constituent members and other key partners to develop an investment programme to upgrade waste infrastructure (including reprocessing facilities, bio-packaging, anaerobic digestion). - Work with local authority constituent members and other key partners to develop an investment programme to upgrade transport infrastructure (linked with logistics). - Work with local authority constituent members and other key partners to develop an investment programme to upgrade energy infrastructure (linked with Energy Capital and other energy strategies). - Create a network of Resource Recovery Hubs across the region. - Launch investment programme for waste, transport and energy.	WMCA's role is to **lead in identifying key gaps** in critical infrastructure which is required to enable a wider transition to the circular economy. WMCA's role is also to **coordinate investments** in these critical infrastructure and **facilitate partnerships** across a wide network of partners.	- Seven local authority members. - LEPs. - National government. - Black Country Consortium - Energy Capital. - Transport for the West Midlands. - DEFRA. - BEIS.	- Build on the notion of the Triple Access System of physical mobility, spatial proximity and digital connectivity.
5.2 Shared Infrastructure	**5.2.1** Create an online map of existing shared space (including co-maker spaces, repair cafes, library of things etc.). **5.2.2** Create an interactive online inventory of unused/idle/vacant spaces that community groups, social enterprises, volunteer organisations and not for profit can use (thanks to an easy booking system). **5.2.3** Develop with partners a common model for local communities to build Circular Community Hubs (hubs can be easily replicated across the region but based on place-based characteristics and needs). This should align with the Social Economy Business Plan.	- Hold workshops with local communities and businesses to co-develop ideas for idle vacant and/or unused spaces. - Explore opportunities to deal with existing landfill sites as many sites can be mined to recover plastics, metals and other precious resources. - Invest in a WMCA Circular Community Hubs.	WMCA's role is to **lead in identifying key gaps** in shared infrastructure which is required to enable local businesses and communities to engage in	- Seven local authority constituent members. - Circular Economy Club. - Sustainability West Midlands. - Black Country Consortium. - SteamHouse. - GBSLEP.	- New York City Crowdsource-Mapping: A citizen-driven project that created an interactive crowdsourced map of vacant spaces. The aim was to turn these spaces into community space such as gardens, farms playground etc. As of October 2016, over 7 acres of new community spaces have been created.

Appendix 7: Circular Manufacturing

Strategic Interventions	Description	Drivers	Benefits	WMCA Role and Partners	Key Performance Indicators
Circular Battery Manufacturing	Opportunity for the West Midlands to develop the first truly circular factory and battery, building on the region's expertise and strengths and enabling collaboration across various stakeholders.	- Demand for batteries is growing exponentially but it is very hard to recycle Lithium-Ion batteries. - The future of electric technologies depends on ability to recycle and repurpose expensive scarce materials. - Demand for scarce materials is predicted to grow by 2050, as high as 1,000% for lithium leading to potential material scarcity. - Transitioning to electric vehicles will result in environment issues that can be addressed with circular solutions.	- Ensure the future of the car industry in the region, which is one of the largest employer with a potential to create 4,000 new jobs. - Increase competitive advantage by being at the forefront of battery technology. - Economic resilience in the region and reduction in reliance on imports of scarce materials. - Reduce need for virgin and scarce materials, limiting environmental degradation.	**WMCA's Role**: Enable. **Partners**: Coventry City Council, Coventry Airport, Birmingham Council, Energy Research Accelerator, Birmingham Energy Institute, Birmingham University, Faraday Institute (ReLib), UK BIC, NCCCCE, Aston University, UKRI, Innovate UK, Warwick University, Innovation Alliance, Industry Partners such as JLR, WMCA Electrification Task Force, National Transport Design Centre, BEIS and WM Steering Group for Gigafactory.	- Jobs created. - Scarce materials repurposed/ recycled. - Amount (£) of private and public investment secured.
Industrial Symbiosis Delivery Programme	Implement a place-based industrial symbiosis delivery programme to cross-fertilise opportunities across the three priority areas. Initial focus could be high-value metal reprocessing and water.	- More than 4,000 businesses in the West Midlands work in metal recycling, reprocessing with a particular strength in aluminium recycling. - SMEs make the bulk of the West Midlands' economy and require additional support to embrace circular processes. - The West Midlands was the home of NISP and can build on this legacy. - Several business support programmes already exist in the region and could be consolidated under industrial symbiosis. - Building a circular water system is key for the region. Opportunity to build on existing projects including United Utilities' Innovation in Water Challenge.	- Increase circularity of resources in the region while immproving competitiveness of companies of all sizes. - Create a demand-pull on the region's existing R&D and innovation programmes, including universities. - Potential to create/save 1,000 jobs in the region. - Potentital of a total economic value added between £150-250 million as well as £280 million cost savings for businesses.	**WMCA's Role**: Enable and potential delivery partner. **Partners**: Industrial Synergies, BEIS, Cast Metals Federation, UK Metal Council, UKMSN+, University of Birmingham, Aston University, existing business support programmes such as ARLI or EBRI, LEPs, Chamber of Commerce, Black Country Consortium, HVM Catapult, DEFRA, Make UK, FSB.	- Number of businesses supported. Number of new jobs created. - Quantity and value of materials recovered/reused. - Value added to manufacturing, including costs saved.
High-Value Fuels from Waste	Use advanced processing technologies to turn waste into high-value fuels to help industrial sectors like aviation, rail, heavy goods and plants sectors decarbonise.	- Sectors such as aerospace are facing challenges to decarbonise. - These sectors are heavily reliant on imported fossil fuels. - The West Midlands is the UK's largest aerospace cluster.	- Reduce CO2 emissions of key industrial sectors. - Increase the volume and value of resources generated from waste. - Reduce waste sent to landfill and incineration by providig a higher-value alternative for key waste streams. - Develop expertise and new technologies that can be exported across the UK and globally.	**WMCA's Role**: Enable. **Partners**: Midlands Aerospace Alliance and their members, Tyseley Energy Park, International Synergies, SUEZ, Veolia, Severn Trent Water, Black Country Consortium, Biffa, National Centre for Decarbonised Heat, Birmingham Energy Innovation Hub, and leading aerospace companies such as Moog Aircraft Group.	- CO2 saved with alternative fuels. - Quantum of non-fossil fuel generated. - Successful development of alternative fuel products and their commercialisation.
Circular Manufacturing Centre of Excellence	Building on existing projects and expertise, create a centre for circular design in manufacturing and advanced reprocessing of waste. The centre would lead in developing new technologies and processes for end of life resource recovery and would serve as a knowledge-sharing hub in the region.	- Waste processing and waste facilities have not fully embraced new technologies (AI and robotics) to improve end-of-life recovery. - Complex manufactured products are difficult to disassemble making resource recovery challenging. - Adequate waste infrastructure is required to support a region-wide transition to a circular economy. - Partnership working is required to support a circular economy. A Centre of Excellence can drive these collaborative processes and encourage knowledge-sharing.	- Provision of practical support around circular design in the manufacturing support, allowing for wider adoption of circular processes. - Innovation in technology, product design and services contributing to economic resilience and competitive advantage of the region. Skills and products can be exported across the UK and globally. - Reduce dependence on expensive materials. - New jobs created in design services, material recovery, reuse and reprocessing. - Greater supply chain resilience, partnership and collaboration.	**WMCA's Role**: Enable. **Partners**: Black Country Consortium, Coventry City Council, Birmingham City Council, Tyseley Energy Park, Birmingham University, Warwick University, Faraday Institute, National Transport Design Centre, Warwick Manufacturing Group, International Synergies, Veolia, SUEZ, Biffa, Severn Trent Water, LEPs, Chambers of Commerce, HVM Catapult.	- Number of new technologies patented. - Number of new jobs created. - Quantity and value of materials recovered/reused. - Value added to manufacturing, including costs saved.

Appendix 8: Circular Construction

Strategic Interventions	Description	Drivers	Benefits	WMCA Role and Partners	Key Performance Indicators
Circular Strategies for Infrastructure	Develop circular strategies and actions plan for major infrastructure projects and utility providers in the region.	- The West Midlands will see significant growth in the next thirty years including HS2 developments. - Aligned with WMCA's WM2041 programmes of work, supporting region-wide decarbonisation and sustainable lifestyles. - The 2022 Commonwealth Games offer an opportunity to showcase low-carbon, circular infrastructure development.	- CO2 and cost savings. - More efficient and sustainable resource use including water and energy. - Develop a secondary material network to support virgin material substitution. - Support investment in innovation including sustainable, circular materials. - New jobs created. - Supply chain resilience.	**WMCA's Role**: Enable and Influence. Lead on its own sites. **Partners**: HS2, Veolia, Biffa, Severn Trent Water, Energy Capital, Transport for the West Midlands, Zero Carbon Homes Task Force, Commonwealth Games Team, and The Construction Futures Research Centre.	- % of materials used that are circular. - % of sustainable, circular materials used.
Circular Building Product Initiative	Work with regional businesses to develop leading circular building systems, products and services and create a one-stop shop for circular buildings.	- To support circular processes in construction, new products and services specifically designed to support a circular economy need to be developed and readily available. - Megatrends report highlighted the increasing demand for environmentally friendly products and services. See the research paper here.	- CO2 savings. - Reduce resource consumption and virgin material extraction. - Opportunity to create a secondary raw material market place. - Create new jobs and products/services that can be exported across the UK or globally. - Increase resilience of local supply chains.	**WMCA's Role**: Enable and Influence. **Partners**: Construction product association, leading building material suppliers in the region, ARLI, existing business support programmes, Zero Carbon Homes Task Force, AMC Task Force, Tyseley Energy Park, and The Construction Futures Research Centre.	- Number of products/services brought to market. - Number of circular buildings built. - % of materials used that are circular.
Zero Waste Construction Hub	Launch a physical and virtual hub to recover and exchange materials, as well as share and incentivise circular design and processes.	- The CD&E sector is responsible for the largest consumer of resource and generation of waste, particularly sand. There is a serious shortage of sand in the UK and its current extraction is leading to environmental damages. - Circular construction processes and design already encouraged by WMCA's Zero Carbon Homes Charter and Routemap. - The region is already promoting and piloting AMC-MMC Construction Methods, and is planning to build a Circular Construction Hub.	- Capture the value of waste generated in construction through reuse/recycling. - Reduce resource consumption and extraction of virgin materials. - CO2 savings and cost savings. - Develop skills and jobs around circular design and construction, increasing the region's competitiveness and resilience as well as creating new jobs. - Potential to build more rapidly and meet housing demand.	**WMCA's Role**: Enable and Influence. Lead on its own sites. **Partners**: Existing WMCA teams and partners working on Zero Carbon Homes (ZCH) Routemap and the AMC Routemap including the ZCH and AMC Task Forces, Institute for Advanced Manufacturing and Engineering, Hadley Group's MMC Hub, Marches Institute of Technology, Black Country Consortium, Tyseley Energy Park, leading developers in the region (Urban Splash etc.), and The Construction Futures Research Centre.	- Tonnes of construction materials not going to landfill or incineration. - Material consumption ratio compared to traditional building methods.
Circular Repurposing Programme	Develop and implement circular approaches for refurbishing and repurposing commercial and residential properties, as well as public building, high streets and public spaces.	- Housing, building and wider infrastructure assets need significant retrofit to meet carbon goals. - High streets and unused/vacant idle public spaces need to be rethought and rejuvenated post COVID-19 pandemic. - There is a need to reduce the amount of physical and financial resources used for repurposing buildings and spaces.	- Contribution to localism and social value with new public spaces and rejuvenation of high streets. - Create new spaces for local communities and businesses to flourish. - CO2 savings including reduction in embodied carbon through the use of circular design and approaches. - Reduce resource consumption and virgin material extraction.	**WMCA's Role**: Enable. Lead on its own site. **Partners**: Local authority constituent members, LEPs, Chambers of Commerce, local community groups, Energy Capital Smart Hub (RESO project) and The Construction Futures Research Centre.	- CO2 saved. - Amount of material reused on site.
Brownfield Land Reclamation	Set up a facility and associated advisory services to unlock the development potential of brownfield sites of all sizes, and to ensure brownfield reclamation adopts a circular approach to site clean-up and clearance.	- West Midlands has a lot of brownfield sites. Smaller sites are harder to develop and new processes and incentives need to be developed. - Wolverhampton is building a National Brownfield Institute which could serve as the proposed facility. These leading research institutions can ensure any proposed approaches remain sustainable and are not energy-intensive.	- Reduce resource consumption, including the amount of materials waste on brownfield sites. - Ensure the highest value use of demolition and excavation waste. - Reduce amount of soils and virgin materials imported. - Design approaches to develop brownfield sites that save money through all phases of a project.	**WMCA's Role**: Enable and Influence. Lead on its own sites. **Partners**: Wolverhampton University, International Synergies, National Centre for Sustainable Construction and Circular Economy, National Brownfield Institute, Brownfield Research and Innovation Centre, local authority constituent members, leading developers in the region.	- Tonnes of soil treated and reused. - Tonnes of secondary raw materials created, - Hectares of land reclaimed.

Appendix 9: Circular Food

Strategic Interventions	Description	Drivers	Benefits	WMCA Role and Partners	Key Performance Indicators
Regenerative Food Production	Support regenerative agriculture and permaculture practices as well as local food growing initiatives, including urban agriculture and horticulture.	- The West Midlands remains an agricultural hub yet currently imports 45-55% of its food. - Agricultural processes create land, water and air pollution which has negative impact on biodiversity and communities' health and wellbeing. - Unsustainable farming practices degrade soil health, which in turn negatively impacts farmers' yield and income.	- Maintain soil health. - Positive contribution to biodiversity increase and increase in natural capital. - Reduce food miles and CO2 associated with farming. - Increase farmers' income and resilience to climate change's adverse impacts. - Potential creation of new revenue streams for farmers. - Healthier diets and reduction of the cost of food with community-based/local food growing schemes.	**WMCA's Role**: Enable and Influence. **Partners**: Coventry's Agroecology and Water Resilience Centre, Circular Economy Club, Sustainability West Midlands, National Farmers Union, District Eating, Food Trails, District Eating, local authority constituent members, LEPs, Chambers of Commerce, West Midlands Food and Drink Manufacturing Forum, Campden BRI.	- Number of accredited regenerative farms. - Number of local food growing schemes (urban agriculture, community-based agriculture, allotments etc.).
Circular Food Manufacturing	Develop circular strategies for food and drink processors and manufacturers, focusing on opportunity to use food waste as a productive resource.	- New regulations around extended producer responsibility for packaging being introduced. - The region already benefits from several R&D stream on improving agro-business processes and making them more sustainable. - New processes and infrastructures are required to support decarbonisation of large agro-businesses.	- Development of new processes and technologies that can be exported across the UK and globally. - Reduction in plastic pollution, especially plastic used in packaging. - CO2 savings and cost savings. - Reduce the impact of agro-business processes on the environment. - Using food waste for energy (including biofuels). For example, opportunity to capture heat from distillery. - Engagement with entire supply chain can enable innovation, efficiencies and new partnerships.	**WMCA's Role**: Enable and Influence. **Partners**: Leading agro-businesses in the region (Mondelez etc.), regional breweries, WRAP, Warwick Manufacturing Group, MTC, Warwick University, Coventry University, International Synergies, Sustainability West Midlands, LEPs, Chambers of Commerce, West Midlands Food and Drink Manufacturing Forum, Campden BRI.	- Number of new technologies patented. - Amount of resources upcycled by agro-businesses. - Amount of plastic
Circular Food Hubs	Create circular food hubs with optimised logistics to collect and redistribute food that would otherwise be waste.	- Clusters and hubs around food are already being planned as part of Repowering the Black Country and the Social Economy Business Plan. - Opportunities for urban horticulture and agriculture identified in the Black Country. - Food waste is the major waste stream identified in the routemap from households going to landfill. - Food waste reduction.	- Contribution to localism. - Health and wellbeing improvements. - Creation of social value. - Reduction in amount of food waste and CO2 emissions associated with it. - Supporting existing community and volunteer groups working in the food sector. - Increase food security, food justice and food sovereignty.	**WMCA's Role**: Enable and potential delivery partner. **Partners**: Circular Economy Club, Sustainability West Midlands, existing community groups and volunteer organisations such as Incredible Surplus and Eat Make Play, District Eating, The Active Wellbeing Society, Food Trails, Tyseley Energy Park, local authority constituent members, LEPs, Chambers of Commerce.	- Reduction in food waste going to landfill. - Amount of food redistributed. - Number of hubs built in the region.
Healthy Consumption	Raise awareness and encourage sustainable, local food consumption, working closely with existing communities and volunteer groups.	- No bans on fast food and unhealthy foods advertisement imposed in the West Midlands. - Obesity, particularly child obesity on the rise in England and the West Midlands. - Low-income neighbourhoods more negatively affected.	- Increase food security, food justice and food sovereignty. - Contribution to localism and generates social value. - Contribution to health and wellbeing particularly that of children and young adults.	**WMCA's Role**: Influence. **Partners**: Circular Economy Club, Sustainability West Midlands, existing community groups and volunteer organisations such as Incredible Surplus and Eat Make Play, District Eating, The Active Wellbeing Society, Food Trails, CLES, regional primary and secondary schools, local authority constituent members, LEPs, Chambers of Commerce.	- Reduction in obesity, including childhood obesity. - Enaction of ban for unhealthy food advertisement in public transport and near schools.
Circular Nutrient Loop	Close the nutrient loop by developing bio-technologies to recover and enhance the value of food waste and other key waste streams such as sewage and wastewater.	- Use of synthetic fertiliser causes environmental degradation. - Synthetic fertilisers increasingly expensive. - Food waste and other key waste streams (sewage and wastewater) currently not used at their highest value. - Build on existing innovative practice such as Minworth's biogas recovery programme.	- Supports bio-remediation and bio-fortification. - Maintains soil health and retain nutrients into the soil. - Creation of new revenue streams and jobs. - Cost savings by reducing reliance on synthetic fertilisers. - Positive impact on biodiversity, increase in natural capital, reduce use of finite resources. - Produce phages for pharmaceuticals and other life science sectors. - Produce biogas and other biofuels for hard to decarbonise sectors.	**WMCA's Role**: Enable and Influence. **Partners**: SUEZ, Veolia, Biffa, Severn Trent Water, National Farmer's Union, regional farms, Tyseley Energy Park, regional farms, Biffa, local authority constituent members, LEPs, Chambers of Commerce, Campden BRI.	- Quality of soil and waterways. - Amount of biogas generated and compost redistributed.

Supporting Document: Baseline Analysis

This baseline analysis was the first step in the development of the WMCA Circular Economy Routemap. It includes a context analysis, the initial high-level material flow analysis as well as the methodology used.

Part 1: Policy Analysis

1.1 International Context

A context analysis was conducted to determine which international, national and regional policies support a transition to the circular economy and what are best practice examples for the West Midlands region.

United Nations Sustainable Development Goals (2015)

Description: The United Nations (UN) set 17 goals for sustainable development that were adopted by UN Member states in 2015. The Sustainable Development Goals (SDGs) are intended to be achieved by 2030. SDG7 Affordable and Clean Energy, SDG8 Decent Work and Economic Growth, SDG9 Industry, Innovation and Infrastructure, and SDG12 Responsible Consumption and Production are particularly relevant for the Circular Economy.

Focus on Circular Economy: Medium

Impact: Encourages consideration of circular economy concepts and inter-connectivity with wider development goals. Actively support other conceptual frameworks such as doughnut economics by Kate Raworth.

Ellen MacArthur Foundation, Policy-Maker Toolkit (2015)

Description: The toolkit was developed to provide insight for policy-makers in implementing the circular economy. In producing the toolkit, eight key insights have emerged and are explored in the document. The Foundation has also developed ten policy levers for circular economy transitions. More information on those can be found here.

Focus on Circular Economy: High

Impact: Provides clear guidance on policies necessary to transition to a circular economy with practical applications.

Paris Agreement and the Nationally Determined Contributions (2016)

Description: The Paris Agreement sets out a global framework to limit global temperature rise below 2°C, with a target of 1.5°C in accordance with the recommendations of the Intergovernmental Panel on Climate Change (IPCC). Signed by 175 countries, including the UK, it is the first legally binding global climate change agreement and came into force in November 2016. The circular economy is one method for countries to reduce their greenhouse gas emissions.

Focus on Circular Economy: Low

Impact: No significant impact on circular economy.

Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report AR5 (2018)

Description: Since the Paris Agreement the IPCC have called for increased action to achieve net zero carbon by 2030, including placing a higher price on emissions, shifting investment patterns, accelerating the transition to renewable energy and enabling demand-side mitigation and behavioural change. The circular economy forms part of solutions countries can take to achieve net zero carbon by 2030.

Focus on Circular Economy: Low

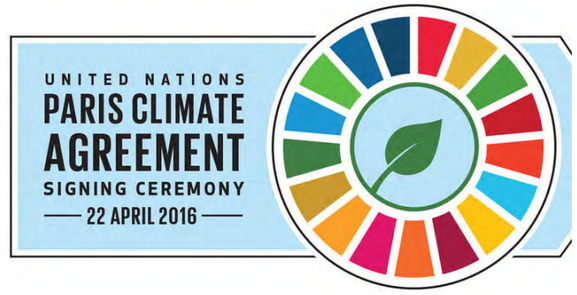
Impact: No significant impact on circular economy.

Ellen MacArthur Foundation, Universal Circular Economy Policy Goals (2021)

Description: The paper aims to create a common direction of travel in policy development for a faster transition to a circular economy. The new policy goals will enable governments and businesses to benefit from the circular economy, which offers solutions to key global challenges such as climate change, biodiversity loss, and pollution. It sets out five universal circular economy policy goals.

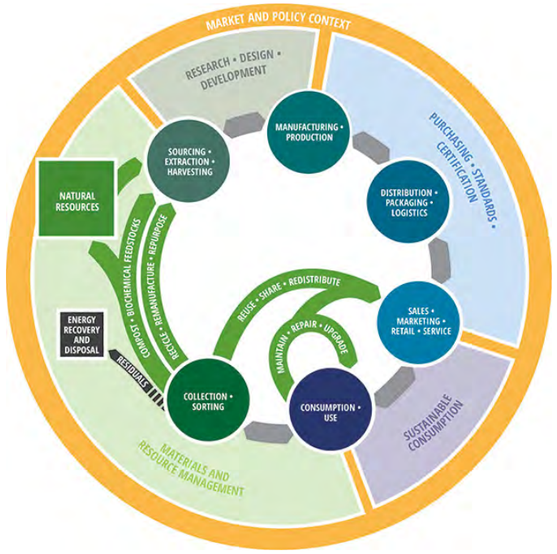
Focus on Circular Economy: High

Impact: Provides clear guidance on policies required to scale up the circular economy.



Part 1: Policy Analysis

1.1 International Context



Worldwide

Doughnut Economics Action Lab (DEAL) (2019)

Description: DEAL was founded as a Community Interest Company in 2019. It launched an online community platform in 2020. Its aim is to change our economic models using Doughnut Economics as a conceptual framework. DEAL provides support to businesses and communities looking to adopt more circular processes and several tools are available on its website.

Impact: DEAL promotes transformational change by reframing economic narratives, influencing strategic policy and encouraging more innovations within the circular economy.

Lessons for WMCA: Adopting circular processes requires interventions at various scale (from industry-wide transformation to local, community-led projects). The use of digital platforms to share data and insights is important to enable local communities and businesses to adopt more circular processes.

You can find more information here.

Canada

Circular Economy Lab

Description: Launched by the Natural Step Canada in 2016, the Lab brings together public and private sector leaders from different sectors and value chains to implement circular economy solutions. They have developed a Circular Economy Framework diagram to present a high-level map of how products and materials move through a circular economy. Their website also provides innovation pathways towards a circular economy.

Impact: Help public and private sector stakeholders in defining shared goals around a circular economy opportunity, accelerate the development of promising ideas and build momentum and commitment for change.

Lessons for WMCA: Convening and mobilising various partners across sectors and industries will be key to catalyse a circular economy in the West Midlands. The WMCA has an important role to play in brokering partnerships between different partners and helping set common goals.

You can find more information here.

Netherlands

Amsterdam Circular Strategy 2020-2025

Description: The aim of the strategy is to halve the use of new raw materials by 2030 and to achieve a fully circular city by 2050. As part of the strategy, the city mapped its main flows from entry to processing, in order to preserve valuable raw materials. The strategy then focuses on three value chains: food and organic waste streams, consumer goods, and the built environment.

Impact: Amsterdam has been developing a framework to monitor their progress towards circularity. This is the first city-wide level to assess circularity.

Lessons for WMCA: Amsterdam first produced a high-level flow analysis of its economy and based on the analysis focused on three value chains. This approach was successful and complemented by in-depth modelling of chosen 'value chains'.

You can find more information here.

Part 1: Policy Analysis
1.2 National Context

At the national level, the following policies and strategies relate to the circular economy and provide some guidance incentives and targets.

Climate Change Act, HM Government (2008)

Description: In 2008, the UK pledged to reduce greenhouse gas emissions by 80% against 1990 levels, by 2050. To achieve this they set carbon budgets and established the Committee on Climate Change. In 2019, the UK became the first nation to make net zero by 2050 a legally binding commitment. Moving to a circular economy model will help meet these targets, although the document does not make specific recommendations in relation to the circular economy.

Focus on Circular Economy: Low

Impact: No significant impact on circular economy.

Clean Growth Strategy, BEIS (2017)

Description: 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.

Focus on Circular Economy: Medium

Impact: 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.

Litter Strategy for England, MHCLG DEFRA and DfT (2017)

Description: This strategy sets out how the UK government will work with different local groups, local authorities, Highways England and businesses to reduce litter. The UK will work to clean up the country, to change attitudes towards littering, and strengthen enforcement powers. This is the first Litter Strategy for England.

Focus on Circular Economy: Medium

Impact: Focuses on reducing littering and only addresses the waste components of the Circular Economy.

25 Year Environment Plan , DEFRA (2018)

Description: The environment plan sets out the UK's goals 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.

Focus on Circular Economy: Medium

Impact: Provides specific targets that are aligned with circular economy principles.

Part 1: Policy Analysis
1.2 National Context

Resources and Waste Strategy for England, DEFRA and EA (2018)

Description: 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. It is worth noting a new 'Waste Prevention Programme for England: a Resource Efficient Economy' is being developed and currently under consultation.

Focus on Circular Economy: High

Impact: Provides specific steps and guidance to maximise resource use and minimise waste, but does not set clear targets. The West Midlands must prepare for upcoming the new waste prevention programme which is currently under consultation.

Sixth Carbon Budget, Climate Change Committee (2020)

Description: 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.

Focus on Circular Economy: Medium

Impact: Recommends a transition to the circular economy without specific policies or measures to kickstart the transition or scale up circular economy activities.

Build Back Better: Plan for Growth, HM Treasury (2021)

Description: The Growth Plan focuses on three pillars of growth: infrastructure, skills and innovation. The government seeks to support net zero by investing £12 billion of funding for projects that will kickstart a Green Industrial Revolution. It will also include creating a new UK Infrastructure Bank which will crowd-in private investment to accelerate progress to net zero.

Focus on Circular Economy: Low

Impact: Supports a wider transition to a net zero, clean economy, allocating specific funding and encouraging innovation. Although it does not refer to the circular economy, it provides enabling mechanisms to support it.

Industrial Decarbonisation Strategy, HM Government (2021)

Description: 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.

Focus on Circular Economy: High

Impact: Encourages industrial symbiosis, and provides incentives for industries to transition to circular, net zero business models and operations.

London

ReLondon Circular Economy Routemap (2016) & Circular Economy Primer (2020)

Description: The Routemap focuses on five priority areas including food, textiles, plastics, electricals and the built environment. It estimates that actions will generate a £7bn opportunity for the capital. The Primer provides guidance for built environment professionals to embed circular economy principles into their projects and design processes.

Impact: ReLondon has demonstrated the wider benefits of transitioning to a circular economy by expressing its economic benefits. The Primer provides clear guidance and requirements to increase adoption of circular design.

Lessons for WMCA: Routemaps should focus on sectors that have the biggest impacts and should be complemented with additional policy guidance and documents targeting specific sectors or aspects of the circular economy.

You can find more information here and here.

Scotland

Circular Glasgow (2020) & Zero Waste Scotland (SWZ)

Description: Glasgow was the first UK city to sign the Circular Cities Declaration. Circular Glasgow is an initiative of Glasgow's Chamber of Commerce, working alongside key partners ZWS and Glasgow City Council. It supports businesses in leading the way through innovation, design thinking and new circular business models. ZWS itself focuses on resource maximisation and waste reduction, using circular economy modelling exercises.

Impact: Circular Glasgow expresses the benefits of the circular economy to businesses and provides a free circular toolkit to businesses.

Lessons for WMCA: Specific initiatives supporting all businesses from all sectors are key to support a transition to a circular economy. Voluntary business commitments need to be supported by a comprehensive policy framework.

You can find more information here and here. Further tools of interest also include Circular Yorkshire's suite of materials for SMEs which can be found here.

Wales

Beyond Recycling (2021) & Building the Circular Economy in Wales (2021)

Description: Wales' aim is to keep resources in use for as long as possible and avoid waste. The government is committed to help businesses reduce their carbon footprints and become more resource efficient. It also aims to eradicate avoidable food waste, to update its procurement rules, and to achieve the highest rates of recycling in the world. Circular Economy Wales (CEW), a Community Interest Company has also published a brochure outlining its ambition surrounding the circular economy.

Impact: Sets a clear direction for Wales in transitioning to the circular economy. CEW brochure addresses explicitly the social dimension of the circular economy.

Lessons for WMCA: Involvement with businesses and residents, using planning, procurement and policies are all required to accelerate the transition to a circular economy. WMCA can use the circular economy to achieve a more inclusive growth.

You can find more information here and here.

Part 1: Policy Analysis
1.3 Regional Context

At the regional level, the following policies and strategies encourage a shift to a circular economy. However, they do not provide mechanisms or specific targets.

Local Industrial Strategy (2019)

Description: The West Midlands Local Industrial Strategy is a long-term plan aimed to increase productivity. It is locally led and developed in partnership with the government, based on clear evidence and aligned to the national Industrial Strategy. It sets out how the West Midlands will meet the Future of Mobility Grand Challenge as the centre of transport innovation in the UK. It provides steps to develop new market opportunities in data driven health and life sciences, modern services and through the application of creative techniques and technologies in future industries. It aims to make sure all communities can contribute to and benefit from economic prosperity.

The strategy also builds on the five foundations of productivity, including targeted action on skills, housing and transport with plans to drive up levels of business innovation and the commercialisation of research and development. The Black Country Land and Property Investment Fund (LPIF) aims to provide a solution to the shortfall through investment in projects which will support the re-use of brownfield land and buildings and the delivery of supporting infrastructure.

Focus on Circular Economy: Medium

Impact: Supports a transition to the circular economy without specific policies or measures to kickstart the transition or scale up circular economy activities.

State of the Region, WMCA (2020)

Description: The document is an annual review of performance across the West Midlands. The document includes a summary of research to deliver the world's first zero carbon industrial cluster in the Black Country.

Focus on Circular Economy: Low

Impact: Supports the circular economy and identifes that a structured approach is required to identify opportunity and drive the transition.

WM2041, WMCA (2020)

Description: In January 2020, WMCA members also launched #WM2041, a strategy which outlines 73 measures aimed at increasing the annual rate of CO_2 reduction in the area. The strategy highlights the need to save energy and resources, to build more connected places, to deliver zero carbon developments and to ensure resilience to locked-in climate breakdown. It has a clear focus on the co-benefits delivered by climate actions, builds on the UNSDGs and the Doughnut Economics model by Kate Raworth. It aims to ensure that the transition to a low carbon future is an inclusive one, an objective that will also form part of Circular Economy Routemap.

Focus on Circular Economy: Medium

Impact: Supports a transition to the circular economy and identifies next steps to help achieve this transition.

Five Year Plan, WMCA (2021)

Description: The Five Year Plan provides clear guidance on the measures that will need to be implemented to reach net zero by 2041. The Five Year Plan supports the circular economy. Key priorities include energy, transport as well as the built and natural environment.

Focus on Circular Economy: Medium

Impact: Support the circular economy and provides strategic priorities for the region.

Part 1: Policy Analysis
1.3 Regional Context

Additional policies, strategies and documents produced by WMCA have been taken into consideration when developing the Circular Economy Routemap. Some documents support a transition to the circular economy but none provide clear requirements or specific policies.

- **A Science and Innovation Audit for the West Midlands, WMCA (2017)**: The audit determined that the region has assets to support wider innovation but these needs to be further expanded. It assessed that the region has enabling competencies including advanced manufacturing and engineering, digital technology and systems integration.
- **Regional Energy Strategy for the West Midlands, Energy Capital (2018)**: The strategy seeks to influence the financial flows directed at local energy projects across the three LEPs of the West Midlands in order to deliver a vision for energy across the region.
- **Levelling up the West Midlands, WMCA (2020)**: The roadmap focuses on community recovery following the COVID-19 pandemic. The roadmap aims to counter the rise in unemployment across the region by providing employment support, developing regional skills infrastructure, and supporting high streets and local businesses that have been hit hard by the pandemic.
- **Recharge the West Midlands, WMCA (2020)**: This document summarises the region's ask to the central government in order to kickstart the economy. The investment case will help create or safeguard 135,000 jobs, support 154,400 young people and workers and build 35,000 new homes as well as support a green economic recovery. They have identified three areas of focus including creating green manufacturing jobs, maximising job creation for local people and investing in healthcare innovation.
- **Design Charter, WMCA (2020)**: It sets 12 design principles for WMCA and its partners to promote good-quality place-making.
- **Advanced Manufacturing in Construction Roadmap, WMCA (2020)**: The roadmap aims to accelerate AMC in the region in line with wider aims to achieve net zero.
- **Zero Carbon Homes Charter and Routemap, WMCA (2021)**: The document encourages the delivery of zero carbon homes in the region with a focus on promoting circular design, circular processes within construction and innovations.
- **WMCA's Digital Roadmap (2021)**: It outlines five missions goals, three of which relate to the circular economy. This includes sharing and using data to improve people's lives, realising the potential of digital to transform our economy and build economic resilience, and using digital public services to build a fairer, greener and healthier region.
- **West Midlands at COP26, WMCA (2021)**: The document informs the position of the West Midlands at the COP26 and sets its ambition to be the home of the green industrial revolution.
- **Resetting the Region, WMCA (2021)**: WMCA is in the process of reviewing its local industrial strategy. This update focuses on five grand challenges: deliver good jobs, support thriving places and communities, embed our green ambitions, tackle inequality and level up, as well as prevent a lost generation.
- **Inclusive Growth Programme, WMCA (2021)**: The WMCA is developing an inclusive growth framework, inclusive growth tests as well as inclusive growth decision-making toolkit.
- **Towards an Ecosystem Approach for Growing the Social Economy, Stage 1 Report iSE Research Team (2021)**: The research is part of wider work to double the size of the social economy in the WMCA area. It provides initial information to inform the development of a ten year business plan.
- **Social Economy Business Plan, iSE Research Team (2021)**: The plan aims to strengthen the social economy in the West Midlands and is currently being developed. Circular economy efforts should support the growth of a social economy in the region.
- **Low Carbon Environmental Goods and Services Market Snapshot Reports, Midlands Energy Hub (2021)**: Three reports were produced for the LEPs in the West Midlands to understand where support is needed to grow low-carbon sectors in the region.
- **Local Transport Plan, Transport for West Midlands (2021)**: A new Local Transport Plan is being developed to respond to the COVID-19 pandemic and support the region's Strategic Economic Plan. It will replaced the current Movement for Growth Strategy.

Part 1: Policy Analysis
1.3 Regional Context

The relevant policies of WMCA's seven constituent local authority members and LEPs were analysed. Most of them do not mention the circular economy explicitly or set out specific policies to support a transition to it. However, more recent policies have started to recognise the importance of moving towards a low-carbon, circular economy, and include actions and policies to move towards such an economy.

Solihull Sustainability Matters (2012)

This document aims to support the achievement of sustainable development in Solihull. One of the aims is to reduce household waste per resident and to increase the recycling rate. Part of the strategy is to promote sustainable consumption and production. It focuses on achieving more with less, reducing inefficient use of resources and taking into account impacts of products and materials across their whole lifecycle.

Sandwell Climate Change Strategy (2012)

The strategy is actively promoting the circular economy including encouraging the use of locally obtained materials within manufacturing processes. The strategy includes actions such as encouraging circular procurement and developing platforms for local businesses and residents.

Walsall Summary Report of WMCA Low Carbon Economy Programme Benchmark (2013)

The objective of the benchmark is to allow local authorities to demonstrate clear progress in addressing climate change and identify priorities for future improvement.

Dudley Borough Development Strategy (2017)

The document guides development within the Borough until 2026. The main policy of interest to circularity is the waste management, conservation areas and green network. The document refers to other guidance and policies rather than setting policies itself.

Birmingham Design Guide Vision Document for Creating Inclusive, Sustainable Places (2017)

The document includes five big design themes including building sustainable buildings, homes and neighbourhoods, ensuring sustainable connectivity and active streets, maximising green infrastructure and biodiversity as well as investing in energy efficiency, low-carbon development, digital infrastructure and waste management.

Birmingham Waste Strategy 2017-2040 (2017)

It provides a framework against which the Council can continue to determine the most appropriate ways to manage waste sustainably. Four principles have been adopted including creating a circular economy. The document encourages the creation of a circular economy and sets specific objectives to do so.

Birmingham City Council Plan 2018-2022 (2018)

The plan outlines five goal outcomes. The most relevant to the circular economy is priority 1 which states that they will work with their residents and businesses to improve the cleanliness of our city. They aim to improve cleanliness of streets and green spaces, increase recycling rates, reuse and green waste, as well as reduce household waste.

Solihull Single Use Plastic Strategy (2019)

The aim of the strategy is to make Solihull a single-use plastic free authority by the end of 2020. Undertook an audit which revealed that over 1.5 million items are used and then disposed of. The top five included plastic cutlery, food packaging, cups and lids, but also less obvious ones such as gloves. More detail of the audit can be found in the SUP Summary of Audits.

Part 1: Policy Analysis

1.3 Regional Context

Solihull Council Plan 2020-2025 (2020)

Solhull's Council Plan aims to deliver sustainable, inclusive grow. The document sets strategic actions to achieve this goal, including actioning their climate change declaration. Although there is no direct reference to the circular economy, the plan seeks to build a vibrant economy, enhance the area's natural environment and revitalise towns and local centres.

Climate Change Strategy for Coventry (2020)

The strategy sets various goals including to define the necessary requirements to achieve a waste recycling rate of 50% for the city. It also sets a goal to set a procurement code for the city, to increase green space, protect habitats and encourage locally grown food. Additional aims that support a movement to a circular economy include supporting and encourage economic growth in low-carbon industries, ensuring climate change is considered in every aspect of operations, services and informs decision making in the city, as well as to be a resource efficient city using energy wisely and reducing/recycling waste.

Repowering the Black Country, Black Country LEP (2020)

This document sets out an ambitious and bold plan to deliver the world's first zero carbon industrial cluster in the Black Country. It will enable clean GVA growth of £16 billion by 2030 and create or safeguard at least 20,000 skilled jobs. The document presents a number of fundable projects across diverse industrial supply chain. The circular economy is mentioned in the document. Indeed, reconfiguring supply chains for foundation industries in the region to be more circular can reduce industrial carbon emissions by between 40-50%.

Solihull Climate Change Prospectus (2020)

The Prospectus articulates Solihull's low-carbon vision and how the area aims to be at the forefront of transitioning to a low-carbon economy. It sets a roadmap to achieve clean growth, clean air, improve the natural environment, and communicate, engage and educate local communities.

Solihull Net Zero Action Plan (2021)

As part of Solihull's commitment to achieve net zero, the council is developing a Net Zero Action Plan. The upcoming Net Zero Action Plan will include several actions to promote a more circular economy. A green paper has been produced to inform the action plan, setting out the evidence base and interventions required to make Solihull Net Zero.

Coventry Social Value Policy (2021)

This policy describes the council's sustainability and ethical criteria and considerations in relation to large-scale development applications, procurement and partnership activities. This policy mentions and encourages a circular economy in Coventry.

Our Future City Plan (2021)

This document outlines the plan to develop Central Birmingham over the next twenty years. It sets the vision for change, highlighting key challenges and opportunities. The circular economy is mentioned as a key concept to ensure Birmingham is an equitable city. Becoming a low-carbon and circular economy is one of the goals outlined in the plan.

Part 2: Material Flow Analysis

2.1 Methodology

As part of the baseline analysis, a high-level material flow analysis was produced. This analysis informed where the Circular Economy Routemap should focus and what actions to prioritise.

Methodology

It is important to note that no standard methodology exists to conduct material flow analysis. We have followed international best practice and our own expertise to develop this baseline analysis.

Our choice of methodology was informed by Finland and the Netherlands' own approach in developing a circular economy routemap. As circular economy pioneers, both countries started by conducting a high-level analysis of material flows within three to five key sectors of their economy.

For the West Midlands, five sectors were selected based on the policy analysis conducted, additional desk-based research and stakeholder engagement. The Local Industrial Strategy was particularly helpful in narrowing down a choice of sectors which reflect the industrial and economic strengths of the region.

Below, you will find a breakdown of the steps to produce this baseline analysis. The following tables have also been produced and can be found on page 83:

- Table 1: Breakdown of inputs
- Table 2: Breakdown of sector activities
- Table 3: Breakdown of outputs
- Table 4: List of unclassified Exiobase activities
- Table 5: Data sources

Step 1: Selecting Boundaries, Inputs, Sectors and Outputs

Boundaries

One of our first steps was to define the boundary of this material flow analysis. For the purpose of this analysis, 'region' includes WMCA's constituent local authorities as well as the geographical area covered by the three LEPs.

Additionally, the boundary of our analysis has been matched to the land area, population size and economic contribution as a share of the UK as closely as possible. We have done so when taking a top-down approach to interpolate national or regional data, as well as when taking a bottom-up approach when extrapolating more granular local data.

Furthermore, according to best practice, the most recent datasets have been used. In this case the year is 2019-2020. Only the Exiobase has data dating from 2011. It is not expected that data on exiobase would have changed significantly between 2011-2019/20. This is an appropriate methodology for high-level, indicative analysis.

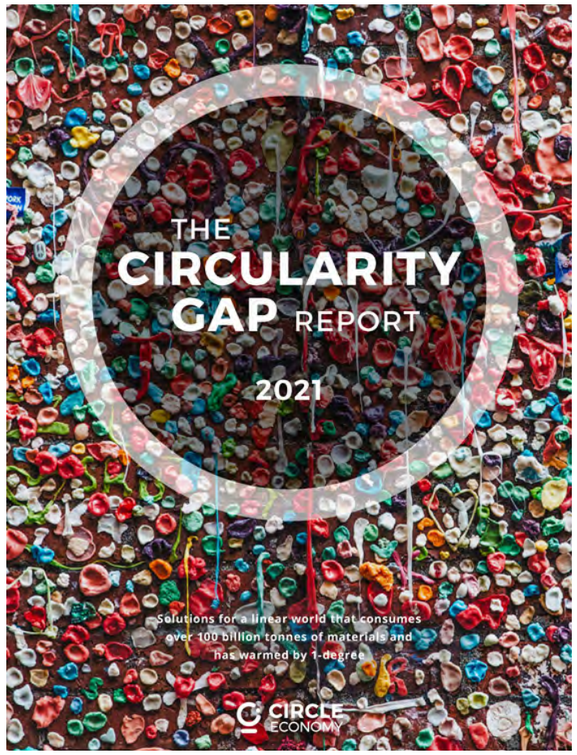
Due to the COVID-19 pandemic it is expected 2020-2021 will look different. It is recommended the data obtained from the 2021 Census is used for future, more accurate modelling.

Inputs (resources)

The choice of resources (inputs), sectors and waste types (outputs) to include in this analysis was informed by Metabolic's Circularity Gap Report, as well as their case study Circular Charlotte. These choices were also informed by the West Midlands' strengths and emerging opportunities.

Inputs include:

- Inputs in Metabolic's report include ores and minerals, which have been grouped under Minerals for this analysis.
- Fossil fuels have been grouped under Energy Carriers.
- Biomass has been grouped under Natural Resources.
- Water was added as a new input of interest.



Part 2: Material Flow Analysis

2.1 Methodology

Sectors

The Circular Charlotte report uses the sectors: Households, Commercial, Construction, Public. This analysis was performed solely as a waste flow analysis, whereas the WMCA analysis had the intention of mapping material flows as well as waste flows and carbon emissions.

For this reason, the sectors were divided as follows:

- The sectors of Households and Construction were kept and renamed Housing and Construction, Demolition and Excavation (CD&E).
- Commercial, which included a range of services and sectors such as Transportation & Warehousing, Food services, Manufacturing, Trade, was dissected and split into relevant sectors for this analysis. Out of this came the sectors: Industrial & Manufacturing, Agriculture & Food and Transport.
- Energy generation was added as a Sector to encapsulate renewable and non-renewable energy generation.

Outputs (waste)

Outputs in this analysis are mainly in the form of waste. Based on the Circular Charlotte example the following outputs are used in this analysis:

- Recycling was modified to Recycling/Re-use as it was deemed important to address the topic of waste re-use.
- Composting was renamed Beneficial use of Organics to encapsulate certain waste types which did not fit clearly under composting, such as Anaerobic Digestion.
- Landfill was kept without modification.
- Incineration, which does not figure in Metabolic's report, was added to this analysis.
- Wastewater was also added as a new output of interest to map the flows of water from start to finish.
- Products & Services and Losses were added to the analysis to map resources which do not end up in the waste stream. Further definitions are provided in the sections below.

A complete breakdown of what has been included in each input, sector and output is provided in Tables 1, 2, 3 and 4.

Step 2: Measuring the inputs

The next step was to measure the inputs of the material flow analysis (corresponding to the left-hand side of the diagrams presented in this report).

Natural resources and minerals

Natural resource and minerals flows are taken from Exiobase. Exiobase is a global, detailed Multi-Regional Environmentally Extended Supply-use Table (MR-SUT) and Input-Output Table (MR-IOT). Information on supply and use is available for 44 countries, covering 200 products and 163 industries.

1. The first step was to classify the products by product type: natural resources (renewable resources), minerals (non-renewable resources), and N/A. These are shown in Table 1 on page 83.
2. The second step was to classify the industries into sectors: Industry & Manufacturing, Construction, Demolition and Excavation (CD&E), Agriculture & Food, Transport, Energy generation (renewable and non-renewable). These are also shown in Table 1.
3. Once this classification of both the products and activities was made, the flow of resources from all countries, by resource type into each sector was visible for the UK.
4. The next step consisted of interpolating this national data for the West Midlands region (as described in the 'Interpolation' step below).

Energy

The following steps were followed:

1. Flows of energy carriers (coal, oil and gas) flowing into each sector are widely available for the Local Authorities (LAs).
2. For sectors of CD&E and Energy generation, LA data is not available. Consequently, the national dataset, Digest of UK Energy Statistics (DUKES), has been used to proportionally split the energy carriers flowing into 'Industrial'.
3. Similarly, for Energy generation (or Electricity), only the sectors of Industry & Commercial and Housing are covered in the LA dataset. Therefore, national datasets (DUKES) were used to proportionally split the energy carriers flowing into the missing sectors.

Part 2: Material Flow Analysis

2.1 Methodology

4. It was important to have a uniformity in units across flows as much as possible, in order to allow an appropriate comparison between flows. For energy carriers, a reasonable decision was to convert all flows of coal, oil and gas into values of tons of oil equivalent. This was done by taking the data values in Gigawatt hours, and using gross calorific values (CVs) of coal, oil and gas to convert into tons of oil equivalent.
5. Renewables include wind, wave and tidal, solar PV, hydro, landfill gas, sewage gas, other bioenergy, anaerobic digestion, biomass and waste.
6. Nuclear energy is not used widely in the region and was therefore not included in the analysis.

Water

The following steps were taken:

1. National water abstraction data is available under the following categories: Public water supply, Spray irrigation, Agriculture (excl. spray irrigation), Electricity supply industry, Other industry, Fish farming, cress growing, amenity ponds, Private water supply, Other.
2. Data is available for the Midlands and is interpolated for the West Midlands.
3. Little information is provided in the methodology documents for water abstraction as to what sectors may be included in "Public water supply", which represents the area with largest share of water abstracted. From a document by The Open University entitled Water in the UK, it states that "the public water supply is the water abstracted, purified and distributed through water mains to houses, offices, some industries and farms by the water companies". For this reason, the integration of data on water supply is incomplete.
4. Water abstraction for CD&E is not provided in the data. This is likely to be included in either 'Other Industry' or 'Public Water Supply'. For this reason, water supply to CD&E cannot be mapped to a sufficient level of detail.

A note on water supply: It is worth noting that we could not obtain high-quality data on the breakdown of public water supply usage.

*A note on water input into energy generatio*n: The Department for Environment, Food & Rural Affairs, ENV15 - Water abstraction tables for England, 2019 was used and contained an entry entitled 'Electricity supply industry'. This informed water supply associated with energy generation.

A note on water input into CD&E: No recent, high-quality data for CD&E's water use could be found online. It was assumed it was lumped into public water supply or other industry. Further in-depth analysis into the material and waste flows could look at the average embodied water of typical construction products using for example the BRE Green Guide.

Step 3: Measuring the outputs

The next step was to measure the outputs (corresponding to the right-hand side of the diagrams presented in this report).

Waste

The following steps were taken:

1. The UK Waste Interrogator was used to gather data on the flow of waste from different sectors for the West Midlands region.
2. There are 20 facility types for the region. In the first stage, these were classified into sectors: Industrial & Commercial wastes, Housing wastes, Construction wastes and Agriculture & Food wastes.
3. The waste types are found under European Waste Codes (EWCs) and each waste type was classified into the chosen waste sectors: Recycling/Re-use, Beneficial use of organic waste, Landfilling and Incineration. Beneficial use of organic waste was initially classified under Composting, but initial analysis of the waste data revealed some EWCs such as 'Anaerobic digestion' did not fit clearly into Composting, so this category was renamed. The full list of EWCs alongside their assigned waste sector can be found in Table 1.

Wastewater

The following steps were taken:

1. Wastewater data has been provided for the WMCA (not West Midlands). A total volume of wastewater and tonnage of sludge is provided.
2. No information is available regarding the relative distribution of wastewater by sector. For this reason, the assumption is made that wastewater is proportional in distribution by sector to water supply by sector. For example, the water supply industry accounts for 49% of the total water abstracted, so it is also responsible for producing 49% of wastewater.

Part 2: Material Flow Analysis

2.1 Methodology

3. The flow of sludge would usually end up in Landfill, Incineration, Farmland, Surface Water or Others, as shown in the Department for Environment, Food & Rural Affairs (DEFRA) report Sewage Treatment in the UK. However, due to outdated nature of this report and the data contained within, as well as the lateness in receiving wastewater data, this flow was not included in the analysis.

A note on wastewater data: Wastewater data coming from each sector was not available. As a result, the assumption had to be made that the proportion of wastewater coming from each sector was proportional to the water abstracted by each sector. This is an approximated assumption and is unlikely to be reflective of a real condition. Furthermore, the data applies to the WMCA region (as opposed to the West Midlands which was used throughout). This will entail slightly smaller figures for Wastewater.

Step 4: Measuring greenhouse gas emissions

Emissions associated with the flows of materials and waste through each sector were measured.

Scope of emission

The DEFRA Environmental Report Guidelines were used.

- *Scope 1 (Direct) GHG emissions*: These include emissions from activities owned or controlled by your organisation that release emissions into the atmosphere. They are direct emissions. Examples of Scope 1 emissions include emissions from combustion in owned or controlled boilers, furnaces, vehicles; emissions from chemical production in owned or controlled process equipment.
- *Scope 2 (Energy indirect) GHG emissions*: These include emissions released into the atmosphere associated with your consumption of purchased electricity, heat, steam and cooling. These are indirect emissions that are a consequence of your organisation's activities, but which occur at sources you do not own or control.
- *Scope 3 (Other indirect) GHG emissions*: Emissions that are a consequence of your actions, which occur at sources which you do not own or control and which are not classed as Scope 2 emissions. Examples of Scope 3 emissions are business travel by means not owned or controlled by your organisation, waste disposal which is not owned or controlled, or purchased materials.

Conversion Factors

The following steps were taken:

1. National GHG conversion factors were used to produce the Emissions Sankey flowchart by accounting for the estimated GHG emissions produced by the use and consumption of natural resources and minerals (scope 3 upstream), water (scope 3 upstream), fossil fuels (scope 3 upstream), waste (scope 3 downstream) and electricity distribution (scope 1).
2. Conversion factors for material use of minerals and energy carriers are applied with conversion factors from the UK GHG conversion factors dataset.

- Fossil fuels – gross caloric values (CVs) used (rather than net CVs), to report the complete combustion of energy carriers.
- When information is not unavailable regarding if a product from the Exiobase or Waste interrogator database is of 'primary material product', 're-used', 'open-loop source' or 'closed-loop source', the conservative assumption was made that the material is of 'primary material product', ie. a product made from virgin materials.

3. Information on metals is very limited in this database, so data on metals conversion factors is gathered from a journal paper entitled the Life Cycle Assessment on Metals.
4. Similarly, for natural resources and foods, conversion factors are taken from the source Our World in Data. Food conversion factors were only accounted for in the stages of "Land use change", "Animal feed" and "Farm". Stages of "Processing", "Transport", "Packaging" and "Retail" were discarded. The database captures the global average impact of those stages, which means the range of impacts from these stages can vary significantly and introduce error to the model, which is why we have excluded them. In contrast, the stages 'land use change', 'animal feed' and 'farm' are generally modelled for each region in the database, so are much more accurate and less likely to introduce error into the calculations.

A note on conversion factors limitations: For material conversion factors, assuming that materials are of 'primary material product', when not specified otherwise, may lead to some conservative scope 3 (upstream and downstream) GHG emission figures.

GHG emissions

Part 2: Material Flow Analysis

2.1 Methodology

The following steps were taken:

1. Whereas the conversion factors are used to represent Scope 2 and 3 emissions, Scope 1 emmisions are directly available from National and Regional databases for each sector.
2. LA data on Scope 1 emissions from each sector group was considered for use in this analysis, however data was missing for the scope of this analysis regarding Energy generation. Furthermore, distinction between Industry and CD&E is not clear and therefore it is difficult to know the split of emissions between these sectors. As a consequence, national emissions data was used and interpolated for the region.
3. For Transport emissions - air and shipping transport does not occur within the West Midlands area and is therefore excluded from the analysis.

Step 5: Interpolation

Interpolation was used when regional data for the West Midlands was unavailable or incomplete for use. The following steps were taken:

4. Interpolation was used when regional data for the West Midlands was unavailable or incomplete for use.
5. Interpolation for National (UK) to regional (West Midlands) was performed on data for natural resources, minerals, energy and emissions. Interpolation for Midlands to West Midlands was performed on data for water abstraction.
6. For the sectors of Industry & Commercial, CD&E, Agriculture & Food and Transport, interpolation was done with the use of the national dataset of Gross Value Added (GVA) by sector.
7. For Housing, interpolation was done with the use of population data.
8. No GVA information is given for interpolating Energy generation for the region. As a consequence, the GVA's from other sectors are averaged, and used to interpolate for Energy generation.

A note on interpolation limitations: Interpolating from national to regional may not always be representative of the West Midlands' actual figures.

Step 6: Measuring products & services and losses

The final steps was to measure products and services as well as losses. The following steps were taken:

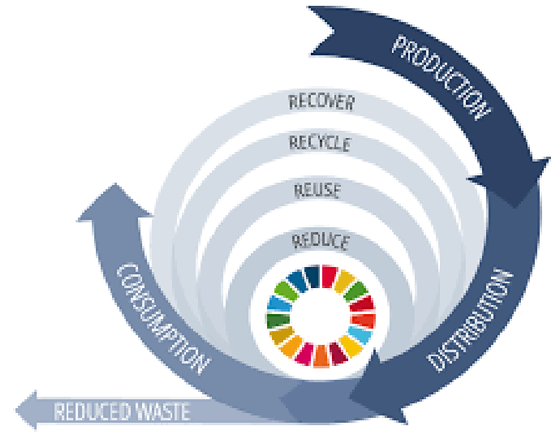
1. Products & Services are the portion of materials going into each sector which do not end up as waste. They form the Product & Services that we acquire and use. They are calculated from the difference in materials (natural resources and minerals) entering a sector, and the waste leaving.
2. Losses are valuable materials and resources lost during transmission and conversion due to system inefficiencies or failures. Information regarding losses in manufacturing and consumption of products is difficult to obtain. However, this section was included to indicate an area which should be considered.

Overview of Key Findings for Material Analysis:

When looking at the material flow analysis for the region, we can see that:

- Overall, the West Midlands region consumes 26,290,000t of minerals (minerals include ores, metals, stone, sand and metals). Most minerals are consumed within the CD&E sector. In comparison, the region consumes 5,700,000t of natural resources, the majority of which goes to the agricultural and food sector.
- When looking at outputs from the West Midlands' analysed sectors, a total of 9,800,000t of waste is recycled or re-used, whilst 7,385,000t of waste still go to landfill or is incinerated. A more detailed analysis of what happens to this waste once it is recycled and re-used should be conducted at local authority level to inform specific waste strategies.
- Based on the sectors analysed, 58% of the materials used in the West Midlands economy do not go to landfill or incinerator, which is in line with the UK average.

The greenhouse gas emissions associated with these flows of materials and waste is presented on page 71. Material and waste flows were also analysed for each individual sector and are presented in the next pages of this report.

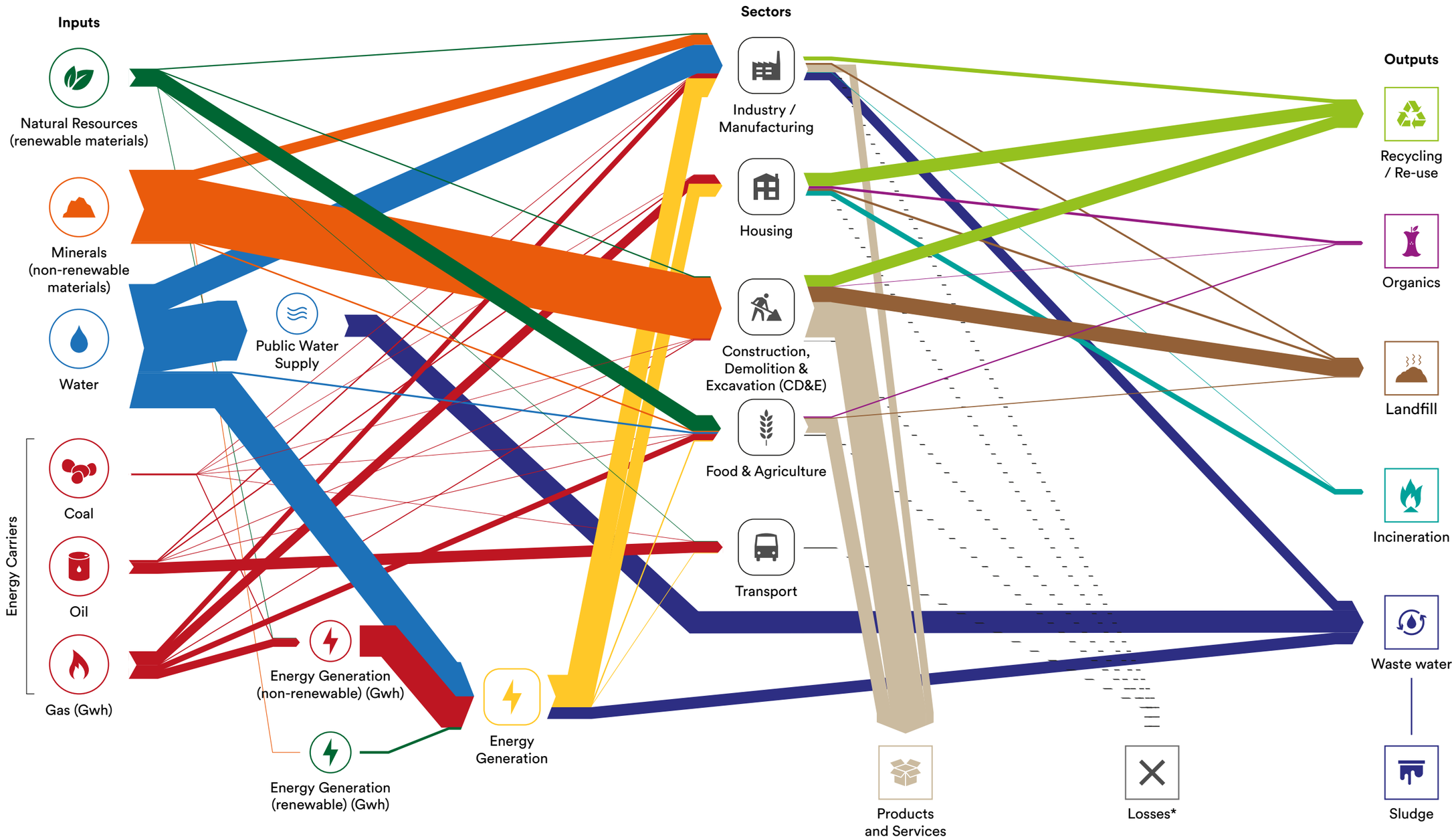


Part 2: Material Flow Analysis

2.2 Overview

Key:

- Natural Resources - kilotonnes
- Minerals - kilotonnes
- Water - Mm^3
- Energy Carriers - kilotonnes
- Energy - Gwh
- Recycling - kilotonnes
- Organics - kilotonnes
- Landfill - kilotonnes
- Incineration - kilotonnes
- Losses - kilotonnes



*Note: Insufficient data is available for losses, so an indicative flow has been represented by a hashed fill.

Part 2: Material Flow Analysis

2.3 Greenhouse Gas Emissions

It is essential that a movement towards a circular economy supports wider decarbonisation efforts. It is why Scope 1, 2 and 3 greenhouse gas emissions associated with material flows in the region were measured based on the best available data.

A breakdown of emissions is provided below.

Scope of Emissions	Total Emissions (tCO_2e/pa)
Scope 1	39,362
Scope 2	6,755
Scope 3- upstream	38,911
Scope 3- downstream	2,473
Scope 3- total	41,384

The use of materials in the West Midlands accounts for the largest amount of greenhouse gas emissions in the region. Producing an estimated 32,828tCO_2e each year, 26,469tCO_2e are associated with the use of minerals compared to 6,359tCO_2e for the use of natural resources.

It is interesting to note that whereas the CD&E sector is the largest consumer of minerals in the region, the industry and manufacturing sector is responsible for the most greenhouse gas emissions. This is because the processes used in this sector are more carbon-intensive than those associated with the CD&E sector. More information is provided in the sectoral analysis.

Another significant source of greenhouse gas emissions in the region comes from energy consumption. Emissions associated with the energy consumed by the sectors analysed totals 6,755tCO_2e per year. This high-level of greenhouse gas emissions can be explained by the region's reliance on consuming non-renewable energy.

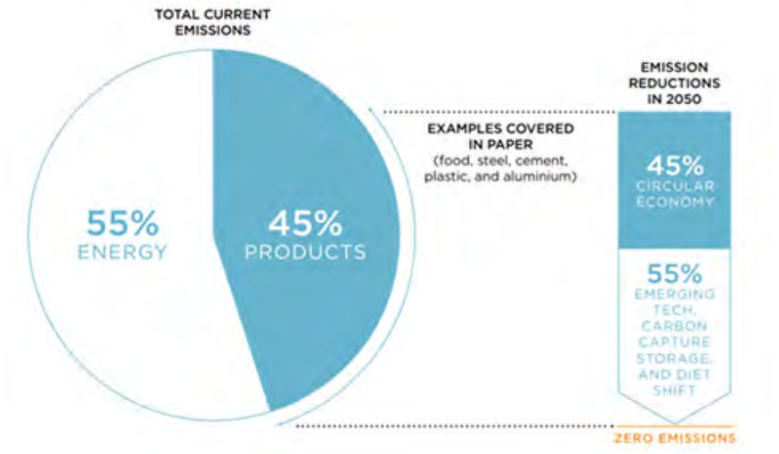
The West Midlands accounts for only 2% of renewable energy generated in the UK. The region uses 2,120.94 Gwh of renewable energy compared to 28,624.40 Gwh of non-renewable energy (coal, oil and gas). That represents a 1:13 ratio, which is smaller than the UK-wide ratio of 1:7.

The West Midlands ration is lower than the UK-wide ratio due to its lower use of wind power compared to the rest of the UK.

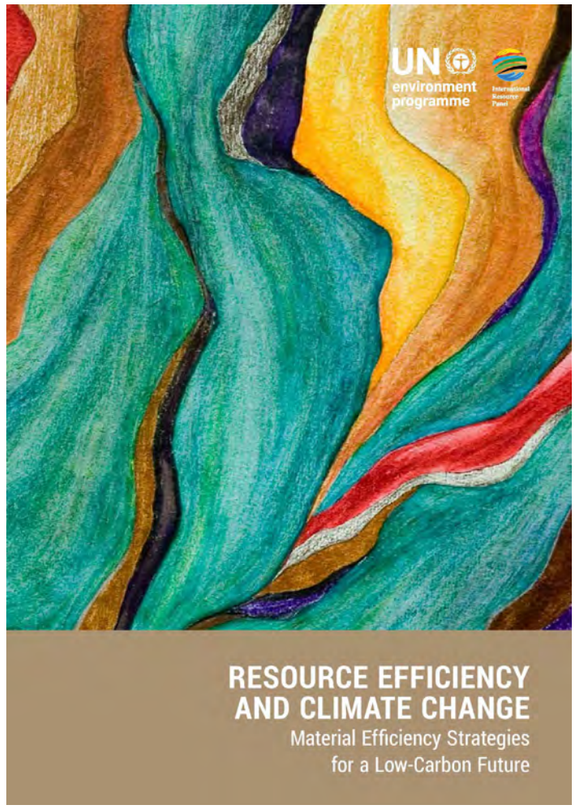
Great carbon savings can be achieved by switching to renewable energy. This routemap supports a wider transition to renewable energy for the West Midlands.

This will require developing local energy plans, investing in enabling digital infrastructure and storage capacity, as well as working with energy providers to invest in local heat and power networks.

The Circular Economy Routemap focuses on resources rather than carbon emissions, whilst recognising the synergies between low-carbon and circularity. Efforts to tackle the climate crisis have predominantly focused on using renewable energy and increasing energy efficiency. These measures only address 55% of greenhouse gas emissions. The remaining 45% of emissions comes from producing our consumer goods such as clothes, cars, toys and electronic goods (see diagram below). These emissions can be tackled by transitioning to a circular economy.



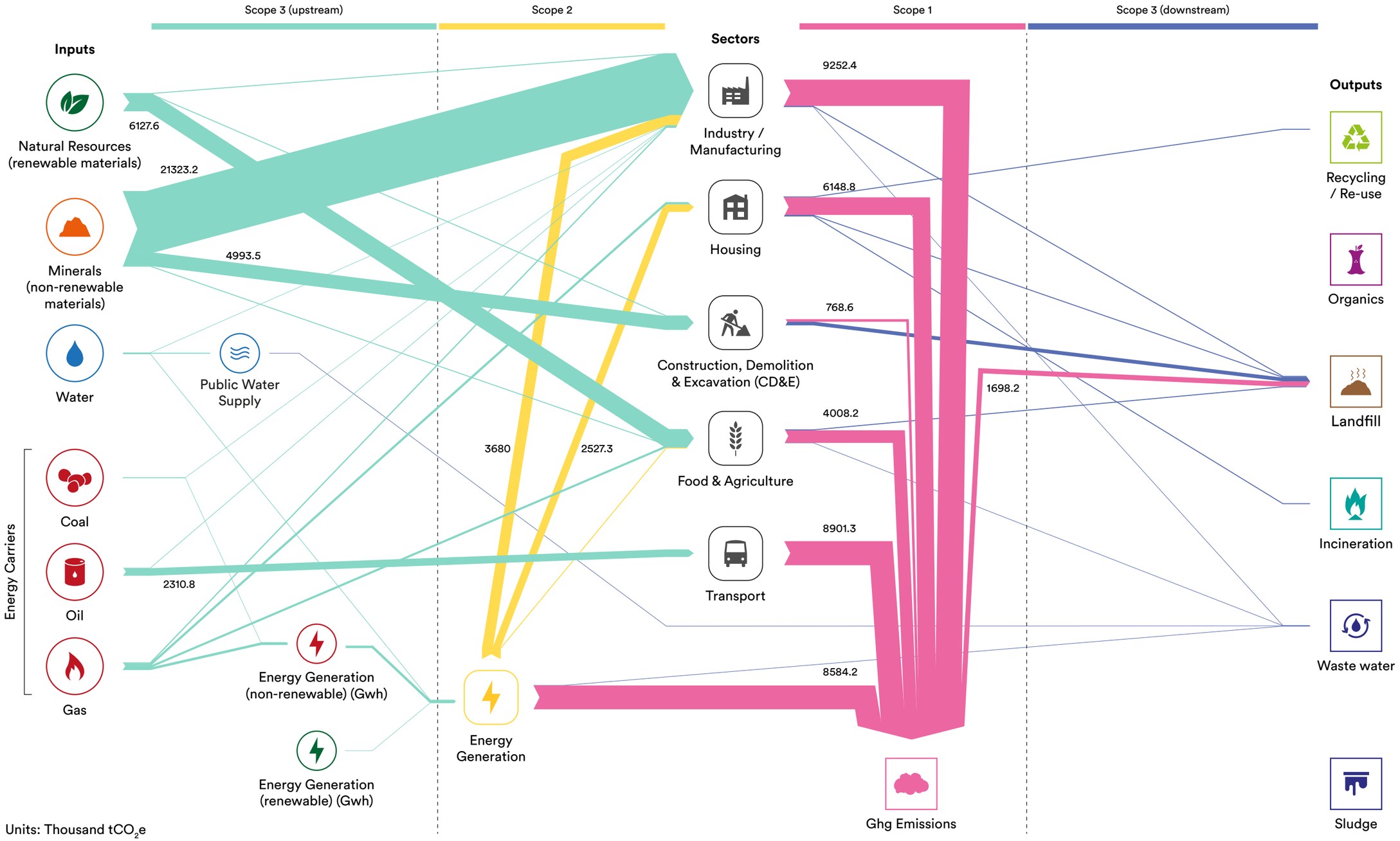
The impact of the circular economy on carbon reductions



According to the UNEP report, Scope 3 emissions from the production of materials increassed from 5GT of CO2e in 1995 to 11 Gt in 2015. The circular economy can help reduce this and contribute to decarbonisation.

Part 2: Material Flow Analysis

2.3 Greenhouse Gas Emissions



Part 2: Material Flow Analysis

2.4 Industry and Manufacturing

Analysis

Inputs

- The industry and manufacturing sector is the second largest consumer of minerals, accounting for 15% of mineral consumption in the region (equivalent to 3.3 million tonnes per year).
- The region's industry and manufacturing sector mineral consumption is higher than that of the UK's industry and manufacturing sector, which accounts for 10%.
- The sector also consumes 575,000t of natural resources.
- Industrial and manufacturing processes accounts for 22% of water usage in the region, consuming 217 million m^3 of water every year.
- 65% of coal consumption in the region is accounted for by the industry and manufacturing sector, which also relies heavily on gas.

Outputs

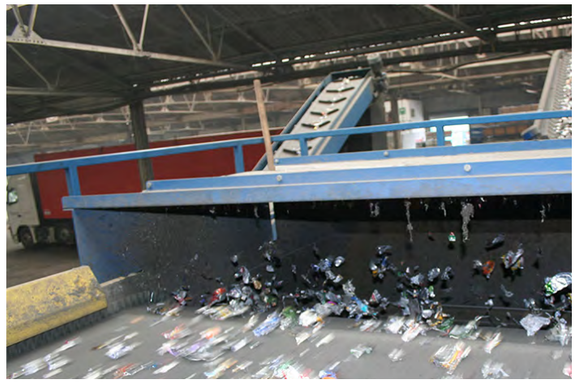
- An impressive 72% of this sector's waste does not go to landfill, although further analysis of what happens to the waste is required. It is likely to be low-value recycling and re-use.
- Based on this analysis, 1,260,000t out of 1,760,000t of waste is reused or recycled. This could be further increased through industrial symbiosis and re-manufacturing processes.
- 400,000t of waste from the industry and manufacturing sector still ends up in landfill and 51,000t to incineration, which has impacts on the natural environment and greenhouse gas emissions.

GHG Emissions

- Manufacturing of basic iron and steel and ferro-alloys, rubber and plastic products and aluminium are the most carbon-intense industrial and manufacturing activities in the West Midlands.
- By adopting circular processes, resource use optimisation and reduction in CO2 emissions can be achieved.

Example of Circular Economy Opportunities

- Industrial symbiosis can be maximised with co-location of industries and creation of sharing platforms. An example is Kalundborg in Denmark.
- Industrial sheds and warehouses can be transformed into sustainable powerhouses as was seen with the NewLogic III building in Tilburg, Netherlands. These types of projects could be trialled at Tyseley Energy Park.
- Reprocessing of metals will see an increase in job demand worlwide. For example, reprocessing of secondary lead into new lead, zinc and tin will see 15% job demand growth worldwide by 2030. Reprocessing of secondary previous metals into new precious metals by 11% (See Alutrade case study). Additionally, opportunities around vehicle scrappage schemes could be explored.
- The £250 million battery Gigafactory project combined with a £35 million investment in the electric charging network to develop the battery and charging technology needed, will create 10,100 high value green new jobs and 29,700 jobs a year in construction in the short term. It is an opportunity for the region to become a hub for battery remanufacturing.
- The Gigafactory would also build upon existing projects like RELIB by the Faraday institute or Warwick University's Centre of Excellence for Batteries. This includes building on the work of the Warwick Manufacturing Group.
- The West Midlands is already pursuing innovations in transport manufacturing such as circular supply chains for luxury cars in Birmingham or Operation Paperclip. The latter aims to advance cutting-edge automotive R&D capability and safeguard or create up to 5,500 jobs across the region.
- Industry and manufacturing is still reliant on dirty fuels. Opportunities exist around transitioning to renewable energy.



Alutrade, West Midlands

Alutrade, an Oldbury-based aluminium recycler, identified a new business opportunity in alternative markets for aluminium recycling. Alutrade started extracting both aluminium and steel from drink cans. As a result, it has diverted more than 6,000t of aluminium waste from the landfill and managed to safeguard jobs when manufacturing decline in the UK is impacting the aluminium industry.

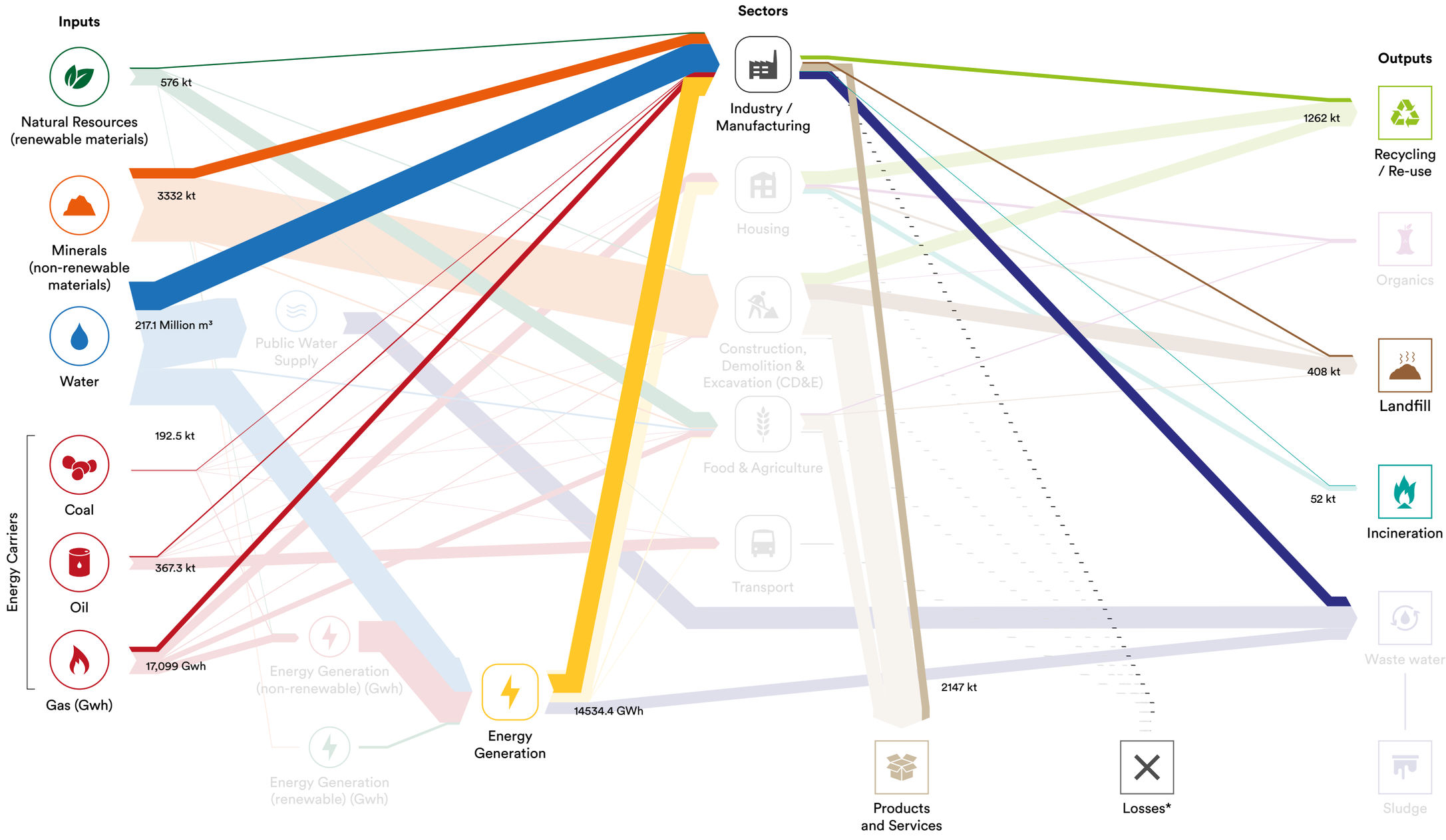
As part of its Repowering the Black Country's programme, the Black Country is looking to decarbonise its industrial cluster, including re-starting its aluminium industry. The programme aims to create 2,550 new jobs and safeguard 2,200 jobs whilst creating the world's first zero carbon industrial cluster by 2030.

Part 2: Material Flow Analysis

2.4 Industry and Manufacturing

Key:

- Natural Resources - kilotonnes
- Minerals - kilotonnes
- Water - Mm³
- Energy Carriers - kilotonnes
- Energy - Gwh
- Recycling - kilotonnes
- Organics - kilotonnes
- Landfill - kilotonnes
- Incineration - kilotonnes
- Losses - kilotonnes



*Note: Insufficient data is available for losses, so an indicative flow has been represented by a hashed fill.

Part 2: Material Flow Analysis

2.5 Housing

Analysis

In this material flow analysis, the housing sector focuses on resource consumption and waste generated by residential households.

Inputs

- Domestic households in the West Midlands account for 42% of gas consumption. Gas is mainly used for space and water heating.
- Gas accounts for 56% of non-renewable energy use in the region, compared to 42% for oil and 2% for coal. This is important when considering wider transition away from non-renewable energy sources.
- Based on available data, housing accounts for 49% of water usage in the region. Housing consumed 968 m^3 of water every year. This high water use signals some potential opportunities in working with residents to decrease their water usage.
- Despite this information, further analysis of water flows in the region, including leaks, is required.

Outputs

- Looking at household waste flows, 4 million tonnes of waste from households does not go to landfill. The scope of this analysis does not include a more detailed breakdown. It is recommended that further analysis is conducted to determine how this waste is recycled/re-used.
- It is worth noting that 550,000t of waste still goes to landfill and that 1.6 million tonnes of waste from housing is incinerated. This represents 23% of all waste coming from the housing sector. The incineration of waste and its wider impact on the environment needs to be carefully considered.
- The analysis conducted on the housing sector confirms that interventions targeting reduction in consumption patterns as well as waste minimisation from domestic households would be beneficial for the region.
- It is worth noting that WMCA is not a waste authority and therefore waste management systems and policies are under the control of local authorities.

Potential Circular Economy Opportunities

- Projects such as the Crystal Palace Library of Things provide incentives and enable communities to reduce their waste and reuse. Reuse platforms and peer-to-peer networks, including Repair Cafés and community hubs are key to strengthen the sharing economy.
- For example, if 50% of the West Midlands' population engaged in reuse networks (similar to Freegle), 2,865 tonnes of waste can be diverted from the landfill every year. These type of sharing platform also create value for their users. In this case, it could unlock up to £2,034,845 a year.
- Behavioural change programmes focusing on reducing water and energy demand from domestic households should complement wider system change required to support a transition to a circular economy.
- For example, to reduce waste generated by households, wider investment in the region's waste infrastructure is required. Local authorities will need to put in place these systems that enable residents to reduce their household waste.
- Local authorities will also need to review waste-related policies.
- In particular, waste segregation, collection and other related policies need to be streamlined between the region's local authorities.
- Local authorities should also align their targets with those set by the national government including achieving zero waste to landfill.

The ReUsers

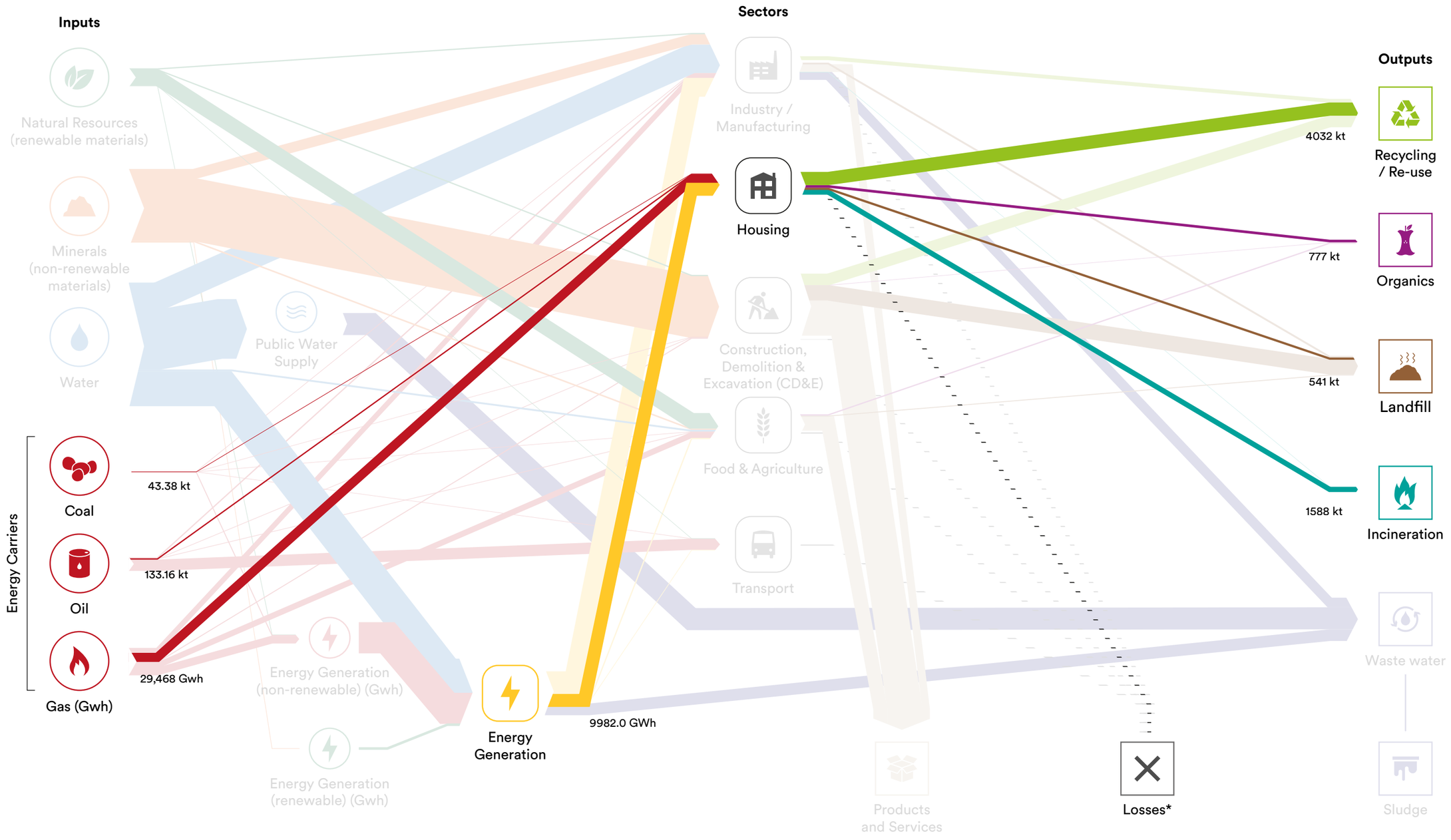
The ReUsers rescues, restores and recycles second-hand items. By doing so, they prevent around 250 tonnes of waste entering landfill every year and provide high-quality used goods at a cost-effective price.

Part 2: Material Flow Analysis

2.5 Housing

Key:

- Natural Resources - kilotonnes
- Minerals - kilotonnes
- Water - Mm³
- Energy Carriers - kilotonnes
- Energy - Gwh
- Recycling - kilotonnes
- Organics - kilotonnes
- Landfill - kilotonnes
- Incineration - kilotonnes
- Losses - kilotonnes



*Note: Insufficient data is available for losses, so an indicative flow has been represented by a hashed fill.

Part 2: Material Flow Analysis

2.6 Construction, Demolition and Excavation

Analysis

The Construction, Demolition and Excavation (CD&E) sector in the West Midlands is responsible for a staggering quantity of material use and waste generated.

Inputs

- Based on the data collected, the CD&E sector consumes 18 million tonnes of minerals every year. The CD&E sector is the largest consumer of minerals in the region.
- It accounts for 82% of the region's mineral use. This is roughly the same as the UK's CD&E sector's consumption, which accounts for 88% of the country's mineral consumption.
- Out of these 18 million tonnes of material used, 10 million tonnes are processed and transformed into 'outputs', in this instance buildings and infrastructure.
- 3.5 million tonnes of material does not go to landfill, although further analysis about how these materials are re-used and/or re-processed is required.

Outputs

- However, 4.5 million tonnes of waste still makes its way to landfill every year. This represents 58% of the CD&E waste.
- A study by Reconomy concluded that 1 tonne of construction waste can be worth up to £1,000. This means the CD&E sector of the West Midlands is currently wasting £5 billion worth of materials each year by letting it go to the landfill.
- Addressing the material consumption and waste generated by the CD&E sector is critical given the extensive growth predicted for the region.
- By addressing the large environmental footprint of the CD&E sector, the region can unlock economic and social opportunities whilst reducing this sector's impact on the natural environment.

Potential Circular Economy Opportunities

- Circular design and circular strategies for the construction sector present an excellent opportunity to design out waste and pollution at the onset of the construction process. WMCA's Zero Carbon Homes Charter already encourages circular design.
- It is key to design for longevity, flexibility, adaptability and disassembly, components that have been embedded for example in Port Loop's sustainability principles.
- Beyond how things are built, strategic planning can play an important role in building sustainable communities. Integrated housing, transport and energy systems are required to help build mixed-used developments that promote low-carbon and circular lifestyles.
- Adopting circular design principles can also reduce embodied carbon to up to 50%.
- By choosing lightweight structures, the amount of materials used in construction can also be greatly reduced.
- Considerations also need to be given to using renewable materials, low-embodied carbon materials, carbon capture building materials, natural materials as well as recycled materials.
- WMCA could also become a leader in Advanced Manufacturing in Construction (AMC) and Modern Methods of Construction (MMC).
- There is an opportunity for WMCA and local authorities to lead on sites they acquire, invest or on public land they develop.
- Opportunities also exist for brownfield regeneration and land remediation, particularly with the announcements of the National Brownfield Institute in Wolverhampton.
- It is important to capitalise on the University of Wolverhampton's built environment expertise and the City of Wolverhampton's ambition to create a National Centre for Sustainable Construction and Circular Economy.

Jack Moody Holding

With the support of NISP, Jack Moody Holding, a construction landscaping and recycling company adopted a new approach to excavated materials. All the material excavated was taken to their site head office for aggregate separation. Recycled material was taken back to the site for refill, reducing the need for virgin material. The company diverted 10,180t of materials away from the landfill and saved 9,267t of virgin material.

HS2

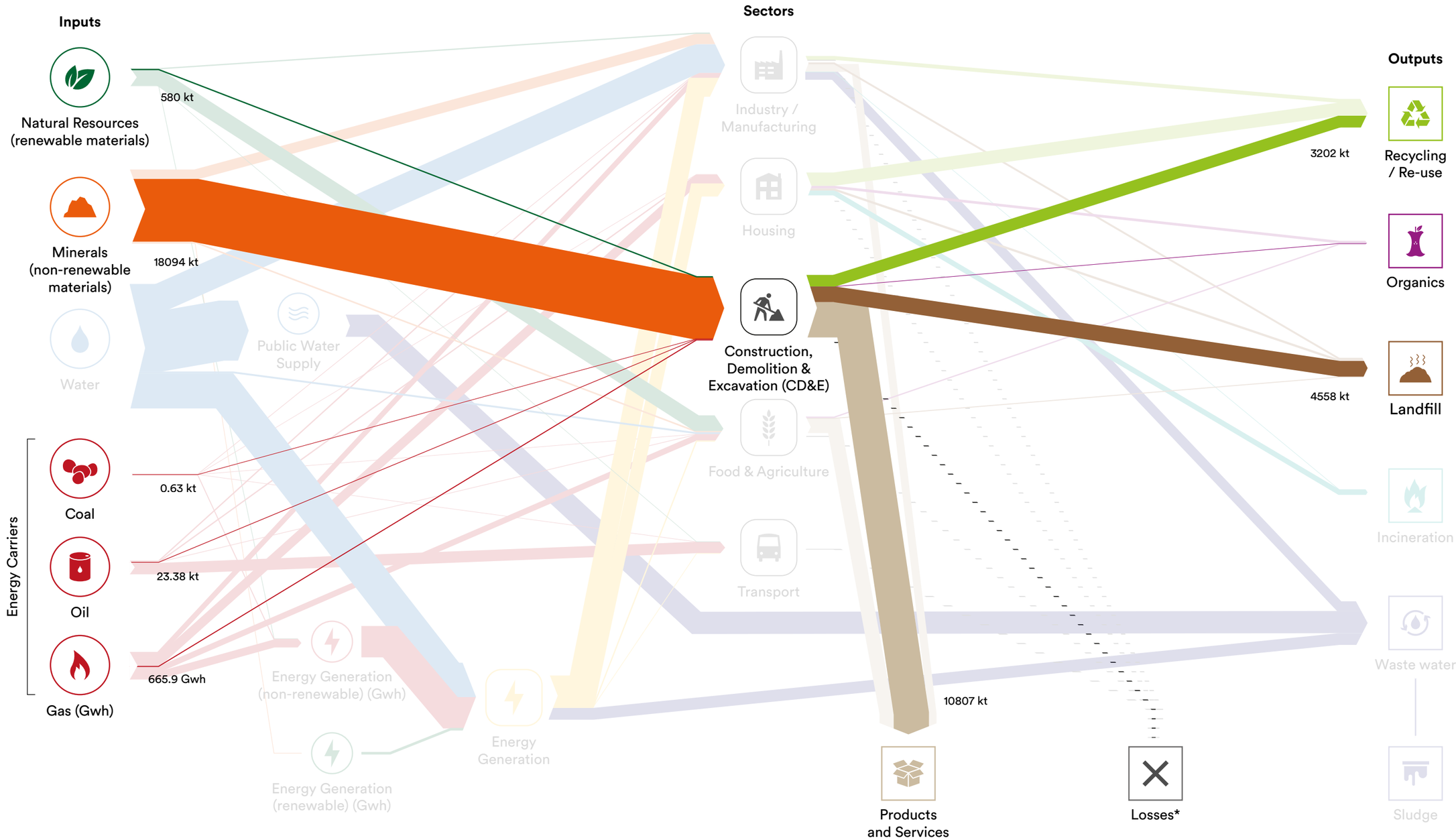
The construction of HS2 stations in the West Midlands offers an opportunity to trial circular design and construction processes.

Part 2: Material Flow Analysis

2.6 Construction, Demolition and Excavation

Key:

- Natural Resources - kilotonnes
- Minerals - kilotonnes
- Water - Mm³
- Energy Carriers - kilotonnes
- Energy - Gwh
- Recycling - kilotonnes
- Organics - kilotonnes
- Landfill - kilotonnes
- Incineration - kilotonnes
- Losses - kilotonnes



*Note: Insufficient data is available for losses, so an indicative flow has been represented by a hashed fill.

Part 2: Material Flow Analysis

2.7 Food and Agriculture

Analysis

A farm-to-gate scope has been used for the food and agricultural sector.

This sector is the largest consumer of natural resources, consuming 4,502,000t of renewable materials each year.

The sector relies heavily on gas, accounting for 21% of gas consumption in the region. In this sector, gas is used mainly in food processing activities.

Gas consumption in the sector dwarfs coal and oil use, representing 99% of the sector's energy consumption. Once again, this is an important statistic in the context of wider decarbonisation and transitioning away from gas. It will be important to identify the most energy intensive processes within the agricultural supply chain and find alternative renewable sources of energy.

High-quality data on the agricultural and food sector's water usage could not be obtained. It was determined that the sector uses 14 million m^3 of water each year. Water usage will also need to be addressed to reduce the impact of food supply chains on the natural environment.

When looking at waste flows, a large amount of food waste still goes to the landfill. 37% food waste goes to the landfill, which represents 238,000t of food waste. This is likely due to food processing plants not separating organic waste. Organic waste generated on farms does not end up in landfill with 378.000t of food waste is composted.

Several opportunities exist within the agriculture and food system. Targeting large agri-businesses and their supply chains will help reduce energy and water use throughout their processes. Other interventions should also focus on food growing opportunity within local community to reduce emissions associated with food transportation.

Potential Circular Economy Opportunities

- Circular food systems do not generate waste with all by-products or surpluses redistributed or re-used as inputs. In a circular economy, organic resources such as those from food by-products, are free from contaminants and can safely be returned to the soil in the form of organic fertiliser.
- Some of these by-products provide additional value by creating new food products, fabrics for the fashion industry, or as sources of bio-energy. These cycles regenerate living systems, such as soil, which provide renewable resources, and support biodiversity.
- Opportunities also exist in terms of eliminating food waste going to the landfill. There is an opportunity to tie food waste programmes with wider soil health programmes of work.
- Opportunities also exist to enhance food packaging and use bio-plastic or other alternatives. This will require investments in waste infrastructure to support processing of bio-plastics. This should build on existing research such as SIMBIO or NOTPLA.
- The food system also offers wider opportunities to promote the circular economy and food resilience within local communities. Such opportunities include community hubs, urban agriculture initiatives or community-supported agricultural programmes. An example is Lufa Farms a Montreal food company who are pioneers in the area of urban farming. In 2011, Lufa planted the first seeds in the world's first commercial rooftop greenhouse.
- Encouraging local food growing not only contributes to food resilience and security, it can positively impact health and wellbeing by encouraging healthier diets and it delivers social value to local communities.
- The region can also build on the work by UKRI's Smart Sustainable Plastic Alliance as well as the UK Plastics Pact by WRAP.

Greenacres Farm, Shropshire

Mark Lea owns and farms Greenacres Farm with his wife Liz, in Kemberton in Shropshire. Green Acres is 450 acre organic farm which Mark farms using agro-ecology techniques.

Five Acre Community Farm, Coventry

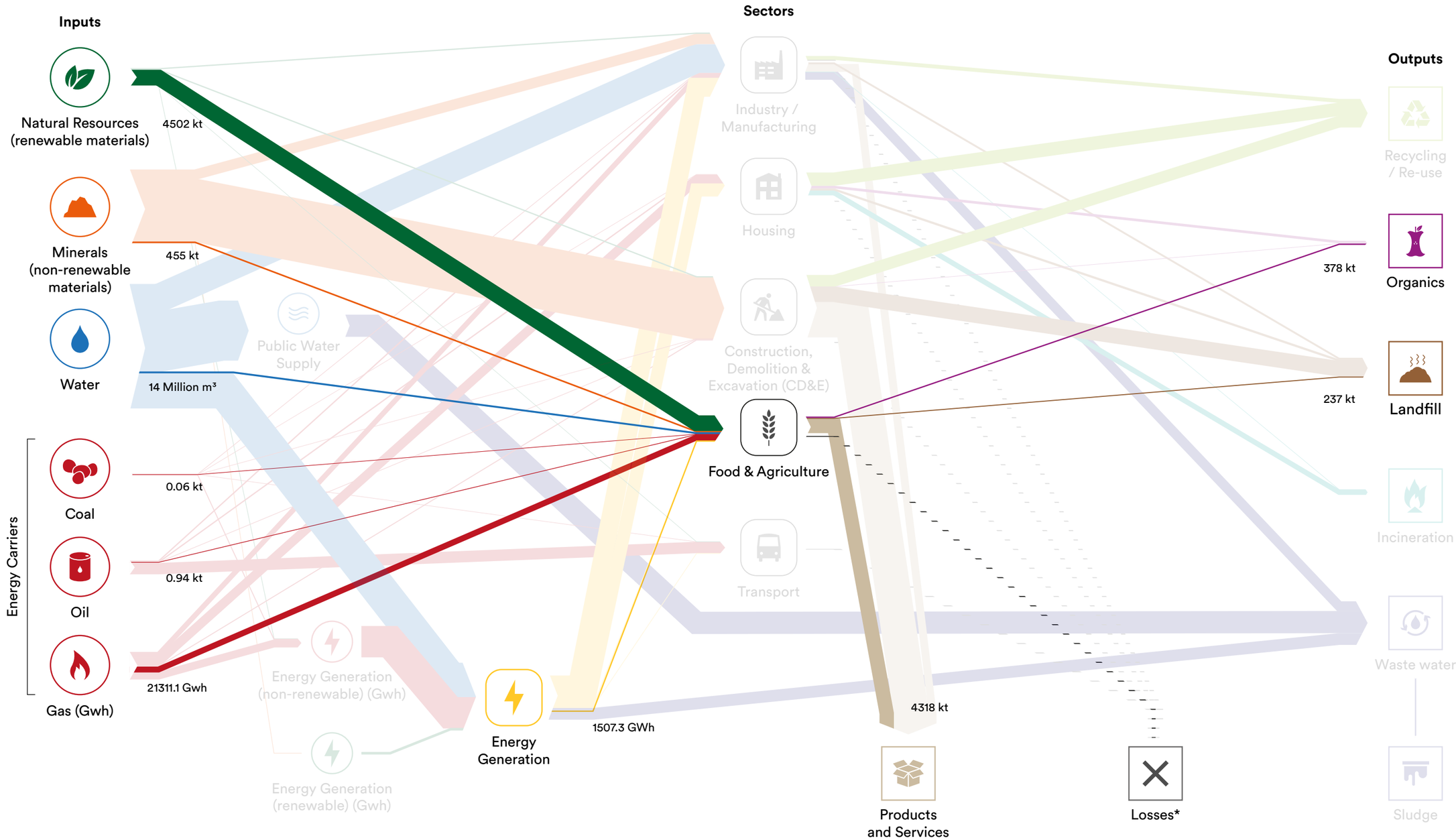
Becca Stevenson is the grower at Five Acre Community Farm near Coventry, a Community Supported Agriculture (CSA) scheme.

Part 2: Material Flow Analysis

2.7 Food and Agriculture

Key:

- Natural Resources - kilotonnes
- Minerals - kilotonnes
- Water - Mm³
- Energy Carriers - kilotonnes
- Energy - Gwh
- Recycling - kilotonnes
- Organics - kilotonnes
- Landfill - kilotonnes
- Incineration - kilotonnes
- Losses - kilotonnes



*Note: Insufficient data is available for losses, so an indicative flow has been represented by a hashed fill.

Part 2: Material Flow Analysis

2.8 Transport

Analysis

The transport sector has been analysed as part of this baseline analysis. For the purpose of this analysis, the transport sector here refers to the energy used by vehicles to move people and goods. Vehicle manufacturing and battery development sit within the industry and manufacturing section.

Inputs

- Transport is the biggest consumer of non-renewable energy in the region.
- It accounts for 35% of non-renewable energy in the region, which represents 42,939.36 GWh per year.
- Transport is the largest consumer of oil, accounting for 84% of oil consumption in the region.
- The transport sector consumes approximately 8,000t of natural resources. This includes additives and bio-fuels, woods and products of wood and cork, as well as products of forestry or logging used for fuel.

GHG Emissions

- A transition to renewable energy to power the transport system will be key for the West Midlands to reduce its carbon footprint and transition to a circular economy.

Potential Circular Economy Opportunities

- The logistics and transport sectors are enablers of the circular economy by enabling better sharing of materials between different companies and/or sectors.
- Opportunities also exist in transitioning away from oil and coal and move towards renewable source of energy (biogas, hydrogen etc.). There are some opportunities around using waste heat as fuel for vehicles, which is already being trialled at the Tyseley Energy Park.
- It is worth exploring the use of street sweeping machines to recover materials, including precious metals, and to prevent micro plastics from entering the ocean.
- Opportunities to adopt first and last mile, fully electric, reverse logistic chains for urban areas should be explored in order to reduce traffic and HGV movements.
- It will also be critical to look at innovations within the transport system, including hydrogen refuelling, lightweight rail, reverse logistics and consolidation hubs, autonomous vehicles and light rail freight.
- In particular, this Circular Economy Routemap should build on the Very Light Rail Innovation Centre in Dudley as well as Coventry City Council's project on very light rail. The latter project aims to deliver all of the benefits of trams but at a fraction of the cost in order to help improve air quality and reduce congestion.
- Opportunities also exist by shifting from a culture of mass ownership to one of sharing, including sharing modes of transport. Active travel and public transport should be promoted as well as Mobility as a Service. For example, mobility credits could drive changes in people's transport behviours and encourage them to use public transport.
- Opportunities with vehicle scrappage schemes can help divert car and other vehicle waste away from landfill and encourage a better reuse of materials.
- Specific transport opportunities can be explored as part of the review of the Local Transport Plan.

Midlands Future Mobility

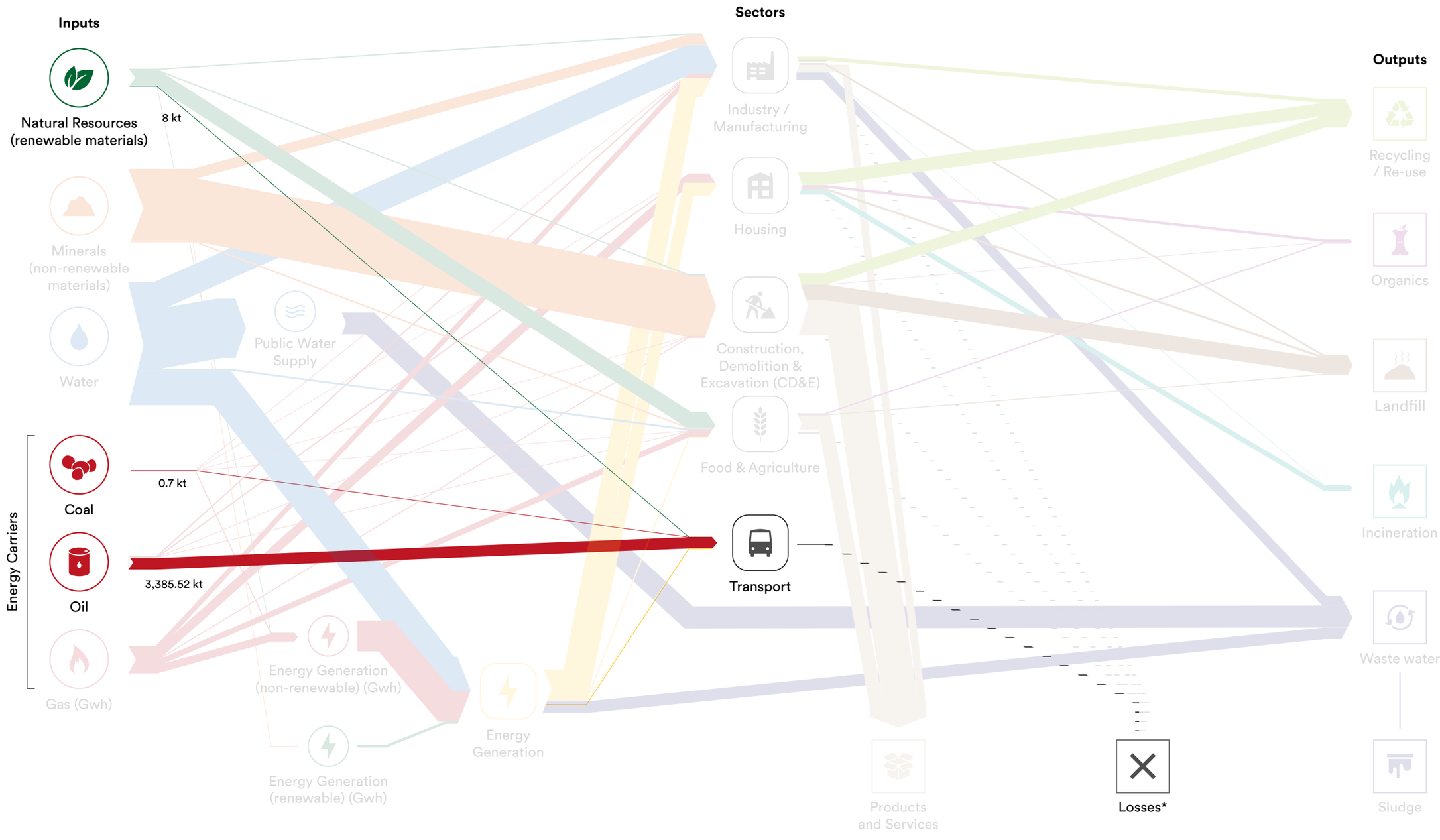
Midlands Future Mobility, by Transport for West Midlands, is instrumenting more than 100 miles of roads in Coventry, Solihull and Birmingham for Computer Aided Vehicles (CAV) developers to come and test their new technology and bring their manufacturing operations to the region.

This is helping to create a cluster effect that is establishing the West Midlands as a premier location for CAV-related companies. It will support better logistics and movements across the region, enabling circular business models and a reduction in carbon emissions associated with transport.

Transport for West Midlands is setting up a Future Mobility Zone which seeks to deploy new mobility services and transport innovation, improving journeys across the region.

Part 2: Material Flow Analysis

2.8 Transport



*Note: Insufficient data is available for losses, so an indicative flow has been represented by a hashed fill.

Part 3: Summary

Context Analysis Summary

The context analysis confirmed that existing policies, strategies and key documents at the international, national, regional and local level rarely focus solely on the circular economy. When they do, they do not always provide specific steps, requirements or mechanisms that supports a transition to a circular economy. The circular economy is often mentioned as a way to reduce greenhouse gas emissions and support a transition to net zero.

A comprehensive policy framework is vital to help scale the transition across all sectors. Policies are but one lever that WMCA and its constituent members can use to scale up the circular economy (see examples in table) Additional levers for change such as procurement, governance, skills, finance, planning and innovation. These are explored in depth in the routemap.

It is worth noting that the national procurement framework does not have specific requirements pertaining to the circular economy. None have been identified at the regional or local level, which will be explored further in this routemap.

Material Flow Analysis Summary

The material flow analysis provided valuable information as to which selected sectors consume the most material and/or generate the most waste.

The material flow analysis highlighted the need to focus on resource consumption rather than energy flows or GHG emissions, in order to avoid duplication with other ongoing work in the region.

The housing and transport sectors explored in this baseline analysis showcased energy flows and were therefore less relevant to the routemap development. We therefore produced more detailed material flow analyses for three sectors: industry and manufacturing, CD&E, as well as food and agriculture.

The three chosen sectors also happen to capitalise on the West Midlands' existing strengths in manufacturing, construction and food production. By adopting more circular processes, the region can unlock new, innovative business opportunities as well as additional value for local businesses and communities, whilst meeting their decarbonisation goals.

Example of Policy Framework
• Attach circular economy requirements and conditions to funds and commissioning frameworks. • Use procurement to grow new circular markets. For example, create tax and procurement policies that encourage repair, sharing, resale and remanufacturing. • Encourage product policies that focus on high-quality design for durable goods and packaging. • Implement labour market policies including developing standards to support trade in circular economy goods, services and systems. • Review and update digital and data regulations across the region to support information sharing and progress monitoring/reporting. • Support harmonisation of resource classification, definitions in waste legislations across region. • Support harmonisation of waste collection and sorting policies across local authorities including disincentivise landfilling and incineration. • Lobby national government to mainstream circular economy principles into national policies and ensure cross-regional alignment.
• Change construction and planning policies to stimulate circular design. • Encourage regenerative production through product and formulation design, sourcing practices and agricultural, land-use policies. • Implement spatial planning policies to enhance material flow and create business opportunities such as industrial symbiosis. • Support and implement extended product responsibility and deposit return schemes policies to strengthen resource loops. • Adapt accounting tools and align taxation and fee incentives with circular economy outcomes.

Example of policies supporting a transition to a circular economy

Part 4: Material Flow Analysis

4.1 Methodology Tables

Table 1: Breakdown of inputs

Inputs in Material and Waste Flow Analysis	Breakdown of Components Included
Natural Resources (renewable-resources)	• Food products not elsewhere classified (nec), and Beverages, Paddy rice, Wheat, Cereal grains nec , Vegetables, fruit, nuts, Plant-based fibers, Crops nec, Oil seeds, Sugar cane, sugar beet, Sugar, Products of vegetable oils and fats, and Processed rice. • Cattle, Pigs, Poultry, Meat animals nec, Animal products nec, Raw milk, Products of meat cattle. Products of meat pigs, Products of meat poultry, Meat products nec, Dairy products, Fish and other fishing products; services incidental of fishing (05) and other Fish products • Manure (conventional treatment), Manure (biogas treatment) • Products of forestry, logging and related services (02) Wood and products of wood and cork (except furniture); articles of straw and plaiting materials (20), Wood material for treatment, Re-processing of secondary wood material into new wood material • Tobacco products (16) • Textiles (17), Wearing apparel; furs (18), Leather and leather products (19) • Pulp, Wool, silk-worm cocoons, Secondary paper for treatment, Re-processing of secondary paper into new pulp, Paper and paper products, Printed matter and recorded media (22) • N-fertiliser, P- and other fertiliser, Chemicals nec; additives and biofuels
Minerals (non-renewable resources)	• Uranium and thorium ores (12), Iron ores, Copper ores and concentrates, Nickel ores and concentrates, Aluminium ores and concentrates, Precious metal ores and concentrates, Lead, zinc and tin ores and concentrates, and Other non-ferrous metal ores and concentrates • Plastics, basic, Secondary plastic for treatment, Re-processing of secondary plastic into new plastic, Rubber and plastic products (25) • Glass and glass products, Secondary glass for treatment, Re-processing of secondary glass into new glass • Stone, Sand and clay, Ceramic goods, Bricks, tiles and construction products, in baked clay, Cement, lime and plaster, Ash for treatment, Re-processing of ash into clinker, and Other non-metallic mineral products • Basic iron and steel and of ferro-alloys and first products thereof, Secondary steel for treatment, and Re-processing of secondary steel into new steel, Aluminium and aluminium products, and Secondary aluminium for treatment, and Re-processing of secondary aluminium into new aluminium, Lead, zinc and tin and products thereof, and Secondary lead for treatment, Re-processing of secondary lead into new lead, Copper products Secondary copper for treatment, and Re-processing of secondary copper into new copper • Other non-ferrous metal products and Secondary other non-ferrous metals for treatment, Re-processing of secondary other non-ferrous metals into new other non-ferrous metals, Precious metals, and Secondary precious metals for treatment, and Re-processing of secondary precious metals into new precious metals • Chemical and fertilizer minerals, salt and other mining and quarrying products nec.
Water	• Water
Energy Carriers	• Coal, Oil and Gas

Part 4: Material Flow Analysis

4.1 Methodology Tables

Table 2: Breakdown of sector activities

Sectors in Material and Waste Flow Analysis	Breakdown of Activities Included
Energy generation (non-renewable)	• Production of electricity by coal, Production of electricity by gas, Production of electricity by petroleum and other oil derivatives and Production of electricity.
Energy generation (renewable)	• Production of electricity by hydro, Production of electricity by wind, Production of electricity by biomass and waste, Production of electricity by solar photovoltaic, Production of electricity by solar thermal, Production of electricity by tide, wave, ocean, Production of electricity by Geothermal
Industry and Manufacturing	• Extraction of crude petroleum and services related to crude oil extraction, excluding surveying, Extraction of natural gas and services related to natural gas extraction, excluding surveying, Extraction, liquefaction, and regasification of other petroleum and gaseous materials • Mining of coal and lignite; extraction of peat (10), Mining of uranium and thorium ores (12), Mining of iron ores, Mining of copper ores and concentrates, Mining of nickel ores and concentrates, Mining of aluminium ores and concentrates, Mining of precious metal ores and concentrates, Mining of lead, zinc and tin ores and concentrates, and Mining of other non-ferrous metal ores and concentrates. Quarrying of stone, and Quarrying of sand and clay, and Mining of chemical and fertilizer minerals, production of salt, other mining and quarrying n.e.c. • Manufacture of fabricated metal products, except machinery and equipment (28) Manufacture of machinery and equipment n.e.c. (29) Manufacture of office machinery and computers (30) Manufacture of electrical machinery and apparatus n.e.c. (31) Manufacture of radio, television and communication equipment and apparatus (32) Manufacture of medical, precision and optical instruments, watches and clocks (33) Manufacture of motor vehicles, trailers and semi-trailers (34), Manufacture of other transport equipment (35), Manufacture of furniture; manufacturing n.e.c. (36), and Manufacture of gas. • Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials (20), Re-processing of secondary wood material into new wood material, Pulp, Re-processing of secondary paper into new pulp, Paper, and Publishing, printing and reproduction of recorded media (22) Manufacture of textiles (17), Manufacture of wearing apparel; dressing and dyeing of fur (18), Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear (19) Manufacture of coke oven products, Petroleum Refinery, Processing of nuclear fuel, Plastics, basic, Re-processing of secondary plastic into new plastic, Manufacture of rubber and plastic products (25) Manufacture of glass and glass products, Re-processing of secondary glass into new glass, and Manufacture of ceramic goods • Precious metals production , Re-processing of secondary precious metals into new precious metals, Aluminium production, Re-processing of secondary aluminium into new aluminium, Lead, zinc and tin production, Re-processing of secondary lead into new lead, Copper production, Re-processing of secondary copper into new copper, Other non-ferrous metal production, Re-processing of secondary other non-ferrous metals into new other non-ferrous metals, and Casting of metals.
Housing	• Household water consumption, waste and energy.
CD&E	• Manufacture of bricks, tiles and construction products, in baked clay, and Manufacture of cement, lime and plaster • Re-processing of ash into clinker, Manufacture of other non-metallic mineral products nec, and Manufacture of basic iron and steel and of ferro-alloys and first products thereof, and Re-processing of secondary steel into new steel Construction (45) and Re-processing of secondary construction material into aggregates
Food and Agriculture	• Cultivation of paddy rice, Cultivation of wheat, Cultivation of cereal grains nec, Cultivation of vegetables, fruit, nuts, Cultivation of oil seeds, Cultivation of sugar cane, sugar beet, Cultivation of plant-based fibers, and Cultivation of crops nec • Cattle farming, Pigs farming, Poultry farming, Meat animals nec, Animal products nec and Raw milk, Fishing, operating of fish hatcheries and fish farms; service activities incidental to fishing (05) and Manufacture of fish products. Processing of meat cattle, Processing of meat pigs, Processing of meat poultry, Production of meat products nec, Processing vegetable oils and fats, Processing of dairy products, Processed rice, Sugar refining, Processing of Food products nec, and Manufacture of beverages • Manure treatment (conventional), storage and land application, and Manure treatment (biogas), storage and land application, N-fertiliser, P- and other fertiliser, Forestry, logging and related service activities (02) and Wool, silk-worm cocoons Manufacture of tobacco products (16)
Transport	• Rail, Road. Aviation and shipping are excluded.

Part 4: Material Flow Analysis

4.1 Methodology Tables

Table 3: Breakdown of outputs

Outputs in Material and Waste Flow Analysis	Breakdown of Components Included
Recycling/Re-use	• Civic Amenity (CA) site • Construction and Timber Manufacturing • Material Recycling Facility, Metal Recycling, Paper Recycling • Hazardous Waste Transfer and Non-Hazardous Waste Transfer / Treatment • Waste from Electrical and Electronic Equipment (WEEE) treatment facility • Non-Ferrous Metal reprocessing • Recovery of Waste and Freegle household re-use figures • Physical Treatment
Organics	• Biological treatment and Chemical Treatment • Anaerobic digestion and Composting
Landfill	• Car Breaker • Clinical Waste Transfer / Treatment, and Physical-Chemical Treatment • Deposit of waste to land (recovery) • Hazardous Waste Transfer/Treatment, Hazardous Merchant Landfill • Inert Landfill, and Inert Waste Transfer / Treatment • Non Hazardous (SNRHW) Landfill, and Non Hazardous Landfill • Mobile Plant - Landspreading, and Mobile Plant - Unknown
Incineration	• Municipal Waste Incinerator • Co-Incinerator
Wastewater	• Wastewater • Sludge (dry matter)

Table 4:List of Unclassified Exiobase Activities

List of Unclassified Exiobase Activities*	• Renting of machinery and equipment without operator and of personal and household goods (71), Computer and related activities (72), Research and development (73), Other business activities (74), Public administration and defence; compulsory social security (75), Education (80), Health and social work (85) • Incineration of waste: Food, Incineration of waste: Paper, Incineration of waste: Plastic, Incineration of waste: Metals and Inert materials, Incineration of waste: Textiles, Incineration of waste: Wood, Incineration of waste: Oil/ Hazardous waste • Biogasification of food waste, incl. land application, Biogasification of paper, incl. land application, and Biogasification of sewage slugde, incl. land application • Composting of food waste, incl. land application, and Composting of paper and wood, incl. land application • Waste water treatment, food, and Waste water treatment, other • Landfill of waste: Food, Landfill of waste: Paper, Landfill of waste: Plastic, Landfill of waste: Inert/metal/ hazardous, Landfill of waste: Textiles, Landfill of waste: Wood • Activities of membership organisation n.e.c. (91), Recreational, cultural and sporting activities (92), Other service activities (93), Private households with employed persons (95), Extra-territorial organizations and bodies

**List of activities that could not be classified into the sectors chosen for this analysis.*

Part 4: Material Flow Analysis

4.2 Data Sources

Table 5: Data Sources

Topic	Corresponding Flows in Material and Waste Flow Analysis	Description of Data	Source of Data	Source Link
Natural Resources and Minerals	Natural Resources and Minerals flowing into sectors.	Worldwide flow of products (164 defined) into activities (164 defined).	EXIOBASE 3.3.17 hsut 2011	https://www.exiobase.eu/index.php/data-download/exiobase3hyb
Energy	Energy carriers into each sector and Energy generation	Sub-national data on fuel type being used by sector.	Department for Business, Energy & Industrial Strategy Sub-national total final energy consumption data 2019	https://www.gov.uk/government/collections/total-final-energy-consumption-at-sub-national-level
	Renewables into Energy generation	Sub-national data on renewable energy type being used for energy generation.	Department for Business, Energy & Industrial Strategy Regional Renewable Statistics 2019	https://www.gov.uk/government/statistics/regional-renewable-statistics
	Energy carriers and electricity generation into each sector	National data on fuel type being used by sector and energy generation.	Department for Business, Energy & Industrial Strategy Digest of UK Energy Statistics (DUKES) 2019	https://www.gov.uk/government/collections/digest-of-uk-energy-statistics-dukes
Water Supply	Water abstraction by sector	National water abstraction for a limited number of sectors	Department for Environment, Food & Rural Affairs ENV15 - Water abstraction tables for England 2019	https://www.gov.uk/government/statistical-data-sets/env15-water-abstraction-tables
Waste	Recycling, Organics, Landfilling and Incineration waste from the sectors of Industrial & Commercial, Housing, CD&E and Agriculture & Food.	Waste data for the West Midlands sorted by waste types (EWC) and facility type.	Environmental Agency Waste Data Interrogator - Wastes Received (Excel) Version 4 2019	https://data.gov.uk/dataset/d409b2ba-796c-4436-82c7-eb1831a9ef25/2019-waste-data-interrogator
	Household Re-use waste	Household re-use data for the West Midlands	Freegle 2020 Contact: Edward Hibbert	N/A
Wastewater	Wastewater and Sludge from sectors	Total wastewater treated and biosolids produced in the WMCA area across the 18 wastewater treatment works and 4 sludge treatment centres.	Severn Trent Water 2002 Contact: Richard Smith	N/A
GHG Conversion Factors	GHG conversion factors for converting materials or electricity	UK GHG conversion factors for Materials (for Use and for Waste), fossil fuels, water, electricity.	Department for Business, Energy & Industrial Strategy Government conversion factors for company reporting of greenhouse gas emissions 2020	https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting
	GHG conversion factors for food products	Global GHG conversion factors for food products	Our World in Data 2020	https://ourworldindata.org/food-choice-vs-eating-local
	GHG conversion factors for metal products	GHG conversion factors for metals	Life Cycle Assessment of Metals: A Scientific Synthesis 2014	https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0101298

Part 4: Material Flow Analysis

4.2 Data Sources

Emissions	Emissions (Scope 1) from each sector	National data on emissions produced by each sector (Scope 1 emissions).	Department for Business, Energy and Industrial Strategy Final UK greenhouse gas emissions national statistics 2020	https://data.gov.uk/dataset/9568363e-57e5-4c33-9e00-31dc528fcc5a/final-uk-greenhouse-gas-emissions-national-statistics
	Emissions (Scope 1) from each sector	Sub-national data on emissions produced for a limited number of sectors (Scope 1 emissions).	Department for Business, Energy & Industrial Strategy UK local authority and regional carbon dioxide emissions national statistics 2019	https://www.gov.uk/government/collections/uk-local-authority-and-regional-carbon-dioxide-emissions-national-statistics
Interpolation	Gross value added (GVA) by sector for interpolation	GVA by sector for the UK and the West Midlands. Used to interpolate Emissions, Energy, Water supply, Natural Resources and Minerals data, for the sectors of Indsutry & Commercial, CD&E, Agriculture & Food and Transport.	ONS Regional gross value added (balanced) by industry: all NUTS level regions 2019	ONS NUTS
	Population data for interpolation	Population data for the UK and the West Midlands. Used to interpolate Emissions, Energy, Water supply, Natural Resources and Minerals data, for the sector of Housing.	ONS Estimates of the population for the UK, England and Wales, Scotland and Northern Ireland 2019	ONS Dataset
Methodology Guidance	N/A	This document provided guidance for producing the material and waste flow analysis.	Metabolic A Roadmap for Building Circular Value Chains 2017	https://www.metabolic.nl/publications/screen/
Example Project Inspiration	N/A	This document sets out a high quality example that was used as inspiration for producing the material and waste flow analysis.	Metabolic CIRCULAR CHARLOTTE Towards a zero waste and inclusive city 2018	https://www.metabolic.nl/publications/circular-charlotte/
Additional Sources	N/A	Information regarding water abstraction in the UK.	The Open University Water in the UK, 2019	https://www.open.edu/openlearn/science-maths-technology/science/environmental-science/water-the-uk/content-section-2
	N/A	Information regarding sewage treatment in the UK	Department for Business, Energy & Industrial Strategy Sewage Treatment in the UK 2002	https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69582/pb6655-uk-sewage-treatment-020424.pdf
	N/A	Methodology for calculating circular transition indicators. Used for calculating the circularity gap and circular material productivity values.	World Business Council for Sustainable Development Circular Transition Indicators V2.0, Metrics for Business, by Business (2021)	https://www.wbcsd.org/Programs/Circular-Economy/Factor-10/Metrics-Measurement/Resources/Circular-Transition-Indicators-v2.0-Metrics-for-business-by-business

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