



SCOTTISH INFRASTRUCTURE
CIRCULAR ECONOMY FORUM

SCOTLAND'S CIRCULAR ECONOMY

Call to action for the
infrastructure sector

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Preface



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I am extremely pleased to introduce this first position paper from the Scottish Infrastructure Circular Economy Forum (SICEF). As we embark on the climate decade with all eyes on industry taking a leadership role in decarbonising our economies, the circular economy provides a compelling model for reducing emissions and stewarding critical resources. This is particularly the case in Scotland with its ambitious target to achieve net zero carbon emissions by 2045 together with the low carbon agenda set out in the National Infrastructure Mission.

SICEF is fortunate to be operating in a policy and regulatory environment that is rapidly evolving to foster infrastructure delivery with a new circular economy mindset.

This environment is creating an innovation catalyst and SICEF sees three mutually supporting enablers coming together at this crucial time:

1. The public sector (including the European Commission) as an active partner, formulating supportive policy and regulations
2. New financing sources and models supporting the transition, driven by a greater scrutiny of new infrastructure sustainability credentials by investors and the public
3. New business models made possible by advances in digital technology, data capture and machine learning

Drawing on these shifts, the right framework conditions can now be put in place to accelerate a functioning recycled and secondary raw materials market and make further adjustments to the regulatory environment that allow the circular economy to thrive. Transitioning to a circular economy will require trust and active co-creation among businesses, governments and civil society and we hope that the ideas and approaches set out here demonstrate that the infrastructure sector in Scotland is stepping up to a leadership role.



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Executive summary

Scotland's infrastructure sector is rising to the major challenge of transitioning from the non-sustainable "take-make-waste" linear economy approach, to a new sustainable circular economy model, where the economic activity sustains and improves our environment.

This is a clear call to action from leading Scottish infrastructure projects, where the consumption of energy, materials, and water, together with consideration of end of life use of materials and products, are embedded in their design decisions from the outset.

The drive toward a more circular economy is not just borne out of a need to comply with current and emerging legislation but is driven by a sector wide recognition that the linear economy approach is unsustainable. The environmental stresses it places on our planet from the extraction, processing, and disposal of materials is now evident in the rising global temperature, increasing frequency of extreme weather events, biodiversity loss, rising sea levels, poor air quality, and fundamental pollution issues such as marine plastic.

Meeting the major challenge of fully embedding the circular economy within all infrastructure projects will optimise resource use while bringing cost efficiencies and environmental

and social value benefits. Since 2017, SICEF has been working to address this challenge.

Transitioning to a circular economy, represents a major economic and industrial opportunity for Scotland. Our vision is for a Scottish infrastructure sector where innovation is an intrinsic part of our culture, society, and economy, and our long-term ambition is to boost Scotland's innovation performance to match the levels of the best performing countries.

This will require trust and active co-creation among businesses, governments and civil society as underlying foundations for successful implementation. SICEF has defined the challenges and opportunities of transitioning to a circular economy, developed a call to action for the value chain and government and policy makers, as well as setting out our own next steps. The time to act is now.

Introduction

SICEF Mission Statement The Scottish Infrastructure Circular Economy Forum (SICEF) is a facility for embedding fully circular infrastructure delivery by 2030.

Waste, as unwanted or unusable material, often arises as a result of process inefficiency. Construction waste in the infrastructure sector accounts for nearly half of the total waste in Scotland, with over 6 million tonnes of construction and demolition waste recorded in 2017.¹ To fully embed a circular economy, we must fundamentally change the way we design, procure, build, maintain and disassemble our infrastructure, ensuring that as much waste as practically possible is designed out at the start of the process, and that assets are built with maintenance, reuse, and recycling in mind.

Infrastructure, the services and facilities necessary for our economy to function, plays a key role in Scotland's economic development and supports our social, economic, and environmental goals. In recognition of this, the Scottish Government's "National Infrastructure Mission" is to increase annual infrastructure investment by 1% of current GDP, or £1.56 billion, by the end of the next Parliament in 2025-26.² Sustainable economic growth provides an opportunity to develop climate resilient infrastructure that aligns with

Scotland's target of achieving net-zero emissions by 2045, minimises the use of natural resources, views 'waste' as a resource and keeps materials in circulation for as long as possible.

A key challenge in relation to the circular economy and infrastructure delivery has been how best to facilitate the exchange of large volumes of secondary materials and products, which might otherwise be disposed of, thus preventing their re-use. It is widely accepted that re-using materials, products, components, and assets helps to extend their useful lifespan, maintain their value, minimise disposal, and reduce embodied carbon and water impacts, and whole life costs.³

The Scottish Environment Protection Agency (SEPA)'s Strategic Infrastructure (Transport and Utilities) Sector Plan⁴ identifies opportunities to work collaboratively with partners, to improve environmental performance throughout the industry supply chain.

The Sector Plan states that the most prosperous societies of the future will be comprised of organisations that use the lowest volumes of water, materials and energy, and create little waste. The type of infrastructure a society builds defines the future it chooses. To guide this future the plan discusses how SEPA will use the traditional regulatory tools and new ways to support the transition to a circular economy while ensuring the protection of Scotland's environment.

SEPA's circular vision for the sector includes the following principles:

- **Strategic infrastructure is designed for life**, built and managed in a way that avoids flood risk, ensures minimal negative environmental and social impacts, and delivers maximum social, economic, and environmental benefits.
- **Strategic infrastructure uses a circular economy approach**, to minimise the use of raw materials, keep materials in use for as long as possible, extracts maximum value from them while in use, and then recovers products and materials at the end of their service life.

Transitioning Scotland's Infrastructure Sector to a circular economy approach presents challenges owing to the following:

- **Scale of the challenge**, including environmental footprint, budget, and resource demands.
- **Longevity of assets**, in that very often there is no 'end of life' in sight.
- **Continuity of service**, including established legacy systems, and organisational connectivity.
- **Developing a new economy**, valuing different things, and altering decision making.

¹ Scotland's Environment Waste Discover Data Tool: <https://www.environment.gov.scot/data/data-analysis/waste-from-all-sources/>

² Scottish Government (2018) Infrastructure investment: evidence summary: <https://www.gov.scot/publications/exploring-economic-rationale-infrastructure-investment/>

³ Scottish Government (2016) Making Things Last: A Circular Economy Strategy for Scotland: https://circulareconomy.europa.eu/platform/sites/default/files/making_things_last.pdf

⁴ Scottish Environment Protection Agency (SEPA) (2019) Strategic Infrastructure (Transport and Utilities) Sector Plan: <https://sectors.sepa.org.uk/media/1154/strategic-infrastructure-sector-plan.pdf>

The circular economy landscape, progress to date

A report by TNO, the Netherlands Organisation for Applied Scientific Research estimated the overall impact of an embedded circular economy in the Netherlands to be €7.3 billion, involving the creation of approximately 54,000 jobs. In addition, the report noted a number of spin-off opportunities for the Dutch economy in terms of strengthening the country's knowledge position.⁵

The UK Government also recognises these benefits, and a recent Defra report stated that, "UK businesses could benefit by up to £23 billion per year through low cost or no cost improvements in the efficient use of resources".⁶

The means of realising these economic benefits are:

- Lean production.
- Reducing waste in manufacture and commerce.
- Reducing the volume of working products thrown away.
- Moving from goods to services and so driving responsibility for the destiny of materials.

Across Scotland, there has been progress in recent years to support the transition towards a circular economy, including the Scottish Government's commitment through 'Making Things Last'⁷, Scotland's circular economy strategy with construction and the built environment being named as one of the priority sectors.

Additionally, there were plans for the Scottish Government to introduce a Circular Economy Bill, however in April 2020, it was announced that this will not be progressed due to COVID-19.

The Scottish Government, supported by the European Union, are currently delivering four Circular Economy Cities and Regions projects across Scotland, in Edinburgh, Glasgow, NorthEast, and Tayside. These areas, housing over half of Scotland's population, offer ideal locations for new circular business models such as reverse logistics, material recovery, re-use, leasing and sharing.

Over £70m of investment, a combination of £40m of Scottish Government funding and £30m of EU Structural funds, has been committed to supporting the circular economy in Scotland. This includes the Zero Waste Scotland Circular Economy Investment Fund (CEIF)⁸, which supports innovative projects to deliver a circular economy business model, service or technology. Since the CEIF launched in April 2016, Zero Waste Scotland has agreed 23 contracts with a range of innovative Scottish companies, with £3.2m paid

out so far and more to follow. To date this investment has attracted £5.4m of private investment into Scotland, £1 million of institutional investment, and has supported over 200 jobs.

The National Manufacturing Institute Skills (NMIS) Academy will provide a comprehensive service for business, industry and the public sector. This will include a drive to embed circular economy skills and thinking in future workforce training. The first phase of NMIS, the Lightweight Manufacturing Centre, opened in June 2019. It provides Scottish industry with the skills and services needed to put it at the forefront of lightweight manufacturing and materials and helps companies of all sizes to compete globally. In 2020, supported by a £48 million investment, construction will begin on an NMIS digital "Factory of the Future" in Renfrewshire that will work with an extended network of existing and planned facilities. These will work with business to develop new processes and technologies to help them overcome manufacturing challenges or take advantage of new opportunities. It will also include a skills academy to provide advanced manufacturing training, upskilling, and support the embedding of circular economy skills in future workforce training.

Additionally the Construction Scotland Innovation Centre (CSIC) links together businesses, university experts and public sector providers to deliver transformational change in construction, including the circular economy.

⁵ TNO (2013) Opportunities for a circular economy in the Netherlands: <https://www.tno.nl/media/8551/tno-circular-economy-for-ienm.pdf>

⁶ WRAP's visions for the UK circular economy to 2020: <http://www.wrap.org.uk/content/wraps-vision-uk-circular-economy-2020>

⁷ Scottish Government (2016) Making Things Last: A Circular Economy Strategy for Scotland: https://circulareconomy.europa.eu/platform/sites/default/files/making_things_last.pdf

⁸ Circular Economy Investment Fund: <https://www.zerowastescotland.org.uk/circular-economy/investment-fund>

SICEF member approaches to the circular economy



TRANSPORT SCOTLAND — COAL TAR RECYCLING

In 2016, the Scottish Roads Research Board (SRRB) began working with industry and legislators to develop evidence and guidance for an innovative ex-situ recycling process for contaminated coal tar based material.

The process involved removing the material from site, before screening and grading, blending with Pulverised Fuel Ash (PFA) and cement, coating in a foamed bitumen, and returning it to site for reuse. This encapsulated the contaminants, and on-site compaction ensured the recycled product had structural strength similar to new material. The process was successfully adopted on a number of major road maintenance contracts in Scotland, including on the M9, A702, A75, and A92. Further innovation has included an in-situ recycling process, where the contaminated materials are "rubbleised" in-situ before undergoing a similar process.

Benefits:

- Approval by SEPA and legislative requirements.
- Ability to upcycle contaminated material, with a current saving of over 14,300 tonnes from landfill or incineration.
- Developing a collaborative approach to recycling across stakeholders.

Further details can be found [here](#).



SCOTTISH WATER — REHABILITATING PIPELINES

Two hundred metres of sewer, which included two pipe bridges across North Calder Water, required repair and refurbishment to reduce the risk of pollution and to maintain service.

Scottish Water deployed an innovative approach to the repair and refurbish the sewer structure, by wrapping it in a carbon fibre and epoxy coating.

Benefits:

- Retains the value of the original structure and material, reducing waste, cost and the time to complete the work.
- Enables work to be delivered in remote areas where accessibility for traditional replacements can be difficult.
- Wastewater continues to flow through the pipe whilst the repair work is undertaken.
- Less site traffic required, reducing disruption to the area.

Further details can be found [here](#).



SP ENERGY NETWORKS — PROJECT FITNESS (FUTURE INTELLIGENT TRANSMISSION NETWORK SUBSTATION)

Project FITNESS delivers a globally innovative state of the art digital substation design based on concepts of standardisation and interoperability; deploying smaller, lighter, safer equipment, with reduced reliance upon raw materials compared to conventional 275kV substations.

Benefits:

- A 25% reduction of steel used for transformers.
- For relays, a 90% reduction of the use of low voltage transformers and a 50-60% reduction in most components.
- A 50% reduction in Polypropylene, Fibreboard, PVC and Gravel used for civil works.
- A 70% reduction of copper wiring used (Copper, Aluminium and Propylene).
- Fewer materials to treat and dispose of at end of life decommissioning.

Further details can be found [here](#).

Challenges and opportunities for the infrastructure sector in Scotland

Moving towards fully circular infrastructure delivery requires changes to the way we design, build, maintain and disassemble when delivering infrastructure projects. This will involve a fundamental change from the “unavoidable surplus material” approach, to a focus from the outset on ensuring zero material to landfill. The effort required for such planning, design, and site controls will be far outweighed by the waste management cost savings. Many of the challenges listed have been well documented over recent years, however, many still remain unsolved.

Challenges

- In many instances, design teams will require product criteria and design standards that do not exist for reuse products.
- Perceived risk of specifying reused, recycled or alternative materials that they might not meet performance requirements.
- Existing products are not currently designed for disassembly, recycling, and reused.
- Surplus material generated by one project may not be required until a much later date, causing issues around storage and licensing.
- A lack of local recycling facilities in Scotland for construction material.
- Limited information available on the performance, provenance and specification of virgin and recycled materials within the supply chain.
- A mismatch between the type, and volume of materials produced and required between different projects, or between the physical locations, causing delivery and logistical issues, leading to increased carbon emissions. Additionally, there must be a guarantee of material availability and lead-in times must be considered to ensure projects are delivered on time and to budget.

Opportunities

- Acceleration of new technologies, techniques and materials that drive efficiency and improve quality of assets.
- Unlocking the potential of new business models through digital technologies.
- Contribution to Scotland's target of achieving net zero carbon emissions by 2045.
- Delivering value utilisation of secondary materials.
- Improving the security of the supply of raw materials (both virgin and secondary / recycled).
- Increasing competitiveness.
- Improved resilience of infrastructure to the effects of climate change.
- Minimising water, energy, and materials to maximise products and services, whilst minimising waste and emissions.
- Optimisation of resource use through the project's life cycle.
- Reduced reliance on virgin materials.
- Strengthening the economy and benefitting communities.
- Remanufacturing is worth £1.1 billion to Scotland's economy, with the potential to create an additional £620 million turnover and 5,700 new jobs by 2020.
- Stimulating innovation and new ways of thinking throughout the supply chain.
- Increased demand for new recycling and re-processing facilities.

Call to action

SICEF members have developed a call to action for the value chain and government and policy makers to support the infrastructure sector to embed circular delivery by 2030.

Call to action for	Details
The value chain	<p>SICEF members identified the following principles, and challenges, for the value chain.</p> <ul style="list-style-type: none"> • Source materials from recycled and secondary sources as a preference over virgin materials. It is appreciated this may result in higher project costs, and organisations must therefore work together to provide consistency during procurement. • Provide robust verified data on the raw materials and resources used in products, through environmental product declaration certificates or material passports, for example. • Employ eco-design principles to reduce environmental impact, particularly focussing on life extension, reparability, and maximising utility and value of constituent parts at end of life. • Consider a service model approach, to extend asset lifespans and facilitate high value.
Government and policy makers	<p>Government and policy makers have a role to play in supporting the sector's move towards circularity, and SICEF members identified the following priority areas.</p> <ul style="list-style-type: none"> • Aid the reuse of materials thus preventing materials becoming waste. Develop regulatory and other tools to drive increased use of secondary materials, design for reparability and disassembly at end of life. • Facilitate collaboration, innovation and sharing of solutions and successes. • Support domestic recycling infrastructure for construction materials. For example, an arc furnace could be developed to allow materials, such as steel to be reprocessed. • Develop a nationwide circular economy target and set of shared goals and objectives with a clear way of monitoring progress; supporting leading organisations and clients in working together.

Next steps for SICEF

All organisations involved in delivering infrastructure projects in Scotland have an important role to play in creating a net-zero, climate resilient, circular economy that uses minimal natural resources across the lifecycle of infrastructure assets. Achieving this vision will require a collaborative approach between all parties.

The roadmap below outlines the next steps for SICEF members; paving the way towards fully circular infrastructure delivery.



⁹ MIROG (2019) The case for a resource exchange mechanism White Paper No. 3, https://www.aecom.com/content/wp-content/uploads/2019/10/MI-ROG-White-Paper_3-The-Case-for-a-REM_Oct2019.pdf

About SICEF

Recognising the key role that infrastructure can play in driving the circular economy forward in Scotland, AECOM founded the Scottish Infrastructure Circular Economy Forum (SICEF) in 2017. The forum is a facility for embedding fully circular infrastructure delivery by 2030. We work together to enable Scotland's infrastructure operators to collaborate across the circular economy theme, and to meet the challenge of delivering major infrastructure in a constrained economy.

Members include Edinburgh Airport, Environmental Association of Universities and Colleges (EAUC), Highlands and Islands Airports, Prestwick Airport, Scottish Environment Protection Agency (SEPA), Scottish Water, SP Energy Networks, SSEN Transmission, Transport Scotland, and Zero Waste Scotland.

AECOM provides the secretariat, with meetings rotating between member organisations, and four sessions per year. SICEF has a sister group, the Major Infrastructure-Resources Optimisation Group (MI-ROG), which is also convened by AECOM.

Acknowledgments

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Disclaimer

The contents of this paper do not necessarily reflect the official opinions of the member organisations named above.

SICEF was founded in 2017 and is convened by AECOM. The Chairman is Robert Spencer. SICEF participants represent organisations including Edinburgh Airport, Environmental Association of Universities and Colleges (EAUC), Highlands and Islands Airports, Prestwick Airport, Scottish Environment Protection Agency (SEPA), Scottish Water, SP Energy Networks, SSEN Transmission, Transport Scotland, and Zero Waste Scotland.

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