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# Foundation Industries Sustainability Consortium

## TransFIRe Celebration Event

12<sup>th</sup> June 2024

Dr Graham Hillier, FISC Chair

The Foundation Industries Sustainability Consortium (FISC) brings together global leaders in innovation, research and technology from across the cement, metal, glass, ceramic, paper, polymer and chemical industries.

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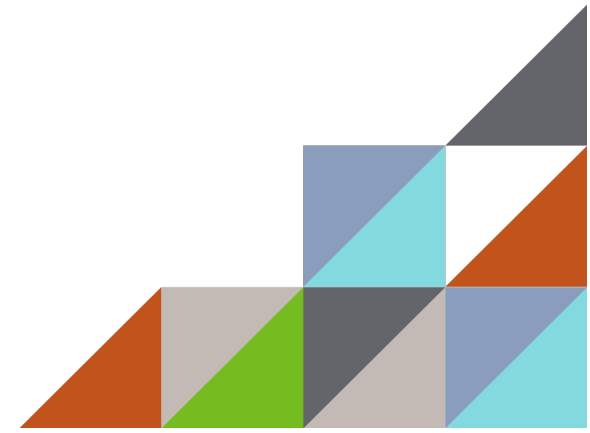
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# Content

- The Importance of the Foundation Industries
- The Need for Research and Innovation
  - Getting an Idea to Market
- A Bit about FISC
- Where we are Now
  - Research Capability, Innovation Capability and FISC
- Examples of Activities that are Moving Forward
- Challenges and Themes
- What Next



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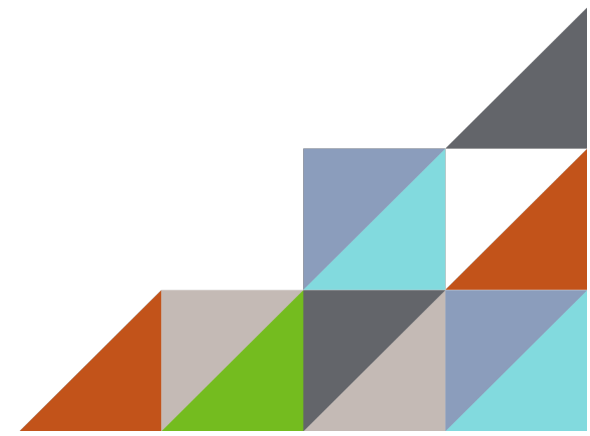
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# The Importance of the Foundation Industries



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# The Importance of the Foundation Industries

- Cement, Ceramics, Chemicals, Glass, Metals, Paper and Polymers are the products of the Foundation Industries
- They truly are the Foundation of a developed economy
- Without them we cannot build or manufacture anything
- Historically they have been seen as polluting, carbon emitting and not very sustainable, but we can't do without them
- In a geopolitically unstable world we cannot rely on imports to supply our needs

**We need to create indigenous, sustainable, low carbon, resource efficient foundation industries if we want to carry on living the way we do now**



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# The Current State of Play in the UK

Source: Personal Calculation

- The total consumption of foundation industry products in the UK (included embedded materials) is over 45 million tonnes per year
- The UK manufactures between 50% and 60% of this demand. The rest is imported
- Between 15% and 25% of total consumption of FI materials are collected as recyclable products but are exported as scrap for reprocessing in other countries
- An innovation drive to reuse this exported material in a circular system in UK facilities could increase indigenous supply to over 75% of total consumption



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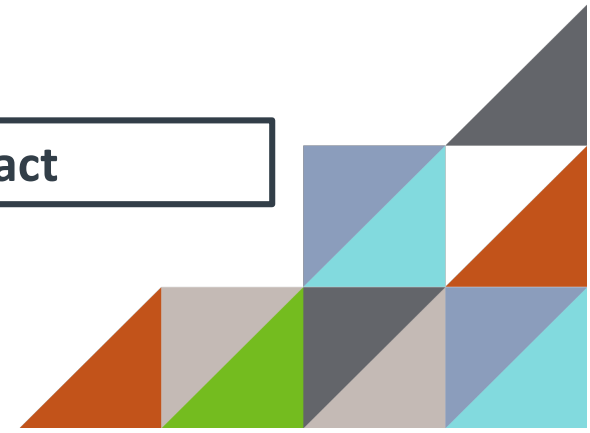
# Three Challenges

- **Challenge 1: Ensure that existing plant and equipment across the foundation industries runs to its best capability.**
  - Resource Efficiency, Economic and Environmental Sustainability and Lowest Realistic Carbon Emissions.
- **Challenge 2: Develop, scale-up and implement the next generation of low carbon sustainable foundation industry processes and products.**
  - Application of knowledge to deliver product to market.
- **Challenge 3: Understand the flow of resources through the UK economy then implement new technologies and business models that drive resource efficiency, circularity and sustainability.**
  - Supply chain collaboration to close materials use and reuse loops.
  - Focus on the servitisation of materials in use, reuse and recycling.
  - Ensure the UK optimises its use of recovered materials to local use.

**If we Focus on these 3 Challenges, we will have significant positive impact**



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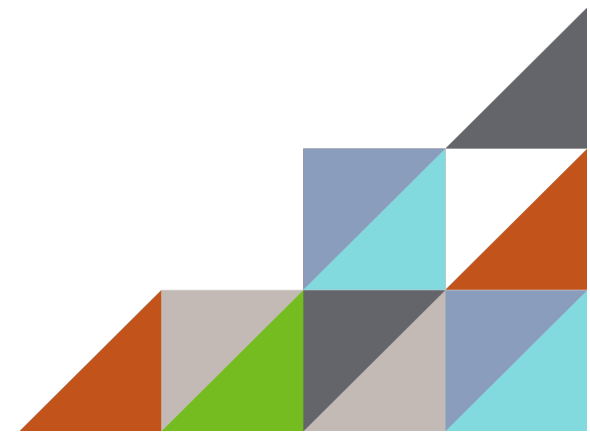
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# The Need for Research and Innovation



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# Steps Required to Get an Idea to Market

## Research

...to *invent* new technologies

## Innovation

...to *convert* those inventions into usable products

## Development

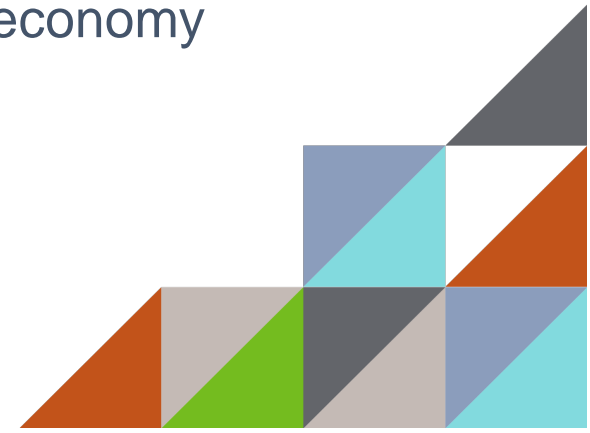
...to *commercialise* the innovations and create a profitable supply chain

## Businesses

...that *create value* within the economy and bring in additional value by selling to those outside the economy



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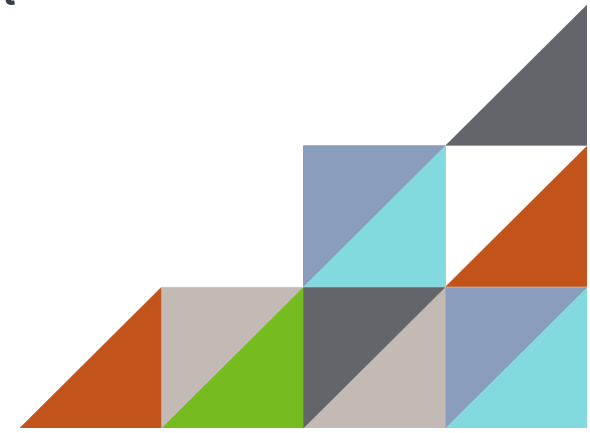
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# The Challenge for the UK

- There is no doubt that the UK is good at publicly funded research and invention
- Multi-national companies have major research, development and manufacturing centres in the UK
- The UK has a strong private investment community
- The UK has creative SMEs
- The UK is less good at translating research into commercial business
- The UK Catapults and FISC centres have created a public/private innovation infrastructure that helps
- Increasingly innovation is about next generation systems not just technologies
- Add capability to our research and innovation infrastructure



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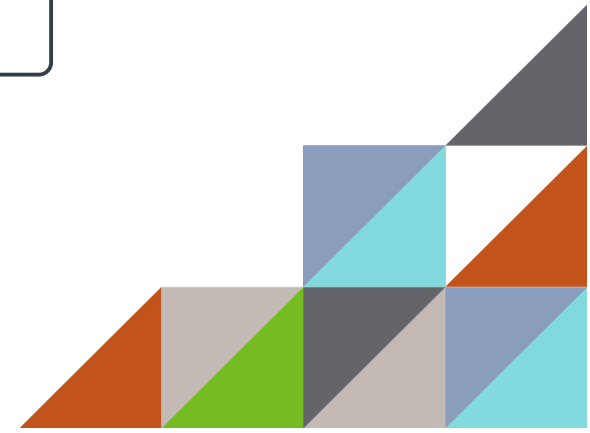
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**Science is interesting, but...**  
it is of most use when it is converted into something  
that creates social and economic value

**Innovation translates science into  
applications**



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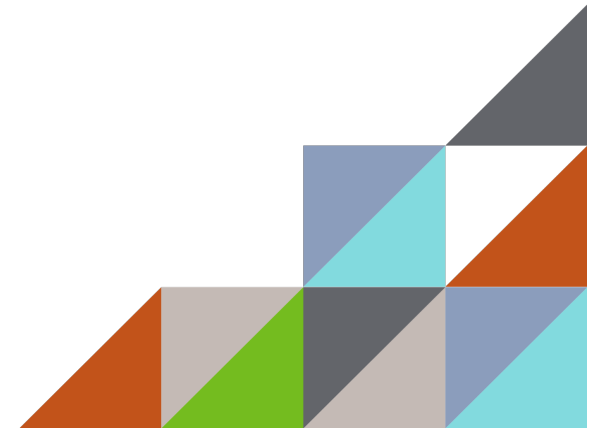
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To me **Innovation** is...

The art, science or process of converting existing inventions and ideas into practical products, processes or services that can be used in everyday life



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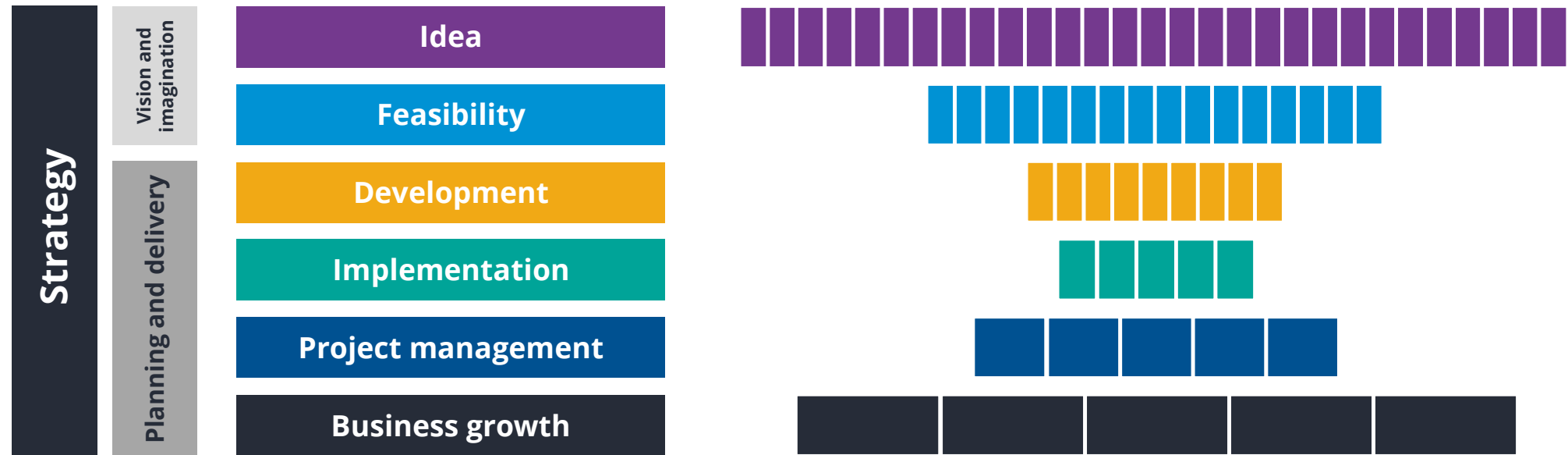


# Innovation process management schematic



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**Managing ideas and opportunities is vital to innovation;  
and dropping the poor ones early is an important skill**



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# CPI's Original Innovation Integrator<sup>®</sup> process



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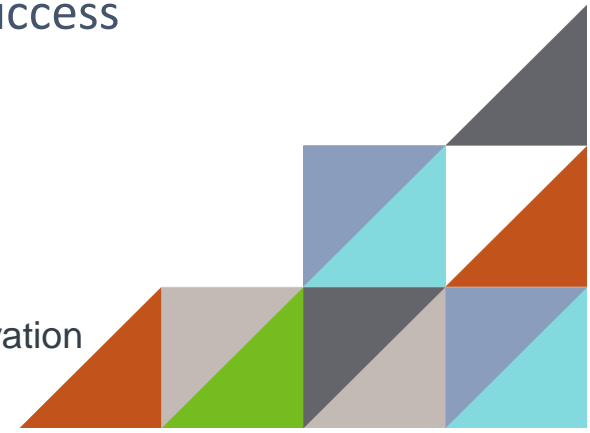
**Without addressing all these factors, innovation will fail**

Long term **commitment** and **collaboration** are key to success



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Source: Centre for Process Innovation





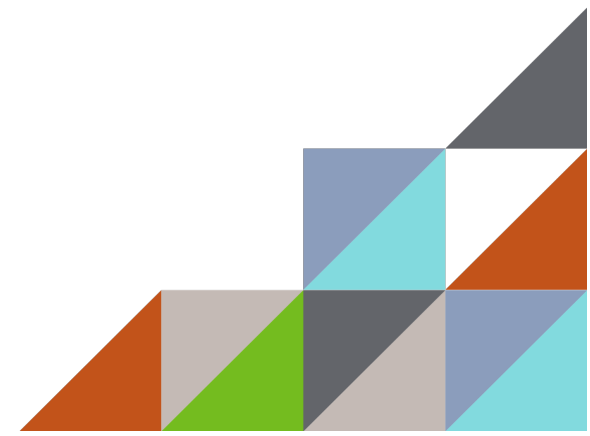
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# A Bit About FISC



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# FISC Vision

**Strengthen** the foundation industries in the UK by working together

To

**Scale and Accelerate** the Innovation needed to drive the transformation of the foundation industries

In order to create

**Sustainable**, low carbon and resource efficient materials delivered to vital **Supply Chains**

Enabled by a

**Skilled and Diverse Workforce** with exciting jobs in vibrant industries that support the UK economy.

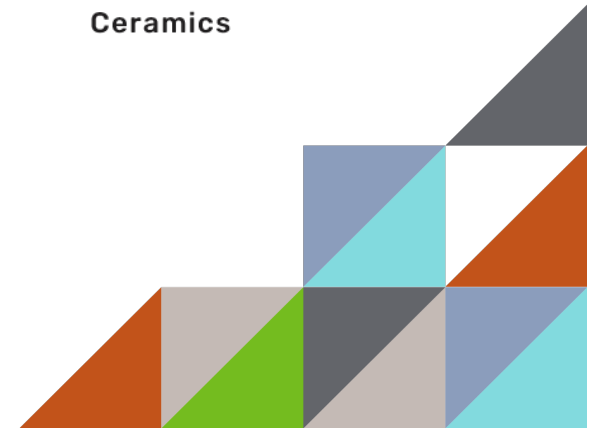


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CPI connects the dots within the innovation ecosystem to make great ideas and inventions a reality. We're a pioneering social enterprise that accelerates the development, scale-up and commercialisation of deep tech and sustainable manufacturing solutions. As a trusted partner of industry, academia, government, and the investment community, we're the catalyst that delivers sustainability and healthcare innovations to benefit people, places, and our planet.

The Materials Processing Institute supports innovation for a sustainable future through materials development and process improvements, which are delivered by project teams utilising state-of-the-art equipment, laboratories, workshops, demonstration, scale-up and production facilities. Research, development, and innovation is focused on advancing materials performance, achieving industrial decarbonisation through a low carbon and hydrogen future, deploying new digital technologies, and reducing waste through a circular economy.

A not-for-profit membership organisation, Glass Futures connects the global glass industry and academia to deliver R&D and innovation, ensuring glass making's future is built on high value and fully sustainable, zero-carbon products. In collaboration with industry, it has delivered the world's first openly accessible, commercially available, multi-disciplinary glass melting facility, the Global Centre of Excellence.

The Henry Royce Institute (Royce) is the UK's national institution for advanced materials research and innovation. Providing access to world-class research capabilities, infrastructure, expertise, and skills development, Royce works with the UK materials community to develop solutions to national and global challenges.

Lucideon specialises in materials technology, processes, and testing. Its application of cross-industry insight, materials science expertise, and innovative thinking allows industry to develop and implement disruptive technology platforms, providing cost and/or product performance benefits. It utilises its many years of experience in development, analysis, and assurance to provide technical consultancy to accelerate its clients' R&D activities.





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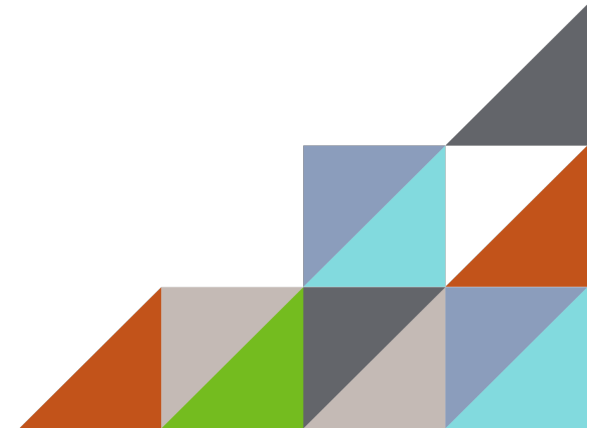
# FISC Infrastructure for collaboration

## A focus on collaboration to drive Foundation Industry Innovation

- Five leading innovation and technology centres with a proven track record that are combining their expertise and R&D capability
- Collaboration with industry supported by:
  - 3 Industry Fellows,
  - 1 Senior Application Scientist,
  - 3 Application Scientists, and
  - 5 theme leaders from the FISC partners
- Collaboration to develop shared solutions, learn from best practice and to innovate across the Foundation Industry sectors
- Future collaboration with other innovation and R&D programmes



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# FISC Delivery Model

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## Connect

**TFI Fellows** will engage with companies and RTOs to landscape the national research & innovation challenges faced by the foundation industries and identify project partnerships for EconoMISER.

This connection will **establish cross sector links** throughout technology and manufacturing readiness levels to initiate projects that will extend beyond the lifecycle of EconoMISER.



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TFI Fellows

## Collaborate

**EconoMISER Application Scientists** will work alongside two or more members of FISC and external project partners to deliver R&D solutions for the Foundation Industries.

FISC is comprised of five research facilities who can offer a wide range test facilities and expertise to help **identify solutions to research and innovation challenges** faced by the foundation industries.



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Application Scientists

## Innovate

The **EconoMISER team and project partners** will develop identified solutions through the network of scale-up centres established by FISC and roll out technology and manufacturing solutions into the Foundation Industries.

EconoMISER is organised around five research themes and will use FISC facilities to **scale-up research through technology and manufacturing readiness levels**



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EconoMISER Scale-Up Centres

## Impact

**EconoMISER** projects will support the decarbonisation and sustainability needs of the **Foundation Industries** through improved resource efficiency, sustainable products and Industry 4.0 solutions.

Outcomes will add security to raw materials supply chains, improve cost competitiveness, accelerate digitisation, and advance skills & diversity within the workforce.



UK Foundation Industries  
Community

FISC Partnership

Stakeholder(s):

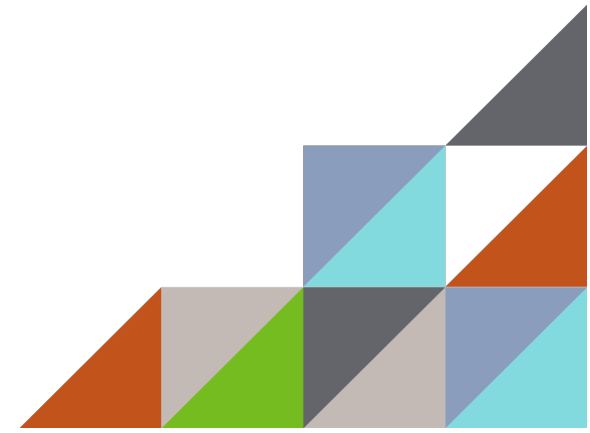
Supported by:

# Delivery Strategy from October 2022



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# EconoMISER

**Economy | Materials | Innovation | Sustainability | Efficiency | Resources**

EconoMISER 1 and 2 are the first major projects of FISC.

The objectives for EconoMISER 1 and 2 are to:

- establish a network of scale-up centres to support the foundation industries (FI);
- upgrade scale-up facilities to enable a more sustainable FI;
- develop a business case for a sustainable network beyond 2024;
- increase industry engagement in scale up and innovation in the UK;
- deliver cross centre working between the facilities to address innovation challenges around sustainability; and
- deliver a plan to transform a workforce fit to deliver net zero for the FI.



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FISC is structured to drive the delivery of **themes that are critical** to the creation of a **zero carbon** resource efficient sustainable foundation industry in the UK.



**Alternative fuels**



**Circular economy, feedstock, recycling and reuse**



**Digital control and sensors**



**Process optimisation**



**Sustainable materials development**



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## EconoMISER 2

Provides additional capabilities that help deliver low carbon technologies from within FISC:

- Enhance Alternative Fuels capability around hydrogen, electricity and plasma heating.
- Install a refractory test facility to prove refractories in alternative fuel systems.
- Provide paper testing facilities to support closed loop use of UK scrap.
- Create a test bed to prove polymer recovery and recycling at pilot scale.
- Drive federated learning to enhance process control and optimisation to leverage existing knowledge for future materials.
- Develop furnace modelling and heat flow optimisation that draws on best practice across the foundation industries.
- Create a sustainable cement testing and development facility.
- Create a support network that can give SME foundation industry companies the best chance of success (Foundation Industry Ventures).



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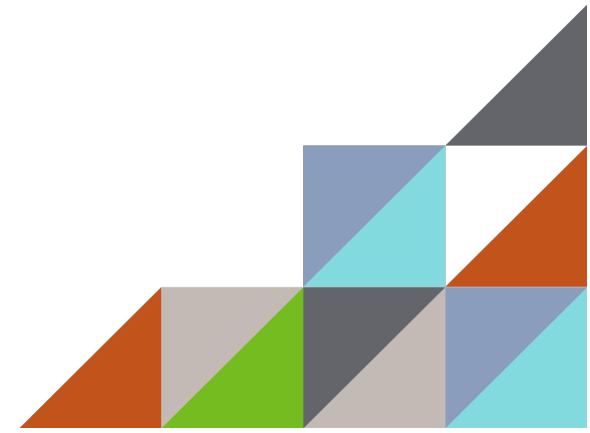
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# Where Are We Now?



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# Where is FI Innovation in the UK Now?

- Lots of excellent research work from a large number of programmes. E.g.:
  - TransFIRe
  - IDRIC
  - Network+
  - SUSTAIN
  - NICER
- Decent Innovation Capability. E.g.
  - High Value Manufacturing Catapult
  - Foundation Industries Sustainability Consortium
  - Other Catapults and Innovation Centres
- Clear Industry and Societal Need

**We need to make sure that our work continues and that our research and innovation is translated into social and economic value**



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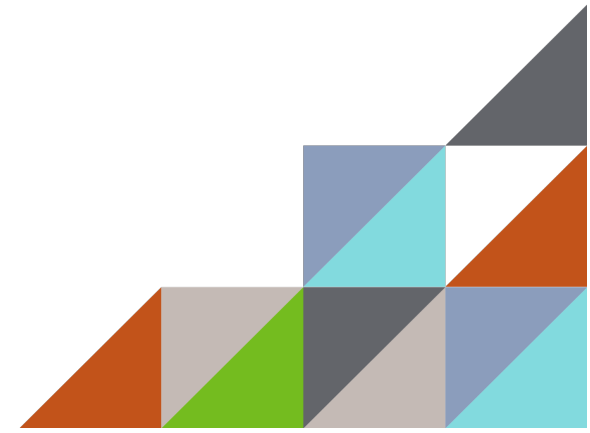
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# Examples of Activities That are Moving Forward



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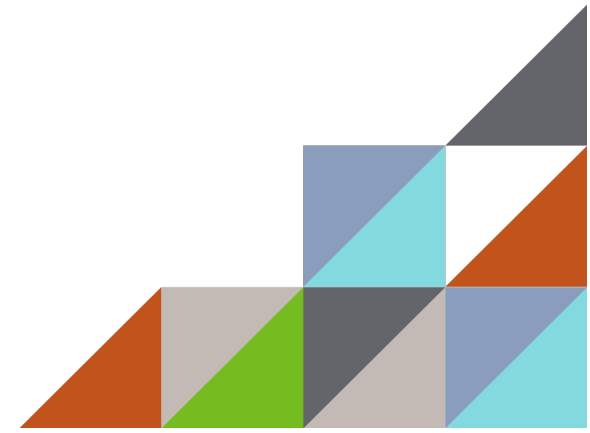
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# Examples of Activities that are Moving Forward

- Wastes to Products and/or Feedstocks
- Low Carbon Cements
  - Applying science, piloting technology, proving in use
  - Testing and standards
  - New materials
- Resource Efficiency
  - Mapping flows, piloting ideas and implementing solutions
- Refractory redesign and recycling
- Alternative fuels
  - Hydrogen, electricity, plasma
- Creating Extra Value from Products
  - Furnace efficiency management not just product sales



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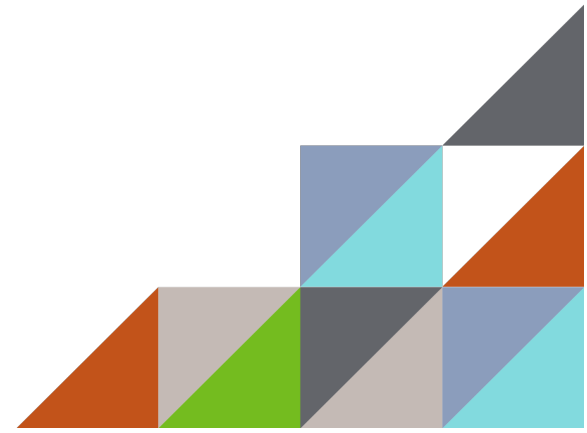
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# Challenges and Themes



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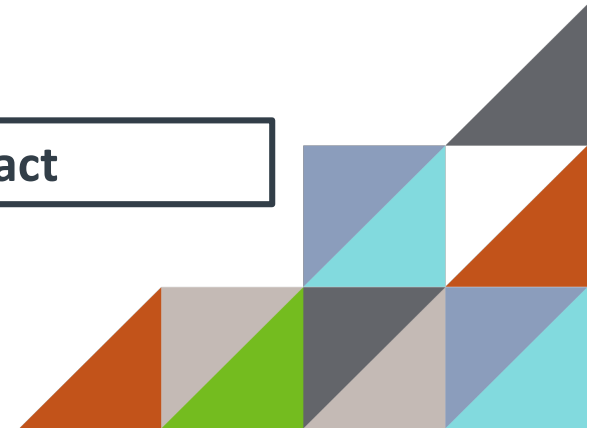
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**If we Focus on these 3 Challenges, we will have significant positive impact**



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# Six Themes

- **Alternative fuels:**
  - Alternative lower carbon fuels. Hydrogen is popular, but electricity is a preferred industry option.
- **Circular Economy:**
  - Using and reusing materials. The focus needs to be on UK use.
- **Digital Control and Sensing:**
  - Advanced digital control and sensing is vital to all three challenges.
- **Process Optimisation:**
  - This is the main driver behind Challenge 1.
- **Sustainable materials:**
  - This is about the next generation of materials such as low carbon cements, but it is also vital to the development of the processes of Challenge 2.
- **Training and Skills:**
  - Availability of process operators and plant engineers. A greater focus on further education is needed.
  - Develop the people that will staff the plants of the future.
  - EDI goes beyond gender and ethnicity to include creating experience and how staff bring the best they can to their work.

**Focusing on these 6 Themes will help us deliver the challenges**



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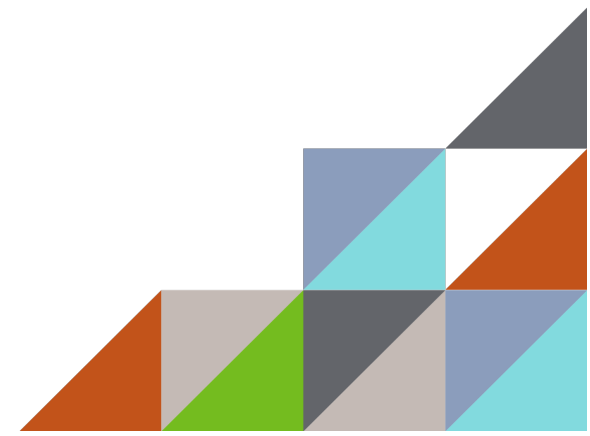
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# What Next



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# What Next?

- We have a strong infrastructure
- We have industry and societal need to become more sustainable
- We have clear Challenges and Themes
- We have high quality research
- We need to link up our research, innovation, public sector, private finance, industry and society to bring our ideas and inventions to market so we make a better and more sustainable economy
- Our ideas are nothing without implementation
- We need to focus our efforts on creating social and economic value

**We must COLLABORATE to develop a strategy that ensures our high-quality research is implemented to ensure low carbon, resource efficient and sustainable FI industries**



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# Key issues

- Engaging with Industry partnerships and trade bodies to define shared challenges, themes and projects
- Long term commitment to research and innovation
- Find a way to secure revenue funding to leverage the capital assets that the UK has invested in:
  - FISC alone has over 1000 people and over £200m of assets
  - Develop the people we need for the future of the FI industries
- Short term nature of UK project development and delivery makes things difficult to implement, collaborate and engage with industry
- Ensure the competence and capability is there from discovery to implementation
- Do what industry and society need

**TransFIRe has made a major positive impact**

**We must work together to ensure it and similar programmes can continue and results are implemented to deliver benefits both socially and economically**



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Contact us to discuss how we can help you solve your innovation challenges:

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