



FISC

Foundation
Industries
Sustainability
Consortium

Decarbonisation: How to do everything everywhere all at once

Presented by Lorraine Ferris

Henry Royce Institute, University of Manchester

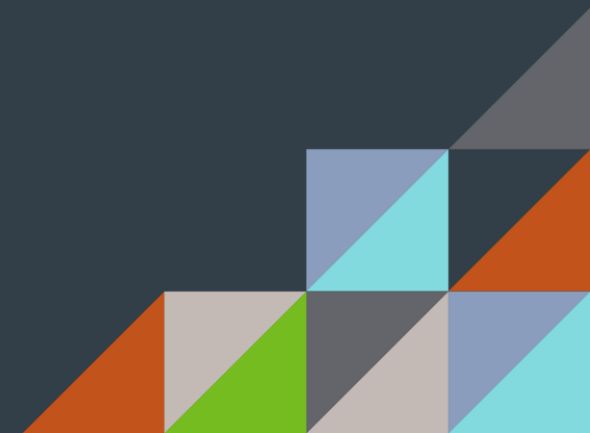
to

TFI Network+ Conference

6 December 2023



Innovate
UK



UN Secretary General Antonio Guterres in response to IPCC report March 23

“In short, our world needs climate action on all fronts -- **everything, everywhere, all at once**.....

We have never been better equipped to solve the climate challenge – but we must move into **warp speed climate action now.**”



An alternative explanation for the title?

- A 2022 American independent film which incorporates elements from a number of genres and film mediums, including absurdist fiction, comedy-drama, surreal comedy, science fiction, fantasy, martial arts films, immigrant narrative, and animation.
- Michelle Yeoh stars as Evelyn Quan Wang, a Chinese-American immigrant who, while audited by the IRS, discovers that she must connect with *parallel universe versions of herself to prevent a powerful being from destroying the multiverse.*



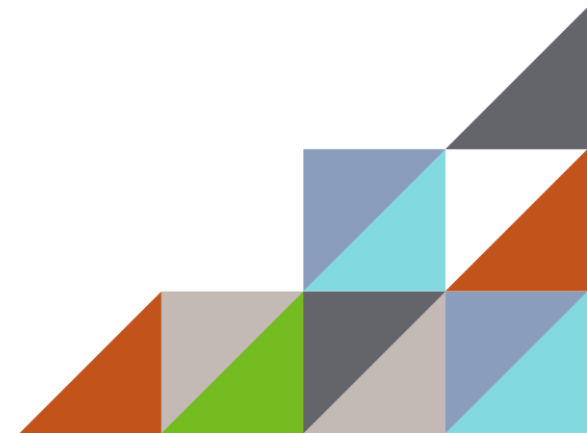


FISC

Foundation
Industries
Sustainability
Consortium

Contents

- Introduction to Economiser
- Industry needs – potential solutions
- Industry needs – the complexity of delivery
- Warp speed climate action?
 - Some ideas
 - What could we do as Network+?





FISC

Foundation
Industries
Sustainability
Consortium

The EconoMISER project

Economic Material Innovation for Sustainable and Efficient use of Resources

AIM: To address Foundation Industry innovation challenges to achieve sustainability and net zero objectives.

The first project of the Foundation Industry Sustainability Consortium (FISC).

The FISC partners collaborate on several cross sector research themes, with the aim of accelerating industry led innovation.





FISC

Foundation
Industries
Sustainability
Consortium

Who are the Foundation Industry Sustainability Consortium?

FISC is a partnership between five research and technology centres who have agreed to collaborate.

The aim being to solve industry innovation challenges to achieve sustainability and net zero objectives by working together and cross-sectorally.

- Centre for Process Innovation
- Glass Futures
- Henry Royce Institute
- Lucideon
- Materials Processing Institute





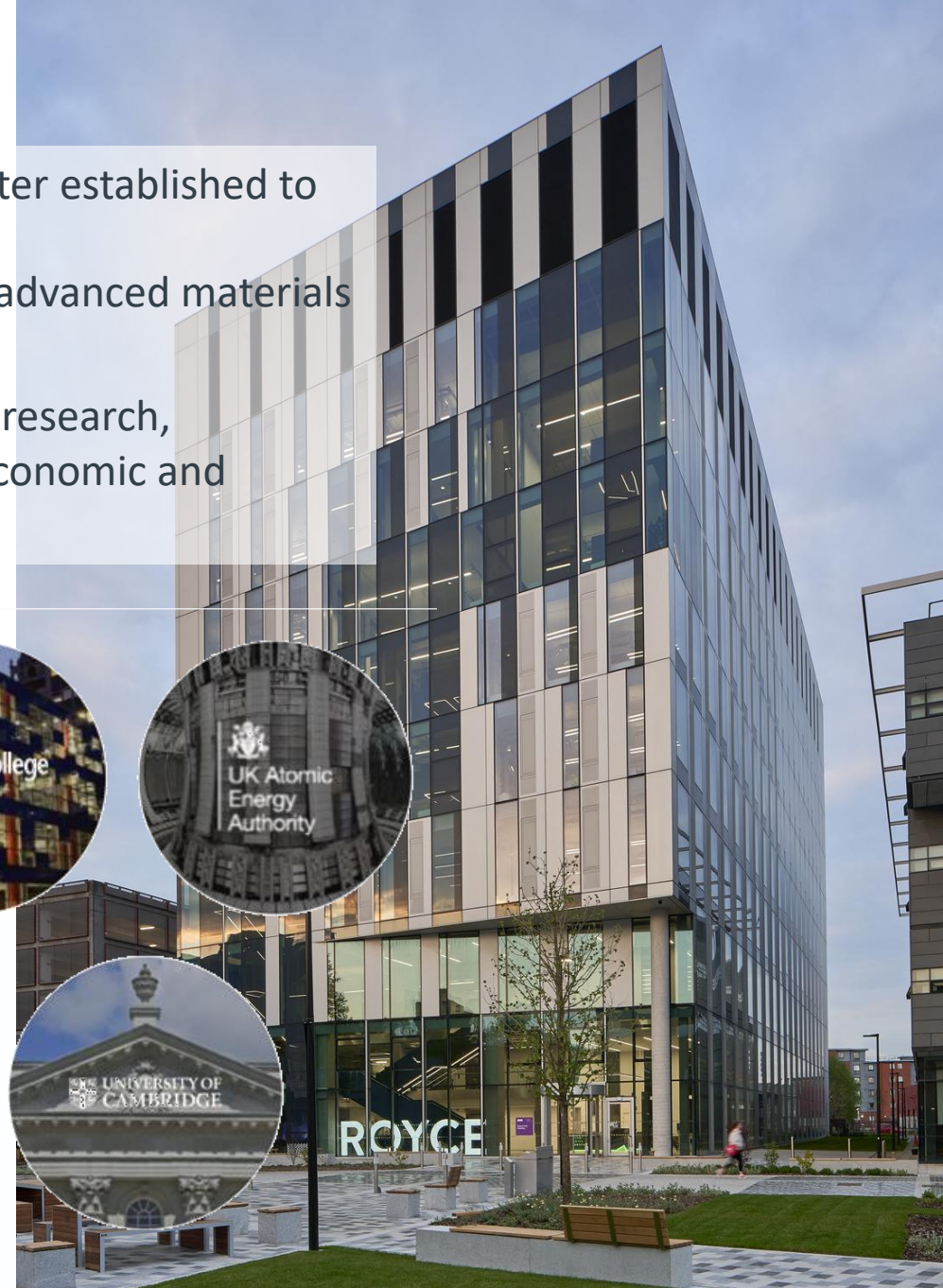
FISC

Foundation
Industries
Sustainability
Consortium

Henry Royce Institute

A national research institute, hosted at the University of Manchester established to

- develop and capitalise on the UK's world-leading excellence in advanced materials research.
- support and grow world-recognised excellence in UK materials research, accelerating commercial exploitation, and delivering positive economic and societal impact for the UK.



ROYCE



FISC

Foundation
Industries
Sustainability
Consortium

The EconoMISER project is structured to drive the delivery of these **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



FISC

Foundation
Industries
Sustainability
Consortium

EconoMISER Project Lifecycle

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.



UK
Foundation
Industries
Community

Foundation
Industries
Sustainability
Consortium

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.



FISC
Partners

Foundation
Industries
Partners

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**



FISC
Partners

Foundation
Industries
Partners

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:



FISC

Foundation
Industries
Sustainability
Consortium

Industrial decarbonisation : Public R&D funding landscape

Transfire

How the foundations industries can develop innovative solutions to reduce energy and resource use. Part of TFI challenge

TFI Network+

Co-create with the Foundation Industries new science and technology that can transform their sustainability
Part of TFI challenge



IDRIC

co-creating whole-system, multidisciplinary solutions that are accelerating the green futures of our industries
Part of Industrial Decarbonisation Challenge

Economiser

Address Foundation Industry innovation Challenges to achieve sustainability / NZ
Part of TFI challenge



UK Research
and Innovation

funding



Innovate
UK



FISC

Foundation
Industries
Sustainability
Consortium

Industry needs – Potential solutions

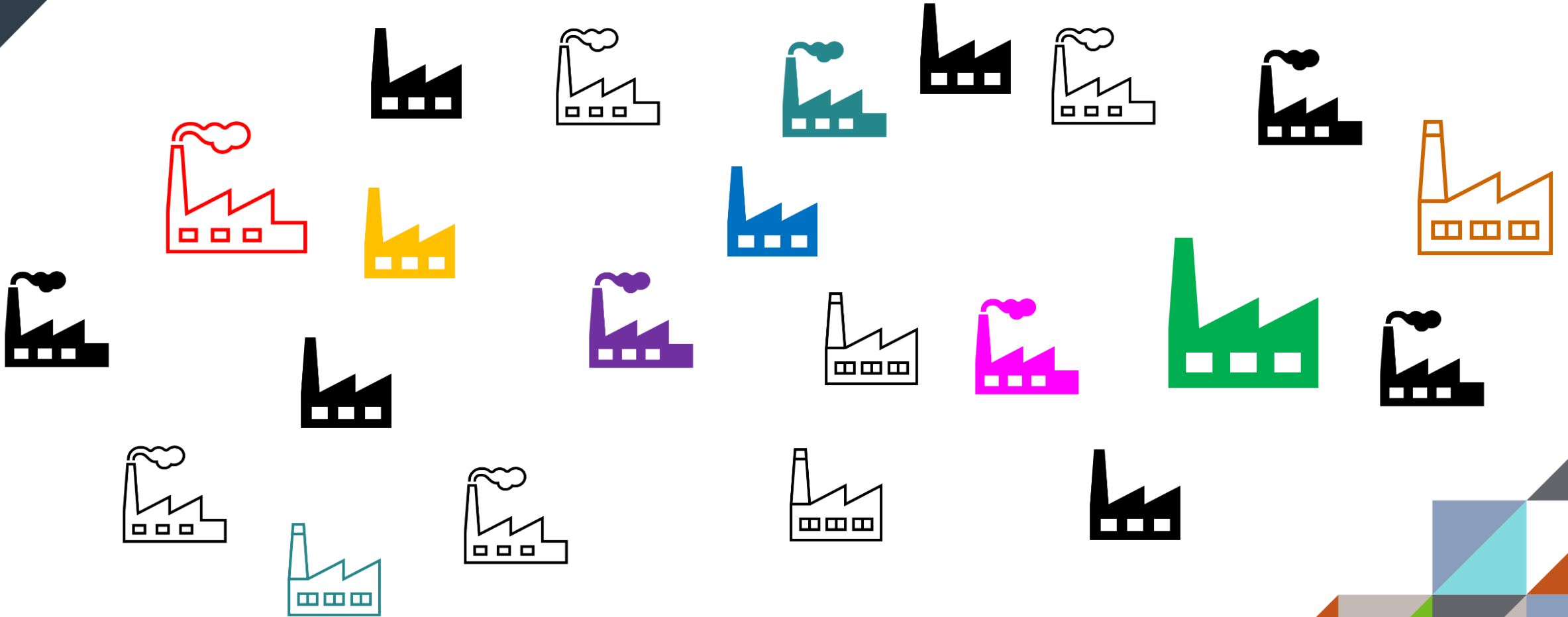




FISC

Foundation
Industries
Sustainability
Consortium

Multiple sites, multiple industries, multiple challenges

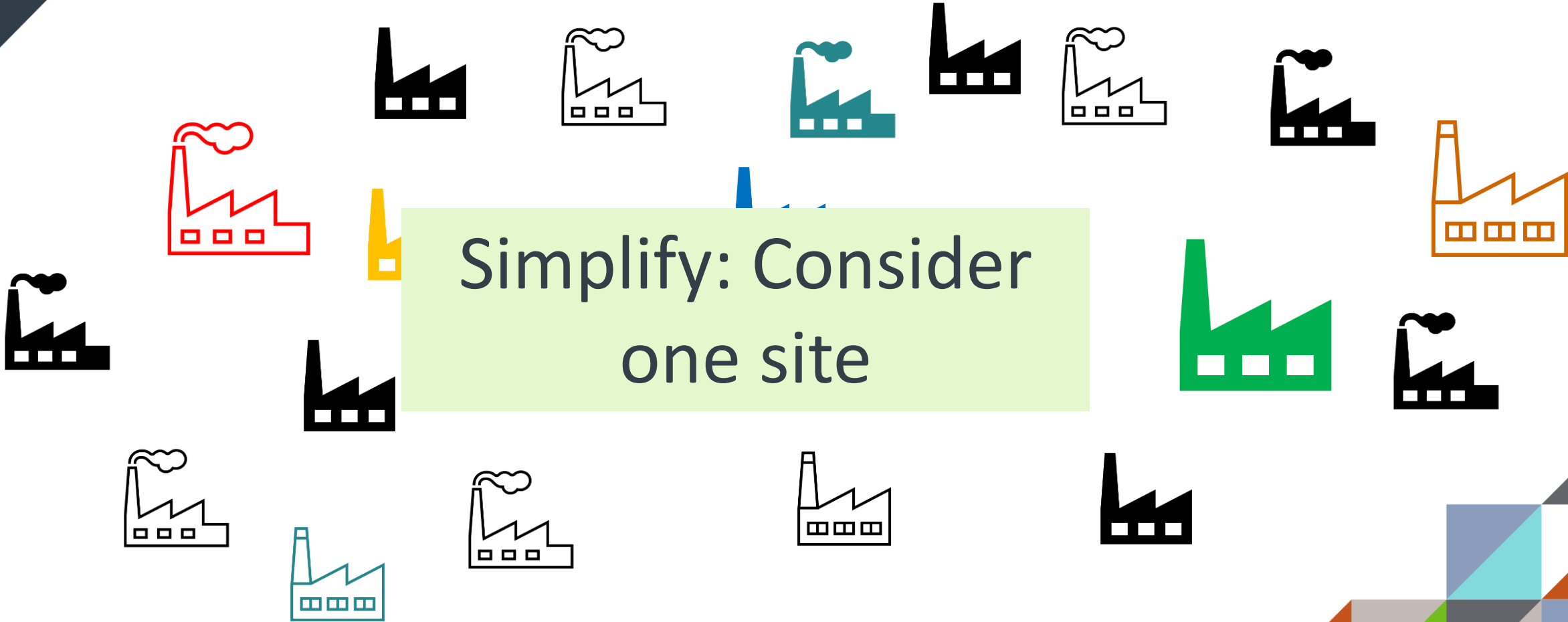




FISC

Foundation
Industries
Sustainability
Consortium

Multiple sites, multiple industries, multiple challenges



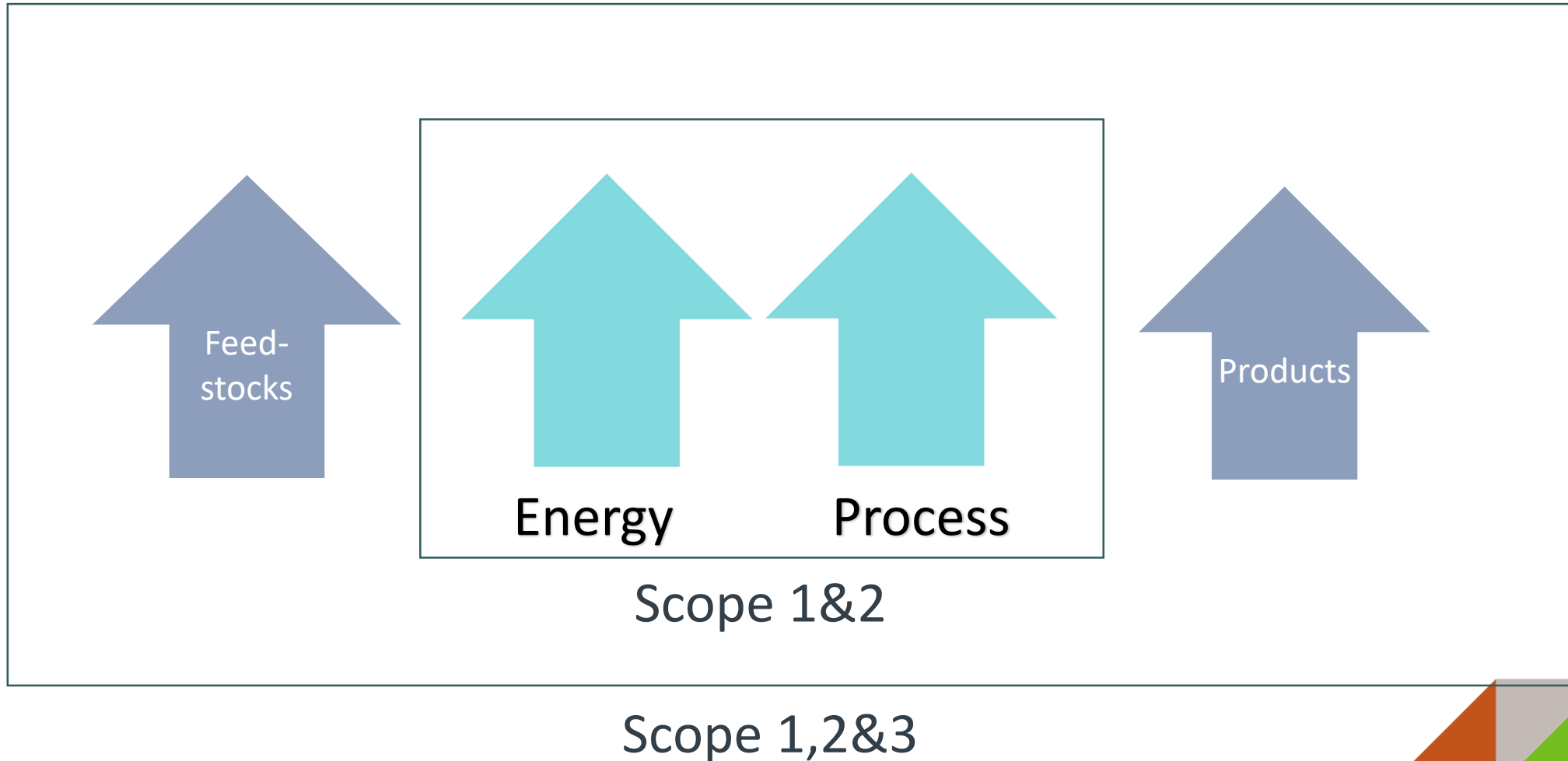
Simplify: Consider
one site



FISC

Foundation
Industries
Sustainability
Consortium

Foundation Industry GHG emissions sources

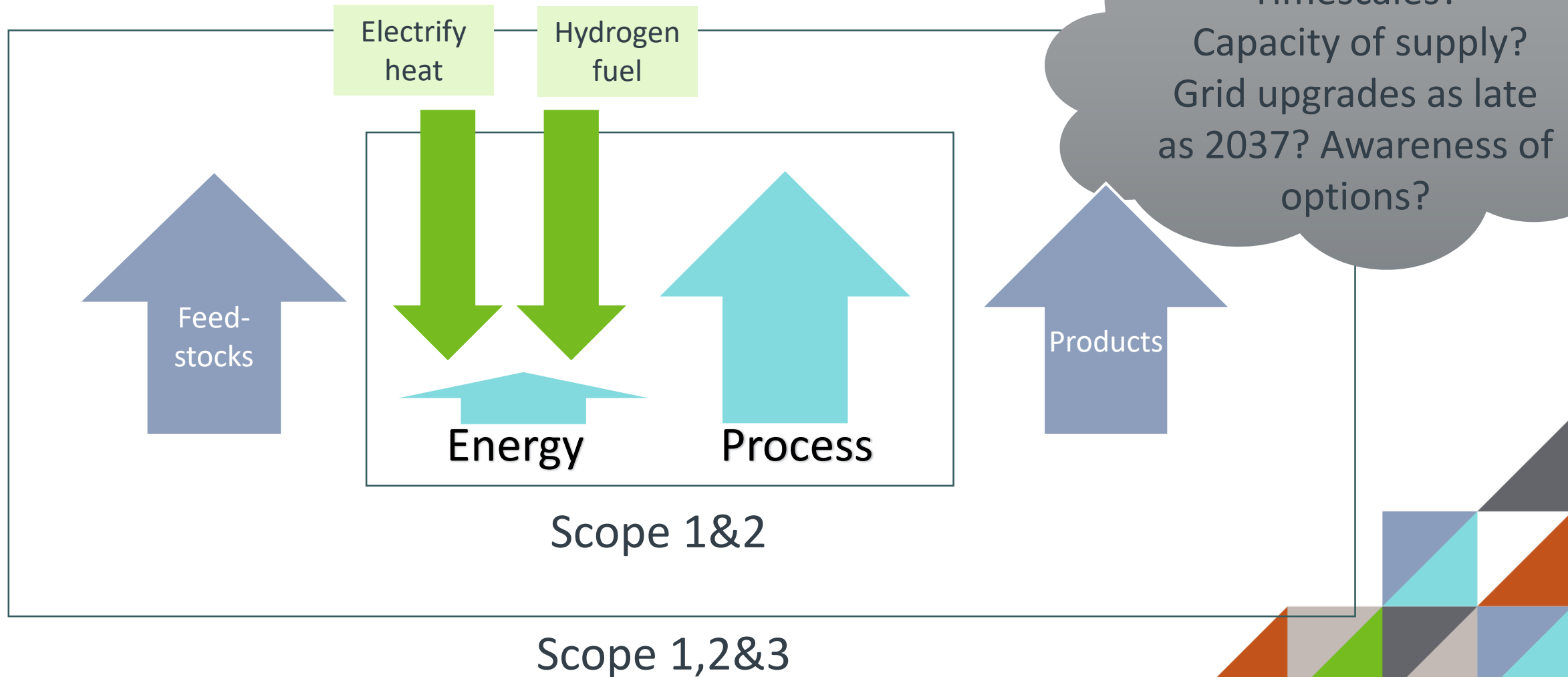




FISC

Foundation
Industries
Sustainability
Consortium

Is hydrogen or electrification the answer?

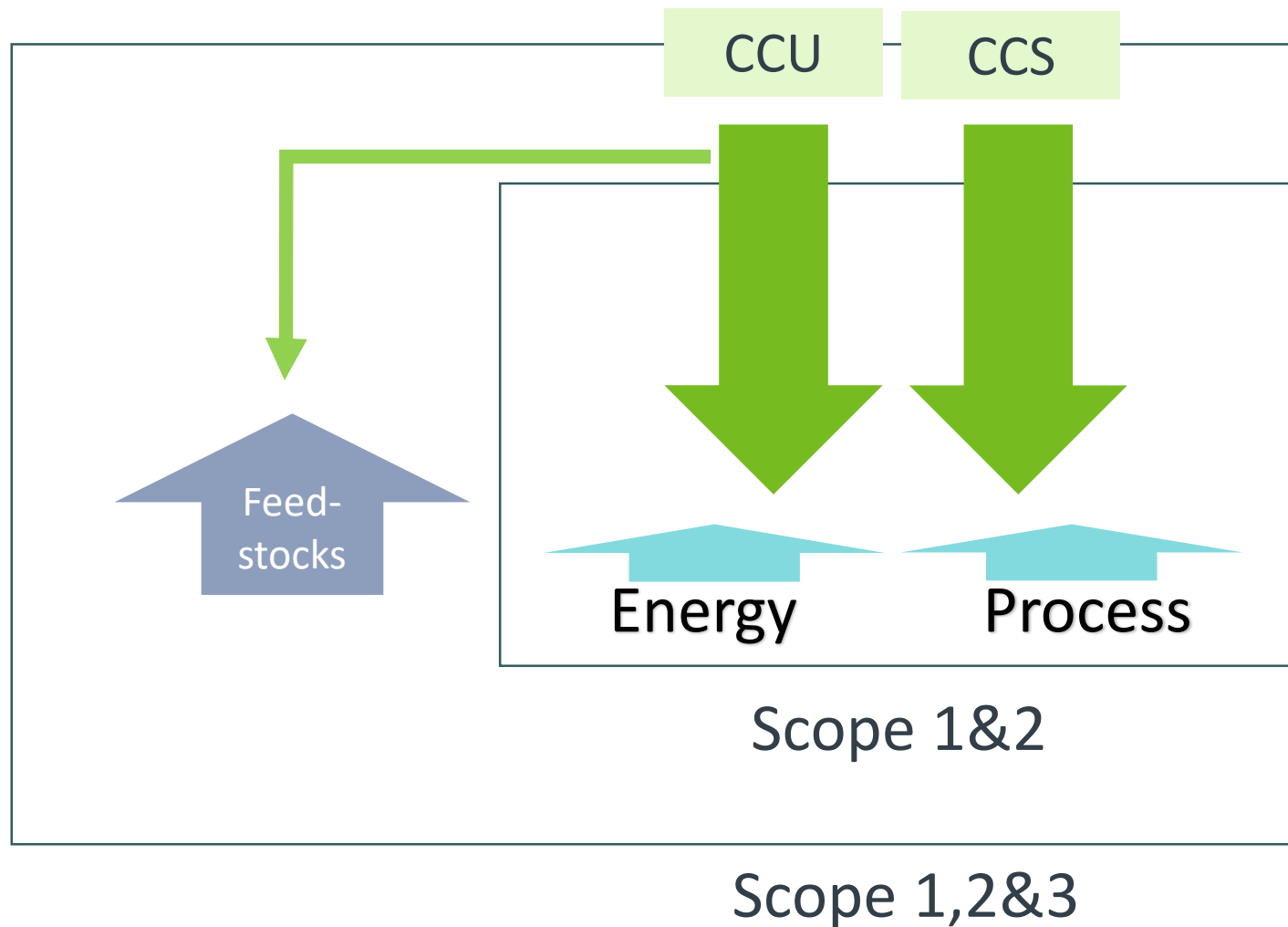




FISC

Foundation
Industries
Sustainability
Consortium

Is Carbon Capture the answer?



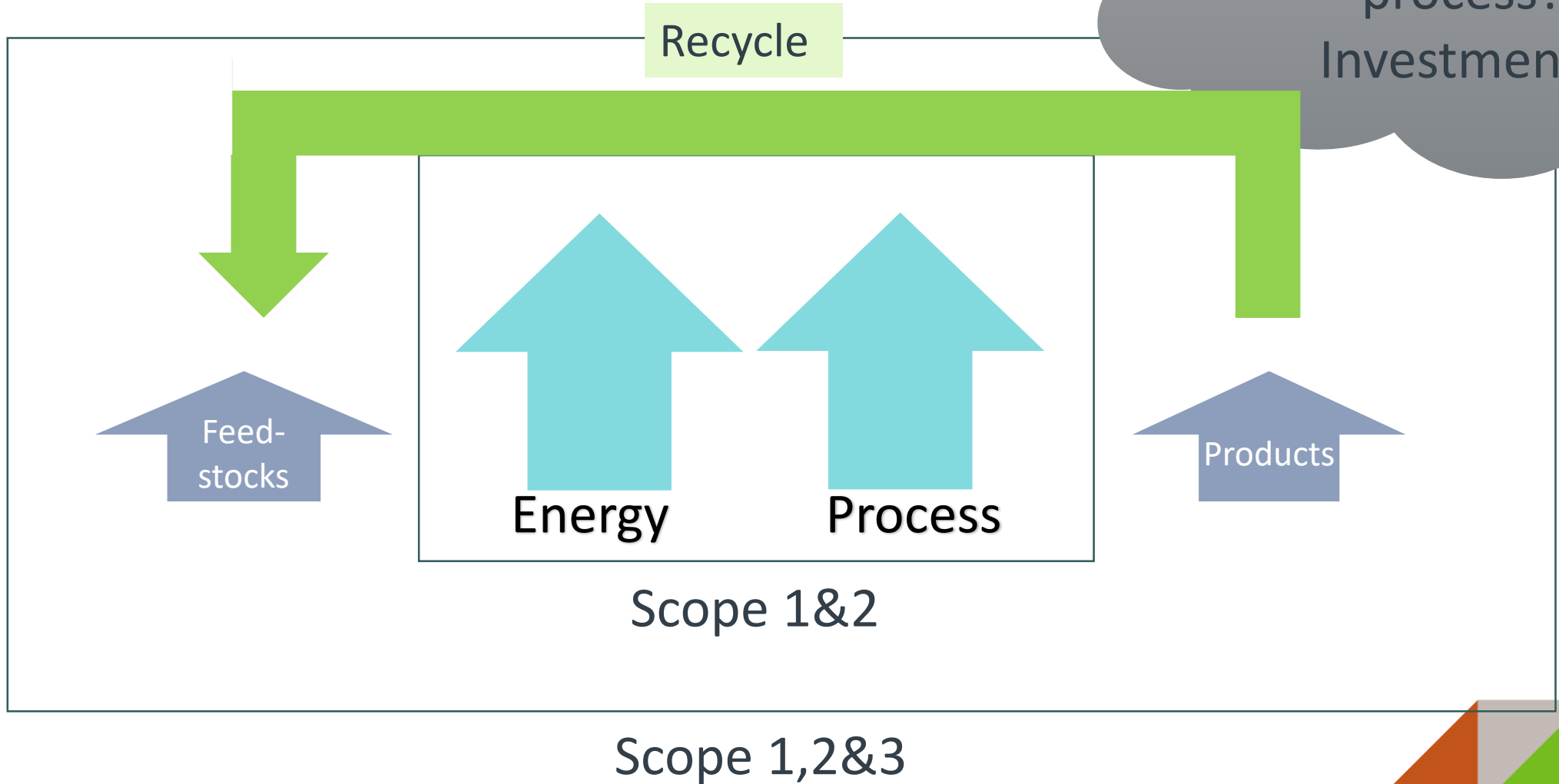
Infrastructure needed & timescale of it? Business models? Investment? Hydrogen? How to select BAT? Technology readiness?



FISC

Foundation
Industries
Sustainability
Consortium

Is Recycling the answer?

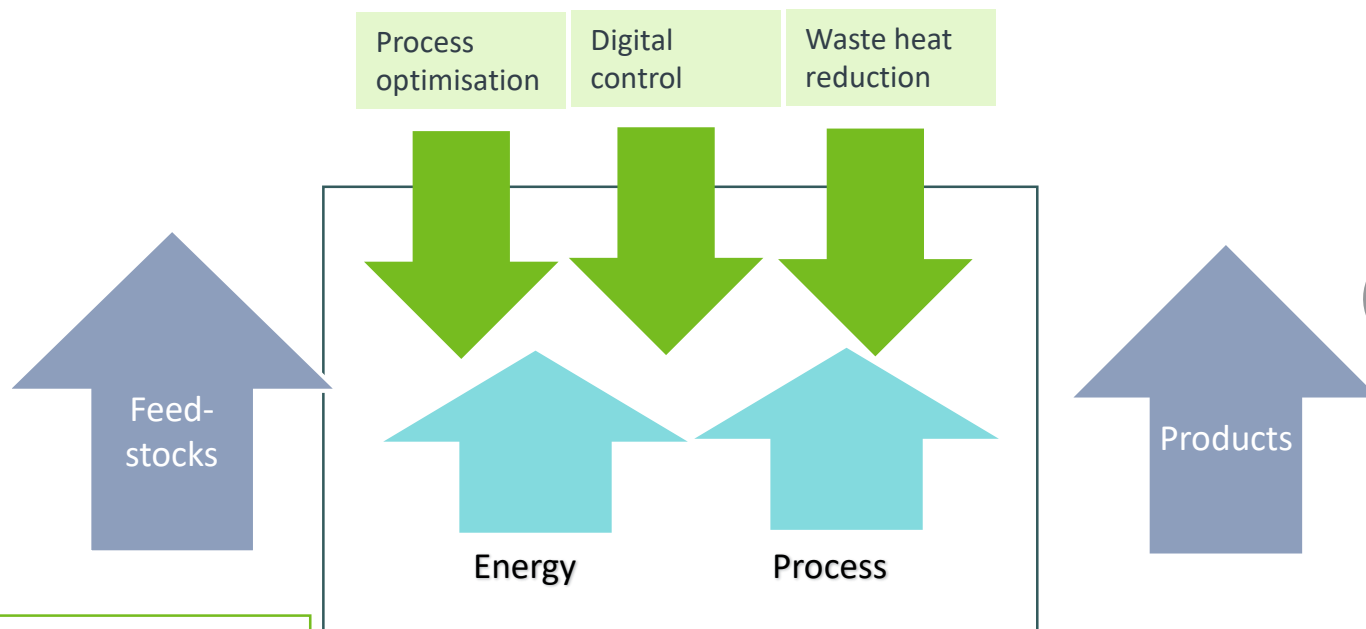




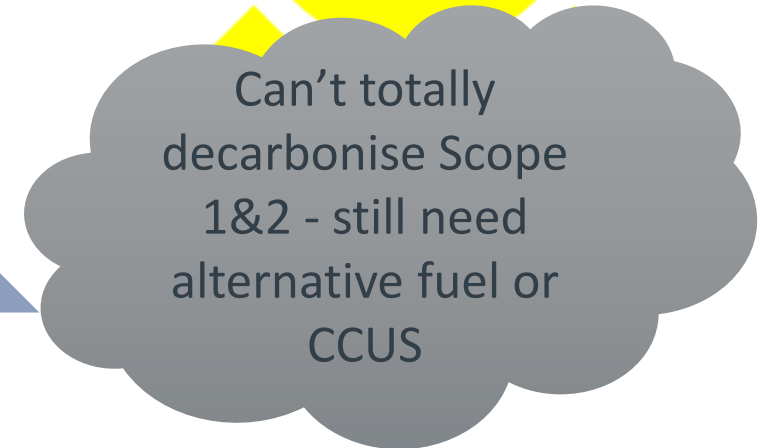
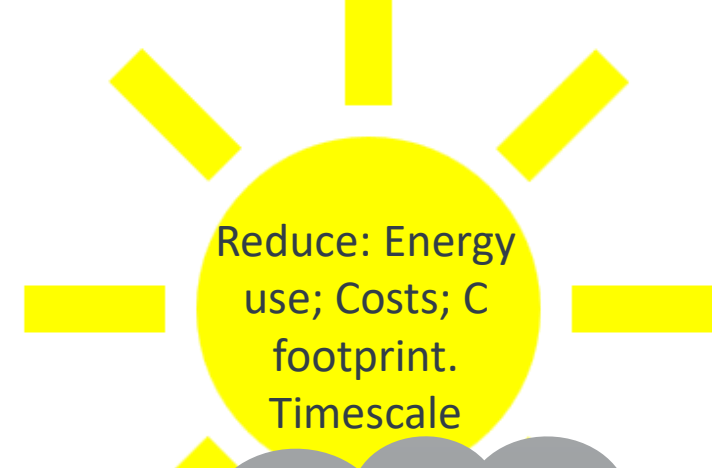
FISC

Foundation
Industries
Sustainability
Consortium

Is Resource efficiency the answer?



Scope 1&2

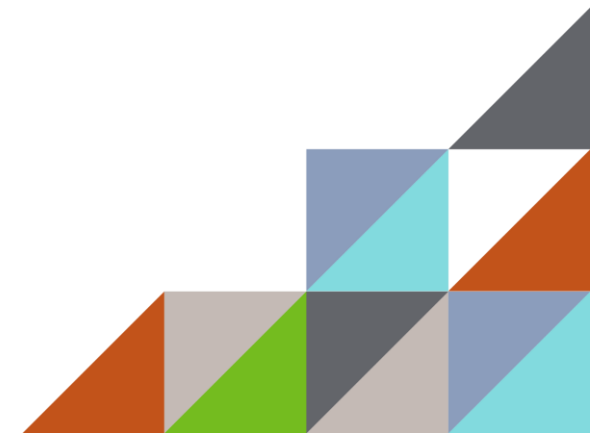


Note: In report to Climate Change Committee, Resource Efficiencies were assumed to contribute c.33% reduction to C emissions by 2050

[DEEP DECARBONISATION PATHWAYS FOR UK INDUSTRY \(theccc.org.uk\)](https://www.theccc.org.uk)

UK government assume resource efficiency will bring about 15% of energy demand reduction from buildings & industry by 2030

[Powering up Britain - GOV.UK \(www.gov.uk\)](https://www.gov.uk)





FISC

Foundation
Industries
Sustainability
Consortium

Overall, the answer is?

Everything, everywhere
~~all at once~~
but phased 😞

Sites must create a plan,
starting with Resource
Efficiencies

Many technologies are
available but most need
**development or
improvement**

Interventions and indicative timescales

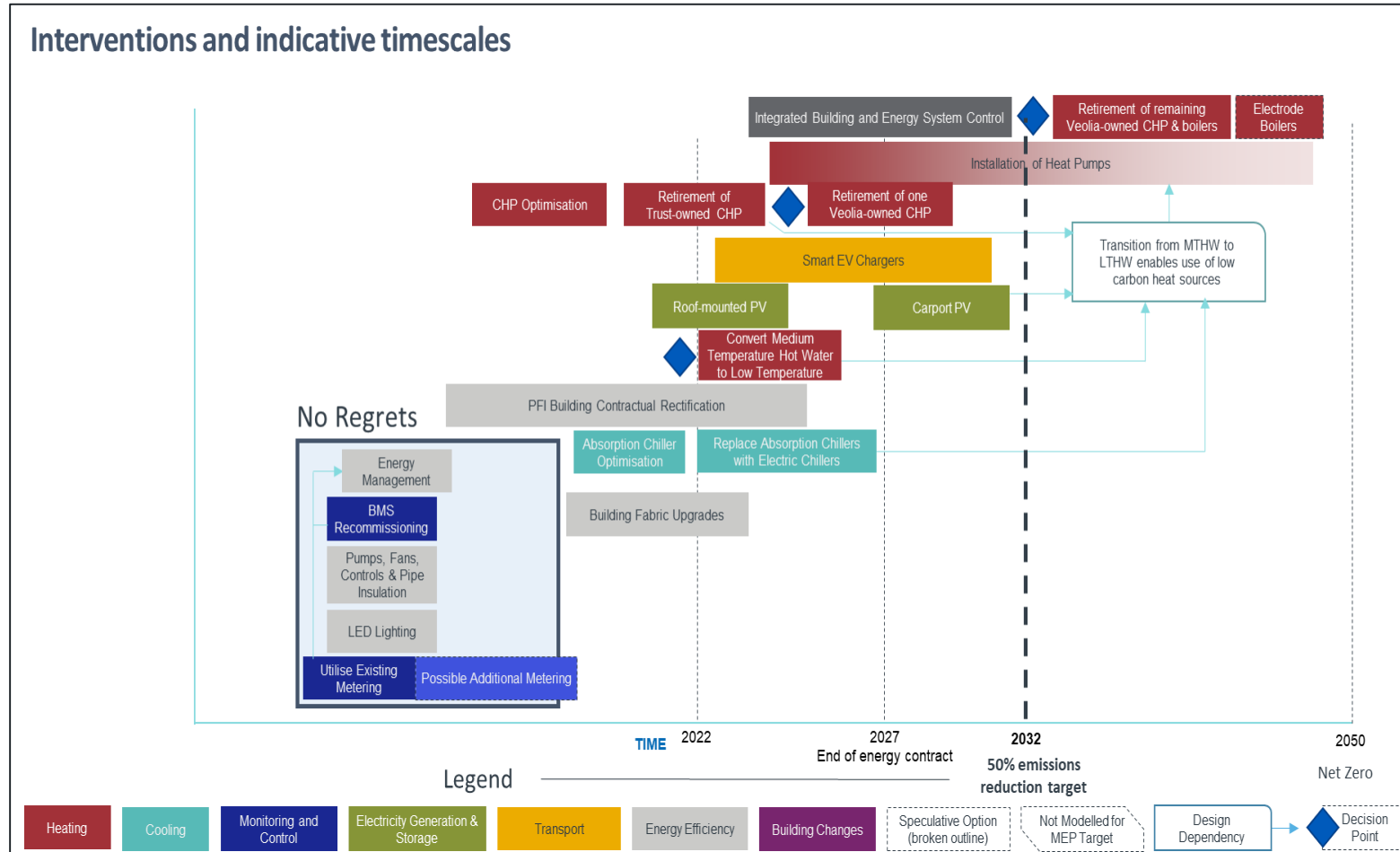


Figure courtesy of Energy Systems Catapult © 2023 Energy Systems Catapult



FISC

Foundation
Industries
Sustainability
Consortium

How is Economiser helping address the challenges?

- Studies of alternative fuels use
- Development of new materials for furnace environments
- Modelling of plasma for next-generation furnaces
- Bringing together academia, suppliers and FI industry to explore feasibility on electrical heating / heat batteries
- Analysis of life-cycle assessments to substantiate sustainability claims
- Pilot processes for glass and carbon fibre composites recycling
- Exploration of chemical recycling processes for polymers
- Application of digital technologies to process improvement / energy reduction in boilers & driers
- & others



FISC

Foundation
Industries
Sustainability
Consortium

Industry Needs : Complexity of Delivery

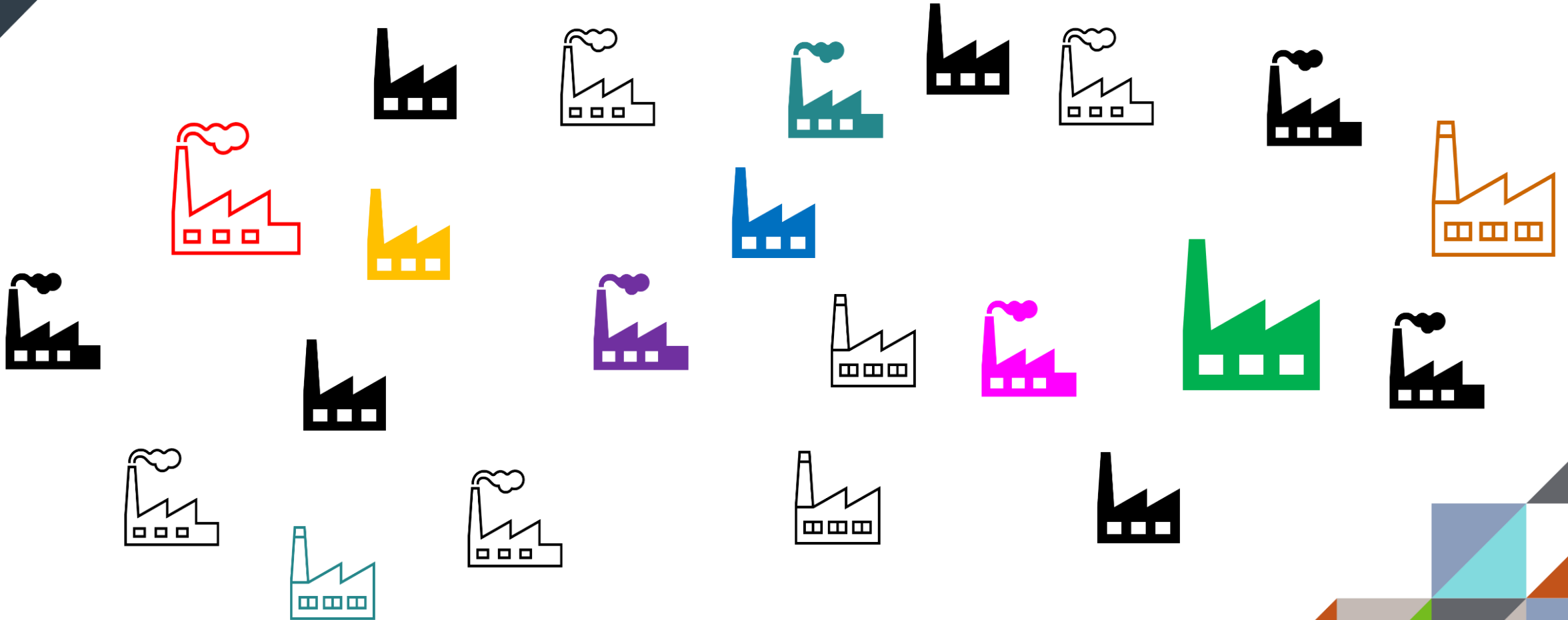




FISC

Foundation
Industries
Sustainability
Consortium

Infrastructure, integration and shared services are critical

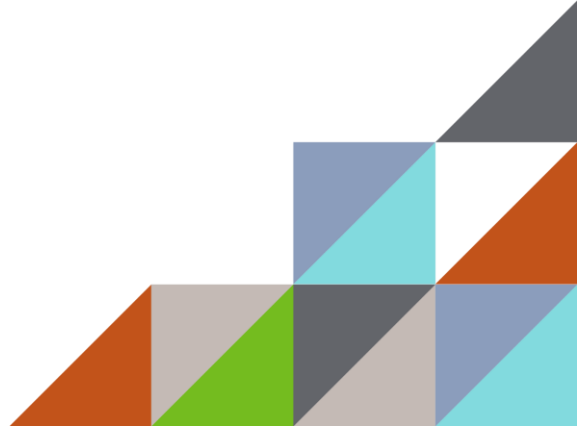
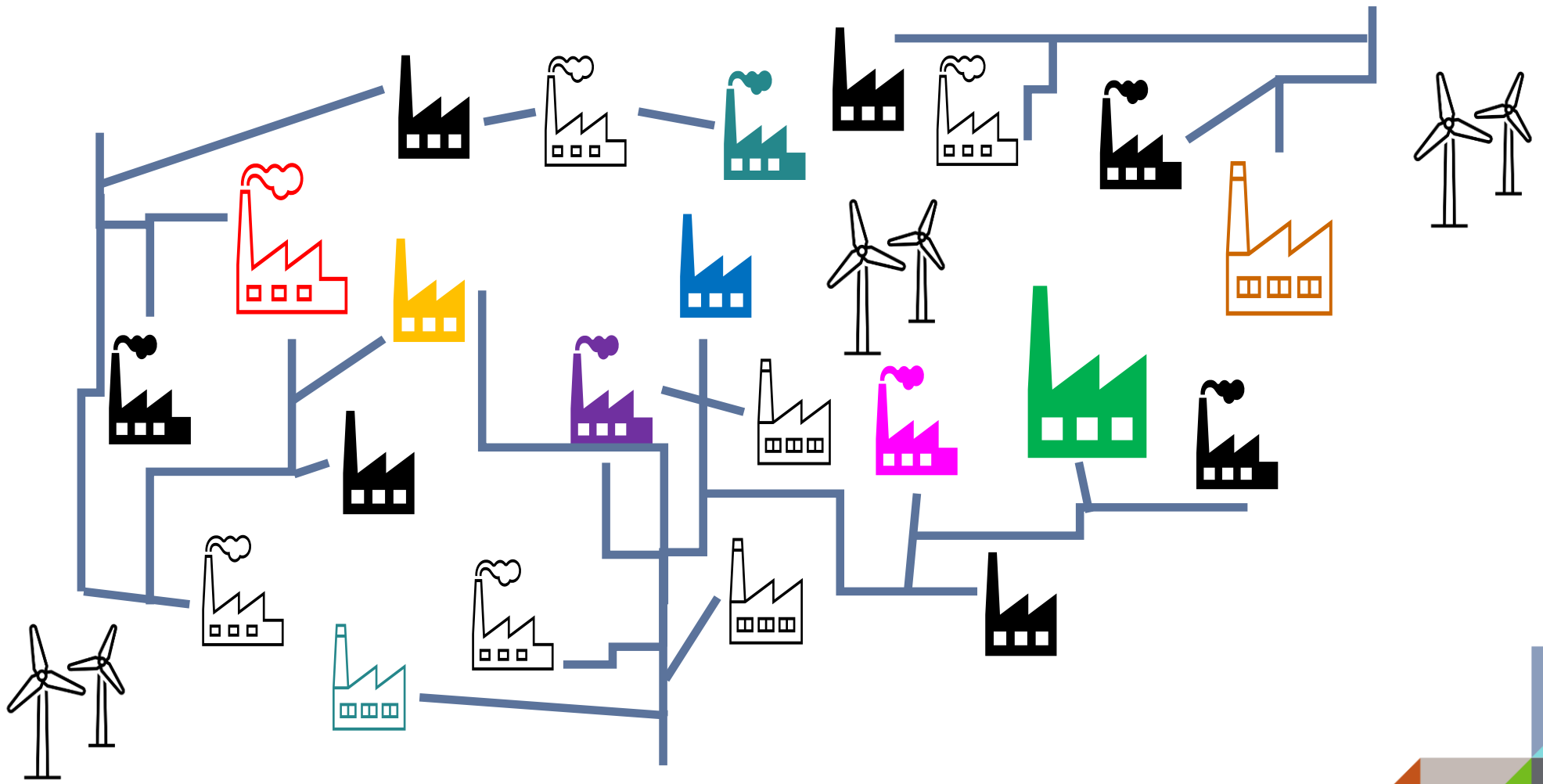




FISC

Foundation
Industries
Sustainability
Consortium

Critical Infrastructure: Electrical

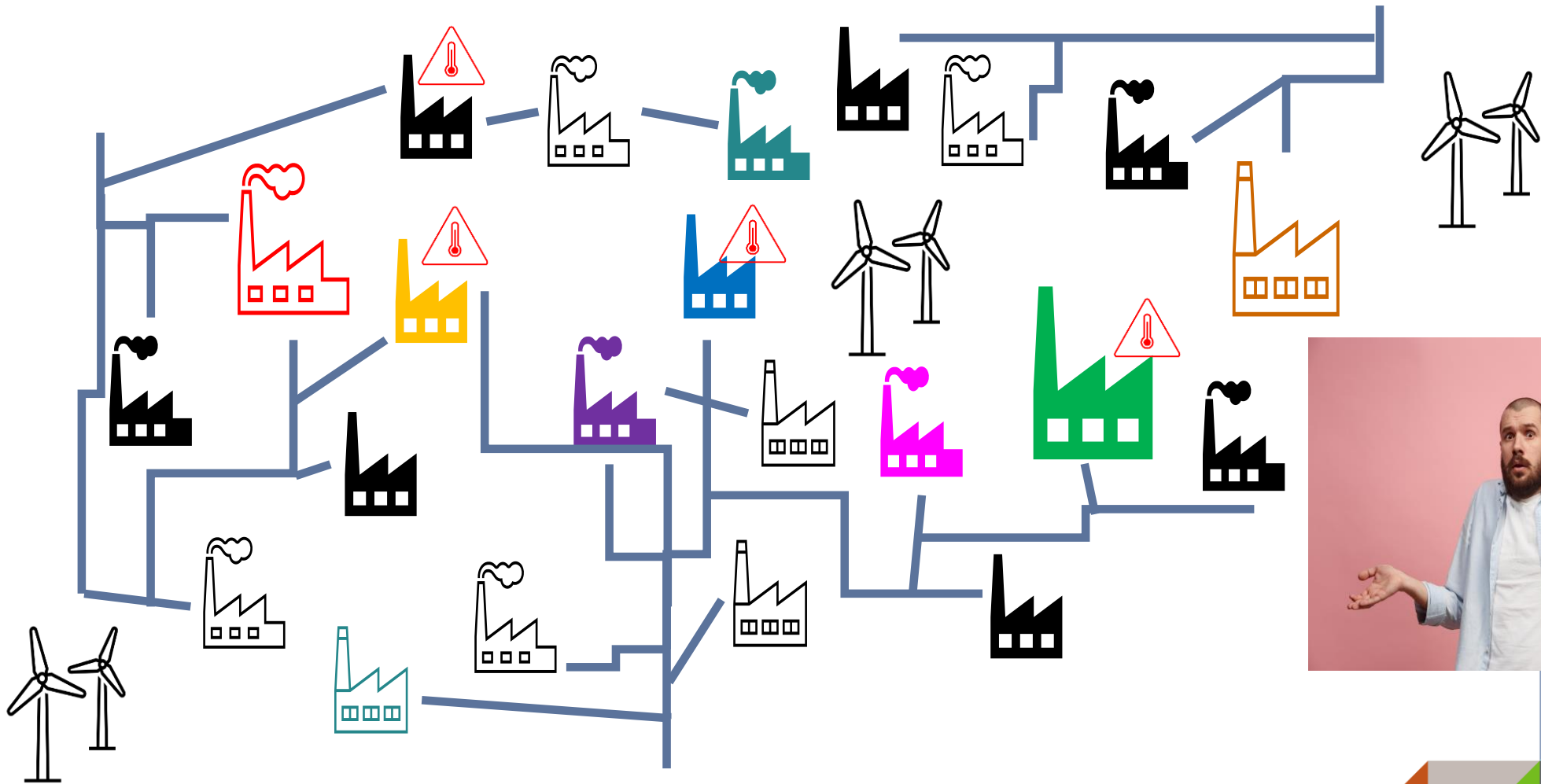




FISC

Foundation
Industries
Sustainability
Consortium

Critical Infrastructure: Waste heat?

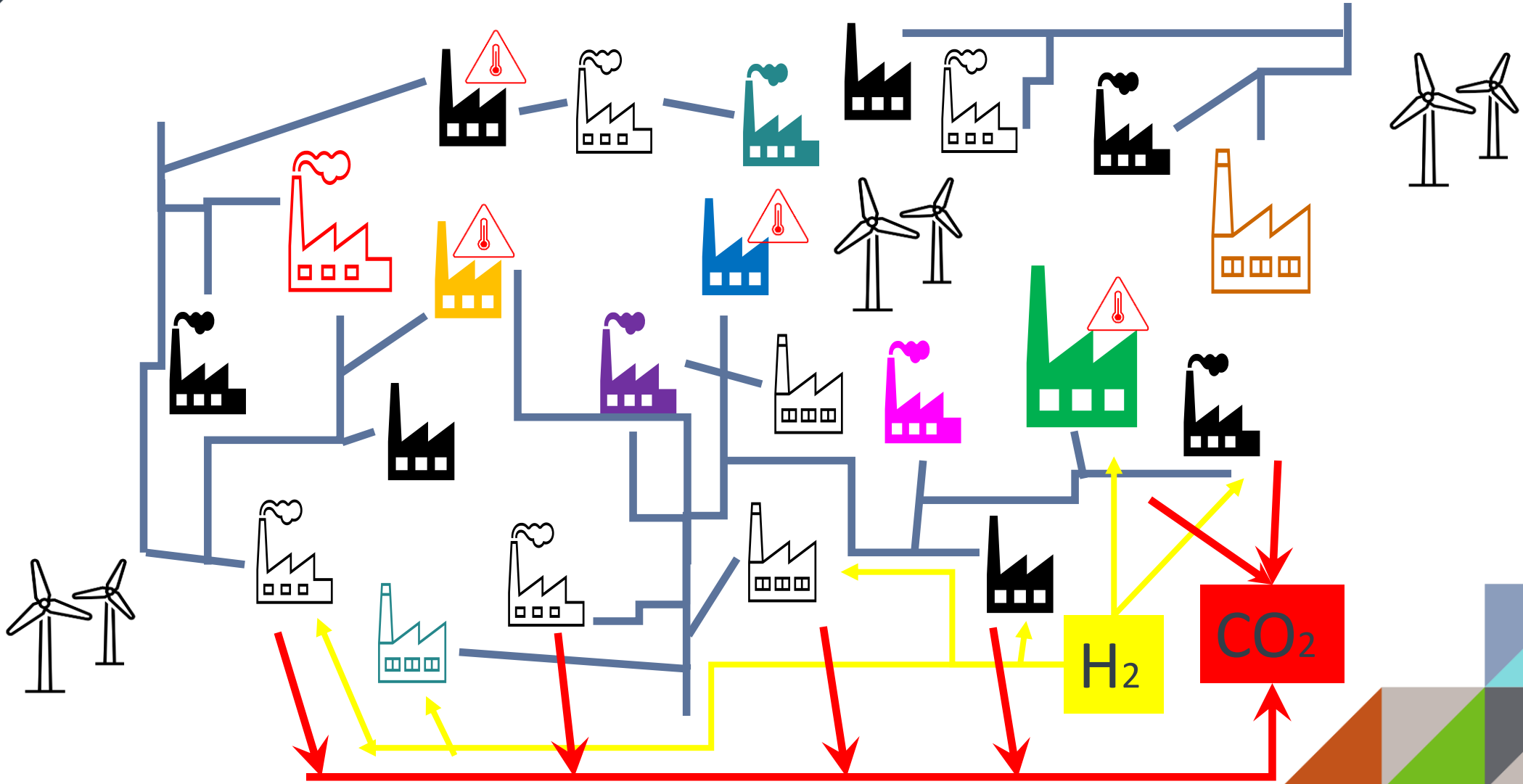




FISC

Foundation
Industries
Sustainability
Consortium

Critical Infrastructure: CCS and / or hydrogen

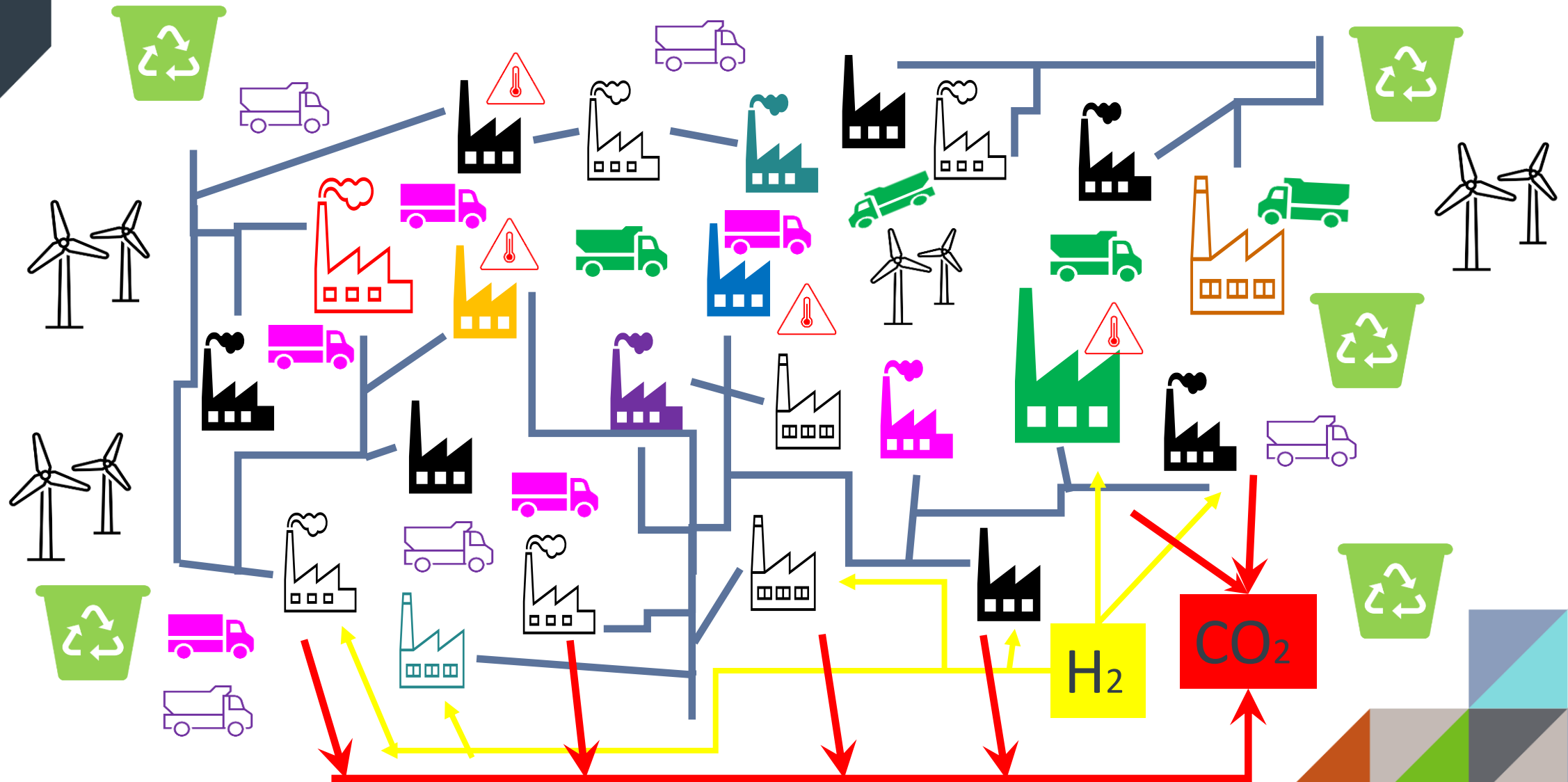




FISC

Foundation
Industries
Sustainability
Consortium

Add shared services for a circular economy:



A photograph of António Guterres, the 9th Secretary-General of the United Nations, speaking at a podium. He is wearing a dark suit, a light blue shirt, and a red patterned tie. He has his right hand raised to his face, with his index finger pointing towards his eye. The background is a blue wall with a white world map. A microphone with a red top is visible in the foreground.

Warp speed climate action?

Some suggestions.....



FISC

Foundation
Industries
Sustainability
Consortium

Industry needs action on:

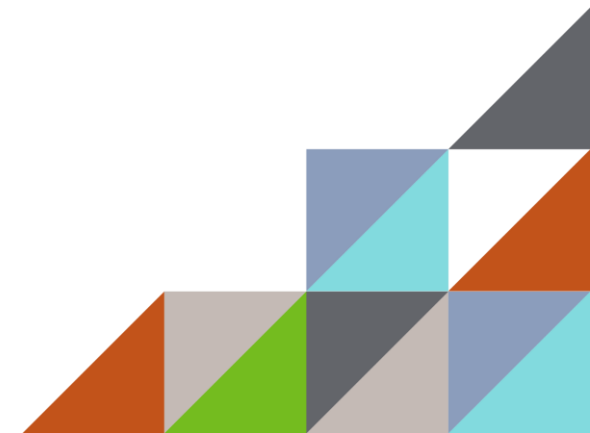
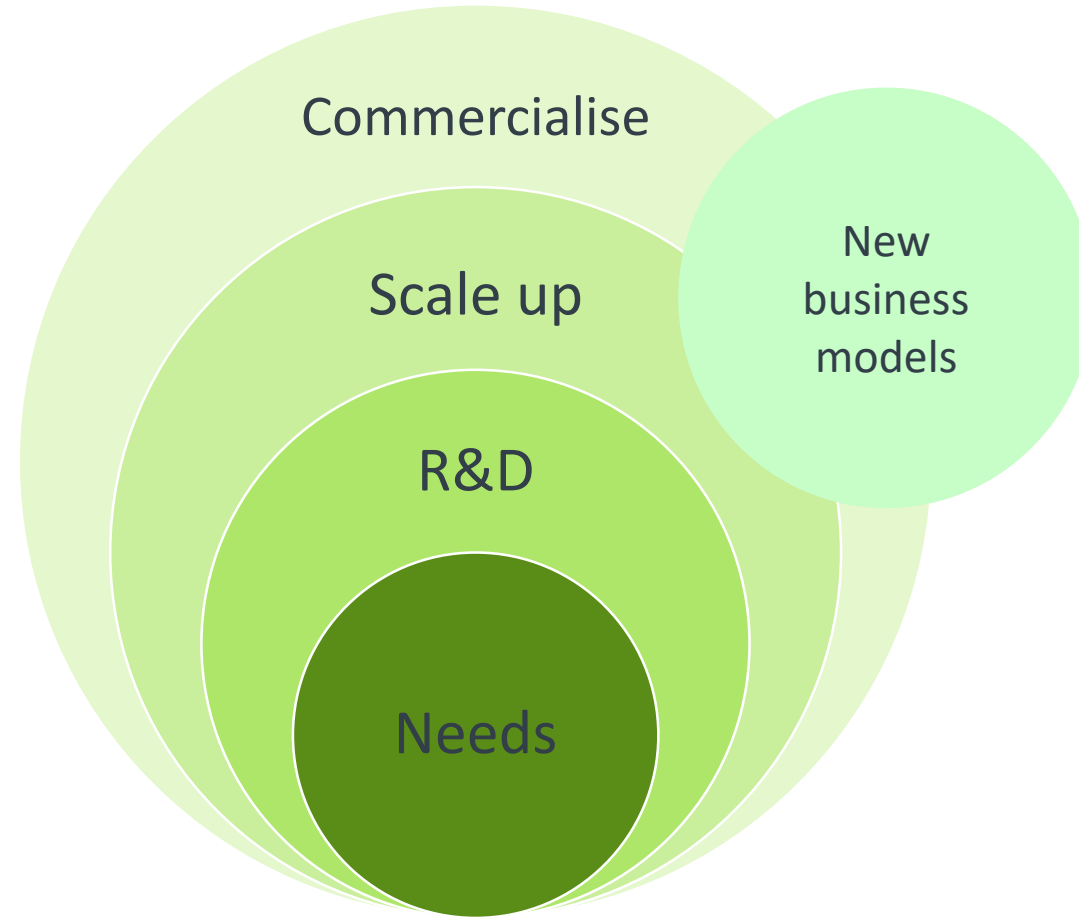
- Infrastructure delivery
- Developing resource efficiencies through process improvement / digitisation
- Developing systems for recovery and use of waste heat (& how to share heat)
- Developing awareness of heat options; electrify or alternative fuels?
- Developing novel heat batteries & thermochemical batteries
- Understanding how to use alternative fuel in specific process
- Materials for alt fuel uses e.g. in next gen furnaces, hydrogen combustion
- Less energy intensive CCUS & hydrogen source for CCU
- Better recycling; technical, sorting, systems & policy
- Policy – influence policies to incentivise not penalise (would result in off-shoring)
- And many, many more.....



FISC

Foundation
Industries
Sustainability
Consortium

Rapid development routes needed



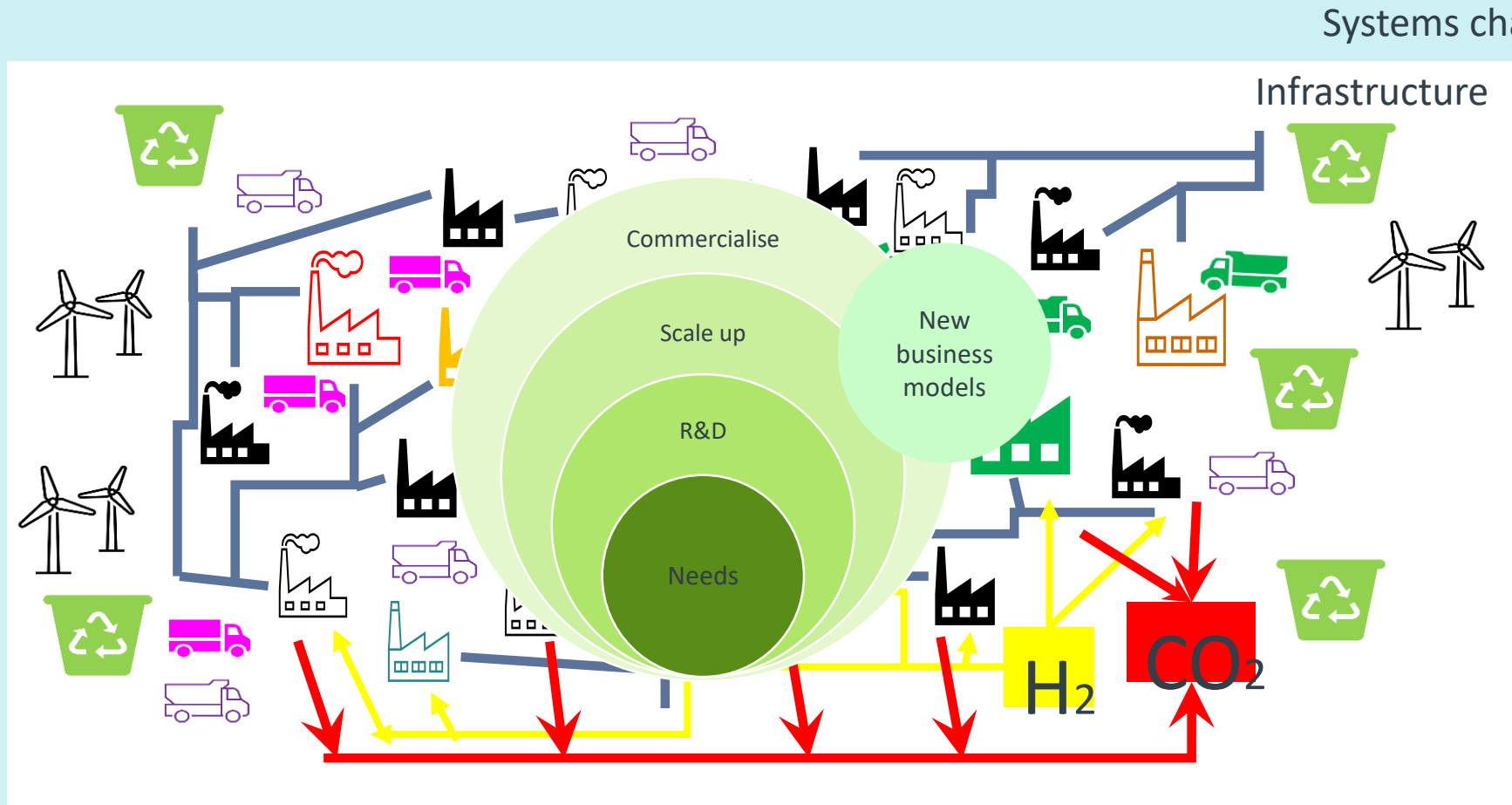


FISC

Foundation
Industries
Sustainability
Consortium

How to deliver innovation within complexity?

Policy





FISC

Foundation
Industries
Sustainability
Consortium

One possible solution?

Connect with parallel universe versions of ourselves.

Probably not.....

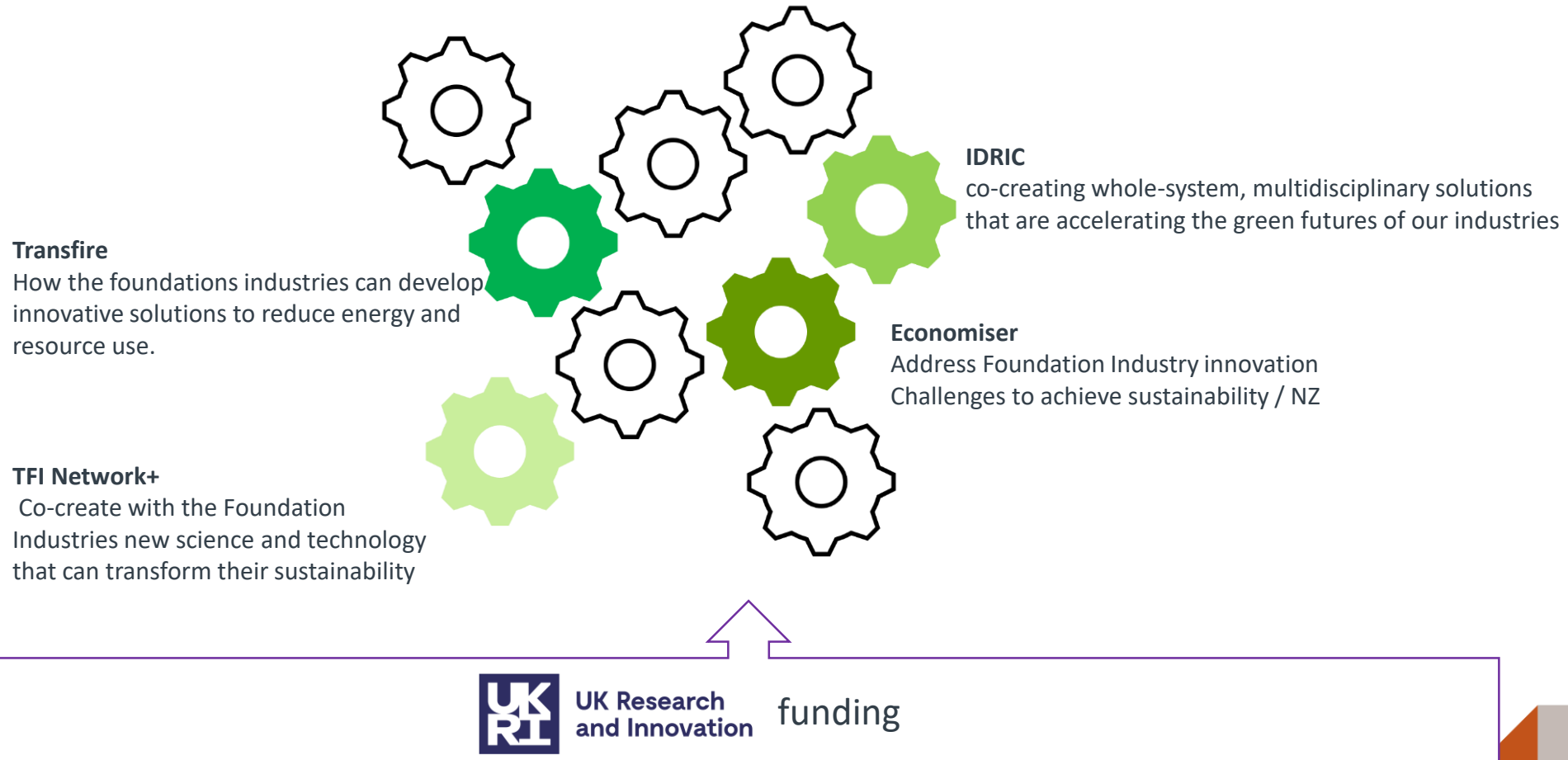




FISC

Foundation
Industries
Sustainability
Consortium

Industrial decarbonisation : Public R&D funding landscape

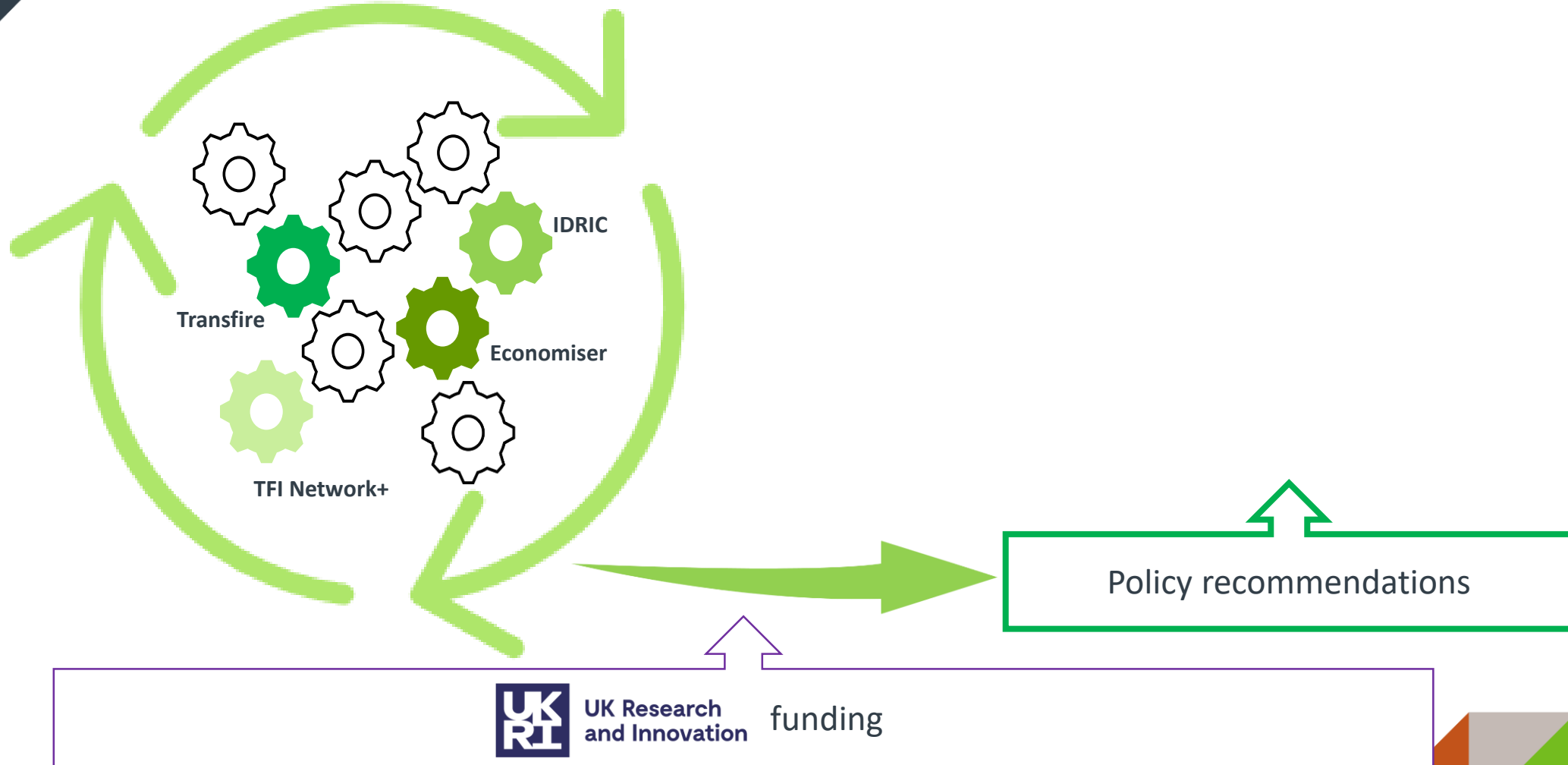




FISC

Foundation
Industries
Sustainability
Consortium

Accelerated utilisation of research outputs is needed to make impact

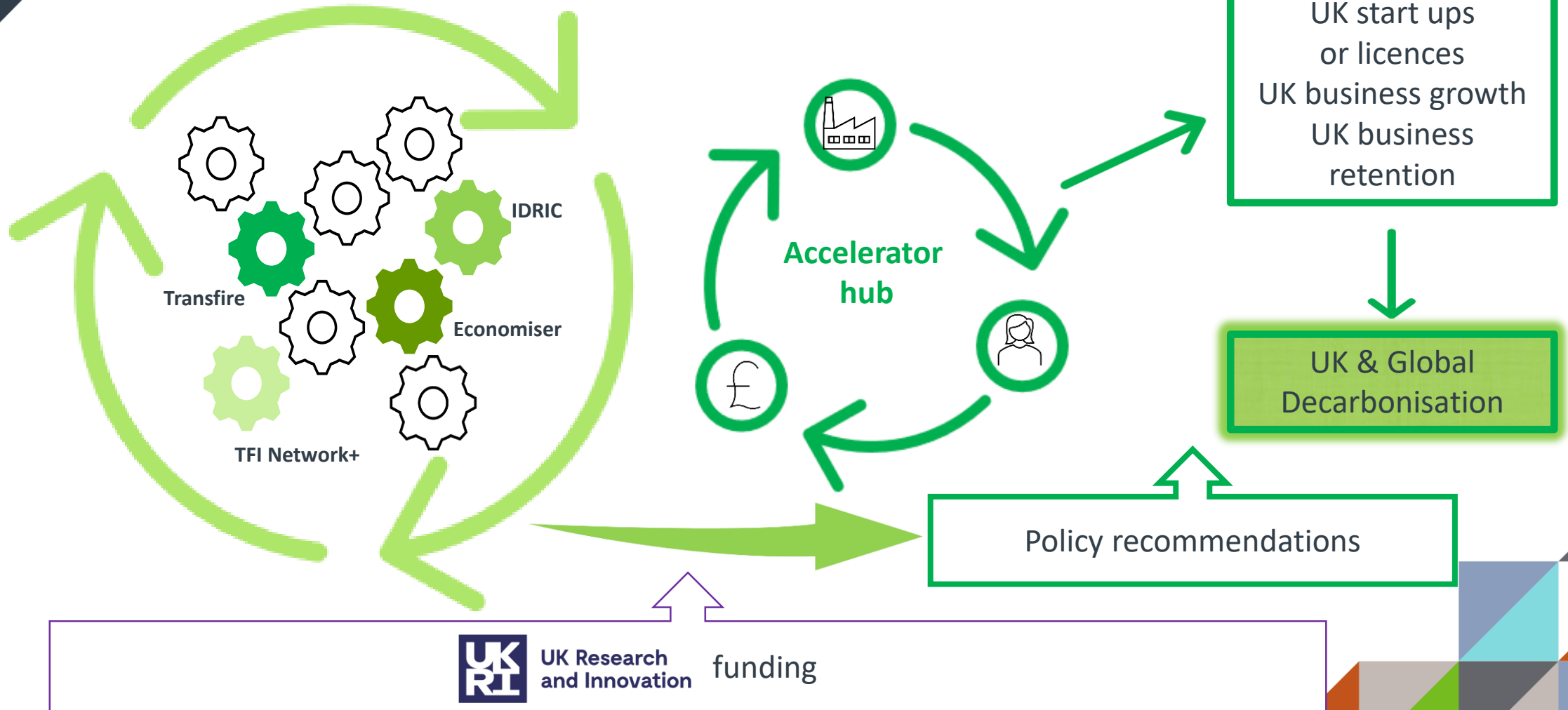




FISC

Foundation
Industries
Sustainability
Consortium

Accelerated transfer, scale up & commercialisation





FISC

Foundation
Industries
Sustainability
Consortium

Contact Us

If you would like to discuss a decarbonisation or sustainability issue faced in your industry, please get in touch with me:

Dr Lorraine Ferris

Royce Fellow | Henry Royce Institute

lorraine.ferris@manchester.ac.uk

