



RESOURCE EFFICIENCY
in Construction and the Built Environment



**UNIVERSITY OF
CAMBRIDGE**

Material, Energy and Carbon in construction

14 February 2019
Department of Engineering

Material, Energy and Carbon in construction

Agenda

Introductions

12.30 - Registration and coffee

13.00 - Welcome - Simon Guest, Professor of Structural Mechanics, Head of Civil Engineering (University of Cambridge)

13.10 - Opening presentation - Jonathan Cullen (University of Cambridge)

Session I: "Material, Energy and Carbon in construction"

13.20 - Simon Sturgis - "Net Zero for Whole Life Carbon" (Targeting Zero LLP)

13.35 - John Orr - "Minimising Energy in Construction – Survey of Structural Engineering Practice" (University of Cambridge)

13.50 - Danielle Densley-Tingley - "Whole life material efficiency research at the University of Sheffield" (University of Sheffield)

14.05 - Discussion

14.30 – Coffee

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14.50 - André Cabrera Serrenho - "Strategies to reduce greenhouse gas emissions of the English housing stock" (University of Cambridge)

15.05 - Iain Cameron - "The Impact of the Client Brief on Material Efficiency in Construction – The New Civil Engineering Building in Cambridge" (University of Cambridge)

15.20 - Rebecca Hartwell – "A regenerative approach to façade engineering with a focus on end-of-life challenges " (University of Cambridge)

15.35 - Discussion

16.00 - Running Projects - open session to present current projects

16.20 - Next Steps

16.30 - Visit to The James Dyson Building and The Dyson Centre (Department of Engineering, Trumpington St)



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Jonathan Cullen

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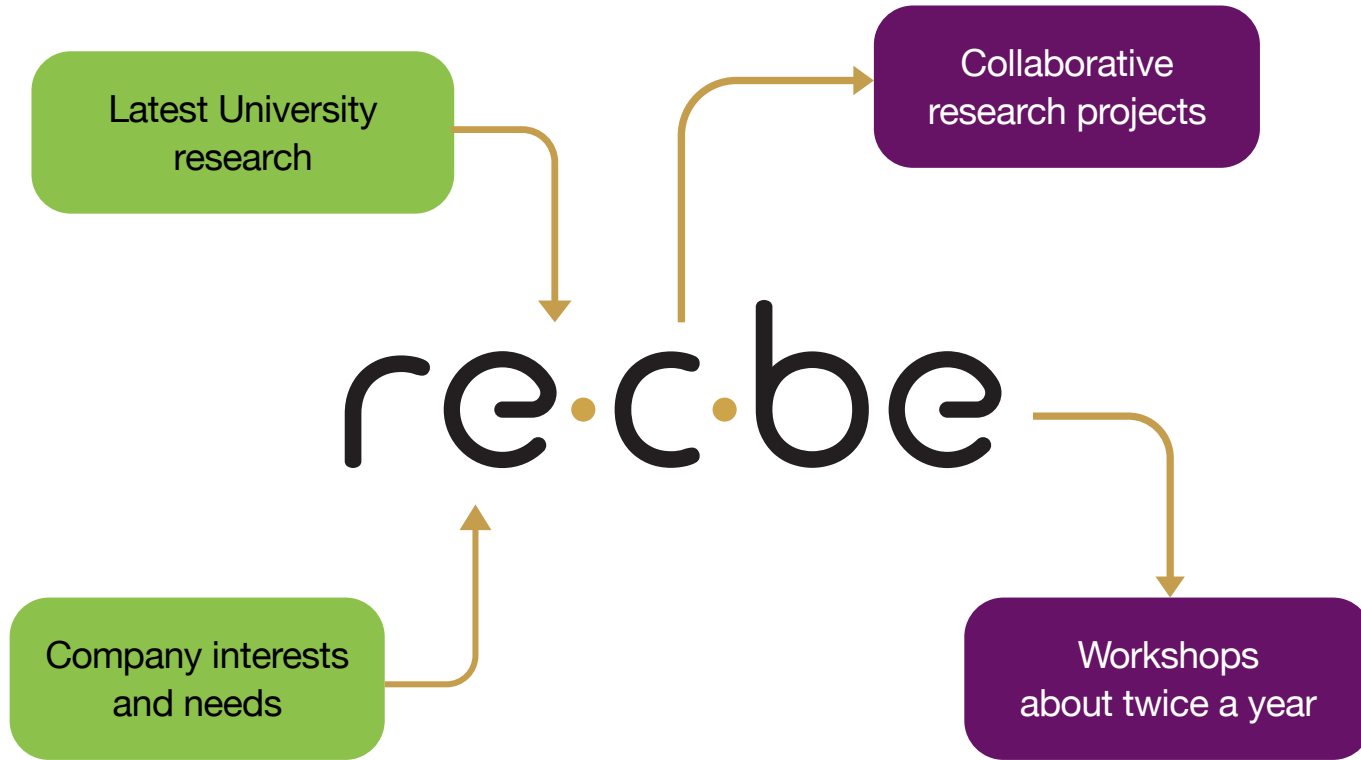
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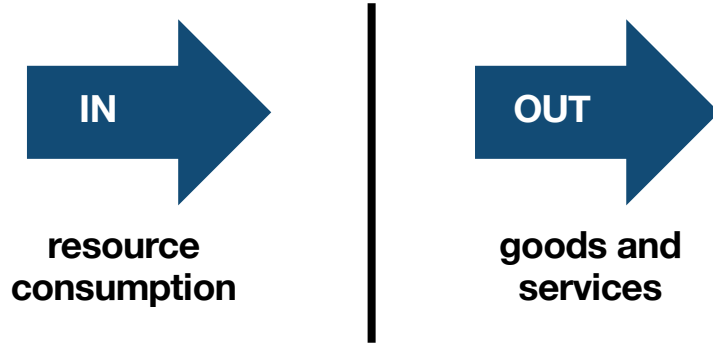
resource
efficiency
collective



Resource Efficiency Collective is a research initiative at Cambridge University. Together, we seek answers to a challenging question: how can we deliver future energy and material services, while at the same time reducing resource use and environmental impact?



Resource efficiency

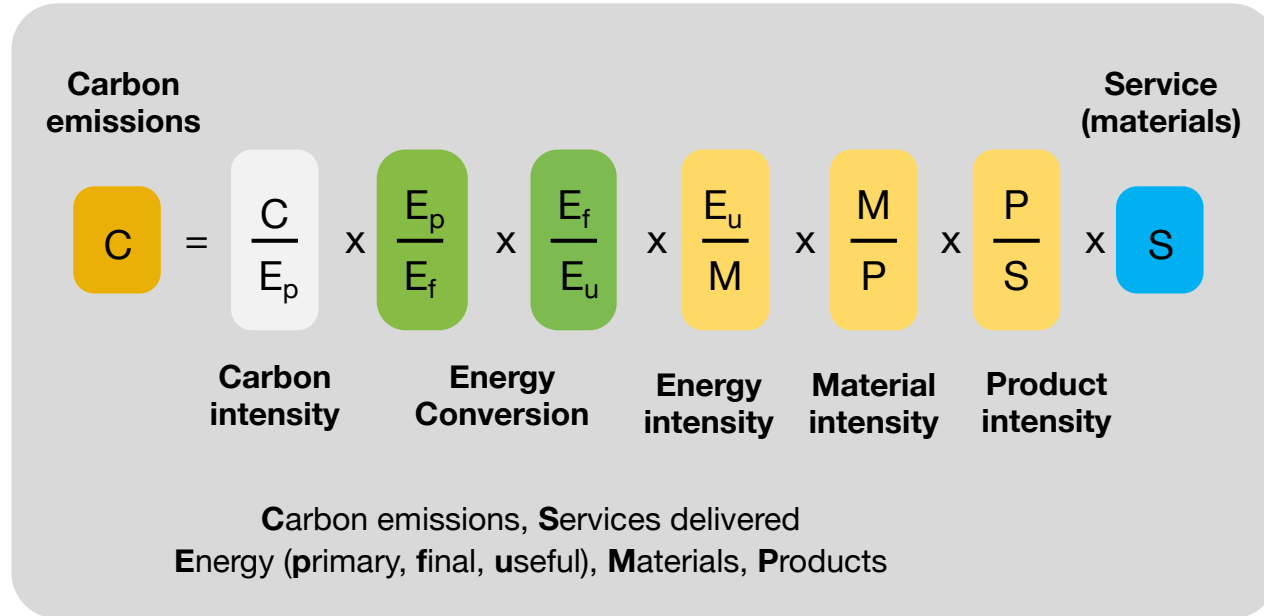


$$\text{Resource efficiency} = \frac{\text{OUT}}{\text{IN}}$$
$$= \frac{\text{service}}{\text{resources}}$$

Delivering goods and services, profitably,
with less resource consumption

Resource efficiency

How can we deliver future energy and material services, while reducing resource use and environmental impact?

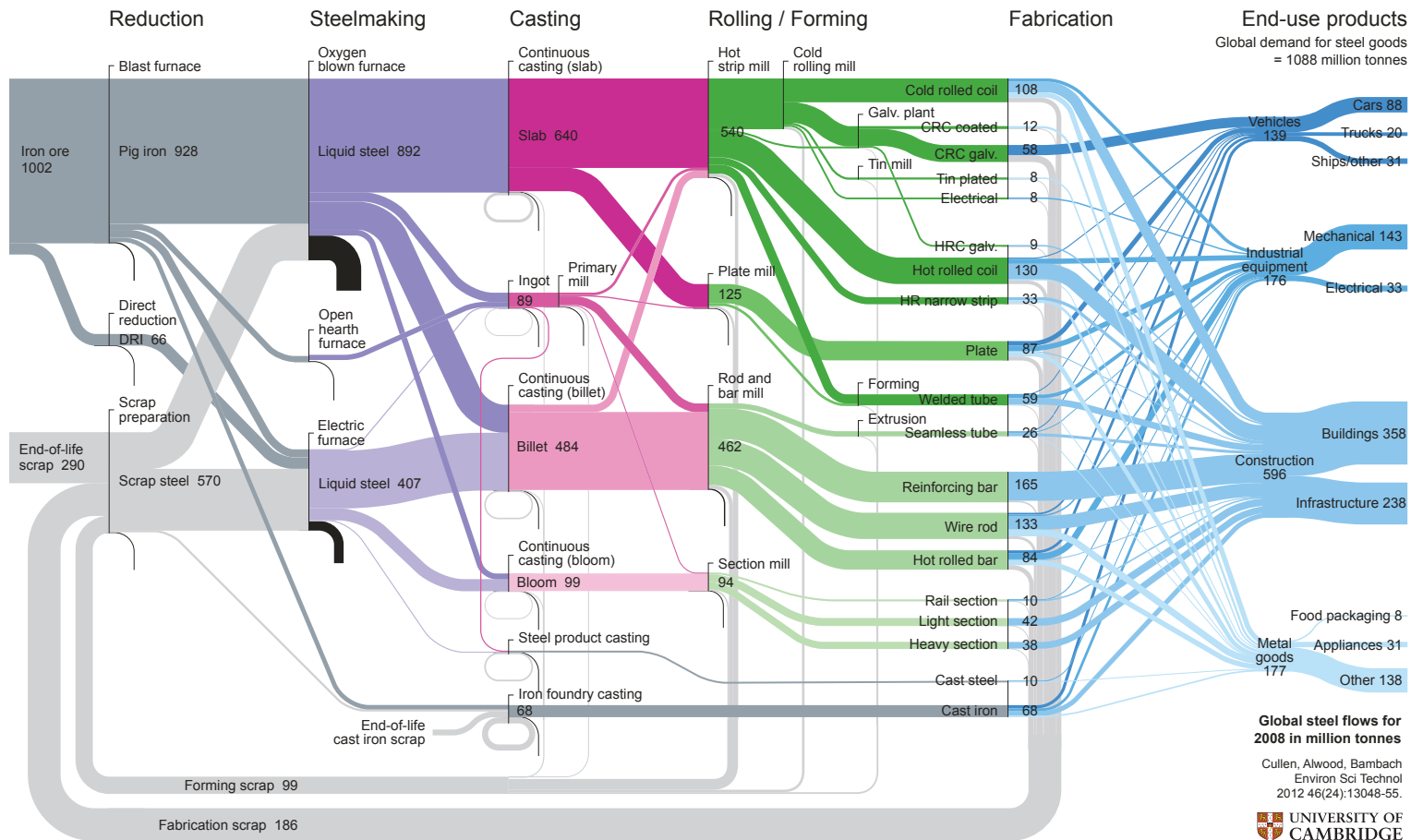


Levers

- Energy decarbonisation
- Energy efficiency
- Service efficiency
- Service reduction

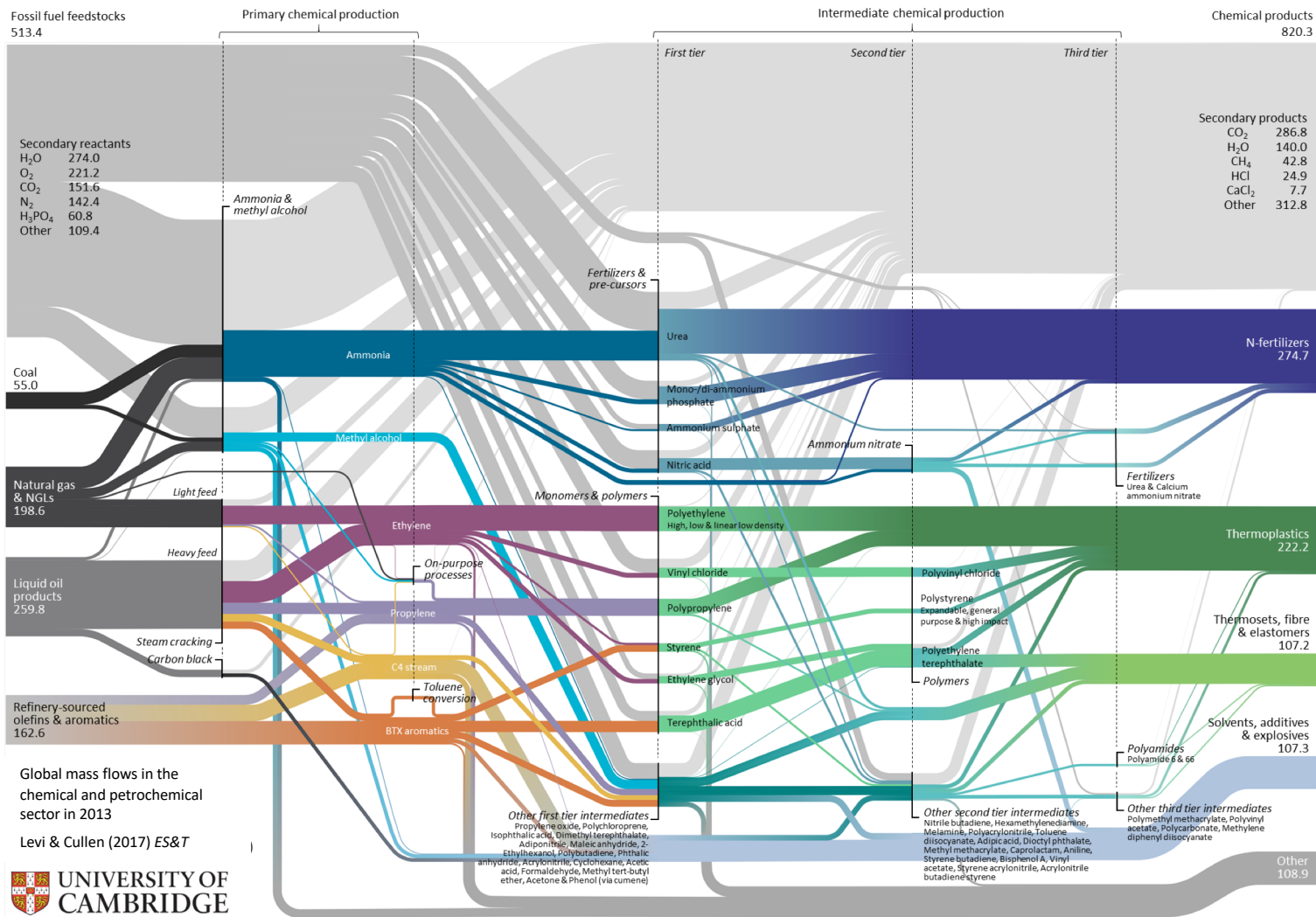
Resource mapping

Global steel flows



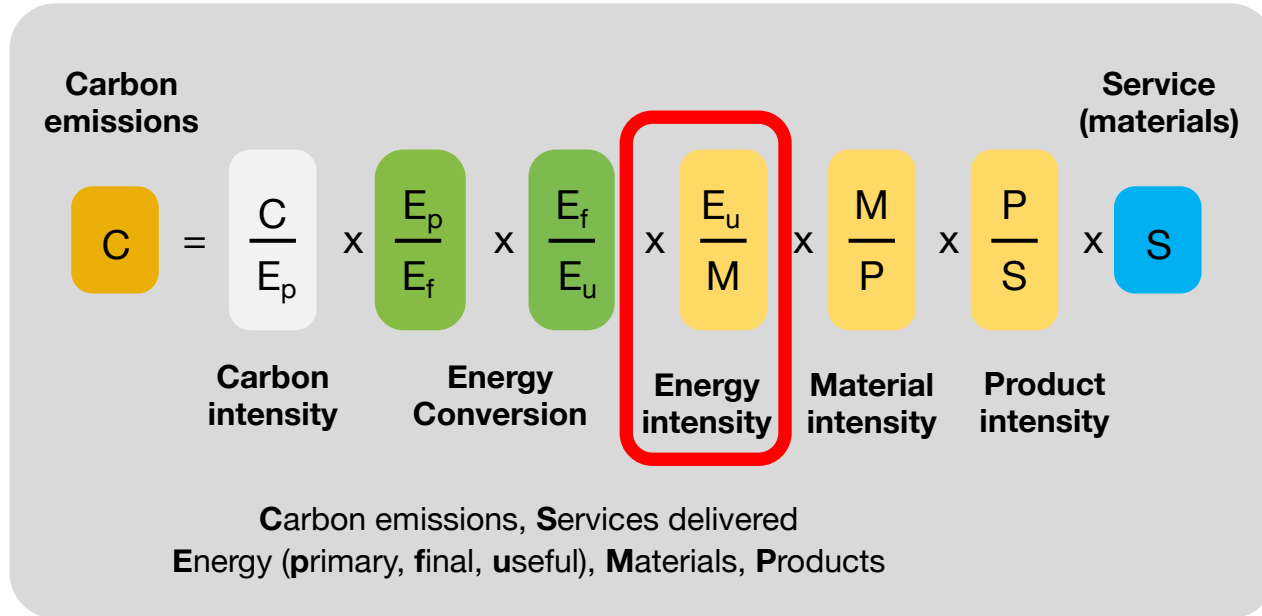
Resource mapping

Global chemical flows



Resource efficiency

How can we deliver future energy and material services, while reducing resource use and environmental impact?

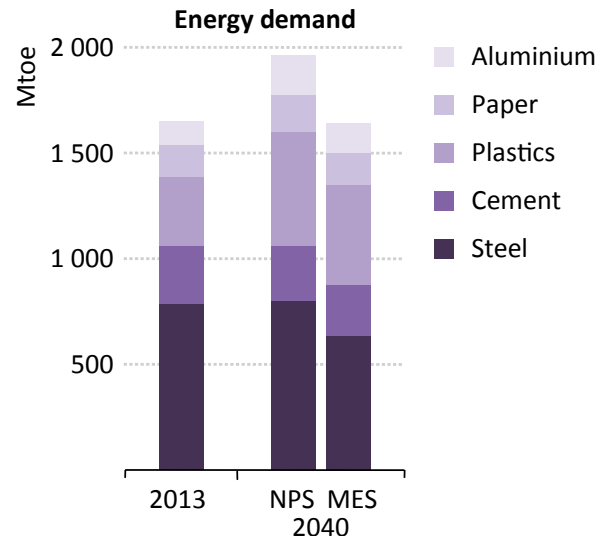
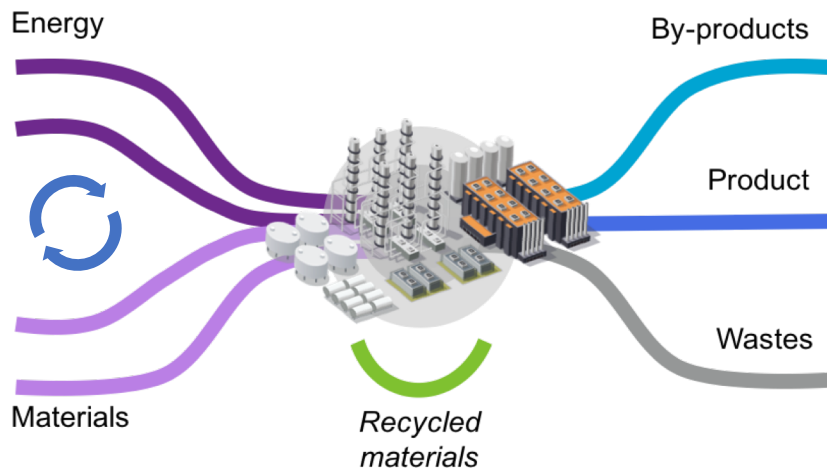


Reducing the resource intensity of construction materials

One fifth of carbon emissions are linked to steel and concrete (more than passenger transport)

Resource intensity (of materials)

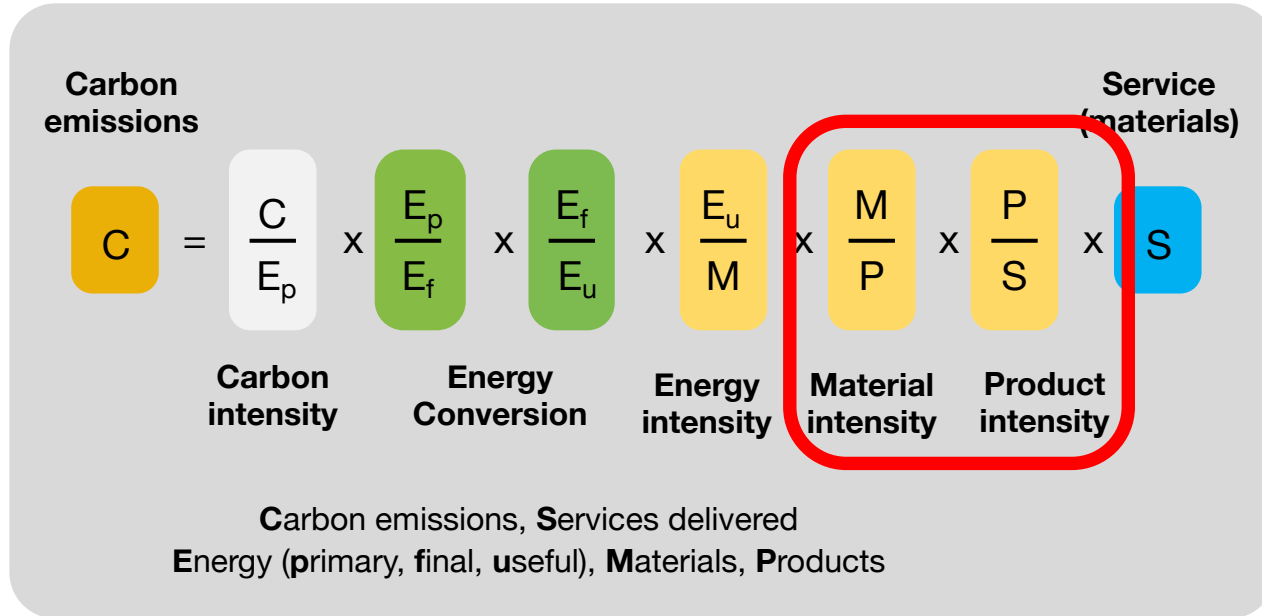
“ Material efficiency **could deliver larger energy savings** in energy-intensive industries than energy efficiency. ”



Note: NPS = New Policies Scenario; MES = Material Efficiency Scenario.

Resource efficiency

How can we deliver future energy and material services, while reducing resource use and environmental impact?



Making buildings with
half the materials and
double the lifetime

Half the materials ...

Making buildings with half the materials
and double the lifetime

Options

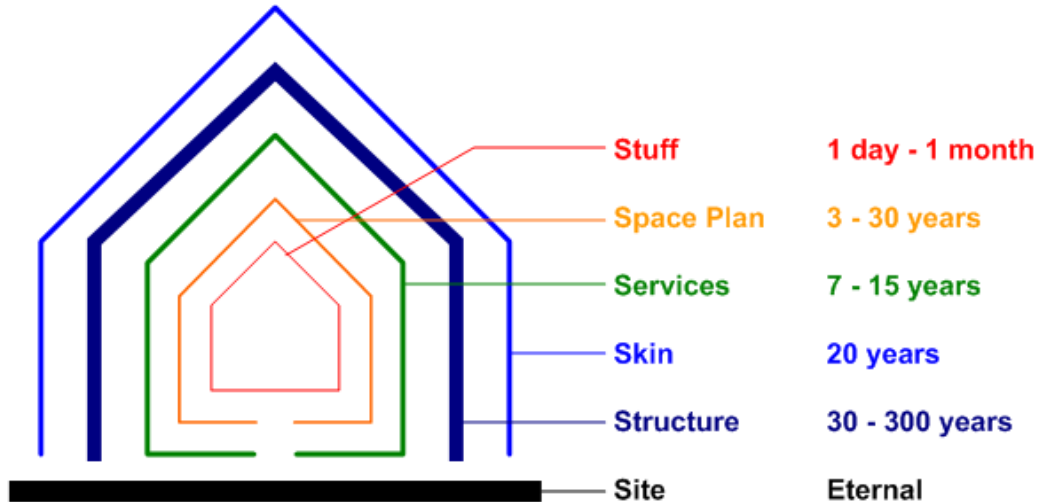
- Reduce design loads
- Avoid over-specification
- Put material where the load is
- Avoid construction waste
- Use alternative materials
- ...

Constraints

- Keep cost the same, or less
- Keep carbon intensity of materials the same, or less
- Keep quality the same
- Make sure buildings are safe
- ...

Double the lifetime

Making buildings with half the materials
and double the lifetime



2 days – 2 months

6 – 30 years

14 – 30 years

40 years

60 – 600 years

Stewart Brand's 6 S's from *How Buildings Learn*

talks

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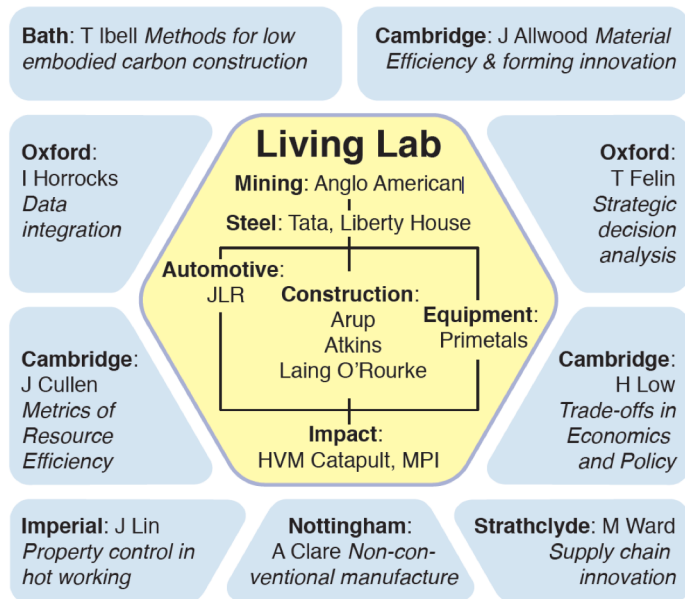
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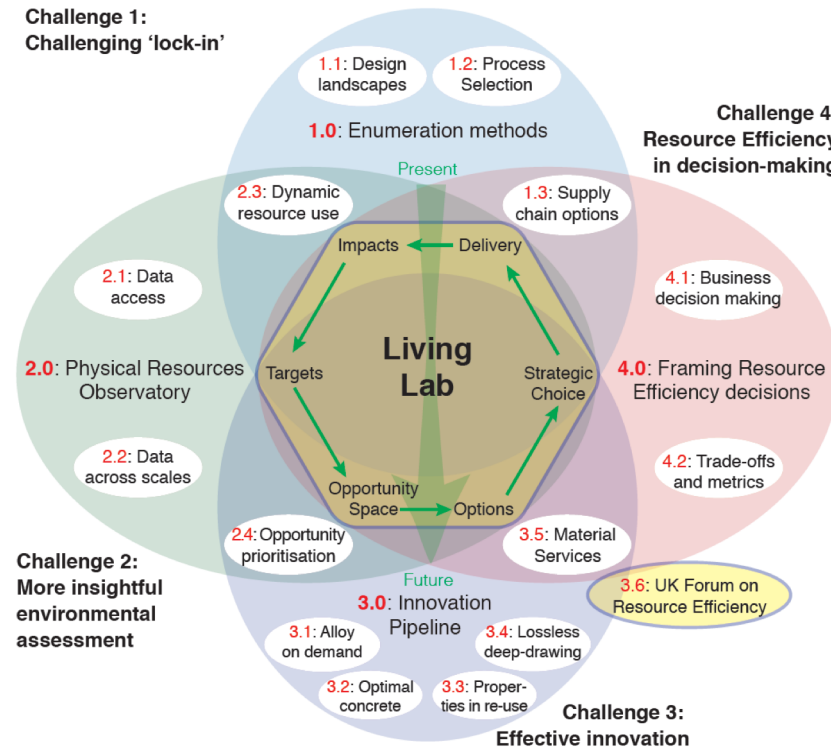
running projects

UK FIRES

Locating Resource Efficiency at the heart of Future Industrial Strategy in the UK



Challenge 1: Challenging 'lock-in'



tour



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