

# **Another Brick In The Wall?**

**Reducing the use of carbon-intensive materials in the UK construction sector**



# Obvious Questions

1. What is a 'carbon-intensive material'?
2. Why do we need to reduce the use of them?
3. What options do we have for reducing their use?
4. What difference could reducing their use make?



# Background

2008 Climate Change Act: **GHG** ↓ **80%**  
EMISSIONS 1990-2050

Built Environment constitutes 47% of total UK emissions<sup>1</sup>

Introduction

Problems

Solutions

Questions



**“ over the next 40 years the  
transition to low carbon can  
almost be read as a business  
plan for construction<sup>2</sup> ”**

Paul Morrell - Chair of Steering Group, IGT

Introduction

Problems

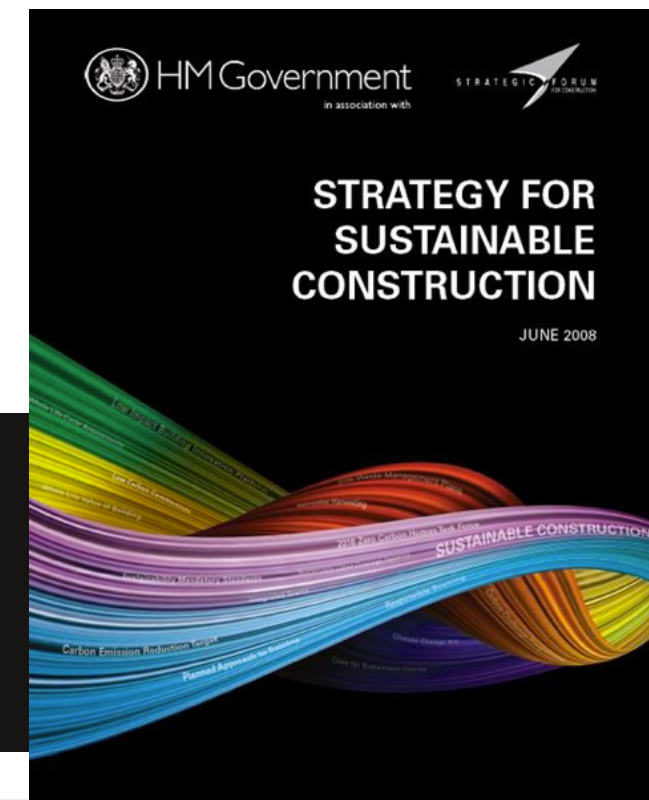
Solutions

Questions

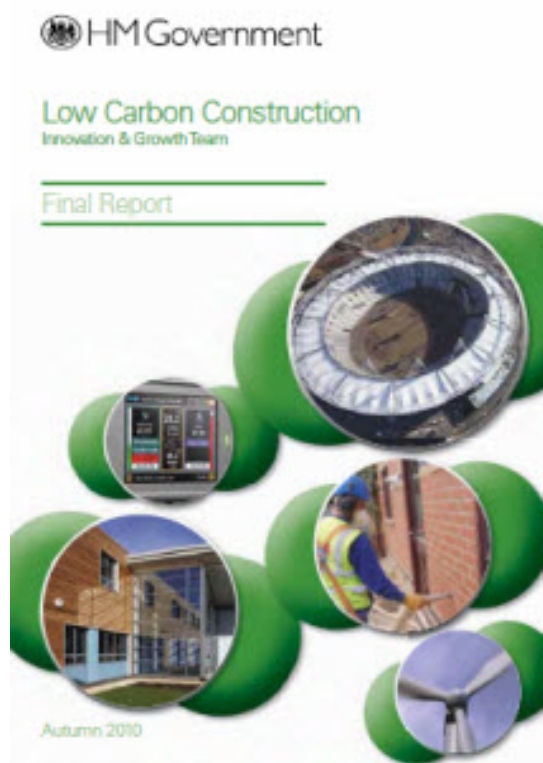




# Halving Waste to Landfill



# The response so far...



## The Low Carbon Routemap for the Built Environment

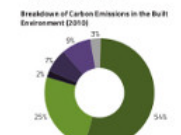
The Green Construction Board

March 2013

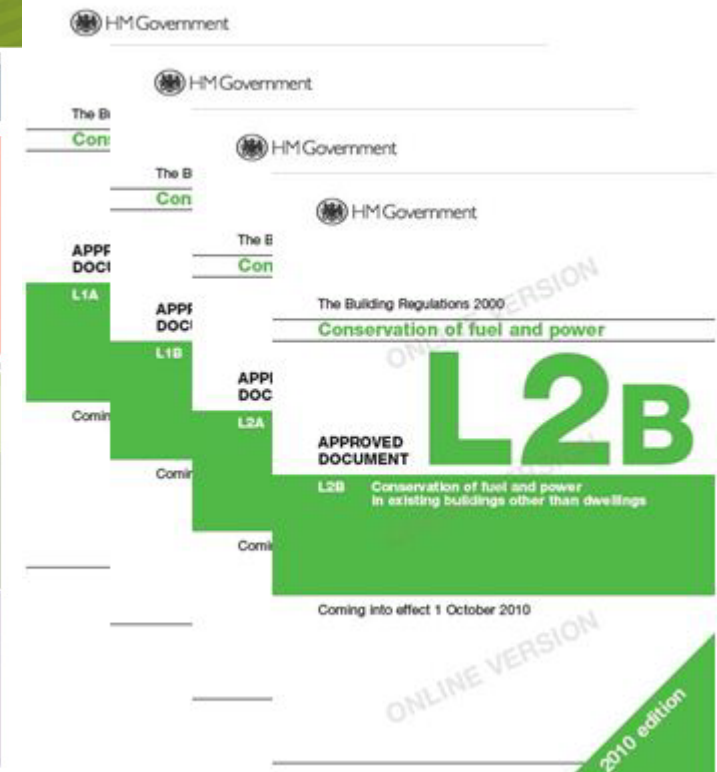
The Green Construction Board has developed the Low Carbon Routemap for the Built Environment to serve as a visual tool enabling stakeholders to understand the policies, actions and key decision points required to achieve the UK Government target of 60% reduction in greenhouse gas emissions vs. 1990 levels by 2050 in the built environment. The Routemap also sets out actions, together with key performance indicators that can be used to deliver and measure progress in meeting the 2050 target.

The Routemap covers both infrastructure and buildings sectors, and addresses segments of a personal and a capital intensive carbon emissions. The emissions covered by the Routemap are as follows:

- Operational carbon in buildings: emissions from regulated energy use (heating, hot water, cooling, ventilation, lighting, and water) and water workover. The use of transport infrastructure by cars for example is excluded. Some components of a building that include buildings that are already in use and are included in the analysis but appear under buildings.
- Capital carbon: emissions arising from the production and manufacture of materials (on the UK and abroad), transport of materials and products, all industry design and construction activities, and the emissions from site activities for the construction and demolition of buildings and infrastructure.



**Built Environment Carbon Reduction Targets**  
Unless otherwise stated, all carbon reduction targets presented in the Routemap are based on a percentage reduction from 2010 and align with the reduction trajectories delivered in scenario 3 of the low carbon routemap model. Collectively they cover domestic, non-domestic and infrastructure and the delivery of an 80% reduction in carbon emissions in the built environment to 2050. In this sense the targets are based on a modelled scenario and do not represent any form of sector commitment.



Introduction

Problems

Solutions

Questions



# Capital Carbon Emissions

18% of total for UK built environment in 2010

Projected 40% of total for built environment by 2050<sup>3</sup>

GCB Routemap suggests capital carbon reductions:

**GHG** ↓ **21%**  
EMISSIONS ↓ 2010-2022

**GHG** ↓ **39%**  
EMISSIONS ↓ 2010-2050

Introduction

Problems

Solutions

Questions



# Material Consumption

The UK construction sector uses:

**6 tonnes<sup>4</sup>**  
of materials  
/person/year

3 Mt of steel<sup>5</sup>

9 Mt of cement<sup>6</sup>

1 Mt of plastics<sup>7</sup>

4.9 Mm<sup>3</sup> of wood<sup>8</sup>

0.3 Mt of aluminium<sup>9</sup>

275 Mt of aggregates<sup>10</sup>



# Material Production

Embodied emissions for materials in UK construction:

760-1350 kg CO<sub>2</sub>e/t of steel<sup>11</sup>

725 kg CO<sub>2</sub>e/t of cement<sup>12</sup>

98.9 kg CO<sub>2</sub>e/t of reinforced concrete<sup>13</sup>

? t CO<sub>2</sub>e/t aluminium



# Production Targets

Cement industry:<sup>14</sup> GHG **↓ 81%**  
EMISSIONS 1990-2050

Tata Steel:<sup>15</sup> GHG **↓ 20%**  
EMISSIONS 1997-2020

EU ETS: GHG **↓ 21%**  
EMISSIONS 2005-2020

Introduction

Problems

Solutions

Questions



# Production Targets

Cement industry: GHG ~~↓ 81%~~ **15%**  
EMISSIONS 1990-2050 2010-2050

Tata Steel: GHG ~~↓ 20%~~ **<10%**  
EMISSIONS 1997-2020 1997-2020

EU ETS: GHG ~~↓ 21%~~ **FREE ALLOCATION<sup>16</sup> + 262m ALLOWANCES<sup>17</sup>**  
EMISSIONS 2005-2020



# Remaining Improvements

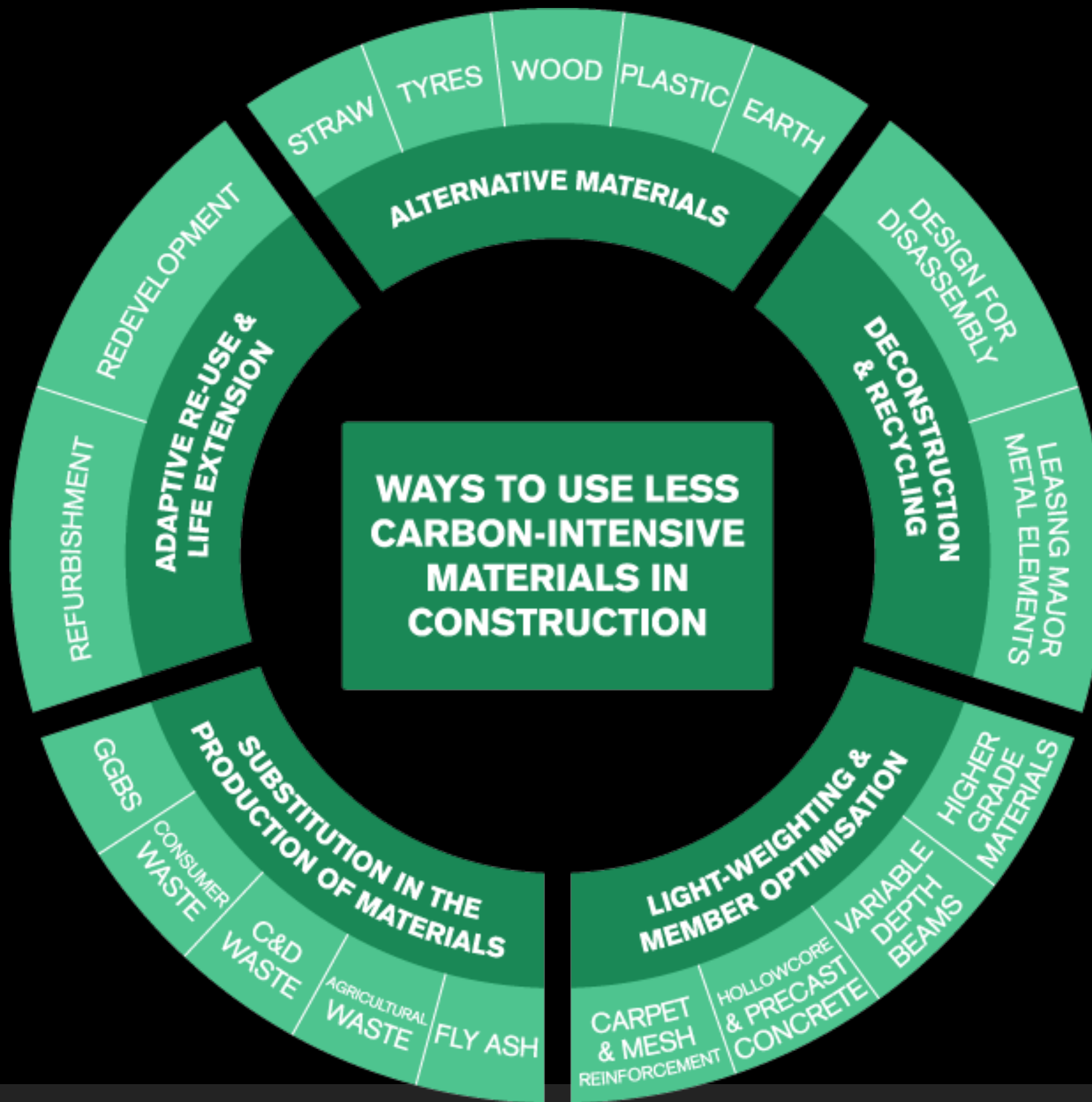
Simple scenario modelling with UK-MRIO shows:

Targeted improvements: **GHG** ↓ **1.8%**  
EMISSIONS 2010-2050

Process emissions only: **GHG** ↓ **4.3%**  
EMISSIONS 2010-2050

Only possible to meet 11% of GCB capital target





Introduction

Problems

Solutions

Questions



# Straw Bale Construction

Pros: excellent thermal properties, cheap, abundant, light weight, low cost sensitivity

Cons: requires high quality construction, careful site management and training

Barriers: public perception, wall thickness

Introduction

Problems

Solutions

Questions



# Variable Depth Members

Pros: sizeable material savings, potential cost savings

Cons: hot-rolling technology still in development, may make re-use of members more difficult

Barriers: capital cost and long roll-out of technology



# Barriers to Alternatives

Typical barriers include:

Public perception and lack of client understanding

Industry perception and lack of technical knowledge

Availability of suitably skilled labour

Uncertain supply chains

Introduction

Problems

Solutions

Questions





# “cost is King, carbon is Queen”

Paul Morrell - Former UK Government Chief Construction Adviser

Introduction

Problems

Solutions

Questions





# Available Reductions?

Difficult to establish supply chain without scope  
Hard to establish viable routemap without estimates  
Models must take account of full supply chain  
emissions and stocks in use  
MFA, EEIO or something new?



# Research Questions

1. Which alternatives offer the greatest practicable potential for reducing emissions in the UK?
2. What barriers exist to those alternatives, and how can they be overcome?
3. How can we estimate potential reductions and establish a viable routemap?

Introduction

Problems

Solutions

Questions



# Challenges for Industry

Lack of standardised data

Limited design tools

Few drivers for change

Widespread (re)training required

“Decade of pain” ahead

Introduction

Problems

Solutions

Questions



# Other Considerations

Influence of performance gap

Role of BIM

Increasing dependence on imports

Who is responsible (and will pay) for reductions?

Impacts other than carbon

Introduction

Problems

Solutions

Questions



# Summary

Capital emissions increasingly important

Reductions will be needed to meet targets

Improvements to material production will be insufficient

Range of alternative options available

Barriers and benefits yet to be evaluated at scale

Introduction

Problems

Solutions

Questions







**Thank you for listening**  
**Any questions?**

**For more information please see**  
[www.jannikgiesekam.co.uk/research](http://www.jannikgiesekam.co.uk/research)



# References

1. University of Oxford (2012) A Low Carbon Economy: New Business Models in the Built Environment  
<http://www.futureofcities.ox.ac.uk/research/lowcarbon>
2. HM Government (2010) Low Carbon Construction Innovation and Growth Team - Final Report
3. Green Construction Board (2013) Low Carbon Routemap for the UK Built Environment
4. Constructing Excellence (2008) Plain English Guide  
<http://www.constructingexcellence.org.uk/zones/sustainabilityzone/plainenglish.jsp>
5. UK Steel (2012) Key Statistics <http://www.eef.org.uk/uksteel/Publications/UK-Steel-Key-Statistics-2012.htm>
6. MPA (2012) Key Facts and Figures at a Glance  
[http://cement.mineralproducts.org/documents/Cement\\_Industry\\_Key\\_Facts\\_and\\_Figures.pdf](http://cement.mineralproducts.org/documents/Cement_Industry_Key_Facts_and_Figures.pdf)
7. British Plastics Federation (2012) Construction <http://www.bpf.co.uk/Innovation/Construction.aspx>
8. John White (2011) UK Construction Resources - Is there a plan? [http://www.edgedebate.com/wp-content/uploads/2011/10/edgedebate42\\_speakerpresentations.pdf](http://www.edgedebate.com/wp-content/uploads/2011/10/edgedebate42_speakerpresentations.pdf)
9. Aluminium Federation (2009) Production Stats  
[http://www.alfed.org.uk/page.asp?node=37&sec=Production\\_Stats](http://www.alfed.org.uk/page.asp?node=37&sec=Production_Stats)
10. WRAP (2007) Sustainable Aggregates [http://aggregain.wrap.org.uk/sustainable\\_2.html](http://aggregain.wrap.org.uk/sustainable_2.html)
11. Tata Steel (2012) The Carbon Footprint of Steel  
[http://www.tatasteelconstruction.com/en/sustainability/carbon\\_and\\_steel/](http://www.tatasteelconstruction.com/en/sustainability/carbon_and_steel/)
12. MPA (2010) Performance 2010: A Sector Plan Report  
[http://www.mineralproducts.org/sustainability/pdfs/cement\\_performance\\_report\\_2010.pdf](http://www.mineralproducts.org/sustainability/pdfs/cement_performance_report_2010.pdf)
13. Spencer, A (2010) Concrete Industry 4th Sustainability Performance Report
14. MPA (2013) Cement 2050 Strategy  
[http://www.mineralproducts.org/documents/MPA\\_Cement\\_2050\\_Strategy.pdf](http://www.mineralproducts.org/documents/MPA_Cement_2050_Strategy.pdf)
15. Tata Steel (2013) Energy and Climate Change  
[http://www.tatasteeleurope.com/en/responsibility/environment/climate\\_change/](http://www.tatasteeleurope.com/en/responsibility/environment/climate_change/)
16. DECC (2011) The UK's National Implementation Measures for Phase III of the EU Emissions Trading System  
[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/48248/3846-uk-nat-imp-measures-phase3-euets.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/48248/3846-uk-nat-imp-measures-phase3-euets.pdf)
17. Sandbag (2011) Carbon Fat Cats - The Companies profiting from the EU Emissions Trading Scheme  
[http://www.sandbag.org.uk/site\\_media/pdfs/reports/Sandbag\\_2011-06\\_fatcats.pdf](http://www.sandbag.org.uk/site_media/pdfs/reports/Sandbag_2011-06_fatcats.pdf)

**For more information please see**  
**[www.jannikgiesekam.co.uk/research](http://www.jannikgiesekam.co.uk/research)**