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Centre for Industrial Energy, Materials and Products

Research Councils UK Energy For a Low Carbon Future

Barriers to low carbon innovation

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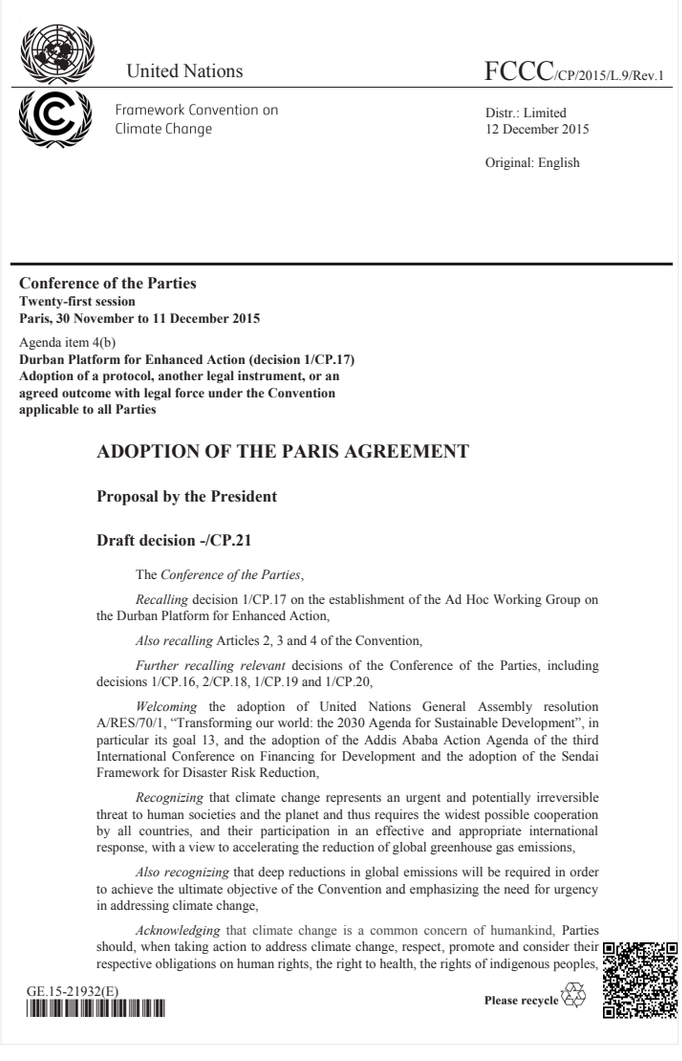
Paris Agreement on climate change

Global agreement in December 2015

- Came into force on 4th November 2016
- Commits to *"holding the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels"*
- Goal of achieving *"a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century"* **i.e. net zero emissions**
- Commits parties to global stock-take and ratcheting up of ambitions every 5 years
- Recent COP 22 negotiations have provided further details of how this will be implemented



United Nations

Framework Convention on Climate Change

FCCC/CP/2015/L.9/Rev.1

Distr.: Limited
12 December 2015

Original: English

Conference of the Parties
Twenty-first session
Paris, 30 November to 11 December 2015

Agenda item 4(b)
Durban Platform for Enhanced Action (decision 1/CP.17)
Adoption of a protocol, another legal instrument, or an agreed outcome with legal force under the Convention applicable to all Parties

ADOPTION OF THE PARIS AGREEMENT

Proposal by the President

Draft decision -/CP.21

The *Conference of the Parties*,

Recalling decision 1/CP.17 on the establishment of the Ad Hoc Working Group on the Durban Platform for Enhanced Action,

Also recalling Articles 2, 3 and 4 of the Convention,

Further recalling relevant decisions of the Conference of the Parties, including decisions 1/CP.16, 2/CP.18, 1/CP.19 and 1/CP.20,

Welcoming the adoption of United Nations General Assembly resolution A/RES/70/1, "Transforming our world: the 2030 Agenda for Sustainable Development", in particular its goal 13, and the adoption of the Addis Ababa Action Agenda of the third International Conference on Financing for Development and the adoption of the Sendai Framework for Disaster Risk Reduction,

Recognizing that climate change represents an urgent and potentially irreversible threat to human societies and the planet and thus requires the widest possible cooperation by all countries, and their participation in an effective and appropriate international response, with a view to accelerating the reduction of global greenhouse gas emissions,

Also recognizing that deep reductions in global emissions will be required in order to achieve the ultimate objective of the Convention and emphasizing the need for urgency in addressing climate change,

Acknowledging that climate change is a common concern of humankind, Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples,

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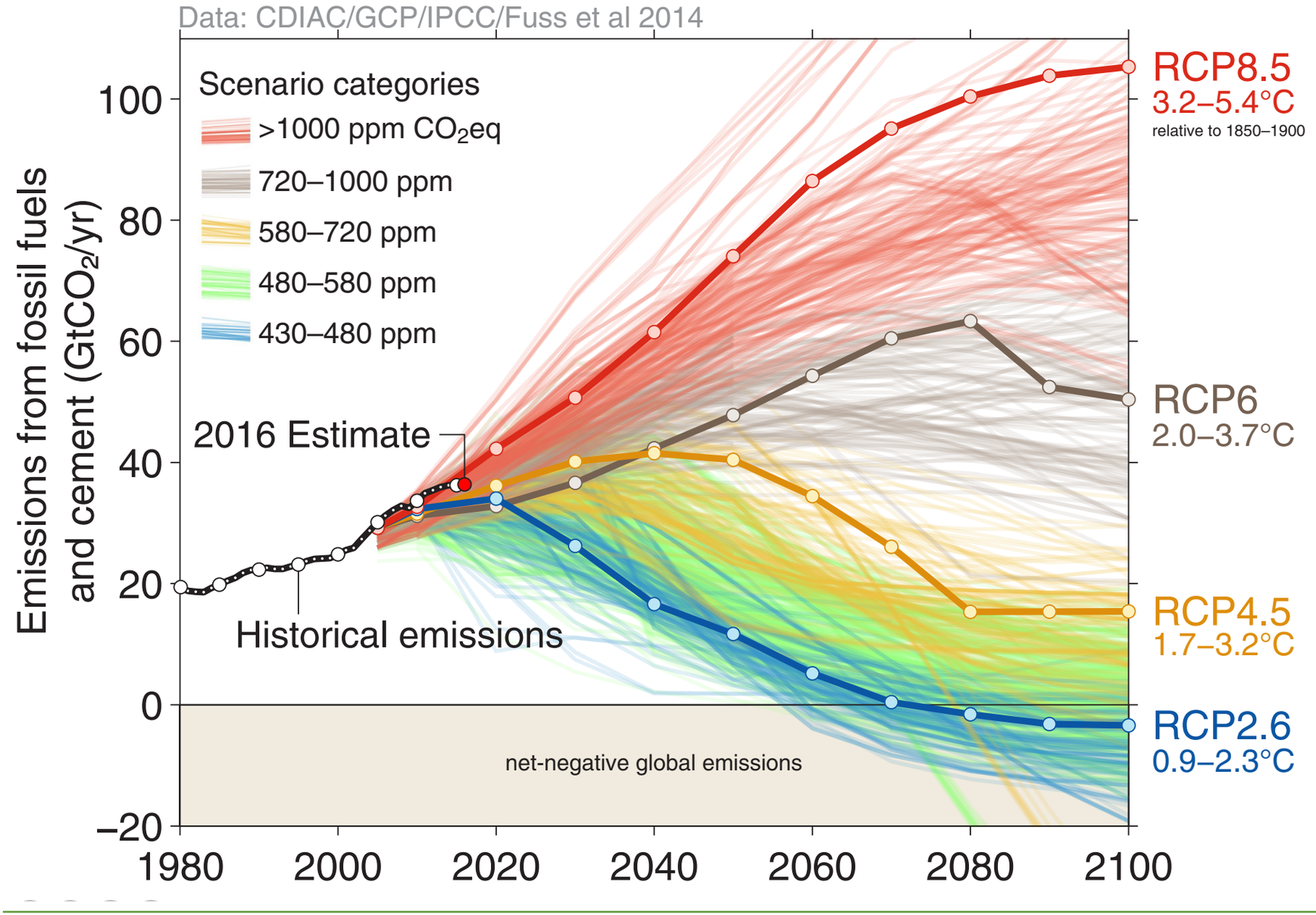
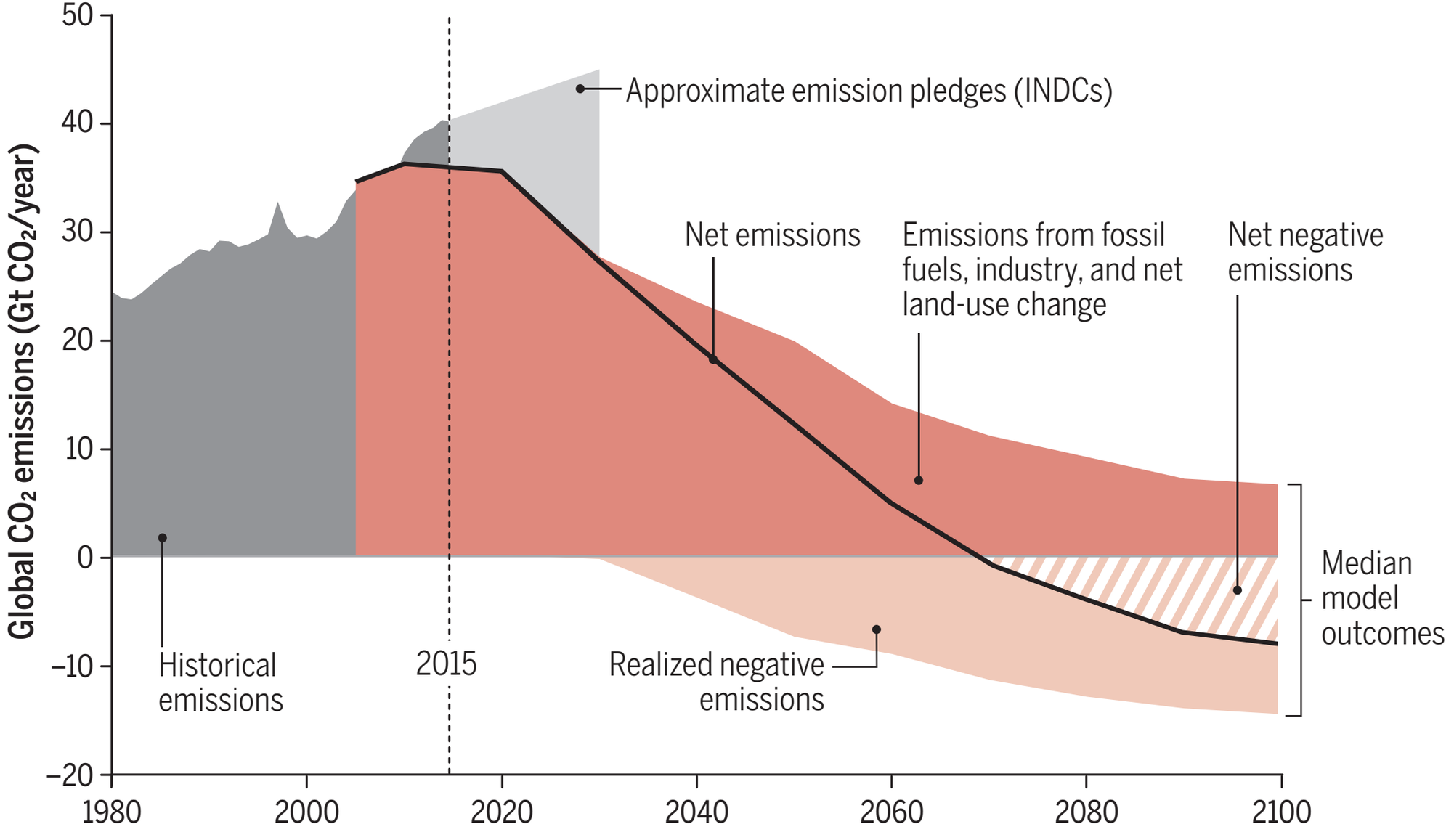
Emissions scenarios to 2100

Current commitments likely to yield around 3°C increase



Current models for >66% chance of 2°C

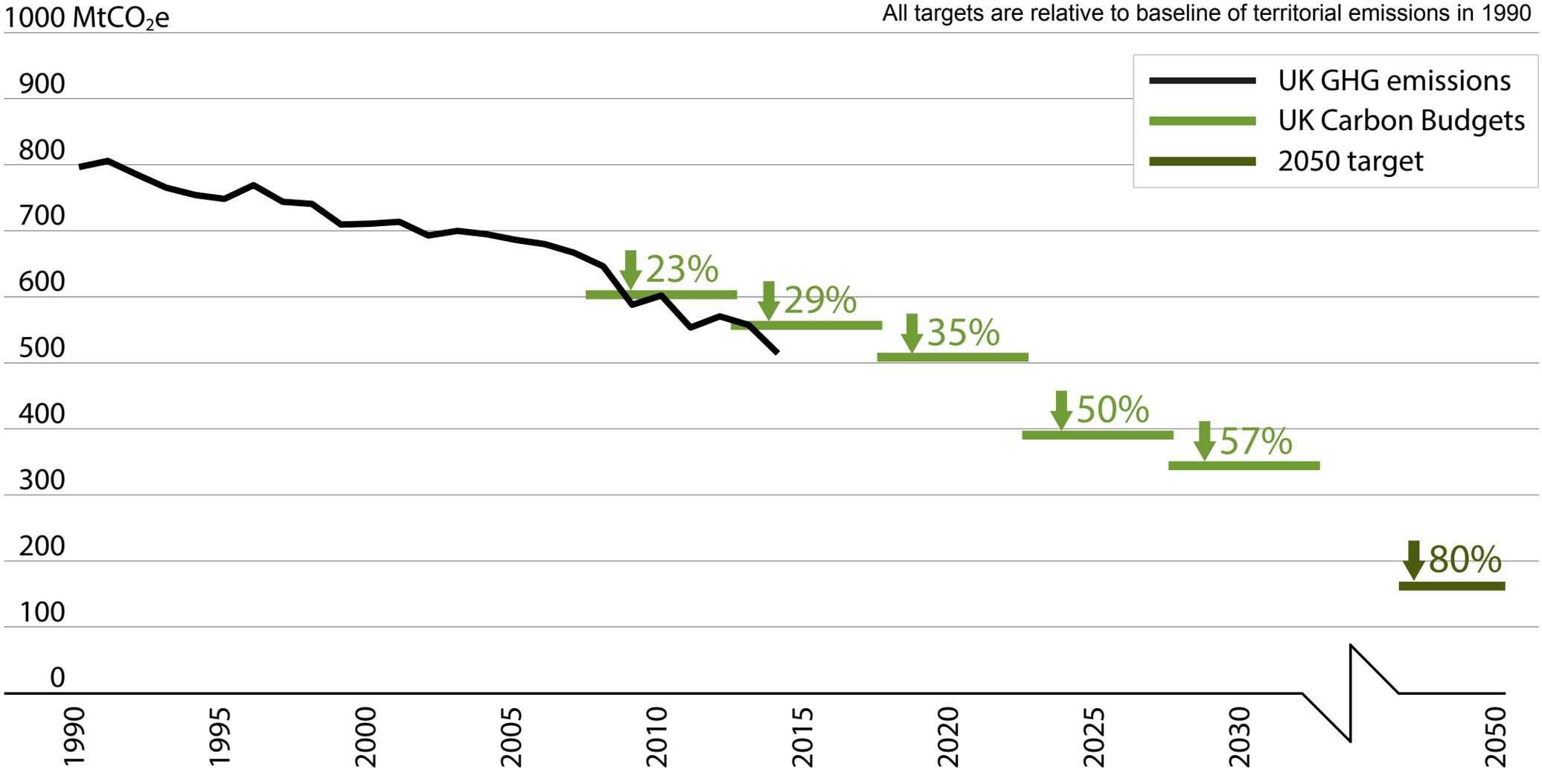
Are heavily dependent on negative emissions technologies



Anderson & Peters (2016) The trouble with negative emissions *Science* 354 pp:182-183

Current targets for the UK

Based on series of legally binding 5 year carbon budgets



New UK goal is net zero emissions

Near the middle of this century

- UK Government has already intimated that the net zero goal must enter UK law:
  "The question is not whether but how we do it"
- CCC advise goal means UK must be net zero CO_2 by 2055-2075 for >66% chance of achieving 2°C or before 2050 for 1.5°C

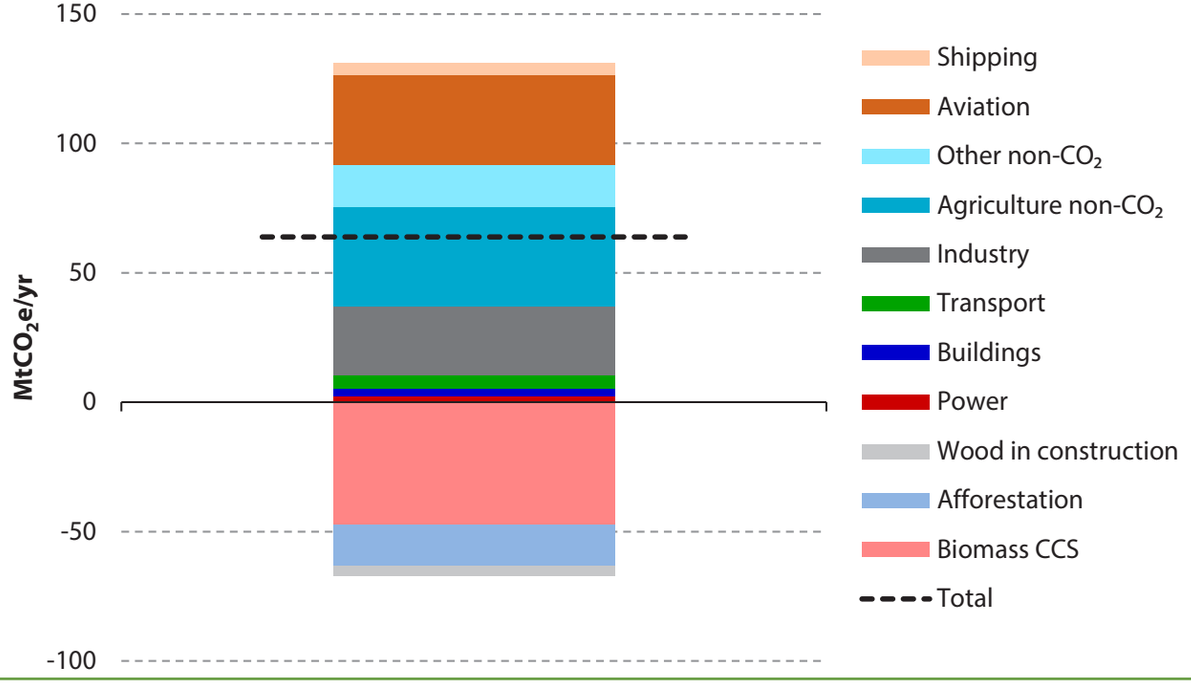
Quote from Andrea Leadsom – Minister of State for Energy - Hansard HC Deb vol 607 col 725 (14 March 2016)
CCC (2016) UK climate action following the Paris Agreement

Achieving net zero in the UK

Will be extremely difficult

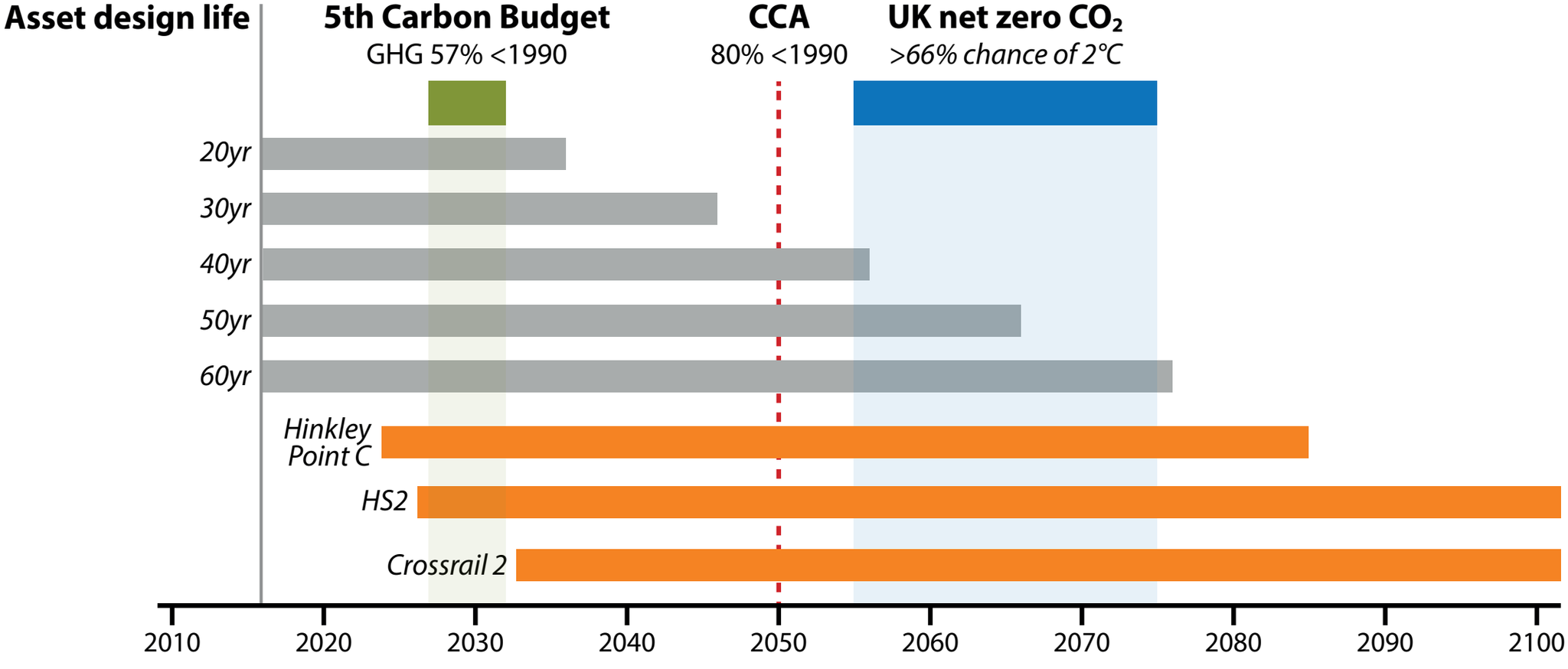
- Requires maximum deployment of all identified mitigation options
- Plus deployment of negative emissions technologies (up to max ~100 $MtCO_2e/yr$)
- Plus further offsetting elsewhere
- Remaining emissions in current CCC scenarios are predominantly from aviation, agriculture and industry (mainly materials production *i.e. construction products*)

Figure 3.1. Residual UK greenhouse gas emissions in 2050 under Max deployment across all sectors



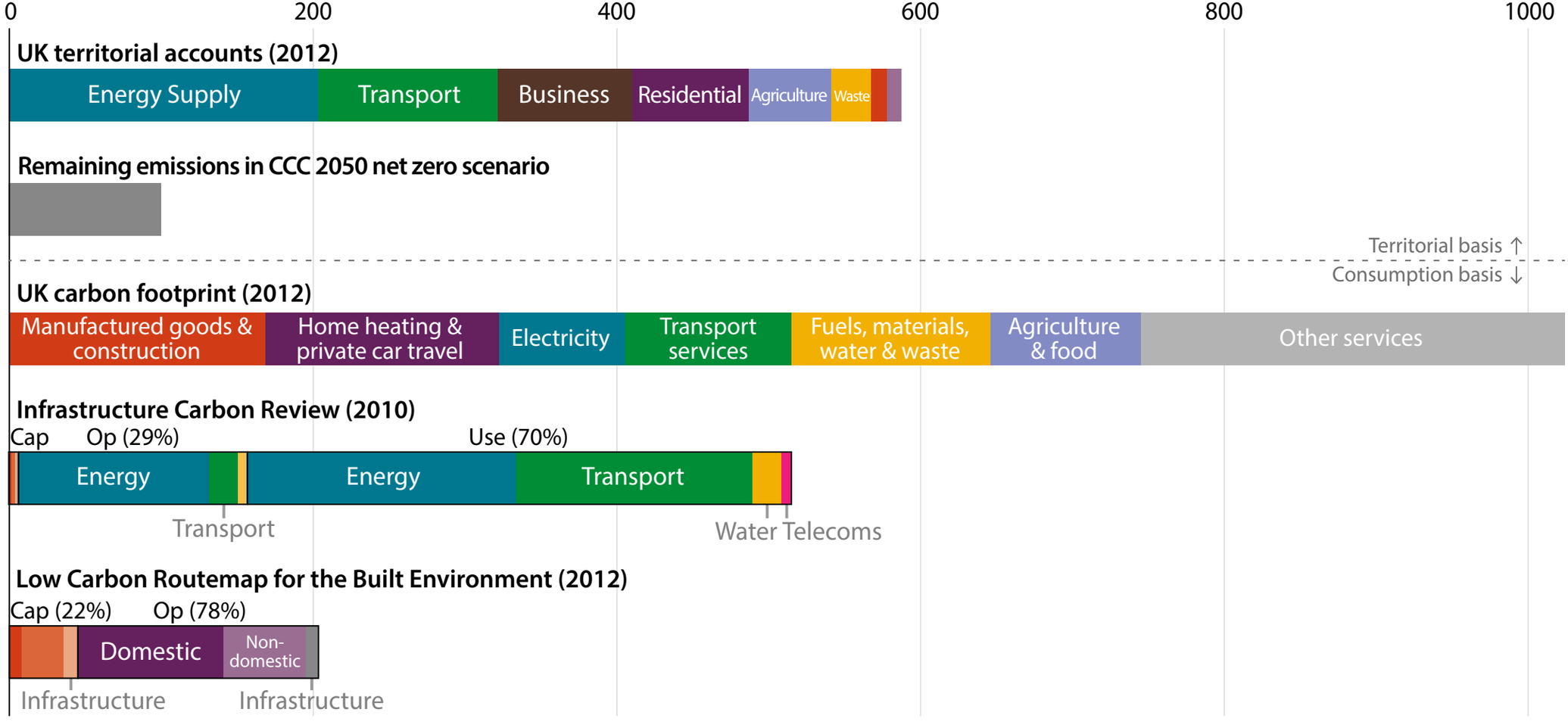
The implications for construction

Many assets under design now must operate in a net zero nation



The challenge

A snapshot of UK greenhouse gas emissions ($MtCO_2e$)



» Priorities are energy and transport

» However long term targets require reductions everywhere, including CapCarb

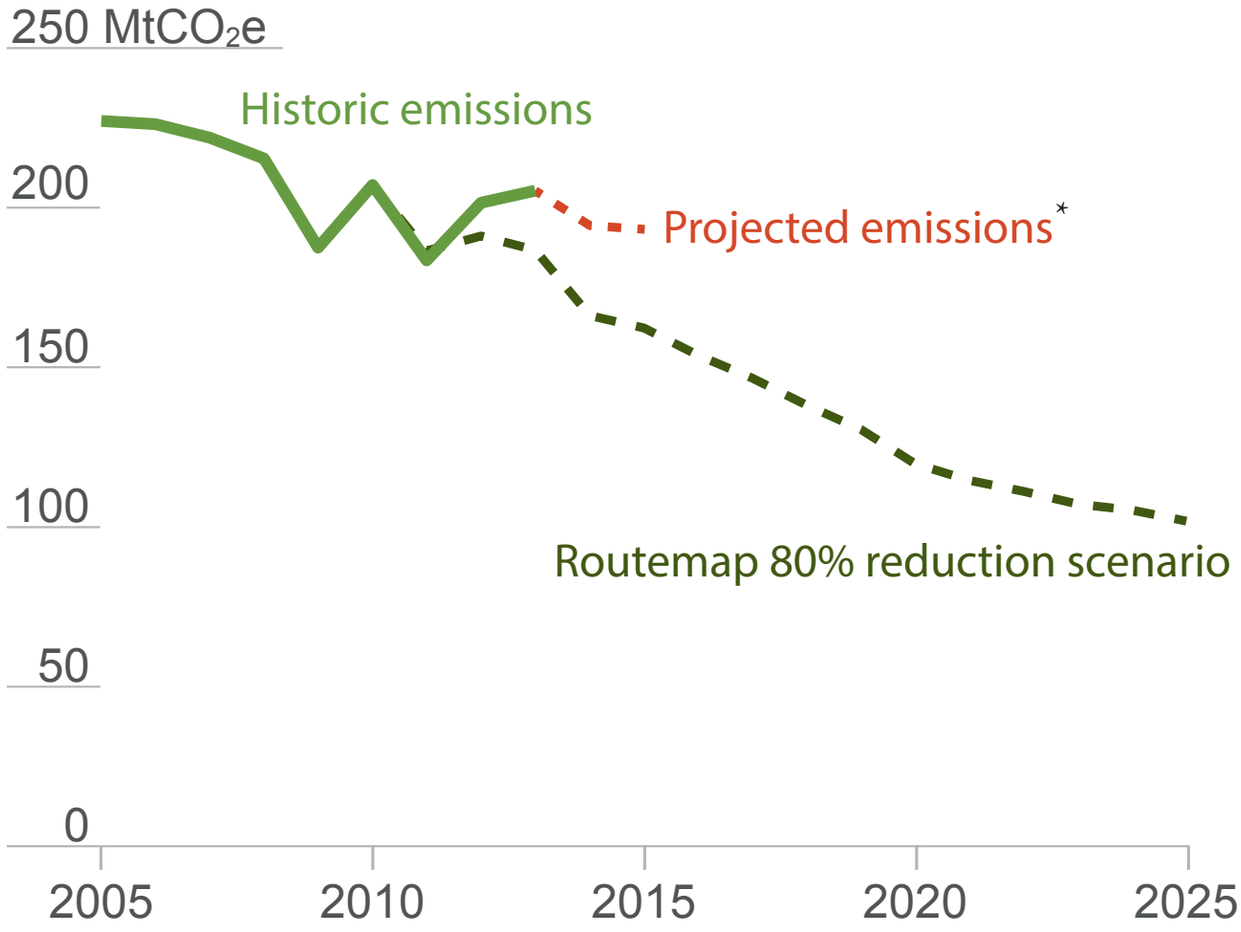
UK's carbon footprint published by DEFRA (1997-2013) based on CIEMAP data

Progress so far

Routemap progress report produced in December 2015

» Progress to 2013 suggests we are not on trend to meet 2025 ambitions

» Capital carbon emissions have increased since 2013 Routemap report



* Projected emissions based upon analysis by presenter using reported OpCarb (including provisional statistics for 2015) and projected CapCarb (using reported financial value of output and extrapolating historic emissions intensity trend)

CIEMAP work

On barriers to low carbon construction

» Meta-analysis of barriers presented in literature

» Surveys and interviews

» Industry and public workshops

Slides from CIRIA 'Advances in innovative sustainable materials' event

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Drivers and barriers to the adoption of sustainable materials

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CIRIA Offices, London These slides are available from www.jannikgiesekam.co.uk/research **05/04/16**

Contents lists available at ScienceDirect

Energy and Buildings

journal homepage: www.elsevier.com/locate/enbuild

The greenhouse gas emissions and mitigation options for materials used in UK construction

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ABSTRACT

The UK construction industry faces the daunting task of replacing and extending a significant proportion of UK infrastructure, meeting a growing housing shortage and retrofitting millions of homes whilst achieving greenhouse gas (GHG) emission reductions compatible with the UK's legally binding target of an 80% reduction by 2050. This paper presents a detailed time series of embodied GHG emissions from the construction sector for 1997–2011. This data is used to demonstrate that strategies which focus solely on improving operational performance of buildings and the production efficiencies of domestic material producers will be insufficient to meet sector emission reduction targets. Reductions in the order of 80% will require a substantial decline in the use of materials with carbon-intensive supply chains. A variety of alternative materials, technologies and practices are available and the common barriers to their use are presented based upon an extensive literature survey. Key gaps in qualitative research, data and modelling approaches are also identified. Subsequent discussion highlights the lack of client and regulatory drivers for uptake of alternatives and the ineffective allocation of responsibility for emissions reduction within the industry. Only by addressing and overcoming all these challenges in combination can the construction sector achieve drastic emissions reduction.

1. Introduction

The evidence of climate change is now "unequivocal" [1] and the anticipated increases in the frequency of extreme weather events, threats to water and food security and the massive loss of biodiversity represent a fundamental risk to the health and livelihoods of a large portion of the global population. The extensive and growing evidence base suggests that it is "extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century" [2], principally through the extraction and burning of fossil fuels alongside changes to land use. Humans have already significantly altered three quarters of the world's terrestrial habitats and continue to extract 60 billion tonnes of raw materials each year [3,4]. The construction sector is the largest user...

In the UK, the volume of carbon dioxide emissions that the construction sector influences is significant, accounting for an estimated 47% of total UK CO_2 emissions [7]. In a typical year, the UK construction industry requires over 420 million tonnes of material resources, energy equivalent to just under 8 million tonnes of oil, and is responsible for over 90% of non-energy mineral extraction [8,9]. The construction sector is also the largest generator of waste, at over 100 million tonnes per year in 2008 [10]. Furthermore, every year the construction industry uses 6500 ha of land and is responsible for a third of all industry-related pollution incidents [11]. In addition to direct environmental impacts from its activities, the sector also has a critical role to play in enabling the supply of clean energy and facilitating sustainable practices in other areas of the economy. The impending transition to a low carbon economy rep...

BRI Building Research & Information 2015
http://dx.doi.org/10.1080/09613218.2016.1086872

Routledge Taylor & Francis Group

RESEARCH PAPER

Construction sector views on low carbon building materials

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As is the case in a number of countries, the UK construction industry faces the challenge of expanding production whilst making ambitious greenhouse gas emission reductions. Embodied carbon constitutes a growing proportion of whole-life carbon emissions and accounts for a significant share of total UK emissions. A key mitigation strategy is increasing the use of alternative materials with lower embodied carbon. The economic, technical, practical and cultural barriers to the uptake of these alternatives are explored through a survey of construction professionals and interviews with industry leaders. Perceptions of high cost, ineffective allocation of responsibility, industry culture, and the poor availability of product and building-level carbon data and benchmarks constitute significant barriers. Opportunities to overcome these barriers include earlier engagement of professionals along the supply chain, effective use of whole-life costing, and changes to contract and tender documents. A mounting business case exists for addressing embodied carbon, but has yet to be effectively disseminated. In the meantime, the moral convictions of individual clients and practitioners have driven early progress. However, this research underscores the need for new regulatory drivers to complement changing attitudes if embodied carbon is to be established as a mainstream construction industry concern.

Keywords: alternative materials, CO_2 reduction, construction sector, embodied carbon, greenhouse gas emissions, market acceptance, professional knowledge

Barriers to low carbon innovation

Often include

» Perception of high costs

» Dearth of knowledge, understanding and skills

» Lack of quality benchmark data (particularly at project level)

» Availability of product carbon information

» Insufficient allocation of responsibility for carbon reduction

» Industry culture

» Lack of client understanding or ambition

» Low value of materials

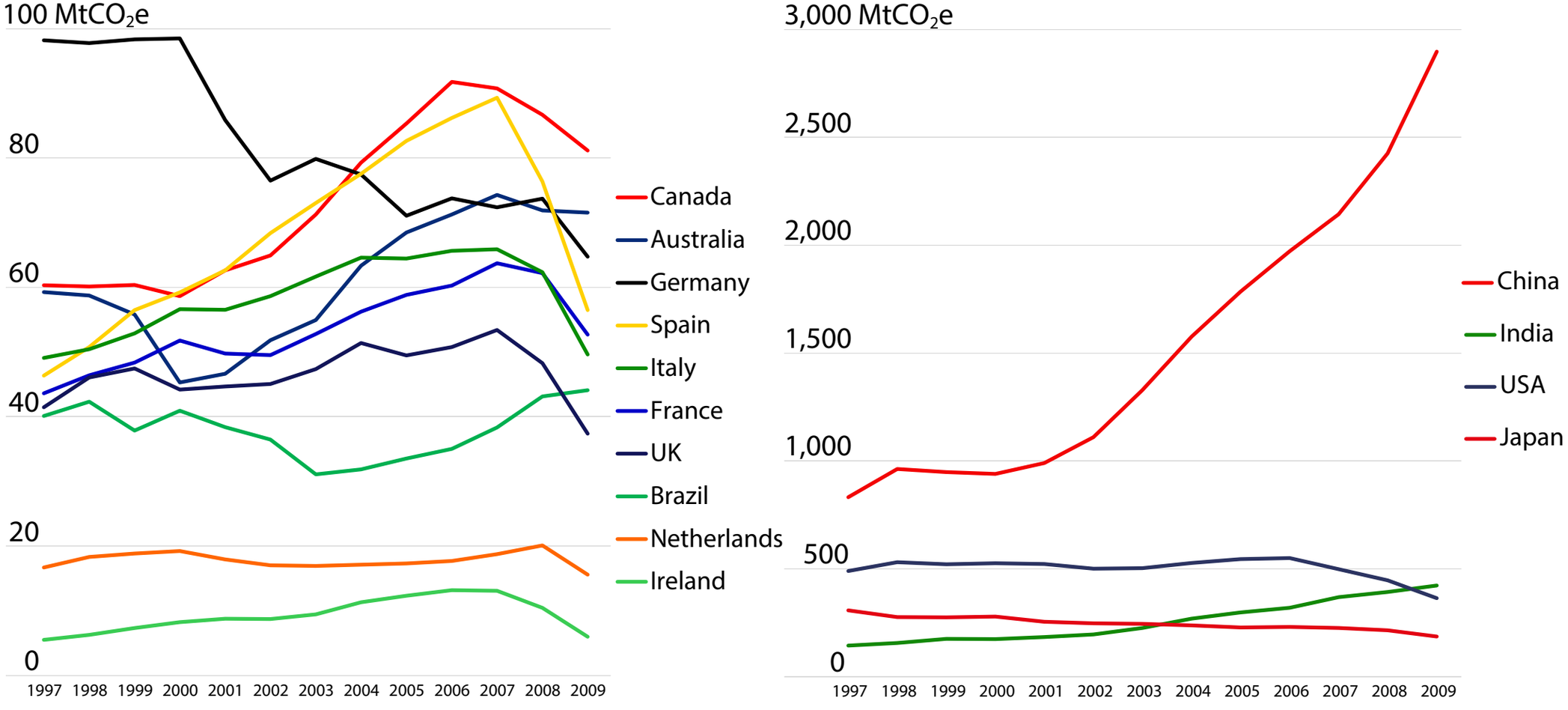
» Procurement and tendering process and timescales

» Negative perceptions of low carbon alternatives

» Lack of demonstration projects and product testing

Vast international market

GHG emissions of construction sector supply chain by country



» Construction firms in these 14 countries alone influence 4.4 $GtCO_2e$ of supply chain emissions

» Substantial opportunities for export of low carbon expertise and products

Based upon CIEMAP MRIO analysis using WIOD data for 40 countries plus 'rest of world'

Common features of innovative projects

Include

» Highly motivated and informed client

» Strong leadership and consistent messaging

» Early engagement of full supply chain

» Targets and contractual obligations that ensure alignment of value chain

» Innovative elements positioned as integral to satisfaction of project constraints

» Frequent communication and knowledge shared across project team

» Effective knowledge capture and post project learning

Securing additional drivers

Requires

» Gathering more data on the link between cost & carbon

» Effectively expressing co-benefits (such as health and productivity gains)

» Inserting better incentives in environmental assessment schemes (e.g. BREEAM)

» Taking ownership of the issue within industry and within Government

» Developing a range of narratives

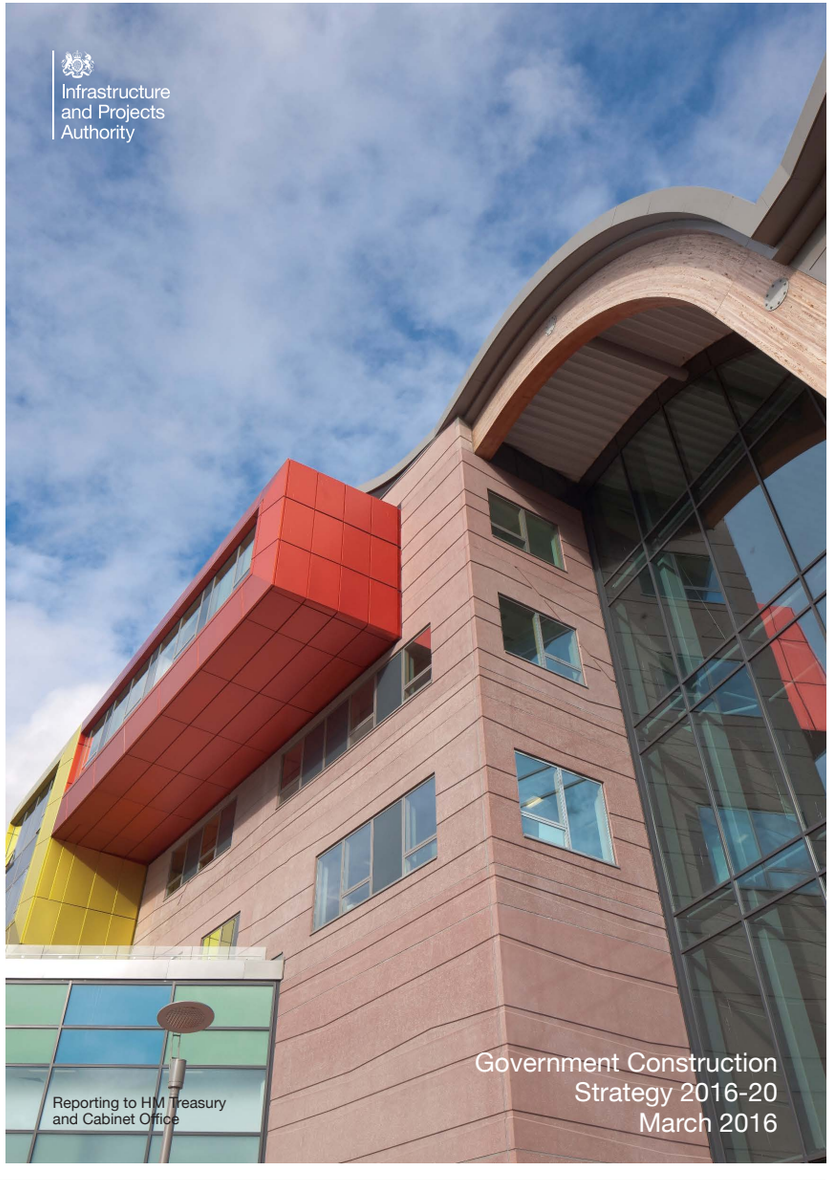
» Co-ordinated advocacy for change

» Recognising the importance of individuals

Government Construction Strategy

For the current parliament

- One of the principal objectives is to *"enable and drive whole-life approaches to cost and carbon reduction"*
- Objective 3.6 is to *"Develop data requirements and benchmarks for measurement of whole-life cost and whole-life carbon (embodied and operational)"*
- *"Government contracts will encourage innovative sustainability solutions on carbon reduction where value can be demonstrated"*
- Ultimately forming *"recommendations for a future approach"*



Summary

Achieving net zero requires unprecedented levels of innovation

» The net zero emissions goal creates a new carbon context

» Earlier mitigation will be more cost effective and reduces dependence upon unproven negative emissions technologies

» Faster progress and greater innovation is needed to get the construction industry back on a trajectory that is consistent with national carbon targets

» There are many barriers to innovation but these are slowly being overcome

» Further coordination and collaboration is required to secure additional drivers

» The costs of inaction and the significant global marketplace for low carbon solutions should be motivations to act now

» We must work together to develop a vision of a low carbon construction industry that is consistent with the goals of the Paris Agreement