CENTRE FOR RESEARCH INTO
ENERGY DEMAND SOLUTIONS

A carbon portrait of construction

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01/11/2018

EPSRC
Engineering and Physical Sciences Research Council

slides available from **www.jannikgiesekam.co.uk**

Publications from CIE-MAP

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CIE-MAP

Centre for Industrial Energy, Materials and Products

Reducing carbon in construction: a whole life approach

The UK construction sector is failing to meet its carbon reduction targets and needs to explore additional mitigation options. The carbon emissions from heating and lighting our buildings (*operational emissions*) have been falling but these are not the only emissions arising from the built environment. Sizeable carbon emissions are incurred in constructing, maintaining and demolishing an asset and producing the materials and components used throughout its life cycle (*embodied emissions*). Considering both the anticipated operational and embodied emissions of a built asset is considered a *whole life approach*. To date the construction industry has mainly focussed on reducing operational emissions, driven by changes in the building regulations and planning requirements. Extending the focus of project carbon assessments and targets from operational to whole life emissions presents designers, clients and contractors with a broader range of mitigation options. The faster proliferation of a whole life approach should be supported by national and local policies for which there are a number of international precedents. Targeted intervention from national and local government could drive innovation in design teams and supply chains, improve sector productivity, reduce the costs of UK buildings and infrastructure, create employment opportunities, boost export markets and deliver immediate reductions in carbon emissions.

Recommendations

1. The Government should establish a well resourced independent body to develop and accelerate the construction sector's decarbonisation agenda.
2. Local authorities should require assessment of whole life carbon emissions on significant schemes as part of the planning process.
3. All publicly funded building projects should include a whole life carbon assessment and whole life carbon targets where project benchmarks can be established.
4. The greenhouse gas emission reporting requirements for quoted companies should be extended to include scope 3 emissions associated with developing new facilities.
5. Product manufacturers should require Environmental Product Declarations to support environmental claims.

Challenges facing UK construction

The National Infrastructure Commission has highlighted three key challenges facing the construction sector: congestion, capacity and carbon[1]. By 2050 there are expected to be an extra 14 million people living in the UK and the construction sector must deliver the housing and infrastructure that will underpin their future prosperity. That requires dramatically increasing housebuilding, retrofitting one existing home every minute, and delivering an infrastructure pipeline worth in excess of £600bn. UK firms are also expected to capture an increasing share of the global market for sustainable construction and be at the forefront of delivering the Government's Clean Growth ambitions[2]. Meanwhile by 2025 the industry is expected to halve delivery time, cut costs by a third, halve the trade gap between exports and imports of construction products, and halve carbon emissions from the built environment[3]. All of this must be achieved by a highly fragmented sector with low financial margins and declining labour availability[4]. None of these targets will be met under business as usual conditions[4,5]. Therefore the construction sector must undergo a radical transformation over the next decade.

The Government has already set out some measures to transform infrastructure performance[2], and modernise the industry through the Construction Sector Deal as part of the Industrial Strategy[6]. This transformation must focus on reducing carbon whilst improving sector productivity through the adoption of more resource efficient designs, novel materials and delivery models. The successful transformation of this industry will be critical to achieving the Government's target of doubling resource productivity over the next 25 years[7] and meeting carbon targets.

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Giesekam et al. (2014, 2015, 2016, 2017, 2018a, 2018b); GCB (2015); Roelich & Giesekam (2018)

Centre for Research into Energy Demand Solutions (CREDS)

New multi-disciplinary centre, funded by EPSRC and ESRC - £19m over 5 years.

The headlines this month...

Final call to save the world from 'climate catastrophe'

Scientists warn of imminent climate catastrophe without massive changes

We have 12 years to limit climate change catastrophe, warns UN

Urgent changes needed to cut risk of extreme heat, drought, floods and poverty, says IPCC

World to miss Paris climate targets by wide margin, says UN panel

IPCC Special Report

"Limiting warming to 1.5°C is possible within the laws of chemistry and physics but doing so would require unprecedented changes"

Jim Skea, Co-Chair of IPCC Working Group III

The Paris Agreement

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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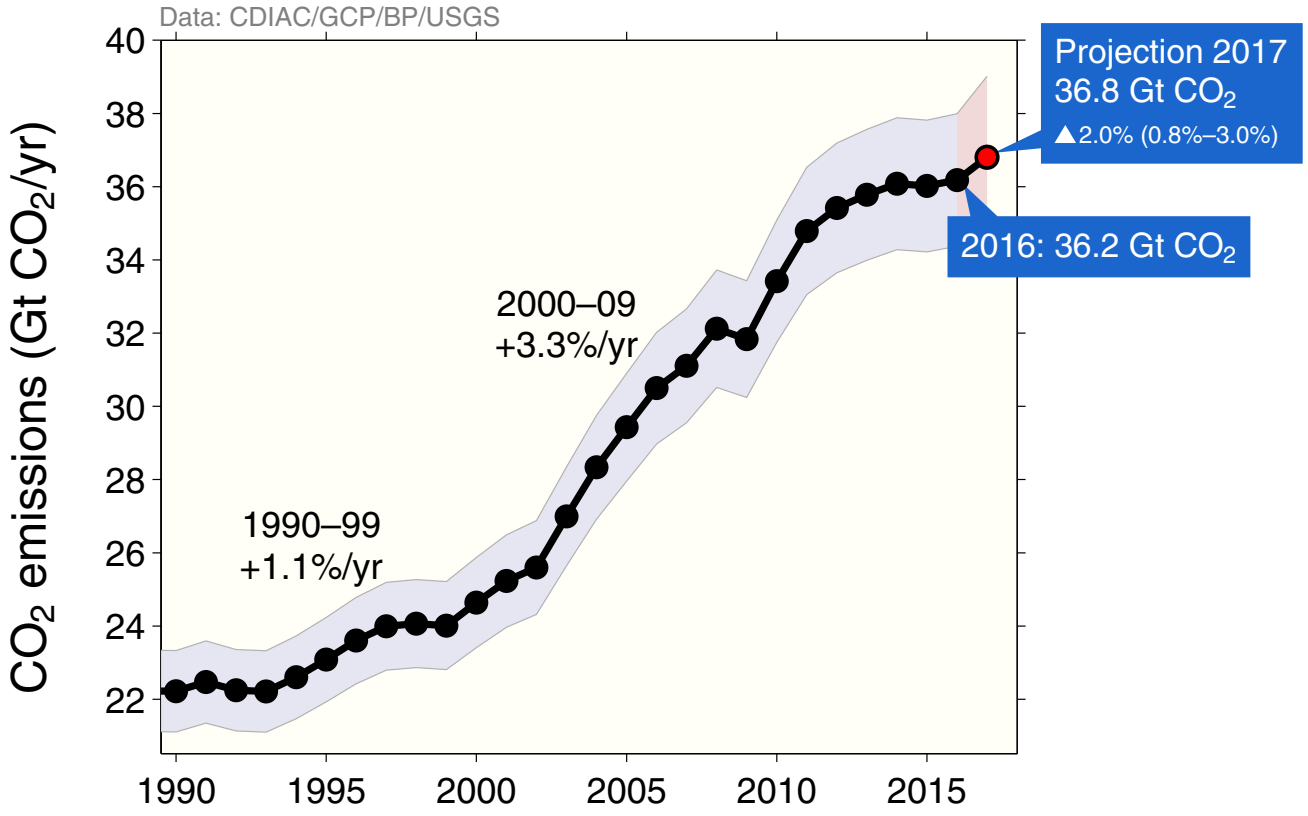
Global carbon emissions continue to rise



Global emissions scenarios - currently on track for ~3°C

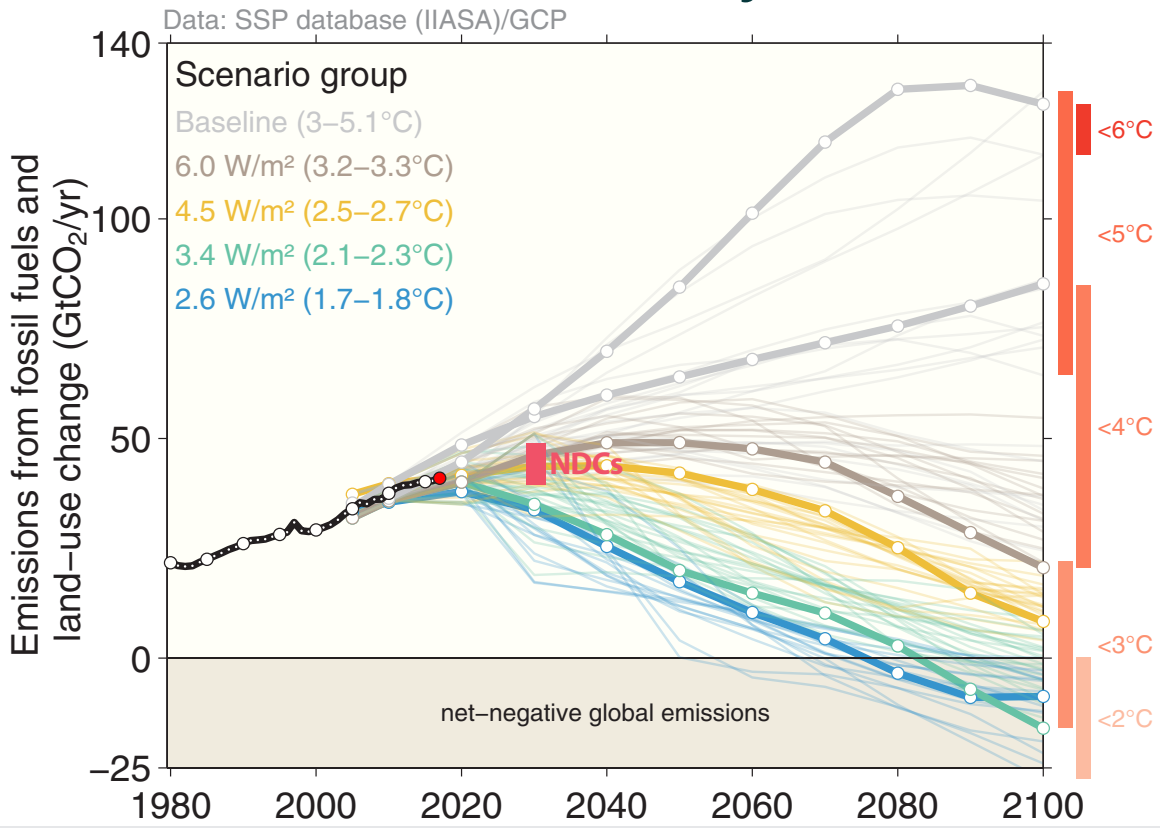


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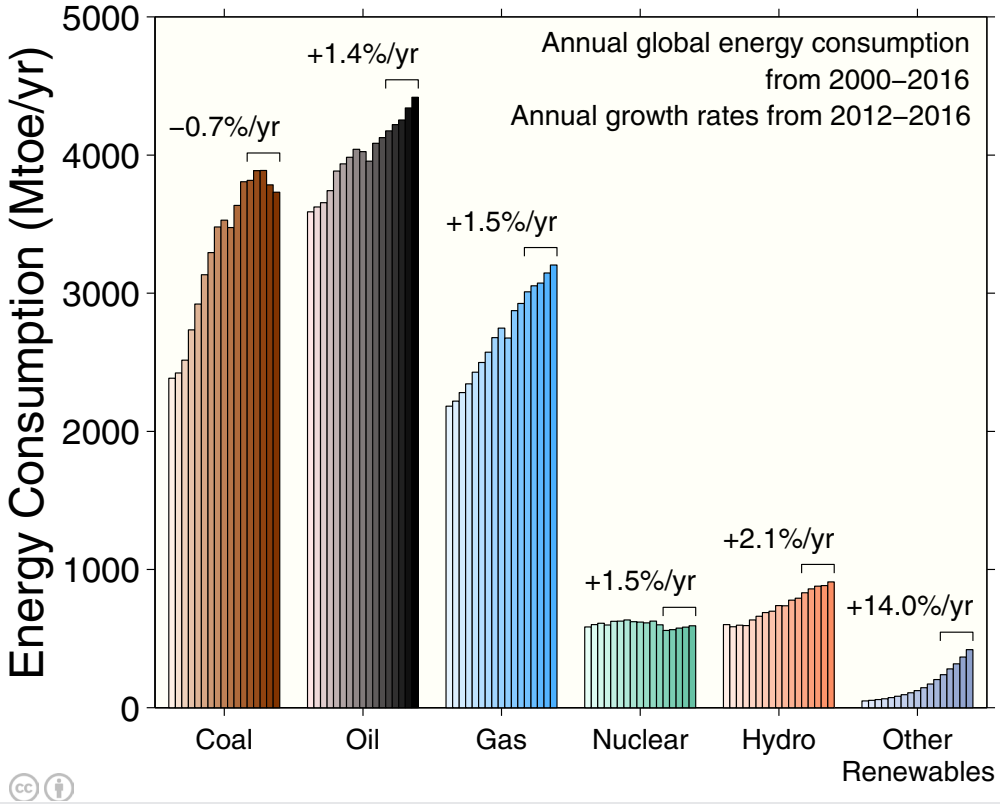
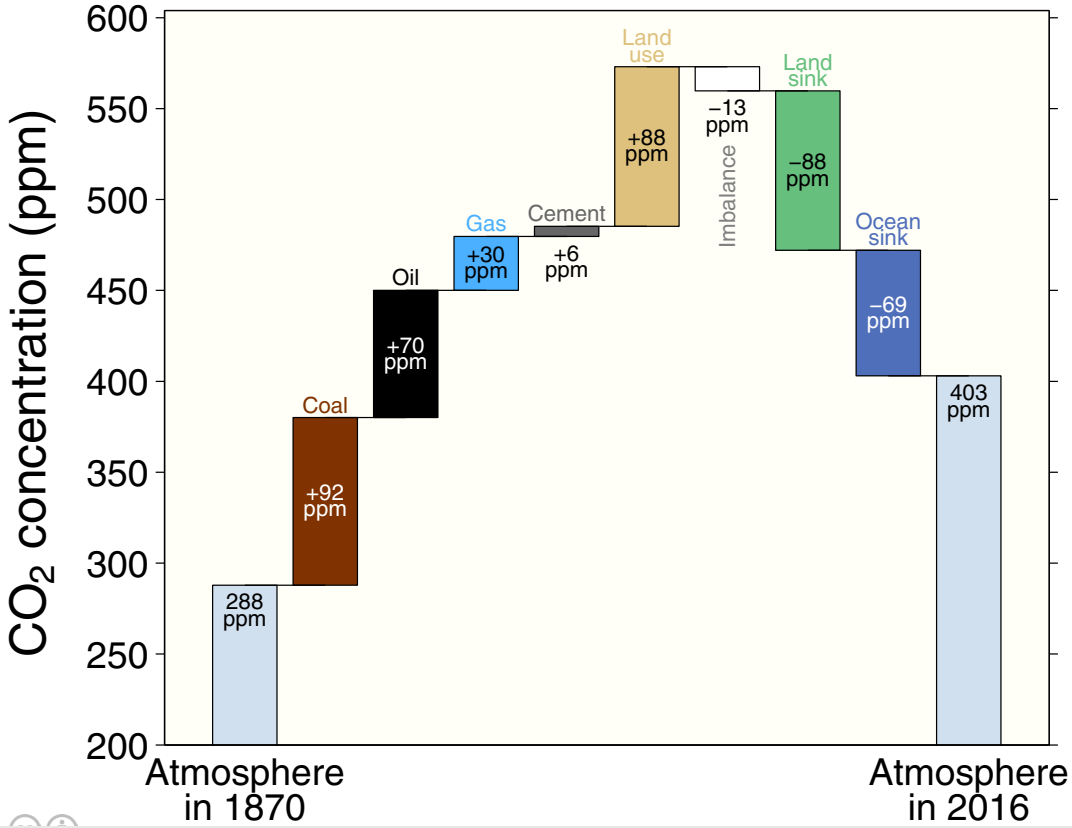
Image from Tuvalu courtesy of Climate Visuals

We need changes in supply *and* demand

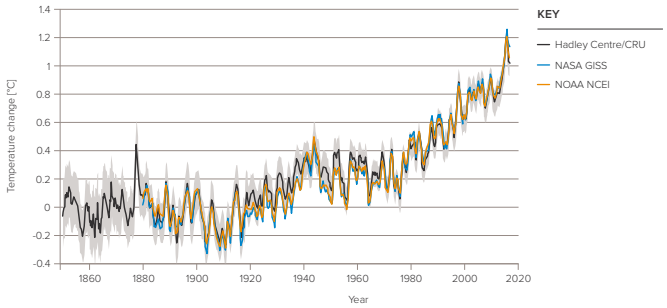


Concentrations unprecedented in last >800,000 years

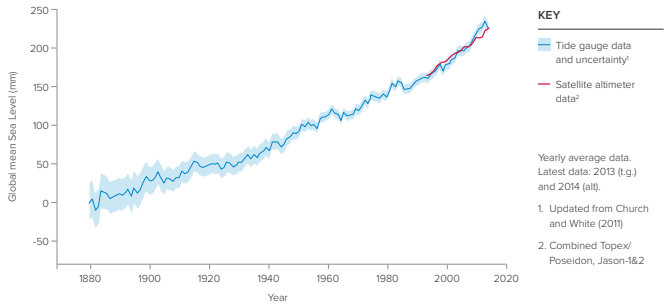


Impacts include

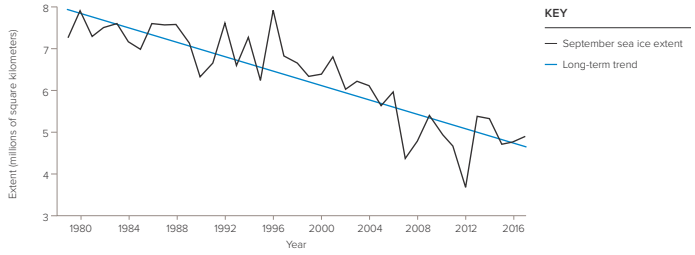
Increasing global temperature



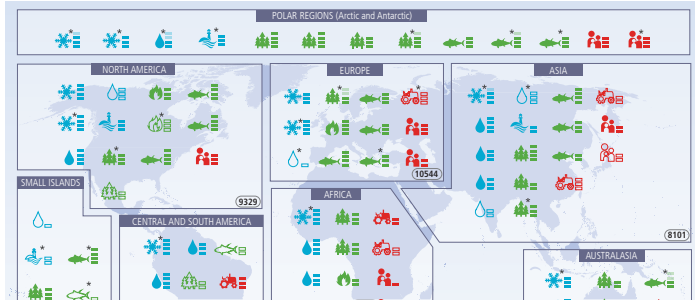
Increasing sea levels



Declining Arctic sea ice



Widespread impacts on ecosystems



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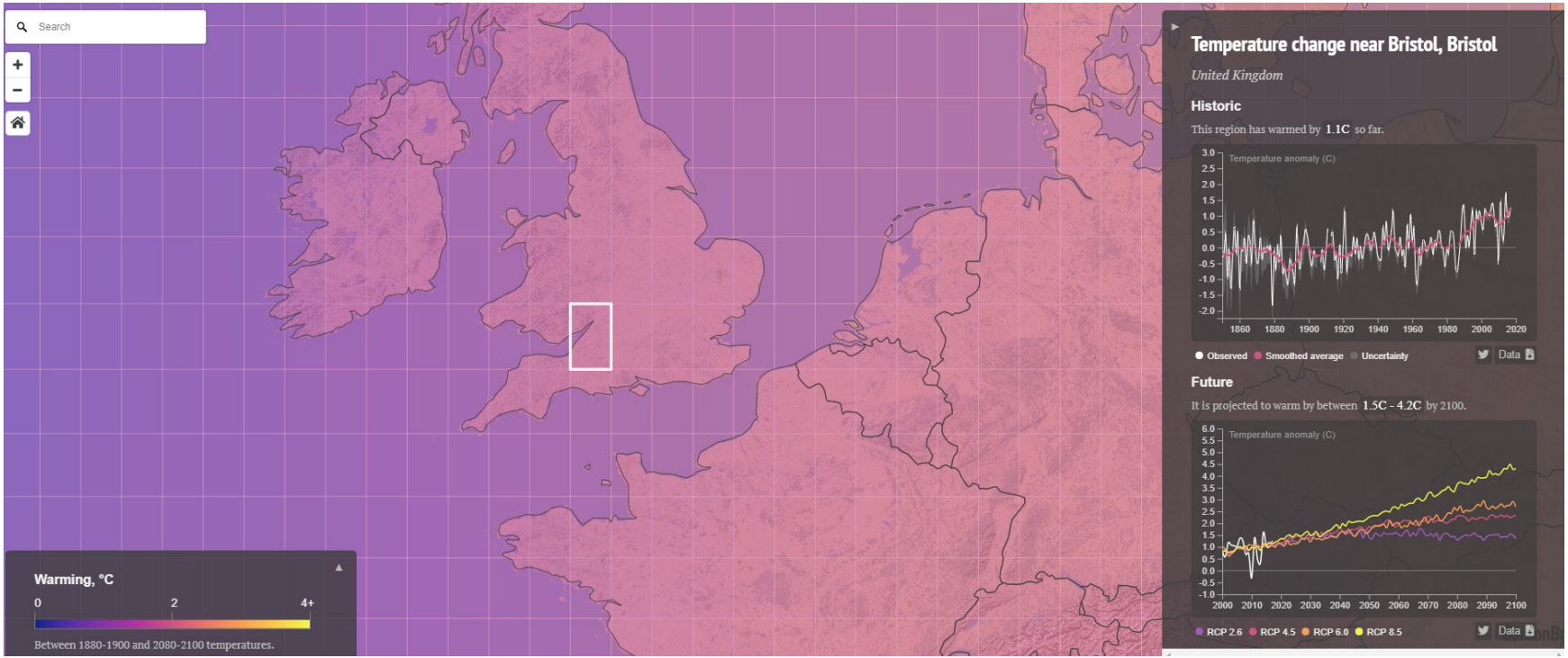
See IPCC (2014) Climate Change 2014 Synthesis report & Royal Society (2017) Climate updates. What have we learnt since the IPCC 5th Assessment Report? for full description of impacts

Already ~1.1˚C warmer where we are today



In comparison to 1951-1980

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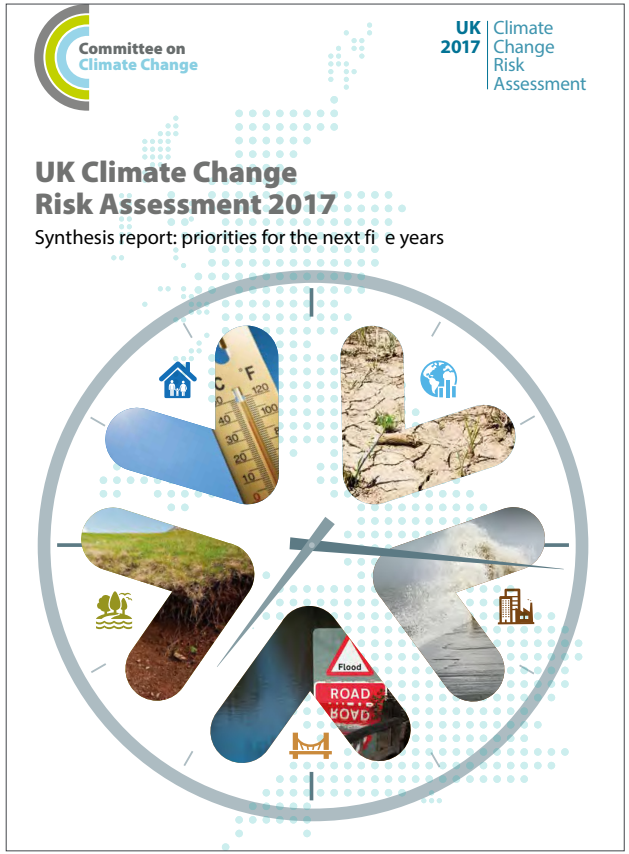
screenshot from interactive developed by Carbon Brief (2018) www.carbonbrief.org/mapped-how-every-part-of-the-world-has-warmed-and-could-continue-to-warm

Substantial risks for the UK

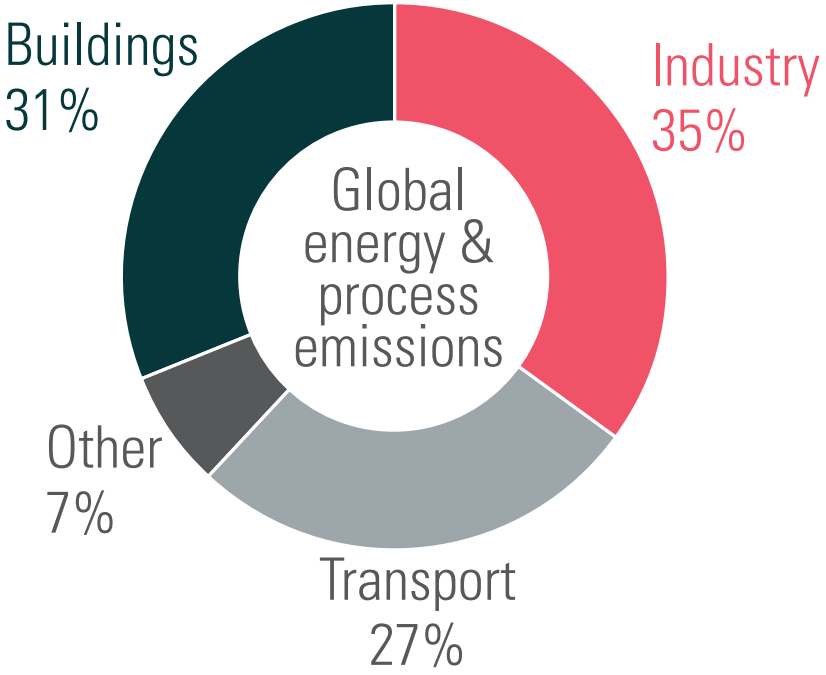
Figure SR.1: Top six areas of inter-related climate change risks for the United Kingdom

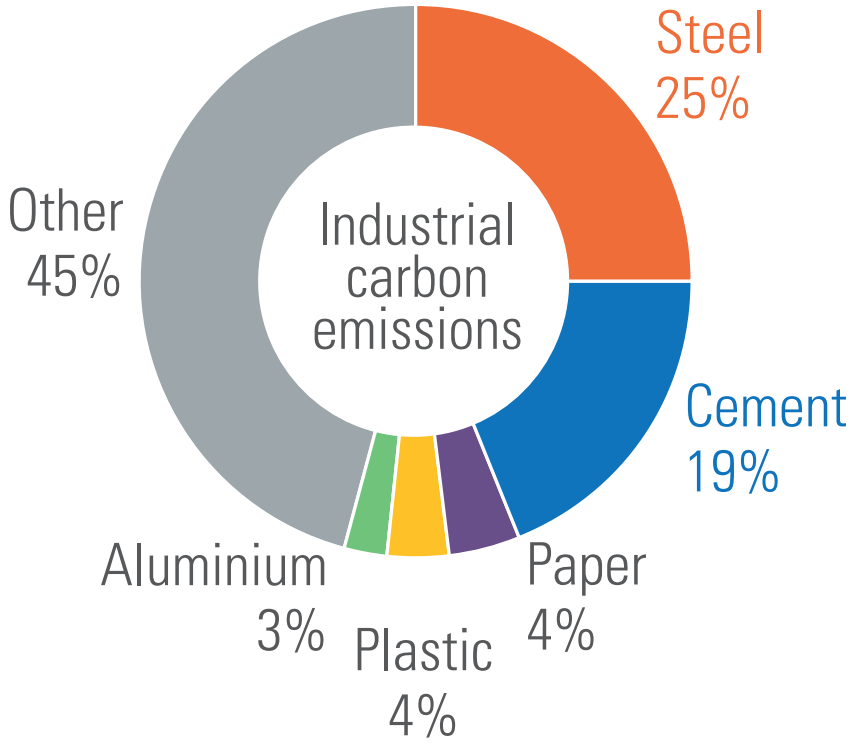
Flooding and coastal change risks to communities, businesses and infrastructure (Ch3, Ch4 **Ch5**, Ch6)	**MORE ACTION NEEDED**
Risks to health, well-being and productivity from high temperatures (**Ch5**, Ch6)	
Risk of shortages in the public water supply, and for agriculture, energy generation and industry (Ch3, **Ch4**, Ch5, Ch6)	
Risks to natural capital, including terrestrial, coastal, marine and freshwater ecosystems, soils and biodiversity (**Ch3**)	
Risks to domestic and international food production and trade (Ch3, Ch6, **Ch7**)	
New and emerging pests and diseases, and invasive non-native species, affecting people, plants and animals (Ch3, **Ch5**, Ch7)	**RESEARCH PRIORITY**
NOW ----→ RISK MAGNITUDE ----→ **FUTURE** LOW MEDIUM HIGH	

Source: ASC synthesis of the main areas of risk and opportunity within the chapters of the Evidence Report.
Notes: Future magnitude is based on a combination of climate change and other drivers of risk (e.g. demographic change), taking account of how current adaptation policies and plans across the UK are likely to reduce risks.



Emissions from the built environment and its supply chains





Adapted from Allwood & Cullen (2012) Sustainable materials with both eyes open

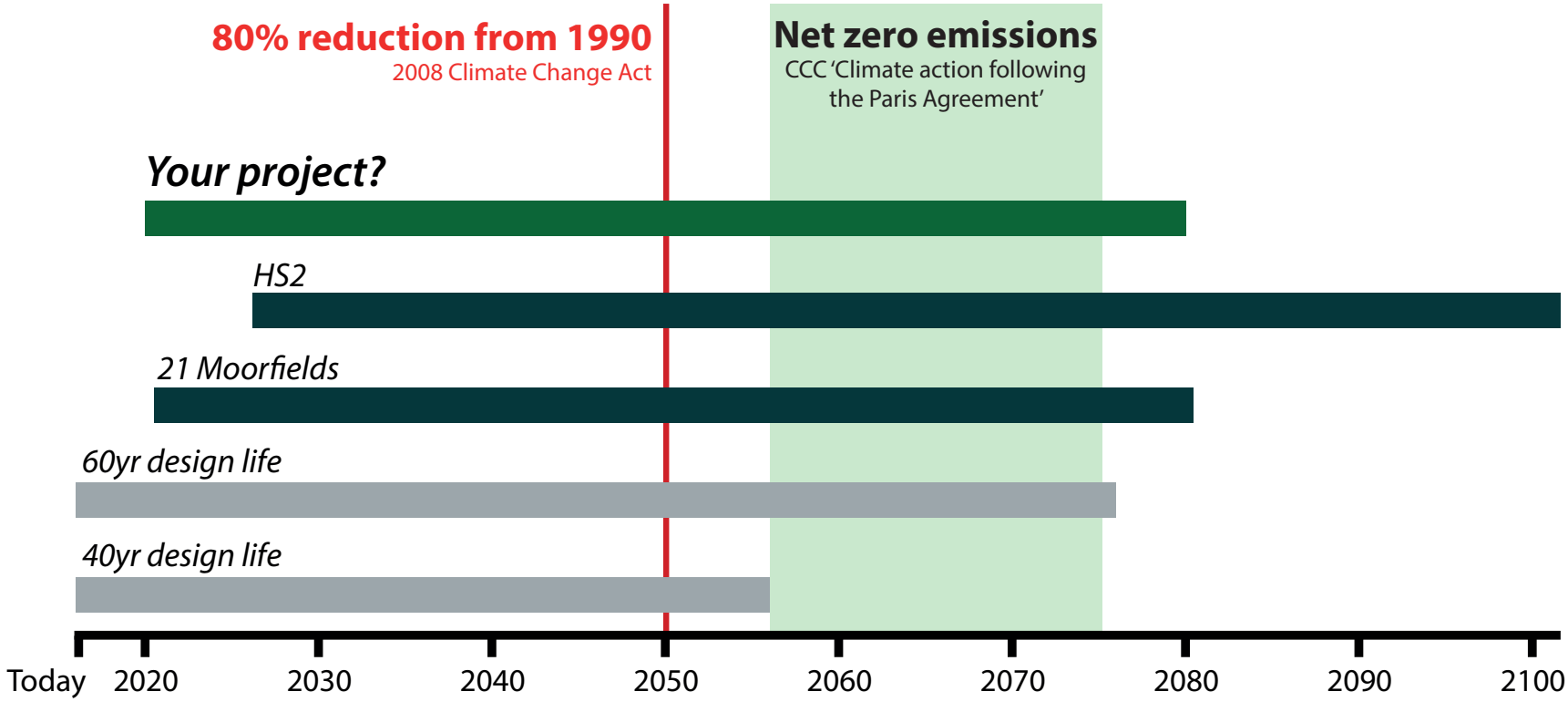
Long term goal is net zero emissions

"...the UK's current emissions targets are not aimed at limiting global temperature to as low a level as in the Agreement"

In 2016 CCC advised that the **UK must be net zero CO_2 by 2055-2075** for >66% chance of achieving 2˚C or before 2050 for 1.5˚C

Updated advice expected early 2019

Implications for UK built environment



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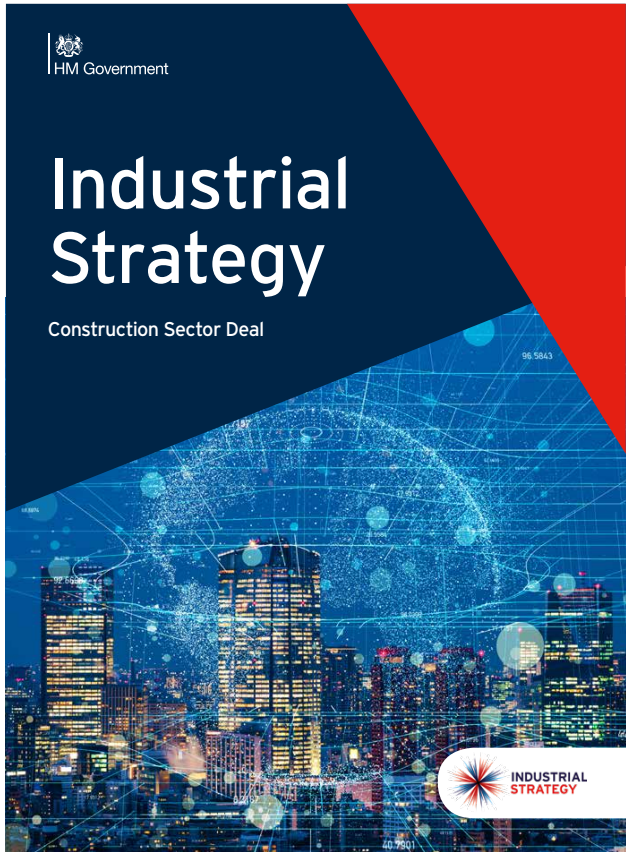
See Giesekam et al. (2018) Aligning carbon targets for construction with (inter)national climate change mitigation commitments *doi:10.1016/j.enbuild.2018.01.023* for detailed discussion

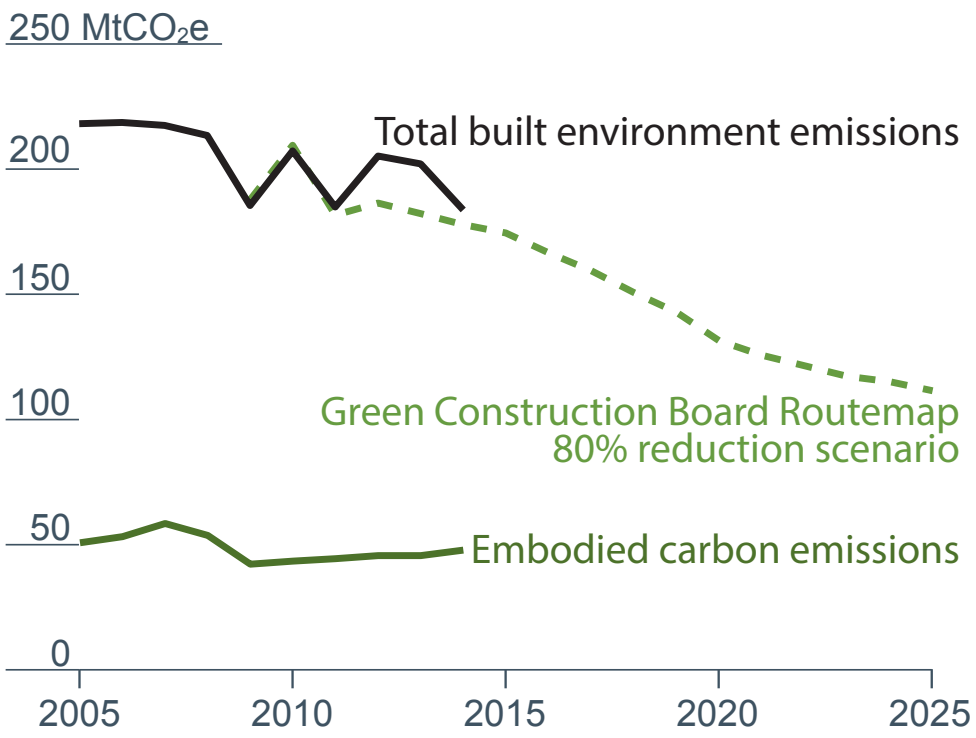
Construction Sector Deal

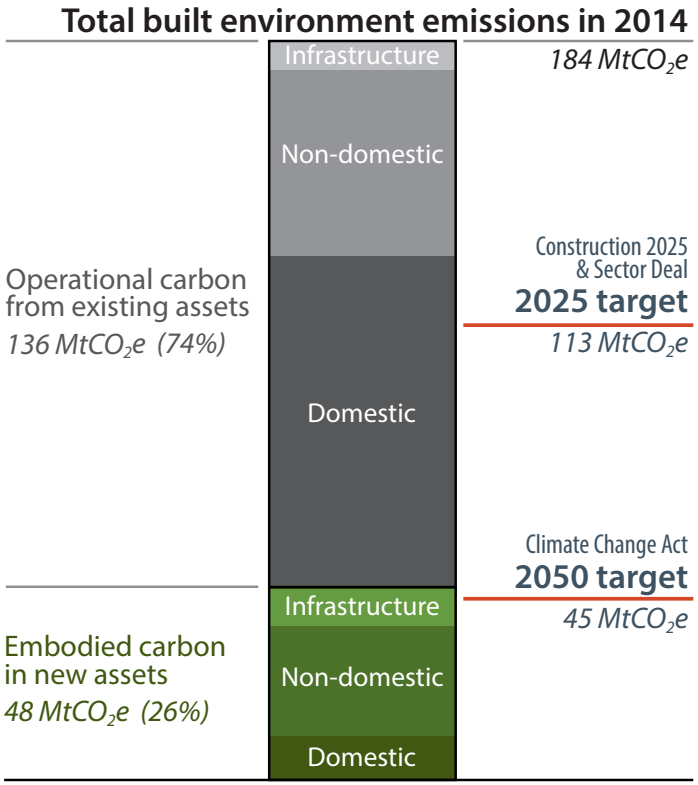
Mission to halve the energy use of new buildings by 2030

Targets 50% reduction in greenhouse gas emissions in the built environment by 2025



Green Construction Board Low Carbon Routemap progress





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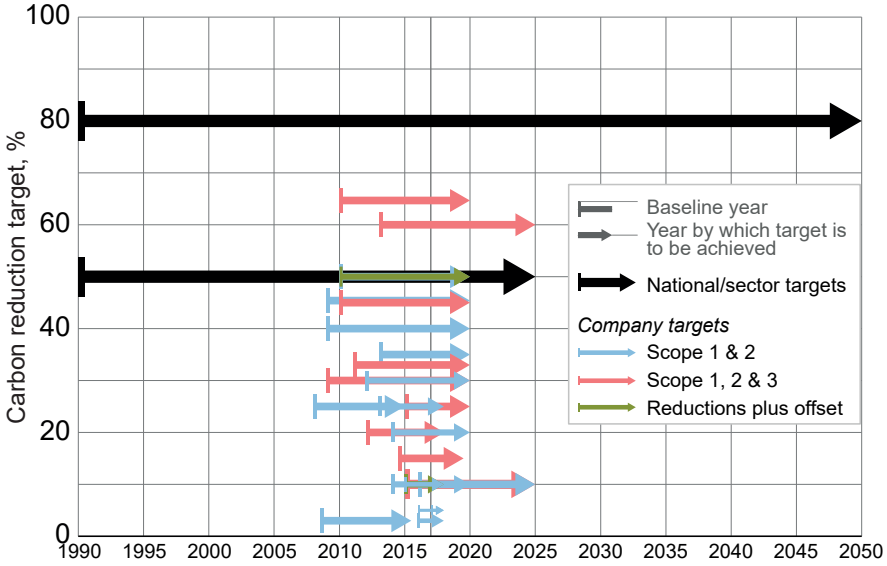
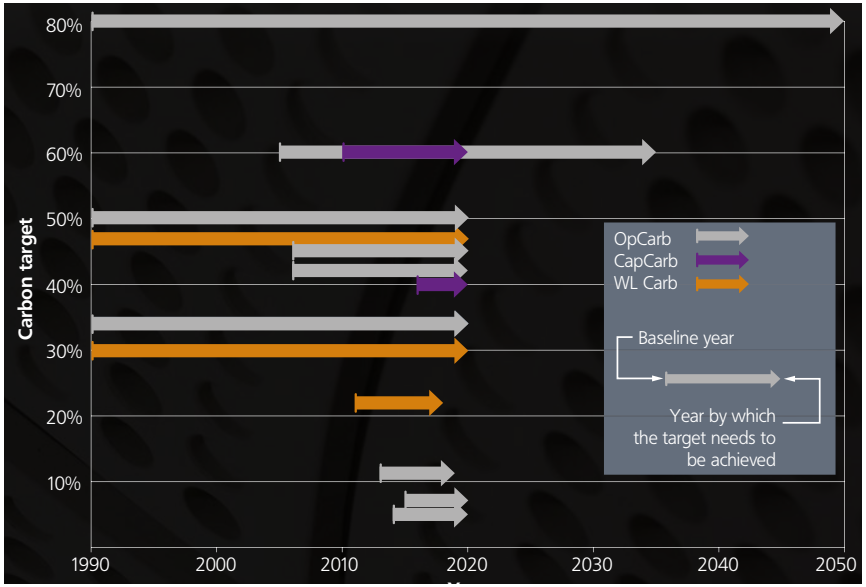
UK construction company carbon targets

Carbon reduction targets of selected UK housebuilders & construction firms (representing turnover of £88.4bn in 2016) - based on July 2017 review



Carbon reduction targets of selected infrastructure clients



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Figures from Giesekam et al. (2018) Aligning carbon targets for construction with (inter)national climate change mitigation commitments & UKGBC (2017) Delivering low carbon infrastructure

Science Based Targets

SCIENCE BASED TARGETS

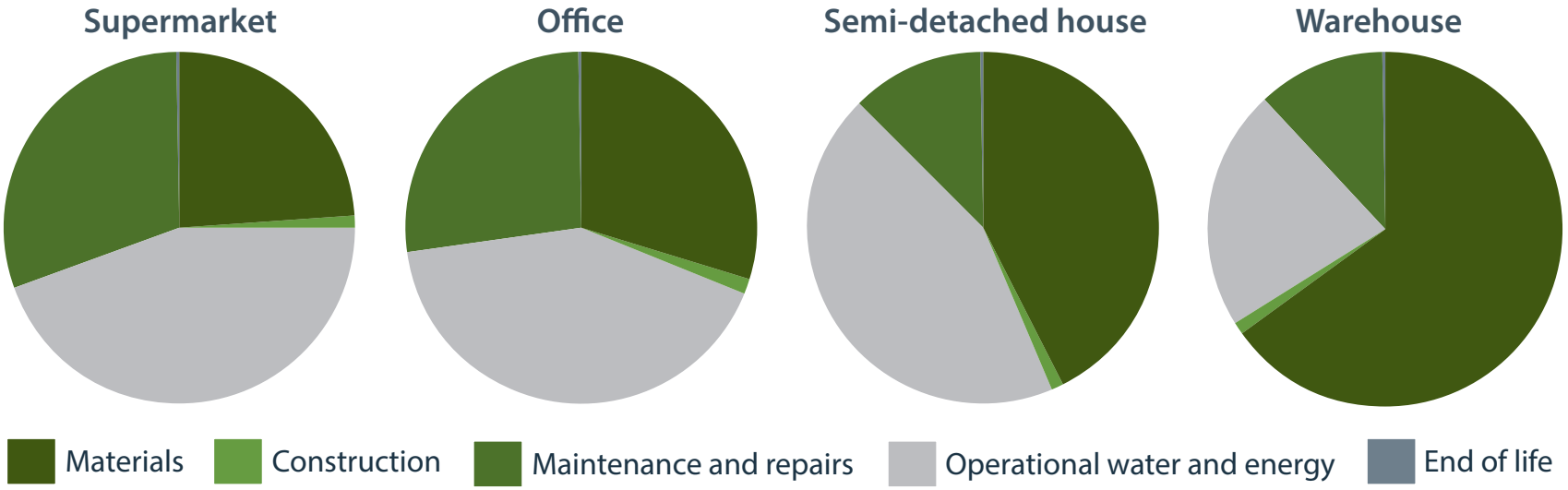
497
companies taking action

149
with approved targets

63
in construction, real estate and supply chain

22 based in UK

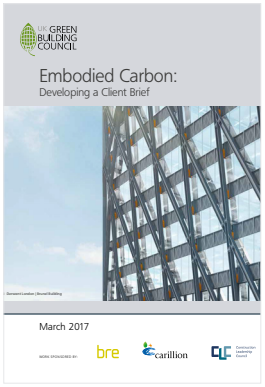
Typical breakdowns of whole life carbon emissions

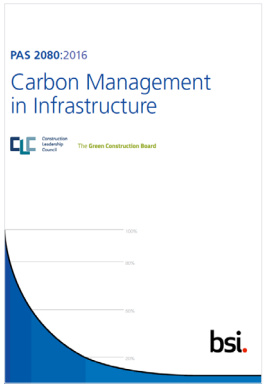


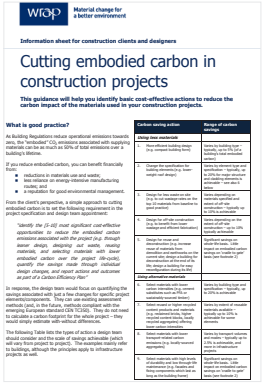
As operational emissions in new buildings reduce, the focus must move towards reducing **whole life emissions**, including embodied emissions

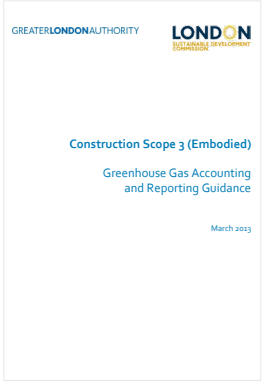
for a primer read Giesekam (2018) Reducing carbon in construction: a whole life approach
Figures from UKGBC (2017) Embodied carbon: developing a client brief

Guidance on embodied/whole life carbon









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RIBA (2018); RICS (2017); UKGBC (2015,2016,2017); GCB & CLC (2016); WRAP (2014); GLA(2013); CPA (2012)

Draft London Plan

August 2018 revisions include:

New Policy SI2 DB: *"Development proposals referable to the Mayor should* ***calculate whole life-cycle carbon emissions*** *through a nationally recognised Whole Life-Cycle Carbon Assessment and demonstrate actions taken to reduce life-cycle carbon emissions."*

This is expanded upon in new 9.2.9A section and included in the energy strategy requirements.

Coming up...

Several important CCC reports (Bioenergy, land use, long term targets, CCUS)

WorldGBC & CIFF campaign

WorldGBC responds to IPCC: The entire building and construction supply chain must decarbonise by 2050 to reach 1.5 degrees

–

Monday 08th October 2018

WorldGBC will begin work to assess how the increasing emissions from building and construction can reach net zero by 2050

Coming up

Keep up to date with CCC publications and events

15 November 2018

CCC report: Bioenergy Review

In the autumn of 2018 we will publish a new report on bioenergy. This will provide an analysis of the latest evidence, and build on the **Bioenergy Review** we published in 2011.

15 November 2018

CCC/ASC report: The future of land use in the UK – impacts on climate change mitigation and adaptation

The Committee on Climate Change and its Adaptation Sub-Committee will publish a joint report on how the future use and management of non-developed land in the UK could change in order to deliver deeper reductions in greenhouse gas emissions and increased carbon sequestration to 2050 and beyond, whilst maintaining its resilience to climate change.

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For more information see: www.theccc.org.uk/coming-up & www.worldgbc.org/news-media/worldgbc-responds-ipcc-entire-building-and-construction-supply-chain-must-decarbonise

Embodied Carbon Living Lab

2 year programme co-created with local stakeholders addressing embodied and whole life carbon emissions on a series of live projects in Yorkshire

Will trial new approaches, conduct a city scale assessment of impacts and propose amendments to participants' construction standards and the local sustainable construction SPD

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email **J.Giesekam@leeds.ac.uk** if you would like to collaborate

A thought on plastics

Image of Yiwu Santa Store at Futian market from 2017 film Bulkland

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Thank you

Please get in touch with any queries

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