2020 Unwin Lecture: Zero Carbon and Infrastructure

THURSDAY 8 OCTOBER 2020

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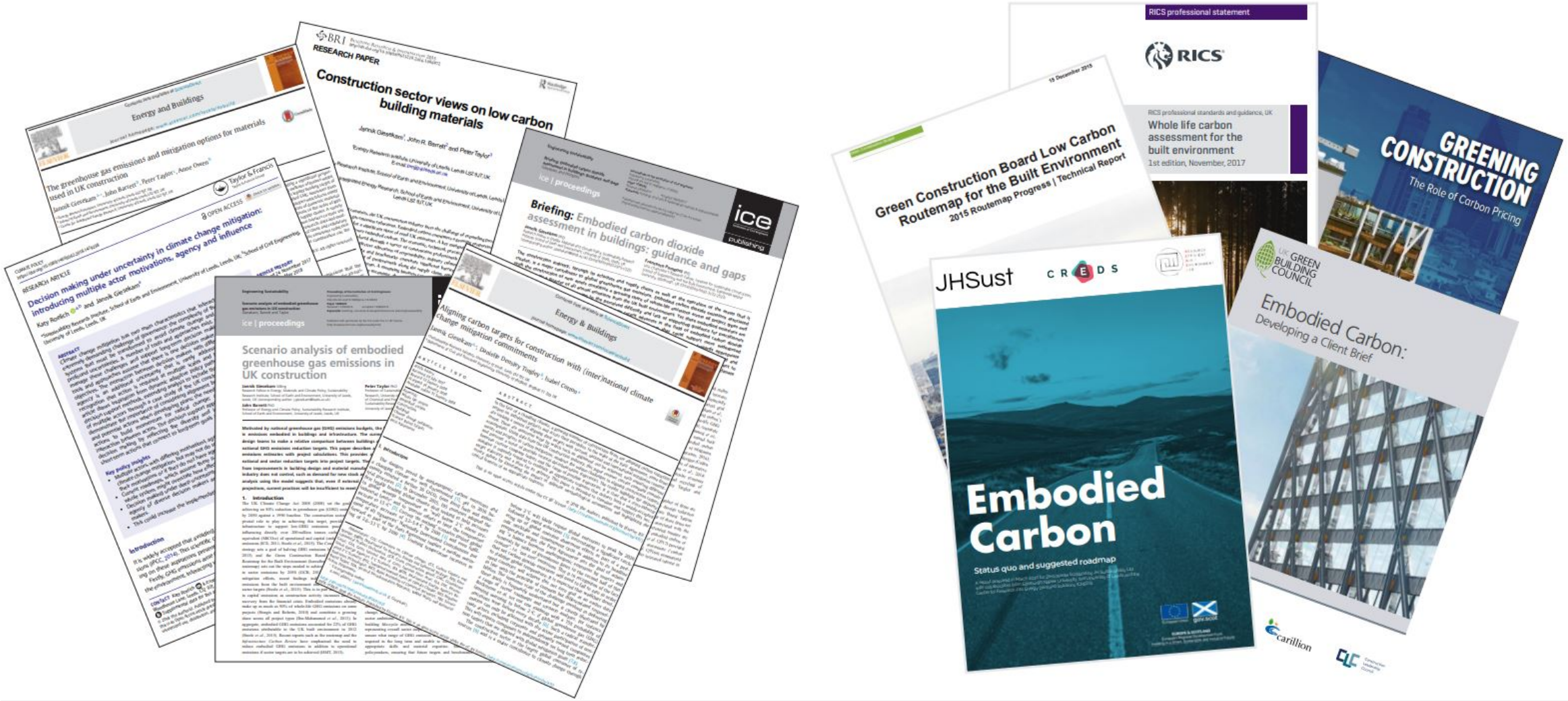
My background

More examples and slides at **jannikgiesekam.co.uk**



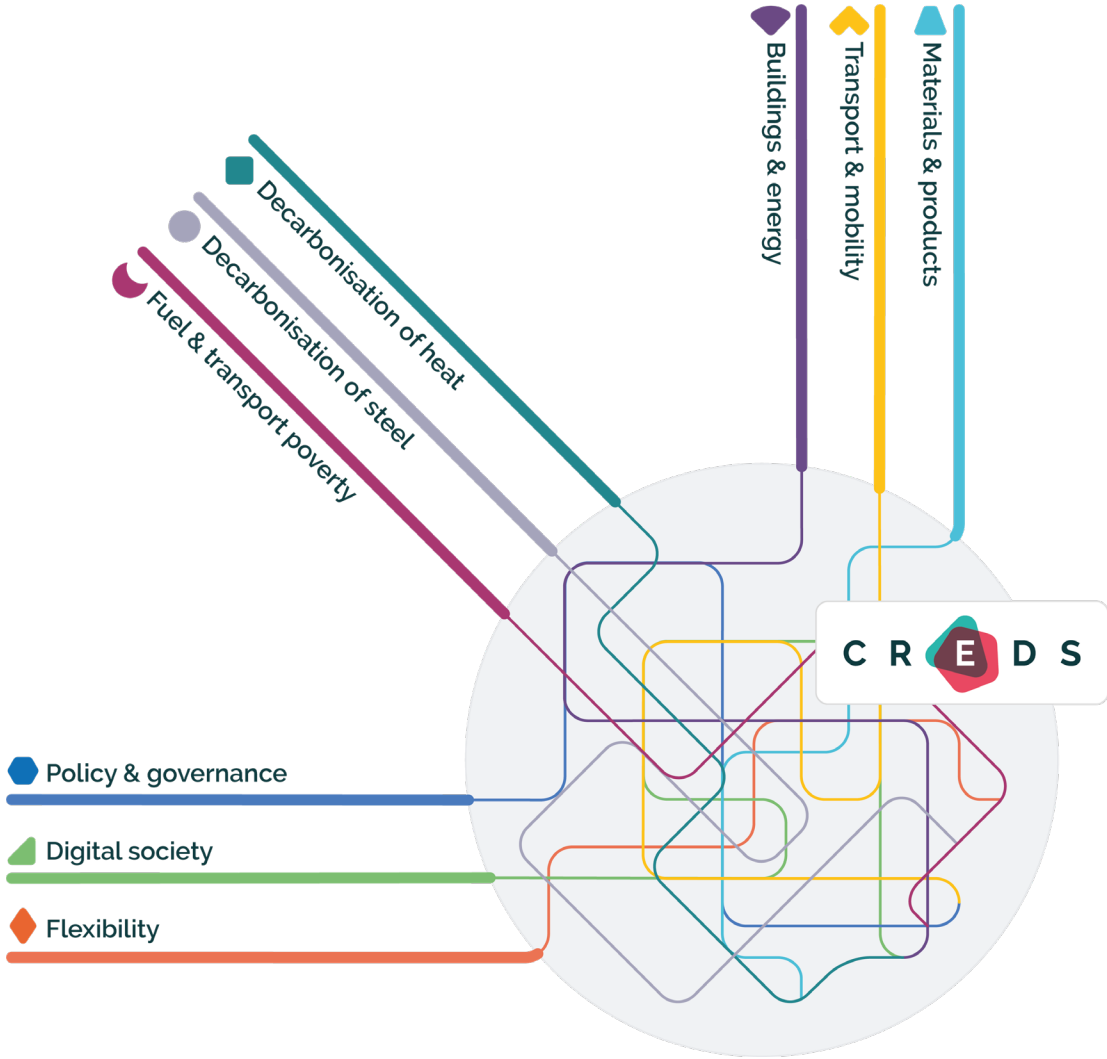
CENTRE FOR RESEARCH INTO ENERGY DEMAND SOLUTIONS

Vision to make the UK a leader in understanding the changes in **energy demand** needed for the transition to a secure and affordable, low carbon energy system.

For updates:

@CREDS_UK

Newsletter, blogs & more at **creds.ac.uk**



Agenda

Background

Terms

Results

Future developments

Background

2013 Infrastructure Carbon Review (ICR)

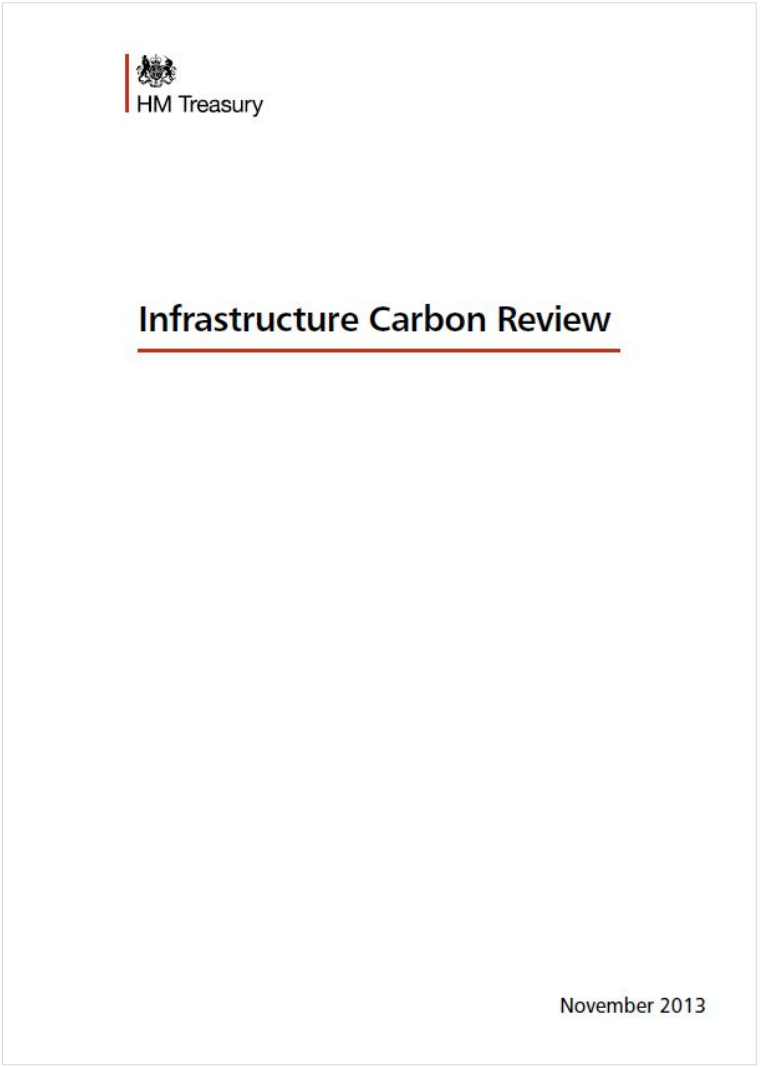
Widely endorsed rallying point for the industry

Set common terms of debate for carbon associated with UK infrastructure

Established narrative ‘reducing carbon reduces cost’

Synthesised recommendations for practice

Gave rise to innovation and new standards



Still online at gov.uk/government/publications/infrastructure-carbon-review

ICR included 2010 baseline & scenarios

Chart 1.A: Current carbon emissions associated with infrastructure

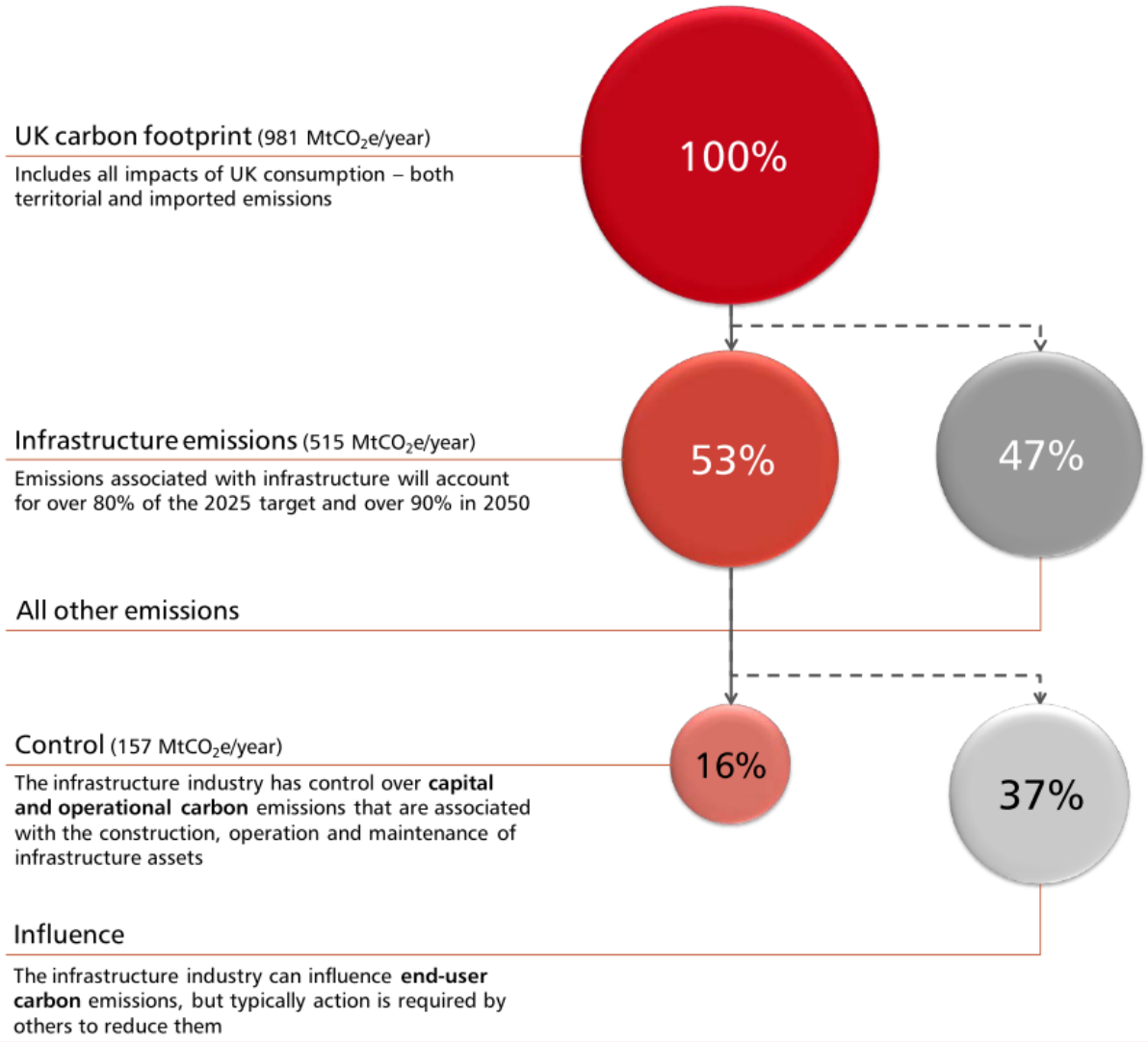
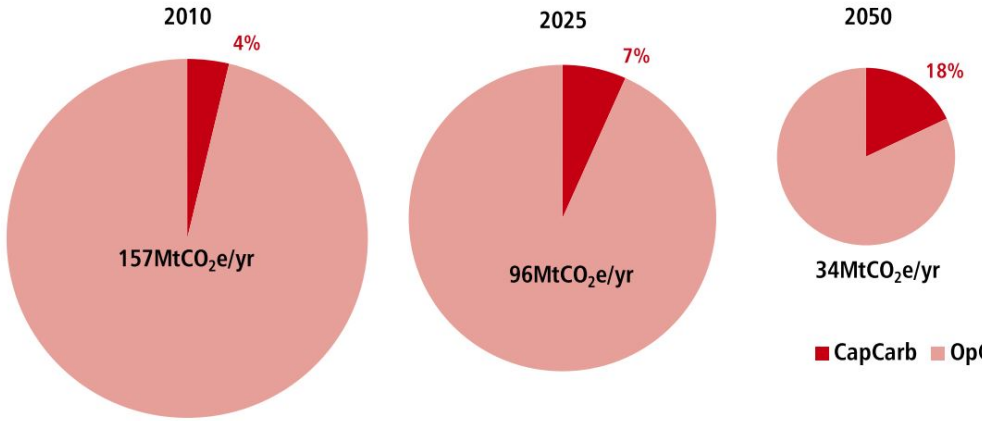


Chart 1.B: Increasing significance of capital carbon



Developments since ICR

PAS 2080: Carbon Management in Infrastructure

The Paris Agreement

UK's Net Zero target

Declaration of climate emergency

Series of 'n year on' ICR events

But no update of key metrics from ICR…

Infrastructure changes since 2010

Widespread changes across parts of the industry.

e.g. prominent transformation in electricity:

- TWh supplied from fossil fuels down 51%
- TWh supplied from renewables quadrupled
- Coal just 2.1% of electricity generation in 2019
- Changes in demand with total consumption down 10%

Figures from DUKES 2020. Photo of Rampion from Nicholas Doherty on Unsplash

ICE Carbon Project

As part of larger work programme WS3.2 set out to:

- Compile update of historic progress since ICR
- Establish improved baseline for use in futures work

Find out more at **www.ice.org.uk/knowledge-and-resources/carbon-project**

Terms

Definitions

Term	Definition
Carbon	used throughout as shorthand for the carbon dioxide equivalent of all greenhouse gases (GHGs).
Capital Carbon (CapCarb)	emissions associated with the construction of an asset.
Operational Carbon (OpCarb)	emissions associated with the operation of an asset.
User Carbon (UseCarb)	emissions from the end users of infrastructure assets.
Whole Life Carbon	emissions associated with the whole life of an asset. Sum of CapCarb + OpCarb + UseCarb
Control	emissions related to the construction and operation of infrastructure assets (CapCarb & OpCarb), that infrastructure sectors have direct control of
Influence	emissions attributed to the use of infrastructure services by the end-users (UseCarb). Although not directly controlled by infrastructure providers, such emissions can be influenced (e.g. by promoting demand management measures)

Scenarios

3 scenarios considered based on 2 variables:

- Whether only Scope 1 emissions are accounted for, or if upstream Scope 3 emissions are also included
- Whether emissions are allocated on the basis of consumption, or control

Results in this presentation are shown in format of: Scenario C (A | B)

	Key features
Scenario A	Scope 1 emissions only, all energy-sector emissions allocated to consumers *Electricity:* use DBEIS's 'consumed' Scope 1 electricity EF, which accounts for all energy industry use and losses *Fuels:* use Scope 1 emissions factors
Scenario B	Scope 1 + upstream Scope 3 emissions, all energy-sector emissions allocated to consumers Emissions are still allocated on the basis of consumption, but upstream Scope 3 emissions, excluded from Scenario A, are included where data is available *Electricity:* use DBEIS's 'consumed' Grand Total electricity EF, which accounts for all energy industry use and losses, under Scopes 1 + 3 *Fuels:* use Scope 1 + Scope 3 emissions factors for respective fuels
Scenario C	Scope 1 + upstream Scope 3 emissions, allocated to sector with control of emissions Emissions are now allocated on the basis of which sector controls their production, and include both Scope 1 and upstream Scope 3 emissions *Electricity:* uses a custom adjusted emissions factor, based on DBEIS's 'generated' Grand Total electricity EF, with losses allocated to the Energy sector *Natural gas:* uses a custom adjusted emissions factor, based on DBEIS's 'generated' Grand Total natural gas EF, with losses allocated to the Energy sector *Other fuels:* use Scope 1 emissions factors. Scope 3 emissions are allocated to the Fuels industry which controls them.

Coverage

Sector	Elements	Operational Carbon	User Carbon
Energy	Gas storage, transmission and distribution, electricity generation (renewable and non-renewable) transmission and distribution	Zero by definition under scenarios A & B. Scenario C includes all losses from consumption of electricity (thermal conversion, transmission & distribution) and supply of natural gas (transmission & distribution).	Energy use not accounted for in other infrastructure sectors - primarily consumed in buildings and non-infrastructure industry
Comms	Fixed voice and data networks, mobile voice and data networks, satellite networks, television and radio broadcast networks and radio spectrum	Network electricity consumption	Data centre and end-user device electricity consumption
Transport	Roads (strategic and local), heavy rail, light rail, airports, ports, metro systems	Public lighting electricity consumption	Vehicle energy consumption, including traction electricity for rail
Waste	Landfill, recycling facilities, waste collection and processing, hazardous waste treatment, energy recovery	Direct process emissions, and Waste sector energy consumption	None identified
Water	Water resources (rivers, reservoirs and dams), drinking water distribution (pipes and pumping stations), wastewater treatment, sewerage systems, flood and coastal defences.	Direct process emissions and Water sector energy consumption	End-user water-related energy consumption (i.e. water heating)

Sources

Large number, predominantly published statistics from:

DBEIS, Defra, DfT, ONS, ORR, IPA, Ofcom etc.

Also a few academic studies & small amount of non-public data.

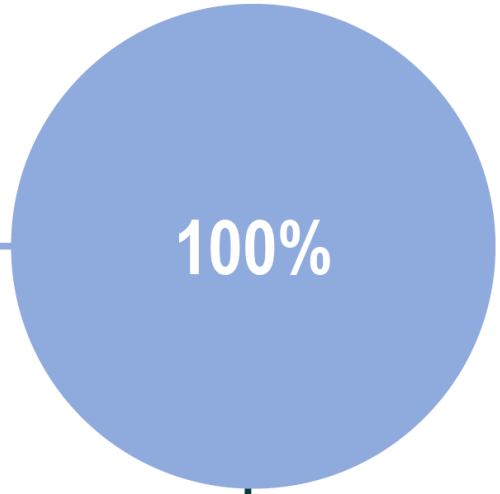
Compilation

Data compiled by Dr Jannik Giesekam in July/August 2020.

Review & QA by ICE Carbon Project WS3 members including Holly Smith (Skanska), Chris Landsburgh (Wills Bros), Tim Chapman (Arup), and Maria Manidaki (Mott MacDonald).

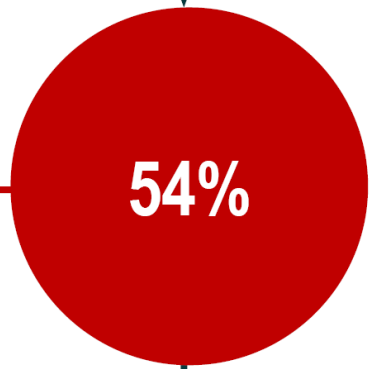
Results

In 2017

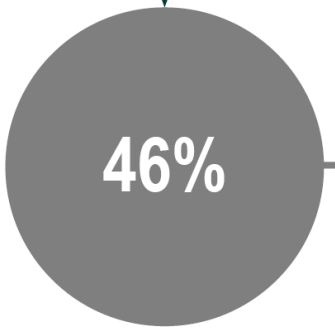


UK Carbon Footprint *773 $MtCO_2e$*

Includes all impacts of UK consumption - both territorial & imported emissions

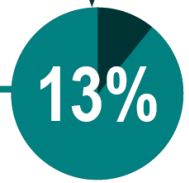


Infrastructure emissions *419 $MtCO_2e$*



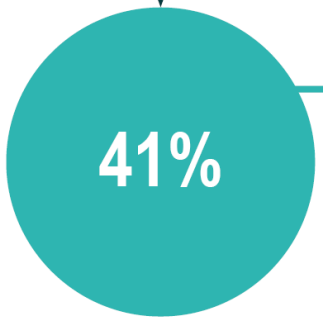
All other emissions *354 $MtCO_2e$*

From other sources



Control *99 $MtCO_2e$*

The infrastructure industry has control over **capital** & **operational carbon** associated with the construction, operation & maintenance of infrastructure assets

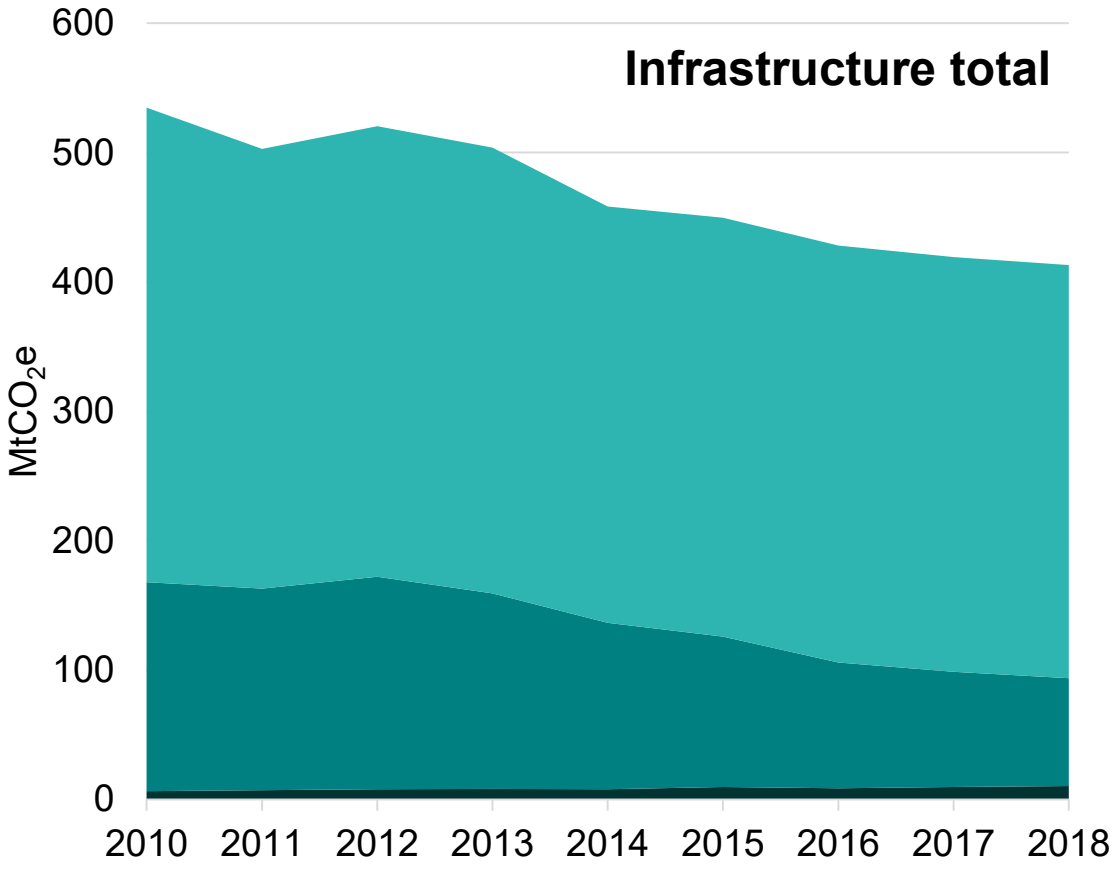


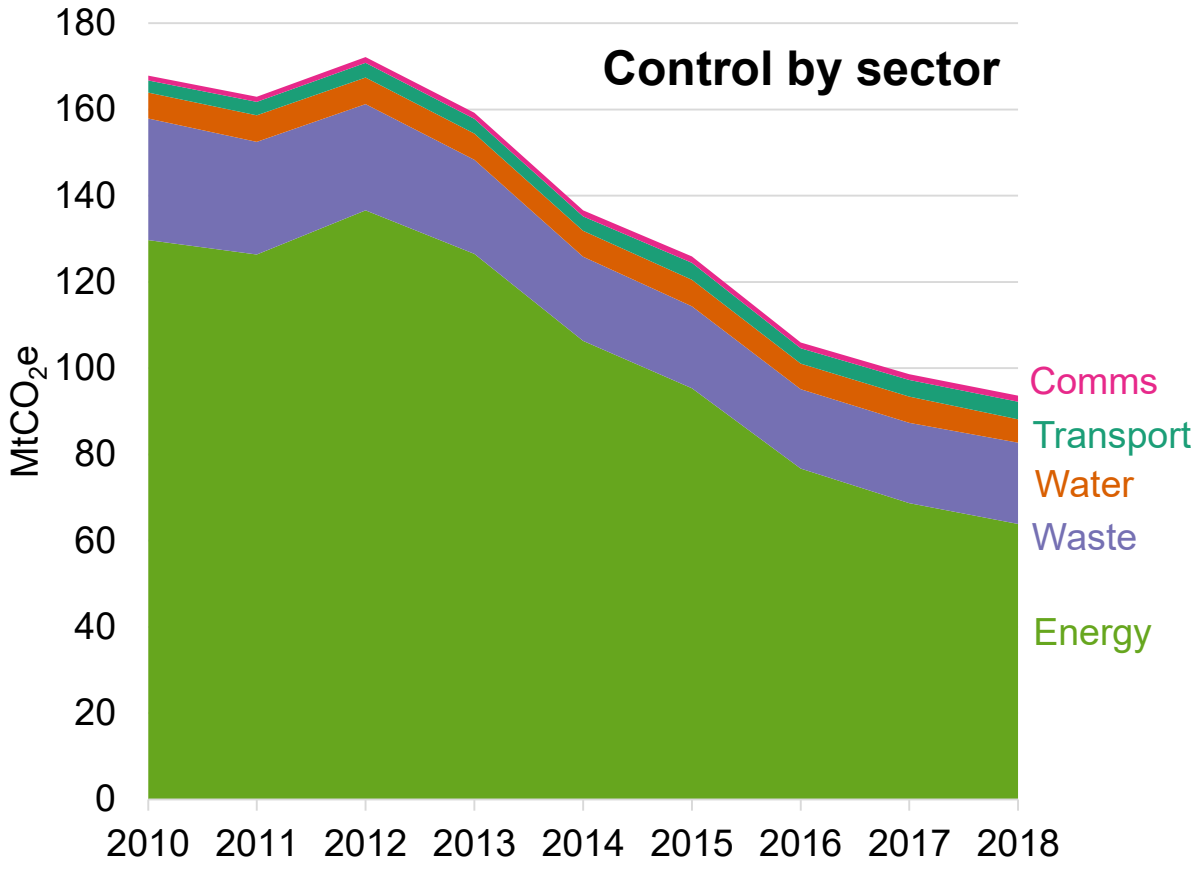
Influence *320 $MtCO_2e$*

The infrastructure industry can influence emissions from end users, but typically action is also required by others to reduce these emissions

Progress 2010-2018

23% reduction in infrastructure carbon 2010-2018 *(14 | 21%)*
44% reduction under 'control' of infrastructure industry *(18 | 21%)*

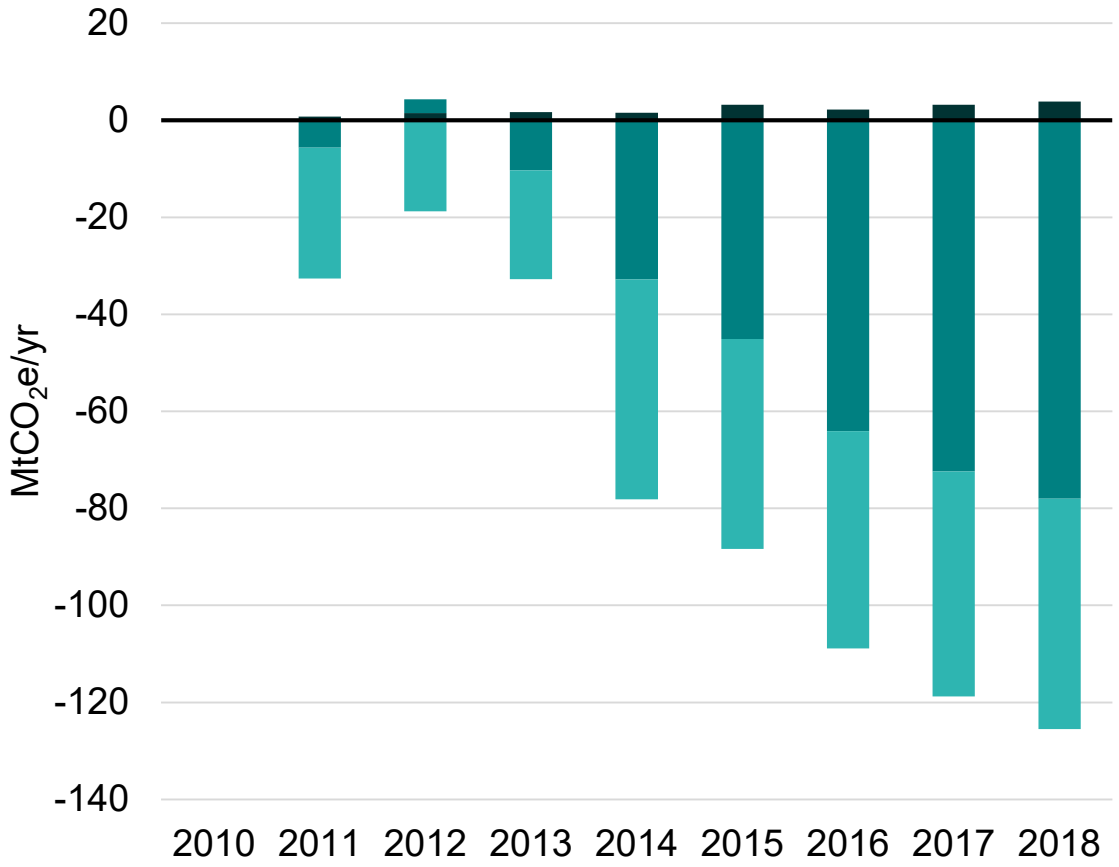


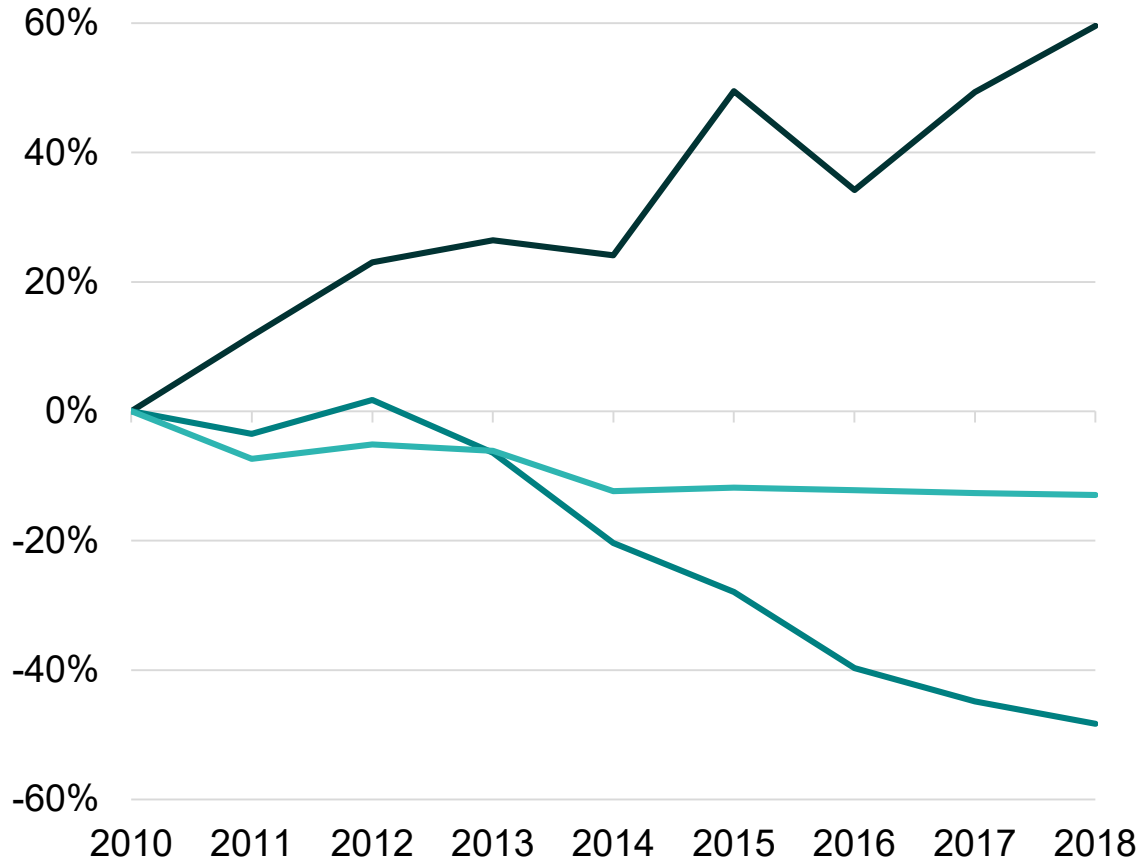


Key: **Capital carbon** **Operational carbon** **User carbon**

Changes from 2010

Declining OpCarb & UseCarb, increasing CapCarb

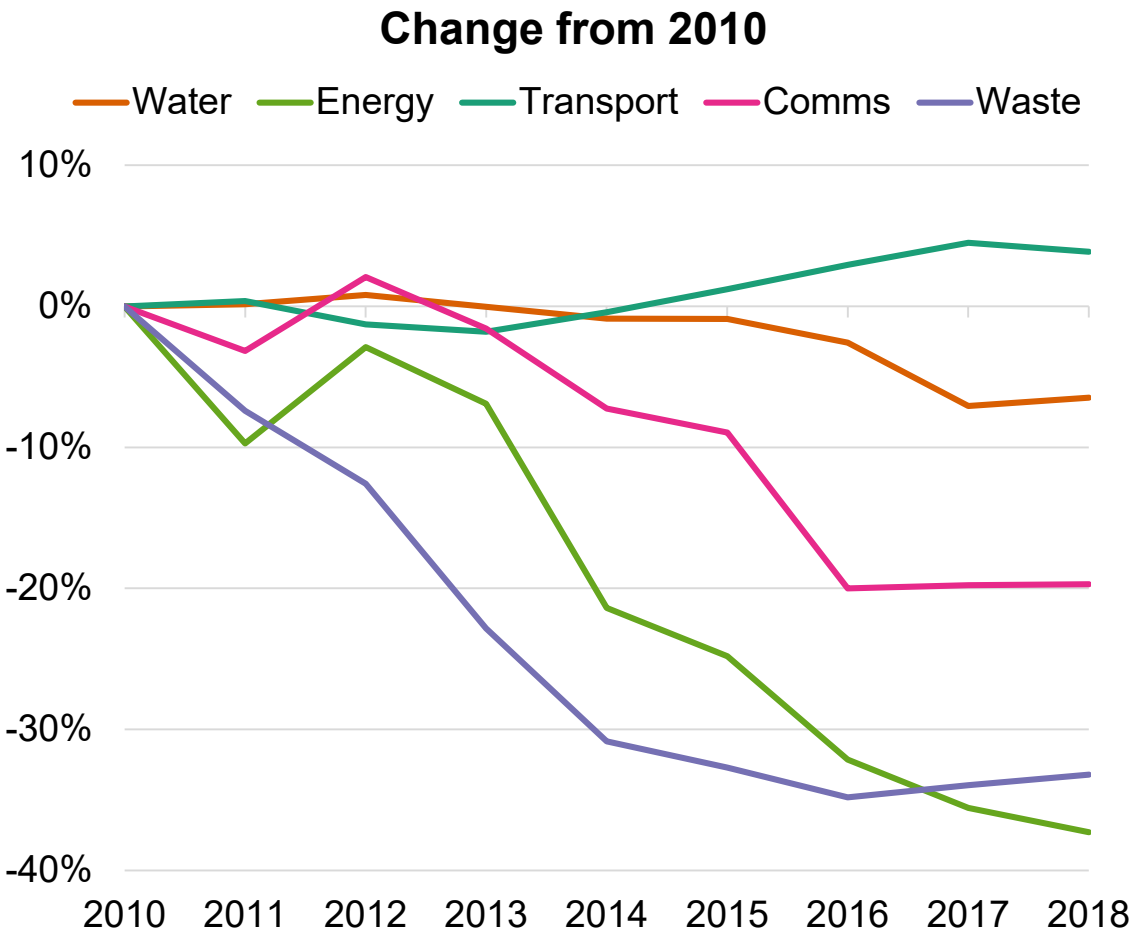


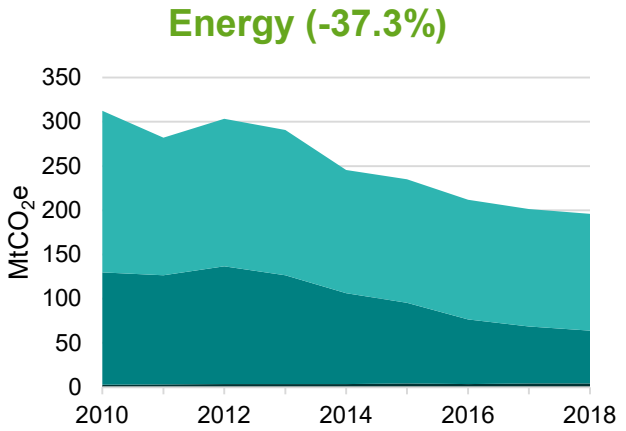


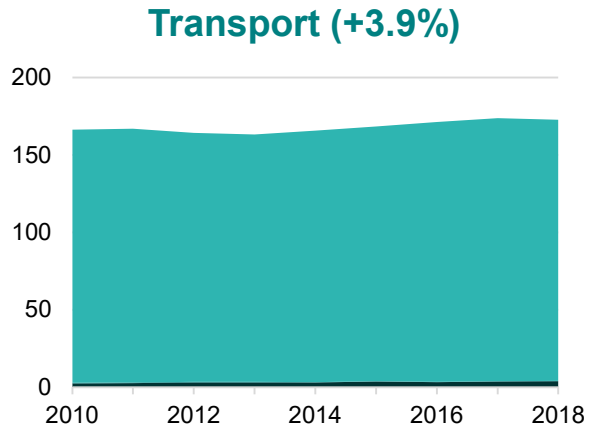
Key: **Capital carbon** **Operational carbon** **User carbon**

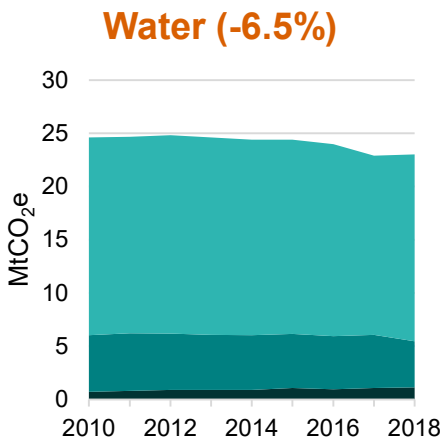
Breakdown by sector

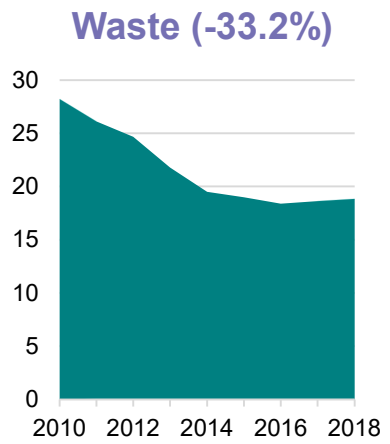
Reductions have been driven by Energy and Waste

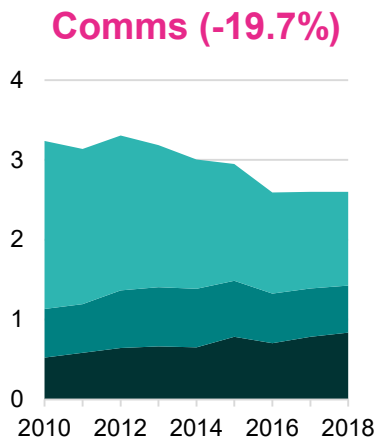








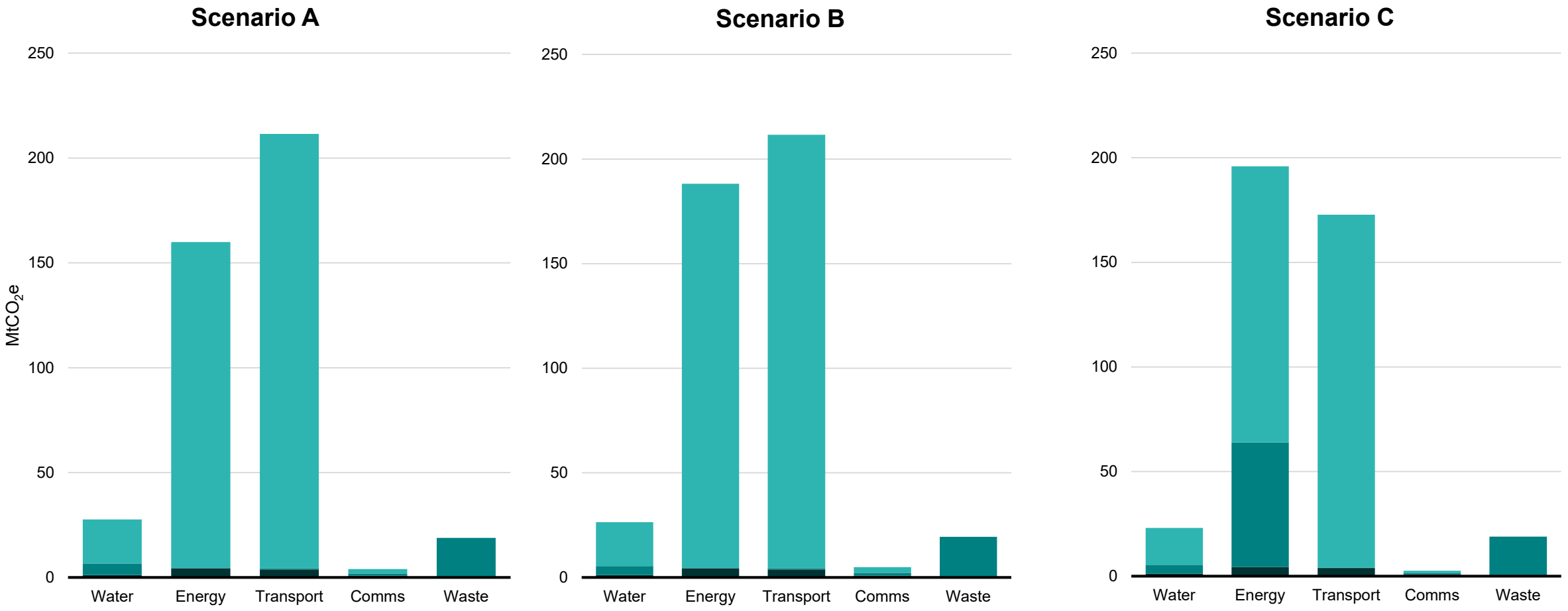




Key: **Capital carbon** **Operational carbon** **User carbon**

Breakdown by scenario - 2018

Losses in Energy sector are key contributor to trends

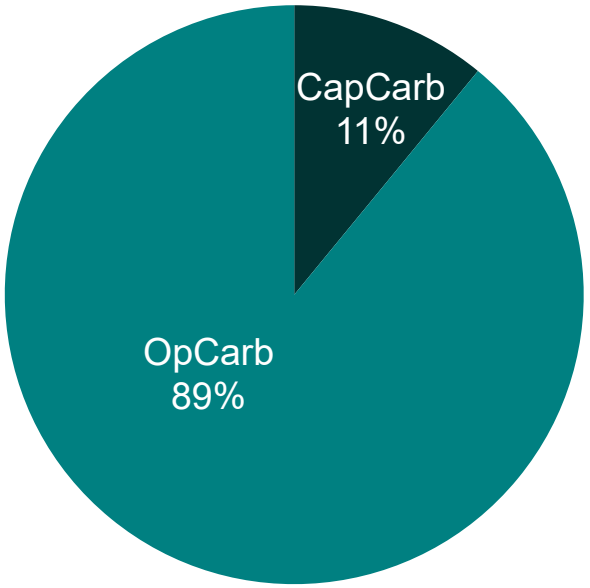


Key: **Capital carbon** **Operational carbon** **User carbon**

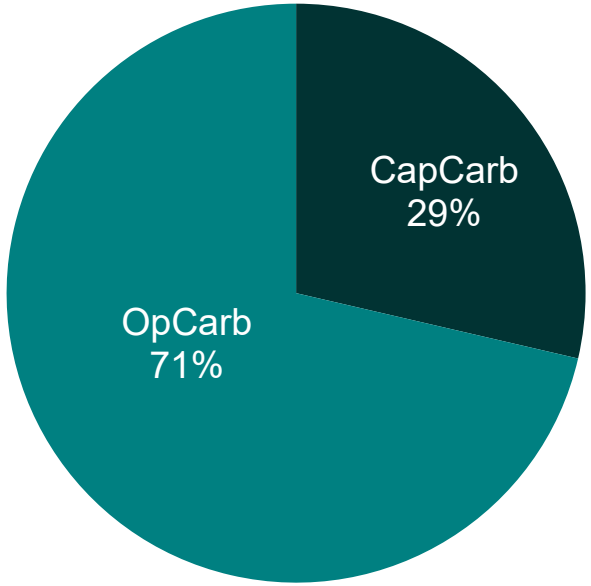
Growing significance of CapCarb

Now >11% of emissions under control *(28 | 29%)*

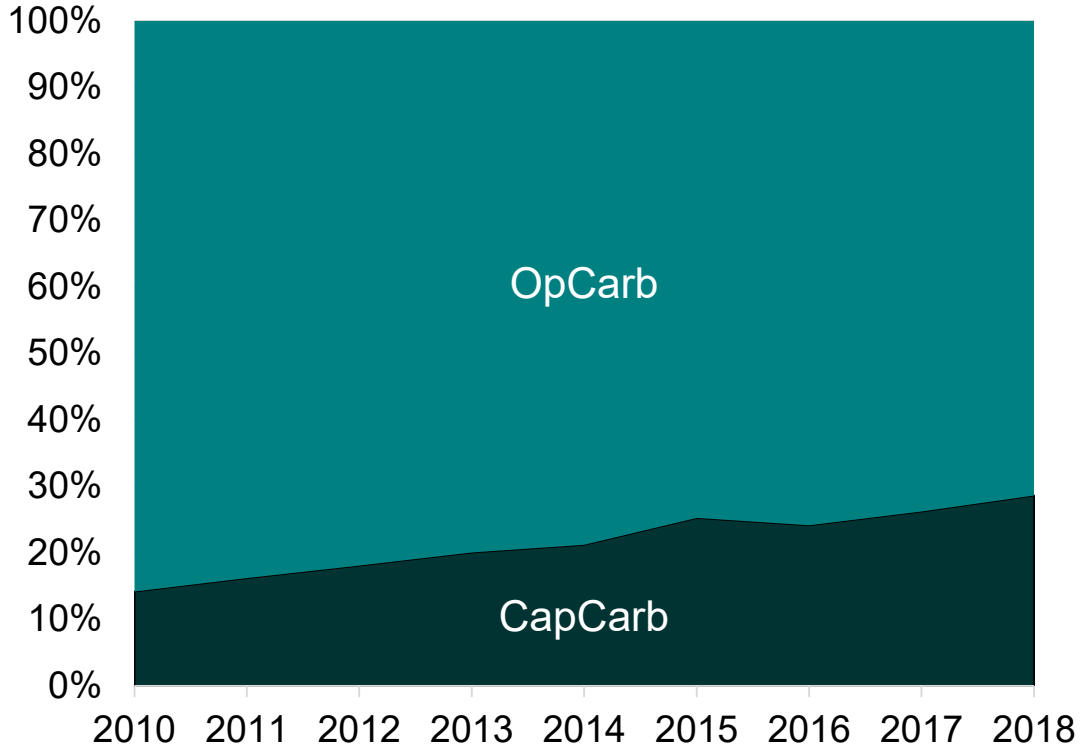
Scenario C - 2018



Scenario B - 2018



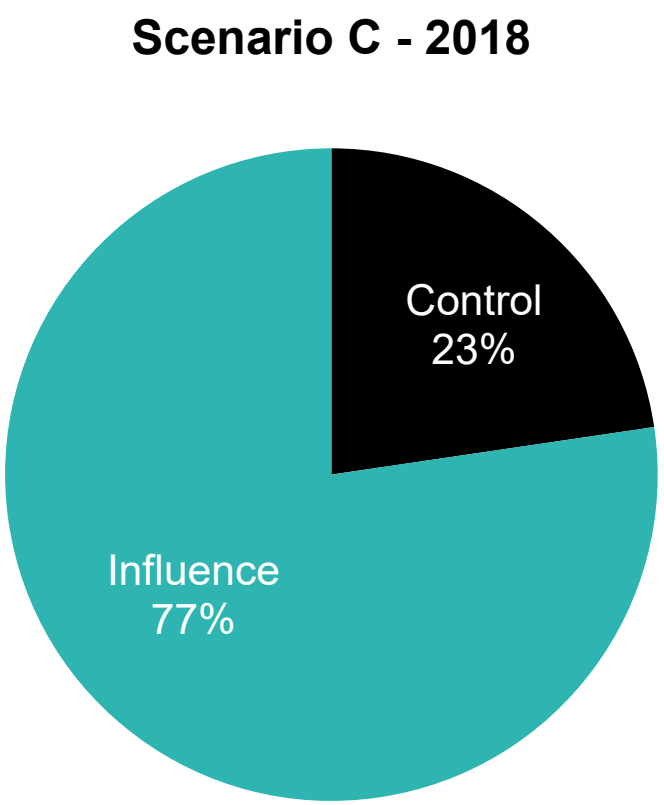
Emissions under control – Scenario B

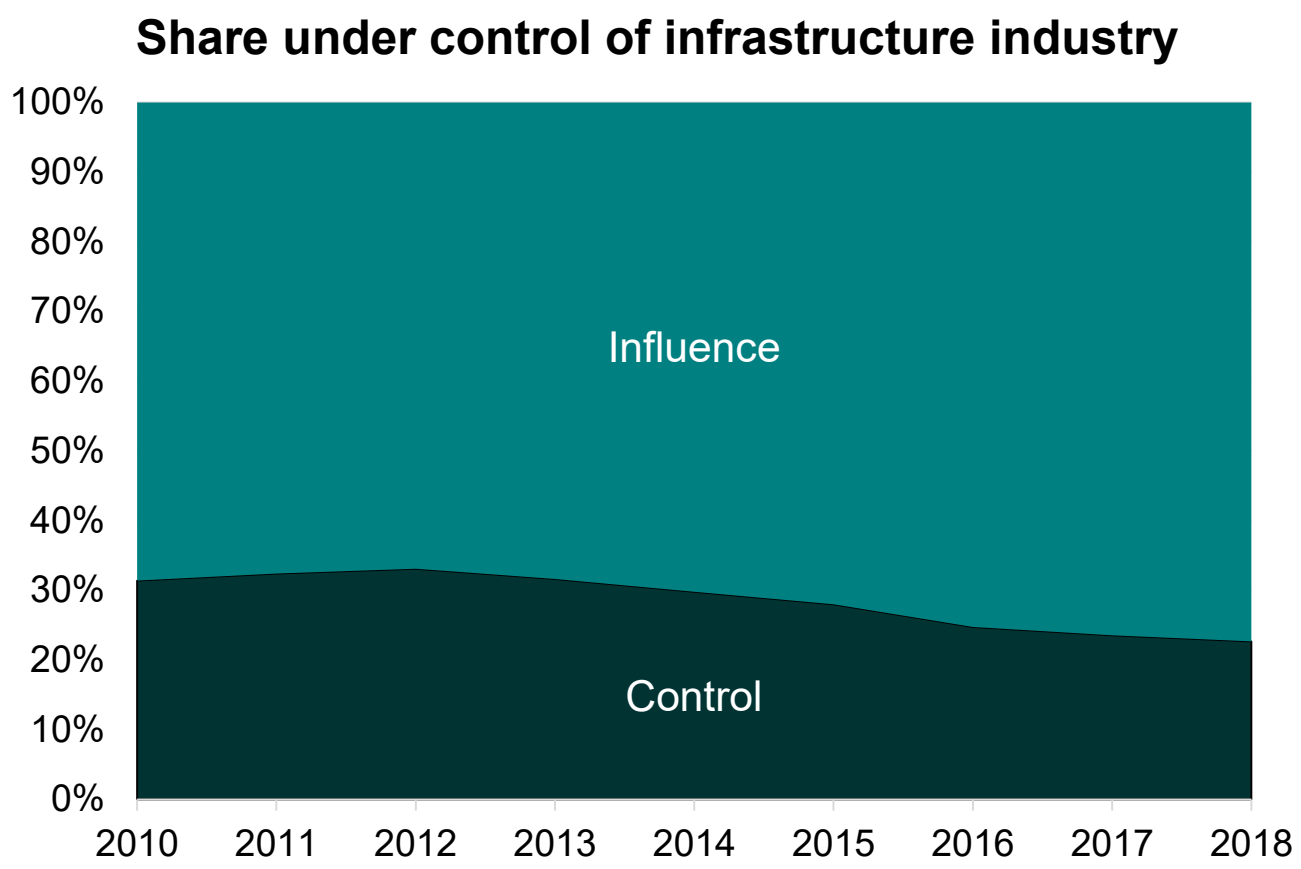


Key: **Capital carbon** **Operational carbon** **User carbon**

Decreasing share under industry control

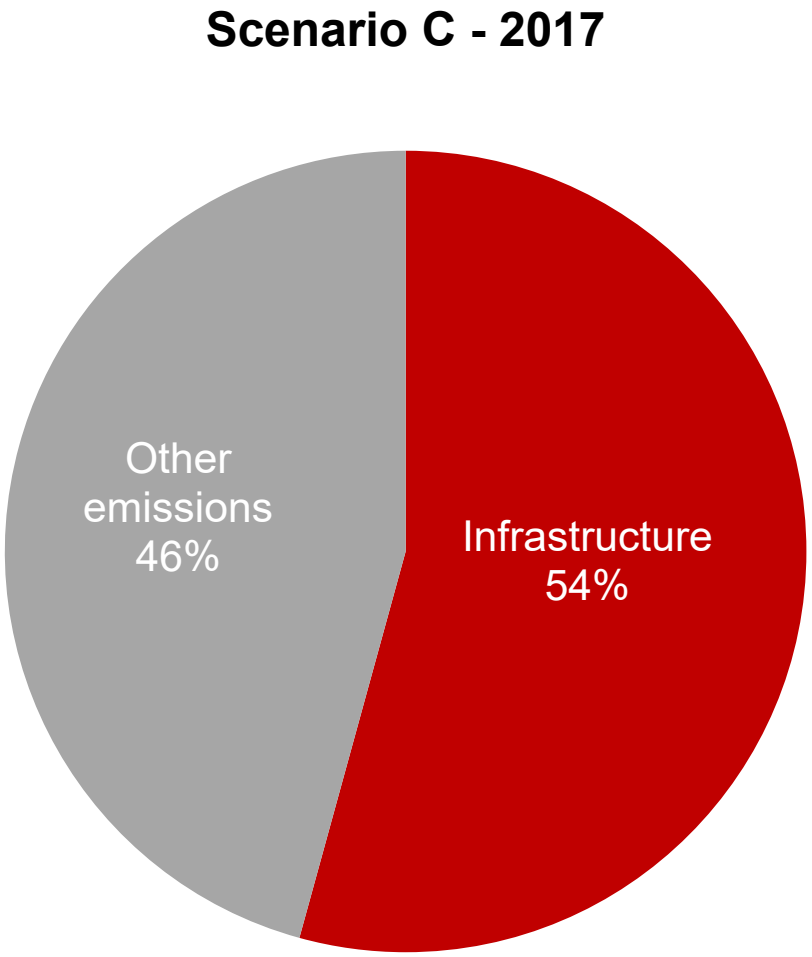
As OpCarb reduces, greater emphasis on CapCarb & UseCarb

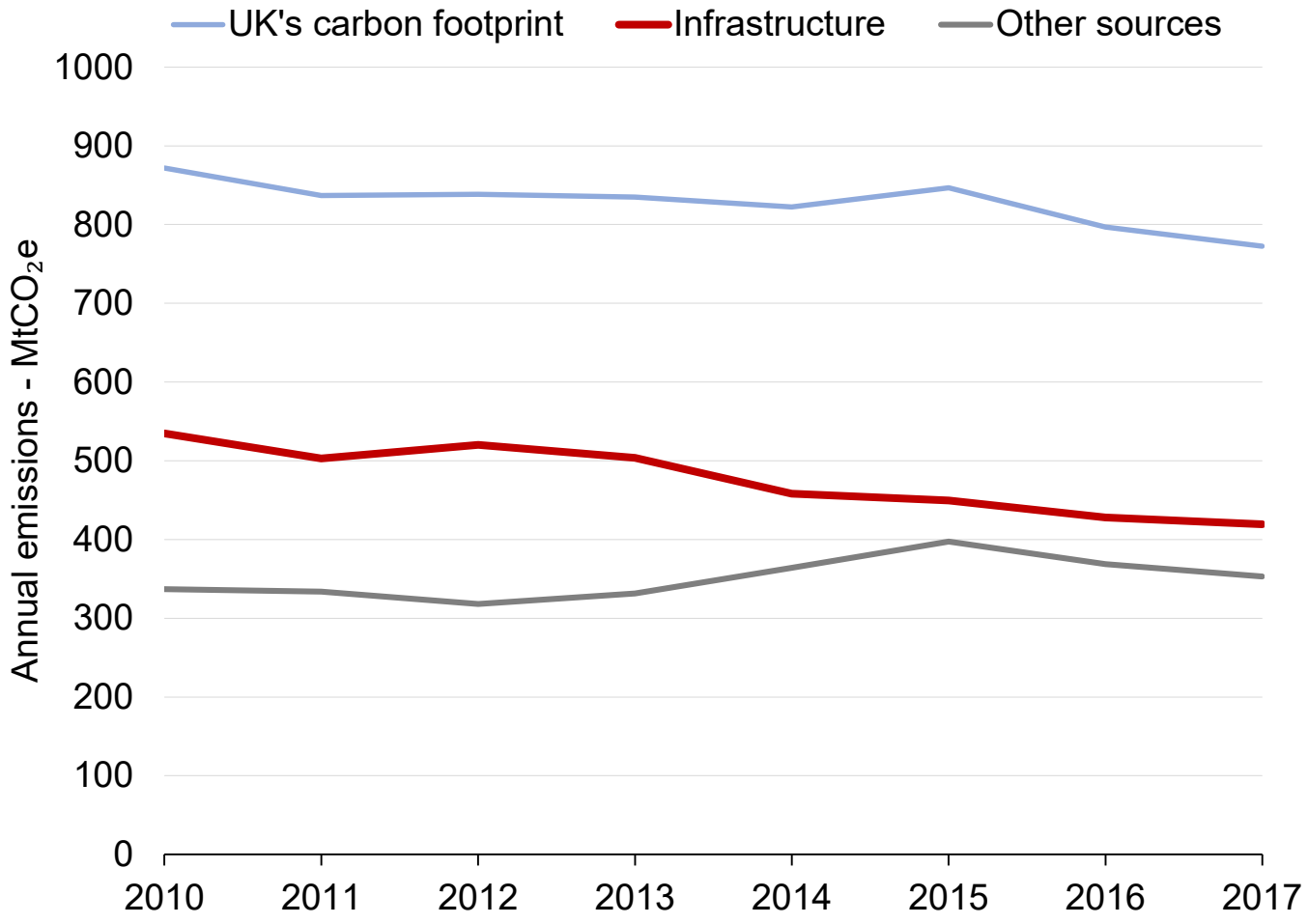




Comparison with UK's carbon footprint

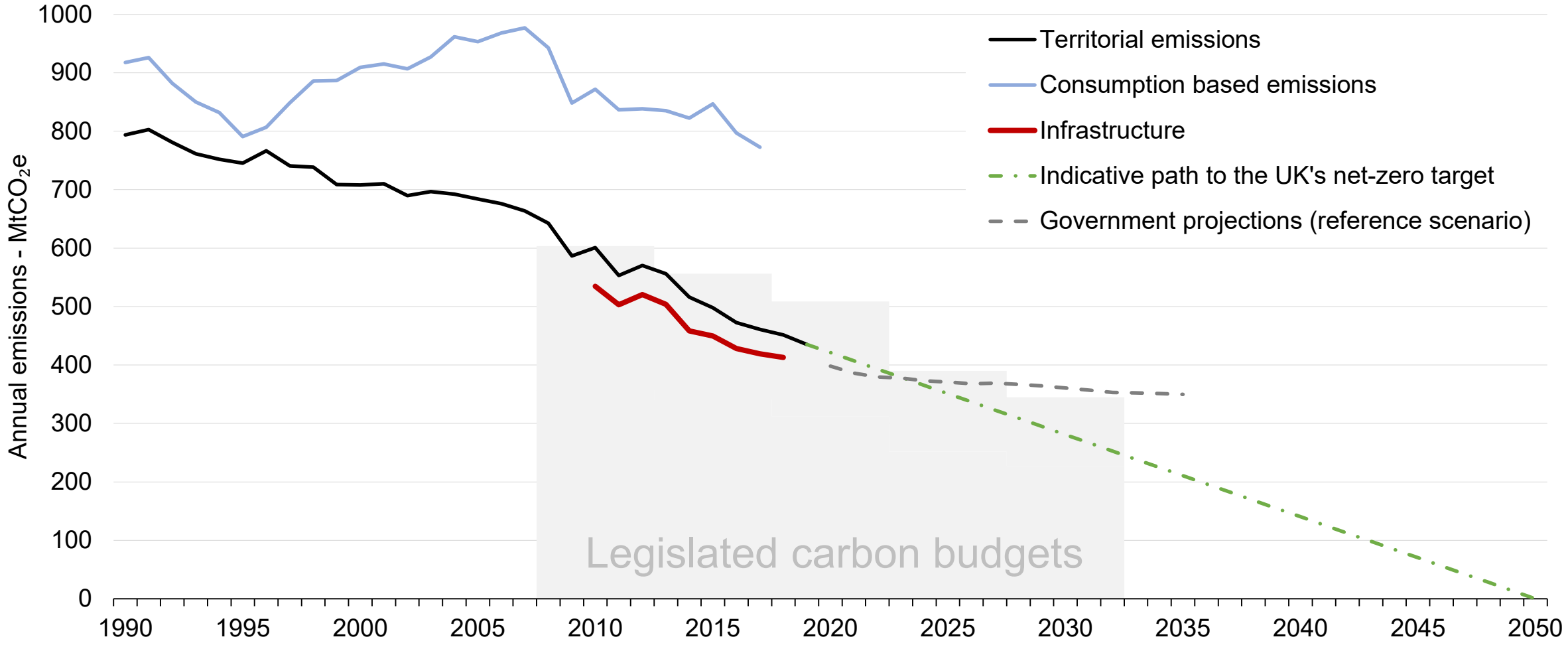
Infrastructure emissions reduced faster than other sources





Implications for next decade

Rate of reduction needs to accelerate from 2010-18 CAGR of -3%



Graph adapted from CCC 2020 Progress Report to Parliament exhibits

Future developments

Curation

ICE will continue with regular programme of updates, providing headline metrics for infrastructure on our journey to net zero

Updates will endeavour to incorporate methodological improvements and additional data sources where possible. Stakeholder engagement is already underway.

Areas for improvement

Greater CapCarb intensity data by asset type

Establish links with new common data gathering platforms

Refresh of data and methodology for construction freight

More comprehensive approach for telecommunications

More sophisticated approach for C&D waste

etc.

Get in touch

If you would like to collaborate or contribute data

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