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Aligning carbon targets for construction with (inter)national climate change mitigation commitments

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ABSTRACT

In the face of a changing climate, a growing number of construction firms are adopting carbon reduction targets on individual projects and across their portfolios. In the wake of the Paris Agreement, some firms are seeking a means of aligning their targets with sectoral, national and international mitigation commitments. There are numerous ways by which such an alignment can be achieved, each requiring different assumptions. Using data from the UK construction industry, this paper reviews current company commitments and progress in carbon mitigation; analyses the unique challenges in aligning construction targets, and presents a series of possible sectoral decarbonisation trajectories. The results highlight the disparity between current company targets and the range of possible trajectories. It is clear that a cross-industry dialogue is urgently required to establish an appropriate response that delivers both a widely-accepted target trajectory and a plan for its delivery. This paper is intended to stimulate and support this necessary debate by illustrating the impact of different methodological assumptions and highlighting the critical features of an appropriate response.

1. Introduction

The dangers posed by anthropogenic carbon emissions and a changing climate are well documented [1], yet in 2016 humanity emitted a further 36 $GtCO_2$ from fossil fuels and industrial processes [2]. In December 2015, 195 countries adopted the first legally binding global climate deal seeking to hold increases in 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" [3]. Current 'do nothing' scenarios project global temperature increases of 3.2–5.4 °C by 2100 [1] and even fulfilment of all signatories' Nationally Determined Contributions put forward as part of the Paris Agreement implies a median warming of 2.6–3.1 °C by 2100 [4]. Limiting temperature increases to below 2 °C will likely require global emissions to peak by 2020 followed by rapid reductions [5], necessitating a significant ratcheting up of global emission abatement efforts as part of a periodic stocktake and commitment cycle. In addition to its headline temperature target, the Paris Agreement sets the 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. This is in recognition of the fact that net carbon dioxide emissions will need to fall to zero in order to stabilise global temperature. It is expected that wealthier developed countries will achieve this net zero goal at an earlier date in line with the principle of common but differentiated responsibilities. The immense scale of the challenge involved in delivering these goals is frequently understated but is clearly illustrated by a range of recent roadmaps and scenario analyses. For instance, Rockstrom et al. set out one roadmap with a 75% probability of limiting warming to below 2 °C, if global greenhouse gas (GHG) emissions were halved every decade [6]. Such a radical transformation can only be achieved with the active participation of non-state actors, including corporate and privately owned companies. This will require companies to independently set long term reduction targets that are aligned with global mitigation goals [7,8].

The construction sector is the largest global consumer of resources [9] and is a major contributor to climate change through

Abbreviations: CCC, Committee on Climate Change; CCS, Carbon Capture and Storage; DBEIS, Department for Business, Energy and Industrial Strategy; EPD, Environmental Product Declaration; GCB, Green Construction Board; GHG, Greenhouse Gases; GIA, Gross Internal Area or Gross Internal Floor Area; IEA 2DS, International Energy Agency's 2 °C Scenario; IEA B2DS, International Energy Agency's Beyond 2 °C Scenario; IPCC, Intergovernmental Panel on Climate Change; NET, Negative Emissions Technologies; RICS, Royal Institution of Chartered Surveyors; SBT, Science Based Target; SDA, Sectoral Decarbonization Approach; WRAP, Waste and Resources Action Programme.

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the GHG emissions incurred both within its supply chains and from the operation of assets it creates [1]. Growing demand for buildings and infrastructure is driving significant increases in material extraction and emissions [10] and further unabated growth has the potential to undermine climate targets [11–13]. An additional challenge within this is enabling developing countries to grow, expanding infrastructure and buildings to support higher standards of living, whilst minimising the associated GHG emissions. Detailed analyses of the GHG emissions attributable to construction sector activities have been conducted for numerous countries, such as Sweden [14], Norway [15], China [16], Australia [17] and the UK [18]. A common trend across countries is an increasing share of project whole life carbon emissions coming from embodied rather than operational emissions [19].

There are a wide range of opportunities to reduce carbon emissions throughout a project's life cycle, including mitigation strategies to reduce embodied emissions in design and construction [20,21]; operation [22] and end of life management [23]. A growing body of guidance and standards has supported some exploitation of these opportunities [24]. Though many firms now undertake routine project carbon assessments, best practice in whole life carbon management is predominantly confined to a small number of multinational firms with significant organisational capacity and expertise. Even amongst these firms there is wide variation in common practices, including assessment and reporting procedures [25]. There are many barriers to the more widespread deployment of these mitigation options [26] and additional policy support is likely to be essential in the medium to long term [27,28]. Yet in spite of the observed barriers and limited drivers, numerous construction firms have publicly adopted carbon reduction targets. These targets vary widely in scope [29] and are typically determined by esoteric means, with many simply decided by individual CEOs, through comparison with competing firms, or copied verbatim from headline national mitigation commitments [30]. Few firms have targets that are truly aligned with sectoral, national or international mitigation commitments, though demand for such alignment has been growing of late. The means by which such an alignment can best be achieved is a subject of ongoing debate amongst industry and academic experts. This paper sets out some of the possible options, their implications and shortcomings, and illustrates the resultant pathways through a case study of the UK.

Section 2 provides context, describing the UK's national emission reduction targets and current construction industry practice. Section 3 discusses current approaches to target alignment and the unique challenges in aligning targets within the construction industry. Section 4 presents a set of illustrative sectoral trajectories and discusses their implications for industry practice. Section 5 concludes with a summary of the key considerations in setting an appropriate sectoral target.

2. Carbon targets and the UK construction sector

The UK construction sector faces the profound challenge of substantially reducing carbon emissions whilst meeting increasing demand for buildings and infrastructure [31]. Over the coming years the UK faces anticipated population growth (some 14 million additional people by 2050 [32]); that will require an additional 3.2 million households by 2037 [33]. This comes on top of an existing housing crisis with record property prices and a local authority housing waiting list exceeding 1.2 million at the time of writing [34]. Furthermore, 8 million 'non-decent' homes require urgent refurbishment [35] and broader targets require the retrofit of more than one home every minute until 2050 [36]. In the meantime an infrastructure pipeline worth around £600bn must be delivered [37], including additional investments in climate adaptation, such as flood defences, and a significant renewal and expansion of energy and communications infrastructure [31].

2.1. UK carbon reduction targets

Over the same period the UK Government is pursuing a legally binding target of reducing GHG emissions by 80% by 2050, set out in the 2008 Climate Change Act. Interim progress towards the 2050 target is aligned with a series of 5 year carbon budgets, currently set into law until 2032 (see Fig. 1). Existing policies are projected to be insufficient to meet the 4th and 5th Carbon Budgets and additional interventions are expected in the coming year [38].

The UK's 2050 target is broadly expected to be elevated in light of the Paris Agreement [39], with the then Minister of State for Energy intimating that a net zero emissions objective will enter into UK law: "the question is not whether, but how we do it".[1] Similar net zero emissions targets have already received parliamentary approval in other developed countries such as Sweden and Norway. In spite of this, the means by which a net zero emissions objective can be delivered and translated into specific targets has yet to be determined. The prospective date by which the UK should deliver net zero emissions is also heavily dependent upon interpretation of the Paris Agreement's Article 2.1a targets and the means of determining a fair allocation of the remaining global carbon budget. Current estimates, based on common interpretations, suggest that the target date for UK net zero carbon dioxide emissions should be within the range of 2045–2075 [39,40]. However, the means by which net zero domestic emissions could be delivered is unknown. The Committee on Climate Change (CCC), who provide independent monitoring and advice to Government, currently have no scenarios under which the UK can achieve net zero domestic emissions. Even "a full and successful roll-out of all options" identified by the CCC, results in GHG emissions in 2050 just over 90% lower than 1990 [39]. Achieving net zero will therefore require both deep mitigation and the widespread deployment of 'Negative Emissions Technologies' (NET), which extract and store carbon. The feasible level of NET that can be delivered in the UK is highly uncertain, with recent technical estimates of the order of 44–180 $MtCO_2e$ per year, which is around 8–32% of current total UK territorial GHG emissions [41]. The precise ceiling of this potential deployment is likely to determine the long term sustainable level that UK emissions must be reduced to through additional mitigation measures. For instance if, through deployment of NET, the UK could deliver 100 $MtCO_2$ per annum of additional carbon sinks, then it could continue to emit 100 $MtCO_2$ per annum from hard to mitigate sources, whilst still achieving the overall net zero objective. Though much is unknown at the present time, it appears likely that the UK will adopt a net zero emissions target in future and all interim strategies, roadmaps and decarbonisation trajectories should account for this.

2.2. The contribution of the construction industry

The potential contribution of the construction industry to low carbon development has been the subject of numerous reviews and strategy documents over the past 20 years [42–48]. Most recently the UK's principal construction strategy, Construction 2025 set a target of halving annual GHG emissions from the built environment by the middle of the next decade [49]. It is envisaged that this can be achieved alongside significant capital cost reductions, following the Infrastructure Carbon Review's conclusion that

[1] "The Government believe we will need to take the step of enshrining the Paris goal of net zero emissions in UK law—the question is not whether, but how we do it" - Andrea Leadsom, then Minister of State for Energy - Hansard HC Deb vol 607 col 725 (14 March 2016)