

January 2025

Executive Summary

# Markets & Mandates

Policy Scenarios for UK CCS  
Deployment & Exploring the Role  
of a Carbon Takeback Obligation



Carbon Balance Initiative



## Authors

**Mirte Boot**

Carbon Balance Initiative & Oxford Net Zero, University of Oxford

**Ingrid Sundvor**

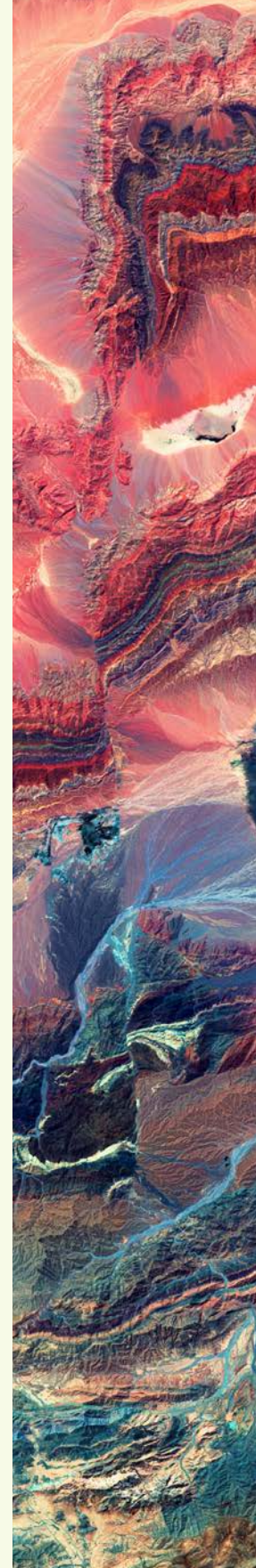
Carbon Balance Initiative & Oxford Net Zero, University of Oxford

**Stuart Jenkins**

Oxford Net Zero, Department of Physics & School of Geography and the Environment, University of Oxford

**Myles Allen**

Oxford Net Zero, Department of Physics & School of Geography and the Environment, University of Oxford



# Executive Summary

**The 'Markets & Mandates' project was initiated in response to calls from government and industry, including the Department of Energy Security and Net Zero (DESNZ)<sup>1</sup> and the CCUS Council<sup>2</sup> to explore long-term policy options for catalysing investments in carbon storage.**

In particular, this project responds to an interest in exploring carbon storage mandates such as a Carbon Takeback Obligation (CTBO)<sup>2</sup>. It considers current government policy for carbon storage deployment, as well as potential long-term policy options that include a carbon storage mandate. It does not seek to evaluate the effectiveness of CTBO in comparison to alternative additional policy tools.

Achieving the UK's net zero emissions target by 2050 is crucial for mitigating climate change and meeting our Paris Agreement commitments. As demonstrated by the IPCC and the UK Climate Change Committee scenarios, alongside rapidly reducing fossil fuel use, permanent geological carbon storage – using carbon capture and storage (CCS) and greenhouse gas removal (GGR) technologies – will be required for any remaining CO<sub>2</sub> emissions at the time of net zero<sup>3,4</sup>. The UK has declared ambitions to store at least 50 megatonnes of carbon dioxide annually by the mid-2030s, positioning itself as a global leader in carbon storage<sup>1</sup>. To achieve this, the Department for Energy Security and Net Zero (DESNZ) has committed £21.7 billion to CCS<sup>5</sup> and outlined a comprehensive vision for Carbon Capture, Usage, and Storage (CCUS)<sup>1</sup>. This vision is anchored in establishing a commercial and competitive UK CCS market, with a focus on reducing the degree of government support needed. Achieving the UK's carbon storage ambitions will require a well-designed policy mix that can operate in and adapt to a rapidly changing global environment.

This 'Markets & Mandates' report examines the benefits and risks of selected policy scenarios for stimulating CCS deployment in the UK, grounded in a scenario analysis and extensive stakeholder input. This includes evaluation of a scenario predominantly centred around the current government-led revenue support package for CCUS and the UK Emissions Trading Scheme (ETS),

inspired by the DESNZ CCUS Vision<sup>1</sup>. The report then introduces a scenario that includes a carbon storage mandate, specifically a Carbon Takeback Obligation (CTBO), in addition to the current policy suite. A CTBO would require obligated entities, such as fossil fuel producers and importers, to store (or pay third parties to store) a rising percentage of the CO<sub>2</sub> embedded in their fossil fuel products. Such a mandate could be designed to complement existing policy instruments to help drive investment in carbon storage and transition to a long-term mature and subsidy-free CCS market.

The report also explores different potential carbon mandate implementation options. It provides an extensive overview of CTBO policy design choices and potential interaction effects with other policies, including a discussion of potential impacts of a unilateral application.

This project does not represent CTBO as a 'magic bullet' solution and emphasises that a comprehensive policy approach is key to achieving decarbonisation. The research identifies potential benefits and risks of relying only on the current policy suite, and of implementing a CTBO alongside current policies. While not an exhaustive study, it provides an initial assessment based on a scenario analysis and stakeholder input, and highlights where additional research and analysis is required.

## Recommendations for Policymakers

Although further quantitative work is needed, the analysis suggests that the current ETS system alone is unlikely to drive sufficient carbon storage development in the UK in the medium to long term. Furthermore, it suggests that supplementing market-based mechanisms with a potential carbon storage mandate could enhance the UK's ability to meet its carbon storage ambitions and strengthen its global leadership in achieving net zero, provided this would be designed to avoid potential risks to developing a self-sustaining CCS market, such as declining UK competitiveness and carbon leakage.

This analysis should be supported by further stakeholder engagement and research, including an exploration of all potential consequences of implementation and additional policies that could be implemented alongside the current policy suite.

### As next steps, this report recommends that government should:

- 1. Define clear objectives and metrics:** Further develop the DESNZ CCUS Vision by establishing success criteria with clear metrics for any future CCS policy mixes to objectively track progress towards the Vision.
- 2. Identify gaps in the current policy mix:** Build on existing research to identify potential gaps in the ability of the current UK CCS policy suite to meet the identified objectives, and discern what supplementary policy instruments should aim to achieve in the short-, medium- and long-term.
- 3. Conduct a quantitative assessment:** Evaluate the potential climate, economic, and social implications of different policy mixes, including scenarios implementing a CTBO or other mandates, through a quantitative assessment. This assessment should make clear and credible assumptions on scenario timelines and policy design choices. It should stress-test policy mixes under various exogenous and endogenous conditions, as well as look at factors that include UK competitiveness, carbon leakage effects, and potential interaction effects between different policies.
- 4. Engage stakeholders:** Maintain continual dialogue with stakeholders to refine policy design and address outstanding questions and concerns.

## Report Outline

The report is divided into two parts. **Part 1** assesses two core CCS policy mix scenarios, while **Part 2** provides an in-depth analysis of the options for carbon storage mandate implementation and design.

### Part 1: Policy Scenarios

Based on stakeholder input, **Part 1** evaluates risks and benefits of different CCS policy scenarios. In line with the DESNZ CCUS Vision<sup>1</sup> and inspired by the CCSA Delivery Plan<sup>6</sup>, each scenario considers a policy suite that transitions across three phases from 'market creation' (2020-2030), to 'market transition' (2030-2035) to a 'self-sustaining market' (2035 onwards). The evaluation of each scenario was grounded in the DESNZ success criteria outlined in the Vision document, stakeholder input from workshops and interviews, and an original analysis of potential policy outcomes based on previous research.

### 1. 'Base Case' Scenario

The 'Base Case' scenario is defined as a transition from a government-led subsidy regime utilising multiple sectoral business models under the CCUS Cluster Sequencing Programme to a market-led regime under the UK Emissions Trading Scheme (ETS).

Scenario analysis and stakeholder input suggest that, while this should kickstart the CCS market and offer potential economic opportunities, relying solely on an ETS could carry significant risks to long-term deployment. The analysis indicates that a market-led ETS alone may not be sufficient to drive timely storage capacity development, risking a failure to achieve the UK's net zero targets, carbon price surges, or a continuing requirement of government subsidies for longer than intended.

## 2. 'Base Case+' Scenario

The 'Base Case+' scenario goes beyond the 'Base Case' scenario by introducing a carbon storage mandate, specifically a form of a CTBO, alongside the ETS. In this scenario, a carbon storage mandate would be implemented in parallel with government revenue support packages (such as contracts-for-difference) and the ETS, between 2030-2035.

This is envisioned to start with a small storage fraction to foster investor confidence, enabling government and industry to progressively adapt and iterate as the stored fraction rises.

The Base Case+ scenario also briefly considers the potential impact of implementing a low-carbon product standard (LCPS) or low-carbon fuel standard (LCFS).

Results of the research suggest that a CTBO and ETS could work in tandem to boost CCS investor confidence, ensure storage development aligns with net zero requirements, and accelerate the energy transition. The overall impact on the investor climate needs further investigation. Many stakeholders appreciated the potential stability and robustness of this mixed approach. Risks were also identified, with some stakeholders expressing concern about an over-reliance on abated fossil fuels and unintended consequences of a mismatch between supply and demand. Other stakeholders underscored the risk of adverse economic impacts on consumers and producers, citing competitiveness and carbon leakage concerns. These risks would need to be addressed through careful consideration of policy design choices and design and a consideration of the broader domestic and global climate policy landscape.

## Part 2: Implementation of Carbon Storage Mandates

**Part 2** explores the operationalisation of carbon storage mandates, particularly the CTBO. It introduces a novel typology for carbon storage mandates and outlines three core principles that underpin the CTBO in the scientific literature – a progressive transition to permanent storage, the principle of 'producer responsibility', and the need for a comprehensive climate policy suite to achieve net zero.

**Part 2** also discusses the five policy design decisions that would need to be made for a CTBO to be implemented: the stored fraction design, obligation placement, technology and location accreditation, governance mechanisms, and interactions with other climate policies, including with the ETS, government revenue support packages, and other climate regulations.

## Scope of the Research

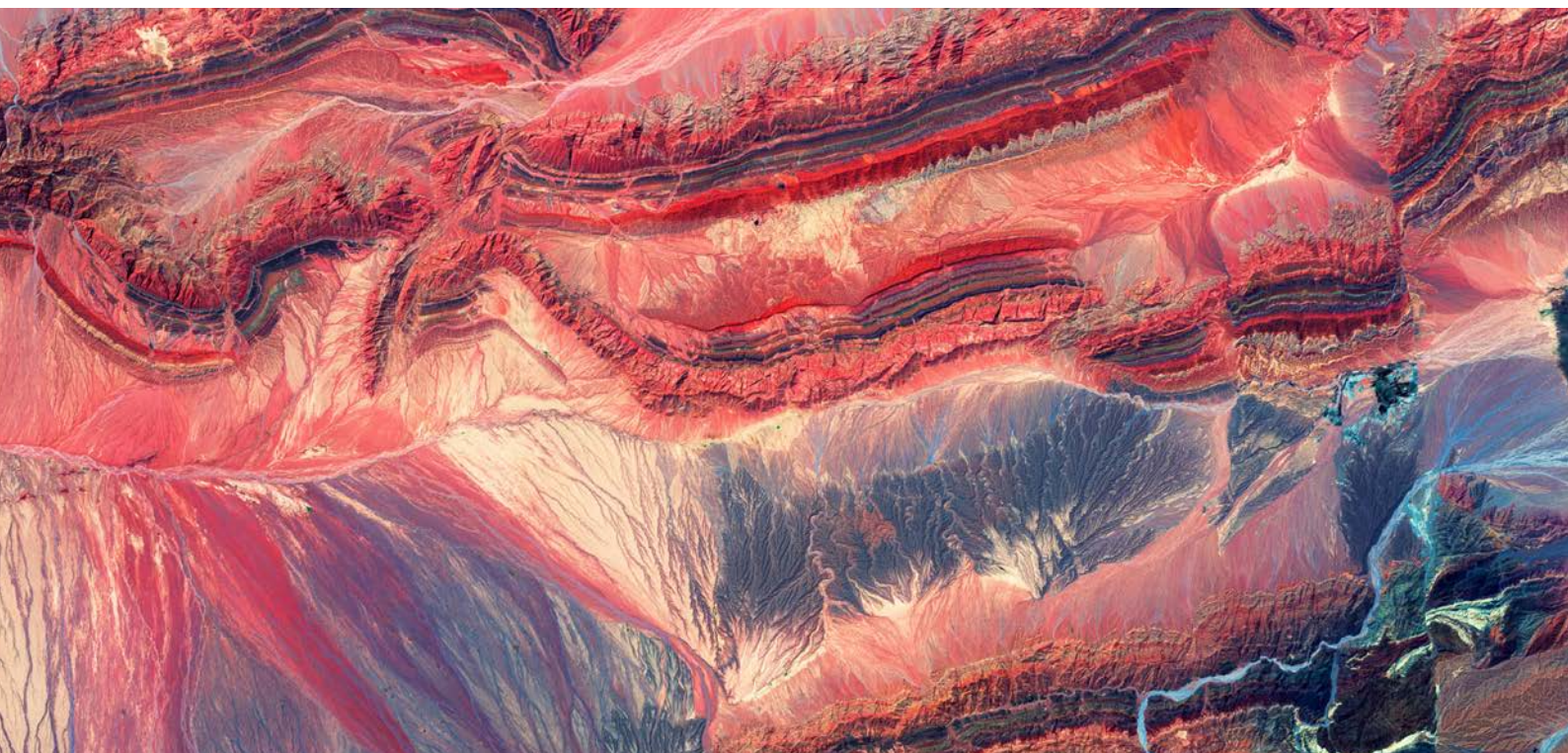
The report focuses on carbon storage mandates, particularly the CTBO, as one option in the CCS policy toolkit. It does not dismiss other market or mandate mechanisms that could be used to supplement the CCS policy mix, including reforms to the ETS. Limitations include a lack of detailed analysis on voluntary carbon markets, as well as on international dimensions, such as interactions with the global climate policy landscape, cross-border CO<sub>2</sub> transport, and export-import dynamics. The study does not fully examine the economic implications of unilateral implementation of a UK-specific policy framework, including potential effects on UK industry competitiveness (both domestically and on export markets) and the investment climate. The assessments are qualitative, recognising the need for further quantitative research. UK-specific policies must account for the role of industrial decarbonisation strategies in achieving net zero goals whilst considering impacts on competitiveness, carbon leakage risks, energy costs, and energy security.

1. DESNZ (2023) Carbon Capture, Usage and Storage: A Vision to Establish a Competitive Market. Department of Energy Security & Net Zero. 20 December 2023. <https://www.gov.uk/government/publications/carbon-capture-usage-and-storage-a-vision-to-establish-a-competitive-market>
2. DESNZ (2023). UK CCUS Council Meeting Minutes: 27th June 2023, Hybrid Meeting. Department of Energy Security & Net Zero. 27 June 2023. <https://assets.publishing.service.gov.uk/media/654282299e05fd0014be7b92/ccus-council-minutes-27-june-2023.pdf>
3. IPCC (2023). Energy Systems In: Climate Change 2022 - Mitigation of Climate Change: Working Group III Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. <https://www.cambridge.org/core/books/climate-change-2022-mitigation-of-climate-change/energy-systems/39CE50CC774A5E9446D7282CD71A718C>
4. CCC (2020). Sixth Carbon Budget. Committee on Climate Change. 9 December 2020. <https://www.theccc.org.uk/publication/sixth-carbon-budget/>
5. DESNZ, The Rt Hon Sir Keir Starmer KCB KC MP, The Rt Hon Rachel Reeves MP & The Rt Hon Ed Miliband MP (2024). Press Release: Government reignites industrial heartlands 10 days out from the International Investment Summit. UK Government. 4 October 2024. <https://www.gov.uk/government/news/government-reignites-industrial-heartlands-10-days-out-from-the-international-investment-summit>
6. CCSA (2023). CCUS Delivery Plan Update. Carbon Capture and Storage Association. September 2023. <https://www.ccsassociation.org/wp-content/uploads/2023/09/CCUS-Delivery-Plan-Update-2023-FINAL.pdf>

## Disclaimer

The views expressed in this report solely represent those of the authors and do not necessarily represent those of Oxford Net Zero, the University of Oxford, Carbon Balance Initiative, the Carbon Capture and Storage Association, or any other associated institution or individuals.

The authors operated independently, and retained editorial control of the final report and its recommendations. The report and executive summary were subject to multiple rounds of review by the CCSA and its members.



Visit us at  
[carbon-balance.earth](https://carbon-balance.earth)

© Carbon Balance Initiative and Oxford Net Zero,  
January 2025

All rights reserved by Carbon Balance Initiative and Oxford Net Zero. This copy is for personal, noncommercial use only. Users may download, print or copy extracts of content from this publication for their own and non-commercial use. No part of this work may be reproduced without quoting the Carbon Balance Initiative and Oxford Net Zero as the source used in this report. Photographic images are subject to separate copyright and are not covered.