CO2RE THE GREENHOUSE GAS REMOVAL HUB

# Greenhouse Gas Removals Regulatory Review:

## Mapping a Novel Legal Landscape by Stakeholder Interviewing

NET ZERO

WASTE LAW

FINANCE

Afforestation, peatland restoration, and marine

INCENTIVES


DEVOLUTION

LAND LAW

PLANNING

Direct air capture with carbon capture and storage

Bioenergy with carbon capture and storage

PERMITTING

GREENHOUSE GAS REMOVAL

Biochar, enhanced rock weathering

By Marsaili Van Looy and Navraj Singh Ghaleigh

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Errors and omissions are the responsibility of the authors alone.


# **Greenhouse Gas Removals Regulatory Review:** Mapping a Novel Legal Landscape by Stakeholder Interviewing

## Executive Summary

A clear, established and harmonious legal framework is crucial for the operation and scaling of any emerging industry, and this is no different for greenhouse gas removals (GGRs). The framework for GGRs is not a bespoke area of law tailored to GGR activities, but rather a complex landscape of pre-existing bodies of law applicable to particular GGRs or parts of GGR value chains. Based on 31 semi-structured interviews with stakeholders in governments, industry, and the research community, this report serves as the first comprehensive review of these diverse bodies of law in the UK.

GGRs are an essential part of the UK's acceleration to net zero, and the UK Government's Clean Energy Superpower Mission. The Climate Change Committee projects that 21.3Mt of engineered removals could be needed by 2040, rising to 35.8Mt by 2050. The National Infrastructure Commission characterises GGRs as a "major new infrastructure sector for the UK worth billions per year by 2050." Accordingly, the need for GGRs is unequivocal, the scaling challenge enormous, and the timing urgent.

GGR techniques are diverse, as are the bodies of applicable law across the UK's four jurisdictions. Underpinning this diversity of legal minutiae, interview findings revealed common themes of legal challenges applicable across GGRs. Each of the main GGR techniques being developed in the UK (direct air capture with carbon capture and storage (DACCS); bioenergy with carbon capture and storage (BECCS); biochar, enhanced rock weathering (ERW), afforestation, peatland restoration, and marine GGRs) are addressed. The purpose of the report is to:

- map the existing regulation of GGRs;
- identify regulatory challenges or barriers for GGR project operators;
- highlight gaps in regulation for all GGR techniques; and
- explore the impacts of these challenges and barriers, and potential solutions.

This table compiles a highly summarised representation of the key legal barriers and challenges experienced by UK GGR stakeholders, summarised below.

| | Planning | Permitting | Land | Waste | Regulatory paradox | Regulatory engagement, expertise, capacity | Finance and legal incentives | Devolution | Other technique-specific challenges |
|---|---|---|---|---|---|---|---|---|---|
| DACCS | | | | | | | | | |
| BECCS | | | | | | | | | |
| biochar | | | | | | | | | |
| ERW | | | | | | | | | |
| Afforestation | | | | | | | | | |
| Peatland | | | | | | | | | |
| Marine | | | | | | | | | |

| | |
|---|---|
| | Consistent challenges affecting stakeholders, preventing scaling |
| | Frequent challenges affecting stakeholders, limiting scaling |
| | Intermittent challenges affecting stakeholders, sometimes limiting scaling |
| | Rare or infrequent challenges affecting stakeholders, rarely limiting scaling |
| | Regulatory gap where the law fails to address or regulate the activity in that legal area |

## Applicable Law

There are four principal areas of law which affect multiple GGR techniques: (a) planning, (b) permitting, (c) land, and (d) waste. (Chapters 7–9)

(a) Planning is the first step for GGR projects involving new facilities, or land-use change. Planning law poses major challenges for GGR projects, especially novel or large-scale developments. Stakeholders reported the challenge of procedural delays and outdated and disproportionate frameworks. Litigation is also a crucial feature of planning law, although is rarely mentioned in the context of GGRs. Recent case law has the potential to shape future GGR project standards regarding life cycle impacts and mitigation.

(b) Permitting applies to almost all GGR projects, for example governing air, water and waste. Permitting delays and rigid procedures can hinder GGR pilot projects, especially where time-limited or intermittent operations are involved. Regulatory uncertainty, lack of evidence, and limited flexibility create burdens for both industry and regulators, slowing these processes.

(c) Land law operates at the intersection of private law rights with public law actions. Access to private land and restrictive agricultural tenancies are often in tension with GGR scaling, a consequence of differing laws and historic rights throughout the UK such as existing lease agreements and other conflicting land rights. This requires a careful balance between climate goals and property protections, including human rights law.

(d) Waste law affects multiple GGR techniques, particularly biochar, BECCS, and ERW. Waste law poses complex regulatory challenges, especially around defining waste and

the cumbersome legal restrictions which apply to GGR projects using waste materials. Further limitations exist when attempting to avoid waste law, such as achieving 'end-of-waste' status. Rooted in assimilated EU law, reform to waste law is complex due to lack of clarity and fragmented responsibilities. These critical hurdles can impact both project operations and costs, and clearer legal pathways are required, for example alterations to the classification of certain biochars as waste.

**Applicable Law – Key Findings:**

| | |
|---|---|
| Chapter 7 | **Planning**<br>Planning reform and greater support from decision-makers are needed for swifter and less onerous planning processes. For an industry which is so nascent and in large part composed of small operators, such burdens are not easily overcome. This is a shifting landscape as UK nations currently approach planning reform such as the *Planning and Infrastructure Bill* (2025). It remains to be seen whether and when these reforms will reduce the challenges faced by GGR operators. |
| Chapter 7 | **Permitting**<br>The complexity of permitting systems requires attention. Whilst UK nations are seeking to address this, for example in Scotland's consolidated permitting processes or through ongoing consultation in England, targeted progress is needed to avoid stymieing the emerging GGR ecosystem. Specific attention is needed for wholesale gaps in permitting regimes for ERW and DACCS. |
| Chapter 8 | **Land**<br>Agricultural tenancies in England and Wales can create direct legal barriers to pursuing land-based GGR activities and associated funding mechanisms. Land law is not easily compared across the UK; however, Scotland is exploring the idea of environmental leases, an approach which could be considered elsewhere. |
| Chapter 9 | **Waste**<br>Waste law needs to develop beyond its legacy structures. For example, developing a comprehensive biochar framework unifying rules for biochar operations across the UK would specify requirements for non-waste biochar standard utilisation and ensure unified access of biochar across the UK. There is a clear risk of waste law inadequacies damaging the prospects of biochar and other GGR technologies, making the UK's sector uncompetitive. |

## Thematic Findings

***Regulatory Paradox (Chapter 3)***

The central challenge faced by both regulators and industry is the difficulty of pursuing regulatory development in the absence of an established evidence base of the GGR activity in question. This stems primarily from regulators' legal mandates, for example mandates

of environmental protection and due regard to the precautionary principle. The challenge arises when evidence cannot be established by industry without greater regulatory clarity and support, which in turn fails to overcome regulators' duty to consider the precautionary principle. This reliance has been documented explicitly in recent government-commissioned reports and policy documents, where the precautionary principle has been noted as being applied in a particularly risk-averse fashion. The precautionary principle exists to balance risk and innovation; however, its current application tips the scales towards 'just say no', erecting a formidable barrier to innovative technology scaling. This is one of many challenges facing regulators, generating a 'regulatory paradox' which affects most GGR projects, particularly those which are more nascent or involve novel technologies.

***Regulatory engagement, expertise and capacity (Chapter 4)***

Regulators are crucial for every stage of a GGR value chain. Consequently, their ability to engage with GGR technology understanding and development, establish and retain expertise, and have the capacity to regulate GGRs, are all imperative. Engagement with industry and inter-regulator engagement vary across regulators. Challenges arise where there is unclear regulatory ownership. In particular, devolved nation regulators are less likely to have dedicated resource for GGR engagement. The novelty of many GGRs creates a collective desire amongst regulators to understand these technologies. However, regulators do not necessarily have the resources to pursue structured knowledge-sharing platforms, or retain in-house expertise. Strong ties with academia and industry are therefore vital to bridge knowledge gaps. Resource constraints apply similarly to regulator capacity, particularly for devolved or smaller regulators which do not have the same access to regulatory expertise that large regulators can utilise. These constraints can lead to risk-averse decision-making. Even for large regulators or government departments, swift decision-making in the face of an innovative sector is often contrary to institutional structures and frameworks. Addressing capacity gaps will ensure more agile and coherent GGR regulation throughout the UK. However, there is little appetite for a new GGR regulator.

***Finance and incentives (Chapter 5)***

A wide variety of finance options and incentives are relevant to GGR scaling, although not all of these are founded in law. The report acknowledges the crucial role contracts for difference (CfDs) and UK Emissions Trading Scheme (ETS) integration will play in supporting engineered GGR scaling, particularly BECCS and DACCS. UK ETS integration for GGRs presents opportunities – however, long-standing considerations such as 'carbon leakage' and ETS revenue recycling remain, as well as more GGR technology-specific considerations, for example product differentiation in biochar, which raises concerns over quality control and pricing impacts. Integral to both the development of standards and methodologies associated with the CfDs and UK ETS, and the pricing mechanisms in early GGR CfDs, is the role of the voluntary carbon market (VCM). Although not regulated and therefore not a primary focus in this report, the VCM is recognised by the UK Government as a crucial aid to early GGR commercialisation, and interlinkages with policy (for example high integrity credits) and future law (CfDs and UK ETS) make the VCM pivotal for regulatory development.

UK agricultural funding is highly relevant to multiple GGRs. This funding varies by nation, with schemes like Environmental Land Management Schemes (ELMS) promoting environmental outcomes. While subsidies potentially offer simplicity over carbon markets, recent closures and uncertainties in various schemes hinder GGR uptake.

The report reflects on GGR technique-specific financial incentive mechanisms suggested by interviewees and their potential. Biochar stakeholders propose capital subsidies, soil-based payments and permit-linked demand to combat high feedstock costs and limited carbon market returns. ERW similarly faces funding gaps across its life cycle; scientific evidence to help unlock government support, and incentives for basalt offtake, are both crucial. Similar scientific evidence challenges exist for marine GGRs, which in turn leads to a lack of structured funding. More established GGR techniques such as peatland restoration rely on public funding, with limited private finance. Afforestation presents the most stable financial system; however, there are calls for results-based subsidies reflecting other ecosystem benefits. Converse to the stable finance available to afforestation, biomass (for BECCS) lacks full value chain support, and requires structured subsidies and tangible farmer incentives to improve uptake and viability.

***Devolution (Chapter 6)***
Select challenges are particular to each UK jurisdiction. Just transition obligations are present in the legal systems of the devolved nations. Scotland in particular legislates just transition principles, which influence GGR policy. This obligation to consider social equity in climate action does not necessarily create a legal barrier, but forms an extra layer of data to consider when making policy decisions.

From a practical perspective, dispersed industry faces vulnerability due to regulatory uncertainty around non-pipeline transport (NPT), which is a challenge for plants and facilities that are not located in industrial clusters. Dispersed industry is more prevalent in certain areas of the UK, and Northern Ireland, for example, lacks suitable offshore geological storage for $CO_2$, creating a need for NPT. Northern Ireland also faces challenges regarding delayed climate legislation and political instability, which indicates similar delay is likely for future GGR regulatory development.

## Key Thematic Findings:

| | Regulatory Paradox |
|---|---|
| **Chapter 3** | Resolution of the Regulatory Paradox is pivotal for successful regulation of GGRs. Following the Corry Review, this report recommends a rebalancing of the precautionary principle to assist the resolution of this paradox. Within this, the use of tools such as regulatory sandboxes can reduce regulatory burdens for pilot projects, stimulating innovation. Other solutions include active knowledge-sharing from projects to assist with evidence accumulation; adjustments to procedures, such as permitting, which fall within regulator remit; and potential creation of a steering or oversight group to facilitate processes between regulators and industry. |

| | |
|---|---|
| Chapter 4 | **Regulator engagement, expertise, capacity**<br>Noting that there is little appetite for a new GGR regulator, novel regulatory approaches are needed to address GGR engagement, expertise, and capacity gaps, such as structured inter-regulatory collaboration and knowledge-sharing, prioritisation of integrated and retained GGR legal expertise, and engagement with stakeholders in industry, research, and independent bodies. |
| Chapter 5 | **Finance and incentives**<br>GGR integration into the UK ETS requires selected techniques to be regulated robustly in advance, and steps should be taken to avoid 'carbon leakage' or de-industrialisation for future GGR techniques which are, so far, underdeveloped.<br>Overarchingly, agri-environmental schemes need to be more reliable, long-term, and accessible in order to benefit land-based GGR techniques. |
| Chapter 6 | **Devolution**<br>An attentiveness to devolution and the needs of each UK nation is essential for the full and coordinated scaling of the GGR sector throughout the UK. The varying planning, financing, and broader governance commitments (such as just transition) between the UK's nations means simple regulatory read-across is not available. |

## GGR Technique-specific Legal Challenges (Chapters 10-16)

Many of the legal challenges and barriers identified in this review span multiple or all GGRs. Besides these areas of commonality, there is notable heterogeneity in the legal issues which affect each GGR method and its respective stakeholders, deriving from the heterogeneity of the GGR technology pathways. The heterogeneous findings contained in the report are not easily synthesised due to their volume and lack of comparability. Applicable areas of law include, for example, construction law for biochar and DACCS, international law for marine GGRs, biomass regulation for BECCS, water regulation for peatland restoration, and biosecurity for afforestation. Certain aspects of black letter law analysed are interwoven with scientific, social, financial, or policy factors which influence how the law impacts projects. Ultimately, every GGR technique presents areas of law or specific legal instruments which are not conducive to sustainable scaling. Therefore, it is clear that work is required by all GGR stakeholders in order to address these barriers constructively and efficiently.

Overall, it is evident that a comprehensive review of GGR regulation is an extreme challenge due to factors such as scope and heterogeneity. The legal mapping and stakeholder engagement undertaken for this review highlight multiple areas of law which negatively impact GGR scaling potential and existing GGR activities. Further research is required as the law develops and consistent engagement with industry, regulators and decision-makers is fundamental to nurturing a supportive and sustainable legal environment for GGR scaling.

**GGR Technique-specific Key Findings:**

| | |
|---|---|
| Chapter 10 | **DACCS**<br>• Certain pre-existing legislation referring to fossil $CO_2$, e.g. CCS regulation, may need to be updated to include atmospheric $CO_2$<br>• Obligations regarding embodied carbon in construction could stimulate $CO_2$ usage in construction |
| Chapter 11 | **BECCS**<br>• Establishment of clear support network for mid-scale and small-scale biomass energy generators transitioning to BECCS<br>• 100% biomass feedstock sustainability threshold requires stringent monitoring and auditing<br>• Ambiguities around regulation and permitting of alternative BECCS pathways require resolution |
| Chapter 12 | **Biochar**<br>• Industry requires a more relaxed legal framework, creating balanced obligations to ensure biochar stability and quality<br>• Suggested creation of common biochar framework |
| Chapter 13 | **ERW**<br>• Evidence gaps need to be addressed to unlock regulatory development<br>• No legislation in the UK addresses ERW activity on agricultural land, creating a regulatory gap and lack of oversight |
| Chapter 14 | **Afforestation**<br>• Regulation and forestry standards should further prioritise resilience and tree species distribution<br>• Synergy is required between policy and law for peatland restoration and woodland restocking<br>• Increased biosecurity and plant health measures are required at local plant nurseries, e.g. mandatory quarantines |
| Chapter 15 | **Peatland Restoration**<br>• The majority of UK peatland is not protected and requires regulatory controls<br>• Some areas of the UK require stricter muirburn legal controls<br>• Further research and potential reform are required to address incompatibilities in water regulation and lowland peatland restoration<br>• A stronger legal presumption against developing renewable energy developments on undegraded peatland is required |
| Chapter 16 | **Marine GGRs**<br>• Evidence gaps need to be addressed to unlock regulatory development<br>• Shore-based structures can avoid international law restrictions, but in future may require bespoke permitting at commercial scale<br>• Suggested inclusion of saltmarsh and seagrass into the UK Greenhouse Gas Inventory |

## List of Abbreviations

| | |
|---|---|
| **BECCS** | Bioenergy with carbon capture and storage |
| **CAP** | Common Agricultural Policy |
| **CCC** | Climate Change Committee |
| **CCS** | Carbon capture and storage |
| **CfD** | Contract for Difference |
| **CS** | Countryside Stewardship |
| **DACCS** | Direct air capture with carbon capture and storage |
| **DAERA** | Department of Agriculture, Environment and Rural Affairs |
| **DCO** | Development Consent Order |
| **Defra** | Department for Environment, Food, and Rural Affairs |
| **DESNZ** | Department for Energy Security and Net Zero |
| **EA** | Environment Agency |
| **EfW** | Energy from waste |
| **EIA** | Environmental impact assessment |
| **ELMS** | Environmental Land Management Scheme |
| **ERW** | Enhanced rock weathering |
| **EU ETS** | European Union Emissions Trading System |
| **GGR** | Greenhouse gas removal |
| **LC/LP** | London Convention / London Protocol |
| **LRWP** | Low Risk Waste Position |
| **LULUCF** | Land use, land-use change and forestry |
| **MRV** | Monitoring, reporting and verification |
| **NFU** | National Farmers Union |
| **NIEA** | Northern Irish Environment Agency |
| **NPT** | Non-pipeline transport |
| **NRW** | Natural Resources Wales |
| **NSIP** | Nationally Significant Infrastructure Project |
| **RTFO** | Renewable Transport Fuel Obligation |
| **SAF** | Sustainable aviation fuel |
| **SBCF** | Scottish Blue Carbon Forum |
| **SEPA** | Scottish Environment Protection Agency |
| **SFI** | Sustainable Farming Incentive |
| **UK ETS** | UK Emissions Trading Scheme |
| **UKFS** | UK Forestry Standard |
| **VCM** | Voluntary Carbon Market |

# Contents

# SECTION I
# Introduction and Background

## Chapter 1 – Introduction

### 1.1 Introduction to this report – the importance of regulating GGRs

Many aspects of Greenhouse Gas Removals (GGRs) are well-known to those involved in the field. Emerging GGR techniques are explored at scale,[1] and it is widely acknowledged that in addition to emission reductions, GGRs are also crucial in order to achieve net zero targets.[2] Each jurisdiction in the UK[3] has indicated through policy, legislative targets and governmental frameworks that it is imperative to pursue and scale GGR activities for the purposes of meeting the greenhouse gas emission reduction targets of each respective nation and the UK as a whole.[4]

Stepping back from known quantities, what remains less understood and established is the regulatory landscape within which GGRs operate, including how each technique is regulated, which techniques have favourable operating conditions within the law, and where the regulatory gaps lie. Across all major GGR techniques, regulatory uncertainty is cited as a fundamental barrier to cost reduction and scaling.[5] It is crucial for any industry, especially

1 Stephen Smith and others (eds), 'The State of Carbon Dioxide Removal 2024' 2nd Ed (2024); Navraj Singh Ghaleigh and Justin Macinante, 'Déjà vu All Over Again: Carbon Dioxide Removals (CDR) and Legal Liability' [2023] Journal of Environmental Law 377, 377-380

2 For example, see V Masson-Delmotte and others (eds), 'Summary for Policymakers' in 'IPCC, Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change' (Cambridge University Press 2021); and Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (26 February 2025) <https://www.theccc.org.uk/publication/the-seventh-carbon-budget/> accessed 5 June 2025

3 The UK is comprised of four legal jurisdictions: England, Wales, Scotland and Northern Ireland (see Chapter 2.2 for details)

4 For an overview of the acknowledgement of removals and ambitions of each jurisdiction, see the latest carbon budgets for: England (UK Government, HM Treasury, 'Carbon Budget Delivery Plan' (March 2023) HC 1269 and CCC's recommendations for the next budget Climate Change Committee (n2)); Wales (Welsh Government, 'Net Zero Wales Carbon Budget 2 (2021-25)' (2021) and recommendations for next carbon budget from CCC – Climate Change Committee, 'Wales' Fourth Carbon Budget' (May 2025)); Scotland (Scottish Government, 'Update to the Climate Change Plan (2018-2032)' (December 2020), which is to be updated to align with the new five-yearly carbon budgets following the introduction of the Climate Change (Emissions Reduction Targets) (Scotland) Act 2024. See also the CCC's recommendations for the next budget – Climate Change Committee, 'Scotland's Carbon Budgets' (May 2025)); and Northern Ireland (similar to Scotland, the introduction of the Climate Change Act (Northern Ireland) 2022 triggers the obligation for Climate Action Plans, the first of which is under consultation as of the date of this report: Department of Agriculture, Environment and Rural Affairs, 'Draft Northern Ireland Climate Action Plan 2023-2027' <www.daera-ni.gov.uk/sites/default/files/2025-07/Draft%20Climate%20Action%20Plan%202023-2027.pdf> accessed 5 June 2025)

5 Josh Burke, Leo Mercer, Sue Rodway-Dyer 'Towards improved cost estimates for monitoring, reporting and verification of Carbon Dioxide Removal'(LSE, Grantham Research Institute on Climate Change and the Environment October 2024) 27

those which are nascent or emerging, to have access to the law and an understanding of how their proposed activities are regulated. Without a clear and established legal framework, it is highly unlikely said industry will find the investment required to be marketable and scalable. Legislative framing means certainty for investors and project operators, which is one of the primary reasons why regulation is so crucial for GGRs and GGR scaling. Robust regulation also creates a framework of accountability and reliability, encouraging good actors and properly monitored and verified outcomes which do not pose an unregulated risk to the environment. GGRs present a conflicting scenario in which certain areas of applicable and established law are vulnerable to over-regulation, and the consequent stifling of innovation and expansion, an issue currently being explored by the UK Government.[6] However, as is demonstrated throughout this report, there are also overt gaps and misalignment in the law which create calls from GGR actors and regulators for increased regulation.

This report delves into the piecemeal regulatory landscape of GGRs across the UK, exploring the law in all four UK nations in order to ascertain where the law is, and is not, facilitative of sustainable scaling of GGR industry, both terrestrial and marine. The purpose of this report is to map the law as it exists for GGRs, identify potential legal gaps and barriers, and provide practical recommendations for future legal developments which may enable sustainable scaling of GGRs. This report is intended for use by industry, regulatory bodies and the research community alike, as it takes the coordination and cooperation of all of these to create successful regulatory evolution.

## 1.2 Scope and stakeholder engagement

### *1.2.1 Scope*

This review is an analysis of UK-wide legislation and regulation which is relevant to GGRs, together with a deep dive into the devolved competences of each of Scotland, England, Wales and Northern Ireland, to provide a thorough picture of how the UK as a whole regulates GGRs across four distinct legal landscapes.

This regulatory review encompasses the following GGR pathways, without advocating for any one over another, while recognising that each GGR technique varies in terms of technology readiness and established support mechanisms, as discussed in more detail throughout the body of this report:

- Direct air capture and storage (DACCS);
- Bioenergy with carbon capture and storage (BECCS);
- Biochar;
- Enhanced rock weathering (ERW);
- Afforestation;
- Peatland restoration; and
- Marine GGRs.

6 UK Government, HM Treasury, 'New approach to ensure regulators and regulation support growth' (31 March 2025) <www.gov.uk/government/publications/a-new-approach-to-ensure-regulators-and-regulation-support-growth/new-approach-to-ensure-regulators-and-regulation-support-growth-html#annex-a-key-regulator-pledges> accessed 10 June 2025

This report is focused primarily on issues of public law and regulation, and therefore omits considerations of private law which may affect GGRs, such as contractual arrangements. The exceptions to this are brief considerations of the role of contracts for difference (CfDs), and the role of land law. This report also excludes consideration of CCS techniques applied to fossil fuels, as they qualify as emissions reduction rather than removal of atmospheric $CO_2$ (for more information on differentiating CCS from GGR, see Chapter 1.4).

### *1.2.2 Stakeholder engagement*

This report is built upon thirty-one semi-structured, qualitative interviews with UK-based stakeholders across industry, government departments and regulatory bodies, independent bodies, and publicly funded GGR demonstrator projects.[7,8] These interviews were exploratory in nature, guided by a core set of themes, allowing participants to guide the conversation towards legal issues they perceived as most relevant or crucial to the pursuit of GGRs.

Themes explored in interviews were as follows:

| Interviewees | Interview themes |
|---|---|
| Industry | • Operational challenges to projects from conception (e.g. planning and permitting) to completion (e.g. products, emissions, waste)<br>• Questions based on comprehensive system boundary assessment models[9] |
| Government departments and Regulators | • Regulator capacity to address GGRs<br>• Engagement with GGRs<br>• Expertise in GGRs |
| Research Community (GGR-D) | • Operational challenges to research and development projects<br>• Legal challenges to GGRs from a research perspective |

Table 1: Interview Themes

The amalgamation of these generative interviews captured diverse and novel perspectives on the existing regulatory landscapes throughout the UK, particularly around legal uncertainties, operational barriers, and inter-institutional dynamics. This exploratory approach has both corroborated previously identified regulatory challenges and has also revealed regulatory challenges which are not explored in existing literature.

7 There are five GGR demonstrator projects receiving funding from the Greenhouse Gas Removals Demonstrators Programme, referred to as GGR-D, for an overview see <https://co2re.org/ggr-projects/>

8 See Annex I for full list of interview participants and associated ethics process

9 For more detail on methods see - Isabela Butnar and others, 'A Review of Life Cycle Assessment Methods to Inform the Scale-Up of Carbon Dioxide Removal Interventions' (5 November 2024) *Wiley Interdisci*plinary Reviews: Energy *and Environment*, Vol 13, Issue 6, e540

## 1.3 How to use this report

This report is designed to support a range of readers – regulators, policymakers, industry stakeholders, and the research community – with an interest in the regulatory landscape for GGRs across the UK. This report is structured thematically and by regulatory challenge, rather than by nation or GGR type alone. Findings are broadly classifiable as follows:

| | **Findings common to all GGRs** | **Findings specific to select GGR techniques** |
|---|---|---|
| **UK-wide findings** | Section II | Section IV |
| **Jurisdiction-specific findings** | Section III | Section V |

Table 2: Report Structure

Key legal findings and recommendations are summarised at the end of each chapter.

## 1.4 Report dimensions – the four corners of GGRs

Although Chapter 2.1 outlines the relevant GGR techniques for the purposes of this report, it is useful to identify the legal parameters of GGRs, and how they are delineated within legislation in the UK. There are two notable definitions of GGRs within legislation. The one referred to most commonly can be found within the Climate Change Act 2008, which defines a UK greenhouse gas removal as "removals of that gas from the atmosphere due to processes, mechanisms or activities in the United Kingdom".[10] Similar definitions are contained within legislation for each devolved nation, with all three nations listing land use, land-use change and forestry (LULUCF) activities as generic forms of removal.[11] Northern Ireland additionally lists the use of CCS technologies as removal pathways.[12] Although multiple GGR pathways include CCS, it should be noted that the focus on GGRs removing greenhouse gases from the ambient atmosphere generally precludes CCS activities in isolation, which typically capture CO2 generated at source from the combustion of fossil fuels, leading to a reduction in emissions rather than a net negative carbon balance.

The other definition of GGRs can be found in the Energy Act 2023, which specifies "activities of capturing carbon dioxide (or any substance consisting primarily of carbon dioxide) that –

10 Climate Change Act 2008, s29
11 Climate Change (Scotland) Act 2009, s17(1); Environment (Wales) Act 2016, s34(3); Climate Change Act (Northern Ireland) 2022, s9(3)
12 Climate Change Act (Northern Ireland) 2022 s9(3)

(a) has been produced by commercial or industrial activities, (b) is in the atmosphere, or (c) has dissolved in sea water"[13] that are then stored "with a view to the permanent containment of carbon dioxide."[14] This definition not only includes removal of greenhouse gases from the atmosphere, but also from industrial activities or sea water. The other notable element of this definition is the use of "permanence", which is a highly topical area of discussion for GGRs.[15]

It is also important to flag that each regulator and project categorises GGR pathways differently. Interviewees most commonly differentiated GGRs by siphoning them off as either 'engineered' (DACCS, BECCS), 'nature-based solutions' (afforestation, peatland) or those which are primarily engineered but with a nature-based element (biochar, ERW, marine). For the purposes of reflecting accurately the positions of interviewees, this report uses those differentiators; however, it acknowledges that the research community does present a variety of alternative ways to categorise GGRs.[16]

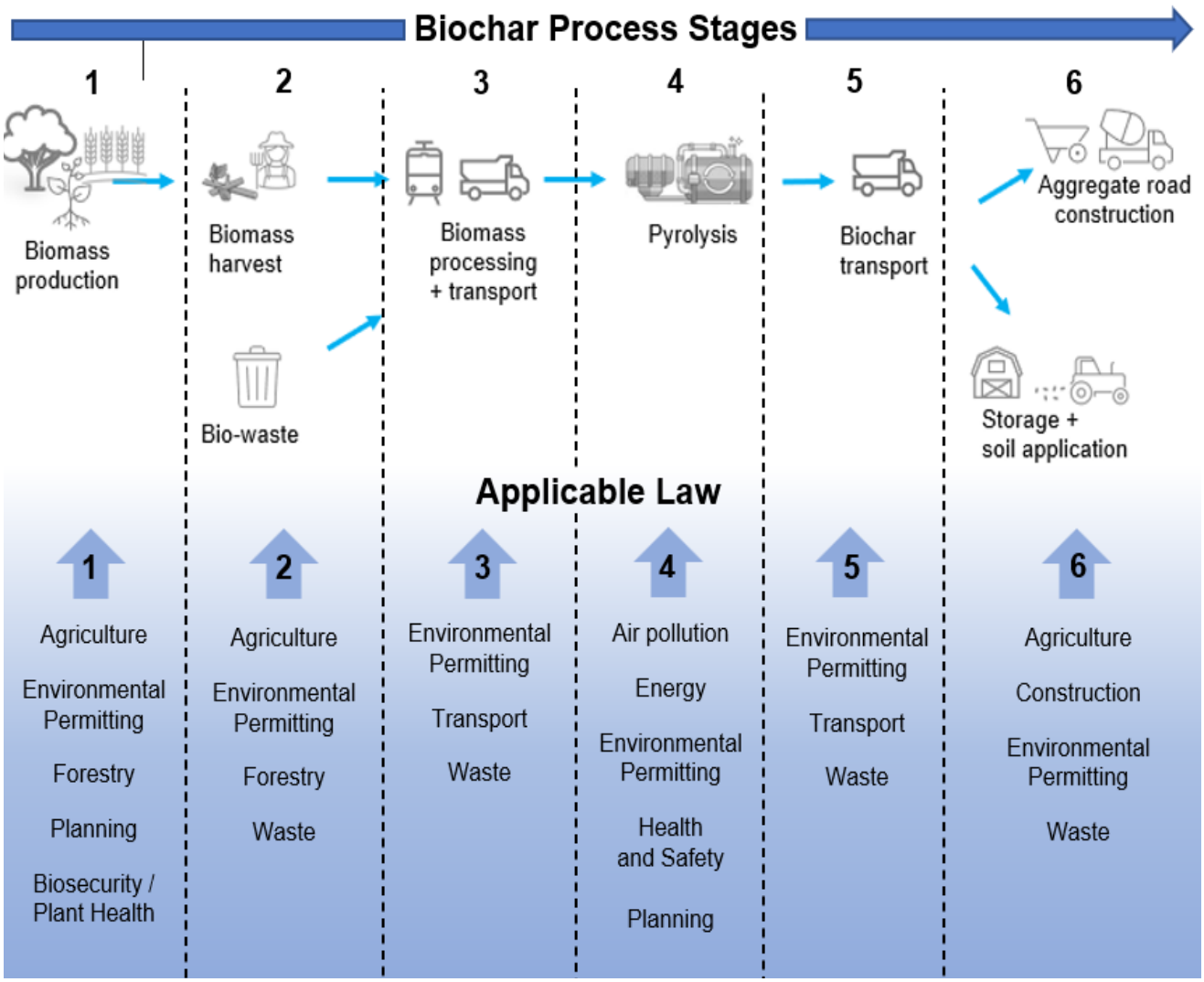
As is explored further within the body of this report, GGRs tend to be considered by interviewees as individual or standalone activities. However, some interviewees discussed GGRs as part of a more integrated supply chain metric or as part of a co-benefit structure. The majority of legal analysis contained within this report focuses on GGRs as individual activities, albeit with complex value chains, for the purposes of mapping relevant legislation and maintaining a contained narrative. It is acknowledged that GGRs have any number of applications (including co-deployment) and the majority of GGR pathways are very flexible in how they can be adopted or utilised as part of a larger supply chain. However, to attempt such a wide scope within this review would dilute the purpose and substance of the report.

# Chapter 2 – Mapping the UK's regulatory framework for GGRs

## 2.1 Stepwise Approach

There is no legislation within the UK which is specific to or dedicated to GGRs. This creates a scenario where the law as relevant to GGRs is piecemeal and must be applied to each stage of the life cycle of a project. This is a complex task for multiple reasons. Legally relevant instruments span primary and secondary legislation, as well as technical standards and frameworks to which legislation refers and demands adherence. Below is an example of a stepwise approach taken to establish areas of law relevant to each stage of a GGR pathway life cycle (using biochar in this example):[17]

13 Energy Act 2023 s67(7)
14 *ibid*
15 For further discussion on permanence see Chapters 5.2.1 and 7.4
16 For example, 'conventional' vs 'non-conventional' GGRs see Smith and Others (n1); for 'engineered' vs 'land-based' see Ghaleigh, Macinante (n1)
17 For an overview of life cycle methods see Butnar and others (n9)




*All GGR process diagrams in this report are provided courtesy of Isabela Butnar, et al. from $CO_2RE$*

Figure 1: Biochar Process Diagram

Interviewees in industry or research undertaking particular GGR technologies were guided through their project life cycle in interview, utilising the above stepwise approach. Through this exercise, interviewees were given the opportunity to highlight the areas of law which posed the greatest challenge for undertaking GGR activities. The substantive findings in this report, in particular Sections IV and V, are the product of this approach.

## 2.2 Layers of law

Complexity is added when separating out the relevant reserved and devolved competences across the UK. With regard to identifying and differentiating between reserved and devolved

legislative competences, at a foundational level, reserved powers are those which are held by Westminster only, in policy areas such as defence, the constitution, and foreign affairs.[18] Each devolved nation has an enabling piece of legislation which outlines the areas of legislative competence withheld by Westminster, the remainder of which are devolved.[19] The range of devolved powers differs slightly between each nation, however the majority of GGR-related legal areas are devolved to each administration.

A second layer of legal influence to consider is the continued role of assimilated EU legislation.[20] A large swathe of UK-wide legislation continues to be founded in EU law as assimilated pre-Brexit, through historic regulations or directives. Such legislation is prevalent in environmental law, which forms a key legal area for GGRs. Assimilated EU laws which have a continued role in the UK are explored throughout this report, particularly in relation to waste law (see generally Chapter 9)**.** With regard to Northern Ireland, EU law is still an active part of its legal system through the Windsor Framework.[21] Through this, Northern Ireland continues to adhere to EU law in areas such as the EU ETS (for electricity generation[22]), agricultural production, plant health rules and state aid. The overall influence and continued role of EU law in the post-Brexit age is viewed as disjointed and difficult to understand for laypersons,[23] which in turn impacts the ability to see clearly the regulatory updates which would facilitate GGR scaling.

A third layer of law to consider is international law. This is particularly relevant for legal principles which permeate UK legislation and also for marine GGR activities, where certain activities are controlled by instruments of international law to which the UK is a party, and therefore must adhere to as a whole. Exploration of these laws, in particular the London Convention and subsequent London Protocol, is contained in Chapter 16 Marine GGRs.

Below is a high-level overview of areas of reserved and devolved competence which are applicable to GGR techniques.[24]

18 Scotland Act 1998, Schedule 5; Government of Wales Act 2006, Schedule 7A; Northern Ireland Act 1998, Schedules 2-3
19 *ibid*
20 See generally Retained EU Law (Revocation and Reform) Act 2023
21 UK Government, 'The Windsor Framework: A New Way Forward' (February 2023) Command Paper 806; see more generally Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community [2019] OJ C 384 I/01
22 UK-EU Withdrawal Agreement (n21), Article 9 and Annex 4
23 Dan Corry, 'Delivering economic growth and nature recovery: An independent review of Defra's regulatory landscape' (April 2025) 32
24 Details of areas of law specific to each GGR technique are outlined at the beginning of each chapter in Section V of the report

| Reserved and Devolved Competences | | | | |
|---|---|---|---|---|
| **Area of law** | **UK Government (applicable to England)** | **Wales** | **Scotland** | **Northern Ireland** |
| **Agriculture** | Devolved | Devolved | Devolved | Devolved |
| **Biosecurity / Plant Health** | **Reserved** | | | Must also consider EU law |
| **Chemicals** (including fertiliser) | **Reserved** | Enforcement powers devolved | Enforcement powers devolved | Must also consider EU law |
| **Climate Change** | **Reserved** | | | |
| **Construction** | Devolved (with exceptions, for example product safety / standards) | Devolved (with exceptions) | Devolved (with exceptions) | Devolved (with exceptions) |
| **$CO_2$ transport and storage (licensing)** | **Reserved** | | | |
| **Emissions Trading** | **Reserved** | | | Must adhere to EU law regarding power generation |
| **Energy** | **Reserved** (with exceptions) [25] | Renewable energy devolved (up to 350MW) | Renewable energy devolved | Electricity and gas devolved[26] |
| **Environmental permitting** (e.g. biodiversity, air, waste, land, resources, hazardous substances, water) | Devolved | Devolved | Devolved | Devolved |
| **Forestry** | Devolved | Devolved | Devolved | Devolved |
| **Health and Safety** (e.g. on site) | **Reserved** | | | |
| **Intellectual property** | **Reserved** | | | |
| **Land** | Devolved | Devolved | Devolved | Devolved |
| **Marine Licensing**[27] | Devolved (with exception of Northern Ireland) | Devolved | Devolved | Devolved to 12 nautical miles[28] |
| **Planning** | Devolved | Devolved | Devolved | Devolved |
| **Transport (e.g. of waste)** | Devolved (with the exception of international) | Devolved | Devolved | Devolved (must also adhere to EU law) |
| **Waste**[29] | Devolved | Devolved | Devolved | Devolved |

Table 3: Reserved and Devolved Competences

25 Energy law is a mix of reserved and devolved powers: reserved competence includes nuclear energy and electricity and gas markets (with the exception of Northern Ireland)
26 Northern Ireland forms an exception due to having a separate electricity grid and market arrangements (for a summary see: UK Government 'Devolution settlement: Northern Ireland' (20 February 2013) at <www.gov.uk/guidance/devolution-settlement-northern-ireland> accessed 20 August 2025)
27 Certain marine activities must adhere to international law, see Chapter 16
28 Offshore region of Northern Ireland is governed by the Marine Management Organisation in addition to English onshore and offshore regions, see: Marine and Coastal Access Act 2009
29 Waste law still influenced heavily by EU law, see Chapter 9

The number of regulatory and legislative instruments available across the UK in relation to GGRs far outweighs the capacity of this report. This report focuses on the primary legislation and legal instruments which are relevant to GGR activities and which either enable or hinder GGR activities in their present form.

## 2.3 Legal principles and policy

This report considers where the law may change in future. Fundamental to considering any legislative or regulatory change, it is important to consider the underlying foundations of the law in question and the legal principles which may be applicable. Although this report is framed as a practical response to the legal challenges faced by those regulating and operating in GGRs, consideration of the more normative side of law is essential. Part of this consideration is the creation of policy. The lines between policy and law are easily blurred, as it is difficult to analyse the intentions of one without the other. This report contains reference to policy frameworks on the premise that legislation exists to give a legal spine to government policy. Beyond that, it does not attempt to analyse policy in isolation or any great detail.[30]

Issues of environmental law form a key pillar of the legislation which applies to all GGRs, cutting across land, air, and water, and environmental protection forms the primary purpose of many of the regulators interviewed for this report. Following the UK's exit from the EU, the Environment Act 2021 was enacted to form a new legal framework for environmental protection and governance in the UK. One of the notable outcomes of the Act was the creation of the Office of Environmental Protection (OEP). The OEP exists to contribute to environmental protection and improvement of the natural environment, acting objectively and impartially.[31] With this purpose, it holds government departments, ministers, regulators, and local authorities to account. The jurisdiction of the OEP extends to England and Northern Ireland, as well as reserved matters (see Table 3).

The Environment Act establishes five core principles, derived from EU law[32] and international law[33], that UK Government Ministers should be guided by when considering policy creation:[34]

| 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|
| environmental protection should be integrated into the making of policies | preventative action to avert environmental damage | precautionary principle, so far as relating to the environment | environmental damage should as a priority be rectified at source | polluter pays principle |

30 For more information on current GGR policy see: Johanna Arlinghaus and others, 'A Taxonomy of Policies to Support Geological Carbon Dioxide Removal' Smith School of Enterprise and the Environment, University of Oxford (May 2025) Working Paper 25-01
31 Environment Act 2021, Chapter 2
32 Consolidated Version of the Treaty on the Functioning of the European Union (2016) C202/47, Art 11 of Title II, and Art 191(2)
33 For example see: Rio Declaration on Environment and Development (adopted 14 June 1992) UN Doc A/CONF.151/26 (Vol I) 31 ILM 874), Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 79
34 Environment Act 2021, s17(5)

These principles are now reflected in a policy statement,[35] which the UK Government must have "due regard"[36] to when making policy as it relates to England (or a reserved matter of Scotland[37]). The remaining three nations are at differing stages of deploying the same environmental principles approach. Scotland has a mirroring list of principles in its post-Brexit legislation as relates to devolved matters,[38] and also a corresponding policy statement.[39] Notably in Scotland, Ministers must also have due regard to these principles when making proposals for legislation, not only policy.[40] Northern Ireland continues to reflect the underlying EU law,[41] and is currently developing an Environmental Principles Policy Statement similar to those produced by England and Scotland, which is currently under consultation.[42] Wales is consulting on legislation to enact these environmental principles in Welsh policymaking,[43] where it is set out that ministers should have "special regard" to the principles.[44] Wales does not yet have a policy statement.

Although broad 'due regard' is all that must be given when making policy (and therefore not prescriptive measures nor outcomes), these principles affect everything from updates to the UK ETS, to changing aspects of environmental law, or creating new policy or legislation to govern GGR activities. The importance of these principles is also clear from recent case law, where a Written Ministerial Statement recently came under scrutiny in relation to the Secretary of State's duty to have due regard to the environmental principles.[45] Therefore, these principles remain at the forefront of policy decision-making, and, in the case of Scotland, legislative decision-making, and must be borne in mind throughout this report. Of particular importance is the precautionary principle, which is explored further in Chapter 3.

As well as environmental policy principles, there are other acts of parliament throughout the UK which influence the decision-making of regulators and governments when considering regulatory change, for example the Well-being of Future Generations (Wales) Act 2015, which sets out national well-being goals and parameters for 'sustainable development.' Similar legislation has been proposed in Scotland through the Wellbeing and Sustainable Development (Scotland) Bill.

From a policy perspective, national governments throughout the UK have set explicit net zero targets. The UK-wide Net Zero target is 100% emission reduction compared to 1990 baseline

35 UK Government, Department for Environment, Food & Rural Affairs, 'Environmental Principles Policy Statement' (31 January 2023) <www.gov.uk/government/publications/environmental-principles-policy-statement/environmental-principles-policy-statement> accessed 25 June 2025
36 Environment Act 2021, s19(1)
37 *ibid*, s19(4)
38 European Union (Continuity) (Scotland) Act 2021, s13(1)
39 Scottish Government, 'Scotland's Guiding Principles on the Environment: Statutory Guidance' (August 2023) <www.gov.scot/publications/scotlands-guiding-principles-environment-statutory-guidance/> accessed 25 June 2025
40 UK Withdrawal from the European Union (Continuity) (Scotland) Act 2021, s14(1)
41 For more information on the relationship between Northern Irish environmental law post-Brexit and the EU, see: Mary Dobbs and others, 'Non-diminution, dynamic alignment and cooperation: exploring the potential of the Windsor Framework to protect the environment' (2024) Northern Ireland Legal Quarterly, Vol 75, No 3, 550-583
42 Department of Agricultural, Environment and Rural Affairs, 'Draft Environmental Principles Policy Statement for Northern Ireland – Consultation Version' (30 September 2024)
43 Environment (Principles, Governance and Biodiversity Targets) (Wales) Bill, s2-3
44 *ibid*, s3(1)(a)
45 This case was taken to appeal, and both the court at first instance and the appeal court found in favour of the Secretary of state: *R (Rights: Community: Action Ltd) v Secretary of State for Housing, Communities and Local Government* [2025] EWCA Civ 990

levels by 2050,[46] with Wales[47] and Northern Ireland[48] both setting the same limit, whilst Scotland is pursuing net zero by 2045.[49] Net zero policy is crucial for forming the mandate for GGRs. Other policies relevant to GGRs are discussed throughout this report, for example in relation to land use.

46 Climate Change Act 2008, s1
47 Environment (Wales) Act 2016, s29(1)
48 Climate Change Act (Northern Ireland) 2022 s1
49 Climate Change (Emissions Reduction Targets) (Scotland) Act 2019, s1

# SECTION II
# UK-wide findings common to all GGRs

## Chapter 3 – Regulatory Paradox

This chapter represents the core of regulatory challenges faced by industry and regulators. The relationship between these two sides of GGR frames the narrative of every section of this report and permeates all legal challenges and gaps identified by interviewees. This chapter explores the responses given by both industry and regulators in interview when they were asked what they require from one another. The responses given are pivotal to the GGR narrative, and finding a solution to the issues highlighted within will unlock regulatory opportunities throughout the UK and enable action.

### 3.1 The needs of regulators and industry

#### *3.1.1 Industry*

The GGR industry is packed full of new entrants and start-up projects, all operating in a nascent space.[50] Many interviewees fall into this category. All interviewees involved in industry were asked what they require from regulators in order to scale GGR activities. The majority of findings presented themselves in discussing the specific regulations which applied to their respective GGR activities (explored further in Section V); however, select overarching needs recurred. Regulators in interview also relayed feedback they had received from industry directly.

One challenge faced by industry is that of access to regulation and general legal knowledge, which is frequently perceived as deeply complex and incohesive.[51] DESNZ's feedback received from industry noted that it is not always the substance of the regulation of an activity itself which poses the challenge to industry, it is access to the breadth of this regulation that creates the hurdle, and a lack of clarity provided to projects on how they should demonstrate legal

50 Christopher Lomax and others, 'The UK State of Carbon Dioxide Removal' (CO2RE The Greenhouse Gas Removal Hub July 2025) available at <https://co2re.org/wp-content/uploads/2025/07/UK-State-of-CDR-Report.pdf> accessed 25 August 2025

51 This challenge is also felt by operators across the EU: European Commission 'Commission Staff Working Document Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: The EU Startup and Scaleup Strategy' (28 May 2025) SWD (2025) 138 final, 4-8

compliance.[52] This challenge is particularly potent for new entrants, where it is well recognised in other industries that smaller and first-of-a-kind projects face disproportionate challenges when interacting with regulators compared to established market players,[53] the latter of which may have their own policy or legal advisors in-house. Similarly, SEPA raised the point that new entrants do not necessarily have sufficient awareness of which regulators control their activities, how to engage with regulators, or whether any permitting is required.[54] This clearly represents a wider need for industry to have clear guidance on the law and how to approach the regulation of their projects.

Multiple interviewees highlighted that regulators may not be incentivised to address regulatory issues until an industry exists, however they equally highlighted that industry cannot be created unless certain regulatory roadblocks are removed. This is an issue more relevant to some GGRs than others, with biochar producers, for example, raising this dilemma in interview (for more detail on biochar regulation see more Chapter 12).[55] The crux of the issue for industry was encapsulated neatly by KEW Technology, who stated that "if you are not in alignment and step-in-step with the right policy and regulatory support, commercialisation is nearly impossible."[56] What is clear from the plethora of regulatory challenges that is raised by industry throughout this report, is that the right policy and regulatory support does not yet exist where it needs to for industry to scale. DESNZ's feedback from industry reflected this same position, reinforcing that clarity and guidelines from regulators would assist projects, as well as the Government setting baselines for quality of GGRs and carbon accounting, with expectations made clear to projects for how to engage in the market.[57] From this perspective, it then falls to regulators to process these needs, a point which has not escaped the UK Government, for example through new policy consideration of how regulators can adapt to better cater for innovation and growth.[58] Meeting the evolving needs of industry is, however, no mean feat.

#### *3.1.2 Regulators*

Regulators at all times are required to maintain alignment with their legal mandates and wider environmental law. Almost all of the regulators interviewed for this report hold an explicit mandate of environmental protection. For example, the Environment Agency is bound legislatively to "protect or enhance the environment, taken as a whole, as to make the contribution towards attaining the objective of achieving sustainable development"[59]. Similarly, NRW's purpose is to ensure that the natural resources and environment of Wales are maintained, enhanced and used sustainably.[60] Scotland and Northern Ireland's environment agencies abide by similar obligations.[61] Regulators are also obliged to comply with existing environmental regulation, which includes use of the precautionary principle, as explored

52 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
53 Jeremy Hall and others, 'The paradox of sustainable innovation: The 'Eroom' effect (Moore's law backwards)' Journal of Cleaner Production 172 (20 January 2018) 3487-3497, 3489
54 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
55 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
56 Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025)
57 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
58 UK Government, HM Treasury, 'New approach to ensure regulators and regulation support growth' (n6)
59 Environment Act 1995, s4(1)
60 The Natural Resources Body for Wales (Establishment) Order 2012, s4
61 For SEPA see Environment Act 1995, s20A, as amended by the Regulatory Reform (Scotland) Act 2014; for NIEA, the responsibilities of NIEA are not contained within a single piece of legislation, but rather a framework document: Department of Agriculture, Environment and Rural Affairs 'Northern Ireland Environment Agency Framework Document' <www.daera-ni.gov.uk/publications/niea-framework-document> accessed 30 August 2025

below.[62] Beyond these core obligations, the expectations placed on regulators have increased exponentially due to the complexity of the law they must navigate and enforce, and their increased powers, duties, and objectives.[63]

In the context of GGRs, all regulators and government departments interviewed actively engage with external stakeholders and relevant industry. Several regulators put forward in interview that supporting innovation was imperative, but the prevailing hurdle to updating or creating regulation for GGRs is a lack of evidence from projects as to technical viability and in some cases environmental risk.[64] From the perspective of environmental regulators, this challenge is relevant particularly for engineered techniques.[65] Although it is acknowledged that for many GGR techniques there is a growing body of evidence (for example as enabled by the DESNZ's GGR Innovation Programme[66]), for some regulators, the lack of evidence in other GGR techniques is so profound that they are hesitant to consider supporting or encouraging those GGR activities at all where there is no knowledge as to whether the activities will have a benefit to their nation and conform to their mandate of environmental protection.[67] It is made clear by regulators that this current stand-still position is not to be conflated with opposition to GGRs, as regulators do actively want to receive information from industry on the trajectory of GGR techniques and their future potential;[68] however, they cannot go against their legal mandate of environmental protection. Similarly, regulators in England are held to the Regulators' Code, which mandates that risk should be considered in every stage of decision-making.[69] The call for robust evidence permeates all GGRs, even those which are historical and well-established, such as afforestation. NatureScot stressed the importance of addressing shifts in evidential certainty within afforestation, due to historically reliable tree species becoming under threat from climate-driven pests and pathogens.[70]

The need for evidence, although necessary, is deemed by Defra to be more useful from project-to-project.[71] Defra highlighted that it is not necessarily a scalable approach, as it is not always clear that the regulator in question has the ability to regulate for these projects cohesively. No regulator has the ability to regulate the GGR industry as a whole, or even a single GGR technology from cradle to grave.[72] Therefore, there is a limit to the facilitation that evidence can bring. A wider-reaching approach requires collaboration between regulators, a point explored further in Chapter 4.2.

62 See Chapter 2.3 for an explanation of environmental principles and Chapter 3.2.1 regarding the precautionary principle
63 UK Government, HM Treasury, 'New approach to ensure regulators and regulation support growth' (n6)
64 Interviews with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025); Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025); Interview with Participant 9437941, Department of Agriculture, Environment and Rural Affairs (online, 9 April 2025); Participant 2481829, Natural Resources Wales (online, 4 March 2025); Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025); Interview with Participant 9550967, NatureScot (in person, 5 March 2025)
65 Interviews with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025)
66 UK Government, Department for Energy Security and Net Zero 'Direct Air Capture and Greenhouse Gas Removal Innovation Programme: Phase 2 projects' <www.gov.uk/government/publications/direct-air-capture-and-greenhouse-gas-removal-innovation-programme-selected-projects/direct-air-capture-and-greenhouse-gas-removal-innovation-programme-phase-2-projects> accessed 25 August 2025
67 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)
68 Interview with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025); Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)
69 UK Government, Department for Business Innovation & Skills 'Regulators' Code' (April 2014) <https://assets.publishing.service.gov.uk/media/5f4e14e2e90e071c745ff2df/14-705-regulators-code.pdf> accessed 25 August 2025, section 3: the Regulators' Code came into statutory effect under the amended Legislative and Regulatory Reform Act 2006
70 Interview with Participant 2021157, NatureScot (online, 2 April 2025)
71 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
72 See Stepwise Approach to GGR processes at Chapter 2.1

Regulators also called for knowledge-sharing from industry.[73] In the context of emerging technologies and the challenges they pose to regulators, this has been referred to in literature as "asymmetries in information"[74], whereby there is a mismatch of the level of knowledge acquired of the new technology by those developing it versus regulators and society at large. This mismatch extends to the next steps for a technology: how or whether it should be scaled at all.[75] As explored further in Chapter 4.2**,** knowledge-sharing practices across regulators will be crucial going forwards, and similarly there are collaborative learning exercises across academia and regulators.[76] However, this is not on a project-level basis. Regulators reported in interview that they have encountered GGR projects making contact with them when planning permission or an environmental permit is required.[77] At that point-of-need stage, it is a challenge for regulators to build the requisite knowledge to engage with the planning or permitting process efficiently and understand exactly what their regulatory role is in a new GGR context. Engagement is required by regulators at the earliest stage possible for projects, which will augment any subsequent applications by the developer.[78]

Another disincentive for regulators to engage in regulatory updates is the need to use taxpayer money when supporting a new industry or changing regulation. DESNZ and Defra both raised this point, stating that without scientific consensus or reliable data that an industry is forming definitively with profitable models, Ministers are unlikely to engage in updating the law.[79] Referring back in this context to industry's position regarding being unable to proceed without regulatory change, it is difficult to see how either position can be resolved. In scenarios where regulators have engaged in lengthy updates to permitting to accommodate industry's claims that permitting is a barrier, they have then not received any permit applications for the same.[80] This is an inefficiency and drain on resources, and from the perspective of regulators reinforces the need to receive robust evidence of successful market modelling and technical feasibility for new GGR projects, prior to engaging in updating the law.

73 Interviews with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025); Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025); Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025); Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025); Interview with Participant 9550967, NatureScot (in person, 5 March 2025)

74 Araz Taeihagh and others, 'Assessing the regulatory challenges of emerging disruptive technologies' (2021) Regulation & Governance 15, 1009-1019, 1010

75 *ibid*

76 See for example: Department for Energy Security & Net Zero, CO2RE, IDRIC, 'Bridging the Gaps: Enhancing CCUS and engineered GGRs through collaborative discussion' <https://co2re.org/wp-content/uploads/2025/05/Bridging-the-Gaps-CCUS-and-GGR-workshop-output-1.pdf> accessed 20 August 2025

77 Interviews with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025); Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)

78 Interview with Participant 9550967, NatureScot (in person, 5 March 2025)

79 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025); Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)

80 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)

Summary of needs across industry and regulators:

| Industry | Regulators |
|---|---|
| Inability to scale industry without regulatory support | To conform at all times to mandates contained in legislation, primarily environmental protection |
| Regulatory clarity and guidelines | Robust evidence required from industry of technical and market viability of GGRs, particularly for engineered techniques |
| Updates to regulation where necessary | Regulator collaboration to enable cradle-to-grave regulation |
| Issue of access and understanding of the law / equal opportunities for smaller projects | Early engagement and knowledge-sharing from industry to promote mutual learning |

Table 4: Regulatory Paradox – needs of industry and regulators

## 3.2 Meeting these needs: a Regulatory Paradox

### *3.2.1 Mandates and legal principles versus evidence*

When comparing the needs and current positions of industry and regulators, it is apparent that the needs of one cannot currently be met by the other, and vice versa. The inability for regulators to be able to better facilitate GGR projects without compromising their regulatory mandates or legal principles, and the inability for industry to scale GGRs without greater regulatory support, together create a paradox whereby both sides are at an impasse. The periphery of this 'Regulatory Paradox' is addressed in existing literature on other industries and multiple jurisdictions,[81] and it can perhaps be perceived as a subset of regulatory challenges faced by 'first movers' in new markets,[82] as opposed to a novel concept. However, there is a notable research gap on this circular challenge faced between industry and regulators, particularly through the lens of industry associated with environmental and climate law. We are now beginning to see this research gap evolve from a political perspective, as the UK Government turns its attention to regulators and industry innovation, for example through Defra's latest consultation on modernising environmental permitting for industry,[83] and the Corry Review on delivering economic growth and nature recovery.[84]

81 For example: Gregory N Mandel, 'Legal Evolution in Response to Technological Change' in Roger Brownsword and others (eds), *The Oxford Handbook of Law, Regulation and Technology* (Oxford Academic 2016) 225-245; Araz Taeihagh and others (n74); Jeremy Hall and others (n53); Janine Fleith de Medeiros, Jose Luis Duarte Ribeiro, 'Market Success Factors of Sustainable Products' (June 2013) Independent Journal of Management & Production 4(1); European Commission 'Commission Staff Working Document Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: The EU Startup and Scaleup Strategy' (n51)

82 Roger Kerin and others, 'First-Mover Advantage: A Synthesis, Conceptual Framework, and Research Propositions' (1992) Journal of Marketing, Vol 56, No 4, 33-52, 47

83 UK Government, Department for Environment Food & Rural Affairs, 'Consultation on modernising environmental permitting for industry' <https://consult.defra.gov.uk/industrial-emissions-team/consultation-on-modernising-environmental-permitti/consultation/subpage.2025-06-02.0294707957/> accessed 20 September 2025

84 Dan Corry (n23)

Turning firstly to the mandates and legal obligations of regulators, a challenge associated with the mandate of environmental protection held by environmental regulators, raised by the EA, is the lack of reference to the climate. All GGRs are intrinsically linked with the climate, and although environmental protection and climate benefits are symbiotic, the legislation to which the EA, for example, is obliged to adhere only addresses the environment.[85] The EA noted that this lens can sometimes potentially cause misaligned expectations from GGR developers, which are approaching environmental regulators for climate purposes and climate-focused projects.[86] Another side to this relationship between environment and climate was raised by SEPA, in that if environmental protection is not achieved, this will most likely contribute negatively to climate change. This balancing act leads back to regulators erring on the side of ensuring environmental protection takes precedence.[87]

Intertwined with the mandate of environmental protection is the requirement for regulators to consider and have due regard to the precautionary principle in their decision-making. Out of all five principles listed at Chapter 2.3, the precautionary principle appears to play the biggest role in GGR regulatory decision-making, besides the principle of environmental protection. Derived from international law, the precautionary principle does not have a universal definition, which can create a challenge of clarity and how onerous the principle should be.[88] The UK Government's Environmental Principles Policy Statement defines the precautionary principle as "assist[ing] the decision-making process in the face of a lack of scientific certainty."[89] The principle therefore operates on an evidence basis. This over-reliance, combined with evidence demands, together present a formidable challenge for GGRs, as an industry with emergent findings. As a consequence, the possibility of introducing experimental regulatory facilitation is severely reduced, although this is now an evolving area, as discussed further below.

On paper, the precautionary principle as set out in the Policy Statement is not intended to "unnecessarily hinder innovation due to novelty…and it should only prevent or defer an innovative development where that risk outweighs the benefits, including potential benefits".[90] In practice however, the precautionary principle as deployed appears to sit at odds with the status of GGR evidence from the perspective of regulators. Most GGR pathways contain a degree of scientific uncertainty, and many involve nascent technologies and procedures which have not accumulated substantial evidence at this stage, which in turn creates this insurmountable hurdle for regulators when attempting to support novel GGR techniques.

The paralysing nature of the precautionary principle has been brought to the UK Government's attention by the recent independent review of Defra's regulatory landscape.[91] The review recommends regulators move away from existing over-reliance on the precautionary principle, and giving greater weight to wider objectives, such as sustainable growth.[92] Adopting this approach would tilt regulators' heavy reliance on the precautionary principle back in the direction of its original intended use in the Policy Statement, which is to focus on the balance

85 Environment Act 1995, s4(1)
86 Interviews with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025)
87 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
88 Stephanie David, 'Environmental Principles' in Nigel Pleming and others (eds), *The Law Of Net Zero And Nature Positive*, (London Publishing Partnership 2025), 3.18
89 UK Government, Department for Environment, Food & Rural Affairs, 'Environmental Principles Policy Statement' (n35)
90 *ibid*
91 Dan Corry (n23), 5
92 *ibid*, 21

between risk and benefits, without hindering innovation, which would provide some margin for regulators to consider GGR pathways which have demonstrated a certain level of evidence and market modelling, where climate benefits are evident. The independent review only extended to Defra regulators (for example the EA), however with all regulators across the UK adhering to the precautionary principle, this position could be applied to all four nations with relative ease. A similar position has been put forward in the recent Nuclear Taskforce interim report.[93] Although focused on regulatory barriers for nuclear energy, the findings from this report include discussion of the "as low as reasonably practicable" (ALARP) principle,[94] in the context of parties who create risk being responsible for the management of said risk. This principle derives from health and safety law, however for the purposes of exploring pragmatic solutions to over-reliance on the precautionary principle, approaches such as ALARP could be considered for enabling GGR pathways in an environmental context.

Subsequent to the Corry Review, Defra has published a consultation on reform to environmental permitting regulation for industrial facilities, built on the recognition that innovation and regulation are not currently aligned, in part due to this stand-off between risk-averse decision-making and the contrasting needs of industry to explore emerging techniques in a conducive regulatory environment. Proposals in this consultation are based upon a review of government missions, including the UK's Clean Energy Superpower Mission[95] and environmental principles (including the precautionary principle). Five overarching reform goals are provided, the most relevant of which for the purposes of addressing the precautionary principle being the enabling of innovation and new technologies and techniques, proportionate regulation, and regulator effectiveness and efficiency.[96] These goals are important from the perspective of the Regulatory Paradox, in particular the focus on support for research and development trials, where the utilisation of 'regulatory sandboxing' has been proposed.[97] Regulatory sandboxes are widely recognised as being effective tools for driving innovation.[98] They create a more proportionate regulatory environment for research and development projects, waiving certain legal requirements and simplifying regulatory approvals to suit time-limited trials. This regulatory environment would ease the evidence burden on project operators, whilst alleviating the risk burden borne by regulators, both of which would minimise the Regulatory Paradox. Creation of controlled and continuously monitored regulatory environments such as sandboxes also present a balanced solution to concerns felt by those who perceive alterations to reliance on the precautionary principle as a potential dilution of the principle or environmental protection, including public perceptions. Changes to environmental protection in law often attract opposition or concern from multiple sources, from specialist practitioners to academics and activists. An ongoing example of this is discourse surrounding the Planning and Infrastructure Bill 2025 (discussed further at Chapter 7.5.1).

93 Nuclear Regulatory Taskforce, 'Nuclear Regulatory Taskforce 2025: Interim Report' (April 2025) <https://assets.publishing.service.gov.uk/media/6899da57e7be62b4f064320e/nuclear-regulatory-taskforce-interim-report-2025.pdf> accessed 18 August 2025

94 *ibid*, 11

95 UK Government, 'Clean Power 2030 Action Plan: A new era of clean electricity' (December 2024) <assets.publishing.service.gov.uk/media/677bc80399c93b7286a396d6/clean-power-2030-action-plan-main-report.pdf> accessed 15 September 2025

96 UK Government, Department for Environment Food & Rural Affairs, 'Consultation on modernising environmental permitting for industry' (n83)

97 UK Government, Department for Environment Food & Rural Affairs, 'Consultation on modernising environmental permitting for industry' (n83)

98 Angela Attrey and others 'The role of sandboxes in promoting flexibility and innovation in the digital age" Organisation for Economic Co-operation and Development Going Digital Toolkit Notes, No 2 (OECD Publishing 2020) <www.oecd.org/content/dam/oecd/en/publications/reports/2020/06/the-role-of-sandboxes-in-promoting-flexibility-and-innovation-in-the-digital-age_ddcd3d40/cdf5ed45-en.pdf> accessed 25 July 2025, 11-12

The results of Defra's consultation and subsequent regulatory development by the UK Government should be monitored carefully by the GGR community, as this may provide new opportunities, especially for industrial projects. Defra is also considering expansion of their review of environmental permitting to the agriculture sector, which would potentially expand possibilities for GGR projects associated with agricultural activities, such as ERW and biochar. It remains to be seen how these intentions will come to fruition.

Another avenue explored by the UK Government is the proposed 'Regulatory Innovation Office', although the initial foci of this body do not quite cover GGR technologies, but rather 'engineering biology.'[99] It remains unclear how this Governmental body will help to create a more experimental legal space for GGR projects in future, but may play a role when implemented. Besides a body or branch of government dedicated to innovation, or the use of regulatory sandboxes, it is important to consider other tools which can be used to reduce the challenges faced by industry and regulators in the Regulatory Paradox. One such tool is Rapid Evidence Assessments (REAs). REAs are fast-paced research exercises to gather evidence under time constraints, contributing to policy formation and implementation.[100] It is clear from this chapter that the Regulatory Paradox is a complex balance of interests and risks, underpinned by entrenched principles of law, for example the precautionary principle, which boast a wealth of legal and policy literature that this report lacks the capacity to explore. A more thorough assessment of this legal and policy landscape, by using tools such as REAs, could reap positive interim results for solutions to the Regulatory Paradox.

In the short term, from the perspective of accruing and providing evidence to regulators in an attempt to surmount the evidence gap, there is no silver bullet from the perspective of industry to achieve this. The role the precautionary principle plays cannot be understated, which is clear when reviewing the literature and governmental material on the subject. At a more holistic level, one interviewee from industry, when reflecting on how industry might overcome this paradoxical scenario in the near future, stated that scaling of GGRs will by necessity be gradual and built upon the results of previous accumulative pilot studies, on the condition that there is knowledge-sharing and transparency of outcomes from said studies.[101] There are, however, barriers to knowledge-sharing from industry's perspective, as discussed below.

### *3.2.2 The balance of innovation and regulation*

It has been noted that in the context of GGRs, regulation tends to be more reactive than anticipatory as the industry has evolved throughout the early 2020s.[102] There is a risk that even if this Regulatory Paradox can shift or break in its current form, a similar situation may present itself when GGRs move to widespread commercialisation, as there may be aspects of those commercial-scale projects which are not properly catered for within law, with no easy solution.

99 UK Government, Department for Science, Innovation and Technology, 'Game-changing tech to reach the public faster as dedicated new unit launched to curb red tape' <www.gov.uk/government/news/game-changing-tech-to-reach-the-public-faster-as-dedicated-new-unit-launched-to-curb-red-tape> accessed 25 July 2025

100 Jonathan Breckon and others, 'Rapid Evidence Assessments: A guide for commissioners, funders, and policymakers' International Public Policy Observatory, CAPE, RREAL, UK Parliament POST (September 2023) <https://theippo.co.uk/wp-content/uploads/2023/10/FINAL-IPPO-POST-CAPE-rapid-evidence-assessments_V61.pdf> accessed 25 July 2025

101 Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025)

102 See generally: Miriam Aczel and others 'Anticipatory Regulation: Lessons from fracking and insights for Greenhouse Gas Removal innovation and governance' (August 2020) Energy Research & Social Science, Vol 90

Despite the reactive nature of legislative change, there are exceptions to this, some of which are intrinsically linked with GGRs, such as CCS. The UK boasts one of the most developed CCS regulatory regimes in the world, despite a lack of operational projects at this time. The climate need and industry push for CCS has spurred a flurry of regulatory activity, even in the past five years, resulting in a comprehensive framework. Emulation of this approach is not unachievable for GGRs, demonstrating that in the face of climate urgency, law can be anticipatory. There are also supporting tools created by Government to facilitate these approaches, such as the Better Regulation Framework, which supports decision-makers in managing the flow of regulation, and creates principles to drive a leading approach in developing regulation.[103]

Regulators are aware of the commercial uncertainties future GGR projects may pose, with SEPA highlighting that this creates the potential need for additional monitoring and modelling requirements than those required for conventional activities where the environmental impacts and monitoring requirements are well understood.[104] The purpose of this is to reduce risk posed by novel technologies, as well as ancillary benefits such as nurturing public confidence and demonstrating no significant harm is occurring.[105] This again places a heavy evidential burden on project developers, raising that barrier to entry and continuing that paradoxical structure. Many of the more nascent GGR projects deploy technologies protected by intellectual property rights, and through this, regulators have found that projects are reluctant to relinquish commercially sensitive information, which can further slow the process when engaging with regulators.[106]

Regulators are acutely aware of these issues and the importance of balancing innovation and regulation. Although industry has called for government-set rules for quality of GGRs, DESNZ in return highlighted the importance of the lack of flexibility that regulation offers. The example drawn was that of independent greenhouse gas methodologies, which have gone through multiple evolutions since their inception in order to adapt to an ever-changing industry.[107] The point in this example is to illustrate the risk of regulating before best practice emerges and settles, as regulation takes time to update, during which time industry can by stymied by out-of-date rules and regulators end up in an inefficient position.[108] Further, if the regulation does not accommodate for technical change, innovation itself can be stifled.[109] Premature entrenchment of standards within regulation has also been flagged as a risk for all industries at an EU level, therefore it is not a risk which can be taken lightly.[110] SEPA built upon DESNZ's point of avoiding time-consuming regulatory change, instead looking for more practical and

103 UK Government, Department for Business & Trade 'Better Regulation Framework: Guidance' (September 2023) <www.gov.uk/government/publications/better-regulation-framework> accessed 25 July 2025
104 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
105 Public confidence and perception of GGRs is highly topical and easily influenced: Emily Cox and others, 'Public perceptions of carbon dioxide removal in the United States and the United Kingdom' (6 July 2020) Nature Climate Change 10, 744-749; Laurie Waller and others, 'Carbon removal demonstrations and problems of public perception' (20 September 2023) Wiley Interdisciplinary Reviews Climate Change, Vol 15, Issue 1
106 Interview with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025); Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
107 See for example Isometric carbon removal registry: Isometric 'Rigorous protocols you can trust' <https://registry.isometric.com/protocols> accessed 29 July 2025
108 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
109 Janine Fleith de Medeiros, Jose Luis Duarte Ribeiro (n81), 4
110 European Commission 'Commission Staff Working Document Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: The EU Startup and Scaleup Strategy' (n51), 6

expeditious approaches such as updating associated permits.[111] An example provided here by SEPA was the revision of the permitting process for hydrogen production by electrolysis of water. Regulators from all four UK nations contributed to a review of emerging techniques in this sector and Guidance for Emerging Technologies was developed, with industry participation, to provide guidance for operators, regulators and the public when considering hydrogen production with CCS. The guidance identifies best practice to address important environmental issues. SEPA has developed a simplified permitting process for hydrogen production via electrolysis in acknowledgement that electrolysis has fewer environmental impacts than other methods of hydrogen production. Similar approaches are being developed by other UK regulators.[112] The option of pursuing these simplified processes for GGRs could help to bridge the regulatory gap for a variety of projects,[113] however permitting is not the only regulatory challenge that industry faces, therefore holding back on other regulatory updates for the sake of best practice may continue to restrict industry's ability to scale.

Returning to the need of industry to have clarity and access to regulation and regulators, this is not easily overcome from the perspective of regulators, and, as was raised by SEPA, projects can operate under the radar of regulators if operators do not know their obligations.[114] This report goes some way towards clearing the regulatory opacity surrounding GGRs, however it is no substitute for legal advice. One potential solution, presented by NatureScot, is to create a regulatory steering group or oversight group, which would facilitate the project management of the regulatory aspects of the GGR project proposal in question, to provide a pathway and demonstrate dependencies without interfering with the decisions of the regulator.[115] This would provide clarity to projects, whilst alleviating some of the challenges regulators face in engaging with new entrants.

Liberation from this paradoxical scenario inevitably involves an increase in risk and potential harm for either of industry or regulators, although there are mechanisms to alleviate these risks, such as the use of regulatory sandboxes. More generally, there is no easy way to allocate said risk, or justify allocating said risk to one side in particular. The default scenario, as demonstrated recently by a similarly nascent industry,[116] is for regulation and government to absorb and control the risks posed by new technologies,[117] which does not come without concern from UK Parliament.[118] Risk profiles differ for each GGR technique, with each bearing its own regulatory challenges, as explored further throughout this report. As with all regulatory change for GGRs, this challenge will be overcome gradually, with the collaborative efforts of industry and regulators. Knowledge-sharing at an early stage of each project, combined with the streamlining of permitting structures and access to legal information where possible from regulators, will begin the process of overcoming the perceived incompatible positions of

111 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
112 UK Government, Environment Agency 'Hydrogen production by electrolysis of water: emerging techniques' (28 March 2024) <www.gov.uk/guidance/hydrogen-production-by-electrolysis-of-water-emerging-techniques> accessed 29 July 2025
113 For more information on permitting see Chapter 7
114 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
115 Interview with Participant 9550967, NatureScot (in person, 5 March 2025)
116 See for example the UK Government legal position regarding CCS in the UK, in particular the arrangement for Track-1 projects and demonstrating risks absorbed by Government: HC Written Statement 13 November 2024, Vol 756, column 31WS; Revenue Support Agreements for Teesside: Low Carbon Contracts Company, 'Revenue Support Agreement' <www.lowcarboncontracts.uk/our-schemes/revenue-support-agreement/> accessed 26 July 2025, together with further risk support regarding litigation: Rachel Millard 'UK to compensate developers if £8bn gas plant project is blocked by court' *Financial Times* (16 December 2024) <www.ft.com/content/9273672b-6132-437b-9ab5-d20767bad59d> accessed 26 August 2025
117 Araz Taeihagh and others (n74), 1012
118 Committee of Public Accounts, *Carbon Capture, Usage and Storage* (HC 351 Eighth Report of Session 2024-25)

industry and regulators. To accelerate these processes, and to explore structured solutions, regulatory sandboxes and REAs can stimulate innovation and growth in a way which is aligned with Government goals.

## CHAPTER 3 – FINDINGS AND RECOMMENDATIONS

- ✓ Consideration of the solutions proposed in the Corry Review and Defra's consultation on environmental permitting, in particular the proposal of regulatory sandboxes, would reduce regulator over-reliance on the precautionary principle
- ✓ Deployment of the precautionary principle should be re-balanced to align with intentional intentions of balancing risk and innovation
- ✓ In the short term, industry should prioritise knowledge-sharing and transparency from pilot studies, to contribute to accumulative evidence
- ✓ Regulators can pursue permitting changes and other flexible options in the short term which do not involve changes to regulation
- ✓ Creation of steering or oversight group to facilitate regulatory aspects of project management / streamline contact process between regulators and industry
- ✓ Further research on this 'Regulatory Paradox' would assist with finding systemic solutions to these issues

Figure 2: Chapter 3 Findings and Recommendations

# Chapter 4 – Regulators and GGRs

This chapter delves into the findings from interviews with regulators and UK Government departments. As outlined in Chapter 1.2.2**,** these interviews explored the engagement, expertise and capacity that regulators possess in respect of GGRs.

## 4.1 Regulator engagement with GGRs

### *4.1.1 Direct engagement of regulators and other bodies*

As demonstrated by the stepwise approach in Chapter 2.1, the regulation of GGRs is piecemeal – thus the role of regulators is also fragmented and spans a wide range of functions. No regulator has ownership of an entire GGR value chain from conception to completion, and therefore the default position of regulators is that they are engaged in sections or specific aspects of GGRs. Regulators throughout the UK vary in terms of how much or little they engage directly with GGRs. However, all regulators interviewed for this report address GGRs as part of their operations either directly or ancillary to other roles, such as being integrated into wider decarbonisation or emission reduction agendas.

Larger regulators and Government departments, for example DESNZ,[119] the Environment Agency,[120] and Defra[121] are all engaged directly with GGRs. At a regulator level, it is the EA which regulates the majority of the operational aspects of GGR techniques in England. In contrast, some regulators and government departments do not have specific individuals or teams working on GGRs. GGRs instead form the periphery of people's roles, through teams like UK ETS, LULUCF, or peatland and forestry.[122] This is a more common scenario for the devolved nations, and inevitably leads to a reduction in direct engagement or GGR-wide awareness.

There are a few independent and non-governmental bodies relevant to GGRs which engage the governments of the four nations in their activities. One example of this is the IUCN UK Peatland Code, an independent certification standard for peatland restoration.[123] Each government in the four nations is represented through the Technical Advisory Board,[124] and various Government departments and regulators throughout the UK are present on the

119 DESNZ has a series of teams with a GGR policy and strategy focus, for example within Major Decarbonisation Projects, and Net Zero Science Innovation and Climate Energy

120 The EA reported in interview that they have an internal GGR Hub which falls within the larger Net Zero and Decarbonisation team: Interview with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025)

121 Defra have experts on GGRs within Net Zero and Climate Change, but no designated GGR policy focus due to policy ownership dynamics with DESNZ (see Chapter 4.1.2)

122 Interview with Participant 9437941, Department of Agriculture, Environment and Rural Affairs (online, 9 April 2025); Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)

123 IUCN UK Peatland Programme, 'Peatland Code' <www.iucn-uk-peatlandprogramme.org/peatland-code> accessed 28 July 2025

124 IUCN UK Peatland Programme, 'Peatland Code Governance' <www.iucn-uk-peatlandprogramme.org/peatland-code/peatland-code-governance> accessed 28 July 2025

Steering Group for the wider IUCN UK Peatland Programme.[125] Regulator involvement with independent standards and research increases engagement with GGR activities, integrating best practices into regulator knowledge. One engagement challenge raised by the IUCN in interview, however, is that of devolution. Increasingly devolved powers across the UK means an increase in the efforts required to facilitate coordination between the four nations. This observation can be applied to all GGRs on the basis that all techniques involve devolved areas of law. The afforestation equivalent of the IUCN UK Peatland Code is the Woodland Carbon Code. Although verified independently, the Woodland Carbon Code differs from the Peatland Code in that it is delivered directly by the forestry regulators of all UK nations.[126] This is one of the only GGR techniques where there is a coordinated standard between each nation government and regulators, perhaps partly due to the relative simplicity and traditional nature of afforestation activity compared to other GGR techniques.

#### *4.1.2 Regulatory competence and remit*

Turning back to the intra-regulator perspective, even regulators which are directly engaged across GGRs could in future encounter GGR engagement challenges, for example due to questions of policy ownership and leadership (as discussed further below within this Chapter 4.1.2). A consequence of this is a potential lack of certainty as to how much resource should be allocated to these GGRs within the regulatory body in question, and the level of leadership required. This has the potential to impact GGR regulatory engagement in the near future, which could exacerbate the challenges felt by industry when engaging with regulators across the UK. Therefore, a dominant question for regulators more generally is which regulators have the proper remit to consider GGR-related issues? Regulatory competence is a funnelling process, from government departments down to individual regulators.[127] It is therefore crucial to have clarity as to which departments and regulators have ownership of various aspects of GGR regulation.

Although the detail of GGR regulatory control is scattered amongst multiple regulators, DESNZ plays the dominant role in GGR policy and strategy development, particularly in England and also across the UK for energy policy. DESNZ's GGR focus is primarily on engineered techniques with industrial scaling potential, although the full spectrum of GGR techniques is recognised within the Government narrative.[128] The need for Government support is unequivocal for GGR scaling, and DESNZ is addressing this support through the recent development of the GGR Business Model and associated CfD, together with proposed integration of certain GGRs into the UK ETS (see Chapter 5.2). DESNZ's statutory abilities to create these models and contracts also grants the ability to decide which GGR techniques are

125 *ibid*
126 Woodland Carbon $CO_2$de, 'Governance' <www.woodlandcarboncode.org.uk/governance> accessed 28 July 2025
127 For example, the EA and Natural England are regulators under Defra, SEPA and NatureScot are regulators under the Scottish Government Environment and Forestry Directorate, NRW is a regulator under Welsh Government, and NIEA is a regulator built within DAERA
128 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025), see also: Element Energy, UK Centre for Ecology and Hydrology, 'Greenhouse gas removal methods and their potential UK deployment' (October 2021) <https://assets.publishing.service.gov.uk/media/616ff80ce90e07197b571c95/ggr-methods-potential-deployment.pdf> accessed 28 July 2025, 92 - here engineered techniques (DACCS and BECCS) have been highlighted since early-stage research as potentially providing the most efficient pathways to the greatest GGR gain in the short term; and the UK Government's latest exploration of the full potential of these GGRs through the Independent Review: UK Government, Department for Energy Security & Net Zero 'Greenhouse gas removals independent review: call for evidence' (16 May 2025) <www.gov.uk/government/calls-for-evidence/greenhouse-gas-removals-input-to-the-independent-review/greenhouse-gas-removals-independent-review-call-for-evidence#how-to-respond> accessed 28 July 2025

to be considered under these support structures,[129] thus defining the parameters of what is and is not considered a GGR within policy development.

Defra, on the other hand, has strongly integrated policy responsibilities in relation to nature-based GGR solutions,[130] although Defra's policy narrative avoids strict GGR terminology. The reasoning behind this, as raised by Defra in interview, is that while DESNZ holds the policy or regulatory responsibilities for GGRs at large, this essentially precludes Defra from owning any of the policy or regulatory responsibility for the same, as they have no statutory power to designate or categorise what techniques can be GGRs or should be supported as GGRs.[131] This delineation is demonstrable in current work being undertaken with the British Standards Institution by DESNZ and Defra for 'Voluntary Carbon and Nature Markets'[132] and 'Nature Markets'[133] respectively. The former contains a direct carbon and GGR narrative, whilst the latter does not.

A substantial part of this chapter focuses on the roles of regulators; however, the role of governmental departments is pivotal. One important example, as flagged by Defra,[134] is how the UK Government, in particular DESNZ and Defra, approach legislation which defines GGRs (see also Chapter 1.4). Defra is responsible for multiple roles under the Climate Change Act 2008, within which GGRs are defined within the parameters of 'atmospheric' $CO_2$,[135] whereas DESNZ have sets of responsibilities in respect of the Energy Act 2023, within which is a more exact definition including capture industrial emissions, atmospheric capture, and sea water capture.[136] These acts both define GGRs in different ways, with the Energy Act providing a more definitive platform upon which the UK Government can develop GGR policy, making this the definition of choice for government departments in many circumstances. Using the more precise legal definition of the Energy Act could assist with elements of policy which are fundamental to GGRs. However, this raises questions as to how to cater for novel GGR techniques within the more structured Energy Act definition, which will need to be addressed in future. The uncertainties present at this most fundamental level of GGR regulation will inevitably percolate to regulators and other bodies, creating a potentially unpredictable policy future in the near-term. In addition, the pressure to create or update legislation which is conducive to GGRs, as well as enabling government departments to meet policy demands, both also contribute to the Regulatory Paradox, potentially stifling legislative progress where and when it is required.

The GGR policy ownership between DESNZ and Defra creates challenges which were raised by a number of interviewees. Defra highlighted that the interlinkage between engineered GGR policy (as governed by DESNZ) and policy governance of nature-based solutions (as governed by Defra) inevitably leads to questions regarding GGR techniques which involve both engineered and nature-based elements, namely biochar, ERW, and marine GGRs. These

129 For statutory powers see generally Energy Act 2023, s67, with GGRs falling under s67(7)
130 For example, forestry, peatland, and wider policy governance for land, air, water, waste etc. See generally: UK Government, Department for Environment, Food and Rural Affairs 'About Us' <www.gov.uk/government/organisations/department-for-environment-food-rural-affairs/about> accessed 28 July 2025
131 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
132 For details see: UK Government, Department for Energy Security & Net Zero 'Voluntary Carbon and Nature Markets: Raising Integrity' (2025) <https://assets.publishing.service.gov.uk/media/67ff86a6ed87b81608546788/vcnm-integrity-consultation-document.pdf> accessed 28 July 2025
133 British Standards Institution 'BSI Flex 701 v2.0 Nature Markets – Overarching Principles and Framework' (March 2025)
134 Information provided by Participant 6570675, Department for Environment, Food & Rural Affairs (online, 12 September 2025)
135 Climate Change Act 2008, s29
136 Energy Act 2023 s67(7)

techniques utilise both nature-based and engineered pathways, therefore questions arise as to how to balance varying interests and controls most efficiently.[137] DESNZ maintains the policy lead on biochar and ERW;[138] however, the role within agriculture that these techniques play is a notable consideration for Defra. Questions were raised regarding this by other interviewees, for example NFU, which noted frustration felt by stakeholders over the perceived opacity between DESNZ and Defra policy ownership of biochar and ERW, which are of interest to the farming community.[139] Similarly, the policy control of biomass for GGRs was raised as an example by PBC4GGR GGR-D, where DESNZ control UK biomass policy due to its linkage to energy,[140] however there are environmental factors relating to biomass which fall more within Defra's remit.[141] It is clear that clarity is required to address these concerns, and how then responsibility for these GGR techniques will be passed through to regulators. It is not yet anticipated how the distribution of regulatory responsibility will be addressed in the long term, it was recognised by DESNZ in interview that it may be primarily a question of practicalities, including factors such as resources, budget and manpower to facilitate scaling of these activities.[142] This is interconnected with questions of regulatory capacity (see chapter 4.3). There is a risk here that with no clear delineation of responsibility from the outset, the pathway to scaling remains unclear and vulnerable to delay.

## 4.2 Regulator knowledge and expertise

Certain regulators have a broad remit when it comes to the regulation of GGRs – for example, those which have a role in planning, environment, or financial support mechanisms. From the perspective of accumulating expertise and knowledge, the benefits and potential challenges that a broad remit can create was explored in interview with the EA, who noted that with many GGR technologies being novel, there is a collective desire amongst regulators for learning and exploring the issues that particular technologies may face, for example where existing legislation does not quite align with GGR activities.[143] It is in these scenarios that consistent and structured cross-regulator collaboration on GGRs would provide benefit and accelerate knowledge accumulation, particularly in the context of potential future GGR projects spanning multiple UK jurisdictions.

With regard to law-specific expertise, knowledge of GGRs within regulators spans multiple disciplines, including science, policy and law. Defra noted that although there is expertise and capacity within the Department, the law is not always the primary consideration.[144] This was a point raised in connection to marine GGR demonstrators associated with Defra, where policy and scientific knowledge were well-aligned, but legal input was lacking until a hurdle presented itself.[145] Therefore, legal expertise should be a priority for government

137 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
138 See for example: UK Government, Department for Energy Security & Net Zero, 'Powering Up Britain: Net Zero Growth Plan' (April 2023) <www.gov.uk/government/publications/powering-up-britain/powering-up-britain-net-zero-growth-plan> accessed 29 July 2025
139 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
140 See for example: UK Government, Department for Energy Security & Net Zero, 'Biomass Strategy' (2023) <https://assets.publishing.service.gov.uk/media/64dc8d3960d123000d32c602/biomass-strategy-2023.pdf> accessed 29 July 2025
141 Interview with Participant 9486769, PBC4GGR GGR-D (online, 6 February 2025)
142 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
143 Interviews with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025)
144 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
145 The legal hurdle in this scenario being the London Convention and London Protocol, see further Chapter 16

departments and regulators across the UK, as it is crucial for the purposes of identifying barriers to GGR deployment. If these barriers are only identified in the latter stages of project development, this can be costly to both projects and regulators. Regulators already go some way towards addressing the importance of the law being at the forefront of GGRs, for example SEPA reported that for new technologies, regulators will collaborate on regulatory gap assessments during policy and legislative development cycles, both at UK and national level.[146] This approach could be deployed in-house at a more integrated scale within regulators, so identification of regulatory gaps and hurdles can be identified at a project level and on an accumulative basis.

Although it has not yet been flagged as an issue for GGRs, there is more general recognition amongst UK regulators that in-house expertise is not easy to acquire or retain.[147] The consequences of this that have been encountered include risk-averse decision-making (an issue already present due to environmental regulator mandates) and challenges of regulators and stakeholders building productive relationships.[148] These issues may become relevant in future for GGRs, so attention should be given to retaining the expertise already accumulated, and augmenting knowledge through collaboration with industry. In the context of public spending pressures, however, development and retention of regulator in-house expertise is a challenge with no easy solution.

DESNZ noted that departments and regulators already benefit from external GGR expertise, deriving from academia and industry.[149] There is the universally recognised importance of regulators having in-house expertise to adapt to novel technologies and industries.[150] However, regulators have strong relationships with the research community which should be utilised where possible. SEPA highlighted that academia can often be the starting point of knowledge assimilation and collaboration,[151] corroborating DESNZ's position. This highlights the importance of a broad stakeholder base for regulators, gaining a range of perspectives to plug their knowledge gaps. These knowledge-sharing techniques are to be encouraged and augmented as the tempo of GGRs increases.

## 4.3 Regulator Capacity

Issues of regulator capacity span efficiency considerations, limited departmental budgets, and structural capacity. Efficiency considerations tie in with both GGR engagement and expertise as discussed above, particularly in relation to how regulators communicate with one another, and how they build and retain expertise. Larger regulators and government departments are strongly linked, for example the EA's widespread role in regulating GGR operations ensures that DESNZ maintains close contact to ensure regulatory alignment, particularly in relation

146 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
147 See for example: UK Government, Department for Business & Trade, 'Smarter Regulation and the Regulatory Landscape: Summary of findings from the Call for Evidence' (May 2024) <https://assets.publishing.service.gov.uk/media/6645ec73bd01f5ed32793d13/summary-of-findings-from-the-call-for-evidence.pdf> accessed 29 July 2025, 51-58
148 *ibid*
149 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
150 Cary Coglianese, 'Regulating New Tech: Problems, Pathways, and People' (December 2021) TechREG Chronicle, Issue 1, 9-10; and UK Government, Department for Business & Trade, 'Smarter Regulation and the Regulatory Landscape: Summary of findings from the Call for Evidence' (n147), para 58
151 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)

to the incorporation of GGRs into the UK ETS and the GGR business models.[152] On the other hand, some smaller regulators noted that increased coordination of communication across the UK would be beneficial going forwards, particularly for the devolved nations approaching new technologies.[153] This would assist with addressing any lack of knowledge that smaller regulators encounter due to capacity constraints, for example budgetary constraints or access to the appropriate expertise.

Some capacity-related issues are attributable to the structure of government departments and regulators. Defra stressed the importance of these limitations in interview, that departments and regulators are not designed to innovate and regulate 'on the hoof', and the expectation for regulators to react rapidly and on a rolling basis to innovation is counter to institutional structures and capacity.[154] The deeply historic and legally evolutionary nature of Defra's regulatory framework has been highlighted by those reviewing the Department's structure.[155] This again loops back to the paradoxical struggle that regulators face when making decisions, combined also with Defra's undefined ability to address GGR policy as discussed at Chapter 4.1.2. Together, these factors reduce the capacity of Defra to respond to GGR innovation rapidly.

## 4.4 A new regulator?

There was mixed appetite across interviewees for a new regulator to manage GGRs under a more encompassing structure. Casting back to initial consideration of GGRs undertaken by DESNZ's former incarnation BEIS (Department for Business, Energy and Industrial Strategy), it was flagged that an independent regulatory function or regulatory body would have to be created for the purposes of monitoring, reporting and verifying GGR activities in the UK.[156] Although interviewees acknowledged there were disparate and often disjointed roles between regulators, the majority of interviewees did not see a new GGR-specific regulator as solving these challenges. This position aligns with the current Government action plan to reduce the number of regulators across England, and streamline other regulators, some of which are UK-wide.[157] An alternative to a new regulator, suggested by the Green Alliance, would be an 'Office for Carbon Removal',[158] creating an overarching governance body to coordinate existing regulators and providing oversight. Intended benefits of this proposal include reduction of fragmentation of GGR governance, which would address some of the concerns surrounding regulator engagement (Chapter 4.1), and also a centralisation and independence of specialist knowledge across GGR techniques, which would seek to address regulator expertise and knowledge-sharing (Chapter 4.2). It remains to be seen whether this proposal or similar will be considered in future GGR regulatory and governance development.

At a GGR technique-specific level, one interviewee vocalised the benefits of centralised regulation of GGR activities, to optimise the best use for and provide oversight of various GGR

152 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
153 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)
154 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
155 Dan Corry (n23), 32
156 UK Government, Department for Business, Energy & Industrial Strategy, 'Monitoring, Reporting and Verification of Greenhouse Gas Removals: Task and Finish Group Report' (October 2021) <www.gov.uk/government/publications/monitoring-reporting-and-verification-of-ggrs-task-and-finish-group-report> accessed 30 July 2025, 5, 27
157 UK Government, HM Treasury, 'New approach to ensure regulators and regulation support growth' (n6)
158 James Elliott, 'The case for a UK Office for Carbon Removal' Green Alliance (June 2023)

supply chains, such as biomass.[159] A more common viewpoint from industry interviewees was that regulators could continue to exercise their current regulatory functions, but in order to address issues such as lack of interlinkage and expertise, regulators should increase communication and knowledge-sharing to promote a more streamlined experience for GGR industry.

## CHAPTER 4 – FINDINGS AND RECOMMENDATIONS

### Engagement

- ✓ Networks such as the EA's GGR Hub are helpful for facilitating GGR engagement
- ✓ Government involvement in reputable independent bodies can increase regulator knowledge and adoption of best practice
- ✓ Crucial to clarify the correct balance of responsibility for GGRs between DESNZ and Defra for accuracy of regulator roles

### Expertise

- ✓ Inter-regulator knowledge-sharing structures should be created to accelerate GGR knowledge dissemination
- ✓ Integrated and retained GGR legal expertise should be a priority area for regulators
- ✓ Regulators should focus on building productive relationships with stakeholders for knowledge-sharing, including the research community

### Capacity

- ✓ Increased coordination and communication would benefit smaller regulators UK-wide
- ✓ Recognition that difference in capacity between regulators leads to gaps in legal expertise
- ✓ Capacity of regulators to respond to rapid innovation can be limited by regulator structure and government department design

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- ✓ Overall, there is little desire for a new GGR regulator, but a need for existing regulators to increase communication and knowledge-sharing to streamline regulation of GGRs
- ✓ A new 'Office for Carbon Removal' has been suggested by the NGO community as a potential solution to GGR regulatory fragmentation and decentralised knowledge

Figure 3: Chapter 4 Findings and Recommendations

159 Interview with Participant 1373498 and Participant 4330535, GGR-Peat GGR-D (online, 4 February 2025)

# Chapter 5 – GGR finance and incentives

A facilitative legal framework for project operations is by no means the only mechanism required to scale GGRs. Financing and incentives for GGR activities are crucial for every project and other stakeholders which are potentially imposed upon by GGR development, such as landowners and land managers. Questions of how to structure and source GGR finance permeate a vast portion of available literature, spanning more general transitional finance,[160] supply and demand,[161] carbon markets,[162] and subsidy regimes.[163]

It goes beyond the scope of this report to discuss these broad financial themes, or analyse the current distribution of finance to public, private, or blended finance for GGR activities. This in turn excludes deliberation of the role of non-legal funding mechanisms, such as concessional finance, which are not based on statutory entitlements or direct legislative allocation. There are, however, certain circumstances where public financing and incentives intersect the law and legal mechanisms, which are discussed within this chapter. For the sake of fullness, this chapter does contain certain financing suggestions from interviewees which may not necessarily fall within existing legislative structures, but nevertheless merit contemplation for the future of GGR scaling.

Properly legislated support for GGR technologies could provide more beneficial financial pathways for projects, as opposed to case-by-case direct grant funding which provides immediate incentive, but is noted by some as potentially not being the most efficient mechanism of support.[164] In addition, legislation is perceived by regulators as being crucial in the context of GGR finance and the reliability of carbon markets, as legislation supports the reliability of GGR claims in the context of establishing strong markets and associated government funding.[165] Each GGR technique has different financial demands at each stage of its life cycle, therefore operators often have specific financial needs for certain parts of the GGR value chain. Through discussing these challenges in interviews, this has led to GGR-specific reflections on finance and incentives throughout this chapter, as opposed to generalised or market-wide financial mechanisms which form the focus of other literature in this area.

160 City of London Corporation, 'Scaling Transition Finance: Findings of the Transition Finance Market Review' (October 2024) <www.theglobalcity.uk/PositiveWebsite/media/Research-reports/Scaling-Transition-Finance-Report.pdf> accessed 30 July 2025

161 See for example: Madison Cuthbertson and others, 'Without mandated demand for greenhouse gas removal – High integrity GtCO2-scale global deployment will be jeopardized: Insight from US economic policy 2020–23' (15 October 2024) Applied Energy, Vol 372

162 For example: Mirte Boot and others, 'Markets & Mandates: Policy Scenarios for UK CCS Deployment & Exploring the Role of a Carbon Takeback Obligation' Oxford Net Zero, Carbon Balance Initiative, Carbon Capture and Storage Association (January 2025)

163 Johanna Arlinghaus and others (n30)

164 *ibid,* 11

165 Interview with Participant 9830922, Natural England (online, 16 April 2025)

## 5.1 Voluntary Carbon Markets

VCMs can be defined as "a set of platforms through which companies, governments and individuals voluntarily finance projects that avoid, reduce or remove emissions."[166] The VCM is not subject to direct public legal control or regulation in the UK. The carbon crediting and offtake agreements which are formed within VCM arrangements still of course are governed by contract and other related aspects of private law.[167] However, these areas of law do not fall strictly within the remit of this report. However, as discussed below, contrary to their non-regulated nature, the VCM forms an integral role to GGR scaling and regulated GGR support in the UK, which makes them a noteworthy feature in this regulatory review.

Despite their non-publicly regulated nature, the UK Government has still provided a steer on how the VCM should be engaged with my UK companies. DESNZ developed six policy principles for voluntary carbon and nature market integrity, outlining what companies should be aspiring to achieve with their engagement in VCMs.[168] These principles include the pursuit of high integrity credits, disclose of credit use, and cooperation to create VCM market growth. One of the principles addresses the accuracy of green claims, for example claims made by companies regarding the use of carbon credits and the company's environmental impact. It is outwith the scope of this report to delve into the intricacies of consumer protection and advertising law, however green claims made by companies form a crucial consideration for the Competition and Markets Authority (CMA) and the Advertising Standards Authority (ASA). False green claims, commonly coined 'greenwashing', are addressed by codes developed by the CMA[169] and ASA,[170] and the ASA has ruled on multiple greenwash claims in the UK.[171] The volume of greenwashing claims in the UK is steadily increasing, and this is something GGR companies should be acutely aware of as the sector scales.

Beyond these principles, the UK Government is considering the role VCM standards and methodologies can play in the development of government-led standards, which will be relevant from a legal point of view through the CfD for engineered GGRs in particular, as well as future integration of GGRs into the UK ETS (see Chapter 5.2). As demonstrated by a recent DESNZ consultation, developing principles for voluntary carbon and nature market integrity is a key focus for GGR market development,[172] and through instructing British Standards Institution, 'Minimum Quality Thresholds' standards for BECCS[173] and DACCS[174] have been developed. This convergence of technical expertise, VCM actors, and law, necessitates strong industry engagement with both Government and bodies creating these standards.

166 Christopher Lomax and others (n50), 33
167 For discussion on liability within VCM, see Navraj Singh Ghaleigh and Justin Macinante, 'Déjà vu All Over Again: Carbon Dioxide Removals (CDR) and Legal Liability' [2023] Journal of Environmental Law 377
168 UK Government, Department for Energy Security & Net Zero, 'Principles for voluntary carbon and nature market integrity' (November 2024) <www.gov.uk/government/publications/voluntary-carbon-and-nature-market-integrity-uk-government-principles/principles-for-voluntary-carbon-and-nature-market-integrity> accessed 6 August 2025
169 UK Government, Competition & Markets Authority, 'Making environmental claims on goods and services' (September 2021) <www.gov.uk/government/publications/green-claims-code-making-environmental-claims/environmental-claims-on-goods-and-services accessed> 20 September 2025
170 See ASA's codes for broadcast and non-broadcast advertising: Advertising Standards Authority, 'Advertising codes' <www.asa.org.uk/codes-and-rulings/advertising-codes.html> accessed 20 September 2025
171 For more information on greenwash in the UK, see Navraj Singh Ghaleigh 'Between Scepticism and Rigour: Greenwash and UK Advertising Regulation' (July 2025) Edinburgh School of Law Research Paper, Vol 2025, No 17
172 UK Government, Department for Energy Security & Net Zero 'Voluntary Carbon and Nature Markets: Raising Integrity' (n132)
173 British Standards Institution, 'Bioenergy with carbon capture and storage (BECCS) – Quantification of greenhouse gas (GHG) emissions and Licensed removals – Specification' BSI Flex 2006 v1.0 (July 2025)
174 British Standards Institution, 'Direct air carbon capture and storage (DACCS) – Quantification of greenhouse gas (GHG) emissions and removals – Specification' BSI Flex 2007: v1.0 (July 2025)

Subsequent to these standards, full methodologies for the verification, accreditation and issuance of GGR credits for DACCS and BECCS activities will be developed, defined within the GGR Business Model as the "GGR Standard".[175] All carbon credits will be put into a registry, in line with international standards, specifically the Integrity Council for the Voluntary Carbon Market's Core Carbon Principles (ICVCM).[176] This again demonstrates the important role voluntary standards are playing in the development of engineered GGR regulation and control in the UK. The role the VCM plays in the GGR Business Model is discussed in more detail at Chapter 5.2.3 below.

## 5.2 UK Emission Trading Scheme, Business Models, and Contracts for Difference

### *5.2.1 UK ETS: BECCS and DACCS*

The UK ETS is UK-wide and was created under The Greenhouse Gas Emissions Trading Scheme Order 2020, following the UK's withdrawal from participating in the EU ETS. The UK ETS is one of the primary focal points of DESNZ for GGR policy and financial support, and in recent years the potential integration of GGR techniques into the UK ETS has been scrutinised widely.[177] Following an extensive consultation, the UK ETS Authority (comprised of representation from all four nations) has outlined jointly which GGR techniques will most likely be integrated into the UK ETS as of 2029. Engineered GGR techniques which have demonstrable and evidenced $CO_2$ sequestration permanence of at least 200 years will be included,[178] which ultimately narrows the near-future focus to DACCS and BECCS technology pathways (although note that woodland and forestry are also being considered in the long-term in certain circumstances[179]). This aligns with the EU's proposed regulatory updates to include BECCS (or other 'BIOCCS' pathways) and DACCS into the EU ETS, with a focus on 'permanent removals'.[180]

The framework for the UK ETS is built within statute, and the CfD structure by which certain ETS-ready GGRs will be supported through Government is also a legal mechanism, albeit a private law contract. The inclusion of a minimum 200-year permanence requirement in both UK ETS legislation and the related CfD creates support for GGR pathways which can evidence the requirement. Through the standards necessitated in contract, these GGRs will carry with

175 UK Government, Department for Energy Security & Net Zero, 'Greenhouse Gas Removals: Standard Terms and Conditions' (August 2025) <https://assets.publishing.service.gov.uk/media/68ad8fcdbceafd8d0d96a180/greenhouse-gas-removal-standard-terms-and-conditions-august-2025.pdf> accessed 18 September 2025, part 1, s1 'Definitions and Interpretation'

176 The Integrity Council for the Voluntary Carbon Market, 'The Core Carbon Principles' <https://icvcm.org/core-carbon-principles/> accessed 5 September 2025

177 See for example: Fankhauser and others, 'Consideration of Greenhouse Gas Removals (GGR) in Emissions Trading Systems: Principles and Practice' $CO_2$RE, NEGEM (April 2022) <https://co2re.org/wp-content/uploads/2022/06/ETS-workshop-report-v3.pdf> accessed 5 September 2025

178 UK Government, Scottish Government, Welsh Government and Department of Agriculture Environment and Rural Affairs, 'Integrating Greenhouse Gas Removals in the Emissions Trading Scheme: Main Response' (July 2025) <https://assets.publishing.service.gov.uk/media/687f61598adf4250705c9765/uk-ets-ggrs-main-response.pdf> accessed 5 September 2025, 19-22

179 UK Government, Scottish Government, Welsh Government and Department of Agriculture Environment and Rural Affairs, 'Analytical Annex to Integrating Greenhouse Gas Removals in the Emissions Trading Scheme: Main Response' (July 2025) <https://assets.publishing.service.gov.uk/media/687e7596791bb4d8c309a079/uk-ets-ggrs-main-response-analytical-annex.pdf> accessed 5 September 2025

180 Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2021/1119 establishing the framework for achieving climate neutrality, COM (2025), 524 final, Recital 8

them thoroughly developed methodologies and verifications, creating a legal catalyst for best practice. The value of creating standards which align with the EU and the Carbon Removals and Carbon Farming (CRCF) Regulation[181] was noted in interview, particularly from the perspective of GGR operators working across multiple jurisdictions.[182] From the perspective of industry, said value includes the creation of an efficient liquid market and unlocks investment, as well as instilling best practice as widely as possible.

From a regulatory perspective, the UK ETS Regulations allocate regulators in each jurisdiction to lead the UK ETS within their jurisdiction, namely the EA, NRW, SEPA, and DAERA (the chief inspector).[183] However, DESNZ maintains a central role in policy and legislative development. Possible complexities arise in relation to Northern Ireland's obligations to adhere to the EU ETS for power generation, and the UK ETS for all other activities. This unique position may present a challenge for future power BECCS projects in Northern Ireland, which would have a power generation element, and a carbon sequestration element, therefore potentially requiring adherence to two ETS frameworks. A notable factor for this challenge is the potential linkage of the UK and EU ETSs, which is an avenue being explored by UK and EU leaders.[184] It remains to be seen how this will develop; however, the prospect is welcomed by industry representatives for CCS.[185]

### *5.2.2 Perspectives on GGR integration into the UK ETS*

Interviewees highlighted several important factors when considering the inclusion of various GGR techniques into the UK ETS. One of the fundamental benefits of UK ETS inclusion noted by industry is the clear demand that a regulated system can create, providing investor certainty for GGR projects.[186] This clarity must also firstly extend to the overall regulation of GGRs in order to facilitate their operation, for example overcoming the paradoxical deficit of evidence which slows regulatory change. Similarly, when considering the allocation of responsibility for GGRs to regulators and the lack of clarity surrounding it, GGR integration into the UK ETS extends to the specific role each relevant regulator will have in measuring carbon removal within GGR projects and the parameters of the life cycle which would need to be considered. The DESNZ consultation on GGR integration into the UK ETS did not allocate regulator responsibility for different GGR technique life cycles. This is an area which will require consideration, bearing in mind the challenges regulators face as outlined in Chapters 3 and 4.

From the perspective of industry, it is not just $CO_2$ which is an important feature of financing for GGR projects, but also the products which projects can manufacture as part of their GGR activities. In relation to biochar, one interviewee noted the vast differences in pricing and quality for biochar produced through voluntary carbon markets. High-quality projects

181 Regulation (EU) 2024/3012 of the European Parliament and of the Council of 27 November 2024 establishing a Union certification framework for permanent carbon removals, carbon farming and carbon storage in products
182 Interview with Participant 8467194, Equinor (online, 14 March 2025)
183 The Greenhouse Gas Emissions Trading Scheme Order 2020/1265, reg 9(1)(b)
184 Juan Fernando López Hernández, 'Linking the EU and UK emissions trading systems' European Parliamentary Research Service, Briefing PE 775.873 (July 2025) <www.europarl.europa.eu/RegData/etudes/BRIE/2025/775873/EPRS_BRI(2025)775873_EN.pdf> accessed 7 September 2025
185 Carbon Capture and Storage Association, 'UK-EU ETS Linkage paves the way for cross-border CO2 transport and storage' (19 May 2025) https://www.ccsassociation.org/all-news/uk-eu-ets-linkage-paves-the-way-for-cross-border-co2-transport-and-storage/ accessed 6 September 2025
186 Interview with Participant 8467194, Equinor (online, 14 March 2025)

are rewarded, but the lack of control of low-quality products poses environmental and reputational risk. Inclusion of biochar to the UK ETS would rectify the lack of quality floor, but from the perspective of biochar industry the negative consequence of this is that the price point for high-quality products would drop, disincentivising high standards.[187] The importance of recognising differentiated products with variable price points was similarly raised in the broader context of including various GGR techniques into the ETS, as some techniques create more durable options than others, requiring to be reflected through price.[188]

Another consideration is the concept of 'revenue recycling', which has been considered throughout the lifespan of the UK ETS since 2020.[189] This concept involves using revenue gained from the UK ETS to support projects, for example decarbonisation projects, or alleviate the financial pressures created from UK ETS expansion, and remains something which is deliberated in research today.[190] The UK Government and devolved nations confirmed they would examine the potential of revenue recycling for decarbonisation projects, however this has not been pursued.[191] The intention behind the revenue raised from the UK ETS is that it will decrease as emissions lower over time, and it would potentially be a challenge to balance the needs of various industries and financial demands when allocating revenue. On the other hand, it is indisputable that we require GGRs to scale, which in turn need cash injection, therefore revenue recycling remains an area of consideration.

In the context of complexities of the UK ETS, the upcoming integration of EfW into the UK ETS in 2028 was raised in interview. This 2028 integration deadline matches that of the integration of GGRs, therefore progress made on the integration process for EfW is a useful indicator of challenges which may arise for GGR integration. Interviewees noted the uncertainties surrounding the methodology by which biogenic and fossil carbon emissions are calculated from waste, and SEPA noted that the UK ETS Authority is continuing to explore the opportunities for providing an appropriate MRV option to meet UK ETS monitoring requirements for EfW. This includes options such as continuous emissions monitoring and sector-specific emissions monitoring factors. SEPA noted that certainty regarding MRV is of key importance to the EfW sector given the inconsistency in the biomass content of their feedstock in comparison to other sectors within the UK ETS.[192] This observation is transferrable to the scenario of introducing GGR techniques into the UK ETS, where MRV is in its relative infancy (in comparison to other sectors) and many problems still exist in seeking what is best for the sector on balance. In a UK ETS integration scenario, the commercial infancy of many GGR techniques may create a challenging environment in which UK ETS emission allowance reductions exceed the availability of decarbonisation projects.[193]

187 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
188 Interview with Participant 8467194, Equinor (online, 14 March 2025)
189 UK Government, HM Treasury, 'Net Zero Review: Analysis exploring the key issues' (October 2021) <https://assets.publishing.service.gov.uk/media/616eb3568fa8f52979b6ca3e/NZR_-_Final_Report_-_Published_version.pdf> accessed 6 September 2025, 36-37
190 See for example the proposal to use revenue to assist with societal impacts from UK ETS: Grantham Research Institute on Climate Change and the Environment and Energy Systems Catapult, 'The future of UK carbon policy: how could the UK Emissions Trading Scheme evolve to help achieve net-zero?' (LSE April 2022) <www.lse.ac.uk/granthaminstitute/wp-content/uploads/2022/04/The-future-of-UK-carbon-policy_How-could-the-UK-ETS-evolve-to-help-achieve-net-zero.pdf> accessed 6 September 2025
191 National Audit Office, *UK Emissions Trading Scheme* (HC 950 Session 2024-25)
192 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
193 Emission allowances permit the emission of one tonne of $CO_2e$: The Greenhouse Gas Emissions Trading Scheme Order 2020 (SI 2020/1265), s18(2)

It is proposed that there also be a differentiated GGR allowance included in the UK ETS, to be awarded to projects upon confirmation and verification of sequestered carbon.[194] This is a position supported by industry.[195] One risk to consider from this perspective is that if emission allowances are too low by the time under-developed GGRs reach commercial scale, and GGR allowances are only offered post-sequestration, this could create challenges for project scaling and commercial viability. The result of this squeeze is well-known and referred to as 'carbon leakage', where these operators will move to another jurisdiction outwith the UK in order to avoid the financial pressures of the UK ETS or other climate obligations.[196] This can lead to deindustrialisation and a likely failure to meet net zero goals. Designing GGR integration into the UK ETS necessitates a delicate balance between multiple interests and market impacts, as seen also with the design of CfDs for GGR projects (discussed further at Chapter 5.2.3), and will not be an easy task.[197]

### *5.2.3 Business Model and CfDs*

DESNZ has recently published the UK GGR Business Model, which is a carefully developed commercial tool designed to accelerate deployment of GGRs, specifically engineered GGRs.[198] Although the Business Model is not a legal mechanism, it is intrinsically linked to Government contracts and standards developed for engineered GGRs, and will inevitably dictate many project decisions made by GGR developers. The scope of this report limits the features of the Business Model which can be discussed, however but it will be an important aspect of engineered GGR development in the coming years.

For the purposes of this chapter, one of the important features of the Business Model is the role of the VCM, which is of integral importance to the Business Model. In the initial stages of the Business Model's implementation through CfDs, the price of GGR credits sold into the VCM by projects will form the reference price under the contract, dictating how much money the UK Government grants to the GGR project.[199] To align further with DESNZ's ambitions for high-integrity VCM engagement, the Business Model offers a 5% price discovery incentive, encouraging higher value carbon credits. These commercial structures demonstrate the role the VCM can have in structured financial support mechanisms going forwards, while the UK's compliance market for GGRs is developed (UK ETS).

Another important aspect of the Business Model from the perspective of early GGR industry is the potential recoverability of development expenditure costs, which would give projects more financial freedom and a reduced risk profile to explore the technical and commercial viability

194 UK Government, Scottish Government, Welsh Government and Department of Agriculture Environment and Rural Affairs, 'Integrating Greenhouse Gas Removals in the Emissions Trading Scheme: Main Response' (n178), 10

195 Interview with Participant 5723057, Drax (online, 6 March 2025)

196 See for example: National Economic Research Associates, 'Updated carbon Leakage Indicators for the UK Emissions Trading Scheme' (December 2024) <https://assets.publishing.service.gov.uk/media/6760245e0fb02bbe4853ef7d/ukets-nera-technical-report.pdf> accessed 20 September 2025; and The Commission for Carbon Competitiveness, 'Fixing the Carbon Leak' (July 2023) <https://carboncommission.co.uk/wp-content/uploads/2023/10/fixing-the-carbon-leak.pdf> accessed 20 September 2025

197 See for example Johanna Arlinghaus and others (n30), 11

198 Relevant documents regarding the Business Model and associated contractual documents: UK Government, Department for Energy Security & Net Zero 'Greenhouse Gas Removals (GGR): business model' (August 2025) <www.gov.uk/government/publications/greenhouse-gas-removals-ggr-business-model> accessed 10 September 2025

199 The 'difference' element of CfDs is the difference between the Strike Price (as agreed within the CfD) and the Reference Price, for a simple explanation see: UK Government, Department for Energy Security & Net Zero, 'Greenhouse Gas Removals: Greenhouse Gas Removals (GGR) Business Model Summary' (August 2025) <https://assets.publishing.service.gov.uk/media/68ad77c2969253904d1557ff/greenhouse-gas-removal-business-model-summary-august-2025.pdf> accessed 10 September 2025

of their projects. These benefits are recognised by DESNZ and form the reasoning for offering this financial support, which will be crucial for new technologies.[200] Similarly, a capital grant is also available for project construction cost support.[201]

Separate to the CfD is the $CO_2$ transport and storage charges, which is a feature of the Business Model that has drawn attention from industry. The strategic separation of transport and storage charges from the upstream GGR project provides a more appealing project risk profile, particularly for emerging GGR technologies which are developing the cost-effectiveness of their technology. The UK Government entity will pay the costs incurred by GGR developers, removing uncertainty as to whether the CfD will cover those costs. This will inevitably create a more appealing prospect for investors, and again reinforces the theme throughout the Business Model of risk reduction for GGR projects.

The private law contractual mechanism of CfDs is, as discussed elsewhere in this report, relevant to engineered GGRs, as the UK Government intends to provide CfDs for certain engineered GGRs, primarily BECCS and DACCS. This is an active workstream for DESNZ, as they look to update and apply the Carbon Capture Revenue Support (Directions, Eligibility and Counterparty) Regulations 2024 in order to operationalise the GGR and power BECCS business models.[202]

The development of the CfD support is pivotal from the perspective of funding enabled through law. CfDs provide predictable financial support for large-scale projects that cannot be addressed adequately by grant funding. Part of the appeal in pursuing this financial structure stems from the need for efficiency and certainty; CfDs are used consistently within the renewable energy industry, and are therefore viewed as lower risk by those who develop and operate them.[203]

Current CfD structures intended for use in engineered GGR projects focus on permanent carbon sequestration, however, the importance of support for carbon utilisation within CfDs is a point which was raised in multiple interviews, as well as recognising the importance that GGR-derived products can bring. Industry voiced concern that projects which make profitable products in GGR pathways could face reduced financial support through the CfD, which risks a reduction of investment made in the project.[204] It was also observed more generally that support for $CO_2$ utilisation would assist small or mid-scale GGR projects.[205] The Business Model does contain adjustments to revenue in certain circumstances if the GGR operator undertakes ancillary operations (for example fuel production or power generation), to ensure the subsidy granted through the CfD is not channelled towards those secondary benefits.[206] This will therefore be an important consideration for certain GGR developers considering utilisation pathways.

200 For a summary explanation of devex eligibility see *ibid*, 11-12
201 *Ibid,* 12
202 UK Government, Department for Energy Security & Net Zero, 'GGRs and Power BECCS business models: amending revenue support regulations relating to directions to a counterparty, publication of information, counterparty's ability to carry out its functions, and eligibility' (April 2025) <www.gov.uk/government/consultations/proposals-for-greenhouse-gas-removal-and-power-bioenergy-with-carbon-capture-and-storage-regulations/ggrs-and-power-beccs-business-models-amending-revenue-support-regulations-relating-to-directions-to-a-counterparty-publication-of-information-count> accessed 10 September 2025
203 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
204 Interview with Participant 7750314, Cambridge Carbon Capture Ltd (online, 7 February 2025)
205 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
206 UK Government, Department for Energy Security & Net Zero, 'Greenhouse Gas Removals: Greenhouse Gas Removals (GGR) Business Model Summary' (n200), 24

## 5.3 Agri-environmental support schemes

Financial support for agriculture varies between England, Wales, Scotland, and Northern Ireland, although all four nations have (or are developing) support mechanisms which include the environment, climate, or sustainability within agriculture. From a carbon sequestration outcomes-based perspective, Government departments noted the value that subsidies can bring, as opposed to the involvement of carbon markets, due to not needing to engage in or assess carbon-related monitoring, reporting, or verification requirements.[207]

At the forefront of agri-environmental support mechanisms in England is the Environmental Land Management Scheme (ELMS), which was created post-Brexit to replace the Common Agricultural Payment (CAP) scheme from the EU (which applied UK-wide). CAP is a subsidy scheme that covers European Union countries,[208] and was criticised pre-Brexit for not supporting the environment successfully.[209] In replacing CAP, the UK Government introduced the Agriculture Act 2020, enabling the Secretary of State to provide financial support for the purposes of environmental improvement and climate change mitigation.[210] The fundamental principle underlying ELMS is "public money for public goods".[211] Stipulations for compliance with ELMS are contained within legislation, including provisions for monitoring, terms of financial assistance, and powers of inspection.[212] These regulations incorporate Countryside Stewardship (CS), the Sustainable Farming Incentive (SFI), and Landscape Recovery.[213]

CS is formed of tiers: Mid Tier (including Wildlife Offer) and Higher Tier. CS Mid Tier, which has recently been closed, included multiple general grant options such as hedgerows and boundaries, water capital, and air quality.[214] CS Higher Tier offers more specific support, with the general purposes being for land management which facilitates environment restoration, biodiversity, water quality, and climate change mitigation efforts.[215] This includes grants to support specific landscapes such as moorland, saltmarsh, and woodland. CH Higher Tier

207 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
208 The regulation of CAP is contained within multiple EU regulations governing the period 2023-2027, for general information see: European Commission, 'The common agricultural policy at a glance' <https://agriculture.ec.europa.eu/common-agricultural-policy/cap-overview/cap-glance_en> accessed 10 August 2025
209 UK Government, 'A Green Future: Our 25 Year Plan to Improve the Environment' (January 2018) <https://assets.publishing.service.gov.uk/media/5ab3a67840f0b65bb584297e/25-year-environment-plan.pdf> accessed 10 August 2025, 36
210 Agriculture Act 2020, s1; For Scotland see the Agriculture and Rural Communities (Scotland) Act 2024, s6; for Wales see the Agriculture (Wales) Act 2023, s8; for Northern Ireland see the Agriculture Act 2020, Schedule 6
211 UK Government, Department for Environment Food and Rural Affairs, 'Environmental Land Management: Policy discussion document' (February 2020 <https://consult.defra.gov.uk/elm/elmpolicyconsultation/supporting_documents/ELM%20Policy%20Discussion%20Document%20230620.pdf> accessed 10 August 2025, 5
212 This is outlined through The Agriculture (Financial Assistance) Regulations 2021, as updated annually via statutory instrument
213 See generally: UK Government, Department for Environment Food and Rural Affairs, 'Environmental Land Management (ELM) update: how government will pay for land-based environment and climate goods and services' (June 2023) <www.gov.uk/government/publications/environmental-land-management-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services/environmental-land-management-elm-update-how-government-will-pay-for-land-based-environment-and-climate-goods-and-services> accessed 10 August 2025
214 UK Government, Rural Payments Agency, 'Applicant's guide: Mid Tier and Wildlife Offers for agreements starting on 1 January 2022' (June 2021) <www.gov.uk/government/publications/countryside-stewardship-mid-tier-and-wildlife-offers-manual-for-agreements-starting-on-1-january-2022/applicants-guide-mid-tier-and-wildlife-offers-for-agreements-starting-on-1-january-2022> accessed 10 August 2025; UK Government, Department for Environment Food and Rural Affairs, 'Countryside Stewardship Mid Tier and Wildlife Offers Manual' (March 2023) <https://assets.publishing.service.gov.uk/media/60e41eb98fa8f50aad4ddb7e/Countryside_Stewardship_Mid_Tier_2020_CS64_v1.0.pdf> accessed 10 August 2025
215 UK Government, Department for Environment Food and Rural Affairs, 'Countryside Stewardship: Higher Tier Manual' <https://assets.publishing.service.gov.uk/media/5f6b20d88fa8f55f363aebaa/CS_Higher_Tier_v2.0.pdf> accessed 10 August 2025; UK Government, Department for Environment Food and Rural Affairs, 'From invitation to agreement: our approach to the new CSHT' (July 2025) https://defrafarming.blog.gov.uk/2025/07/22/from-invitation-to-agreement-our-approach-to-the-new-csht/ accessed 10 August 2025

is to be offered initially on an invitation-only basis, creating uncertainty for those who have previously depended on Mid Tier support which is coming to an end.[216]

A similar scenario also presents itself in relation to SFI, which is designed to provide support per hectare for an array of environmental land management activities, such as soil health, moorland management, and nutrient management.[217] This scheme has recently been closed to new applications due to budgetary considerations, creating an abrupt deadline which was subsequently criticised and back-tracked for incomplete applications and certain other specific cases.[218] Uncertainties regarding SFI and CS were reflected in multiple interviews, and a lack of definitive funding in the near future from these sources restricts incentives for landowners and land managers to consider GGR projects which may benefit from such support.

The Landscape Recovery Scheme differs from the above support mechanisms in that it is designed to fund a select number of large-scale bespoke projects, blending public finance and private investment.[219] This scheme sees multiple landowners and land managers working together for the benefit of larger areas of land over a long duration (20-30 years). As is discussed in more detail at Chapter 8, the ownership and management of land can be complex and inharmonious with environmental or climate action. The Landscape Recovery Scheme has so far seen positive traction; however, questions exist over how these long-term commitments to land will co-exist with land law and changes in land management between Scheme collaborators. Questions have also been raised in connection to both the public and private funding elements, Scheme management, and complexity of collaboration.[220]

Agri-environmental schemes vary throughout the UK, and each nation has its own agricultural needs and priorities. At present, the Basic Payment Scheme (BPS) remains a feature in each nation, albeit being phased out over time, prior to the operationalisation of other jurisdiction-specific agri-environmental schemes which are being introduced. BPS is described as a safety net,[221] and is area-based, as opposed to outcome or action-based, the latter of which is far more valuable for environmental purposes.

In Wales, the Agriculture (Wales) Act 2023 introduced the Sustainable Land Management Framework, which is comparable to ELMS. Heralded as the first ever agricultural act for Wales,[222] it enables the powers of the Welsh Government to provide agri-environmental

216 James Agyepong-Parsons, 'England at 'risk of losing important habitats' as farming grant deadlines loom' ENDS Report (11 August 2025) <www.endsreport.com/article/1928494/england-risk-losing-important-habitats-farming-grant-deadlines-loom?bulletin=ends-report-daily-bulletin&utm_medium=EMAIL&utm_campaign=eNews%20Bulletin&utm_source=20250811&utm_content=ENDS%20Report%20Daily%20(48)::www_endsreport_com_articl_2&email_hash=> accessed 13 August 2025

217 UK Government, Department for Environment Food and Rural Affairs, Rural Payment Agency, 'Sustainable Farming Incentive (SFI): Handbook for the SFI 2023' (August 2025) <https://assets.publishing.service.gov.uk/media/6890cccb25ba7325501b09e6/SFI23_handbook_v12.0__August_25.pdf> accessed 14 August 2025, 9-10

218 UK Government, Department for Environment Food and Rural Affairs, Rural Payment Agency, 'SFI scheme information: re-opened offer for 2024' (August 2025) <www.gov.uk/government/publications/sustainable-farming-incentive-scheme-expanded-offer-for-2024/sfi-scheme-information-expanded-offer-for-2024#check-if-youre-eligible-to-applyfor-the-re-opened-sfi-2024-offer> accessed 20 August 2025; HC Written Statement 12 May 2025, Statement UIN HCWS626

219 Rebecca Kenner 'Landscape Recovery: first projects move into delivery phase' Department for Environment, Food & Rural Affairs, UK Government (29 August 2025) <https://defrafarming.blog.gov.uk/2025/08/29/landscape-recovery-first-projects-move-into-delivery-phase/> accessed 23 September 2025

220 See for example: Iona Y Huang and others, 'Landscape Recovery Pilot Scheme: to participate or not to participate?' Harper Adams University, Agriculture and Horticulture Development Board (March 2023) at <https://ahdb.org.uk/trade-and-policy/elms/landscape-recovery/assessing-attitudes> (accessed 23 September 2025)

221 For an overview see: Scottish Government, 'Rural Payments and Services' <www.ruralpayments.org/topics/all-schemes/basic-payment-scheme/basic-payment-scheme-full-guidance/> accessed 20 September 2025

222 Welsh Government, 'The Agriculture (Wales) Act 2023: Introducing the Sustainable Land Management Framework' (2023) <www.gov.wales/sites/default/files/publications/2023-11/agriculture-wales-act-2023-introducing-sustainable-land-management-framework.pdf> accessed 10 September 2025, 4

support. Support will be designed to align with legislated well-being goals for Wales,[223] demonstrating the value in devolved control of these support mechanisms. The Sustainable Farming Scheme is intended to be introduced in 2026,[224] and will include 12 universal actions for claimants. These include woodland maintenance, habitat maintenance (including newly restored peat), and benchmarking of environmental performance,[225] and all applicable actions are mandatory for claimants.

Scotland has announced an assortment of updated agri-environmental support, through the Agricultural Reform Route Map.[226] This includes a Whole Farm Plan, requiring an audit of the areas applicable to the claimant of Basic Payment Scheme support, which can include biodiversity audit and soil analysis. Importantly, the carbon audit is required for all claimants. From a GGR perspective, an interesting feature is support conditions to prohibit a range of activities on peat, including ploughing, applying substances such as fertiliser, and other activities that might damage the peat.[227]

In Northern Ireland, the Agriculture Bill (Northern Ireland) 2024 enables powers to provide agri-environmental support. This Bill remains in draft form, with the latest paper provided in January 2025 outlining parts of the Bill to be considered.[228] This slow legislative development is indicative of the long lead times agri-environmental support may face. Northern Ireland has in 2025 introduced the Farm Sustainability Transition Payment, to replace BPS,[229] with the Farm Sustainability Payment to follow in 2026. These transition payments remain area-based payment mechanisms, as opposed to orientated around environmental outcomes.

It is clear that each nation is at a different stage of agri-environment support development, with varying implementation and structures. For agri-environmental businesses operating in more than one UK jurisdiction, balancing and navigating funding sources will likely be complex, however there are benefits to these divergences, for example the tailoring of agri-environmental support to suit the respective nation, such as the aforementioned alignment of Welsh support with the well-being goals, or protections that Scottish agri-environmental support can provide to peatland.

Financial schemes and policy changes relevant to landowners and land managers frequently make headlines. Landowners and land managers form an influential portion of stakeholders relevant to GGR activities, and increasing policy tensions indicate a potential future difficulty for GGRs, a point raised by multiple interviewees. Current tensions with the farming community, namely changes to agricultural property relief,[230] have prompted a judicial

223 See Chapter 6.1 regarding Just Transition
224 Details can be found here: Welsh Government 'Sustainable Farming Scheme 2026: scheme description' (July 2025) <www.gov.wales/sustainable-farming-scheme-2026-scheme-description-html> accessed 10 September 2025
225 *ibid*
226 Scottish Government, 'Agricultural Reform Route Map' (June 2025) <www.ruralpayments.org/topics/agricultural-reform-programme/arp-route-map/> accessed 10 September 2025
227 *ibid*
228 Mark Allen, 'The Agriculture Bill (Northern Ireland) 2024' Northern Ireland Assembly Research and Information Service Research Paper (16 December 2024) <www.niassembly.gov.uk/globalassets/documents/raise/publications/2022-2027/2025/aera/0525.pdf> accessed 10 September 2025
229 Department of Agriculture, Environment and Rural Affairs, 'Guide to Farm Sustainability Transition Payment 2025' (October 2024) <www.daera-ni.gov.uk/publications/guide-farm-sustainability-transition-payment-2025> accessed 10 September 2025
230 UK Government, HM Treasury, 'Summary of reforms to agricultural property relief and business property relief' (October 2024) <www.gov.uk/government/publications/agricultural-property-relief-and-business-property-relief-reforms/summary-of-reforms-to-agricultural-property-relief-and-business-property-relief> accessed 10 September 2025

review.[231] This case is not linked to GGRs, but forms a useful benchmark of the tolerance of the farming community to change which is likely to have negative financial implications. From another perspective, the challenges and impacts that climate change is bringing to farming have led to legal challenges elsewhere in Europe, which should also be paid heed.[232] The general pressures faced by the farming community, combined with the likely future expectations of UK farmers to utilise GGR techniques (which, for example, will likely become more tangible for England following a confirmed Land Use Framework[233]) may create the prospect of litigation going forwards if the required support is not provided.[234]

In addition, changes to finance pathways proposed through the Planning and Infrastructure Bill have caused tension. Contrary to the 'public money for public goods' position is the proposal for a Nature Restoration Fund to be created through a Nature Restoration Levy from developers, within the Planning and Infrastructure Bill.[235] This fund is designed to provide a private stream investment for nature-related farming practices, orchestrated through statute, however many have criticised this and have raised concerns over how this will balance with public funding, creating a risk of funding shortfalls.[236] Although this funding is nature-orientated, as opposed to directly applicable to GGRs, it is demonstrative of the tensions which exist around government funding models and how legislation can influence funding streams and the perceptions of stakeholders receiving these funding streams.

231 FarmingUK 'Farmers launch legal fight over 'family farm tax' inheritance changes' FarmingUK (26 June 2025) https://www.farminguk.com/news/farmers-launch-legal-fight-over-family-farm-tax-inheritance-changes_66801.html accessed 10 September 2025

232 Charlotte E Blattner and others, 'Why farmers are beginning to take their government to court over climate change' (30 January 2025) Nature, Vol 637, 1050-1052

233 For the draft framework see: UK Government, 'Land Use Consultation' (January 2025) <https://consult.defra.gov.uk/land-use-framework/land-use-consultation/supporting_documents/Land%20Use%20Consultation.pdf> accessed 10 September 2025

234 For further comment on land use and land law Chapter 8

235 Planning and Infrastructure Bill 2025, s66-75

236 See for example: The Wildlife Trusts, 'The Wildlife Trusts warn UK Government not to inflict unparalleled policy 'hammer blow' on the countryside ahead of Comprehensive Spending Review' (4 June 2025) <www.wildlifetrusts.org/sites/default/files/2025-06/The%20Wildlife%20Trusts%20warn%20UK%20Government%20not%20to%20inflict%20disaster%20on%20the%20countryside.pdf> accessed 10 September 2025

## CHAPTER 5.1 – 5.3 – FINDINGS AND RECOMMENDATIONS

### UK ETS

- ✓ UK ETS will provide crucial support to engineered GGR pathways able to demonstrate carbon sequestration permanence, creating investor certainty
- ✓ Stakeholders suggest that associated standards and methodologies align with EU CRCF Regulations
- ✓ Northern Ireland must consider interactions between the UK ETS and EU ETS for the purposes of power generation
- ✓ The overall regulation of GGRs and the role of each regulator should be well-established and barriers resolved prior to UK ETS integration
- ✓ UK ETS pricing to reflect product and carbon sequestration quality produced by projects was noted as an important consideration from industry
- ✓ The concept of revenue recycling and channelling UK ETS revenue into GGR projects requires consideration from the perspective of industry
- ✓ If emissions or GGR allowances are not balanced correctly within the UK ETS, there is a risk of excluding new entrants or triggering de-industrialisation

### CfDs

- ✓ CfDs provide predictable financial support for projects
- ✓ CfDs are an appealing mechanism for Government as they have been utilised in other industries, therefore being perceived as lower risk
- ✓ Industry voiced concerns regarding the incorporation of carbon utilisation and GGR-generated products into CfDs, concluding support for CO2 utilisation would assist small and medium-sized projects

### Agri-environmental support mechanisms

- ✓ Government subsidies can bring direct benefits for GGR projects, without engaging in carbon-related MRV
- ✓ Withdrawal of schemes under ELMS and a lack of distinct funding options for land owners and land managers creates uncertainty
- ✓ Each UK jurisdiction provides different agri-environmental support mechanisms, potentially creating confusion for businesses or land managers operating across multiple UK jurisdictions, however equally creating scope for tailored support for each nation and its bespoke needs
- ✓ Government funding models face tension and complexity, which could potentially form a hurdle for future GGR support

Figure 4: Chapter 5.1-5.3 Findings and Recommendations

## 5.4 Finance and incentive support requirements identified by GGR stakeholders

All interviews addressed to some extent how funding mechanisms would or could impact the scaling potential of each GGR technique. For BECCS and DACCS, these considerations congregated primarily around UK ETS and CfD as discussed above, however for other GGR techniques, findings from interviewees are as set out below.

### *5.4.1 Biochar*

The financial viability of biochar was a key topic for all biochar stakeholder interviews. In some instances, and dependent on feedstock, issues of cost were pinpointed as the biggest restrictions to biochar scaling,[237] despite other regulatory barriers. Fundamentally, the finance available through voluntary carbon markets at present is not sufficient to create a profitable pathway for biochar as solely a carbon sequestration product, primarily due to the cost of biomass (avoiding waste pathways).[238] In turn, this limits how much cost can be lowered when selling biochar to land owners and land managers. It was also raised in interview that the current voluntary carbon accounting frameworks can sometimes fail to accommodate the full life cycle of biochar production, and instead only focus on the production process.[239] In the case of future regulatory or UK ETS inclusion of biochar as an engineered GGR solution, this full life cycle perspective should be taken into account. In response to the financial hurdles faced at the stage of selling to land owners and land managers, in particular farmers, the NFU stated that preferred incentive for farmers would be a commission of the money gained from carbon credits in order to compensate the potential risk or inconvenience of biochar landspreading activities.[240]

When exploring potential solutions to the financing and incentive structure for biochar, various options were discussed. One suggestion was to incorporate the use of pyrolysis into agri-environmental funding support, for example direct funding to subsidise capital expenditure costs for pyrolysis equipment for the purposes of carbon sequestration on agricultural land.[241] Other developers corroborated this position, noting that the initial capital for biochar projects is the challenge for a lot of projects, as opposed to ongoing running costs.[242] With the capital expenditure of this equipment being identified as the primary cost for biochar producers, such an incentive would assist new entrants with lower budgets. An alternative finance structure for addressing capital expenditure concerns would be low-interest loans or finance options provided to projects from government. However, it was noted here that this may create challenges when establishing risk allocation.[243]

Several other pathways to funding and incentivising biochar scaling were considered in interview. One option would be through direct grands and subsidies per hectare of biochar

237 Interview with Participant 7740413, GGR-Peat (online, 17 February 2025)
238 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
239 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
240 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
241 Analogies were drawn to the previous Farming Equipment and Technology Fund 2023: Interview with Participant 9316963, CapChar Ltd (online, 10 February 2025)
242 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
243 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)

scattered, such as remunerating landspreading as soil improvement through SFI.[244] This approach rewards the end stages of the life cycle. It has been noted that farmers are uncertain of the relationship between ELMS payment schemes and the deployment of biochar, and risk of ineligibility for scheme payments could dissuade farmers from spreading biochar unless there is clear guidance.[245] Another soil-focused incentive process would be to finance specific impacts arising from the spreading of biochar, such as credits associated with specific nutrient removals. This approach would be perhaps more akin to an independent standard such as the IUCN UK Peatland Code.

An alternative approach to creating demand for biochar would be to impose conditions within permitting, for example in relation to ammonia treatment (e.g., poultry farms) or slurry stores, under which biochar use is mandated to treat the waste produced.[246] The inclusion of requirements within permits would push the demand for biochar. Comparisons were drawn to recent developments in Denmark, where a carbon tax is now set on agricultural emissions, incentivising low-carbon solutions through necessity.[247] Biochar specifically has been granted a long-term subsidy framework, providing world-leading support for biochar, which several interviewees noted could be emulated in the UK.[248]

One final observation from industry was the potential GGR techniques such as biochar and ERW bring in relation to the 'insetting' of net zero targets, as opposed to offsetting. This would involve providing stakeholders which are seeking to reduce emissions, such as councils or large estates, with the opportunity to be involved in the GGR supply chain directly, as opposed to offsetting emissions by purchasing external carbon credits.[249] This provides multiple benefits to both the stakeholder and GGR operator, as investment is being injected directly into the GGR project through integration into the stakeholder's supply chain, as well as providing a transparent net zero narrative for the stakeholder. This also provides the opportunity to imbed GGR processes within local communities.

#### *5.4.2 ERW*

From the perspective of industry, deficiencies in financial support for ERW activities apply across the project life cycle. Funding requirements have been identified for the production and transport of basalt, as well as direct support for establishing further scientific evidence to underpin ERW activities.[250] In a scenario similar to marine GGR techniques, the evidence remains a prevalent consideration for ERW, and fuels the Regulatory Paradox preventing government support being provided for commercial operations. Certain innovation funding schemes exist, as administered by regulators, however these are focused primarily on farming practices, as opposed to whole GGR value chains, and are also case-by-case as opposed to

244 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
245 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
246 For the benefits biochar can provide to poultry farming see: Black Bull Biochar, 'Scientists, poultry producers, and biochar manufacturer collaborate to help restore River Wye' (8 May 2025) <www.blackbullbiochar.com/articles/scientists-poultry-producers-and-biochar-manufacturer-collaborate-to-help-restore-river-wye> accessed 3 June 2025
247 Økonomiministeriet, 'Regeringen og parterne i Grøn trepart indgår historisk Aftale om et grønt Danmark' (24June 2024) <https://via.ritzau.dk/pressemeddelelse/13927192/regeringen-og-parterne-i-gron-trepart-indgar-historisk-aftale-om-et-gront-danmark> accessed 3 June 2025
248 For pyrolysis specifically, see Klima-, Energi- og Forsyningsministeriet 'Strategi og arbejdsprogram for pyrolyse' (October 2024) <www.kefm.dk/Media/638638923282563772/Strategi%20og%20arbejdsprogram%20for%20pyrolyse.pdf> accessed 3 June 2025
249 Interview with Participant 9316963, CapChar Ltd (online, 10 February 2025)
250 Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025)

structured funding mechanisms such as ELMS.[251]

Crucial to the ERW supply chain is the final offtake of basalt to be spread on land. The lack of incentives for the offtake of weathering material can be compared readily to the lack of incentives to purchase biochar, including the challenge of solving how farmers could be subsidised for application of GGR products to agricultural land. It is at this stage of the life cycle that ERW could be considered within existing support structures, for example under SFI.

### *5.4.3 Marine GGRs*

Potential finance options for marine GGRs were only discussed in interview in the context of nature-based solutions and blue carbon. From the Scottish perspective, at the forefront of marine finance is the Scottish Marine Environmental Enhancement Fund (SMEEF).[252] Due to the questionability of additionality of blue carbon projects, SMEEF provides a useful platform for projects to receive funding from a co-benefits or community benefit perspective.[253] Similar schemes exist elsewhere in the UK, with varying focus on the environment, fisheries,[254] community capacity building,[255] and blue carbon restoration.[256] Blue carbon habitats like saltmarsh are already intended for inclusion in CS Higher Tier in England,[257] providing a support mechanism for blue carbon through agri-environmental payments. A second, more general suggestion for supporting blue carbon is to utilise the closed area space within offshore windfarms, where other activities are not permitted. Support or incentive to undertake blue carbon activities in closed areas would likely create an increase in those activities.[258]

Finance and incentives for other marine GGR activities, specifically engineered techniques, is a gap yet to be addressed in detail. So far, UK projects have received innovation funding for research and development purposes, however it is unclear as to whether more commercial-scale financing initiatives will be considered when such a small amount of evidence exists currently, linking back to the Regulatory Paradox.

### *5.4.4 Peatland Restoration*

Peatland funding has previously existed through multiple mechanisms, for example the Nature for Climate Peatland Grant Scheme,[259] and the IUCN UK Peatland Code also creates financial incentive to undertake peatland restoration. The fact that there are not currently any agri-environmental schemes applicable to peatland available in England and Wales[260] was raised by the IUCN as a concern, highlighting the importance of long-term financial signals for peatland restoration.[261] ELMS is identified as the primary source of financial support for peatland restoration activity in England,[262] which includes lowland peat under premium

251 For example, Farming Innovation Programme, as operated partly by Defra
252 Scottish Marine Environmental Enhancement Fund <https://smeef.scot/> accessed 3 June 2025
253 Interview with Participant 1300336, Scottish Blue Carbon Forum (online, 26 February 2025)
254 E.g. England Fisheries and Seafood Scheme
255 E.g. Wales Coastal Capacity Building Fund
256 E.g. Northern Ireland Marine Environment and Fisheries Fund
257 UK Government, Department for Environment Food and Rural Affairs, 'Countryside Stewardship: Higher Tier Manual' (n218)
258 Interview with Participant 1300336, Scottish Blue Carbon Forum (online, 26 February 2025)
259 UK Government, Department for Environment Food and Rural Affairs, Natural England, 'Nature for Climate Peatland Grant Scheme' (April 2021) <www.gov.uk/guidance/nature-for-climate-peatland-grant-scheme#restoration-grant> accessed 5 June 2025
260 UK Government, Department for Environment Food and Rural Affairs, 'An update on the Sustainable Farming Incentive' (11 March 2025) <https://defrafarming.blog.gov.uk/2025/03/11/an-update-on-the-sustainable-farming-incentive/> accessed 6 June 2025
261 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
262 UK Government, HM Treasury, 'Carbon Budget Delivery Plan' (n4), 101-102

payments.[263] Private finance for peatland restoration is not likely to be common throughout the UK, therefore government support is crucial. However, interviewees noted the importance of public finance being able to provide incentives without excluding the possibility of private finance contribution.[264]

One of the challenges associated with incentivising peatland restoration is the role of private land ownership. Previous suggestions for overcoming this hurdle have included a carbon emissions land tax.[265] This suggestion has not been incorporated into any proposed reforms, however it was flagged in interview as an interesting hypothetical solution to incentivising private landowners.[266]

In Scotland, requirements have been added to grant aided expenditure[267] to protect peatland from activities on peat which may degrade it.[268] Specific finance for peatland restoration in Scotland is also provided through Peatland ACTION.[269] Northern Ireland presents a unique position as it has domestic funding and has also recently received EU funding for peatland restoration.[270] Historically, it has been noted that agricultural funding for peatland has been difficult to track at a national level.[271] The call from this is that future funding should enable monitoring of peatland for the purposes of government peatland restoration targets. From the perspective of the IUCN, future funding should also include support for maintaining existing healthy peatlands.[272]

#### *5.4.5 Afforestation*

In line with the established nature of afforestation activities throughout the UK, interviewees did not highlight many immediate challenges with afforestation financing or incentives. Current incentives for woodland creation in England will in time transition to ELMS, to be established under CS woodland creation offers.[273] One challenge associated with these subsidies and incentives is the compatibility with agricultural tenancies, something which the UK Government is seeking to address in England for example (see Chapter 8). The ability for tenant farmers to access the financial support required for GGR activities on agricultural land is crucial.

One more overarching challenge which arose through interview was the need for a results-

263 UK Government, Department for Environment Food and Rural Affairs, 'Agricultural Transition Plan update January 2024' (March 2024) <www.gov.uk/government/publications/agricultural-transition-plan-2021-to-2024/agricultural-transition-plan-update-january-2024#annex-4-premium-payments> accessed 12 June 2025
264 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
265 John Muir Trust, 'Carbon Emissions Land Tax: delivering large-scale natural carbon capture' <www.johnmuirtrust.org/assets/000/002/025/CarbonEmissionsLandTaxFINAL_Nov21_original_original.pdf?1641306944> accessed 12 June 2025
266 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
267 See: Scottish Government, 'Scottish Local Government Finance 'Green Book' for Grant Aided Expenditure and other allocations' (2024-25) <www.gov.scot/publications/scottish-local-government-finance-green-book-2024-25/> accessed 12 June 2025
268 Scottish Government, 'Agricultural Reform Route Map' (n226)
269 NatureScot, 'Peatland ACTION – Fund – How to apply' <www.nature.scot/climate-change/nature-based-solutions/nature-based-solutions-practice/peatland-action/peatland-action-fund-how-apply> accessed 12 June 2025
270 See for example: Special EU Programmes Body, '€40m of PEACEPLUS funding awarded to boost biodiversity, nature recovery and resilience' (2 June 2025) <www.seupb.eu/latest/news/eu40m-peaceplus-funding-awarded-boost-biodiversity-nature-recovery-and-resilience> accessed 13 August 2025
271 IUCN UK Peatland Programme, 'Agricultural Issues: Key Recommendations' Issues Brief (March 2024) <www.iucn-uk-peatlandprogramme.org/sites/default/files/2024-04/Agricultural%20issues%20brief%20-%2010%20key%20recommendations.pdf> accessed 13 August 2025, 4
272 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
273 UK Government, Forestry Commission, 'England Woodland Creation Offer' (Mary 2021) <www.gov.uk/guidance/england-woodland-creation-offer#ewco-transition-into-environmental-land-management-schemes-elms> accessed 13 August 2025

based government subsidy to be available for afforestation, as opposed to action-based subsidy.[274] This includes moving away from flat-rate subsidies, which have been criticised for being inefficient mechanisms to support afforestation that offers co-benefits besides carbon sequestration.[275] Interviewees recognised the extensive regulatory history of existing subsidy structures through CAP and then ELMS, however one suggestion was to emulate initiatives created for the water industry, for example 'Upstream Thinking' which works in collaboration with water companies.[276] This initiative channels finances upstream to farmers to incentivise them to pursue better options for water management than to pay for damage already caused. This creates a competitive market where the benefits are tangible and measurable. For afforestation, interviewees envision incentivisation structures which reflect the variation in tree growth and carbon sequestration between locations to ensure planting the right tree in the right place, and rewarding the ecosystem benefits that are gained from active woodland maintenance.[277]

#### *5.4.6 biomass crops*

Biomass crop growth is crucial for GGR techniques such as BECCS. Select grants have been provided in the past,[278] however stakeholders in this area have highlighted that these incentive schemes have not considered the whole value chain of biomass production, creating gaps between policy and commercial reality.[279] Part of this challenge as identified by these stakeholders is the low price of biomass in comparison to other crop options, which does not incentivise farmers to grow it.[280] One option proposed in interview would be to consider subsidies for other parts of the BECCS value chain, for example creating subsidies for power stations to utilise domestic biomass, which is a cost benefit that then filters down to farmers providing the biomass. There are, however, constraints associated with domestic biomass supply and other factors such as biomass sustainability (for more information see Chapter 11) and a balance of other land-use priorities, such as food production. From a more holistic perspective, it was highlighted in interview that there is an importance for farmers to be paid for physical goods produced, as opposed to only in abstract through carbon credit schemes.[281] This emphasises the importance of how subsidies and incentives are structured in order to maximise uptake.

274 Interview with Participant 4905913, Net Zero Plus (online, 10 March 2025)
275 Ian Bateman and others, 'How to make land use policy decisions: Integrating science and economics to deliver connected climate, biodiversity and food objectives' (November 2024), Proceedings of the National Academy of Sciences (PNAS), Vol 121, No 49
276 See: Westcountry Rivers Trust, 'Upstream Thinking: Innovation for Conservation' <https://wrt.org.uk/project/upstream-thinking/> accessed 14 June 2025
277 Interview with Participant 4905913, Net Zero Plus (online, 10 March 2025)
278 For example: UK Government, Department for Business, Energy & Industrial Strategy, '£26 million government funding to boost biomass in UK' (December 2021) <www.gov.uk/government/news/26-million-government-funding-to-boost-biomass-in-uk> accessed 14 June 2025
279 Interview with Participant 9486769, PBC4GGR GGR-D (online, 6 February 2025)
280 *ibid*
281 *ibid*

## CHAPTER 5.4 – FINANCE AND INCENTIVE SUPPORT REQUIREMENTS IDENTIFIED BY GGR STAKEHOLDERS

### Biochar

- ✓ Farmers should receive carbon credit commission to compensate for landspreading activity
- ✓ Capital expenditure costs for pyrolysis used on agricultural land could be included within agri-environmental funding
- ✓ Low-interest loans could provide another pathway to supporting initial capital expenditure, but poses challenges for balancing risk
- ✓ Support for utilising biochar in order to improve soil quality or soil nutrients, potentially through a structure such as SFI or through credits for certain nutrient quantities
- ✓ Classification is required for the relationship between ELMS and biochar deployment from the perspective of farmers
- ✓ Biochar usage could be incentivised through necessity, for example emulation of the Danish agricultural emissions tax
- ✓ Biochar and other GGR techniques such as ERW may benefit from 'insetting' structures

### ERW

- ✓ Funding support required throughout the project value chain, including production and transport of basalt
- ✓ Scientific evidence gathering requires support in order to overcome Regulatory Paradox
- ✓ More structures support required, as opposed to case-by-case
- ✓ Incentivisation challenges for offtake and spreading of weathering material emulate those relating to biochar offtake and spreading

### Marine

- ✓ Marine finance options can support under-developed blue carbon projects
- ✓ Closed area space created by offshore windfarms presents an opportunity for funding blue carbon projects within these spaces
- ✓ Finance for engineered marine GGR projects is not explored in detail

### Peatland

- ✓ Peatland restoration requires consistent subsidy availability from agri-environmental schemes, which is not currently available and creates concern and uncertainty for stakeholders
- ✓ Future funding should enable peatland monitoring for the purposes of government peatland restoration targets
- ✓ Funding should include support to maintain existing healthy peatlands

### Afforestation

- ✓ Importance of results-based government subsidies, as opposed to action-based
- ✓ Possible creation of incentives structures to encourage reward of ecosystem benefits created from active woodland maintenance

### Biomass crops

- ✓ Future funding support for domestic biomass crop growth requires to consider the whole value chain of biomass production
- ✓ Incentives are required to overcome the low price of biomass
- ✓ Subsidies could address the downstream BECCS value chain, incentivising domestic biomass and increasing demand
- ✓ It is important for farmers to receive payment for physical products produced, as opposed to only abstract schemes.

Figure 5: Chapter 5.4 Findings and Recommendations

# SECTION III
# Jurisdiction-specific findings common to all GGRs

## Chapter 6 – Devolution

There are some challenges to GGR activities for regulators and industry which are more prevalent within individual nations, be that for legislative or capacity reasons. Some of these devolved challenges influence all GGRs, however some are more specific to groups of techniques. Overall, these challenges are not numerous in the context of this report, and devolution-specific challenges which span multiple GGR techniques were not raised frequently in interview. As GGRs scale, further disparities and deviations in the laws of the four nations may develop or become more apparent.

### 6.1 Just Transition

The decision-making lens through which governments have to view legislative change is outlined generally at Chapter 2.3. However, for Scotland, Northern Ireland and Wales, there are additional considerations when making regulatory decisions, namely just transition obligations. In the context of environmental targets (and therefore GGRs), just transition at a general level refers to addressing "inequalities created or exacerbated by climate policy on consumers and communities.[282] The concept of just transition is recognised in international law.[283] This chapter discusses at a practical level the influence that just transition principles within legislation can have on GGR development, however it is recognised that analysis of the relationship between GGRs, fossil fuels, and the just transition runs much deeper than the scope of this report can accommodate, and that it is a multifaceted global debate.[284] Further analysis of the benefits and challenges of the just transition lies outwith the scope of this report.

The just transition is a concept which has been imbedded in Scottish legislation since 2019, through the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019, amending the Climate Change (Scotland) Act 2009. Under this Act, policy actions taken by the Scottish Government in relation to greenhouse gas emissions (namely climate change plans) require to adhere to five legislated just transition principles.[285] These principles encompass, amongst other things: support for jobs; low-carbon investment and infrastructure; and resource-

282 Henry Grub, Jonathan Wentworth, 'What is a just transition for environmental targets?' UK Parliament POSTnote 706 (UK Parliamentary Office of Science and Technology 16 October 2023)
283 Paris Agreement to the United Nations Framework Convention on Climate Change (adopted 12 December 2015, entered into force 4 November 2016) TIAS No 16-1104, 3156 UNTS, Preamble
284 See Sara Nawaz and others, 'Carbon Removal for a Just Transition' (5 November 2024) Climate Policy, Vol 25, No 6, 926-937
285 Climate Change (Scotland) Act 2009, s35C

efficient and sustainable economic approaches.[286] These legislative obligations were heralded as being the first of their kind in the world, leading the way in the just transition.[287]

With Scotland looking to pursue a variety of GGRs,[288] the just transition principles are highly relevant to GGR policy decision-making, for example for engineered GGRs or those which involve land use, which could have a wider impact on jobs, infrastructure, resources and finance.[289] To oversee alignment with just transition obligations, the independent Just Transition Commission was created in 2018. The Commission explicitly acknowledges the interconnected nature of net zero with the just transition, although notes that if approached incorrectly, net zero goals can be achieved without aligning with just transition principles and obligations,[290] leading to social and economic injustices including job losses and community displacement.[291] Avoiding a detrimental approach to large-scale GGRs through this lens is an important consideration for Scottish Government and regulators.

Whether or not just transition obligations pose a challenge for GGRs in Scotland was raised in interview, in particular with SEPA. Due to the integrated nature of just transition into Scottish climate change policy, regulators do not see it as necessarily an additional factor for policymakers, and with or without policy as influenced by the just transition, the obligation to protect the environment remains the same for regulators with such a mandate, which creates natural alignment.[292] Therefore, there are not any distinct challenges arising at this time from the just transition. From the perspective of other UK jurisdictions, the primary consideration for just transition in Scotland is one of data. From the scientific perspective of GGRs, the substance of and pace at which each UK nation can accrue and share data differ due to the need for Scotland to gather additional just transition data in comparison to the other nations. Defra reports that this does not necessarily create complications, but is important to consider when regulators are data-mapping for GGRs.[293]

The other UK jurisdiction with explicit just transition obligations built into legislation is Northern Ireland, through the Climate Change Act (Northern Ireland) 2022. Here, DAERA must have regard to the just transition objectives within the Act when deciding policies in relation to carbon budgets.[294] The just transition objectives built into the 2022 Act align with those legislated for in Scotland, but are more extensive, including objectives to support various groups such as the agriculture sector, persons most affected by climate change, rural areas, and future generations.[295]

286 Climate Change (Scotland) Act 2009, s35C
287 Scottish Government, 'Climate Change: Just Transition' <www.gov.scot/policies/climate-change/just-transition/> accessed 15 June 2025
288 Scotland's latest Climate Change Plan outlines future use of GGRs, see for example details of engineered removals at section 3.8 of the following: Scottish Government, 'Update to the Climate Change Plan 2018-2032' (December 2020) <www.gov.scot/publications/securing-green-recovery-path-net-zero-update-climate-change-plan-20182032/documents/> accessed 15 June 2025; and for Scottish Government scoping of GGRs see more generally: Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' Final Report (November 2023) <www.gov.scot/publications/negative-emissions-technologies-nets-feasibility-study/documents/> accessed 15 June 2025
289 These impacts are recognised in multiple jurisdictions: Sara Nawaz and others (n287), 927-928
290 David Drabble and others, 'Measuring and Evaluating Success in the Scottish Just Transition' (Just Transition Commission 2024) <www.justtransition.scot/wp-content/uploads/2025/03/Measuring-and-evaluating-success-in-the-Scottish-Just-Transition-March-2025.pdf> accessed 16 June 2025,17-18
291 *ibid*, 45-46
292 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
293 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
294 s30(2) and s30(3)
295 *Ibid,* s30(3)

Due to limited interview engagement with Northern Irish regulators, these just transition obligations were not discussed directly. However, given the harmony between Scottish and Northern Irish just transition legislation, it is reasonable to assume that the low level of challenge that just transition obligations bring to GGRs is similar between these nations. One potential additional consideration from a Northern Irish perspective is the explicit reference to agriculture and rural communities, which is particularly relevant for GGRs which involve land use and land-use change.

In contrast to Scotland, Northern Ireland does not yet have an independent commission for just transition; however, the creation of a commission and its accompanying regulations are under development,[296] and it is one of the aims and recommendations of the Scottish Just Transition Commission to establish equivalent commissions in each UK nation,[297] so this position may also develop in future for England and Wales.

In terms of how Wales and England are addressing just transition, Wales enacted legislation in 2015 to address its social, economic, environmental, and cultural well-being, under the Well-being of Future Generations (Wales) Act. The Act sets out obligations for the Welsh Government and local governments to align decision-making with seven well-being goals, and adhere to the principle of sustainable development. Although the Act is not dedicated solely to the principles of just transition, as seen in Scotland and Northern Ireland, the broad goals and principles contained within the Act support elements of the just transition. For more specific just transition framework, Wales is in the process of addressing just transition through policy.[298] In comparison, Westminster does not yet have a strategy or policy piece for England which addresses just transition or places just transition obligations on Government, so it remains to be seen how this will develop in future.

Overall, just transition obligations do not form a barrier to GGR development at this stage, only an extra layer of law to consider in the cases of Scotland and Northern Ireland. Just transition is, however, something which is likely to become relevant to all UK nations if the Scottish Just Transition Commission's goals of creating a commission in each jurisdiction comes to fruition, coupled with either firm policy or legislative commitments in England and Wales.

## 6.2 Dispersed industry and CCS development

Some challenges which arise for GGR stakeholders are physical limitations which are reflected in regulation. One challenge which was noted in interview, in particular by DAERA in Northern Ireland and NatureScot in Scotland, was the contrast in legal development between pipeline transport of $CO_2$, compared to non-pipeline transport. This is particularly relevant for GGR projects looking to transport and store $CO_2$ permanently, such as BECCS and DACCS, and

296 Department of Agriculture, Environment and Rural Affairs, 'Consultation on the establishment of a Just Transition Commission' (November 2024) <https://consultations2.nidirect.gov.uk/daera/consultation-establish-just-transition-commission/supporting_documents/Consultation%20on%20the%20establishment%20of%20a%20Just%20Transition%20Commission.PDF> accessed 16 June 2025

297 David Drabble and others, (n293), 77

298 Welsh Government consulted on a Just Transition Framework, with a summary of responses published in 2024, a completed framework is yet to be published: Welsh Government, 'Consultation – summary of responses: Just Transition Framework' (June 2024) <www.gov.wales/sites/default/files/consultations/2024-06/just-transition-consultation-analysis-final-report.pdf> accessed 16 June 2025

also those projects wishing to transport $CO_2$ for usage. Pipeline transport and storage of $CO_2$ has been at the forefront of policy and legislative development at a UK level since the UK Government's renewed dedication to CCS development in 2020.[299] Since then, legal and policy structures have been developed to support the scaling of CCS in the UK,[300] focused primarily on industrial clusters.[301] So far, two of these clusters have reached final investment,[302] with the remaining two forming a new focus for Government going forwards.[303] The vast legislative and policy energy channelled into pipeline CCS stems from the need for an efficient and cost-effective route for Government to achieve net zero targets, with clusters providing this route.[304] The regulatory push for CCS is complex, fast-paced and deserving of a great deal of literary attention as it continues to develop. Although this report lacks the scope to address CCS in isolation, CCS development remains highly relevant for BECCS and DACCS development and the barriers and enablers that CCS development provides are addressed herein.

In contrast to the dense industrial clusters presented on the UK mainland, Northern Ireland faces a more decentralised challenge, where industry is more dispersed and agricultural emissions are difficult to negate through CCS alone.[305] Engineered GGRs are therefore also likely to be dispersed.[306] Pipeline would be a highly inefficient $CO_2$ transport solution for these sites, and there is the additional consideration that Northern Ireland lacks suitable geology for offshore storage.[307] Consequently, Northern Ireland has been recognised by industry and DESNZ as one of the key areas of the UK which would benefit from NPT going forwards, in order to both transport and store $CO_2$.[308] Although DESNZ is dedicating resource to exploring the role of NPT across the UK, including its integration into the UK ETS,[309] this is still several steps behind the development of pipeline $CO_2$, due to cost-effectiveness as detailed above. From the perspective of DAERA, the risk from this staggered approach is that Northern

299 UK Government, 'The Ten Point Plan for a Green Industrial Revolution' (November 2020) <https://assets.publishing.service.gov.uk/media/5fb5513de90e0720978b1a6f/10_POINT_PLAN_BOOKLET.pdf> accessed 16 June 2025, 22

300 For example, this has involved development of Contracts for Difference, through the UK CCS Network Code and business models for industrial carbon capture, transport and storage, and waste industrial carbon capture, see generally: UK Government, Department for Energy Security & Net Zero, 'Carbon capture, usage and storage (CCUS): business models' (December 2020) <www.gov.uk/government/publications/carbon-capture-usage-and-storage-ccus-business-models> accessed 20 June 2025

301 The four clusters currently targeted under CCS are split into Track-1 (HyNet and East Coast Cluster) and Track-2 (Acorn and Humber); For an overview of the UK Government's clustering sequence see: UK Government, Department for Energy Security & Net Zero, 'Carbon Capture, Usage and Storage: A Vision to Establish a Competitive Market' (December 2023) <https://assets.publishing.service.gov.uk/media/6594718a579941000d35a7bf/carbon-capture-usage-and-storage-vision-to-establish-a-competitive-market.pdf> accessed 20 June 2025, 24-25

302 UK Government, Department for Energy Security & Net Zero, 'Carbon Capture, Usage and Storage, 'Contracts signed for UK's first carbon capture projects in Teesside' (December 2024) <www.gov.uk/government/news/contracts-signed-for-uks-first-carbon-capture-projects-in-teesside> accessed 20 June 2025; and UK Government, Department for Energy Security & Net Zero, 'Major carbon capture project to deliver jobs and growth' (April 2025) <www.gov.uk/government/news/major-carbon-capture-project-to-deliver-jobs-and-growth> accessed 20 June 2025

303 UK Government, Department for Energy Security & Net Zero, 'Funding secured for Britain's industrial future' (June 2025) <www.gov.uk/government/news/funding-secured-for-britains-industrial-future> accessed 20 June 2025

304 UK Government, Department for Energy Security & Net Zero, 'Powering Up Britain: Net Zero Growth Plan' (138)

305 See generally: David Rooney and others, 'Carbon Capture, Utilisation and Storage Potential in Northern Ireland' The Bryden Centre (April 2021); and Graham D M Andrews, 'Geological carbon storage in northern Irish basalts: prospectivity and potential; (September 2023) Frontiers Climate Vol 5, 4

306 Climate Change Committee, 'Northern Ireland's Fourth Carbon Budget' (March 2025) www.theccc.org.uk/wp-content/uploads/2025/03/Northern-Irelands-Fourth-Carbon-Budget-1.pdf> accessed 23 June 2025, 13

307 For an assessment of potential Northern Irish geological storage and associated risks see generally: Deirdre Lewis and others, 'Assessment of the potential for geological storage of carbon dioxide in Ireland and Northern Ireland' (February 2009) Energy Procedia 1(1)

308 UK Government, Department for Energy Security & Net Zero, 'Carbon capture, usage, and storage (CCUS): Call for evidence on non-pipeline transport and cross-border CO2 networks' (November 2024) <https://assets.publishing.service.gov.uk/media/6735db4354652d03d516113c/non-pipeline-transport-cross-border-cfe-summary-of-responses.pdf> accessed 26 June 2025, 9

309 UK Government, Scottish Government, Welsh Government and Department of Agriculture Environment and Rural Affairs, 'UK Emissions Trading Scheme: Non-pipeline transportation of carbon dioxide' (January 2025) https://assets.publishing.service.gov.uk/media/674762df2f94bef8ff48c097/uk-ets-non-pipeline-transport-co2-consultation.pdf accessed 26 June 2025); for further information on UK ETS see Chapter 5.2

Ireland could face a disadvantage when developing engineered GGRs for permanent storage, especially if these projects are small-scale or independent units.[310] Northern Irish pursuit of DACCS and BECCS is a future consideration from the perspective of the Northern Ireland Executive, as opposed to a current focus within policy.[311] However if a clear regulatory regime for NPT is not established, there will be little incentive for GGR projects to explore permanent storage solutions in Northern Ireland in the near future. The important correlation between investment certainty and a clear strategy for NPT in the UK was highlighted previously in 2022.[312] Without said clarity, dissuasion from investment at such an early stage can damage the scaling potential of these technologies, which are suggested at large scale as being crucial for net zero in Northern Ireland.[313]

Returning to the UK mainland, the challenge of dispersed industry and GGRs is also present. From industry interviews, the focus on industrial clusters came up in in the context of BECCS, where it was noted that nearly half of industrial emissions in the UK arise from dispersed sites, as opposed to clusters, and therefore have important GGR potential, particularly for modular or free-standing GGR pathways.[314] NatureScot flagged the appeal NPT presents for Scotland, where evidence is already accumulating for modular GGR and CCS projects, such as for emissions at distilleries.[315] One difference to the Northern Irish position is the access to offshore storage that Scotland possesses, however this does not necessarily lead to any greater certainty for Scottish regulators as to how NPT may be developed in a GGR context.[316] Scottish regulators acknowledge the clustering pathways DESNZ has prioritised, and the Scottish CCS cluster is one step closer to a definitive pathway through the recent funding announcement.[317] On the other hand, until the regulatory structures and Government support for Scottish CCS are fully in place, there is risk of delay to the development of $CO_2$ transport and storage in Scotland which could impact GGR projects. Overall, it is clear that NPT is a strong interest area for regulators and industry alike, where regulatory uncertainty could lead to infrastructure and GGR investment delays if clear pathways are not provided.

## 6.3 Decision-making and data gaps in Northern Ireland

From a top-down perspective, out of all UK nations, Northern Ireland faces the strongest systemic barriers to GGR scaling. The primary reason for this is the relationship between environmental and climate policy, and the political landscape. Climate-related policy and law in Northern Ireland have long been subject to delay, coming into the spotlight through

310 Interview with Participant 9437941, Department of Agriculture, Environment and Rural Affairs (online, 9 April 2025)
311 The current Northern Ireland Climate Action Plan classifies DACCS as a "speculative options pathway": Department of Agriculture Environment and Rural Affairs, 'Draft Northern Ireland Climate Action Plan' (n4), 26
312 In the context of CCS, see: Chris Skidmore, 'Mission Zero: Independent Review of Net Zero' (January 2023) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1128689/mission-zero-independent-review.pdf> accessed 26 June 2025, 122
313 Climate Change Committee 'Northern Ireland's Fourth Carbon Budget' (n309), 52
314 Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025); dispersed emission statistics can be found here: UK Government, 'Industrial Decarbonisation Strategy' (March 2021) <https://assets.publishing.service.gov.uk/media/6051cd04e90e07527f645f1e/Industrial_Decarbonisation_Strategy_March_2021.pdf> accessed 26 June 2025, 17
315 Interview with Participant 9550967, NatureScot (in person, 5 March 2025); see for example The Carbon Removers: The Carbon Removers, 'Our Vision' https://thecarbonremovers.com/about/ accessed 26 June 2025
316 Interview with Participant 9550967, NatureScot (in person, 5 March 2025)
317 UK Government, Department for Energy Security & Net Zero, 'Funding secured for Britain's industrial future' (June 2025) <www.gov.uk/government/news/funding-secured-for-britains-industrial-future> accessed 26 June 2026

challenges such as the Renewable Heat Incentive scandal in 2017[318] and Brexit.[319] Suggestions for climate change legislation in Northern Ireland have been put forth since as early as 2011,[320] however only in 2022 did the Climate Change Act (Northern Ireland) finally come into force. Similarly, following further political uncertainty,[321] Northern Ireland's first Climate Action Plan, as obligated through the aforementioned Climate Change Act, was only introduced in draft stage for consultation in 2025, although it was scheduled to be published by June 2024 at the latest. This is notably further behind than the equivalent climate change policy and legislation of the other three UK jurisdictions. The Northern Ireland draft Climate Action Plan outlines future focus on GGRs,[322] and is therefore an important (and legislatively obligated[323]) step which cannot afford to face further delay.

Climate change legislation which sets net zero targets is an important catalyst for GGR development, and it is clear that policy and legislative postponement do not create an environment conducive to GGR scaling. Interviewees vocalised concern also that changes to subsidies or financial support enabled through legislation can trigger political tension, which is highly relevant to GGRs and scaling potential.[324] Without a clear policy position on emissions reduction and GGRs, subsequent regulatory support will not be forthcoming. Another consequence of delay and political uncertainty is an impact on governmental and regulator capacity. Regulators and civil servants do not have the capacity to fulfil their ordinary functions when the Executive is destabilised. Therefore, this will also have an impact on the ability of Northern Ireland to gather the same GGR-focused engagement, expertise and capacity that other regulators are seeking to accumulate.

318 Northern Ireland Audit Office, 'Northern Ireland Non-Domestic Renewable Heat Incentive Scheme: Assessing progress with the implementation of the Public Inquiry recommendations' (March 2022) <www.niauditoffice.gov.uk/publications/html-document/northern-ireland-non-domestic-renewable-heat-incentive-scheme-assessing> accessed 26 June 2025; for analysis see: Ciara Brennan and others, 'Political, economic and environmental crisis in Northern Ireland: the true cost of environmental governance failures and opportunities for reform' (9 August 2017) Northern Ireland Legal Quarterly, Vol 68, No 2, 123-157

319 Ciara Brennan and others, 'Out of the frying pan, into the fire? Environmental governance vulnerabilities in post-Brexit Northern Ireland' (3 June 2019) Environmental Law Review 21(2) 84-110

320 Committee on Climate Change, 'The appropriateness of a Northern Ireland Climate Change Act' (November 2011) <www.theccc.org.uk/archive/aws2/Northern%20Ireland%20-%20Annex%20-%20advice%20on%20CC%20Act.pdf> accessed 27 June 2025; and associated update: Committee on Climate Change, 'The appropriateness of a Northern Ireland Climate Change Act – December 2015 Update' (October 2015) <www.theccc.org.uk/wp-content/uploads/2016/01/CCC-2015-update-to-the-appropriateness-of-a-Northern-Ireland-Climate-Change-Act.pdf> accessed 27 June 2025

321 For a summary of the difficulties the Northern Ireland Executive has faced see: David Torrance, 'Northern Ireland (Executive Formation) Bill 2022-23' (Research Briefing no CBP9725, House of Commons Library, 22 February 2023), 5-6

322 Department of Agriculture Environment and Rural Affairs, 'Draft Northern Ireland Climate Action Plan' (n4), 239-240

323 Climate Change Act (Northern Ireland) 2022, s29

324 Interview with Participant 9486769, PBC4GGR GGR-D (online, 6 February 2025); Interview with Participant 4905913, Net Zero Plus (online, 10 March 2025)

## CHAPTER 6 – FINDINGS AND RECOMMENDATIONS

### Just transition

- ✓ Just transition obligations applicable to Scotland, Wales and Northern Ireland have not yet created additional challenges for GGR decision-making, but these nations require additional data to be accrued when making decisions
- ✓ Just transition principles and obligations may become applicable to England in future

### Dispersed industry

- ✓ Non-pipeline CO2 transport should be a regulatory and policy priority, as it is crucial for supporting dispersed industry, modular GGR technologies, and nations with unsuitable geological storage facilities (Northern Ireland)

### Northern Ireland

- ✓ Northern Ireland faces extensive delays to climate-related regulation and policy-making, which subsequently impacts GGR support and scaling

Figure 6: Chapter 6 Findings and Recommendations

# SECTION IV
# UK-wide findings specific to select GGR techniqes

## Chapter 7 – Planning, consenting and permitting

Planning is the cornerstone of any project involving new buildings or facilities, changes in land use, or major alterations, therefore it can impact many, if not all GGRs. Permitting is similarly crucial and applicable across the GGR technique spectrum, providing projects with the ability to operate in line with human safety and environmental thresholds. Many GGR operators will require both planning and permitting prior to undertaking their projects, therefore they are pivotal areas of law for GGR technologies and must be facilitative. Certain GGR-specific planning and permitting issues are addressed throughout Section V of the report, whilst this chapter presents an overview of the challenges faced by GGR technologies when navigating planning and permitting requirements throughout the UK.

### 7.1 The structure and importance of planning, consenting and permitting in the UK

Planning law and policy are layered, operating at national government level all the way down to local planning authority level, creating a complex web of rules, processes, and guidance. Planning is an area where policy operates alongside legislation, and each of the four nations has its own policies and frameworks to specify long-term national targets and priorities which planning law implements.[325] Planning law is devolved throughout the UK, and consenting applications ordinarily fall to local planning authorities to process, deliberate, and determine.[326] The exceptions to this are large-scale infrastructure projects, which are decided upon at a government level. In England, for example, these projects qualify as Nationally Significant Infrastructure Projects and require a DCO to be made by the relevant Secretary of State.[327] The common denominator between all government levels making planning decisions is that the decision-maker is democratically elected,[328] underpinning why planning decisions, albeit made within legal frameworks, may be made on the basis of current policy.

325 For example, Scotland: The National Planning Framework and the Scottish Planning Policy, England: National Planning Policy Framework; Northern Ireland: Regional Development Strategy, Strategic Planning Policy Statement; Wales: Future Wales – The National Plan, Planning Policy Wales
326 Core legislation for each jurisdiction: Planning Act 2008 (England); Planning Act (Northern Ireland) 2011; Town and Country Planning (Scotland) Act 1997 as amended by the Planning etc. (Scotland) Act 2006 (Scotland); Planning Act 2008, Planning (Wales) Act 2015 (Wales)
327 Legal basis for NSIPs contained within Planning Act 2008
328 Or individual(s) acting on delegated authority granted by such representative(s)

Permitting procedures are overseen by the relevant regulators throughout the UK. Permitting throughout the UK controls activities which could impact the environment, including waste, water, air, industry and land. As is discussed throughout this report, permits vary greatly depending on circumstances, including standard and bespoke permits, exemptions, government regulatory positions, and the inherent presence of assimilated EU law. This chapter does not attempt to delve into details of specific permitting regimes, as this is better addressed in Section V with regard to specific GGR techniques. There are, however, certain generic features of permitting which apply across GGR techniques, particularly novel or first-of-a-kind techniques.

Permitting presents a relatively rigid process, with few exceptions. Planning law also contains rigorous procedure and conditions, but the underlying decision-making can potentially be more flexible due to being fuelled by policy. Strict processes or risk-averse decisions do not necessarily mean that planning and the environment always work symbiotically. This is particularly apparent from debates surrounding the current proposed changes to planning law in England (discussed at Chapter 7.4 below).

One crucial environmental-focused aspect of planning law is the role of EIAs (Environmental Impact Assessments). Founded in EU law, EIAs form the central pillar of assessing the impacts a project may have on the environment, and are obligatory in each UK jurisdiction.[329] Although the framework necessitating EIAs and their contents is entrenched within legislation, EIAs are not tools for legal decision-making directly. Rather, EIAs are a tool to facilitate the gathering and presenting of information to allow the decision-maker of an application for consent to consider the environmental impacts of a proposed project. EIAs are not required for all projects, but where they are required (for example for waste incineration, various CCS activities, or water abstraction), they must be taken into account by the decision-maker in their deliberation, and in turn will influence the final consenting decision. The requirement of an EIA, and also the required content (i.e. the impacts it assesses) will vary between projects. Certain projects must undertake an EIA,[330] whilst other projects may be 'screened' as requiring an EIA, for example on account of the size of the project or its proximity to an environmentally sensitive area.[331] The content of an EIA is decided by 'scoping', which defines the scope of the EIA once it has been confirmed that one is required.[332] The Environmental Statement resulting from the EIA process is subject to strict expectations for measuring and mitigation of environmental impacts, as demonstrated in the context of litigation at Chapter 7.4. Failure to provide to the relevant deciding authority the required information will result in delays and cost, therefore it is imperative that clear guidance is provided by governments in order to facilitate the process projects are required to undertake.

The challenges that planning law and permitting present for GGRs are both procedural and substantive. Planning and permitting apply to all GGR techniques, but most prominently to

329 See Town and Country Planning (Environmental Impact Assessment) Regulations 2017 (England); Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 (Northern Ireland); The Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (Scotland); The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 (Wales)

330 These developments are set out in legislation, for example in England: The Town and Country Planning (Environmental Impact Assessment) Regulations 2017, Schedule 1

331 The Town and Country Planning (Environmental Impact Assessment) Regulations 2017, Schedules 1-3

332 Directions for scoping and screening contained within EIA regulations for each jurisdiction, e.g., The Town and Country Planning (Environmental Impact Assessment) Regulations 2017, s15-16

engineered pathways, and the barriers this area of law creates for projects are incredibly ubiquitous, despite being of devolved competence across all four UK nations. Many GGR projects across the UK are still at the demonstrator, proof-of-concept, or research and development phase. As a consequence, only select projects have faced commercial-scale planning and permitting procedures, which are the most rigorous. Despite this narrow pool, the barriers faced by GGR projects in this area of law are resounding.

## 7.2 Permitting – challenges

One of the greatest challenges projects have faced so far is delays to permits being granted, which halts any further project development from being able to take place.[333] In some scenarios, delays to permitting decisions can be several months, even for decision by larger regulators. Costs associated with these delays are not easily absorbed by GGR operators, and this issue is also prevalent within planning, as discussed below.

It was highlighted by interviewees that standard permitting procedures are challenging for new projects, as any tick-box scenarios are difficult to navigate. Many GGR projects are pilot studies, which are unlikely to operate indefinitely or undertake continuous or constant operations, unlike a commercial project. One project noted that there is no option available for time-limited permits in certain circumstances, and no option for projects which operate intermittently on a research basis, as opposed to continuous commercial operation.[334] The challenge arising from these limitations is that assessments (e.g. risk assessments) are based on annual or lifetime impacts, which can be vastly disproportionate for pilot projects. This disproportionality is equally present where existing permitting exemptions are not clear, and therefore some research and development projects may end up in a position of having to apply for a full permit in order to ensure compliance.[335] This creates an overly burdensome situation for projects and can lack efficiency. It has been suggested in the context of permitting to consider the role of regulatory sandboxes (see further Chapter 3.2), where time-limited permits can be granted, with specific monitoring requirements more tailored to a pilot study.[336]

A further challenge raised by GGR industry relates back to the expertise within regulators and the evidence available to regulators from the industry. For novel technologies, the full impacts of a certain chemical or process on the environment or human health may not yet be established due to a lack of previous practical experience. It therefore becomes a challenge to evaluate impacts if they are not definitive, and regulators are unable to dictate specific safety or risk levels in relation to emissions, water, land or air if the GGR technique is not evidenced and understood.[337] This facet of the Regulatory Paradox is a particular challenge for regulators which rely upon assessments for granting permits.[338] Regulators do provide processes such as pre-application systems for permits to facilitate early engagement between proposed projects

333 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
334 Raised in the context of England; Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
335 Raised in the context of England; Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
336 IDRIC, 'Industrial decarbonisation: challenges and opportunities in planning, consenting and permitting for a timely and sustainable transition' IDRIC Policy Insight Report (April 2025) <https://idric.org/wp-content/uploads/IDRIC-Planning-Consenting-and-Permitting-Briefing.pdf> accessed 27 August 2025, 8
337 Raised in the context of England; Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
338 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)

and regulators,[339] which can help to bridge evidence gaps and promote mutual understanding. From the perspective of regulators there is existing demand from industry in the form of direct queries seeking clarity on regulatory requirements for novel technologies, which is actively encouraged.[340] This demand is an indicator of the legal uncertainty GGR industry faces, and case-by-case knowledge accumulation by regulators is beneficial for individual permitting applications. However, it is no substitute for a more streamlined and conducive permitting system.

## 7.3 Planning and consenting – challenges

Challenges encountered within planning law vary greatly for GGR projects. At research and development stage, some GGR projects have encountered no issues. Other GGR projects which use modular, mobile facilities, and who are positioned as 'turnkey providers' for industry, avoid the responsibility of planning or permitting as the onus to abide by such processes will fall on the recipients of those mobile facilities.[341] For free-standing or larger facilities built by GGR projects, planning law can form a far greater challenge.

There is a wealth of literature addressing the shortcomings of planning law. In the context of net zero, planning law poses a threat by being slow and out of date, creating an inharmonious system where carbon mitigation innovation cannot scale adequately.[342] This position is corroborated by calls from the CCC to reform spatial planning policy due to misalignment with net zero goals,[343] and the net zero independent review has identified planning as a bottleneck for net zero projects.[344]

In interviews, the barrier planning law poses has been cited as a crucial hurdle, particularly in the form of delays to gaining planning permission, which can create severe costs for projects.[345] There is also an identified lack of synergy between planning processes and permitting processes, leading to some scenarios of one delaying the other.[346] Even in scenarios where there is no notable delay, the process of being granted planning consent can be a very long and administratively challenging process, particularly for first-of-a-kind projects, or in the context of large-scale infrastructure requiring government-level consent.[347] The National Infrastructure Commission corroborates this point, reporting that the average timescales for a DCO as of 2021 was over four years.[348] Another interviewee highlighted that the challenge of delays to planning decisions is heightened for those undertaking novel technology pathways

339 For example Environment Agency: 'Get advice before you apply for an environmental permit' (August 2021) <www.gov.uk/guidance/get-advice-before-you-apply-for-an-environmental-permit> accessed 27 August 2025
340 Interview with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025)
341 This position was highlighted in interview by CapChar: Interview with Participant 9316963, CapChar Ltd (online, 10 February 2025)
342 See generally IDRIC (n340)
343 Climate Change Committee, 'progress in reducing emissions: 2023 Report to Parliament' (June 2023) www.theccc.org.uk/wp-content/uploads/2023/06/Progress-in-reducing-UK-emissions-2023-Report-to-Parliament-1.pdf> accessed 27 August 2025, 366
344 Chris Skidmore, 'Mission Zero: Independent Review of Net Zero' (n315), 87
345 For example, DACCS projects in Scotland: Joe McQuillen and others, 'Cost and profitability of direct air capture in Scotland' (Climate Xchange March 2025) <www.climatexchange.org.uk/wp-content/uploads/2025/05/CXC-_Cost-and-profitability-of-direct-air-capture-in-Scotland-March-2025.pdf> accessed 27 August 2025, 75-76
346 Ricardo, 'Strategic Spatial Planning for Low Carbon Industrial Clusters' Report for the Environment Agency (April 2025) <https://assets.publishing.service.gov.uk/media/6863e7f8b466cce1bb121ae0/phase-4-strategic-spatial-planning-report.pdf> accessed 27 August 2025, 22
347 Interview with Participant 5723057, Drax (online, 6 March 2025)
348 As noted recently in UK Parliament House of Commons: HC Deb 23 April 2025, vol 765, column 41WS-44WS;

and who may have to consult external experts in order to navigate the process.[349] Accessing expertise via external instruction may not be an option for all projects, and even large projects with established legal and policy teams view the planning system as creating a burden which is surmountable, albeit costly, for large developers, but may be much harder to approach for smaller projects or new-build facilities, particularly if on a new site or if requiring a DCO.[350] From the perspective of some specific GGR technologies, for example DACCS, the presence of a "very strict, complex or slow planning process is not attractive for DAC deployment"[351]. It is clear that multiple GGR technology pathways struggle with the obstructions planning laws present, regardless of project size. Support at local planning authority level has proven valuable for projects. In scenarios where GGR projects are co-located at existing facilities, connections between said facilities and the local authority can facilitate planning decisions. It has been recognised that without established connections, start-ups and new entrants without planning authority affiliations face more challenging circumstances.[352]

Planning and permitting are identified as crucial legal challenges to scaling engineered GGRs, particularly those involving CCS.[353] Small or medium-scale projects involving new technologies or CCS components have struggled with the impact of standards created for CCS systems based on large power plants and industrial-scale projects, which are disproportionate to the standards necessary for GGR technologies involving CCS, which are much smaller scale.[354] This application of incomparable standards leads to onerous and overly risk-averse conditions for pilot projects, dissuading development or eventual scaling.

Another fundamental challenge of planning law from the perspective of industry is the element of public consultation. Any objection to a project can lead to delays, and in more extreme circumstances can lead to court proceedings (see more Chapter 7.4). Issues already faced by projects stem back to the lack of clarity surrounding GGR projects and how they are catered for within planning and permitting legal structures. For example, certain GGR projects may only have the option to classify as a waste incineration facility, even if that is not the primary objective of the plant. This misrepresentation due to having to use pre-existing application structures can create confusion or discourse in public consultation, ultimately leading to objections.[355] The uncertainty and aversion to risk can also increase the level of information requested by local planning authorities for the planning applications beyond ordinary practice. This can further complicate the pre-application public consultation stage as well as the information-gathering of the application stage, and ultimately create a barrier which smaller projects or start-ups may not be able to overcome. It has been suggested that building public confidence and understanding in low-carbon projects should be a focus for governments and regulators,[356] however this poses a challenge to implement at local levels, particularly in cases where a novel technology is being explored, or existing planning or permitting applications do not reflect accurately the purpose of the project.

349 Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025)
350 Interview with Participant 5723057, Drax (online, 6 March 2025)
351 Joe McQuillen and others, 'Cost and profitability of direct air capture in Scotland' (n345), 75
352 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
353 Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' (n288), 62-63
354 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
355 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
356 IDRIC (n340), 12

## 7.4 Planning – the role of litigation

The majority of this report discusses the law – be that law governing standards, procedures or principles – in its black-letter form, however it is important to also consider the role and impact of legal disputes. The prospect of litigation in a GGR context is not a topic which was discussed in interviews for this report, nor is it typically at the forefront of GGR considerations; however, greenhouse gas-related litigation is an extremely important emerging facet of law and will almost certainly influence future GGR projects in future. This is particularly relevant for GGR projects engaged in planning law and those requiring Environmental Impact Assessments (EIAs), which are a pivotal evaluation tool used in planning processes and often subject to litigation.[357],[358] So far, case law has arisen in England, however Supreme Court judgments apply throughout the UK.

One of the most important cases to have taken place in recent years is *R (on the application of Finch on behalf of the Weald Action Group) v Surrey County Council*.[359] This Supreme Court judgment clarified the obligation under Environmental Impact Assessment regulations[360] to assess downstream or indirect ('scope 3') greenhouse gas emissions when undertaking an EIA for an oil and gas project. This case was the first of its kind to scrutinise the downstream chain of causation from upstream oil and gas emissions, considering crucially the "direct and indirect significant effects"[361] of said emissions on land, air, climate, soil, water etc.[362]

There are multiple linkages between this case and GGRs. Firstly, GGRs are explicitly relevant to the EIA Guidance published in response to *Finch*.[363] The Guidance, published a year after the judgment, directs project applicants to consider emission mitigation measures for their project, including the use of GGRs in the scenario where emission avoidance, reduction or prevention options are limited, which is especially relevant for scope 3 emissions.[364] Within this, the Guidance specifies that GGRs should be:

- "transparent and easily verifiable at a project level";[365]
- permanent; and
- have "robust third-party monitoring, reporting and verification methodologies to ensure the measure is genuine and of high integrity, which may include UK Government removal standards as they are developed".[366]

The parameters of 'permanence' and the need for robust methodologies are both key aspects

357 EIAs "tend to be something of lightning conductors for claims" - Stephen Tromans KC and others 'Significant UK Environmental Law Cases 2020-21' (March 2021) Journal of Environmental Law, Vol 33, Issue 2, 467-483, 467
358 For more on planning law and EIAs see Chapter 7
359 UKSC 20
360 Town and Country Planning (Environmental Impact Assessment) Regulations 2017, deriving from the EU EIA Directive 2011/92/EU
361 As set out in the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, s4(2)
362 For full list see *ibid* s4(2)
363 UK Government, Department for Energy Security and Net Zero, 'Environmental Impact Assessment (EIA) – Assessing effects of downstream scope 3 emissions on climate' (June 2025) <https://assets.publishing.service.gov.uk/media/6853fa3d1203c00468ba2b15/Supplementary_guidance_-_Effects_of_Scope_3_Emissions.pdf> accessed 27 July 2025
364 *ibid* p13
365 *ibid*
366 *ibid*

of GGRs which have been explored at research[367] and governmental[368] levels in recent years. The "permanent containment of carbon dioxide" is as definitive as categorisation of permanence has got within UK legislation. Hard definitional boundaries of what permanence means have not historically been drawn, but there are changes taking place that indicate this is a point of evolution, in particular under proposed changes to the UK ETS to include engineered removals demonstrating a 200-year permanence requirement (see Chapter 5.2). When considering these potential legislative developments alongside the GGR criteria set out in the *Finch*-dictated Guidance, it is evident that case law is starting to influence the focus on certain GGR techniques, and potential future development and scaling. Regulators and project developers alike should keep abreast of litigation, as it is already becoming clear that other types of development will be subject to the *Finch* ruling.

Although the facts in *Finch* and subsequent Guidance only relate to oil and gas applications, the reach of the case has since stretched to other types of development, for example the English case of *R (on the application of Alison Caffyn) v Shropshire County Council*,[369] involving the proposed construction of a chicken megafarm and associated nitrogen pollution. In this case, Shropshire County Council was tested on whether the full chain of causation had been considered in the EIA in relation to the environmental impacts of the nitrogen-emitting chicken manure and the effects of its application to land as digestate. Notably, the Council put forth that it had considered emission mitigation measures by utilising regulated anaerobic digestion to treat the manure, which would then be spread on offsite land, however the Council stated that it would not be possible to assess the impacts of this landspreading to watercourses due to a lack of standardised assessment.[370] This was not enough to satisfy the court, and a reasonable assessment should have been made to assess the effects of the final landspreading.[371] The planning permission for the megafarm was subsequently quashed.

There are several important observations to be made from this case in the context of GGRs, as it is not unreasonable to assume that GGR projects of a scale requiring an EIA could pose "direct and indirect significant effects",[372] for example in the context of storage reversals,[373] chemical use, or deployment of GGR products. The first observation regards the use of mitigation measures in an EIA; if not assessed correctly, these measures are not enough to circumvent the standards set in *Finch* to conduct a reasonable assessment of environmental impacts. Secondly, several novel GGR techniques involve complex supply chains and areas of the life cycle which have not yet been assessed robustly or have standardised assessment procedures available. This lack of assessment could be the undoing of a GGR project, as decision-making in these cases is circumstance-dependent and evaluative,[374] so there is a wider scope for projects to be both approved or denied. Ultimately, the fundamental

367 For example see: Solene Chiquier and others, 'A comparative analysis of the efficiency, timing, and permanence of CO2 removal pathways' (September 2022) Energy & Environmental Science, Issue 10, 4389-4403; Josh Burke, Felix Schenuit, 'Governing permanence of Carbon Dioxide Removal: a typology of policy measures' (November 2023) CO2RE The Greenhouse Gas Removal Hub, Policy Report

368 DESNZ, for example, has a team dedicated to GGR methodologies and standards, and British Standards Institution have been instructed to developed standards for BECCS and DACCS in correspondence with the business models:, British Standards Institution, 'Bioenergy with carbon capture and storage (BECCS) – Quantification of greenhouse gas (GHG) emissions and Licensed removals – Specification' (n173); British Standards Institution, 'Direct air carbon capture and storage (DACCS) – Quantification of greenhouse gas (GHG) emissions and removals – Specification' (n174)

369 [2025] EWHC 1497 (Admin)

370 *ibid* para 31

371 *ibid* para 32

372 Town and Country Planning (Environmental Impact Assessment) Regulations 2017, s4(2)

373 For legal analysis of reversals see Navraj Singh Ghaleigh and Justin Macinante (n1)

374 [2025] EWHC 1497 (Admin) para 20

importance of "direct and indirect significant effects"[375] of a development, as scrutinised in *Finch*, will permeate EIA case law of various types going forward, and it is important that regulators and developers involved in EIA procedures are aware of these obligations in a GGR context.

Although the case law explored above addresses emitting development scenarios, there has also been case law in the context of carbon sequestration developments, particularly in relation to CCS projects. A primary example of this in the UK is the case of *R (Dr Boswell) v. (1) Secretary of State for Energy Security and Net Zero (2) Net Zero Teesside Power Ltd. (3) Net Zero North Sea Storage Ltd.*,[376] which was recently dismissed at appeal.[377] This case at first instance involved a challenge to a Development Consent Order (DCO) for a gas-fired power station with CCS as part of the East Coast Cluster, on the basis that an inaccuracy had led to a double-counting error of emissions which would be sequestered via CCS. Despite the potential of "significant adverse effects",[378] the DCO was granted and Boswell then disputed the decision on multiple grounds, including EIA legislation and planning policy.[379] Nationally significant planning decisions typically rely on consideration of the 'planning balance' of a project, where the need for the project is weighed against the potentially negative impacts it may have. In this case, the impact of negative emissions was offset by the importance of the project under net zero planning policy and meeting the national need for CCS. The court reiterated this stance in its judgment,[380] which found in favour of the CCS-enabled power station.

This case does not necessarily provide cautionary tales based on legal irregularities, as the court found in favour of the project, but this case does demonstrate the risk of legal challenge to projects involving CCS and net zero policy-based decisions. A similar scenario presented itself three years earlier in *R (on the application of ClientEarth) v (1) Secretary of State for Business, Energy and Industrial Strategy (2) Drax Power Limited*.[381] Here, the planning for additional gas-fired generating units at Drax Power Station (containing CCS reserve space) was challenged, and, as followed in the Boswell judgment, planning policy and net zero necessity tipped the scales of the planning balance in order to decide the case in favour of Drax. Planning policy throughout the UK supports GGRs,[382] therefore in any future GGR-related cases, particularly for large-scale infrastructure, this is likely to play a significant role in decision-making. It is also important to note that the future trajectory of these types of cases, namely judicial reviews, will likely change, where the Planning and Infrastructure Bill seeks to set a limit on judicial review proceedings,[383] with the justification that currently the

375 Town and Country Planning (Environmental Impact Assessment) Regulations 2017, s4(2)
376 [2024] EWHC 2128 (Admin)
377 *R (on the application of Andrew Boswell) v The Secretary of State for Energy Security and Net Zero and other companies [2025]* EWCA Civ 669
378 *ibid* para3(b)
379 Legislation and policy cited in the claimant's grounds: Infrastructure Planning (Environmental Impact Assessment) Regulations 2017; Institute of Environmental Management and Assessment Guidance; Overarching National Policy Statement for Energy (EN-1)
380 [2025] EWCA Civ 669 para76
381 [2021] EWCA Civ 43
382 See further Chapter 7
383 Planning and Infrastructure Bill 2025 – note this applies to England, with some limited provisions affecting Scotland (see: Scottish Parliament, Legislative Consent Memorandum <www.parliament.scot/-/media/files/legislation/bills/lcms/planning-and-infrastructure-bill/splcms656.pdf> accessed 2 September 2025) and Wales (Welsh Parliament, 'The Welsh Government's Legislative Consent Memorandum on the Planning and Infrastructure Bill' (May 2025) <https://laiddocuments.senedd.wales/cr-ld17196-en.pdf> accessed 2 September 2025)

average time period for major infrastructure decisions in England and Wales is four years,[384] with 58% of DCO decisions being challenged through judicial review.[385] Although the range of major infrastructure goes far beyond only energy or net zero-related projects, this proposed legislative change may impact future case law for GGR projects.

### CHAPTER 7.4 – FINDINGS AND RECOMMENDATIONS

- ✓ Projects and regulators alike should keep up to date with case law, particularly regarding planning, EIAs and carbon sequestration
- ✓ Projects undertaking EIAs must consider the direct and indirect effects of their project (e.g. to land, water, air, soil, climate)
- ✓ A lack of standardised assessment for direct and indirect effects does not exonerate the project developer from undertaking a reasonable assessment of effects
- ✓ The EIA Guidance deriving from Finch supports the pursuit of permanent GGRs with robust MRV
- ✓ Projects related to net zero policy (e.g., CCS) have already attracted contention, with the courts finding in favour of the projects based on the planning balance
- ✓ Future areas of contention could include pressures on the farming community, depending on GGR deployment expectations, if the correct support is not provided

Figure 7: Chapter 7.4 Findings and Recommendations

## 7.5 Proposed changes to planning and permitting

Turning back to regulation, it has been noted in the context of planning law and climate change that if proper reform is not made, it will materially hinder net zero prospects.[386] Even within the UK Government, there has been recognition for a number of years of the incompatibility and inefficiency of the planning system as relates to net zero ambitions.[387] Similarly, restrictions and complexities presented by environmental permitting are a current focus for Defra.[388]

384 UK Government, Ministry of Housing, Communities & Local Government 'Factsheet: Critical infrastructure reforms' (September 2025) <www.gov.uk/government/publications/the-planning-and-infrastructure-bill/factsheet-critical-infrastructure-reforms> accessed 20 September 205
385 HC Written Statement 23 January 2025, Statement UIN HCWS385
386 Christopher Moss, 'Land Use Planning' in Nigel Pleming and others (eds) (n88), 5.09
387 Chris Skidmore (n312), s4.1.8
388 UK Government, Department for Environment Food & Rural Affairs, 'Consultation on modernising environmental permitting for industry' (n83)

### *7.5.1 Planning and Infrastructure Bill*

In March 2025, a new Planning and Infrastructure Bill was proposed by the UK Government. The bill focuses primarily on English planning law; however, it contains certain provisions which affect both Scotland[389] and Wales.[390] A substantial portion of this bill addresses housing developments and other infrastructure, however there are some crucial aspects of this bill which fall within the scope of this report for the purposes of GGRs, such as facilitating NSIPs, focus on nature recovery, and reforming decision-making within the planning system.[391] The bill also introduces the concept of a Nature Restoration Fund.[392] The challenges associated with this fund are discussed further at Chapter 5.3.

The Planning and Infrastructure bill has been a subject of extreme contention so far. One example of this is in the context of judicial reviews. The bill as proposed would seek to limit the stages of the judicial review process, and also seek to limit the ability to appeal a judicial review decision made in relation to a national policy statement or the making of a DCO (for NSIPs), provided the appeal is deemed as being "totally without merit".[393] This change was proposed in response to an independent review highlighting the restrictions and delays frequent judicial review applications can cause for NSIPs.[394] There will most certainly be evolution of this position as objections to the bill accumulate, particularly in relation to the balance between project efficiency and the tool of scrutinising public decision-making and, in turn, accessing justice.[395] If this legislative change, or a version of it, comes to fruition, it could be a crucial factor for large-scale GGR projects, particularly from a project risk management perspective.

Another facet of planning law which the bill seeks to address is environmental protection, including a more collective approach to addressing wider environmental issues beyond individual sites. If executed correctly, this connected approach has been identified as beneficial at scale for the environment.[396] However, multiple stakeholders have noted concerns as to how effectively the bill will protect and restore the environment, particularly in the context of easing restrictions to planning consents.[397] UK Government rebuttals to these concerns demonstrate this area as one of contention which will not be resolved easily,[398] particularly as legal proceedings have been raised against the UK Government in relation to purported

389 For specific sections which affect Scotland and require consent from the Scottish Parliament (primarily electricity generation), see Scottish Parliament, Legislative Consent Memorandum (n383)
390 For specific sections which affect Wales and require consent from the Welsh Parliament, see Welsh Parliament, 'The Welsh Government's Legislative Consent Memorandum on the Planning and Infrastructure Bill' (n383)
391 UK Government, Ministry of Housing, Communities & Local Government, 'Guide to the Planning and Infrastructure Bill' <www.gov.uk/government/publications/the-planning-and-infrastructure-bill/guide-to-the-planning-and-infrastructure-bill> accessed 29 August 2025
392 Planning and Infrastructure Bill, s66-75
393 Planning and Infrastructure Bill, s12
394 UK Government, Ministry of Housing, Communities & Local Government, 'Independent review into legal challenges against Nationally Significant Infrastructure Projects' (October 2024) <www.gov.uk/government/publications/independent-review-into-legal-challenges-against-nationally-significant-infrastructure-projects/independent-review-into-legal-challenges-against-nationally-significant-infrastructure-projects#part-3-potential-procedural-reforms> accessed 29 August 2025
395 See for example: The Law Society, 'More evidence needed before restricting judicial review appeals' (25 March 2025) <www.lawsociety.org.uk/contact-or-visit-us/press-office/press-releases/more-evidence-needed-before-restricting-judicial-review-appeals> accessed 29 August 2025
396 Letter from Office for Environmental Protection to The Rt. Hon. Angela Rayner MP (2 May 2025) <www.theoep.org.uk/report/oep-gives-advice-government-planning-and-infrastructure-bill> accessed 29 August 2025
397 HC Research Briefing *Planning and Infrastructure Bill 2024-25: Progress of the Bill* (5 June 2025) (CBP10277), 47-51; see also Claudia Hyde, 'The Planning and Infrastructure Bill: an 'overall improvement'?' Landmark Chambers (16 May 2025) <www.landmarkchambers.co.uk/news-and-cases/blog/public-and-administrative-law/the-planning-and-infrastructure-bill-an-overall-improvement> accessed 23 September 2025
398 HC Research Briefing *Planning and Infrastructure Bill 2024-25: Progress of the Bill* (5 June 2025) (CBP10277, 51

reductions to environmental protection through the bill.[399] These contentions create a complex landscape for future GGR projects in terms of interpreting and adhering correctly to new legal frameworks. The future enacted legislation arising from this planning reform could also potentially generate impacts on land-based GGR projects, from the perspective of environmental protection and prioritisation of carbon sequestration activities. Further reforms are anticipated for planning law, indicating that development of this area of law is far from complete, and is one which will likely lead to fundamental changes to existing systems of which future projects will require to be aware.[400]

### *7.5.2 Environmental impact Assessments*

Post-Brexit, EIAs in their current form have been under scrutiny, and the UK Government has indicated that EIAs will instead become 'Environmental Outcomes Reports.'[401] The OEP has previously highlighted the flaws with EIAs from an English perspective, which, as they note, are not necessarily related directly to the black-letter law, but the broader planning framework.[402] These systemic flaws are threefold, namely: access to information, access to expertise, and monitoring, reporting and evaluation following a decision. The proposed adoption of Environmental Outcomes Reports is the UK Government's answer to address these flaws, together with alterations to the Habitats Regulations Assessment process in order to improve access to evidence and data.[403] The UK Government has further indicated its pursuit of EORs through its Planning Reform Working Paper, advocating an "outcomes-focused" [404] direction; however, this does not yet define a specific approach. From the perspective of other nations, Scotland has proposed legislative changes in order to allow Scottish Ministers to modify EIA and Habitats Regulation Assessment procedures going forwards.[405] Changes to well-entrenched systems, especially those created through assimilated EU law, inevitably lead to further complexity for developers, which in turn creates a more burdensome position for small companies or start-ups. It is important that GGR operators which are pursuing projects requiring planning consent keep abreast of changes to regulation and procedure required in order to prevent unwanted delays to their projects.

### *7.5.3 Permitting in England*

Environmental permitting systems in England have recently become a priority for the UK Government and regulators, in particular through the 'Regulation for Growth' Action

399 Leigh Day, 'Wild Justice starts legal proceedings against Government's controversial Planning and Infrastructure Bill (May 2025) <www.leighday.co.uk/news/news/2025-news/wild-justice-starts-legal-proceedings-against-government-s-controversial-planning-and-infrastructure-bill/> accessed 29 August 2025

400 George Parker and others, 'Rachel Reeves orders fresh planning overhaul for 'critical' infrastructure projects' *Financial Times* (12 August 2025) <www.ft.com/content/e3fa09b0-35b8-4788-86ac-ae9a1227b6d1> accessed 29 August 2025

401 UK Government, Department for Levelling Up, Housing and Communities, 'Government response to the Office for Environmental Protection's review into the implementation of environmental assessment regimes' (January 2024) <www.gov.uk/government/publications/review-of-the-implementation-of-environmental-assessment-regimes-in-england-government-response/government-response-to-the-office-for-environmental-protections-review-into-the-implementation-of-environmental-assessment-regimes> accessed 29 August 2025

402 Office for Environmental Protection, 'Environmental assessments are not as effective as they should be due to practical barriers to implementation, says OEP' (October 2023) <www.theoep.org.uk/report/environmental-assessments-are-not-effective-they-should-be-due-practical-barriers> accessed 29 August 2025

403 UK Government, Department for Levelling Up, Housing and Communities, 'Government response to the Office for Environmental Protection's review into the implementation of environmental assessment regimes' (n401)

404 UK Government, Department for Levelling Up, Housing and Communities, 'Planning Reform Working Paper: Development and Nature Recovery' <www.gov.uk/government/publications/planning-reform-working-paper-development-and-nature-recovery/planning-reform-working-paper-development-and-nature-recovery> accessed 29 August 2025

405 The Natural Environment (Scotland) Bill 2025

Plan,[406] the Corry Review,[407] and Defra's latest consultation on streamlining environmental permitting.[408] These documents all highlight the inefficiencies of the existing regulatory landscape, in particular the challenges associated with being overly risk-averse, which are discussed at length in Chapter 3. Defra's consultation explores potential reform to environmental permitting in order to streamline current systems, focused on permitting for industrial facilities. The consultation recognises the delays to permitting that industry faces, as well as the paralysing nature of extremely risk-averse regulation. Proposed solutions include reformed approaches to research and development projects, including more relaxed regulatory environments for pilot projects through 'regulatory sandboxing', as well as the creation of standards which can be updated rapidly, and proportionate regulation to support industry planning and investment.[409] It remains to be seen how these goals will come to fruition post-consultation, but it is a landmark step in reforming environmental permitting which will likely benefit future GGR projects, in particular those involving industrial processes.

### *7.5.4 Planning and permitting – devolved nations*

Devolved nations are also undertaking reform of planning and permitting legislation, which centres similarly around the current legal complexity that planning and permitting both create. In Wales, the Planning (Wales) Bill is to be introduced to the Welsh Parliament in September 2025. This bill is not intended to change the law fundamentally, but has been created in response to recognition that planning law is "currently hard to understand and navigate."[410] The bill simplifies, aligns and consolidates the existing piecemeal regulation of planning in Wales, extracting relevant provisions from the Town and Country Planning Act 1990 and other acts in order to harmonise the law with current terminology and policies. Simplification of planning law, when executed correctly, can create a more facilitative legal environment for start-up or small-scale projects.

In Scotland, permitting systems have been reformed through the extension of the Environmental Authorisation (Scotland) Regulations 2018. The original regulations covered radioactive substances regimes, however this consolidation of existing law centralises and joins up the currently separate permitting processes for water, pollution, waste, and other industrial activities.[411] This novel permitting structure will be deployed through a staggered process, commencing in November 2025 with certain high-risk permitting areas such as radioactive substances. This regulatory shift is crucial for GGR techniques such as DACCS and any GGR pathways involving waste, and will involve careful navigation. If executed as envisioned, this permitting structure could greatly benefit GGR operators, particularly new entrants, and could influence permitting law changes in other UK nations.

406 UK Government, HM Treasury, 'A new approach to ensure regulators and regulation support growth' (March 2025) <www.gov.uk/government/publications/a-new-approach-to-ensure-regulators-and-regulation-support-growth> accessed 29 August 2025
407 Dan Corry (n23)
408 UK Government, Department for Environment Food & Rural Affairs, 'Consultation on modernising environmental permitting for industry' (n83)
409 *ibid*, see Goals 1-5
410 Welsh Government, 'Consolidation of planning law' (June 2025) <www.gov.wales/draft-planning-wales-bill-overview> accessed 29 August 2025
411 Scottish Environment Protection Agency, 'Environmental Authorisations (Scotland) Regulations' <https://beta.sepa.scot/regulation/authorisations-and-compliance/easr-authorisations/> accessed 29 August 2025

Northern Ireland has previously considered the efficacy of its existing planning system, noting where monitoring of provisions or policy is required,[412] and it has also updated ancillary aspects of planning law. It is not indicated in the existing literature that there will be imminent legislative reform in Northern Ireland to replicate the consolidation frameworks of Wales and Scotland, or large-scale regulatory change similar to England.

### *7.5.5 Community Benefit Schemes*

The UK Government is currently exploring the concept of mandatory community benefit schemes for low-carbon energy infrastructure.[413] These reform proposals introduced for low carbon energy infrastructure do not necessarily impact GGR projects directly, however they do spark contemplation of how GGR projects could interact with community benefit in future. Community benefit schemes are designed to provide benefits to local communities which may be impacted by large-scale infrastructure such as windfarms. So far in the UK these schemes have been developed as best practice and will be considered throughout the planning process, but they are not strictly mandated within legislation nor do planning decisions depend upon them being present.[414]

The concept of whether analogous schemes could be considered for future GGR projects which might impact local communities was explored in various interviews, and has been noted briefly in surrounding literature.[415] One interviewee noted that there are differences which need to be considered, for example the impacts of a GGR project could be highly localised, however the benefit of the carbon sequestration is more holistic and dispersed (as opposed to, for example, the benefit of energy generation available at source).[416] Few GGR projects have so far encountered notable or contentious community impacts created by their projects (see Chapter 16.2.2 regarding the challenges of community protest), however one example of localised community impact was raised in interview in the context of peatland restoration activities. Rewetting and restoration of peat can devalue land through lowered productivity, which in turn has an impact on employment and profit in the area.[417] From this scenario it is clear that it is not just engineered GGRs which may impact communities, and this is an area of law which also intersects just transition considerations (Chapter 6.1). Consideration of community benefit schemes and localised interaction may become relevant for an array of GGR projects in future.

412 Northern Ireland Executive, Department for Infrastructure, 'Review of the Implementation of the Planning Act (NI) 2011' (January 2022) <www.infrastructure-ni.gov.uk/sites/default/files/publications/infrastructure/review-planning-act-report-jan2022.pdf> accessed 29 August 2025

413 UK Government, Department for Energy Security & Net Zero, 'Community benefits and shared ownership for low carbon energy infrastructure: working paper' (May 2025) <www.gov.uk/government/publications/community-benefits-and-shared-ownership-for-low-carbon-energy-infrastructure/community-benefits-and-shared-ownership-for-low-carbon-energy-infrastructure-working-paper-accessible-webpage> accessed 29 August 2025

414 UK Government, Department for Energy Security & Net Zero, 'Community Benefits Guidance for Onshore Wind in England' <https://assets.publishing.service.gov.uk/media/686782a3e134dfbc2e9e6d8a/community-benefits-guidance-for-onshore-wind-in-england.pdf> accessed 29 August 2025, 9

415 For example: IDRIC (n340), 12

416 Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025)

417 Interview with Participant 7740413, GGR-Peat (online, 17 February 2025)

## CHAPTER 7.5 – FINDINGS AND RECOMMENDATIONS

- ✓ Planning and permitting are complex areas of law
- ✓ Delays to permitting decisions create severe impacts for projects, creating costs which are a challenge to cover
- ✓ Standard permitting procedures can be unsuitable for GGR projects as they provide inflexible options to choose from, not having regard to the finite nature of pilot projects or intermittent operations
- ✓ Risk assessments required for permits can be disproportionate to the scale of the GGR project
- ✓ Regulators face difficulties when attempting to evaluate project impacts for novel technologies, as these impacts are not yet definitive and lack supporting evidence
- ✓ Even in scenarios where planning decisions are not delayed, the process is still extremely long and complex for first-of-a-kind projects, particularly large-scale infrastructure
- ✓ Utilisation of external expertise to navigate the planning system is not an option for all projects, particularly small-scale operators
- ✓ CCS systems within GGR projects can face disproportionate standards due to the current planning system being based on industrial scale CCS systems
- ✓ Connections within local planning authorities can facilitate planning decisions, however establishing contact as a new entrant can be challenging
- ✓ There is a lack of understanding surrounding GGR projects, exacerbated by inflexible planning application structures, which in turn can create confusion for public consultation proceedings, creating contention and delays
- ✓ Changes to English planning law may affect judicial review and environmental protection, creating contention and a complex legal landscape for future GGR projects to navigate
- ✓ Deeply entrenched EIA law and procedures are subject to change through proposed Environmental Outcomes Reports, again leading to future complexity for GGR developers
- ✓ Planning law in Wales is intended to be consolidated in future, as well as permitting systems in Scotland also being consolidated and synchronised, which may be complex to navigate in its early stages
- ✓ GGR projects in future may consider community benefit schemes in scenarios where the project will create local impacts

Figure 8: Chapter 7.5 Findings and Recommendations

# Chapter 8 – Land law

This chapter forms an exception in this report in that it engages with an area of private law. Land law is a complex area that has the potential to create hurdles for GGRs which require land use and access, such as afforestation (Chapter 14), peatland restoration (Chapter 15), and biomass crop growth for BECCS (Chapter 11). Land law can also impact climate mitigation and net zero actions more broadly. This therefore forms a private law barrier in a public law context, and should be addressed accordingly. It should be noted that in exploring these issues, this report does not attempt to make recommendations as to the optimal allocation of land use for GGRs, only the legal challenges that exist from an objective perspective.

Land law is a deeply historic and codified area of law throughout the UK. Unlike some areas of law, land law differs distinctly between UK nations. Land law is a highly relevant challenge for GGRs, particularly in the context of those demanding large areas of land or use of agricultural land. Land use and land-use change are complex areas with many stakeholder groups, competing interests, and legal rights. The full extent of land law as it relates to GGRs is an evolving area, as nations create policies for land use and reform agricultural land management.

## 8.1 Land use policy

Almost every interview engaged with the subject of land use and land-use change. How the UK uses its limited land optimally is a question which is at the forefront of policy development, for example through the development of the Land Use Framework in England.[418] Besides the development of English policy, each UK nation has various policy and strategy documents which outline land use. In Scotland, there is a legislative requirement to produce a Land Use Strategy every five years,[419] although the strategy itself is not binding. The latest strategy runs from 2021-2026, and references the carbon sequestration value of afforestation and peatland.[420] Scotland has also produced a Land Rights and Responsibilities Statement which creates principles for land ownership, importantly that land rights should support environmental and net zero goals.[421]

In other UK nations, land use is a policy focus, without legal obligations. Wales has set out a broad National Plan,[422] and Northern Ireland is yet to develop a general framework for land use, but it has developed a strategy for agricultural land.[423] The effective use of land, including

418 Proposals for a Land Use Framework were open for consultation in 2025: UK Government, 'Land Use Consultation' (n233)
419 Climate Change (Scotland) Act 2009, s57
420 Scottish Government, 'Scotland's Third Land Use Strategy 2021-2026' (March 2021) <www.gov.scot/publications/scotlands-third-land-use-strategy-2021-2026-getting-best-land/> accessed 29 August 2025
421 Scottish Government, 'Scottish Land Rights and Responsibilities Statement 2022' (September 2022) <www.gov.scot/publications/scottish-land-rights-responsibilities-statement-2022/> accessed 30 August 2025
422 Welsh Government, 'Future Wales: The National Plan 2040' (February 2021) <www.gov.wales/sites/default/files/publications/2021-02/future-wales-the-national-plan-2040.pdf> accessed 30 August 2025
423 Department of Agriculture, Environment and Rural Affairs, 'Delivering Our Future, Valuing Our Soils: A Sustainable Agricultural Land Management Strategy for Northern Ireland' (May 2018) <www.daera-ni.gov.uk/sites/default/files/publications/daera/16.17.079%20Sustainable%20Land%20Management%20Strategy%20final%20amended.PDF> accessed 30 August 2025

for carbon storage purposes, is also delineated in the National Planning Policy Framework.[424] Land use is also interlinked with national climate change plans, carbon budgets, and specific targets set for afforestation and peatland restoration.

This report does not make attempts to analyse these policy documents in isolation, as they are not legally binding. In the context of GGRs and land however, the proposed Land Use Framework for England contains important proposals which were discussed by multiple interviewees. At the forefront of these discussions was the proposal for land use or management changes to account for climate and the environment, for example the highest target being a 9% land-use change by 2050.[425] Interviewees recognised the impact such a target could have, in particular for the farming community and the pressures activities such as afforestation, peatland restoration, or biomass crop growth could bring to agriculture.[426] As is discussed throughout this chapter, the farming community is a pivotal stakeholder for GGR activities, and the law surrounding agriculture is complex and generally ill-fitting with GGR scaling ambitions. Although the policies outlined above do not prescribe any legal obligations, it is inevitable that ambitious policy targets will drive legal change, including within land law.

## 8.2 Land ownership rights

Regardless of the existence of ambitious policy for land-use change or GGR activity scaling such as peatland restoration and afforestation, the majority of land in the UK is privately owned and protected robustly by law. Although these laws differ in each UK jurisdiction, there are commonalities which arise due to other sources of law, specifically human rights, under which every person has the right to peaceful enjoyment of their possessions,[427] which includes the property or land they own. This heavily protected private right is difficult to navigate in the context of GGRs. The crucial caveat to this right is that a person may be deprived of their right if it is in the public interest to do so. The challenge therefore is how to balance GGR activities as being in the public interest, against private property rights.

This fundamental consideration spans all four nations, however has recently been explored in Scotland in the context of proposed land reform.[428] In Scotland, various reforms to land law are being proposed through the Land Reform (Scotland) Bill. One of the reforms relevant to GGRs is the proposed obligation on land managers to set out information in land management plans, delineating how they intend to achieve net zero emissions, adapt to climate change, and increase or sustain biodiversity.[429] If enacted, this obligation will encourage land managers to consider GGR pathways. This reform does not necessarily prescribe any specific action a land manager must take to fulfil their land management plan and therefore it has not been raised

424 UK Government, Ministry of Housing Communities & Local Government 'National Planning Policy Framework' (December 2024) <https://assets.publishing.service.gov.uk/media/67aafe8f3b41f783cca46251/NPPF_December_2024.pdf> accessed 30 August 2025, 36
425 UK Government, 'Land Use Consultation' (n233), 15
426 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
427 Human Rights Act 1998, Schedule 1 Part II The First Protocol Art 1, adopting the European Convention on Human Rights (ECHR) (1950) 213 UNTS 222
428 For discussion of the balance of rights and public interest see: James Muir KC, 'Balancing rights and interests in Scottish land reform' Scottish Land Commission (February 2022) <www.landcommission.gov.scot/downloads/620f73b06cbc1_Land%20Lines%20-%20Balancing%20rights%20and%20interests%20in%20Scottish%20land%20reform.pdf> accessed 30 August 2025
429 Land Reform (Scotland) Bill, s44B

as a point of contention at this stage. On the other hand, if a proposal for legislative reform is perceived as creating interference with private ownership rights and is perceived as an overstep of regulatory power, then it can face fierce opposition from stakeholders. One such example is the Natural Environment (Scotland) Bill, introduced by the Scottish Government in February 2025. In its original form, this Bill proposed the introduction of Deer Management Nature Restoration Orders, which would impose duties on land owners and land managers in relation to deer culling and provide the regulator with the ability to enter private land for deer management purposes. Following consultation and opposition,[430] this proposal was dropped. The importance of balancing land ownership rights with legislative reform will be a very relevant consideration for any future reform which seeks to encourage or impose GGR-related targets or obligations on landowners.

## 8.3 Land access

From the perspective of some interviewees, access to private land was noted as a logistical barrier for GGR activities in more remote regions, particularly in the context of upland peat restoration, where privately owned land was identified in interview as being one of the greatest barriers to widespread peatland restoration throughout the UK.[431] Project operators may have to access land which is owned by various parties in order to access the designated site, which necessitates private agreement with individual landowners. However, not all nature-based GGR projects encounter challenges relating to land law. The path of least resistance for some projects is to collaborate with some of the UK's largest landowners (by acreage), such as the National Trust or an environmental regulator such as Natural England.[432] Not only does this approach circumvent challenges of engaging with individual private landowners, it also provides efficiency for projects, as large non-private landowners are likely to have strong connections to regulators which control GGR activities such as peatland restoration or afforestation.

## 8.4 Agricultural tenancies

Agricultural land use comprises 70% of the UK's land coverage,[433] and tenancies form an important portion of agricultural land in the UK, particularly in England and Wales. Over half of English farmable land is tenanted, either in whole or in part.[434] The law as relates to tenancies is crucial from the perspective of GGR scaling, as it can pose restrictions to the ability to change the use of tenanted land. This is particularly relevant for afforestation and peatland restoration, where interviewees have noted that increasing targets for these activities do not

430 E.g.: Scottish land and Estates, 'Excessive Government Powers Over Deer Management Risk Damage to Modernisation Proposals' (January 2024) <www.scottishlandandestates.co.uk/news/excessive-government-powers-over-deer-management-risk-damage-modernisation-proposals> accessed 30 August 2025

431 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025) – note land access rights differ throughout the UK

432 See for example GGR-Peat uplands project in South Pennines: UK Centre for Ecology & Hydrology, 'GGR-Peat' <www.ceh.ac.uk/our-science/projects/ggr-peat> accessed 30 August 2025;

433 UK Government, Department for Environment, Food & Rural Affairs, 'Agricultural Land Use in United Kingdom at 1 June 2024' <www.gov.uk/government/statistics/agricultural-land-use-in-the-united-kingdom/agricultural-land-use-in-united-kingdom-at-1-june-2023> accessed 31 August 2025; Interview with Participant 7740413, GGR-Peat (online, 17 February 2025)

434 Tenancy Working Group, 'The Rock Review: Working together for a thriving agricultural tenanted sector' (October 2022) <https://assets.publishing.service.gov.uk/media/6347da6ae90e0731ac4a55c0/The_Rock_Review_-_Working_together_for_a_thriving_agricultural_tenanted_sector.pdf> accessed 31 August 2025, 9

consider fully the inaccessibility of large areas of land that tenure arrangements can create.[435]

Agricultural tenancies in England and Wales vary greatly in substance, as with any private law agreement, however they are all underpinned by legislation and specific statutory conditions, and can be split into two categories: historic tenancies which were created prior to 1995, falling under agricultural holdings legislation;[436] and more modern farm business tenancies, falling under agricultural tenancies legislation.[437] The latter form of tenancy can, depending on the minutiae of the agreement, provide a more lenient structure whereby tenants can change the use of the land in certain circumstances and pursue environmental schemes.[438] Tenancies prior to 1985 are more archaic in nature, create a more rigid structure, and provide lifetime security of tenure.

One of the fundamental challenges identified in interview with regard to the limitations tenancy arrangements create, is the legal ability to change land use for GGR purposes. This is not an insurmountable problem for traditional owner occupier scenarios, where the right to change land use is clear. However, for tenants the legal position is not always clear and, in many circumstances, not permitted due to tenancies limiting the actions of tenants to only agricultural activities.[439] In addition, as noted in a recent independent review commissioned by Defra, specific provisions within legislation can allow the termination of tenancies for certain tree-planting activities.[440] The culmination of these statutory controls is clearly limiting for the scaling of GGR activities on agricultural land.

Another potential barrier posed by tenancy arrangements is the harmony between agri-environmental schemes and tenancies, which may impact a tenant's ability to enter into ELMS, for example, without seeking permissions or potentially breaching conditions of the tenancy.[441] The ability of tenant farmers to be able to access agri-environmental subsidies was similarly the focus of the recent independent review regarding tenant farming in England.[442] This concern over the incompatibility between financial mechanisms and existing tenancies stretches also to the ability of tenant farmers to access natural capital markets under existing arrangements.[443] A lack of access to public finance and incentives further limits the feasibility of GGR activities.

Finding solutions to these legal barriers will require detailed engagement with black letter law. It was discussed in interview that there are many other implications for tenant farmers and tenancy agreements in the context of land-use change. These impacts can include changes to rent, tax, business relationships between private landlords and tenants, and the potential for tenants in certain circumstances to lose their accommodation on the farmland if their leases are changed.[444] Any changes to legislation will not only have to consider the financial impacts from tenancies, but also the social and cultural impacts that farmers value, placing them in

435 Interview with Participant 3743080, Net Zero Plus (online, 1 May 2025)
436 Agricultural Holdings Act 1986
437 Agricultural Tenancies Act 1995
438 For a summary see: UK Government, Department for Environment, Food & Rural Affairs, 'Agricultural Tenancies' (August 2012) <www.gov.uk/guidance/agricultural-tenancies> accessed 31 August 2025
439 What qualifies as agriculture is limited within the Agricultural Holdings Act 1986, s96
440 Tenancy Working Group, 'The Rock Review: Working together for a thriving agricultural tenanted sector' (n434), 69
441 Noted in Rebecca Cattermole 'Agricultural Holdings' in Nigel Pleming and others (eds) (n88), 24.02
442 Tenancy Working Group, 'The Rock Review: Working together for a thriving agricultural tenanted sector' (n434)
443 Dustin Benton and others, 'Natural capital: the battle for control' (January 2022) <https://green-alliance.org.uk/wp-content/uploads/2022/01/Natural_capital_the_battle_for_control.pdf> accessed 1 September 2025
444 Interview with Participant 3743080, Net Zero Plus (online, 1 May 2025)

a unique position.[445] Progress in this space will be important for the purposes of financial support for GGRs activities on agricultural land, as well as providing clearer pathways for tenants to undertake GGR activities. It remains to be seen how the newly-founded Tenancy Agricultural Forum will navigate these challenges and provide the requisite solutions in England and Wales.[446]

Scotland presents a lower agricultural tenancy rate than England and Wales,[447] but this does not mean it is immune to similar legal challenges in the context of climate change and GGR activities. In Scotland there is an array of agricultural tenancies and other forms of tenure such as crofting, which is its own unique area of law.[448] Agricultural tenancies tend to fall within the Agricultural Holdings (Scotland) Act 1991, under which said tenancies will endure indefinitely unless notice to quit is given or termination is set out within the lease.[449] There are also more modern tenancies such as Short Limited Duration Tenancies, or Limited Duration Tenancies. Agricultural tenancies in Scotland were proposed for reform in 2021 in order to facilitate climate change adaptation and mitigation within farming, including biodiversity.[450] Since then, the Land Reform (Scotland) Bill has been proposed, containing provisions for Scottish Ministers to create a model lease which enables landowners to let out land wholly or partly for an environmental purpose.[451] This reform creates new opportunities for landowners to let land for multiple purposes such as sustainable agriculture and climate change adaptation, consequently creating a more facilitative pathway for GGR activities.

Northern Ireland has a notably different tenancy system and is therefore often excluded from UK studies on tenancy agreements. Agricultural tenancies are uncommon in Northern Ireland due to multiple historic factors, and instead landowners and land managers will more often enter into conacre or agistment agreements, which are more akin to contractual licences. Just over 40% of Northern Irish farms are partly rented through such arrangements, with over 50% of farms being owner occupied.[452] This presents a slightly more fluid legal position than other nations in the UK. It was noted in interview that the challenges felt across Scotland, England and Wales do not transpose into Northern Ireland.[453]

445 Interview with Participant 3743080, Net Zero Plus (online, 1 May 2025)
446 UK Government, Department for Environment, Food & Rural Affairs, 'Farm Tenancy Forum: terms of reference from 2024' (November 2024) <www.gov.uk/government/publications/farm-tenancy-forum-terms-of-reference-from-2024/farm-tenancy-forum-terms-of-reference-from-2024> accessed 31 August 2025
447 The majority of Scotland's farms are owner occupied: Land Reform Review Group, 'The Land of Scotland and the Common Good' (May 2014) <www.gov.scot/publications/land-reform-review-group-final-report-land-scotland-common-good/> accessed 31 September 2025, 194-195
448 Crofting involves smaller areas of land usually dedicated to low-intensity livestock, covering 750,000 hectares of land in Scotland: Crofting Commission, 'What is crofting?' <www.crofting.scotland.gov.uk/what-is-crofting> accessed 31 August 2025
449 The perpetuity of these leases is referred to as 'tacit relocation': see Agricultural Holdings (Scotland) Act 1991, s3
450 Scottish Government, 'Strategic Environmental Assessment (SEA) for the Agricultural Tenancies proposals Environmental Report' (October 2023) <www.gov.scot/publications/strategic-environmental-assessment-sea-agricultural-tenancies-proposals-environmental-report/pages/2/> accessed 31 August 2025
451 Land Reform (Scotland) Bill, s7
452 Northern Ireland Statistics and Research Agency, 'Statistical Review of Northern Ireland Agriculture' Department of Agriculture, Environment and Rural Affairs (2023) <www.daera-ni.gov.uk/articles/statistical-review-ni-agriculture> ,49
453 Interview with Participant 3743080, Net Zero Plus (online, 1 May 2025)

## 8.5 Other land rights

Beyond tenancies, there are multiple other rights which may arise in relation to land and may impact the ability of a landowner to consider GGR activities or land-use change. An example of this is common grazing rights, where multiple parties have rights over the same area of land for livestock grazing.[454] Common grazing land forms 7% of the UK's utilised agricultural land,[455] and the ability to change the use of common grazing land is a challenge due to requiring the consensus of all parties with the right to use that land.[456] In Scotland, 30% of peatland falls within common grazing areas,[457] therefore this type of land right could prove an important factor for future peatland restoration in Scotland. Current research has made clear that it is not yet understood how the statutory rights associated with common grazing in Scotland work alongside peatland restoration associated with the IUCN UK Peatland Code, for example in the context of owning carbon credits and how all parties with rights to the land can engage with the contractual process.[458] Although this scenario forms a small facet of GGRs, it demonstrates the complexity that land rights can create, and finding solutions to the complexity of common grazing could facilitate peatland restoration scaling, particularly in Scotland.

Other examples of legal rights related to land include grazing licences, where a third party has a contractual right (as opposed to a statutory right) to use land for grazing purposes. Other contracts include instructions of contractors for contract farming, where a third-party contractor will undertake farming operations and management, without having any ownership rights to the farmland. It is important to acknowledge these types of frameworks, as they will impact LULUCF decisions made by agricultural landowners, however in comparison to the issues posed by tenancies, these contractual arrangements are not seen as creating barriers for GGR scaling activities.[459]

454 Common grazing rights in Scotland are tied to crofts
455 UK Government, Department for Environment, Food & Rural Affairs 'Farming evidence – key statistics' (September 2024) <www.gov.uk/government/publications/farming-evidence-pack-a-high-level-overview-of-the-uk-agricultural-industry/farming-evidence-key-statistics-accessible-version> accessed 31 August 2025
456 For a summary of the rights of commoners in England see: UK Government, Department for Environment, Food & Rural Affairs, 'Managing common land' (March 2015) <www.gov.uk/guidance/managing-common-land#commoners-rights> accessed 31 August 2025
457 Ewan Jenkins and others, 'Peatland restoration: A Guide for Crofting Communities' (University of St Andrews February 2024) <https://pure.st-andrews.ac.uk/ws/portalfiles/portal/299985102/Booklet_Community_Guide-Feb-final.pdf> accessed 31 August 2025
458 *ibid*
459 Interview with Participant 3743080, Net Zero Plus (online, 1 May 2025)

## CHAPTER 8 – FINDINGS AND RECOMMENDATIONS

- ✓ Land use policy is an important influence for land law development, and increasingly land use policy is focusing on climate change and net zero goals
- ✓ Balancing private land ownership rights with public interest actions such as GGR activities is challenging and complex, particularly in the context of proposing legislative reform to land management practices
- ✓ Access to land forms a barrier for projects unless they collaborate with established non-private landowners
- ✓ Agricultural tenancies in their historic forms can severely restrict the ability of tenants or landlords to pursue GGR activities on leased agricultural land
- ✓ Agricultural tenancies can also restrict the ability of tenants to access carbon markets or public funding mechanisms such as ELMS
- ✓ The barriers posed by these tenancies require to be addressed in order to facilitate GGR scaling
- ✓ Scotland is proposing through draft legislation a model environmental lease in order to address these challenges, an approach which other nations could emulate, noting however the distinct land law of each nation
- ✓ Fewer challenges associated with agricultural tenancies or other rent mechanisms are present in Northern Ireland compared to the rest of the UK
- ✓ Other land rights must be considered when approaching land-use change, such as common grazing, grazing contract licences, and contract farming

Figure 9: Chapter 8 Findings and Recommendations

# Chapter 9 – Waste Law

Waste law is an area of law which cuts across multiple GGR techniques such as biochar (Chapter 12), ERW (Chapter 13), DACCS (Chapter 10), and BECCS (Chapter 11). Waste law presents some very specific challenges for these GGRs, which are better addressed in the respective aforementioned GGR-specific chapters. This chapter gives an overview of waste law in the UK, providing a framing for issues which GGR industry and regulators have encountered so far.

## 9.1 Regulation of waste in the UK

Waste law in the UK extends across multiple statutes, devolved regulations, regulator protocols and guidance, and importantly underlying EU law which has been assimilated into domestic law post-Brexit. EU law relevant to the UK stems primarily from the Waste Framework Directive, which has been transposed into domestic law through acts such as the Environmental Protection Act 1990. Waste law also includes adoption of European Waste Classifications. The EA, SEPA, and NRW all jointly maintain technical guidance on the classification of waste and relevant waste codes which derive from European Waste Classifications.[460] These classifications arise from the European Commission Decision establishing a list of waste,[461] and dictate the substances which are classified as wastes in the UK.[462] Northern Ireland has similar guidance.[463] Overall, waste law is extremely complex to navigate, which poses a hurdle to smaller GGR operators or start-ups.

## 9.2 Defining waste

Waste is defined within assimilated EU law as "any substance or object which the holder discards or intends or is required to discard"[464], and 'controlled waste' is any household, industrial or commercial waste.[465] A problem posed for multiple GGR technologies is firstly how to delineate what is and is not a waste.[466] This is critical to the business pathways of GGR techniques as it may involve specific permitting or licensing responsibilities, as discussed more within each GGR-specific chapter in this report. When differentiating between waste and by-

460 Natural Resources Wales, Scottish Environment Protection Agency, Environment Agency, 'Waste Classification' 1st Edition v1.2.GB (October 2021) <https://assets.publishing.service.gov.uk/media/6152d0b78fa8f5610b9c222b/Waste_classification_technical_guidance_WM3.pdf> accessed 2 September 2025

461 Commission Decision (2000/532/EC) replacing Decision 94/3/EC establishing a list of wastes pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste

462 See guidance for England, Scotland and Wales: Natural Resources Wales, Scottish Environment Protection Agency, Environment Agency, 'Waste Classification' (n460)

463 Northern Ireland Environment Agency, 'Waste Classification' 1st Edition v1.2.NI (January 2022) <www.daera-ni.gov.uk/sites/default/files/publications/daera/WM3%20NI%20v1.2.pdf> accessed 1 September 2025

464 Waste Framework Directive (2008/98/EC), Art 3(1); for domestic law see also Environmental Protection Act 1990, s75(2)

465 See generally Environmental Protection Act 1990, s75(4);

466 For the EC's decision tree on classifying a waste, see: Communication from the Commission to the Council and the European Parliament on the Interpretative Communication on waste and by-products (21 February 2007) COM(2007) 59 final; for UK Gov advice, see UK Government, Environment Agency, 'Check if your material is a waste' (August 2021) <www.gov.uk/guidance/check-if-your-material-is-waste> accessed 2 September 2025

products, there are multiple considerations to be taken into account, such as the intended use of the substance, whether it was produced deliberately and has a specific use, and subsequent processing of the material. A by-product must be integral to the production process, have a definitive further use, be usable without further processing, and fulfil all existing legal criteria for its intended use.[467] The burden of proof for these criteria is high, operated on a case-by-case basis by the relevant regulators and requiring a risk assessment to compare the intended by-product with an existing analogous product,[468] which can create an onerous position for GGR projects seeking to prove the by-product nature of a material they have produced.

Similarly, a substance ceases to be a waste only in certain circumstances. Assimilated EU law outlines that a substance ceases to be a waste when it has undergone a recycling or recovery process which can then be used for specific purposes for which demand or a market exists, and the use of that substance will not cause negative environmental or human health impacts.[469] However, in practice the threshold for proving these criteria can be extremely challenging, as documented for specific GGRs (explored more in the context of biochar at Chapter 12).[470] The legal hurdles presented by the law surrounding by-products and end-of-waste are crucial for both industry and regulators to navigate in order to create clear positions for various GGR pathways.

## 9.3 Altering waste law

As outlined, waste law UK-wide derives mostly from EU law, and many provisions of EU waste law have been assimilated and remain firmly entrenched in the UK legal systems, including fundamental provisions such as the definition of waste. With the exception of Northern Ireland and the provisions of the Windsor Protocol, the UK is no longer bound to adopt or comply with EU law which has been developed post-Brexit, and under the Retained EU Law (Revocation and Reform) Act 2023, assimilated EU law can be altered, revoked, or replaced within the UK.

However, although in theory Government Ministers have the regulatory freedom to update the law as required, in practice it proves more of a challenge, particularly in the context of waste, as it is likely that direct alteration to the Waste Framework Directive (as assimilated) would be required. There are multiple complexities arising from this, such as potential impacts if UK waste law does not emulate EU law, as waste is highly transboundary in nature. For the purposes of GGRs, complexity when reforming or altering waste law arises due to a lack of clear power allocation between government departments and regulators.[471] Defra reported that within regulations, there is no clear delineation of where the responsibility sits for updating waste law as required to accommodate certain GGR activities such as biochar production. It is clear that until such challenges can be solved, GGR techniques involving waste will be vulnerable to regulatory complexities.

467 Classification of by-product contained within Waste Framework Directive (2008/98/EC), Art 5(1)
468 For details on tests associated with by-products see: UK Government, Environment Agency, 'Check if your material is a waste' (n465)
469 Waste Framework Directive (2008/98/EC), Art 6(1), applied domestically as criteria for end-of-waste status as determined by the relevant regulator in each jurisdiction, see more Chapter 12.1.1
470 Luka Strubelj and Navraj Singh Ghaleigh, 'Biochar Regulation in the UK: A Wasteful Approach to Greenhouse Gas Removal' CO2RE The Greenhouse Has Removal Hub (June 2025) <https://co2re.org/wp-content/uploads/2025/06/biochar-waste-regulation-pb.pdf> accessed 2 September 2025, 5
471 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)

## CHAPTER 9 – FINDINGS AND RECOMMENDATIONS

- ✓ Waste law is a complex structure of assimilated EU law, a mixture of reserved and devolved domestic law, regulatory position statements, exemptions, and frameworks. This poses a challenge to GGR operators to ascertain the law as applies to their projects
- ✓ Defining waste is an important hurdle for GGR projects which use/produce wastes, or use/produce by-products, as falling within the category of waste increases regulatory burdens
- ✓ The burden of proof to achieve by-product status is high, requiring risk assessments and over evidence criteria which can be difficult for GGR projects to achieve
- ✓ End-of-waste is similarly challenging and costly to achieve, as discussed more in the context of biochar at Chapter 12
- ✓ Crucially, alterations to waste law are challenging due to the entrenched nature of assimilated EU law. It is not clear how certain aspects of waste law can be updated, a challenge which must be resolved in order to facilitate future GGR pathways which use or produce substances currently classified as waste

Figure 10: Chapter 9 Findings and Recommendations

# SECTION V

# Findings specific to both jurisdiction and GGR technique

This section of the report addresses issues specific to certain GGRs, exploring individual legal challenges that projects have faced which are applicable to specific technologies or nations. A consequence of this generative exploration and the variable life cycles of GGR projects is a lack of standardised approach presented in this Section V. Rather than imposing an artificial structure of analysis for each GGR technique and documenting areas of law which have not created barriers for projects so far, this section of the report focuses on the areas of law which present the greatest challenges for projects at this time. It is also important to note that many of these challenges cannot be addressed fully without first having considered the overarching challenges applicable to all GGRs, as discussed in Section II of this report. Specific regulations cannot be altered or introduced without first having resolved the barriers which affect all jurisdictions or all GGR techniques.

## Chapter 10 – DACCS

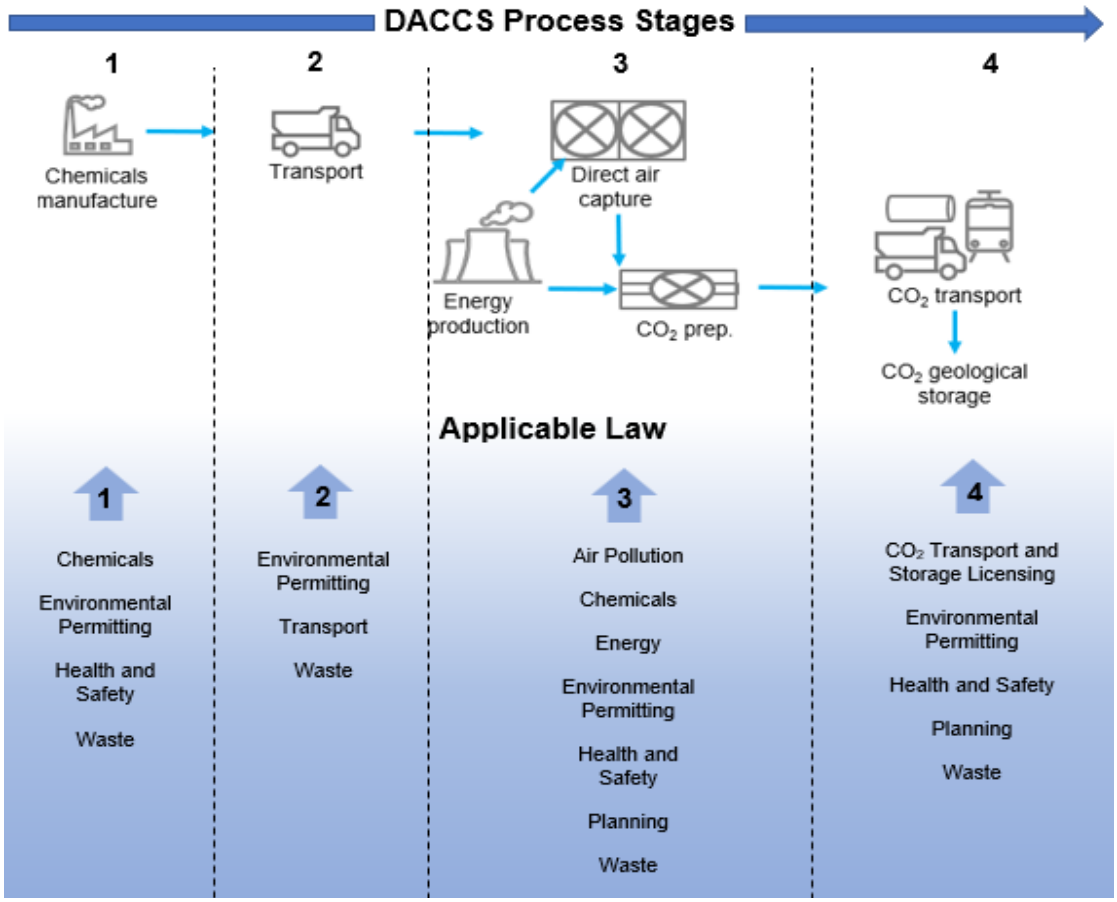


Figure 11: DACCS Process Diagram

DACCS is the process by which $CO_2$ is captured directly from ambient air.[472] In simple terms, this can be either a chemical (liquid-state) or physical (solid-state) process, depending on the technology pathway utilised.[473] The captured $CO_2$ is then stored geologically. In some circumstances, as explored below, the $CO_2$ is also utilised in products and processes. When considering the boundaries of the regulatory focus for DACCS, these most often only stretch to pipeline transport and storage of the $CO_2$, as opposed to NPT. The legal and physical challenges presented by a lack of NPT in the UK are addressed at Chapter 6.2. Ultimately, there may be legal barriers associated with DACCS which do not come to light until commercial operation begins in the UK, however this chapter discusses challenges which have already become apparent at this early stage of development.

## 10.1 Interaction with CCS development

DACCS and BECCS form the primary focus of GGRs from the perspective of UK Governmental support. A substantial portion of the development of DACCS and BECCS support is around the GGR Business Model and associated CfDs, as opposed to prescriptive regulation. As discussed in Chapter 5.2, business models are commercial in nature, as opposed to legal, and although CfDs are legal structures, they form the backbone of individual, private law contracts (with the UK Government-owned Low Carbon Contracts Company[474]) and the substance of such contracts falls outwith the scope of this regulatory review. The GGR Business Model and CfD are designed as technology-agnostic, in order to accommodate future technologies beyond DACCS and BECCS.[475]

In the near future, however, DACCS and BECCS projects are the most achievable engineered GGR options and have both being shortlisted for project negotiation lists at CCS clusters,[476] creating a definitive path to scaling for these projects. The prioritisation of DACCS and BECCS is, as noted by DESNZ, a conscious decision, based on the evidence and scalability of all GGR techniques, to prioritise the largest project feasibility in the near-term in order to remain compatible with Government and regulator goals such as maximising carbon sequestration.[477] A natural consequence of this prioritisation sequence is that any remaining regulatory gaps or challenges for DACCS operations require to be addressed in the short-term, in order to prevent unnecessary delay.

The UK's regulatory landscape for CCS has been deliberately thorough, existing to drive

472 International Energy Agency, 'Direct Air Capture' <www.iea.org/energy-system/carbon-capture-utilisation-and-storage/direct-air-capture> accessed 7 August 2025

473 See the following for more detailed DACCS pathways: Victor Eke and others, 'A comprehensive review of life cycle assessments of direct air capture and carbon dioxide storage' (May 2025) Sustainable Production and Consumption, Vol 55, 217-241, 221-222

474 Low Carbon Contracts Company, 'Contracts for Difference' <www.lowcarboncontracts.uk/our-schemes/contracts-for-difference/> accessed 2 September 2025

475 See the historic development of the GGR Business Model: UK Government, Department for Energy Security and Net Zero, 'Greenhouse Gas Removals: Update on the design of the Greenhouse Gas Removals (GGR) Business Model and Power Bioenergy with Carbon Capture and Storage (Power BECCS) Business Model' (December 2023) <https://assets.publishing.service.gov.uk/media/6581851efc07f3000d8d447d/ggr-power-beccs-business-models-december-2023.pdf> accessed 2 September 2025, 10

476 UK Government, Department for Energy Security and Net Zero, 'HyNet expansion: project negotiation list' (August 2025) <www.gov.uk/government/publications/hynet-track-1-expansion-selected-projects/hynet-expansion-project-negotiation-list> accessed 2 September 2025

477 Joe McQuillen and others, 'Assessing the Feasibility for Large-scale DACCS Deployment in the UK' Imperial College London, City Science (February 2025) <www.theccc.org.uk/wp-content/uploads/2025/02/Assessing-the-Feasibility-for-Large-scale-DACCS-Deployment-in-the-UK-2.pdf> accessed 2 September 2025

forward the UK's CCUS Vision to create a competitive market for CCS in the UK.[478] Ascertaining which specific parts of the CCS regulatory landscape are devolved or reserved adds additional complexity to navigating the regulation of DACCS and BECCS from the perspective of devolved nations. This challenge of establishing legal responsibilities was highlighted in the recent Welsh consultation on CCUS policy, for example in relation to onshore and offshore pipelines and storage infrastructure.[479] Factors such as onshore and offshore location of infrastructure change the regulatory responsibility of those parts of the CCS project accordingly.[480] These complexities will likely be ironed out as CCS clusters are developed, however it is an additional consideration for future CCS-dependent GGR projects which may be more dispersed or utilising NPT.

## 10.2 CCS regulatory framework

CCS regulation in the UK is widely acknowledged as being robust[481] and one of the best developed CCS regimes globally.[482] There are therefore few immediate concerns from the perspective of stakeholders regarding the operation of CCS regulation at this stage, however this may change when the regulatory system is stress-tested when CCS clusters become operational.

GGRs were included definitively within legislation through the Climate Change Act 2008, as amended by the Energy Act 2023.[483] When considering the implications of historic legislative definitions, DESNZ highlighted a potential legislative gap where CCS legislation existing prior to the introduction of GGR into the law governs fossil $CO_2$, but not other sources of $CO_2$ from GGR sources, primarily biogenic or atmospheric $CO_2$.[484] The probability of legislation referring to fossil $CO_2$ derives from the linkages between oil and gas regulation and CCS regulation. For example, multiple regulators governing CCS activities initially regulated oil and gas. The NSTA was previously the Oil and Gas Authority, now also regulating offshore storage of $CO_2$,[485] and Ofgem, the UK's downstream natural gas regulator, now also regulates the transport and storage network for CCS.[486] From a legislative perspective, the entanglement of CCS and oil and gas law could become more apparent if and when oil and gas assets are re-used for CCS activities.[487] These ties with oil and gas are important for the purposes of addressing potential gaps in CCS regulation which may affect GGR techniques involving permanent $CO_2$ sequestration as derived from atmospheric or biogenic carbon.

The legislative frameworks which form the main arteries of CCS regulation, for example

478 UK Government, Department for Energy Security & Net Zero, 'Carbon Capture, Usage and Storage: A Vision to Establish a Competitive Market' (n301)
479 Welsh Government, 'Welsh Government's preferred policy on carbon capture, utilisation and storage' (December 2024) <www.gov.wales/sites/default/files/pdf-versions/2024/12/1/1733150847/welsh-governments-preferred-policy-carbon-capture-utilisation-and-storage.pdf> accessed 5 September 2025, 8-9
480 *ibid*
481 For example: UK Government, Department for Energy Security & Net Zero, 'Carbon Capture, Usage and Storage: A Vision to Establish a Competitive Market' (n301), 11
482 See generally: Global CCS Institute, 'Global Status of CCS 2024: Collaborating for a Net-Zero Future' (2024) <www.globalccsinstitute.com/wp-content/uploads/2024/11/Global-Status-Report-6-November.pdf> accessed 5 September 2025
483 Climate Change Act 2008, s29
484 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
485 The NSTA is the licensing and permitting authority for CCS in line with The Storage of Carbon Dioxide (Licensing etc.) Regulations 2010, for an overview of responsibilities see: North Sea Transition Authority, 'Carbon storage' <www.nstauthority.co.uk/regulatory-information/carbon-storage/> accessed 5 September 2025
486 Ofgem acts as the economic regulator for CCS transport and storage activities, including the licensing regime for transport infrastructure through the Energy Act 2023
487 UK Government, Department for Business, energy & Industrial Strategy, 'Carbon Capture, Usage and Storage: A Government Response on Re-use of Oil and Gas Assets for Carbon Capture and Storage Projects' (2020) <https://assets.publishing.service.gov.uk/media/5f36c6df8fa8f51744decfe4/CCUS-government-response-re-use-of-oil-and-gas.pdf> accessed 5 September 2025

licensing regulations[488] and the Energy Acts,[489] do not limit the definition or source of $CO_2$ to fossil-derived $CO_2$, forming a $CO_2$ origin-agnostic approach. Within the Energy Act 2023, carbon capture activities span carbon captured from commercial and industrial activities, the atmosphere, or dissolved in sea water.[490] Concern arises in relation to residual and ancillary legislation relevant to the CCS value chain which remains potentially limited to fossil-derived $CO_2$. As of 2023, the UK had 68 pieces of legislation relevant to CCS, creating one of the most robust regulatory frameworks in the world.[491] A consequence of this vast network is that it can be challenging to identify via desktop research all potential applications of legislation which may still be limited to fossil $CO_2$. For the purposes of GGR scaling, this is an area of law which should be monitored closely as projects develop, as updates to regulation can be time-consuming and risk project delay. DESNZ is already taking steps to approach these legislative misalignments in some cases, for example through proposed updates to the Carbon Capture Revenue Support Regulations 2024, in order to accommodate GGR techniques that capture CO2 from the atmosphere or seawater within the regulations.[492]

## 10.3 DACCS project permitting

The full extent of how permitting procedures impact the scaling of DACCS is yet to be explored, as existing projects operate within the confines of research and development. In Scotland, challenges to permitting are to be addressed through the Environmental Authorisation (Scotland) Regulations 2018 (as outlined in Chapter 7.5.4). DACCS-specific measures under this reformed permitting process will come into place in 2027.[493] In the context of how this new regulation will better regulate DACCS, previous regulatory impact assessments identified that the current regulatory regime only controls DACCS activity arising from a facility which already falls within existing regulation.[494] Therefore, any free-standing DACCS facilities would not require a permit from SEPA, and therefore not be subject to legislative control for water, pollution, or noise.[495] The consolidated regulatory framework will help to close this gap. It is anticipated that lower risk DACCS activities, particularly solid-state DACCS, will attract a less stringent level of authorisation required than liquid-state DACCS.[496],[497]

488 For detailed criteria of $CO_2$ eligible for storage, see The Storage of Carbon Dioxide (Licensing etc.) Regulations 2010, Schedule 2
489 Energy Act 2008, Energy Act 2016, Energy Act 2023
490 Energy Act 2023, s67(7)
491 Ian Havercroft, Nabeela Raji, 'CCS Legal and Regulatory Indicator 2023' Global CCS Institute <www.globalccsinstitute.com/wp-content/uploads/2023/10/CCS-Legal-and-Regulatory-Indicator-Report-Global-CCS-Institute-.pdf> accessed 5 September 2025, 11
492 UK Government, Department for Energy Security & Net Zero, 'Greenhouse Gas Removals and Power Bioenergy with Carbon Capture and Storage Business Models' (April 2025) <https://assets.publishing.service.gov.uk/media/680b3ecc7a11df940be1aae4/ggr-power-beccs-revenue-support-regulations-consultation.pdf> accessed 5 September 2025, 20
493 Scottish Government, 'Business and Regulatory Impact Assessment: Environmental Authorisations (Scotland) Amendment Regulations 2024 – new activities' (October 2024) <www.legislation.gov.uk/ssi/2025/165/pdfs/ssifia_20250165_en_001.pdf>, 6
494 Pollution Prevention & Control (Scotland) Regulations 2012, Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (recast) ('Industrial Emissions Directive')
495 Scottish Government, 'Business and Regulatory Impact Assessment: Environmental Authorisations (Scotland) Amendment Regulations 2024 – new activities' (n492), 9-10
496 *Ibid,* 10
497 Solid-state DACCS generally presents lower temperature processes and more flexibility of energy source, compared to liquid DACCS which requires higher temperatures, likely nascent-stage reliance on fuel combustion: McQuillen and others, 'Assessing the Feasibility for Large-scale DACCS Deployment in the UK' (n476), 12-14; liquid state also presents increased risk from chemical handling: Victor Eke and others (n472), 239

Although Wales has a more preliminary focus on research and development-phrase DACCS projects at present, it was flagged by NRW that, similar to the regulatory gap evidenced in Scotland, DACCS would not be controlled adequately by the Environmental Permitting Regulations for England and Wales. The Environmental Permitting (England and Wales) Regulations 2016 address 'carbon capture and storage' as a regulated activity,[498] as does associated planning legislation requiring EIAs.[499] However, direct air capture is not mentioned within the permitting regulations and therefore that section of the value chain does not strictly require a permit, despite potential environmental risk inherent to all new technologies. NRW remarked that the risk profile for this regulatory gap in Wales is quite low, citing factors such as the availability of low-carbon power near suitable geological storage,[500] however also noted that it is important that permitting regulations are in alignment with planning law, in order to avoid future confusion. Similar also to the Scottish position is NRW's preference for a light touch consenting approach for solid-state DACCS technologies in comparison to chemical (amine) based capture, due to the differing levels of risk presented by each and the likely scaling of solid-state DACCS in the near-term.

England is also governed by the Environmental Permitting (England and Wales) Regulations 2016. There is a more direct and short-term need for a cohesive permitting regime in England due to anticipated commercial-scale DACCS projects emerging in line with CCS cluster sequencing, particularly solid-state DACCS pathways.[501] It is therefore important that regulatory alignment is sought.

It is not clear as to whether this regulatory gap is being considered in Northern Ireland. The Northern Irish legislative provisions for the permitting of CCS are identical to current Scottish legislation,[502] therefore a similar legal gap likely exists, however reforms in this area may remain an unlikely focus for Northern Ireland while future scaling of DACCS is anticipated to be distant.[503] An efficient outcome for Northern Ireland would be to emulate legislative updates made by other UK jurisdictions which are looking to scale DACCS in the nearer term.

In contrast to identifying gaps in regulation, there is also the difficulty that existing permitting regulations may be too robust for emerging research and development projects. Feedback from existing DACCS facilities addressed the stringency of noise assessments which were to be undertaken as part of the permitting process. An element of disproportionality was found to arise when the DACCS facility is co-located at an industrial site, where from the perspective of industry the robustness of the noise assessments which require to be undertaken is perhaps disproportionate to the context of the project, in terms of both location and the scale of the pilot.[504] This disproportionality has also been noted in wider CCS contexts.[505] Such stringency can create project delays, especially for start-ups or smaller operators engaging with a regulator for the first time. Operators with experience in this area have recommended early engagement with relevant regulators, to avoid delays from any unanticipated legal

498 Environmental Permitting (England and Wales) Regulations 2016, Schedule 1, Part 2, Chapter 1, Section 6.10
499 In the context of England, certain CCS activities, such as $CO_2$ transport pipelines exceeding a certain length fall within the Town and Country Planning (Environmental Impact Assessment) Regulations 2017, Schedules 1 and 2
500 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)
501 For example: UK Government, Department for Energy Security and Net Zero, 'HyNet expansion: project negotiation list' (n475)
502 The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013, Schedule 1
503 Department of Agriculture Environment and Rural Affairs, 'Draft Northern Ireland Climate Action Plan' (n4), 26
504 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
505 Ricardo, 'Strategic Spatial Planning for Low Carbon Industrial Clusters' (n346) 22

obligations.[506] Future updates to permitting, for example Scotland's approach of considering less onerous authorisation for low-risk projects, may help to avoid scenarios such as these.

When considering the entire project life cycle for DACCS, certain pathways will produce waste substances throughout the process, for example chemical waste. Navigating waste law within DACCS projects has not yet posed any notable challenges from industry's point of view, particularly as projects will often use licensed waste carriers to dispose of wastes produced by DACCS processes.[507] Outsourcing this part of the life cycle reduces significantly the regulatory burden on DACCS operators, as the transport of waste is heavily regulated,[508] particularly controlled waste whereby the carrier must be registered.[509]

## 10.4 CO2 Utilisation

DACCS projects can be modular or free-standing in nature, therefore being well-suited to decentralised industrial pathways. The key driver for the location of DACCS projects is having a commercially viable destination for the captured $CO_2$. The first point of consideration for many DACCS projects is the availability of pipeline transport for $CO_2$ storage, which has presented a challenge in some cases as this involves reliance on the UK Government's CCS cluster sequencing.[510] Due to the long lead times for these clusters, nearer-term large DACCS projects face a challenge of how to situate themselves in a constrained market for geological storage options. The impact of these challenges from a legal perspective is the necessity to turn to $CO_2$ usage opportunities. $CO_2$ usage pathways have trailed behind pipeline storage, a challenge recognised not just in the UK but throughout Europe.[511]

As noted by project operators, many DACCS projects are pursuing point-of-use technology, as opposed to considering geological storage pathways.[512] This is attributed to the infrastructure limitations delineated above, and as a result, most projects will utilise the $CO_2$ onsite, avoiding transportation altogether. This limits the legal insights as to what aspects of transport law may be challenging, if any. One interviewee highlighted that no specific legal challenges with transporting $CO_2$ had been encountered so far, however this is in a very limited capacity as a research and development project.[513] The post-capture transport of other materials, specifically waste, similarly does not pose a challenge from the perspective of operators at present.[514]

Regarding the alternative commercial pathway of $CO_2$ utilisation, there are multiple options available, such as sustainable aviation fuel, the food and drinks sector, and construction materials.[515] The latest recommendations from the CCC in relation to the Seventh Carbon

506 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
507 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
508 See for example in England: The Environmental Protection Act 1990, Control of Pollution (Amendment) Act 1989, The Waste (England and Wales) Regulations 2011
509 (England) The Control of Pollution (Amendment) Act 1989, s2
510 For example, see: Mission Zero Technologies: Phase 1 Final Report' (January 2022) <https://assets.publishing.service.gov.uk/media/6281f1e4e90e071f61322114/mission-zero-technologies-d4.8-project-phase-1-report.pdf> accessed 5 September 2025, 13
511 Emilie Yliheljo, Tiina Paloniitty, 'Can't see the carbon for the CO2? Regulating CCU value chains under and beyond climate law' (October 2024) Review of European, Comparative & international Environmental Law, Special Issue, 424-437
512 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
513 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
514 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025)
515 Joe McQuillen and others, 'Assessing the Feasibility for Large-scale DACCS Deployment in the UK' (n476), 117

Budget indicate that DACCS plays a role in future SAF production,[516] and the UK SAF Mandate creates increasing legal pressure to pursue SAF pathways.[517] Certain pilot and research studies in the UK are exploring the creation of synthetic fuels through DACCS,[518] but the evidence base is in its earliest stages of progression. Legal challenges in relation to SAF fall mostly outwith the life cycle of a DACCS project, which is primarily based on the $CO_2$ output which is then utilised in the creation of SAF. For industry, the technical specification of fuel is crucial, in particular the technical specifications of 'SAF' and 'biofuel', the former of which is regulated by the Renewable Transport Fuel Obligations (Sustainable Aviation Fuel) Order 2024, and the latter of which is regulated by the Renewable Transport Fuel Obligation (RTFO) framework.[519] RTFO restricts the use of certain feedstocks, which industry seeks to avoid and it can create complications for $CO_2$ derived from waste activities (see more detail on waste law at Chapter 9). This is a challenge for regulators when engaging with industry to ascertain fuel specification.[520] These specifications do not however affect the $CO_2$ produced from DACCS which is used in SAF, therefore this distinction potentially forms only a peripheral legal consideration for project operators. When considering scaling opportunities for DACCS within the law, there is the possibility to build in a specific GGR requirement within the SAF Mandate, necessitating utilisation of GGR pathways in conjunction with other emission reduction methods, which lowers further the greenhouse gas emissions of the fuel.

Regarding other $CO_2$ use cases, the $CO_2$ demand in the food and drink sector is well-established, although strict purity standards are a technical consideration for DACCS projects.[521] One notable pathway explored by projects as an alternative to geological storage, which raises the most notable legal challenges, is $CO_2$ usage or sequestration in construction materials, for example the storing of $CO_2$ within concrete, aggregates, and cement. Interviewees and researchers involved in both DACCS and BECCS pathways have noted that construction material is an appealing market avenue, but one which lacks certainty and buoyancy due to multiple factors.[522] Some of these uncertainties derive from issues such profitability and competitive pricing with conventional construction materials, however others derive from the law.

The construction sector is extremely heavily regulated and standardised, and rightly so. Issues in construction can be extremely costly or create a threat to health and safety. It is therefore a high threshold for new products to meet the requirements of the myriad of standards which must be adhered to in construction, including ISO, UKAS, BSI, CEN, etc.,[523] creating limitations for new low-carbon materials.[524] Not only is meeting these standards costly, it creates a risk-averse

516 Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (n2), 241-242
517 UK Government, Department for Transport, 'Sustainable Aviation Fuel Mandate: Compliance Guidance' (January 2025) <https://assets.publishing.service.gov.uk/media/6762717b26a2d1ff182534f7/saf-mandate-compliance-guidance-2025.pdf> accessed 4 August 2025; this is enabled by The Renewable Transport Fuel Obligations (Sustainable Aviation Fuel) Order 2024
518 E.g., Mission Zero, 'University of Sheffield: Creating pioneer fuels' <www.missionzero.tech/projects/university-of-sheffield> accessed 5 August 2025
519 Energy Act 2004, The Renewable Transport Fuel Obligations Order 2007
520 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
521 Joe McQuillen and others, 'Cost and profitability of direct air capture in Scotland' (n345), 30
522 Interview with Participant 1981518, Mission Zero Technologies (online, 24 January 2025); Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025); see also Joe McQuillen and others, 'Cost and profitability of direct air capture in Scotland' (n345), 45-48
523 For demonstrative purposes, in England see generally: UK Government, 'The Building Regulations 2010: The Merged Approved Documents' (2024) <https://assets.publishing.service.gov.uk/media/6717d29438149ce9d09e3862/The_Merged_Approved_Documents_Oct24.pdf> accessed 5 August 2025
524 Building regulations and industry practices cited as limitations to low-carbon building material scaling: UK Government, Department for Energy Security & Net Zero, 'Engineered Greenhouse Gas Removals: Government response to the consultation on a GGR Business Model' (June 2023) <https://assets.publishing.service.gov.uk/media/64955096831311000c296222/engineered-ggrs-government-response.pdf> accessed 5 August 2025, 20

market where contractors could be wary of new products such as low-carbon materials deriving from novel technologies. There is also the added consideration that product standards, which apply UK-wide, may affect devolved nation markets disproportionately if there are unavoidable restrictions on low-carbon materials outwith regulatory control. There is no easy way to approach alteration to this regulatory environment without potentially increasing risk. Therefore, there is instead a need to provide incentives or obligations to pursue low-carbon options. Many of the most high-profile regulated or accredited bodies in the construction industry have put forward support for legal limits on embodied emissions in building projects,[525] with the House of Commons Environmental Audit Committee having iterated this stance previously, particularly the need for standardised control of embodied carbon.[526] The challenges are so widespread, the UK Government has recently commissioned research to explore the practical, technical and economic impacts of embodied carbon in construction.[527]

A definitive legislative stance on embodied carbon in new buildings would follow the lead of countries like Denmark, which has introduced legislation to limit how much $CO_2$ equivalent a new building can emit, with this limit lowering annually.[528] The Netherlands, France, and California have all also enacted regulation addressing embodied carbon in new buildings.[529] The creation of a continuously increasing obligation on building emissions, in tandem with existing obligations placed on the upstream construction sector through the ETS,[530] creates a tightening noose whereby low-carbon pathways will require to be sought throughout the construction value chain. This would provide a scalable project pathway for DACCS projects, and would similarly benefit biochar, which can also be utilised in construction materials for carbon sequestration (for biochar see Chapter 12).

From the perspective of maintained $CO_2$ sequestration and liability, the construction industry involves a high number of companies and organisations in the value chain, particularly for commercial buildings. This ranges from owners and developers to contractors, appointed specialists and subcontractors. This number of relevant parties increases as ownership of the building is passed, thus creating a chain of responsibility for materials used in the construction process (in this case low-carbon materials deriving from DACCS), where parties can be liable for many years through contract. If scheduled monitoring of the $CO_2$ sequestered in the material is required, or there is risk of $CO_2$ storage reversal, it will fall to contractual and insurance relationships to allocate liability and provide financial recompense respectively, both of which are crucial for any carbon crediting and accounting arrangements. This is another complex consideration for DACCS projects when considering utilisation of $CO_2$ in construction materials.

525 Institute of Structural Engineers, 'Embodied carbon regulation: alignment of industry policy recommendations' (January 2024) <www.istructe.org/resources/climate-emergency/embodied-carbon-regulation/> accessed 5 August 2025
526 Environmental Audit Committee, Building to net zero: costing carbon in construction (HC 103 First Report of Session 2022-23)
527 UK Government, Ministry of Housing, Communities & Local Government', 'The practical, technical and economic impacts of measuring and reducing embodied carbon in new buildings: Executive summary' (July 2025) <www.gov.uk/government/publications/consideration-of-embodied-carbon-in-new-buildings/the-practical-technical-and-economic-impacts-of-measuring-and-reducing-embodied-carbon-in-new-buildings-executive-summary> accessed 5 August 2025
528 Environment Protection Act (LBK No. 5 of 2023) (Denmark), for a summary see: DLA Piper, 'Environmental assessment and sustainability' <www.dlapiperrealworld.com/law/index.html?t=construction&c=DK&s=legal-framework&q=environmental-assessment-and-sustainability> accessed 5 August 2025
529 Environmental Audit Committee, Building to net zero: costing carbon in construction (HC 103 First Report of Session 2022-23), 16
530 Activities such as producing metals, cement, lime, glass etc., are included within the UK ETS – see The Greenhouse Gas Emissions Trading Scheme Order 2020, Schedule 2

## CHAPTER 10 – FINDINGS AND RECOMMENDATIONS

- ✓ UK Government support for DACCS through business models and CfDs creates a time-constrained need to address remaining regulatory barriers prior to scaling
- ✓ Navigating devolved and reserved functions for regulating CCS activities can be complex for devolved nations
- ✓ Lack of legal clarity as to which CCS legislation remains limited to fossil CO2, which requires further research and potential updating as DACCS projects are developed
- ✓ Introduction of the Environmental Authorisations (Scotland) Regulations will create a more joined-up permitting landscape for DACCS projects in Scotland
- ✓ Wales is considering updates to environmental permitting regulations to include DACCS, an approach which should also be a focus for England
- ✓ Approach across nations is to offer a less onerous permitting procedure for solid-state DACCS projects in comparison to liquid-state, which may influence industry decisions
- ✓ Long lead times on CO2 transport and storage infrastructure creates demand for CO2 usage pathways instead
- ✓ CO2 usage in construction materials engages a complex area of regulation, with few incentives for change – embodied carbon mandates for new buildings may assist in overcoming this barrier, although questions remain surrounding liability for low-carbon construction materials, particularly as ownership passes

Figure 12: Chapter 10 Findings and Recommendations

# Chapter 11 – BECCS

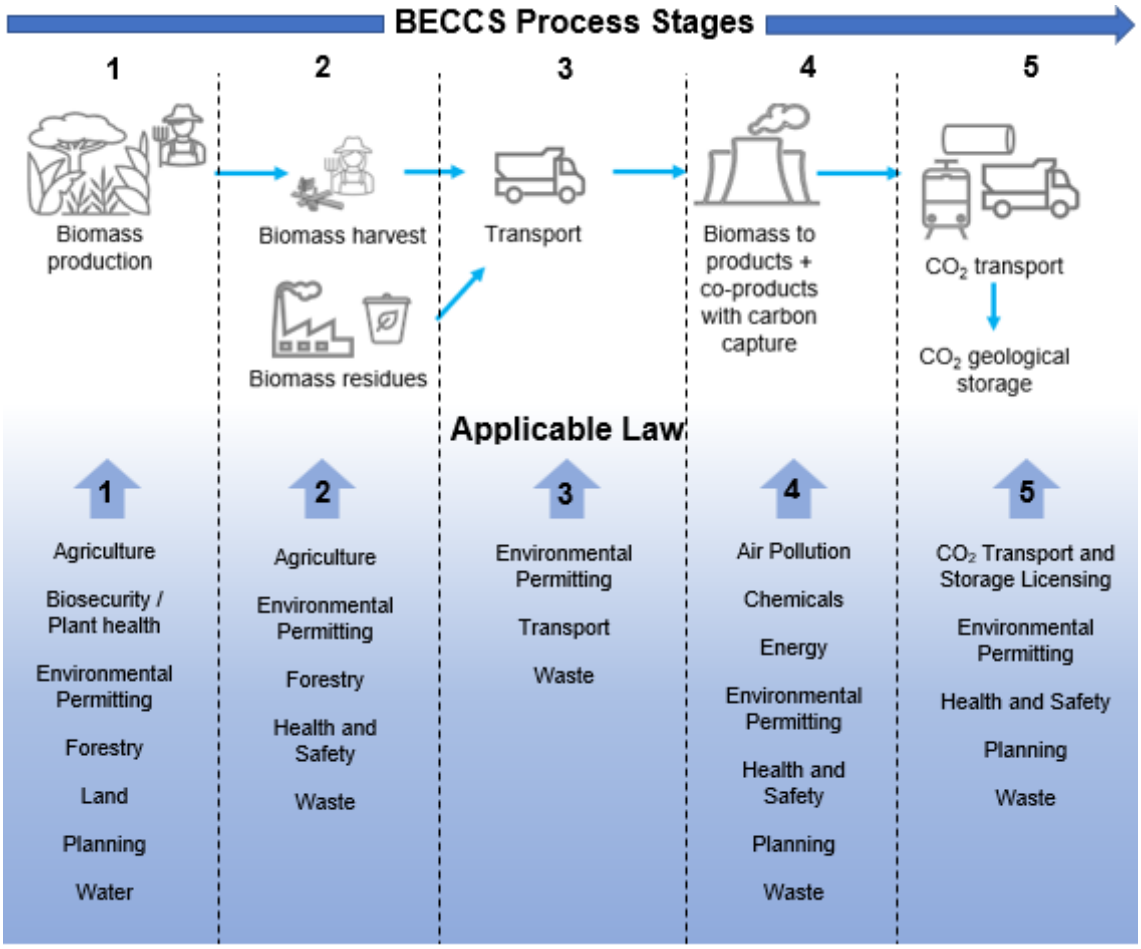


Figure 13: BECCS Process Diagram

BECCS is a GGR technique which presents multiple pathways, for example BECCS power (utilising biomass), BECCS energy-from-waste (EfW), or BECCS with product utilisation pathways.[531] From the perspective of regulators and the UK Government, BECCS provides fewer unknown variables than some other engineered GGR techniques, comprised of two established industrial activities (biomass energy generation, and CCS respectively), in turn creating a priority GGR pathway for the UK.[532] The potential BECCS may have in each

531 There are other more niche uses for BECCS such as biomethane and hydrogen production, for an overview see: Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' (n288), 20-21

532 UK Government, Department for Energy Security & Net Zero, 'The ability of BECCS to generate negative emissions' Task and Finish Group Report (August 2023) <https://assets.publishing.service.gov.uk/media/64d4b25a5cac65000dc2dd1f/task-finish-group-report-ability-beccs-to-generate-negative-emissions.pdf> accessed 5 August 2025

devolved nation is being explored,[533] and it is forecast by the CCC that BECCS will comprise 89% of engineered removals by 2040.[534]

BECCS is intended to be on the receiving end of UK Governmental support by way of the GGR Business Model and CfD funding mechanism for carbon sequestered, the details of which have been released recently.[535] This GGR Business Model also applies to DACCS (see Chapter 10) and takes a technology-agnostic approach. However, there is also another business model dedicated to BECCS which focuses on BECCS that also generates a certain threshold of electricity, referred to as 'power BECCS'.[536]

## 11.1 Power BECCS

Power BECCS is the term used by the UK Government to describe BECCS pathways which incinerate sustainable biomass to generate electricity (at a minimum of 100 megawatt output capacity[537]), capturing emissions using CCS.[538] The focus of power BECCS development relates primarily to one power station in the UK at present,[539] but others may also come into consideration in the future.[540] Unlike the GGR Business Model where the CfD financial mechanism is for carbon sequestered, power BECCS has its own designated business model which comprises a dual-CfD approach, encompassing both electricity generation and carbon sequestration.

For existing biomass energy plants, UK Government support has been crucial for plant operations, providing £22 billion across the industry between 2002 and 2023.[541] The way support is received currently, through the Renewables Obligation and CfD schemes, is set to expire in 2027.[542] Following this, financial reliance for Drax Power Station and other generators above 100 megawatt output capacity will be placed on a low-carbon dispatchable CfD (which caps energy generation volumes) as a short-term support mechanism until 2031. For Drax, CCS is currently expected to be introduced at that point,[543] however this will be dependent on the availability of $CO_2$ transport and storage infrastructure. The CCC have set out that beyond 2027, "there is no role for large-scale unabated biomass generation at high load-factors in

533 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025); Scotland: Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' (n288); Northern Ireland: Department of Agriculture Environment and Rural Affairs, 'Draft Northern Ireland Climate Action Plan' (n4),

534 Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (n2), 271

535 See generally: UK Government, Department for Energy Security & Net Zero, 'Greenhouse Gas Removals (GGR): business model' (n198)

536 UK Government, Department for Energy Security & Net Zero, 'Business model for power bioenergy with carbon capture and storage ('Power BECCS')' (August 2022) <https://assets.publishing.service.gov.uk/media/62f4b8e7e90e076cfcd5420e/power-beccs-business-model-consultation.pdf> accessed 7 August 2025

537 UK Government, Department for Energy Security & Net Zero, 'GGRs and Power BECCS business models: amending revenue support regulations relating to directions to a counterparty, publication of information, counterparty's ability to carry out its functions, and eligibility' (n202)

538 UK Government, Department for Energy Security & Net Zero, 'Business model for power bioenergy with carbon capture and storage ('Power BECCS')', 13

539 Drax Power Station

540 For example, Lynemouth Power Station

541 National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 4

542 UK Government, Department for Energy Security & Net Zero, ' Transitional support mechanism for large-scale biomass generators: government response' <www.gov.uk/government/consultations/transitional-support-mechanism-for-large-scale-biomass-electricity-generators/outcome/transitional-support-mechanism-for-large-scale-biomass-generators-government-response-html> accessed 8 August 2025 – to be enabled through The Contracts for Difference (Miscellaneous Amendments) (No. 2) Regulations 2025 (draft statutory instrument)

543 Development Consent Order for CCS development has been granted: UK Government, Planning Inspectorate, 'Drax Bioenergy with Carbon Capture and Storage Project: Documents' <https://national-infrastructure-consenting.planninginspectorate.gov.uk/projects/EN010120/documents> accessed 9 August 2025

the pathway".[544] This unambiguous position, together with the proposed short-term subsidy framework, reinforces industry's position that the power BECCS business model and CfD must be fully developed and investible as soon as possible, together with the obvious need for the requisite $CO_2$ transport and storage infrastructure to be constructed in order to pursue BECCS within the current proposed timescales.[545]

One potential risk from this regulatory push is the influence and power of large industrial stakeholders, particularly when engaging with a UK Government which has positioned itself as "unreservedly pro-business".[546] The unique nature of Drax Power Station creates a natural monopoly, which inevitably produces an insular feedback loop for developing new policy and law for large-scale biomass power generation, in this case the power BECCS business model and CfD. Drax has a large in-house policy presence, which is crucial for developing regulatory alignment and enabling industrial strategies, which is a primary focus for the UK Government.[547] However, as recognised by the Government, "industrial strategies may fall victim to political capture: through lobbying and influence activities, vested interests can distort the welfare-maximising design of industrial policies",[548] and challenges can also arise in acquiring accurate and representative evidence for informed decision-making.[549] Industry-generated or industry-friendly research can tip the scales of policy-making in a company's favour,[550] and concerns still exist that the accuracy or adequacy of evidence provided by Drax for legal purposes is not capable of verification at a Government level (see more below at Chapter 11.2.1).[551] Drax has previously undertaken an independent international audit of its full chain of operations, providing independent evidence to Ofgem accordingly,[552] but with so few projects of this type in existence, the lack of comparators creates a research vacuum in which policy or legislation is influenced directly by the experiences and needs of a single entity. Ultimately, however, pragmatists acknowledge that Drax is sector-leading in its BECCS ambitions, and therefore the current approach is deemed necessary for power BECCS development; however, this comes with the expectation that Drax will set a precedent of the highest standards for the benefit of the industry.[553]

From the perspective of smaller stakeholders in BECCS, concerns have been raised to the UK Parliament that the power BECCS-focused approach and the decisions made with regard to legal support mechanisms for generators over 100 megawatts give no certainty to mid-scale or small-scale biomass energy projects looking to transition to BECCS in the years

544 Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (n2), 210
545 Interview with Participant 5723057, Drax (online, 6 March 2025)
546 UK Government, Department for Business & Trade, 'Invest 2035: the UK's modern industrial strategy' <www.gov.uk/government/consultations/invest-2035-the-uks-modern-industrial-strategy/invest-2035-the-uks-modern-industrial-strategy#creating-a-pro-business-environment> accessed 9 August 2025
547 UK Government, Department for Business & Trade, 'The UK's Modern Industrial Strategy' (June 2025) <https://assets.publishing.service.gov.uk/media/68595e56db8e139f95652dc6/industrial_strategy_policy_paper.pdf> accessed 9 August 2025
548 UK Government, Competition & Markets Authority, 'Industrial policies: new evidence for the UK' (April 2025) <www.gov.uk/government/publications/industrial-policies-new-evidence-for-the-uk/industrial-policies-new-evidence-for-the-uk#executive-summary> accessed 9 August 2025
549 *ibid,* citing: Dani Rodrik, 'The New Economics of Industrial Policy' (August 2023) Harvard Kennedy School Working Paper No. RWP23-022
550 Matthew Jenkins and Suzanne Mulcahy, 'Businesses' lobbying practices' Transparency International (October 2018) <https://knowledgehub.transparency.org/assets/uploads/helpdesk/Businesses-Lobbying-Practices_2018.pdf> accessed 9 August 2025, 9-10
551 National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 9-10
552 Secondary Legislation Scrutiny Committee, Draft Contracts for Difference (Miscellaneous Amendments) (No. 2) Regulations 2025 (HL 117 Twenty Fourth Report of Session 2024-25
553 The High Level Panel on BECCS Done Well, 'BECCS Done Well' (November 2022) <www.forumforthefuture.org/Handlers/Download.ashx?IDMF=99511f06-6d45-4225-8699-f2f722dba465> accessed 10 August 2025, 44

ahead, as there is no confirmed pathway nor specific Government support provided for them currently post-2027.[554] Concerns therefore exist throughout the BECCS value chain with regard to scaling and opportunities for small-scale projects going forwards, particularly if existing biomass energy facilities become economically unviable without emission abatement infrastructure, which in turn may not be achievable without Government support.

## 11.2 BECCS feedstocks

### *11.2.1 Sustainable feedstock*

The feedstock component of the BECCS value chain is crucial, both in terms of carbon removal potential and the law. The carbon sequestration value of biomass crops has become a key focus of the UK's carbon budgets,[555] and therefore it is crucial from the perspective of BECCS projects to measure accurately the overall sustainability of the biomass feedstock used, including greenhouse gas emissions associated with the biomass, and its provenance.

The certification of sustainable feedstock is a priority element of the life cycle of BECCS projects from the perspective of regulators and Government.[556] Renewables Obligations legislation across all four nations contains obligations regarding biomass sustainability,[557] for example generators using woody biomass must ensure a minimum of 70% of their biomass is sourced sustainably.[558] The priority of sustainable biomass use is also present in the EU, thorough the principle of the cascading use of biomass, in order to achieve resource efficiency.[559]

Sustainability audit reports from suppliers must be submitted to and approved by Ofgem[560] (or in the case of Northern Ireland, Ofgem operates under an Agency Services Agreement to administer the legislative obligations of the Northern Ireland Authority for Utility Regulation).[561] The biomass sustainability criteria is split into two: criteria for the greenhouse gas emissions from the production of biomass,[562] and land criteria.[563] The former sets maximum thresholds and monitors and reports the emissions from, for example, the pelletisation process of biomass, and the transport to the biomass incineration facility. The latter sets requirements relating to the land source of biomass, for example if it derives from a protected area, or from poorly managed forests. Adherence to these criteria is imperative in order to receive Renewables Obligations Certificates under the legislated scheme. Other than Drax Power Station, which is a statistical anomaly due to its scale,[564] other generators around the UK in

554 National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 17
555 Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (n2), 196
556 UK Government, Department for Energy Security & Net Zero, 'The ability of BECCS to generate negative emissions' (n531), 14-15;
557 Derived from EU Law: Renewable Energy Directive (2009/28/EC)
558 England and Wales: Renewables Obligation Order 2015; Scotland: The Renewables Obligation (Scotland) Order 2009; Northern Ireland: The Renewables Obligation Order (Northern Ireland) 2009
559 For a summary of the cascading principle, see for example Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources (RED III), Preamble, para 10
560 For detailed guidance on Ofgem's responsibilities see: Ofgem, 'Renewables Obligation (RO) Guidance: Sustainability Criteria' (May 2025) <www.ofgem.gov.uk/sites/default/files/docs/2018/04/ro_sustainability_criteria.pdf> accessed 10 August 2025
561 England and Wales: Renewables Obligation Order 2015; Scotland: The Renewables Obligation (Scotland) Order 2009; Northern Ireland: The Renewables Obligation Order (Northern Ireland) 2009
562 Renewables Obligation Order 2015, Schedule 2; Scotland, *ibid* Schedule A1; NI, *ibid* Schedule A1A
563 Renewables Obligation Order 2015, Schedule 3; Scotland, *ibid* Schedule A2; NI, *ibid* Schedule A2
564 Within 2002-2023, Drax received £6.5 billion through Renewables Obligations Certificates and CfD support: National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 4

receipt of the Renewables Obligations Certificates have received annual funding of £9.3 million on average between 2002 and 2023.[565]

Contentions around sustainable sourcing of biomass inevitably congregate around Drax Power Station, which has historically been subject to extreme scrutiny by Ofgem over inadequate data reporting.[566] Although this breach was rectified, concerns remain around the monitoring of sustainability and how effective third-party certification schemes are in practice.[567] Concerns are set to continue as the Financial Conduct Authority recently announced an investigation into historical statements regarding biomass sourcing at Drax in 2024, as well as other financial disclosure and transparency rules.[568] Stringent sustainability criteria, and importantly, adherence to said criteria, are crucial for scaling of BECCS from the perspective of emerging projects, as they harbour concerns that negative public perceptions created from companies breaching the law can impact the perception of other future projects.[569]

Criticisms have arisen that the legislated threshold of 70% sustainable biomass is not high enough, or monitored insufficiently.[570] The Biomass Strategy suggested an increase of the legal threshold to 100% sustainable biomass, placing the onus on the biomass user to evidence this threshold in order to avoid overly burdensome obligations to small landowners.[571] The Biomass Strategy 2023 also suggests a cross-sectoral framework to create balance and a standard approach across industries,[572] which is now being developed as the Biomass Sustainability Common Framework (which DESNZ plans to consult on).[573] Crucially, the short-term transitional support mechanism intended for biomass energy plants over 100 megawatts (though CfD) shall reflect the proposed 100% sustainable biomass threshold, with payment being contingent on meeting this criteria, as well as payment not being granted for the use of primary and old-growth forests as biomass.[574] Reasoning for updating this threshold includes alignment with the EU Renewable Energy Directive III.[575] This increased obligation will only apply to the few generators exceeding 100 megawatt output, and will also be flexible for "operational realities",[576] so it is unclear how this caveat will work in practice, particularly as some generators operate their own woody biomass supply chain. Despite these limitations, the increase is a notable strengthening of the sustainability obligation and may provide a benchmark for the forthcoming Biomass Sustainability Common Framework, and creates an indication that the UK will seek to remain aligned with EU Renewable Energy Directive III.

565 National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 4
566 UK Government, Ofgem, 'Ofgem Decision: investigation into Drax Power Limited' (August 2024) <www.ofgem.gov.uk/publications/ofgem-decision-investigation-drax-power-limited> accessed 10 August 2025
567 National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 10; voluntary certification schemes are permitted by Ofgem for confirming compliance with sustainability criteria, see: Ofgem, 'Renewables Obligation (RO) Guidance: Sustainability Criteria' (n559), para 6.8-6.16
568 London Stock Exchange News, 'Drax: Notification of Investigation by FCA' (August 2025) <www.londonstockexchange.com/news-article/DRX/notification-of-investigation-by-fca/17203583> accessed 10 August 2025
569 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
570 National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 4, 5
571 UK Government, Department for Energy Security & Net Zero, 'Biomass Strategy' (n140), 44-45
572 *Ibid*, 42, 123
573 UK Government, Department for Energy Security & Net Zero, 'Transitional support mechanism for large-scale biomass generators: government response' (n541)
574 *ibid*
575 Explanatory Memorandum to The Contracts for Difference (Miscellaneous Amendments) (No. 2) Regulations 2025, para 5.6
576 UK Government, Department for Energy Security & Net Zero, 'Transitional support mechanism for large-scale biomass generators: government response' (n541)

### *11.2.2 Domestic feedstocks*

Some interviewees recommended increasing domestic feedstock sources,[577] or potentially creating incentive to use domestic feedstocks through mechanisms like the CfD.[578] In 2022, 66% of biomass used for electricity generation, heat, and transport in the UK was domestically sourced.[579] Capacity for increasing domestic feedstock supply in the UK relies on multiple factors, including land use and feedstock type. The CCC predicts that by 2050, dietary changes such as a reduction in meat and dairy consumption will increase land available for land-use change, including energy crops, dependent on support mechanisms for landowners and land managers.[580] Beyond land use, the availability of biomass is an additional capacity constraint for some BECCS pathways. Large-scale BECCS projects require enormous levels of feedstock,[581] which was a concern raised by Drax in the context of utilising domestic feedstock. For projects at scale, it may not be possible to achieve required levels of homogeneity through high levels of domestic feedstock sources, particularly for woody biomass.[582] It is unlikely, therefore, that necessity for only domestic feedstock utilisation will become a legal consideration in the near future.

The legal designation of various domestic feedstock varieties is an important consideration in the upstream BECCS value chain. Common biomass feedstocks are willow and miscanthus,[583] and other species such as hemp are also explored.[584] As discussed in Chapter 14.3, the characteristics of woody crops like willow can lead to land owners or land managers needing to consider forestry regulation or land-use change in certain circumstances, creating hurdles for biomass growth. Miscanthus, on the other hand, is treated as an arable crop,[585] and is therefore more versatile and appealing for growers and does not pose the same legal challenges. Although the primary focus of current research projects tends to revolve around willow and miscanthus,[586] hemp is also considered a biomass energy crop, and is used in field trials. In order to grow this a land owner or land manager would require a controlled drugs domestic licence from the Home Office,[587] due to drug regulations. From the perspective of researchers and stakeholders in this area, the variability in how the law governs different species or varieties of biomass is overly complex, and industry would benefit from a government-led system to provide clear guidance on all predominant biomass types and how they are regulated.[588]

577 Interview with Participant 9486769, PBC4GGR GGR-D (online, 6 February 2025)
578 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
579 National Audit Office, *The Government's support for biomass* (HC 358 Session 2023-24), 4
580 Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (n2), 197
581 Drax Power Station used 7.6 million tonnes of biomass in 2024: Drax Group plc, 'Drax ESG Performance Report 2024' (February 2025) <www.drax.com/wp-content/uploads/2025/03/ESG-Performance-Report-2024.pdf> accessed 11 August 2025, 6
582 Interview with Participant 5723057, Drax (online, 6 March 2025)
583 See generally: Mohamed Abdalla and others, 'Assessing the Sustainability of Miscanthus and Willow as Global Bioenergy Crops: Current and Future Climate Conditions (Part 1)' (December 2024) Agronomy, 14, 3020
584 Hemp as a biomass crop: Saba Amir, 'Hemp as a biomass crop' Biomass Connect (April 2023) <www.biomassconnect.org/wp-content/uploads/2023/04/Hemp-as-Biomass-Crop-1.pdf> accessed 12 August 2025
585 See for example in UK Government, Department for Energy Security & Net Zero, 'Biomass Strategy' (n140), 77
586 See: PBC4GGR, 'More about the crops' <https://pbc4ggr.org.uk/more-about-the-crops/> accessed 12 August 2025
587 For guidance see: UK Government, Home Office, 'Industrial hemp licensing' (August 2019) <www.gov.uk/guidance/controlled-drugs-industrial-hemp> accessed 12 August 2025
588 Interview with Participant 9486769, PBC4GGR GGR-D (online, 6 February 2025)

## 11.3 Planning and permitting

### *11.3.1 Power BECCS pathways*

Biomass incineration has long been integrated as a permitted activity within the law.[589] For the CCS portion of the life cycle, in regulations CCS is defined as "carbon dioxide streams from an installation for the purposes of geological storage"[590]. As biomass incineration constitutes an 'installation', the BECCS life cycle falls within the existing permitting regulations, and therefore does not pose the same permitting regulatory gap that DACCS does. This also creates a clear permitting pathway for existing biomass energy plants to convert to BECCS with the addition of CCS. Interviewees did not highlight any immediate legal barriers to the permitting of BECCS facilities pursuing geological carbon sequestration, but the challenge of planning permission, particularly for new BECCS projects, was raised as a potential future challenge (see Chapter 7.3). When considering how the current permitting system could be improved, one Scottish Government-commissioned study has suggested that the sustainability criteria of biomass feedstock be built into guidance for permitting requirements in future, particularly in proposals for new biomass or EfW facilities.[591]

As evidenced also by DACCS projects, BECCS pilots across the UK have so far deployed point-of-use technology. Therefore, a similar scenario presents itself regarding legal factors relating to transport of biomass, which are currently not considered in depth by projects due to small-scale operations. For larger projects, however, transport is a key consideration from the point of view of permitting and biomass sustainability criteria. For the permitting of future large BECCS projects, in particular those using waste materials, the registration of transport is potentially crucial,[592] and impacts on the surrounding environment of associated increased transport will also be considered as part of the planning process.[593] Future BECCS projects may require feedstock sources which are dispersed, increasing transport impacts. Even if projects utilise third-party registered waste carriers, there could still be impacts to planning or permitting decision-making when considering the whole life cycle of the project. A second consideration for the transport of all biomass is sustainability. The greenhouse gas emissions associated with the transport of solid biomass for biomass energy projects falls under the greenhouse gas emissions criteria for calculating biomass sustainability.[594] Overall, transport is an important step in the project life cycle for BECCS, particularly for larger projects or those transporting waste materials.

### *11.3.2 BECCS alternative pathways*

Besides the common pathway of biomass energy generation and subsequent carbon sequestration, BECCS technologies can be extremely varied, in terms of both feedstock and outputs. For example, pathways can involve waste feedstocks, enhanced gasification

589 'Burning any fuel in an appliance with a rated thermal input of 50 or more megawatts' - Environmental Permitting (England and Wales) Regulations 2016, Schedule 1, Part 2, Chapter 1, s1.1
590 Environmental Permitting (England and Wales) Regulations 2016, Schedule 1, Part 2, Chapter 1, s6.10
591 Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' (n288), 62-63
592 Relevant for the use of household, industrial or commercial wastes, see Control of Pollution (Amendment) Act 1989, s2
593 for details on planning law see Chapter 7
594 Renewables Obligation Order 2015, Schedule 2; Scotland, (n560) Schedule A1; NI, (n560) Schedule A1A

processes,[595] or outputs such as biochar (explored more in Chapter 12).[596] The consideration of waste (EfW) in BECCS pathways depends on the portion of biogenic waste utilised, as opposed to fossil waste which is generally not considered as GGR.[597] BECCS plants can also produce products or utilise waste-to-fuel pathways in addition to $CO_2$ capture. $CO_2$ output from BECCS processes can also be used rather than sequestered, similar to alternative pathways explored under DACCS (see Chapter 10.4).[598] Projects exploring $CO_2$ utilisation pathways have recognised that this can attract additional regulatory systems to adhere to, such as the production and specifications of food-grade $CO_2$.[599]

Different BECCS pathways are at various stages of development or readiness level. One such pathway is advanced gasification, which has been considered in a CCS context in recent years.[600] One project developer undertaking advanced gasification, utilising waste for the purposes of creating syngas, identified that legislation and permitting does not provide a specific designation for advanced gasification, creating complexities as to how such projects categorise themselves for permitting purposes.[601] Although the plant and the molecule produced by the plant can be consistent, differences in the final downstream use of that molecule (e.g., as a fuel, or in the chemicals industry) can dictate which regulatory regime is applied and therefore which permits are required. It is recognised that these pathway variations can in future potentially create additional challenges for regulators as well when assessing projects, as opposed to the consistency of a specific permit for advanced gasification.[602] From the perspective of industry, without a specific designation, a legal barrier is created for projects to navigate and interpret dispersed law. It is unclear whether updates for such pathways will be considered in the short-term due to lower technology readiness levels being associated with gasification and enhanced gasification technologies,[603] again feeding back into the Regulatory Paradox where widespread evidence is not yet established.

Ultimately, if the activity in question does not fit a standard permit classification, which in the case of BECCS is most likely "incineration and co-incineration of waste",[604] then a bespoke permit may be required. This can present a more complex process and expensive for projects, involving increased engagement with regulators and navigating a system for which the project has no specific precedent to follow, creating inefficiency. The absence of a permit option which accommodates BECCS activities and other similar novel pathways adequately (e.g., BIOCCUS) is a challenge felt across multiple projects, as discussed more in Chapter 7.[605]

595 For example: KEW Technology Ltd, 'Innovation Projects' <https://kew-tech.com/project-type/innovation/> accessed 13 August 2025
596 For example: Ricardo, 'Ricardo's heat and power demonstrator: BIOCCUS' <www.ricardo.com/en/news-and-insights/campaigns/ricardo-bioccus> accessed 13 August 2025
597 Fossil waste utilisation does not lead to a negative carbon balance: Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (n2), 245, Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' (n288), 20-21
598 For an overview of the variety of pathways available see: Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' (n288), 20-21
599 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
600 UK Government, Department for Business, Energy & Industrial Energy, 'Advanced Gasification Technologies – Review and Benchmarking' (October 2021) <https://assets.publishing.service.gov.uk/media/615aa9cb8fa8f52985dd7475/agt-benchmarking-summary-report.pdf> accessed 14 August 2025
601 Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025)
602 Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025)
603 See for example: Scottish Government 'Negative Emissions Technologies (NETS): Feasibility Study' (n288), 20
604 Environmental Permitting (England and Wales) Regulations 2016, Schedule 1 Part 2, Chapter 5, s5.1,
605 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025); Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025)

## 11.4 BECCS EfW pathways

Multiple interviewees noted the importance of the role of waste in BECCS,[606] which is utilised as a feedstock as part of a BECCS EfW pathway. Many advocates exist for the value of BECCS EfW and see it as a pathway which should receive the correct support from regulators, as it decreases feedstock pressures, and improves landfill statistics.[607] From another perspective, it is recognised that the use of waste, for example in (enhanced) gasification, can create barriers in planning and permitting due to the poor reputation of historic gasification projects.[608] It is clear that the roles that waste categorisation and law play in every stage of a project's life cycle are complex to navigate, leading to both delay and cost in some circumstances.

As discussed generally at Chapter 9, waste law is extremely strict and onerous to comply with. These restrictions are equally applicable to BECCS when feedstock is categorised as a waste, for example waste wood or municipal solid waste. Even prior to commercialisation of BECCS projects, restrictions are likely to exist for research and development projects utilising waste, as any research and development project treating more than 50 tonnes of waste per year must adhere to the waste incineration permitting requirements within legislation.[609] This could impact the feasibility of approaching innovative BECCS technologies if research and development level pilot studies are exposed to such stringent rules.

Certain BECCS projects utilise waste feedstock to produce a substance for use other than $CO_2$. Waste law is crucial in these circumstances, as if the substance produced from the plant classifies as waste, this restricts its use or ability to define it or sell it on as a product. As is also explored in the context of biochar (see Chapter 12), achieving end-of-waste status (applicable in England) is an arduous process with a high evidence threshold.[610] Only one waste gasification pilot project in the UK has so far achieved end-of-waste status,[611] utilising pelletised black binbag waste to create clean syngas. End-of-waste status is appealing from a legal perspective, as producing a waste substance necessitates compliance with strict waste management regulations throughout the UK, and for gasification, end-of-waste status exempts plants from certain permitting requirements.[612] The challenges associated with achieving end-of-waste are not appealing for pilot or small-scale projects, therefore this may not be a viable solution to waste permitting in many project scenarios.

The current hierarchy of waste is entrenched within legislation: prevention, preparing for

606 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025); Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025)
607 Baringa, 'The role of biomass and BECCS in the UK energy system' Final Report, REA Biomass UK (June 2025), 13
608 UK Government, Department for Business, Energy & Industrial Energy, 'Advanced Gasification Technologies – Review and Benchmarking' (n599), 11, 41-42
609 Environmental Permitting (England and Wales) Regulations 2016, Schedule 1, Part 1, s3(g); Pollution Prevention and Control (Scotland) Regulations 2012; The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013
610 For guidance on end-of-waste in Scotland, see: Scottish Environment Protection Agency, 'Guidance: Waste' <www.sepa.org.uk/regulations/waste/guidance/> accessed 14 August 2015; for Wales, see: Welsh Government, 'Recycling, waste and the circular economy' <www.gov.wales/recycling-waste-circular-economy> accessed 14 August 2025; There is currently not an option available for end-of-waste in Northern Ireland as of 2025
611 KEW Technology Ltd, 'Our commercial scale plant' <https://kew-tech.com/our-commercial-plant/> accessed 14 August 2025
612 Environmental Permitting (England and Wales) Regulations 2016, Schedule 13; Pollution Prevention and Control (Scotland) Regulations 2012, s3A; The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013, Schedule 1

re-use, recycling, other recovery, and disposal.[613] Some within industry have suggested a reframing of the law to give legal weight to the important role BECCS EfW plays, specifically an additional step in the waste hierarchy after recycling, to represent chemical recycling of waste, converting non-recyclable waste through advanced gasification (or other conversion technologies such as pyrolysis) into a usable chemical product through low-carbon processes.[614] The waste hierarchy is entrenched firmly in all industries and processes involving waste. Therefore, adding a step within law to the waste hierarchy would create an incentive to pursue these GGR processes as opposed to incineration for energy generation only. There are notable challenges associated with such an endeavour, however. The waste hierarchy derives from EU law, which forms the backbone of waste laws throughout the UK,[615] therefore there would likely be careful consideration of any changes to this, and a high threshold of industry need demonstrated, in order to catalyse such change. Further challenges associated with altering assimilated EU law are noted at Chapters 9.3 and 12.2.4.

Additional BECCS EfW incentives have also been suggested by industry. One such example is the Recycled Transport Fuel Obligation (RTFO) scheme, which provided certificates to incentivise the production of low-carbon fuels for transport (only applicable to SAF until January 2025, replaced by the UK SAF Mandate[616]), utilising a counterfactual approach to assess greenhouse gas emission savings from the change of fate in the material used, for example waste diverted from unabated incineration.[617] Industry suggests utilising a similar incentive structure for BECCS EfW where the fuel output is intended for recipients other than purely transport, such as fuels for industry (e.g., chemical) or infrastructure.[618] This expansion to straddle other industries would facilitate increased BECCS EfW pathway options, which may become particularly relevant as EfW is included into the UK ETS as of 2028. Complications arise however in terms of monitoring, reporting and verification for these pathways, as greenhouse gas emission boundaries and the role of fossil waste are not easy to calculate or necessarily compatible with existing GGR positions.[619]

613 The Waste (England and Wales) Regulations 2011; The Waste (Scotland) Regulations 2011; The Waste Regulations (Northern Ireland) 2011

614 Amna Bezanty, 'Advanced Gasification for Waste-to-energy Products' KEW Technology, Decarbonisation Technology (November 2024) <https://cdn.decarbonisationtechnology.com/data/articles/file/266-advanced-gasification-for-waste-to-energy-products.pdf> accessed 14 August 2025

615 Waste Directive 2008/98/EC, Art 4

616 The Renewable Transport Fuel Obligations (Sustainable Aviation Fuel) Order 2024

617 UK Government, Department for Transport, 'RTFO Guidance for Recycled Carbon Fuels' (2024) <https://assets.publishing.service.gov.uk/media/67585702f72b1d96e06bc01d/rtfo-guidance-for-recycled-carbon-fuels.pdf> accessed 14 August 2025, para 2.6, 3.10, 3.31

618 Interview with Participant 6408135, KEW Technology Ltd (online, 24 February 2025)

619 i.e. the general exclusion of fossil waste incineration from GGR categorisation, for a detailed description of industry's position see: Amna Bezanty, 'Advanced Gasification for Waste-to-energy Products' (n615), 22-23

## CHAPTER 11 – FINDINGS AND RECOMMENDATIONS

- ✓ Power BECCS plays an important role in in anticipated GGR scaling, therefore the pursuit of a robust and investible power BECCS business model and CfD is crucial, together with operational CCS transport and storage networks within the timescales of UK Government financial support agreements
- ✓ A high standard threshold must be exercised when creating support frameworks for single power BECCS entities
- ✓ A clear support framework should be established for mid-scale and small-scale biomass energy generators looking to transition to BECCS, to create investor certainty
- ✓ A 100% biomass feedstock sustainability threshold is a positive outcome for large-scale biomass electricity generators; however, the development of a Biomass Sustainability Common Framework will clarify whether this threshold will extend to generators below the 100 megawatt output threshold
- ✓ Caution should be exercised in relation to the monitoring and auditing of sustainability criteria
- ✓ A central information source would benefit land owners and land managers when attempting to navigate a variety of legal regimes controlling various biomass varieties and species
- ✓ There are no immediate challenges associated with the permitting of power BECCS facilities, however it is recommended that biomass sustainability criteria be included in guidance for permitting requirements for new biomass facilities
- ✓ Transport of biomass will be an important consideration for large-scale BECCS projects in future from the perspectives of planning, permitting, and biomass sustainability
- ✓ The regulation of alternative BECCS pathways such as advanced gasification is ambiguous and lacks specific permitting designation, creating a challenge from the perspective of industry
- ✓ Waste law creates multiple barriers for BECCS EfW pathways, including research and development-scale projects
- ✓ End-of-waste status presents an appealing solution for BECCS EfW projects producing substances for further use, however this is an onerous and expensive process and may not be a feasible option for small projects
- ✓ Potential alterations to the waste hierarchy of increased incentives akin to the RTFO could help to incentivise BECCS EfW in future, on the condition of robust monitoring, reporting and verification, however challenges remain for categorising the fossil portion of waste for GGR

Figure 14: Chapter 11 Findings and Recommendations

# Chapter 12 – Biochar

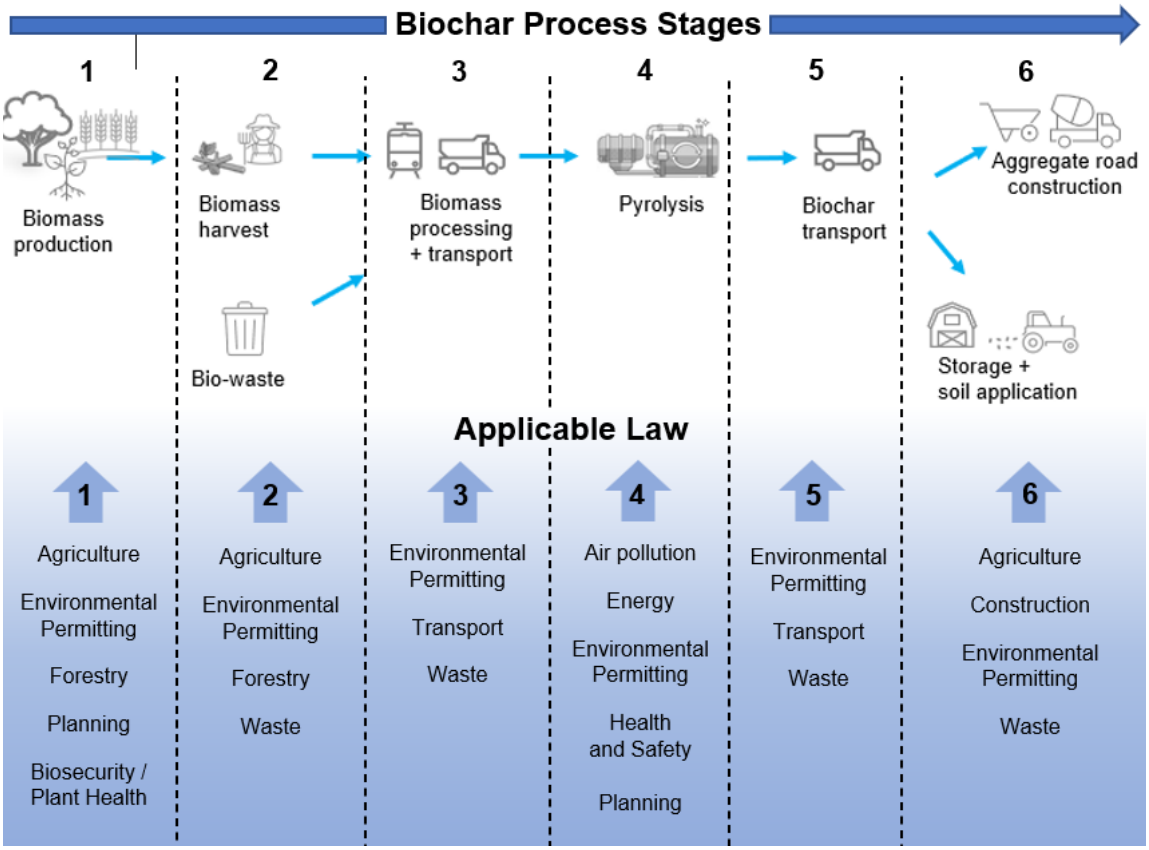


Figure 1: Biochar Process Diagram

Biochar is a diverse substance which can be used for carbon sequestration and included in an assortment of products, from agricultural fertilisers,[620] to construction materials[621] and feed supplements.[622] Biochar can also be utilised in peatland restoration research activities (see Chapter 15.2.2). From industry's perspective, the legal facilitation of various utilisation pathways for biochar is crucial for the financial viability of biochar production, as carbon crediting alone is unlikely to provide incentive enough for end-users.[623]

Unlike several other GGR techniques, there is a growing body of legal literature addressing directly the regulatory challenges applicable to biochar scaling in the UK.[624] This chapter seeks

620 Shubh Pravat Singh Yadav and others, 'Biochar application: A sustainable approach to improve soil health' (March 2023) Journal of Agriculture and Food Research, Vol 11,
621 Yuying Zhang and others, 'Biochar as construction materials for achieving carbon neutrality' (October 2022) Vol 4, 59
622 Nicky-Lee Willson, 'Feed supplementation with biochar may reduce poultry pathogens, including Campylobacter hepaticus, the causative agent of Spotty Liver Disease' (April 2019) PLOS One, 14(4)
623 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
624 Crucial to legal analysis is Luka Strubelj and Navraj Singh Ghaleigh, 'Biochar Regulation in the UK: A Wasteful Approach to Greenhouse Gas Removal' (n469), as well as direct calls from industry to UK Government: Letter from Professor Colin Snape and Dr Steve Smith to The Rt Hon Steve Reed OBE MP, Secretary of State for Environment, Food and Rural Affairs and The Rt Hon. Ed Miliband MP, Secretary of State for Energy Security and Net Zero (19 November 2024). Regulatory barriers have also been noted historically in leading technical documents: Peter Brownsort and others, 'An Assessment of the Benefits and Issues Associated with the Application of Biochar to Soil' UK Biochar Research Centre (June 2010)

to augment the positions contained within this leading literature, in particular through findings from stakeholder interviews.

## 12.1 Waste – an established legal barrier

The entanglement of biochar with waste law has been documented at length,[625] including in direct calls to the UK Government to explore revisions to current regulatory frameworks.[626] As reported within said literature, waste law applies throughout the biochar production value chain, influencing feedstocks, pyrolysis processes and materials produced. Any biochar produced from a wide variety of untreated wood and plant matters carries a waste code.[627] This current position within waste law is so stifling that multiple operators interviewed deliberately operate under the legislative margins so as to avoid onerous waste regulation, for example utilising sawmill virgin woodchip. These avoidance tactics increase the economic challenges for biochar projects, in some cases tripling feedstock costs.[628]

Waste law is largely consistent throughout the UK, due to foundational legislation such as the EU Waste Framework Directive, and the Environmental Protection Act 1990. This position is slightly more complex for Northern Ireland, however, due to certain elements of EU waste law still being relevant post-Brexit, for example the cross-border transport of waste,[629] as well as certain fertiliser products regulation which is relevant to biochar (see further Chapter 12.3.3 below).[630] As such, any future legislative amendments for biochar production in Northern Ireland will require careful consideration, balancing relationships with both mainland UK and the EU.

### *12.1.1 Feedstock*

Central to biochar production is the chosen feedstock, which is linked intrinsically to waste law. Multiple GGR technologies utilise waste as feedstock, for example BECCS EfW. As explained within the current leading legal texts on this matter, waste feedstock impacts the ability to use the subsequent biochar.[631] One of the only existing solutions to avoid this subsequent biochar being categorised as a waste is applying for end-of-waste status which, as outlined in Chapters 9 and 11.4, is a process involving high evidence demands and strict regulation of project operations in order to maintain compliance. Each nation deploys a case-by-case assessment procedure through the relevant regulator.[632] However, Northern Ireland has recently halted end-of-waste applications due to regulator capacity constraints.[633] End-of-waste therefore lacks efficiency due to the ad-hoc nature of applications.

625 Luka Strubelj and Navraj Singh Ghaleigh (n469)
626 Letter from Professor Colin Snape and Dr Steve Smith (n623)
627 This is waste code 19 01 18 (as identified by the European Waste Catalogue and set out in guidance: Natural Resources Wales, Scottish Environment Protection Agency, Environment Agency, 'Waste Classification' (n460)
628 Multiple projects use sawmill woodchip as it is categorised within law a co-product (see for example guidance from EA for chipping of virgin wood: UK Government, Environment Agency, 'T6: treating waste wood and plant matter' (April 2014) <www.gov.uk/guidance/waste-exemption-t6-treating-waste-wood-and-waste-plant-matter-by-chipping-shredding-cutting-or-pulverising#when-you-do-not-need-a-t6-exemption> accessed 17 August 2025): Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025); Interview with Participant 9316963, CapChar Ltd (online, 10 February 2025)
629 UK-EU Withdrawal Agreement (n21), Annex 2
630 Relevant to chemicals, goods, and agricultural production within the UK-EU Withdrawal Agreement (n21)
631 See generally: Luka Strubelj and Navraj Singh Ghaleigh (n469)
632 Unless a Quality Protocol (Resource Framework) applies, see more at 12.2.3
633 Department of Agriculture, Environment and Rural Affairs, 'End of waste regulations' <www.daera-ni.gov.uk/articles/end-waste-regulations> accessed 15 August 2025

Industry has called for revision of certain types of waste which demonstrate potential being reclassified (under stringent conditions) either as co-products or acquire an exemption status under waste regulation. One waste substance which industry has called to be repositioned within law is tree surgeon arisings, specifically where the arisings have reliable provenance and full traceability, as they go through the same processes as whole tree wood chip, which is considered to be a by-product. In law, a by-product not classified as a waste, it is instead a secondary substance produced by an operation, with a definitive further use without requiring any further processing beyond ordinary practice.[634] As certain tree surgeon arisings fulfil these criteria from the perspective of biochar industry, revision of the legal designation of these arisings would provide opportunities for biochar producers. With regard to other waste substances, industry has also produced research demonstrating the potential of food-waste anaerobic digestate as a feedstock for biochar production, [635] which faces restrictions of use as it is currently not included within LRWP 61.[636]

### *12.1.2 Pyrolysis*

Pyrolysis and incineration have long been conflated within law and policy, a concern which remains present from the perspective of industry today.[637] Within the context of incineration, pyrolysis is associated traditionally with the processing of tyres and plastics,[638] which therefore creates challenges for industry when engaging with regulators which are not necessarily familiar with the concept of utilising pyrolysis for biochar production.[639] This concern also cuts across permitting requirements, as explored at Chapter 12.3 below.

In the waste hierarchy (see more at Chapter 11.4), pyrolysis is identified as 'other recovery' in which "pyrolysis which produce[s] energy (fuels, heat and power) and materials from waste".[640] If energy recovery is not included in the process, pyrolysis will be deemed a waste disposal mechanism.[641] Interviewees welcome the calls for such regulation to move away from the restrictions of waste law, however this brings with it a dialogue similar to that of gasification and enhanced gasification (see Chapter 11.3.2) regarding the fossil portion of waste utilised in the pyrolysis process and thus the ability to categorise utilisation of such waste as GGR.[642] A more output-agnostic approach to regulating the pyrolysis process for biochar production would benefit project pathways, easing limits on one consistent step of the biochar creation process, however this ought to be balanced with regulatory requirements for quality and stability of biochar produced, which are important features for industry seeking to build a best-practice reputation.

634 Derived from EU law (Waste Directive 2008/98/EC, Art 5), as applied by through national legislation such as the Environmental Protection Act 1990, and Environmental Permitting (England and Wales) Regulations 2016
635 Disni Gamaralalage and others, Biowaste to biochar: a techno-economic and life cycle assessment of biochar production from food-waste digestate and its agricultural field application' (March 2025) Biochar, Vol 7, 50
636 Letter from Professor Colin Snape and Dr Steve Smith (n623), 2
637 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
638 UK Government, Department for Business, Energy & Industrial Energy, 'Advanced Gasification Technologies – Review and Benchmarking' (n599), 10
639 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
640 HC Research Briefing *Incineration of waste in England* (1 April 2025) (CBP 10229), 8
641 Luka Strubelj and Navraj Singh Ghaleigh (n469), 4
642 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)

### *12.1.3 Positions from regulators*

Low Risk Waste Positions (LRWPs) governing biochar operations present barriers that biochar industry raised consistently in interview,[643] adding weight to concerns raised within literature[644] and previous calls to government for change to LRWPs.[645]

LRWPs are applicable in England, and set out activities involving waste which are allowed by the regulator without having to seek a full environmental permit. If producers and users of biochar which is categorised as waste wish to avoid producing, storing, or spreading volumes requiring a full permit,[646] LRWPs 60[647] and 61[648] apply. These risk-averse limitations placed by LRWPs form a fraction of the biochar volumes sought by project operators.

Another concern is that the EA has the ability to revoke or amend LRWPs at any time.[649] This flexibility can, on the one hand, create the ability for regulators to keep in line with evolving industry, something that entrenched legislation fails to do. However, on the other hand it can be challenging for industry to maintain alignment with changing rules, creating risk of contravention or unpredicted and potentially costly alterations to project operations or contracts.

England is the only UK nation to which the existing LRWPs apply. Emulation of the LRWPs 60 and 61 are being considered in Wales to govern biochar, but this a position which has reportedly not progressed so far.[650] In Scotland, SEPA historically produced a publicly-available interim Position Statement in 2012 regarding biochar, which acknowledged its role in soil improvement, recommending an exemption to Scottish waste legislation to reflect the low-risk nature of small biochar manufacturing facilities.[651] The SEPA Position Statement provides higher permitted biochar storage capacity than LRWP 61, but is more restrictive of the types of waste which can be used as feedstock. Since this position was created, Scotland has enacted changes to the way the law governs the use of waste on land for the improvement of soil, consolidating existing legislation.[652] This reform, which comes into place in November 2025, is designed for the purposes of environmental protection and obligates that parties intending to spread waste on land for soil improvement must apply for authorisation. Biochar is listed explicitly as an applicable waste within SEPA's guidance.[653] Authorisation can take the form of

643 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025); Interview with Participant 9316963, CapChar Ltd (online, 10 February 2025); Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
644 Luka Strubelj and Navraj Singh Ghaleigh (n469), 5
645 Letter from Professor Colin Snape and Dr Steve Smith (n623)
646 In England, see standard rules on environmental permits for mobile plant for landspreading: UK Government, Environment Agency, 'Standard rules SR2010No4 mobile plant for landspreading' <https://assets.publishing.service.gov.uk/media/5c9c86aded915d07b1a25d0e/SR2010_No_4_mobile_plant_for_landspreading.pdf> accessed 16 August 2025
647 UK Government, Environment Agency, 'Storing and treating waste to make biochar: LRWP 60' <www.gov.uk/government/publications/low-risk-waste-positions-miscellaneous/storing-and-treating-waste-to-make-biochar-lrwp-60> accessed 15 August 2025
648 UK Government, Environment Agency, 'Storing and spreading biochar to benefit land: LRWP 61' <www.gov.uk/government/publications/low-risk-waste-positions-landspreading/storing-and-spreading-biochar-to-benefit-land-lrwp-61> accessed 15 August 2025
649 Powers of the EA contained within Environmental Protection Act 1990 and Environmental Permitting (England and Wales) Regulations 2016
650 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)
651 Scottish Environment Protection Agency, 'Position Statement: Manufacture and use of Biochar from Waste' (August 2012) <www.sepa.org.uk/media/156613/wst-ps-031-manufacture-and-use-of-biochar-from-waste.pdf> accessed 15 August 2025
652 This has been enacted through the Environmental Authorisations (Scotland) Regulations 2018 (EASR)
653 Scottish Environment Protection Agency, 'EASR Guidance - recovery of waste on land for the purpose of soil improvement' WAS-G-EASR-10 (April 2025)

a simplified registration procedure for single sites, or a full permit for multi-site spreading.[654]

Northern Ireland similarly produces Regulatory Position Statements, and has recently produced one addressing low risk activities relating to waste. This position does not however mention biochar, nor pyrolysis.[655] Northern Ireland also continues to adhere to EU legislation, which, as documented within research, ties biochar to fertiliser regulation as well as waste regulation.[656]

Ultimately, project developers seeking to operate in jurisdictions with no clear position on biochar have raised the challenge that legal uncertainty drives operators into pursuing obscure practices, as opposed to a clear regulatory position which entices a homogenous and accountable approach.[657] Therefore, UK-wide alignment where possible should be pursued, as well as unambiguous regulatory positions.

## 12.2 Proposed changes to waste law

Previously proposed changes to the regulation of biochar take different approaches, from a centralised overhaul of regulation and creation of comprehensive standards, to a more piecemeal approach of adapting laws already in place.

### *12.2.1 Common Biochar Framework*

There was consensus amongst interviewees that a consistent, UK-wide standard for biochar is crucial, including regulatory alignment throughout the UK. A "common biochar framework" across the UK has been suggested as a potential structure for creating a standard for non-waste biochar utilisation.[658] This would include biochar category definitions, a GGR function criteria, harmonisation between government departments and waste regulation, and rules on application of biochar to soil.[659] The pursuit of a UK-wide standard or legislative criteria was supported by interviewees, with it being highlighted that existing standards created through the voluntary carbon market are extremely heterogeneous and not conducive to consistently safe and beneficial biochar production.[660] In the context of creating common frameworks or legislation, industry highlighted the importance of considering the definition of 'biochar', as it is an incredibly broad term within industry, and legislating for a substance named 'biochar' could inadvertently create limitations or exclude certain biochar products unless the correct technical parameters are in place.[661]

When exploring the potential content of these future biochar standards in the UK, one pathway

654 For details see: Scottish Environment Protection Agency, 'Use of waste on land for soil improvement' <www.sepa.org.uk/regulations/waste/soil-improvement-using-waste/> accessed 16 August 2025
655 Department of Agriculture, Environment and Rural Affairs, 'Regulatory Position Statement – Low risk activities' (December 2024) <www.daera-ni.gov.uk/sites/default/files/publications/doe/RPS_Low_Risk_Activities_December2024.pdf> accessed 16 August 2025
656 See Luka Strubelj and Navraj Singh Ghaleigh (n469); and Luka Strubelj, 'Waste, Fertilising Product, or Something Else? EU Regulation of Biochar' (9 September 2022) Journal of Environmental Law, Vol 34, Issue 3, 529-540
657 Interview with Participant 9316963, CapChar Ltd (online, 10 February 2025)
658 Luka Strubelj and Navraj Singh Ghaleigh (n469), 8
659 *ibid*
660 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025); Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
661 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)

suggested both in interview and research is emulation of the European Biochar Certificate[662] (EBC) standard.[663] For projects currently seeking to comply with the EBC, the practicalities associated with this were reported in interview as a challenge, as there is only one EBC-certified laboratory in Europe, located outside the UK. Others noted, however, that even with domestic laboratories, costs would not reduce markedly.[664] From a legal perspective however, it has been noted that the EBC does not fully encompass the complexity of legal regimes throughout the UK, therefore would form part of the framework.[665] From a technical perspective, industry suggests that any such standard introduced should be tied to the chemical composition of the biochar (i.e. a carbon to hydrogen ratio indicating biochar stability which is suitable for the biochar's designated usage),[666] and also heavy metal and pollutant limits.[667] Applying these criteria to control the quality of imported biochar is an important feature highlighted by both industry and existing literature.[668]

The suggested technical standard could be intrinsically linked with the proposed comprehensive framework.[669] Others in the industry have suggested that the feedstock source is not relevant if the biochar specification can meet technical requirements such as heavy metal or pollutant limits.[670] The technical specification of the biochar is a crucial stipulation from the perspective of landowners and land managers which may deploy biochar. In the context of land law risks, agricultural landowners and land managers require assurances for products spread on their land. There requires to be regulatory certainty as to the source and chemical composition of the biochar.[671] These needs mirror those present in relation to ERW, as set out at Chapter 13.3.

The preference within industry is to create a regulated standard which is quality-controlled by the devolved governments or a regulated certification body. The relative success of the UK Forestry Standard could be used as an analogous structure, as an evolving framework which is an integral part of permitting and standards to which regulators throughout the UK adhere. In the scenario of an industry-wide standard or framework being created, industry specified the importance of considering proportionality of monitoring and reporting requirements for small operators or research and development pilots.[672] As demonstrated across multiple GGR techniques, commercial-scale permitting and regulation of activities are not necessarily conducive to small-scale or pilot activities.

### *12.2.2 Defining and framing biochar within law*

Besides the centralised contemplation of a common framework across the UK, other aspects of future biochar regulation were contemplated in interview. In terms of the future framing of biochar within law, it was highlighted by interviewees that current UK legislation does not

662 These standards also include a 'World Biochar Certificate': European Biochar Certificate, <www.european-biochar.org/en/> accessed 15 August 2025
663 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
664 Information provided by Participant 3746405, Biochar Demonstrator (online, 17 September 2025)
665 Luka Strubelj and Navraj Singh Ghaleigh (n469), 8
666 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
667 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
668 Luka Strubelj and Navraj Singh Ghaleigh (n469); Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
669 Luka Strubelj and Navraj Singh Ghaleigh (n469)
670 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
671 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
672 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)

recognise nor address the benefits biochar can bring to soil nutrition, moisture retention or other biological benefits.[673] EU law, in comparison, provides for biochar as a fertilising product, such as fertiliser, soil improver, or growing medium.[674] When deliberating potential categories for biochar within UK legislation, for example that of "soil improver" as utilised by the EU,[675] some interviewees voiced reluctance on the basis that it is a variable concept, and highly dependent on the soil, crops and other variables connected to the biochar. One interviewee highlighted that although there are definitive benefits to be gained from adding biochar to impoverished soils, it is not guaranteed consistently as it is with fertiliser. Therefore, the benefits are more horticultural than large-scale agricultural deployment.[676]

### *12.2.3 Resource Frameworks (Quality Protocols)*

Another suggestion from legal experts is to develop a Resource Framework[677] for biochar in order to create a set of criteria for biochar achieving end-of-waste status,[678] as opposed to the existing case-by-case process for establishing end-of-waste status for individual projects. Resource Frameworks are frameworks created with the relevant regulator to show when a material has ceased to be a waste. Interviewees are receptive to this approach and noted comparisons to the Quality Protocol (the former incarnation of Resource Frameworks) for anaerobic digestate which exists in various forms across all four nations. Anaerobic digestate has come onto the radar of biochar producers as it been considered as a biochar feedstock in recent research, particularly food waste digestate.[679] Anaerobic digestate is in many circumstances considered a waste substance. However, a Quality Protocol was co-created between English, Welsh and Northern Irish regulators to develop a set of criteria under which anaerobic digestate would no longer be considered a waste, and instead a product. This protocol was created in alignment with regulator-approved independent accreditation standards BSI PAS 100 and PAS 110.[680] These independent standards also apply to other Quality Protocols such as the composition of compost.[681] A similar process is adopted in Scotland, where SEPA have provided a regulatory position statement excluding PAS 110-compliant anaerobic digestate from waste law, on the condition the digestate meets certain criteria prescribed by the regulator, such as compliance of facilities with environmental authorisations, appropriate certification of the digestion process and resultant digestate, the feedstock must be from certain biowastes or biomaterials, and no further processing

673 For an overview see: Peter Brownsort and others, 'An Assessment of the Benefits and Issues Associated with the Application of Biochar to Soil' (n623), as recommended to those considering spreading of biochar, through the EA's website: UK Government, Environment Agency, 'Landspreading: benefits and risks of the waste types you can use' (May 2022) <www.gov.uk/guidance/landspreading-benefits-and-risks-of-the-waste-types-you-can-use/19-waste-codes> accessed 16 August 2025

674 Regulation 2019/1009 on the making available on the market of EU fertilising products, Annex I, Part I

675 For more information on the description of biochar within EU law, see Luka Strubelj, 'Waste, Fertilising Product, or Something Else? EU Regulation of Biochar' (n655)

676 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)

677 UK Government, Environment Agency, 'Request a resource framework to show when a material has ceased to be waste' (January 2022) <www.gov.uk/guidance/request-a-resource-framework-to-show-when-a-material-has-ceased-to-be-waste>

678 Luka Strubelj and Navraj Singh Ghaleigh (n469), 7

679 Disni Gamaralalage and others, Biowaste to biochar: a techno-economic and life cycle assessment of biochar production from food-waste digestate and its agricultural field application' (n634)

680 British Standards Institution standards are available through subscription: British Standards Institution, 'PAS 100: Specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials' <https://knowledge.bsigroup.com/products/specification-for-whole-digestate-separated-liquor-and-separated-fibre-derived-from-the-anaerobic-digestion-of-source-segregated-biodegradable-materials>

681 Waste and Resources Action Programme, Environment Agency, Northern Ireland Environment Agency, 'Quality Protocol: Compost' (2012) <https://assets.publishing.service.gov.uk/media/5a7c0761ed915d01ba1cab0f/geho0812bwpl-e-e.pdf> accessed 16 August 2025

is required for the resultant digestate to then be used.[682] To complement the suggestion from experts of creating a new Resource Framework for biochar, industry has suggested the creation of a new BSI PAS standard for biochar, to provide an independent certification upon which the Resource Framework could rely, mirroring the approach taken for anaerobic digestate.

Creation of a Resource Framework for biochar would ease the restrictive legal boundaries permeating biochar production. However, as highlighted by those suggesting this route, the costs and time involved in creating a Resource Framework are not conducive to the capacity of small operators. Resource Frameworks involve extensive engagement from industry, and the minimum suggested cost for this exercise is £40,000,[683] with some in biochar industry having received estimates of up to £100,000. This cost, together with the identified challenges associated with incorporating the carbon sequestration elements of biochar into said criteria and seeking contribution from DESNZ,[684] leads to a challenging environment for change in an industry comprised of small operators, and does not assist existing biochar operators or support new entrants, particularly in the short-term.

#### *12.2.4 Navigating assimilated EU law*

As discussed at Chapter 9.3, altering waste law is a complex process. The challenge of changing the designation of biochar from being a waste to being another process such as recycling, for example, is yet to be resolved. Specific wastes (including biochar) are identified through waste codes, deriving from EU law, but there is not necessarily a clear mechanism in place for reclassifying these codes. The uncertainty of allocation of regulatory responsibility between Defra and the EA is also apparent to biochar industry. Further complications arise when considering regulatory competence for biochar as a GGR technique, for example the aforementioned ambiguity of designated responsibility between Defra and DESNZ with regard to GGR techniques containing both nature-based and engineered elements. While these imbalances and uncertainties remain, confident navigation of assimilated waste law will continue to prove challenging and potentially fragmented.

## 12.3 Permitting and use cases for biochar

#### *12.3.1 Permits and incineration*

Permitting of biochar production or pyrolysis facilities involves not only waste licensing, but also legal consideration of other factors such as air quality and compliance with health and safety legislation. For operators in England utilising waste feedstocks and spreading biochar to land above the LRWP 60 and 61 thresholds, waste management permits will be required, as well as a permit to spread waste to land for agricultural benefit or ecological improvement.[685] Permitting overall poses less of a challenge for larger biochar producers, particularly those

682 Scottish Environment Protection Agency, 'Position Statement: Regulation of Outputs from Anaerobic Digestion Processes' (February 2017) <www.sepa.org.uk/media/219842/wst-ps-016-regulation-of-outputs-from-anaerobic-digestion-processes.pdf> accessed 16 August 2025

683 UK Government, Environment Agency, 'Request a resource framework to show when a material has ceased to be waste' (n676)

684 See further: Luka Strubelj and Navraj Singh Ghaleigh (n469), 7-8

685 See for example in England: UK Government, Environment Agency, 'Landspreading to improve soil health' (May 2022) <www.gov.uk/guidance/landspreading-to-improve-soil-health#check-if-you-need-a-permit> accessed 15 August 2025

which have existing waste permits or designated permitting in-house expertise to navigate legal challenges.[686]

Pyrolysis facilities vary greatly in size and specification. This variation is equally present in the surrounding legislative requirements. Firstly, if a pyrolysis facility does not fit within an existing standard rules environmental permit, then a bespoke permit may be required. Bespoke permits may require onerous risk assessments, technical information and emissions control strategies.[687] The challenges associated with this are also addressed with regard to BECCS EfW at Chapter 11.4.

For a pyrolysis facility which utilises waste, there is a myriad of permitting requirements which may need to be considered in the context of incineration or boilers such as: permits for certain installations;[688] whether the pyrolysis plant qualifies as a medium combustion plant;[689] whether the plant qualifies as a small waste incineration plant;[690] or what permits apply to mobile pyrolysis facilities.[691] Relevant permitting provisions depend on thermal input to the facility, the tonnage of waste burned, and the substance produced. Some pyrolysis plants may also qualify for certain exemptions from the Industrial Emissions Directive,[692] leading to reduced specific operating conditions including temperatures and emissions.[693] In circumstances where the pyrolysis does not use waste or produce waste, permitting requirements are still potentially present depending again on the specifications of the plant under permitting for installations. However, the permitting framework for pyrolysis utilising waste feedstocks is stringent and challenging to navigate. From a research and development perspective, pyrolysis plants will be considered under the assimilated Industrial Emissions Directive provisions and therefore be subject to more stringent regulation if they treat more than 50 tonnes of waste a year.[694] This is the same limitation which applies to BECCS projects (see Chapter 11.4) and creates a permitting environment where producers of biochar from waste material are facing no choice but to engage in commercial-scale permitting procedures.[695]

As seen in other GGR techniques with an engineered component, a common pathway for small-scale projects is to co-locate on sites which produce the relevant feedstock or already hold the requisite permits, utilising research project exemptions where applicable.[696] Many

686 e.g. Ricardo BIOCCUS project: Ricardo, 'Ricardo's heat and power demonstrator: BIOCCUS' (n595)
687 England: UK Government, Environment Agency, Department for Environment, Food & Rural Affairs, 'Waste: environmental permits' (February 2016) <www.gov.uk/guidance/waste-environmental-permits> accessed 9 August 2025
688 For example, A1 installations: - UK Government, Environment Agency, Department for Environment, Food & Rural Affairs, 'A1 installations: environmental permits' (February 2016) <www.gov.uk/guidance/a1-installations-environmental-permits#check-if-you-need-a-standard-rules-permit> accessed 10 August 2025
689 England and Wales: UK Government, Environment Agency, Department for Environment, Food & Rural Affairs, Natural Resources Wales, Welsh Government, 'Medium combustion plant; when you need a permit' (July 2019) <www.gov.uk/guidance/medium-combustion-plant-when-you-need-a-permit> accessed 10 August 2025
690 England: UK Government, Department for Environment, Food & Rural Affairs, 'Environmental permitting guidance: waste incineration' (December 2015) <www.gov.uk/government/publications/environmental-permitting-guidance-the-waste-incineration-directive/environmental-permitting-guidance-waste-incineration#small-waste-incineration-plants> accessed 11 August 2025
691 England and Wales: UK Government, Environment Agency, Department for Environment, Food & Rural Affairs, Natural Resources Wales, Welsh Government, 'Medium combustion plant; when you need a permit' (n688)
692 As contained within domestic law: Environmental Permitting (England and Wales) Regulations 2016, Schedule 1, Part 1, s3(g); Pollution Prevention and Control (Scotland) Regulations 2012; The Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013
693 For a list of pyrolysis plant activities which are exempt in England, see: UK Government, Department for Environment, Food & Rural Affairs, 'Environmental permitting guidance: waste incineration' (n689)
694 England: UK Government, Department for Environment, Food & Rural Affairs, 'Environmental permitting guidance: waste incineration' (n689)
695 Interview with Participant 1262387, Ricardo (online, 13 February 2025 and 13 March 2025)
696 e.g. Black Bull Biochar, CapChar

biochar facilities are mobile and do not increase transport demands within current planning or permitting limits. A consequence of this approach is that full permitting processes have not been explored readily by biochar projects, therefore the true extent of permitting law is not yet apparent in biochar operations.

### *12.3.2 Future permitting considerations*

Concern was raised in interview regarding the more widespread use of biochar, should it be more readily approved for usage in future frameworks. In a similar scenario to the concerns over unprotected peatland (see Chapter 15.2.1), any land which is not protected lacks oversight and this poses a risk from the perspective of environmental regulators in the context of biochar application, particularly in large quantities.[697] If biochar is produced from feedstock which does not carry a waste code, then very few limitations apply to the spreading of said biochar, as it is considered a product. Many protected areas around the UK do not allow additions to land without explicit permissions, and if spreading a product on agricultural land, land managers will require to adhere to standard obligations such as to not spread in excess of the needs of the soil or spread on frozen land.[698] The absence of regulated monitoring of the spread of product-based biochar to unprotected land was an observation raised by industry, which reported that many operators creating stable biochar adhere to LRWP 61[699] even though there is no obligation to do so.[700] Interviewees also voiced concern that biochar spreading limits created by the LRWP are not readily monitored, creating a scenario where limits may be breached by bad actors. The need for regulatory oversight of landspreading of biochar is also an important aspect for farmers.[701] It is clear from these findings that industry requires an unambiguous set of rules applicable to biochar which both enable good actors and create clear controls for potentially damaging activities.

It should not be assumed that if updates to waste law come to fruition and exempt certain biochar production that this will reduce any other legal obligations or permitting requirements for pyrolysis facilities. For example, non-waste anaerobic digestion is to be regulated in Scotland in the same way that waste anaerobic digestion is, despite not using waste as a feedstock. The justification for this tightening of permitting is that the non-waste process still produces the same environmental risks, regardless of which feedstock is used.[702] The analogy of anaerobic digestion to biochar is imperfect in a number of ways, but this precautionary and process-focused approach may become relevant when considering any future reformed permitting of biochar.

### *12.3.3 Biochar in fertiliser*

Inclusion of biochar in fertilising products is a common pathway for biochar producers. This applies for projects which do not use waste feedstock, or have achieved end-of-waste status for their biochar. Fertiliser regulations specify particular safety and contaminant limits for fertiliser composition, excluding the ability to include waste materials, which are not mentioned within permitted materials for fertilisers.[703] In the context of fertiliser and facilitating biochar usage within

697 Interview with Participant 9830922, Natural England (online, 16 April 2025)
698 e.g. The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018
699 Sets limits for the spreading of biochar created from waste: UK Government, Environment Agency, 'Storing and spreading biochar to benefit land: LRWP 61' (n647)
700 Interview with Participant 7153836, Black Bull Biochar (online, 7 February 2025)
701 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
702 Scottish Government, 'Business and Regulatory Impact Assessment: Environmental Authorisations (Scotland) Amendment Regulations 2024 – new activities' (n492)
703 The Fertilisers Regulations 1991 (applies to England, Wales, and Scotland)

the law, it is well-documented that EU law has accelerated beyond the UK.[704] The introduction of EU Fertilising Products Regulations[705] is an important step in biochar regulation from the perspectives of legal experts, as it creates a route in law for biochar to achieve status as a fertilising product without bespoke procedures such as end-of-waste approvals.[706] This law is relevant to the UK due to its applicability in Northern Ireland, which must comply with certain EU law under the Windsor Framework. Biochar could therefore have a potential pathway through fertiliser to transcend the hindrance of waste law in Northern Ireland. It remains to be seen whether the UK will align with this law, or create an incompatibility which then potentially restricts trade of biochar fertilisers between mainland UK and Northern Ireland. As emphasised in multiple interviews, cohesion and alignment of law and standards for biochar throughout the UK is crucial for maximising scaling potential of biochar.

#### *12.3.4 Biochar in construction*

Another documented pathway for biochar is for use in the construction industry, which has been suggested as a more versatile designation for biochar use, as opposed to limited application to agricultural land.[707] As documented in Chapter 10.4, construction is regulated extremely rigorously, and therefore poses challenges for new entrants into the market for construction materials. This challenge is potentially increased in the scenario where biochar is classified as a waste. Utilising something which classifies as a waste in a construction material can be subject to statutory restrictions, for example a limit to the tonnage of the waste that can be used over a period of time, how long it is stored for prior to use, and specific limited construction uses it is allowed for (e.g. roads, car parks).[708] In addition, in order to gain an exemption to use certain wastes in construction at permitted tonnages and purposes, exemption criteria must be met and the relevant construction business must register with the required regulator.[709] Biochar is not currently listed as a waste code available under these exemptions; therefore, a full environmental permit will be required for using biochar in construction. These limitations likely do not create incentive for companies to use biochar material, as any delay to progress of a construction project, for example, could result in a breach to waste storage conditions on or offsite, and applying on a case-by-case basis for a full permit is an additional hurdle most construction companies will not want to navigate where avoidable. As with the standards explored at Chapter 12.2.1, which are centred around the chemical composition of the biochar, there are calls to expand this principle to construction use cases for biochar, as is the case in the EBC.[710] Biochar which is not a waste does not bring the same stringent set of obligations. However, as noted in Chapter 10.4, the construction industry remains far from being a receptive market to low-carbon materials due to rigorous legislation and a lack of incentives to utilise low-carbon materials.

704 Luka Strubelj and Navraj Singh Ghaleigh (n469), 7; Luka Strubelj (n655)
705 Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003 [2019] OJ L 170/1 (Fertilising Products Regulation)
706 As introduced by delegated regulation: Commission Delegated Regulation (EU) 2021/2088 of 7 July 2021 amending Annexes II, III and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding pyrolysis and gasification materials as a component material category in EU fertilising products
707 Interview with Participant 3746405, Biochar Demonstrator (online, 3 February 2025)
708 England and Wales: Environmental Permitting (England and Wales) Regulations 2016, Schedule 3, Chapter 2
709 In England, businesses must register with the EA: UK Government, Environment Agency, 'U1: using waste in construction' (September 2019) <www.gov.uk/guidance/u1-waste-exemption-use-of-waste-in-construction#waste-limitsat-a-site> accessed 12 August 2025
710 Information provided by Participant 3746405, Biochar Demonstrator (online, 17 September 2025)

## CHAPTER 12 – FINDINGS AND RECOMMENDATIONS

- ✓ Waste law barriers to biochar scaling are well-documented but remain valid and unresolved
- ✓ End-of-waste status is not a sustainable solution for designating biochar as non-waste
- ✓ Tree surgeon arisings should be reconsidered as a co-product in certain scenarios, and anaerobic digestate should similarly be considered for its biochar feedstock potential
- ✓ Regulators are not necessarily familiar with pyrolysis designed for the purpose of creating biochar, therefore knowledge-sharing is crucial
- ✓ Industry requires a legal framework which eases certain restrictions currently placed on biochar production, whilst also creating balanced obligations to ensure quality and stable biochar
- ✓ LRWPs are not commensurate with the volumes of biochar production and spreading activities required by GGR industry
- ✓ LRWP-equivalent positions of devolved nation regulators is unclear and inconsistent, creating confusion for operators
- ✓ Multiple stakeholders suggest the creation of a common biochar framework, adopting a centralised approach to overhaul the regulation of biochar
- ✓ A common biochar framework would require to meet the needs of industry and other stakeholders with respect to technical specification in particular
- ✓ Development of a Resource Framework and relevant BSI PAS standards would create an option within law for biochar to be considered end-of-waste, however prohibitive expense and time is a hindrance for industry, which is comprised of small operators
- ✓ Assimilated EU waste law is a complex environment and challenging to update, requiring careful navigation by Government and regulators accordingly
- ✓ Permitting systems for pyrolysis are complex for biochar pathways utilising waste, however challenges to permitting are likely not fully explored due to under-developed industry and co-location strategies
- ✓ Without efficient monitoring of biochar spreading activities in future, unprotected land is at risk from bad practice or environmental damage

Figure 15: Chapter 12 Findings and Recommendations

# Chapter 13 – ERW

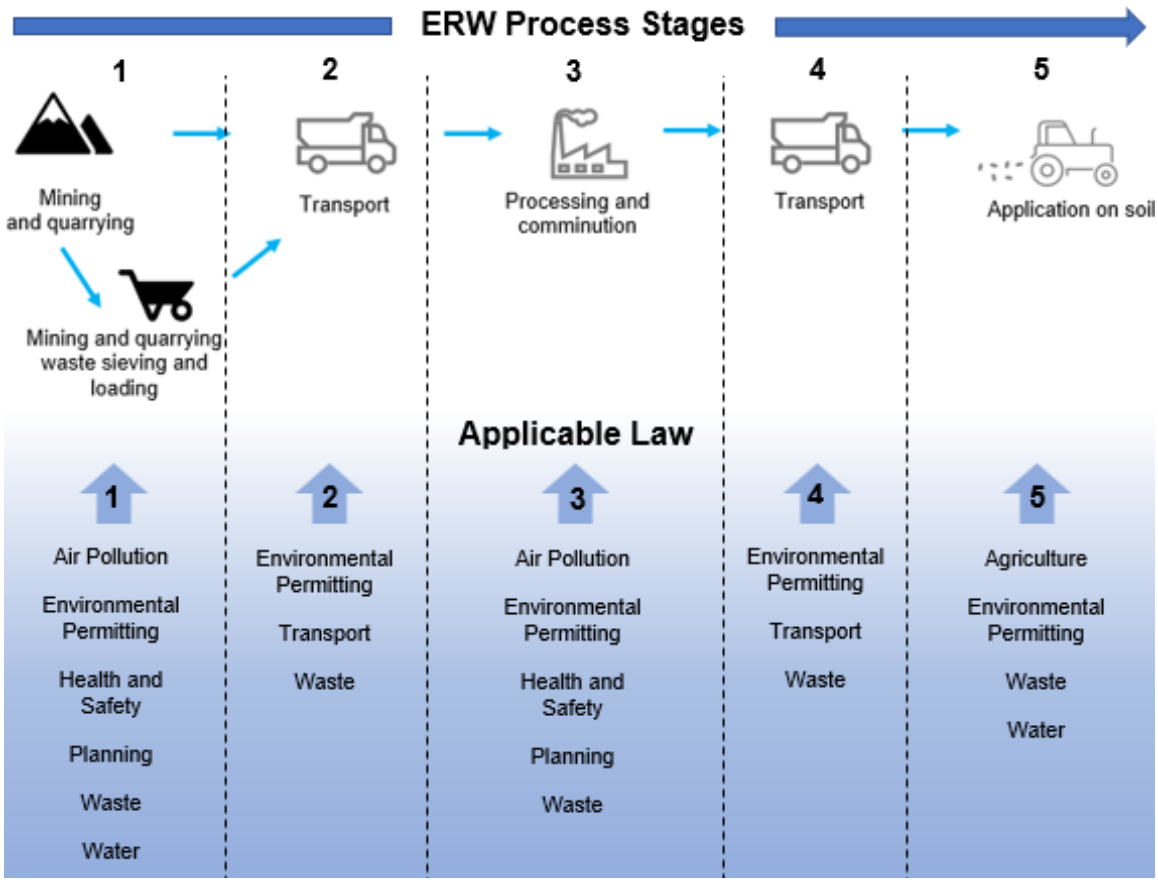


Figure 16: ERW Process Diagram

ERW involves the application of fine rock dust, typically quarry-sourced silicate rock (e.g., basalt), to land for $CO_2$ sequestration.[711] Although basalt is currently a common material used in the UK, other types of rock can be used, or industrial or construction waste.[712] ERW is one of the lesser understood GGR techniques from a regulatory point of view. Its potential for deployment around the UK has been considered and mapped at a UK-level, most recently in

711 For details on specific rock types used in UK research trials, see for example: University of Sheffield, 'Our research' <https://sheffield.ac.uk/uk-enhanced-weathering/our-research> accessed 8 July 2025; for rock types used in commercial UK operations, see: UNDO, 'What is Enhanced Rock Weathering' <https://un-do.com/enhanced-weathering/> accessed 8 July 2025

712 Frank McDermott and others, 'Enhanced weathering for CO2 removal using carbonate-rich crushed returned concrete; a pilot study from SE Ireland' (August 2024) Applied Chemistry, Vol 169, 106056; Megan Danczyk and Christopher Oze, 'Suitability of rocks, minerals, and cement waste for CO2 removal via enhanced rock weathering' (November 2024) Communications Chemistry, 7, 272; Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' UK Parliament POSTnote 726 (15 August 2024), 7

a UK Parliamentary briefing.[713] This briefing sets out at a foundational level some of the crucial legal gaps associated with ERW, which are explored in this chapter.

Legal challenges associated with ERW demonstrate succinctly the Regulatory Paradox – specifically the cyclical challenge of a lack of evidence preventing regulators from providing regulatory support to GGR activities. However, the lack of support restricts the ability of GGR industry to provide the requisite evidence (see Chapter 3 regarding the Regulatory Paradox). ERW raises many questions in the context of evidence availability. As a nascent technique, the evidence gaps were noted by multiple interviewees, all of whom vocalised the consequent need for a precautionary approach[714] to ERW deployment, particularly in relation to agricultural land.[715] There are existing concerns within the farming community that current ERW operators are progressing ahead of the evidence base, creating unquantified risks.[716] Defra similarly voiced concerns that whilst industry is seeking to define an evidence base and establish best practice, experimentation and changes in feedstock material create a moving target which evades settled regulation.[717] This lack of consistent and sufficient evidence creates a barrier for regulators. From the perspective of ERW industry, there is the economic necessity to pursue revenue-generating activities. Accordingly, there is a profound challenge in balancing intended ERW operations with an uncertain regulatory environment.[718] This challenge is augmented by scientific evidence recommending increased levels of rock to be spread per hectare for optimal ERW.[719]

## 13.1 Regulation and regulatory challenges

The widely noted evidence gaps become a greater concern when considering the fact that there is a regulatory gap; the application of "potentially hazardous or toxic rock dust"[720] to crops and agricultural land is not regulated as a specific action in any jurisdiction across the UK. When prospective operators have scoped their projects on site, there have not been any reported legal restrictions encountered by the project operators beyond permission from the landowner or land manager.[721] This contrasts starkly with all other GGR techniques addressed herein, where the default position is that business activities are regulated as potentially posing an environmental risk which require permitting from the designated regulator.[722]

A lack of regulatory control over spreading rock dust to land creates a notable void in legal oversight and consideration of other impacts. One way to assess these impacts is to scope

713 Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' (n711)
714 See Chapter 2.3 Legal principles and policy and Chapter 3 regarding Regulatory Paradox for further discussion of the precautionary principle
715 For example NFU, Defra, SEPA, NRW
716 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
717 Interview with Participant 6570675, Department for Environment, Food & Rural Affairs (online, 14 March 2025)
718 Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025)
719 Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025) citing David J Beerling and others, 'Enhanced weathering in the US Corn Belt delivers carbon removal with agronomic benefits' (February 2024) Proceedings of the National Academy of Sciences, Vol 121, No 9
720 Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' (n711)
721 The ERW-relevant interviewee for the purposes of this report is scoping ERW activity for future commercial operation, but was not operating at the time of giving interview - Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025)
722 For a representative list of regulated activities requiring permits, see Environmental Permitting (England and Wales) Regulations 2016 Schedule 1, Part 2 (England and Wales); Pollution Prevention and Control (Scotland) Regulations 2012, Schedule 1 (Scotland); Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013, Schedule 1 (Northern Ireland)

the legal frameworks which apply to similar practices, such as agricultural liming or fertilising practices. If spreading either lime or fertiliser to land, a land manager would be required to consider various criteria including the composition of the materials (whether or not derived naturally), when and how they are spread to land, and the interaction of that land spreading with surrounding ecosystems including waterways.[723] Without the legal obligation to consider these factors, ERW operators are not held to certain limits or procedures and there is a lack of direct legal recourse through legislation should environmental damage arise from their activities on agricultural land.

Points of the ERW value chain which draw legal attention are the weathering material used, the land to which it is spread, and any subsequent environmental impacts. For the purposes of this report, the value chain from the point of extraction or production of the weathering material onwards is acknowledged; however, no explicit gaps or challenges have been raised with regard to said extraction or production at this stage, specifically in the context of basalt rock dust. Quarries can benefit from use of basalt as it is otherwise unprofitable[724] and typically falls within their existing regulated remit for extraction and processing purposes.[725] Future scaling implications for the upstream value chain of ERW have been noted as practical challenges – for example, the carbon-intensity of transport and the spreading site's proximity to the quarry[726] – but not thus far as legal challenges. Future research in this area should engage directly with producers of ERW materials to explore any legal challenges which emerge with potential new industry pressures.

Returning to the ERW material used, another challenge exists in considering whether or not the material is categorised as a waste, product, or by-product. The navigation of complex waste legislation is a challenge for ERW operators, including the challenge of how to define a waste.[727]If the ERW material does indeed classify as a waste, that introduces a stringent set of legal rules to which operators must adhere. As highlighted in interview, extensive stakeholder engagement has been undertaken by the EA with the UK's first commercial ERW operator to attempt to categorise ERW material, specifically basalt rock dust, to confirm correctly its position as a by-product, as opposed to waste.[728] The delineation between waste and by-products is discussed at Chapter 9.2. Other ERW materials, however, may easily fall into various waste categories,[729] for example construction wastes or mining wastes.[730] These categories derive from EU law, as set out in Chapter 9**.**

For the application or spreading of certain wastes to soil, a permit is required. The requisite permits typically contain specific criteria necessitating proof of agricultural or ecological benefit of the spreading of the waste, as well as other criteria including potential risk

723 See generally: The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 (England); The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (Scotland); The Nutrients Action Programme (NAP) Regulations (Northern Ireland) 2019 (Northern Ireland); The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 (Wales)
724 Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' (n711), 9
725 For obligations relevant to quarrying see generally The Quarries Regulations 1999
726 Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' (n711), 12
727 See Chapter 9 regarding the definition of waste
728 Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025)
729 Waste categories derive from the European Waste Catalogue, reflected in guidance: Natural Resources Wales, Scottish Environment Protection Agency, Environment Agency, 'Waste Classification' (n460) (E,W,S); Northern Ireland Environment Agency, 'Waste Classification' (n463) (NI)
730 Natural Resources Wales, Scottish Environment Protection Agency, Environment Agency, 'Waste Classification' (n460)

assessments.[731] This scenario presents multiple challenges for ERW. Firstly, application for and compliance with permits is a strict legal process which imposes financial and time costs on operators, especially at the preliminary stages of their project. Secondly, the evidence base to prove agricultural or ecological benefit of ERW activity is not yet substantial.[732] Therefore, if the operator's chosen ERW material classifies as a waste it is likely to be an extremely challenging hurdle for the operator to substantiate the claim of agricultural or ecological benefit for the purposes of the permit. Similarly, as outlined in the recent pivotal UK Parliamentary briefing on ERW, the EA in England sets out substances which are exempt from waste regulations for the purposes of spreading to agricultural land to maintain or improve soil, as replacements for fertilisers or agricultural lime.[733] ERW operators and research publications advocate for ERW as a suitable fertiliser or lime replacement;[734] however, this has not been proven at scale. Should this research be further proven and corroborated, certain suitable ERW materials could potentially be considered under the EA's exemption or fall under the permitting regime for land spreading.

When considering the lack of regulation for ERW activities and the complexity of waste law, the lack of regulatory clarity is a risk felt across industry and regulators, creating questions as to whether ERW is being undertaken correctly and safely within the parameters of existing law. The importance of regulatory clarity was corroborated by NFU in interview, highlighting there is a demand for tighter regulation on ERW before the farming community would wish to engage with it commercially, to confirm ERW does not hinder or restrict food production (something which can only be confirmed through the evidence base, prior to a regulatory framework being introduced). The NFU raised that with the right regulatory frameworks to address environmental and food safety, ERW would be an appealing GGR option for farmers.[735]

## 13.2 Regulator positions across the UK

The four nations all have varying targeted approaches for ERW. As noted in Chapter 13.1 above, the EA in England has engaged with the UK's first active commercial ERW operator to analyse the legal position of basalt rock dust. This engagement benefitted knowledge accrual by the regulator, whilst supporting industry development. From a nation-wide perspective, this engagement has created a more developed initial pathway for ERW industry within England, although there remains the challenge of allocating regulator responsibility for ERW and thus distinct capacity and budget allocation.[736]

731 See for example in England: UK Government, Environment Agency, 'Landspreading: form LPD1 guidance' <www.gov.uk/government/publications/landspreading-apply-to-deploy-mobile-plant/landspreading-form-lpd1-guidance#section-b-deployment-details> accessed 8 July 2025; and UK Government, Environment Agency, 'Landspreading: provide a waste and receiving soil analysis' <www.gov.uk/government/publications/landspreading-apply-to-deploy-mobile-plant/landspreading-provide-a-waste-and-receiving-soil-analysis> accessed 8 July 2025; Wales: Natural Resources Wales, 'Apply for deployment of a mobile plant permit' <https://naturalresources.wales/permits-and-permissions/waste-permitting/apply-for-deployment-of-a-mobile-plant-permit/?lang=en> accessed 8 July 2025; For Northern Ireland and Scotland see generally: NetRegs, 'Disposing of waste by landspreading' <www.netregs.org.uk/environmental-topics/waste/managing-waste-materials/disposing-of-waste-by-landspreading/> accessed 8 July 2025

732 For recent or ongoing research see: Kirstine Skov and others, 'Initial agronomic benefits of enhanced weathering using basalt: A study of spring oat in a temperate climate' (March 2024) PLOS One 19(3); and David J Beerling and others (n719) for research regarding agricultural benefits; for industry's position on agricultural benefits see UNDO, 'Co-benefits for climate and community' <https://un-do.com/> accessed 9 July 2025

733 UK Government, Environment Agency, 'U10: spreading waste to benefit agricultural land' (April 2014) <www.gov.uk/guidance/waste-exemption-u10-spreading-waste-to-benefit-agricultural-land> accessed 9 July 2025

734 *ibid*

735 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)

736 For more detail on the balance of regulatory responsibility between nature-based and engineered GGRs in England see Chapter 4.1

Commercial ERW operations in the UK have so far only taken place in Scotland and England.[737] SEPA commented on the position of ERW in Scotland, noting that there is a regulatory gap and little dedicated attention to ERW within the regulator, however, SEPA's role as regulator can only extend to the law as exists. If ERW interacts negatively water bodies, air quality or other regulations over which SEPA has jurisdiction, then there is a potential for SEPA's regulations to apply to ERW operations, but that would be after the fact, when environmental damage has already transpired or a legal limit has been exceeded.[738] From this perspective, regulators are aware of the potential risks that ERW could pose, without possessing the tools to address it directly due to it being a regulatory lacuna. Again, proposals for regulatory change to control and enable ERW can only emerge in correlation with evidence provided, and then with that change regulators can be given clear oversight of ERW activities.

Northern Ireland has provisionally identified ERW as a speculative future pathway.[739] However, if ERW does become a more standardised and regulated activity elsewhere in the UK, Northern Ireland presents a large percentage of agricultural land and therefore a potentially appealing landscape for ERW activities. This again connects back to the issue of evidence for ERW. Northern Ireland sets out the need for "a robust assessment"[740] of ERW through evolving scientific research, prior to support and scaling.

Wales has similarly not been presented with the commercial deployment of ERW. Therefore, there has not been a drive to create a specific regulatory framework. NRW highlighted in interview that it is paying close attention to results from demonstrator projects[741] in order to support the evidence base before considering regulatory change or specific allocation of capacity within NRW to dedicate to ERW. Unlike Northern Ireland, Wales has quite limited arable land, and therefore, at this stage ERW is perceived as being a lower priority GGR technique from the perspective of regulators.[742] Research is, however, exploring the role of ERW on grassland and pastureland; therefore, this may form a factor for future regulatory decisions in Wales if it is developed further.[743]

## 13.3 The future of ERW regulation

Although ERW is not equally on the agenda of each nation, it is evident that if industry is to continue operations or attempt to scale, there requires to be a clear regulatory framework in place. When considering what future ERW regulation could look like, it is clear from the perspective of regulators and existing literature explored in this chapter that regulation needs to address the application of rock dust to land. From the perspective of industry, such regulation should provide clear standards for their activities, in turn assisting with project risk

737 See UNDO's operations: Oliver Gordon, 'Speeding up rock weathering can help decarbonise the atmosphere' Energy Monitor (March 2023) <www.energymonitor.ai/tech/carbon-removal/speeding-up-rock-weathering-can-help-decarbonise-the-atmosphere/?cf-view> accessed 8 July 2025; and distribution of basalt quarries in the UK, primarily in Scotland and Northern Ireland: Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' (n711), 11
738 Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
739 Department of Agriculture Environment and Rural Affairs, 'Draft Northern Ireland Climate Action Plan' (n4), 26
740 Department of Agriculture Environment and Rural Affairs, 'Draft Northern Ireland Climate Action Plan' (n4), 239
741 GGR-D Enhanced Rock Weathering project: $CO_2$RE, 'Enhanced Rock Weathering' <https://co2re.org/ggr-projects/enhanced-rock-weathering/> accessed 8 July 2025
742 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)
743 For research see: University of Sheffield, 'Field sites used for GGR by UK agriculture via ERW' <https://sheffield.ac.uk/uk-enhanced-weathering/our-research/field-sites-ggr-uk-agriculture-erw> accessed 9 July 2025

allocation. Industry recommends firstly a standard of regulation which aligns with existing voluntary standards utilised by ERW industry,[744] for example Isometric,[745] and The Integrity Council for the Voluntary Carbon Market's Core Carbon Principles.[746] Secondly, industry recommends regulations pertaining to ERW should mirror liming, for example criteria around minerality and toxic metal levels in the material,[747] without imposing any unnecessary or onerous restrictions.[748] From the perspective of recipient stakeholders (i.e. the farming community), regulatory clarity on the product specification of the ERW material is imperative, and should include a legal obligation to specify the location which supplied the material, the chemical composition of the material, and the technical specification (i.e. particle size distribution).[749] Both industry and recipient stakeholder perspectives are reflected within the UK Parliament's briefing, which highlighted the possibility of developing regulations to stipulate the composition of weathering material spread on land.[750] This in turn replicates the current standards for conventional land spreading licences, under the conditions of environmental permits, or existing specifications for products such as lime and fertiliser.[751] From the purposes of facilitating early industry and start-up operators, in relation to spreading quantities the NFU suggested that thresholds could be created. Modest volumes of ERW, at a level evidenced scientifically, could fall below a minimum threshold demanding regulatory oversight, creating an exemption to permitting regimes.[752] In England, this would perhaps take the form of a new Low Risk Waste Position by the EA, depending on the ERW material used,[753] although there are limits to this approach, as explored further in 12.1 Waste – an established legal barrier.

Ultimately, the level of control which the law imposes correlates directly to the risk of an activity as proven through evidence. Considering the gaps in ERW evidence, it is unclear at this stage how stringent legislation would be when regulating application of ERW materials to land, and which materials should be exempt from stringent regulation such as waste law. The only certainty is that explicit regulatory gaps cannot be left unaddressed if ERW is to become scalable and approachable by industry. The lack of direct legislation creates an uncertain pathway for industry, which cannot be maintained both from the perspective of industry support and environmental protection. Despite each UK nation having slightly differing positions on ERW, a synergised approach to ERW regulation (similar to aligned legal positions on existing land spreading practices) would create the most efficient approach.

744 Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025)
745 Isometric, 'Enhanced Weathering in Agriculture' <https://registry.isometric.com/protocol/enhanced-weathering-agriculture> accessed 10 July 2025
746 The Integrity Council for the Voluntary Carbon Market, 'The Core Carbon Principles' (n176)
747 The exclusion of certain ERW materials due to toxicity is discussed briefly in the context of legislation: Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' (n711), 16 ;
748 Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025)
749 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
750 Natalie Forrest, Jonathan Wentworth, 'Enhanced rock weathering: Potential UK greenhouse gas removal' (n711) 16
751 for example, liming specifications contained in Fertilisers Regulations 1991
752 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
753 See generally: UK Government, Environment Agency, 'Environmental permits: low risk waste positions' (August 2019) <www.gov.uk/government/collections/environmental-permits-low-risk-waste-positions> accessed 9 July 2025

## CHAPTER 13 – FINDINGS AND RECOMMENDATIONS

- ✓ There are clear evidence gaps in ERW which prevent regulatory change and industry certainty
- ✓ There is no legislation throughout the UK which addresses directly the activity of spreading rock dust to agricultural land, creating a regulatory gap and lack of oversight, in turn increasing environmental risk
- ✓ A clear regulatory framework requires to be established to specify the composition of ERW materials and regulate its application to land
- ✓ The current upstream legal environment for ERW does not present any overt legal challenges, but should be analysed further if ERW operations are scaled
- ✓ Waste law creates a complex environment for categorising ERW materials, potentially necessitating permits and imposing requirements such as proving agricultural or ecological benefit to spreading waste to land
- ✓ English and Scottish regulators comparatively have given the greatest consideration to ERW, whilst Northern Irish and Welsh regulators perceive ERW as a future consideration which requires greater research
- ✓ Regulation will require to be built upon the requisite ERW evidence, potentially replicating the regulatory structures for liming or fertiliser and aligning throughout the UK
- ✓ If robust evidence of ERW activity is provided, small quantity ERW applications could be permitted through an exemption process

Figure 17: Chapter 13 Findings and Recommendations

# Chapter 14 – Afforestation

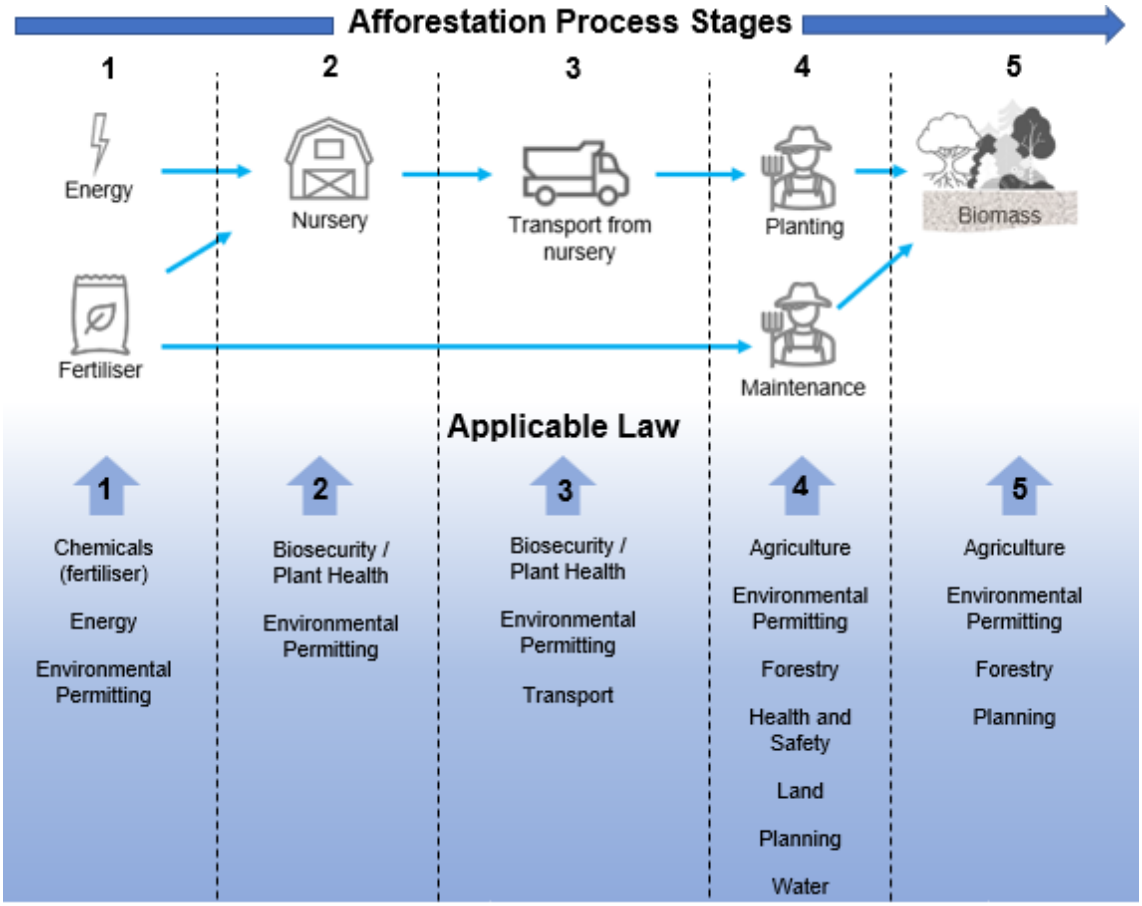


Figure 18: Afforestation Process Diagram

This chapter explores laws and legal challenges pertinent to afforestation activities. This includes discussions of reforestation or deforestation where applicable to GGR activities, acknowledging the importance of additionality. Afforestation boasts one of the most mature legislative frameworks out of all GGR techniques addressed in this report. This is a position held by regulators and industry alike, with industry reporting that afforestation regulation is accessible and understandable.[754] There is a wealth of historic forestry activity in the UK, and therefore an established regulatory framework. Although this regulatory framework was not always been orientated towards climate or carbon sequestration goals, there is inadvertently a supportive regulatory landscape in place for afforestation as a GGR technique. In comparison to other GGRs documented throughout this report, there are fewer controversies or legal

754 Interview with Participant 1054011, Environmental Project Developer (ERW and afforestation) (online, 20 March 2025)

opacities to be noted for afforestation, but it is not immune to challenges, as explored below.

## 14.1 Afforestation policy and procedure

Nations across the UK have set explicit forestry targets.[755] Although these targets are policy-driven, they provide a clear position and goal for regulators. One of the primary motivations for tree-planting at these scales is carbon sequestration, however researchers have raised the point that tree-planting targets and carbon sequestration targets do not always correlate proportionately.[756] Although analysis of the intricacies of measuring carbon sequestration from trees goes beyond the remit of this report, this potential disconnect is an important factor for future policy-making in this area. Similarly, it has been noted that regulator capacity compounds the challenge of enabling leading researchers to map tree planting and carbon sequestration data fully, as data gaps remain, for example in Northern Ireland.[757] Policy and research activities require alignment in order to pursue afforestation successfully and efficiently, and although this report is focused on regulation, it is acknowledged that the economics of afforestation was raised in multiple interviews as posing one of the greatest challenges for those working in the forestry community.[758]

The fact that all UK nations have historically failed to meet tree planting targets indicates there is more that can be done,[759] including at a legal level, to increase afforestation. Interestingly, the law is already being used for these purposes, however in a different way. The law defining woodland (and therefore what can be included within tree-planting targets) was recently updated in England, expanding the definition to trees outside woodland,[760] and therefore simulating an increase in tree coverage.

The legislative challenges posed by afforestation are not necessarily associated with current operations, unlike some other GGR techniques explored herein. Interviewees reported it is relatively simple to have afforestation or reforestation activity approved by regulators. For example, NRW highlighted in the context of Wales that most projects present as low risk – therefore, they proceed to opinion under EIA regulations, as opposed to requiring full

755 England has set 30,000 hectares per year across the UK: UK Government, 'The England Trees Action Plan 2021-2024' (May 2021) (note this is a UK-wide target, as opposed to only England); Scotland has set 18,000 hectares by 2024-25: Scottish Government, 'Update to the Climate Change Plan (2018-2032)' (n4), 175; Wales has set 43,000 hectares by 2030: Welsh Government, 'Written Statement: Trees and Timber' (July 2021) <www.gov.wales/written-statement-trees-and-timber> accessed 18 July 2025; Northern Ireland has set 9,000 hectares per year from 2020 to 2030: Department of Agriculture, Environment and Rural Affairs, 'DAERA Forestry Grants' <www.daera-ni.gov.uk/articles/daera-forestry-grants#toc-0> accessed 18 July 2025

756 Interview with Participant 4905913, Net Zero Plus (online, 10 March 2025); see also Ian Bateman and others, 'How to make land use policy decisions: Integrating science and economics to deliver connected climate, biodiversity, and food objectives' (n275)

757 Interview with Participant 4905913, Net Zero Plus (online, 10 March 2025)

758 Interview with Participant 3743080, Net Zero Plus (online, 1 May 2025); Interview with Participant 4905913, Net Zero Plus (online, 10 March 2025)

759 England: Environmental Audit Committee, *Government tree planting meets less than half its annual targets, despite the growing demands on UK woodland for net zero* (HC 637 Fifth Report of Session 2022-23); Scotland: Sarah Madden, 'Root of the Problem: Underfunding, Underdelivering' Woodland Trust (July 2025) https://www.woodlandtrust.org.uk/press-centre/2025/07/root-of-the-problem-underfunding-underdelivering/> accessed 18 July 2025; Wales: Natural World Fund, 'Wales plants 'dismal' 12% of woodland target' (August 2024) <https://naturalworldfund.com/wales-plants-dismal-12-of-woodland-target/> accessed 18 July 2025; Northern Ireland: Lynsey Nixon, 'DAERA's Forests For Our Future Programme Fails to Meet Planting Targets for Northern Ireland' Woodland Trust (June 2025) <www.woodlandtrust.org.uk/press-centre/2025/06/daeras-forests-for-our-future-programme-fails-to-meet-planting-targets-for-northern-ireland/> accessed 18 July 2025

760 The Environmental Targets (Woodland and Trees Outside Woodland) (England) Regulations 2023

consent and therefore a more detailed EIA application process.[761] This does not necessarily mean project developers have unlimited scope for development, as the EIA regulations exist to protect the environment and there are multiple legally designated sensitive or protected areas which limit forestry activities.[762] These limitations are not necessarily seen by regulators as presenting a challenge,[763] and were not raised by industry in interview, however this consideration does correspond to land use challenges detailed in Chapter 8 and similarly potential conflicts with peatland areas at Chapter 15.2.1.

## 14.2 Afforested peatland

The UK boasts both ambitious afforestation targets and ambitious peatland restoration targets. It is a well-recognised issue that a sizeable portion of UK peatland is afforested, as high as 18%,[764] which has led to degradation of the underlying peat. All four UK nations follow the UKFS, which sets out a 'general presumption' against afforestation on deep peat. Under legislation, if an operator wishes to afforest an area of deep peat,[765] this will likely trigger the need for an EIA.

With respect to peatland, felling licences is one area of law which was raised in interview as posing a potential challenge for GGR activities. When a forest owner or manager wishes to fell their forest, a felling licence is required across the UK in most cases.[766] The role of peat in tree felling was raised by NRW in interview, during which its role as regulator under the Forestry Act 1967 was highlighted. Within that role, NRW is required to consider retention of forest cover in their licensing decision, and can only grant unconditional felling licences for forests (which involves no restocking obligation) if the felling party is intending to restore the peat upon which the forest was planted, on the provision that the felling party can demonstrate the restoration is a priority for the site.[767] NRW proposes that the licensing system should instead carry a presumption against restocking on deep peat, recognising the harm caused to peat through forestry and the carbon sequestration value of peat,[768] as opposed to imposing an obligation to demonstrate the priority of restoration.[769] Although not a point raised in interview by others undertaking forestry activities, all forestry regulators across the UK adhere to the

761 Natural Resources Wales, 'Environment Impact Assessment for forestry activity' >https://naturalresources.wales/guidance-and-advice/environmental-topics/trees-woodlands-and-forests/environmental-impact-assessment-for-forestry-activity/?lang=en> accessed 19 July 2025

762 Sensitive or protected areas include SSSIs (Areas of Special Scientific Interest in Northern Ireland), National Parks, Areas of Outstanding Natural Beauty, National Nature Reserves; World Heritage Sites etc.

763 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025)

764 IUCN UK Peatland Programme, 'Forestry' <www.iucn-uk-peatlandprogramme.org/forestry> accessed 18 July 2025

765 The depth criteria for deep peat varies per nation, as contained in the Forestry environmental impact assessment regulations for each nation, Scotland: The Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017; England: The Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999; Wales: The Environmental Impact Assessment (Agriculture) (Wales) Regulations 2017; Northern Ireland: Environmental Impact Assessment (Forestry) Regulations (Northern Ireland) 2006

766 For four nations guidance see: UK Government, Forestry Commission, 'Tree felling licence: when you need to apply' (July 2018) <www.gov.uk/guidance/tree-felling-licence-when-you-need-to-apply> accessed 18 July 2025; for underlying legislative requirements see Scotland: Forestry and Land Management (Scotland) Act 2018; England: Forestry Act 1967; Northern Ireland: Forestry Act (Northern Ireland) 2010; Wales: Environment (Wales) Act 2016

767 For felling criteria see: Natural Resources Wales, 'Trees, woodlands and forests' <https://naturalresources.wales/guidance-and-advice/environmental-topics/trees-woodlands-and-forests/?lang=en> accessed 19 July 2025

768 See for example: Woodland Trust, 'Trees and peat in the nature and climate crises' Position Statement (September 2023); and UK Government, Department for Environment, Food and Rural Affairs, Forestry Commission, Natural England, 'Decision support framework for peatland protection, the establishment of new woodland and re-establishment of existing woodland on peatland in England' (July 2023) <https://assets.publishing.service.gov.uk/media/66bb1a6aab418ab05559366a/July_2023_Decision_support_framework_for_peatland_protection_V4.pdf> accessed 19 July 2025

769 For further details on deep peat see Chapter 15

UKFS, therefore this could be a transferrable consideration for these jurisdictions and the future of forestry legislation.

From the Welsh perspective, parallel to the legislative position on restocking is the Welsh Government's forestry policy, which assumes no net loss of forested areas.[770] This creates a policy driver for continuous reforestation, which in turn can create pressure to restock on peat. An explicit prioritisation in the UKFS of restoring deep peat as opposed to restocking woodland would create a pathway for all UK nations through adherence to the UKFS, potentially addressing these concerns for regulators. From the perspective of GGRs, this creates a disconnect between potential peatland restoration and forestation practices; however, the carbon sequestration benefit of avoiding restocking forest and instead restoring peatland differs depending on the site, as noted by the UKFS, which states that the positive or negative impact of restocking forest on deep peat varies, and is to be determined on a case-by-case basis.[771] One interviewee also highlighted that the cost and infrastructure challenges of restoring afforested peatland are considerable.[772] The case-dependent nature of restocking decisions creates complexity for regulators that want to demonstrate a prioritisation pathway for either peatland restoration or forestation. The challenges raised highlight the importance of coordinated policy positions and statutory responsibilities imposed on forest regulators. For further information on peatland, see Chapter 15.

## 14.3 Biomass for energy and woodland

As discussed in Chapter 11.2**,** certain biomass crops could be categorised as trees and woodland in certain circumstances. It is not always an easy task to define 'woodland' as the criteria straddle multiple pieces of legislation, addressing area size, tree width, height, canopy cover etc.[773] The Forestry Commission recognises that varying definitions are used, and it is the legal context in which you use it (for example in relation to a certain act) that is important.[774] The UK Biomass Strategy highlights that short rotation forestry and short rotation coppice grown for biomass-specific purposes are recently exempt from forestry legislation.[775] For the purposes of planning law, however, if the planting changes the use of a certain area of land from, for example arable, then this triggers the legal category of land-use change.[776] From a stakeholder perspective, the risk of falling within the bounds of forestry regulation deters farmers from pursuing short rotation coppice of woody crops,[777] as stringent criteria are then introduced for both the creation of the woodland as a land-use change,[778] and then

770 Welsh Government, 'Woodlands for Wales: The Welsh Government's Strategy for Woodlands and Trees' (2018)
771 Forestry Commission, Scottish Forestry, Natural Resources Wales, Northern Ireland Forest Service, 'The UK Forestry Standard' (October 2024), 109
772 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
773 For example see England: UK Government, Forestry Commission, 'Definition of trees and woodland' <www.gov.uk/government/publications/definition-of-trees-and-woodland/definition-of-trees-and-woodland#background> accessed 19 July 2025; and in the context of requiring a felling licence, criteria also apply, for example in England see Forestry Act 1967, s9; for Scotland see generally: NatureScot, 'Planning and development: trees and woodland' <www.nature.scot/professional-advice/planning-and-development/planning-and-development-advice/habitats/planning-and-development-trees-and-woodland> accessed 18 July 2025; Wales: Natural Resources Wales, 'Trees, woodlands and forests' (n767); Northern Ireland: Department of Agriculture, Environment and Rural Affairs, 'Woodlands' <www.daera-ni.gov.uk/articles/woodlands> accessed 18 July 2025
774 *ibid*
775 See The Environmental Targets (Woodland and Trees Outside Woodland) (England) Regulations 2023, amending the Environment Act 2021
776 For example, under the Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999
777 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
778 Woodland creation involving a change in land-use requires an EIA, for relevant legislation see n765

subsequently the obligation to then retain that woodland in perpetuity apart from limited circumstances.[779]

The concerns around being bound by restrictive regulation are compounded by many farmers being inexperienced in tree husbandry, which creates an additional risk factor if they are then bound by law to maintain woodland.[780] This does not necessarily suit the commonly rotational nature of farming practices, and creates a legal long-term commitment for the farmer. Raising this point in interview, the NFU suggested, the creation of a more flexible option for farmers, straddling biomass crop plantation and afforestation.[781] The Biomass Strategy similarly suggests a legal mechanism whereby biomass crop growth does not trigger land-use change.[782] This suggested exemption would create an option which would provide the farmer with flexibility to pursue biomass crop growth without committing to long-term forestry or a permanent land-use change.

## 14.4 Woodland Carbon Code

Linked to procedural considerations within afforestation is the importance of carbon accounting. Afforestation, like peatland, carries an independent quality assurance standard which is endorsed by all forestry regulators in the UK. For afforestation throughout the UK, this standard is the Woodland Carbon Code.[783] This is a voluntary standard; however, with the weight of governmental support behind it, the Code attracts widespread adherence. This has been bolstered by the Woodland Carbon Guarantee, introduced by the Forestry Commission.[784] This guarantee, which is currently closed, previously facilitated the Government as a guaranteed buyer for Woodland Carbon Code credits generated. The contractual incentive created direct support for the Code through a governmental funding mechanism. Unlike the Peatland Code, the Woodland Carbon Code is focused on carbon, providing verified carbon units which are recognised internationally.[785] The Code is widely regarded as successful and reliable, with the only challenge raised in interview being its focus on planted forestry, creating limitations for consideration of natural woodland.[786] This limitation was raised as an evidence gap, which links back to the variability and challenges of data mapping forestation activity throughout the UK.

## 14.5 Regulating for future risks

One of the primary challenges to afforestation is competing land uses across the UK, which will likely become more complex in the years to come. Chapter 8 discusses land use in more detail; therefore, the remainder of this chapter focuses on other stresses placed on

779 Deforestation similarly demands an EIA process
780 Interview with Participant 3743080, Net Zero Plus (online, 1 May 2025)
781 Interview with Participant 6358223, National Farmers' Union (online, 28 February 2025)
782 UK Government, Department for Energy Security & Net Zero, 'Biomass Strategy' (n140), 77
783 Woodland Carbon Code, 'The quality assurance standard for UK woodland carbon projects' <www.woodlandcarboncode.org.uk/> accessed 19 July 2025
784 UK Government, Forestry Commission, 'Woodland Carbon Guarantee (currently closed) <www.gov.uk/guidance/woodland-carbon-guarantee> accessed 19 July 2025
785 Woodland Carbon Code, 'About the Code' (May 2025) <www.woodlandcarboncode.org.uk/about-code> accessed 19 July 2025
786 Interview with Participant 9830922, Natural England (online, 16 April 2025)

afforestation and the surrounding legislation. These challenges to afforestation take the form of external threats and how the law responds to them. It is established that access to and operation of the law in relation to afforestation is well-established, however the law is not necessarily as robust when addressing the vulnerability of existing forest. The longevity of forests is crucial from a GGR perspective, as tree loss resulting in carbon leakage can impact carbon crediting and credit offtake agreements, potentially leading to financial or other losses for the afforestation project operator.[787] The longevity of forests and the legal parameters surrounding permanence requirements may also become increasingly relevant should DESNZ decide to include afforestation within the UK ETS, creating permanence thresholds.[788]

### *14.5.1 Storms, pests and pathogens*

Evidence suggests that climate change will drive increased storm extremes across the UK, particularly extreme wind and rain, in the years to come.[789] Forests are susceptible to wind storm damage and several thousand hectares of coverage can be lost in a single storm event.[790] Forests are similarly at risk from pests and pathogens, another issue recognised generally as being catalysed by climate change.[791] One shared solution to these threats is tree species diversification, which is recognised as improving both forest resilience to weather events,[792] and increasing resilience to pests and pathogens.[793] The current UKFS, to which all UK nation forestry regulators must adhere,[794] stipulates that a limit of 65% of a forest management unit can be one single species of tree.[795] This limit has recently reduced from 75% in the previous incarnation of the UKFS.[796] Although the reduction is an improvement, it is something which cannot be applied to existing woodland which is vulnerable to climate-related damage due to historic monoculture practices. An additional consideration is that although the UKFS states forests should be planned to enhance resilience and mitigate climate change risks,[797] there are no stipulations within the UKFS (beyond the 65% threshold) which dictate the distribution of these diverse species within the forest management unit, and this in turn can still lead to areas of monoculture and vulnerability. These concerns were

787 For example, see BSI Nature Markets standard which outlines changes to supply of credits, with rectification actions including returning payments for credit removals, utilising insurance, or forest reinstatement: British Standards Institution 'Nature markets – Overarching principles and framework – Specification' BSI Flex 701 v2.0 (March 2025), 17; see also Woodland Carbon Code which considers emissions as significant if exceeding 5% of project carbon sequestration: Woodland Carbon Code, 'Carbon sequestration' (June 2025) <www.woodlandcarboncode.org.uk/3-carbon-sequestration> accessed 19 July 2025

788 UK Government, Scottish Government, Welsh Government and Department of Agriculture Environment and Rural Affairs, 'Integrating Greenhouse Gas Removals in the Emissions Trading Scheme: Woodland Evidence Annex' (July 2025) <https://assets.publishing.service.gov.uk/media/687e75a78adf4250705c96ed/uk-ets-ggrs-main-response-woodland-annex.pdf> accessed 19 July 2025; UK Government, Scottish Government, Welsh Government and Department of Agriculture Environment and Rural Affairs, 'Integrating Greenhouse Gas Removals in the Emissions Trading Scheme: Main Response' (n178), 30-35

789 Colin Manning and others, 'Compound wind and rainfall extremes: Drivers and future changes over the UK and Ireland' (June 2024) Weather and Climate Extremes, Vol 44, 100673

790 See for example: Tom Wilkinson, 'Storm Eowyn: National Trust seeks help after losing 10,000 trees' Forestry Journal (January 2025) <www.forestryjournal.co.uk/news/24895234.storm-eowyn-national-trust-seeks-help-losing-10-000-trees/> accessed 20 July 2025; and Scottish Forestry, 'Diverse forests needed to cope with storm damage' (November 2022) <https://webarchive.nrscotland.gov.uk/20250903145806/https://www.forestry.gov.scot/news-releases/diverse-forests-needed-to-cope-with-storm-damage> accessed 20 July 2025

791 Forest Research, 'Pests & Diseases' <www.forestresearch.gov.uk/climate-change/risks/pests-and-diseases/> accessed 20 July 2025; also see generally: UK Government, 'UK Climate Change Risk Assessment 2022' (January 2022)

792 Forest Research, 'Windthrow' <www.forestresearch.gov.uk/climate-change/risks/windthrow/> accessed 19 July 2025

793 Elsa Field and others, 'Tree diversity reduces pathogen damage in temperate forests: A systematic review and meta-analysis' (February 2025) Forest Ecology and Management, Vol 578, 122398

794 The UK Forestry Standard is a technical standard, as opposed to legal. However, compliance with the technical criteria stipulated within the UKFS is compulsory for felling licences, grant schemes and other regulatory processes

795 Forestry Commission, Scottish Forestry, Natural Resources Wales, Northern Ireland Forest Service, 'The UK Forestry Standard' (October 2024), 13

796 *ibid*, 32

797 *Ibid*, 13

raised by NatureScot in interview.[798] Although updates to the UKFS are technical in nature, as opposed to legal, they are still important from a legal perspective as all forest regulators must adhere to the UKFS, and funding and grants for woodland creation also demand compliance with the UKFS.[799]

### *14.5.2 Biosecurity and plant health*

In relation to pests and pathogens and potential adaptive measures, NatureScot highlighted the role of biosecurity and corresponding plant health legislation. Firstly, it should be noted that although all four UK nations share the UKFS and carry similar forestry regulation, Northern Ireland is a somewhat more distinct jurisdiction in relation to plant health and biosecurity. Movement of plants and seeds was a topic of focus when negotiating the Windsor Framework,[800] and therefore although DAERA coordinates with UK-wide bodies, its regulatory arrangements are separate and there is a distinct list of plants which cannot be moved between mainland UK to Northern Ireland.[801]

In the UK, imported trees, seagrass, and other plants, can create risks. With the threat of pests and pathogens increasing, so too must the rigour of legal control of the movement of these pests and pathogens increase. A common observation and issue with legislation in general is that it is reactive, slow to be introduced, and in the case of plant health has historically only been enacted after a threat has become widespread.[802] In a period of fast-paced change, reactive legislation is insufficient to protect existing and future forestry from pests and pathogens. Attempts to increase the rate of adaptability are demonstrated through the Plant Biosecurity Strategy for Great Britain,[803] and the deployment of emergency legislation to control certain pests.[804] Fulfilling the policy aims of the strategy, combined with enacting legislation and regulated guidance swiftly and where necessary, will assist in protecting the longevity of afforestation activities.

A concern raised by NatureScot however is the role of nurseries. When comparing the legal obligations and protections at a national level with those at a local or nursery level, it becomes clear that there is an imbalance and potential loophole whereby local plant nurseries do not have to undertake mandatory quarantines.[805] NatureScot advocated in interview for standards for local nursery biosecurity to be increased to reduce the risk of spreading infected material between sites.[806]

798 Interview with Participant 9550967, NatureScot (in person, 5 March 2025)
799 For example, England Woodland Creation Offer: UK Government, Forestry Commission, 'England Woodland Creation Offer' (May 2021) <www.gov.uk/guidance/england-woodland-creation-offer#how-to-apply-for-ewco-step-by-step> accessed 21 July 2025
800 HC Research Briefing *Northern Ireland Protocol: The Windsor Framework* (21 March 2023) (CBP 9736), 40-41
801 UK Government, Department for Environment, Food & Rural Affairs, 'Regulated plants for planting under a Northern Ireland plant health label' <www.gov.uk/government/publications/apply-to-use-northern-ireland-plant-health-labels/regulated-plants-for-planting-under-a-northern-ireland-plant-health-label-niphl> accessed 22 July 2025
802 See for example UK's reaction to ash dieback, where complications arose due to interlinkage with EU legislation: Environment, Food and Rural Affairs Committee, *Tree health and plant biosecurity* (HC Tenth Report of Session 2013-2014) (11 March 2014)
803 UK Government, Department for Environment, Food & Rural Affairs, 'Plant biosecurity strategy for Great Britain (2023 to 2028)' (January 2023) <www.gov.uk/government/publications/plant-biosecurity-strategy-for-great-britain-2023-to-2028/plant-biosecurity-strategy-for-great-britain-2023-to-2028> accessed 20 July 2025
804 UK Government, Forestry Commission, 'New restrictions to limit impact of Ips typographus tree pest' (October 2024) <www.gov.uk/government/news/new-restrictions-to-limit-impact-of-ips-typographus-tree-pest> accessed 22 July 2025
805 Jonathan Wentworth, 'Plant Biosecurity in Great Britain' UK Parliament POSTbrief 51 (25 April 2023), 22, 32
806 Interview with Participant 9550967, NatureScot (in person, 5 March 2025)

Another solution is to explore the potential of more resilient tree varieties; however, these may not be native to the UK. Although afforestation is an established GGR technique, it is not immune to evidence challenges, something which Natural England noted in the context of its uncertainty as to whether the current regulatory regime relating to non-native tree species is sufficient.[807] This applies, for example, to species such as paulownia, which have been introduced to the UK for limited afforestation use.[808] Paulownia plantations have been subject to EIA procedures; however, due to their very recent introduction, there is uncertainty as to wider ecological impacts. For this reason, environmental regulators are cautious of the evidence base that new species carry, especially when these innovative solutions coincide with increasing afforestation targets and climate-related challenges.

#### *14.5.3 Deer management*

Another important consideration for afforestation is the role of deer and the costs and risks they create for afforestation activities, particularly in Scotland.[809] NatureScot is Scotland's regulator of wild deer,[810] and the challenges NatureScot faces regarding deer management are reflected in the proposed Natural Environment (Scotland) Bill, introduced by the Scottish Government in February 2025. This Bill proposes an increase to NatureScot's powers to direct land managers regarding deer management,[811] introducing powers to impose deer management plans and intervene when deer mismanagement creates damage to woodland.[812] Increased control of deer in relation to woodland would have a positive impact for afforestation activities, but stakeholders still have concerns over the funding and subsidy support for deer culling,[813] as well as more specific concerns around the proposed extended reach of NatureScot's powers of intervention. These concerns remain, despite the removal of proposed Deer Management Nature Restoration Orders, which were regarded by many stakeholders as an infringement on land and property rights (see also Chapter 8 regarding the role of property rights in GGRs). The Bill is in the early stages of consideration and, due to the variety of opposition presented by land managers, is likely to evolve as it moves through parliamentary stages. This legislative example represents the difficulty in balancing a variety of stakeholder interests alongside increased pressures on GGR activities.

## 14.6 The future of afforestation regulation

Ultimately, although the majority of existing law for afforestation is well-established and entrenched throughout the UK, if the legislation does not keep abreast of the changing physical threats which afforestation faces, then the regulatory environment will cease to be fit for purpose and stifle scaling. The priority from the perspective of regulators is to facilitate forest resilience, to ensure afforestation activities can be robust and reliable for the foreseeable

807 Interview with Participant 9830922, Natural England (online, 16 April 2025)
808 Jack Haugh, 'Hybrid species of Paulownia will be grown in the UK for the first time' Forestry Journal (January 2022) <www.forestryjournal.co.uk/news/19859690.hybrid-species-paulownia-will-grown-uk-first-time/> accessed 20 July 2025
809 Interview with Participant 2021157, NatureScot (online, 2 April 2025)
810 NatureScot, 'Managing Scotland's wild deer' <www.nature.scot/professional-advice/land-and-sea-management/managing-wildlife/deer-scotland/managing-scotlands-wild-deer> accessed 22 July 2025
811 NatureScot's existing powers are contained within the Wildlife and Natural Environment (Scotland) Act 2011, s5A
812 Natural Environment (Scotland) Bill, s13
813 See for example: Scottish Land and Estates, 'Scottish Land & Estates Responses to the Newly Published Natural Environment Bill' (February 2025) <www.scottishlandandestates.co.uk/news/scottish-land-estates-responds-newly-published-natural-environment-bill> accessed 22 July 2025;

future.[814] This position is recognised at a policy and strategy level,[815] but questions remain as to how to ensure this at a legislative level as well. Should the risks to certain species continue to increase, legislative restrictions may need to be considered for planting susceptible species, particularly in larger densities.

## CHAPTER 14 – FINDINGS AND RECOMMENDATIONS

- ✓ Afforestation poses fewer regulatory challenges than other GGR techniques, as it is a long-established practice
- ✓ The priority for afforestation regulation is to facilitate forest resilience, adapting to future threats
- ✓ Synergy is required between peatland restoration and woodland restocking, ensuring policy-driven targets and legal responsibilities of forestry regulators are aligned
- ✓ Solutions should be sought to reduce the burden to farmers when planting woody biomass, potentially introducing a non-permanent afforestation option to provide flexibility
- ✓ Tree species distribution should be mandated and specified within the UKFS in order to reduce risks posed by storm events, pests, and pathogens
- ✓ The law needs to be able to react quickly to threats from pests and pathogens, therefore biosecurity and plant health law is an important focus for facilitating afforestation
- ✓ Increased biosecurity obligations are required at local plant nurseries, for example mandatory quarantines
- ✓ Regulators would prefer to see a precautionary approach deployed in relation to utilising non-native tree species in the UK
- ✓ Proposed updates to deer management legislation in Scotland demonstrate the difficulty in balancing stakeholder interests with GGR activities

Figure 19: Chapter 14 Findings and Recommendations

814 Interview with Participant 2021157, NatureScot (online, 2 April 2025)
815 For example: Scottish Forestry, 'A Routemap to Resilience for Scotland's Forests and Woodlands' (August 2025) <www.forestry.gov.scot/publications/routemap-resilience-scotlands-forests-and-woodlands> accessed 20 September 2025

# Chapter 15 – Peatland Restoration

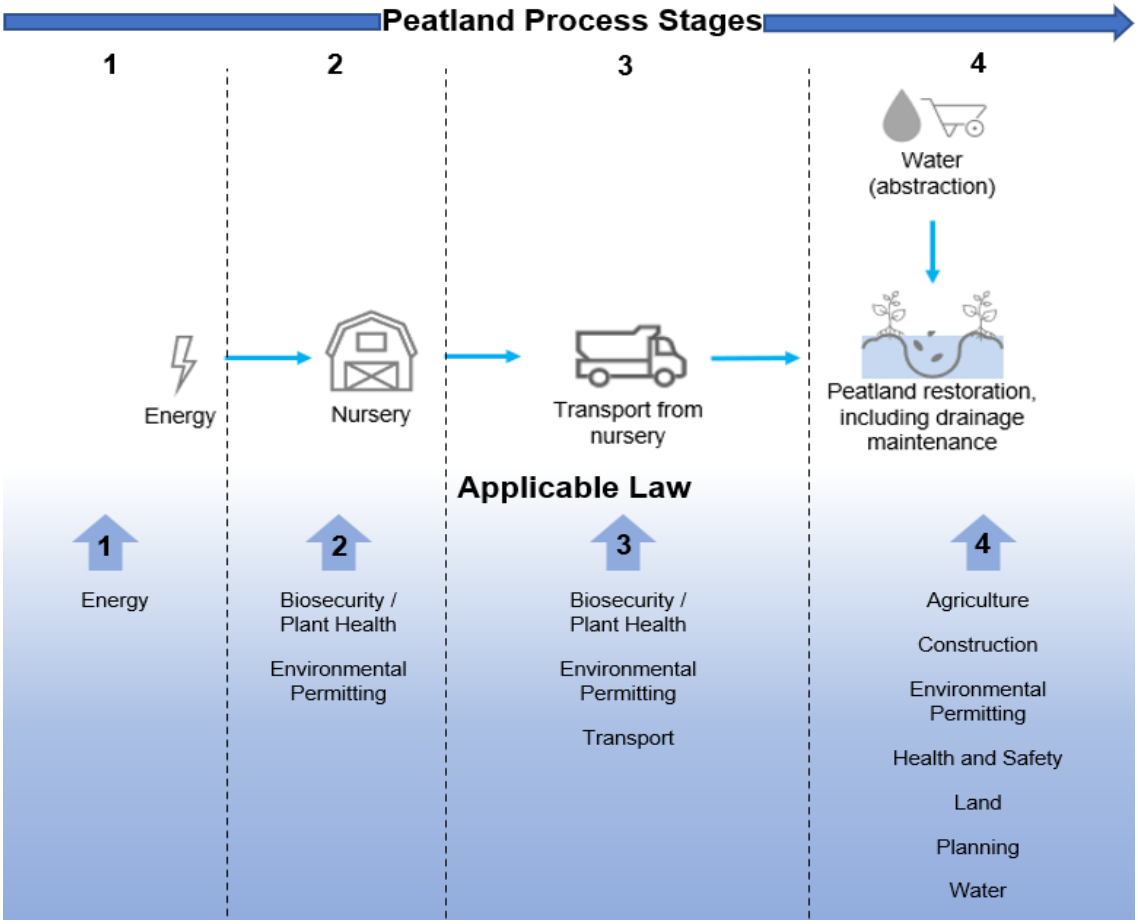


Figure 20: Peatland Process Diagram

Peatland conservation and restoration is widely regarded as a crucial activity in the UK to assist net zero goals. The importance of increased peat restoration and rewetting is advocated for in numerous climate-related sources, for example the CCC's latest carbon budget recommendations,[816] and the UK has been set a target of restoring or having in good and sustainably managed condition two million hectares of peatland by 2040.[817] Within this target, each UK nation has its own goals, although the targets set in Northern Ireland remain in draft since a 2021 consultation.[818]

816 Climate Change Committee, 'The Seventh Carbon Budget: Advice to Government for 2038–2042' (n2), 195-196
817 IUCN UK Peatland Programme, 'UK Peatland Strategy 2018-2040' (2018), 12
818 For peatland targets see, Scotland: NatureScot, 'Scotland's National Peatland Plan: Working for our future' (2015) <www.nature.scot/doc/scotlands-national-peatland-plan-working-our-future> accessed 13 July 2025; Wales: Natural Resources Wales, 'National Peatland Action Programme, 2020-2025' (November 2020); Northern Ireland: Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Peatland Strategy to 2040' (September 2025); England: UK Government, 'England Peat Action Plan' (May 2021)

The complexities of categorising peatland restoration as either GGR or emission reduction are recognised in this report, as reflected in the latest views from industry in response to the UK Government's contemplation of including peatland restoration in the UK ETS.[819] This was a consideration also raised by multiple interviewees, one of which highlighted that leading research in the area focuses on finding viable farming models for peatland, as opposed to purely restoration activity.[820] Exploration of this issue lies beyond the scope of this report. However, as an activity which is designated as being crucial for the UK's net zero targets, it is important to explore the legal environment within which peatland restoration is situated, and its associated challenges. For these purposes, peatland restoration is included in this report.

## 15.1 Role of the IUCN UK Peatland Programme

Similar to the independent monitoring and certification standards for woodland in the UK (see further Chapter 14.4 in relation to the Woodland Carbon Code), the IUCN UK Peatland Programme provides a voluntary and independent certification framework for peatland restoration to provide carbon credits through The Peatland Code.[821] The Peatland Code is designed to align with regulator processes and public funding opportunities.[822] All four UK nations are obligated to report on peatland restoration and land-use change under the UK's Greenhouse Gas Inventory,[823] which has contained peatland carbon emissions since 2019.[824] The IUCN UK Peatland Programme maintains alignment with and provides monitoring on UK peatland policy and supports greenhouse gas obligations through scientific research.[825] With the mapping of peatland across the UK being far from complete,[826] the IUCN UK Peatland Programme is seen to provide a crucial function in creating a reliable standard and knowledge-sharing platform, for example the governance of the Peatland Programme includes regulators from all four nations[827] which assists in creating cohesion and government visibility.

Comparison between the Woodland Carbon Code and the Peatland Code identifies that although both are voluntary and independent standards endorsed by governments UK-wide, peatland does not receive the same support that forestry does. Interviewees observed that forestry and forestry regulators have a long history and established value – for example, the Forestry Commission was established in 1919.[828] Through this, there have been concerted government resources dedicated to the expansion and management of woodland, for multiple purposes, for over one hundred years. When comparing the structure of resources, unlike forestry there is no 'Peatland Commission' or analogous regulator. Similarly, although all four

819 UK Government, Scottish Government, Welsh Government and Department of Agriculture Environment and Rural Affairs, 'Integrating Greenhouse Gas Removals in the Emissions Trading Scheme: Main Response' (n178), 30
820 Interview with Participant 1373498 and Participant 4330535, GGR-Peat GGR-D (online, 4 February 2025)
821 IUCN UK Peatland Programme, 'Peatland Code' version 2.1 (October 2024)
822 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
823 Climate Change Act 2008 includes UK-wide obligation to report on LULUCF sectors.
824 IUCN UK Peatland Programme, 'Peatland addition to the UK GHG inventory adds 3.5% to national emissions' (February 2021) <www.iucn-uk-peatlandprogramme.org/news/peatland-addition-uk-ghg-inventory-adds-35-national-emissions> accessed 10 July 2025
825 IUCN UK Peatland Programme, 'UK Peatland Strategy: Progress Report 2024' (September 2024) <www.iucn-uk-peatlandprogramme.org/uk-strategy> accessed 11 July 2025
826 E.g. up to date cohesive mapping data for England only became available in 2025: UK Government, Natural England, 'A new peat map for England' (May 2025) <https://naturalengland.blog.gov.uk/2025/05/12/a-new-peat-map-for-england/> accessed 11 July 2025
827 IUCN UK Peatland Programme, 'Governance' <www.iucn-uk-peatlandprogramme.org/about-us/governance> accessed 11 July 2025
828 Established through Forestry Act 1919

nations have dedicated funding regimes for peatland restoration,[829] the Woodland Carbon Code has received direct grant incentives in the form of the Woodland Carbon Guarantee (see Chapter 14.4). However, the Peatland Code has not received the same facilitation, which interviewees indicated is a gap which needs addressed.[830] From the perspective of interviewees, consideration needs to be made of capacity around the UK, particularly in light of peatland restoration having ambitious targets in UK policy, potentially without the requisite support yet expected to rival afforestation targets.[831] Within peatland restoration activity, the challenges posed to upland and lowland peat differ, with both being discussed below.

## 15.2 Peatland restoration – operations

### *15.2.1 Protected sites*

The presence of peatland on protected sites around the UK is another consideration for project operators. Legal designations and protections of areas of land around the UK fall into various categories, and roughly 41% of UK peatland falls within protected sites.[832] When approaching peatland restoration in a protected area, this can necessitate legal assessments and the need for consent from the relevant regulator. Peatland restoration may likely involve planting, the movement of existing plants or debris, or changes to drainage or water tables. For demonstration purposes, if such activity were to be intended for a Site of Special Scientific Interest (SSSI) in Scotland, the operator (for example the owner or occupier of the land) would require to check the SSSI-specific 'Operations Requiring Consent,'[833] which frequently contains peatland restoration-related operations, and apply for consent from the regulator (NatureScot). Certain peatland restoration activities across the UK may also require an EIA[834] or Habitats Regulations Assessment.[835]

The web of site-specific legal criteria and consent processes is viewed by some regulators as being overly prescriptive for peatland restoration projects, noting that consents can often be required for even sampling and research purposes, which is counter to scaling.[836] This process can be relatively easy depending on the type of protected site and if the peatland project is tailored to the existing management process of the land or associated natural processes.[837] However, this might also create limitations to the project potential.

On the other hand, other regulators and peatland certification bodies are in favour of this prescriptive process where certain novel or experimental approaches to peatland restoration are being undertaken,[838] for example the utilisation of biochar (see more in Chapter 15.2.2).

829 For example England Nature for Climate Peatland Grant Scheme; Scotland Peatland ACTION funding; Wales (historic grants, currently closed); Northern Ireland Peatland Challenge Fund (closed) and PEACEPLUS EU funding
830 Interview with Participant 1373498 and Participant 4330535, GGR-Peat GGR-D (online, 4 February 2025)
831 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025); Interview with Participant 1373498 and Participant 4330535, GGR-Peat GGR-D (online, 4 February 2025)
832 Kemen G Austin and others, 'Mismatch Between Global Importance of Peatlands and the Extent of Their Protection' (February 2025) Conservation Letters, Vol 18, Issue 1
833 NatureScot, 'Sites of Special Scientific Interest (SSSIs) – Consents' <www.nature.scot/professional-advice/protected-areas-and-species/protected-areas/national-designations/sites-special-scientific-interest-sssis-consents> accessed 14 July 2025; NatureScot, 'Map Search' <https://sitelink.nature.scot/map> accessed 14 July 2025
834 For example, for water abstraction or transfer of water resources
835 Habitats Regulations Assessments apply to European Sites, for example in England and Wales, this derives from The Conservation of Habitats and Species Regulations 2017
836 Interview with Participant 9830922, Natural England (online, 16 April 2025)
837 Interview with Participant 1373498 and Participant 4330535, GGR-Peat GGR-D (online, 4 February 2025)
838 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025); Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)

Environmental protection here becomes priority. However, research demonstrates that up to 80% of peatland is degraded or damaged; therefore, it is questioned as to whether this wealth of protections and site stipulations has been enforced properly.[839] Therefore, from one perspective, entrants to peatland restoration can face strict regulatory processes for utilising protected sites, but from another perspective, it is unclear if said regulatory processes have been enforced correctly in the past.

Stringent legal controls and protections exist for many sites around the UK; however, some criticise the fact that protection and prevention from harm to peatland does not stretch enough beyond protected areas, lacking a cohesive approach[840] and fragmented governance.[841] The risk is that although certain peripheral regulation may provide protection,[842] there is a lack of dedicated regulation to ensure the peatland specifically is not further damaged nor degraded due to legal vulnerability.[843]

Another consideration of land protection is afforested peatland. If the chosen peatland restoration site is afforested, a felling licence without the obligation to restock will be required. Felling licences could be challenging to acquire if the woodland is cut prematurely for the purposes of peatland restoration, as allocating carbon losses would be complex.[844] For more information on felling licences and peatland, see Chapter 14.

### *15.2.2 Biochar for peatland restoration*

Recent peatland restoration research has explored the carbon sequestration potential of adding biochar to degraded peatland – for example, pyrolysing plant material from the relevant peatland and returning the subsequent biochar to that peatland.[845] As indicated above, regulators and other peatland bodies are somewhat wary of this exercise due to a lack of evidence base. Biochar use on peatland has so far been very isolated research, requiring specific permission from and extensive engagement with the relevant regulator to establish the impacts of the project.[846] Although it is far from certain as to whether use of biochar on peatland will become more common practice, one important legal consideration for future usage is the regulation of biochar (see Chapter 12), and its potential categorisation as a waste material. Peatland is a waterlogged landscape, and if you apply biochar which classifies as a waste, then the current position across each UK nation is to not apply biochar to waterlogged soil.[847] This stipulation can also be crucial for certain exemptions under waste law. Therefore, any application for spreading biochar to peatland steps outside the ordinary procedures dictated by legislation, creating a hurdle for operators and a complex challenge for regulators to monitor and assess the risk profile of the proposed activity.

839 IUCN UK Peatland Programme, 'Agricultural Issues: Key Recommendations' (n271), 5
840 *ibid,* 5; Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
841 Rebekka Artz and others, 'The State of UK Peatlands: an update' (September 2019), 15
842 For example water, atmospheric pollution, grazing levels or muirburn IUCN UK Peatland Programme, 'Agricultural Issues: Key Recommendations' (n271), 5
843 IUCN UK Peatland Programme, 'UK Peatland Strategy: Progress Report 2024' (n825), 11
844 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)
845 Peduruhewa H Jeewani, 'Rewetting alongside biochar and sulphate addition mitigates greenhouse gas emissions and retain carbon in degraded upland peatlands' (August 2025) Soil Biology and Biochemistry, Vol 207, 109814; and Fred Worrall, 'Carbon Modelling Phase 3' MoorLIFE 2020, Durham University (September 2022)
846 Interview with Participant 1373498 and Participant 4330535, GGR-Peat GGR-D (online, 4 February 2025)
847 For example, in alignment with: UK Government, Environment Agency, 'Storing and spreading biochar to benefit land: LRWP 61' (n648), UK Government, Environment Agency, 'U11: spreading waste on non-agricultural land' (April 2014 <www.gov.uk/guidance/waste-exemption-u11-spreading-waste-to-benefit-non-agricultural-land> accessed 15 July 2025 (England); or for example The Waste Management Regulations (Northern Ireland) 2006 (Northern Ireland)

### *15.2.3 Water regulation*

A crucial element of peatland restoration is water use, as peatland activity often involves rewetting, alterations to drainage, or the need for water abstraction or impounding. This is a distinct legal difficulty for lowland peatland restoration, as this often requires the need for an abstraction or impounding licence. These licences are required in all four UK nations if you intend to utilise certain volumes of water from a natural source or block water flow to increase the water table.[848] From the perspectives of interviewees, the challenges for lowland peatland restoration activity lie in both the complexities of navigating these licences, in particular abstraction licences, and the balance of agricultural needs with environmental restoration needs.[849]

Water abstraction is a contentious topic, particularly in England where stresses to freshwater systems and water storage are increasing due to climate change.[850] Resilience and sustainability of water resources are paramount,[851] and therefore the precautionary principle and environmental protection are key priorities for regulators in this area.[852] This is a challenging regulatory environment for lowland peat project developers, with many competing stakeholders and challenging conditions, particularly in drought-sensitive areas.

Abstraction licences can create difficulties for peatland projects as they can be altered or revoked where necessary,[853] and permissions may fluctuate in drier weather. For example, in areas of drought, the EA may request a reduction in abstraction (e.g. voluntarily) or there may be reduced flow available for abstraction, leading to a reprioritisation for licensees.[854] This leads to a lack of stability or certainty, and potentially times where abstraction is not possible in the volumes required for restoration activities such as rewetting of peatland, impacting the viability of the project. As a part of this, farmers are crucial stakeholders in lowland peatland restoration or rewetting activities. The owner or occupier of the land may hold an abstraction licence for crop irrigation, and if water demand on their land increases due to rewetting activities, this can impact or require an alteration of their existing licence, which can be subject to delay during times of dry weather and drought.[855] Despite the prospect of potential subsidies or funding for lowland peatland restoration activities,[856] farmers with drought-induced licence reductions or reduced water flow will logically prioritise crop irrigation over rewetting activities. Peatland restoration projects applying for licences autonomously will

848 England and Wales: Water Resources Act 1991; Scotland: The Water Environment (Controlled Activities) (Scotland) Regulations 2011; Northern Ireland: Water Abstraction and Impoundment (Licensing) Regulations (Northern Ireland) 2006;
849 Interview with Participant 1373498 and Participant 4330535, GGR-Peat GGR-D (online, 4 February 2025)
850 Jonathan Wentworth and Jade Ward, 'Water supply resilience and climate change' UK Parliament POSTbrief 40 (May 2021)
851 Securing resilience of water resources is a general duty of the Water Services Regulation Authority (currently Ofwat) entrenched in legislation (For England and Wales - Water Resources Act 1991, s22 as amended by the Water Act 2014)
852 The importance of having the correct review of abstraction licences by regulators, particularly in the context of protected habitats, was highlighted in the juridical review case of *Harris and Harris v Environment Agency and Natural England* [2022] EWHC 2264
853 As of 2028, certain licences which are varied or revoked for the purposes of protecting the water environment in England will not qualify for compensation (Water Resources Act 1991, s61ZA)
854 UK Government, Environment Agency, 'Drought: how it is management in England' <www.gov.uk/government/publications/drought-management-for-england/drought-how-it-is-managed-in-england> accessed 16 July 2025
855 Water abstraction licence applications are subject to a "large backlog" as of 2025: UK Government, Environment Agency, 'Water abstraction during prolonged dry weather and drought' (June 2019) <www.gov.uk/guidance/water-abstraction-flexible-options-in-exceptional-dry-weather> accessed 17 July 2025
856 For example, peat-specific funding under the UK Government, Department for Environment, Food & Rural Affairs, 'Lowland agricultural peat: water for peat pilots' (January 2024) <www.gov.uk/government/publications/lowland-agricultural-peat-water-for-peat-pilots/lowland-agricultural-peat-water-for-peat-pilots> accessed 16 July 2025; or Countryside Stewardship Higher Tier which includes restoring lowland peat, discussed at Chapter 5.3

have to take many stakeholders into account and potential downstream impacts,[857] and this could be more challenging depending on the location, as when considering the licence application, the EA must take existing licences and water demands into account, which could out-compete emerging projects.[858] There is the added consideration as to whether peatland rewetting or restoration activity for the purposes of carbon sequestration, as opposed to other environmental benefit, would qualify as environmental protection within the decision-making process. This highly regulated environment is understandably a disincentive for various bodies to engage in rewetting activity where there could be uncertainty of achieving a licence, or no guarantee of supply or increased stress put on existing licences for agriculture.

Besides abstraction, lowland peatland restoration or rewetting is often dependent on drainage, which presents similar issues to abstraction licensing. Most English lowland peat is located within Internal Drainage Boards (IDBs), which are public bodies that manage water levels, balancing agricultural and environmental needs.[859] The conflict in demand for water supply between agriculture and peatland restoration was highlighted in the Lowland Agricultural Peat Task Force Chair's Report, which flagged the important role IDBs play in making available the water necessary to form strategic solutions to these conflicting needs, together with increased Government investment.[860] The legal structure and mandate of IDBs has been noted as perhaps incompatible with restoring or rewetting peatland, because although IDBs are to have regard to certain environmental needs,[861] the current law states the primary purpose of IDBs is to drain the land,[862] which is contrary to rewetting practice. Bringing a carbon narrative into the role of IDBs and reviewing their mandate and powers to include carbon as a priority may assist in rebalancing the protection of lowland peat.[863] This suggestion may in turn ease some of the pressures of water supply to lowland peat through abstraction licensing, however the suggestions have been criticised as not going far enough to prioritise the protection of lowland peat in IDB areas, whilst also failing to address issues of food security that such reprioritisation might bring.[864] Overall, there is further research to be done in this area to ascertain how peatland restoration should be situated within the current regulatory framework for water, particularly in England. This is a recognised gap and legal solutions may become more apparent following the UK Government's pilot studies.[865]

857 UK Government, Environment Agency, '5. Taking action: water for the environment: National Framework for Water Resources 2025' <www.gov.uk/government/publications/national-framework-for-water-resources-2025-water-for-growth-nature-and-a-resilient-future/5-taking-action-water-for-the-environment-national-framework-for-water-resources-2025#increased-demand-for-water-for-peatlands> accessed 15 July 2025, see at 5.5 'Increased demand for water for peatlands'

858 UK Government, Environment Agency, '10. Water resources planning and abstraction licensing: National Framework for Water Resources 2025' <www.gov.uk/government/publications/national-framework-for-water-resources-2025-water-for-growth-nature-and-a-resilient-future/10-water-resources-planning-and-abstraction-licensing-national-framework-for-water-resources-2025> accessed 15 July 2025, at 10.1 'How we allocate water rights'

859 Association of Drainage Authorities, 'Internal Drainage Boards' <www.ada.org.uk/member_type/idbs/> accessed 16 July 2025

860 Lowland Agricultural Peat Task Force, 'Chair's Report' Department for Environment, Food & Rural Affairs (June 2023), 16

861 Land Drainage Act 1991, s61A

862 Land Drainage Act 1991, s1 "for the purposes of the drainage of land"

863 Lowland Agricultural Peat Task Force (n860), 35-36

864 The Wildlife Trusts, 'Agricultural Lowland Peatlands: A discussion paper' <www.wildlifetrusts.org/sites/default/files/2025-01/2025_Peatlands_Discussion_Paper_WEB.pdf> accessed 15 July 2025, 6

865 UK Government, Department for Environment, Food & Rural Affairs, 'Lowland agricultural peat: water for peat pilots' (n856)

### *15.2.4 Muirburn*

Updates to the regulation of muirburn potentially present a facilitative environment for peatland restoration. Muirburn is a process by which land managers utilise controlled burning to manage vegetation, often located on upland peatland.[866] The role of muirburn in managing landscapes across the UK is a point of contention. Peatland is vulnerable to wildfires which are an increasing risk the UK, [867] which for example can be caused by muirburn managed incorrectly.[868]

Each UK nation has a different legal position on muirburn. Scotland has recently enacted a licensing obligation on all muirburn, which naturally encompasses all burning activity located on all peatland, including unprotected land.[869] Under these rules, a licence will ordinarily only be granted for muirburn on peatland (over 40 centimetres) if the muirburn is to restore the natural environment or reduce wildlife risk on peatland.[870] This strong legislative position, coupled with the fact that 66% of the UK's peatland is situated in Scotland,[871] helps to address the vulnerability of unprotected peatland. However, concerns from stakeholders over the logistics of the new licensing system, and gaps in peat-depth surveys, have delayed the new system until 2026.[872] Although not applicable to muirburn, it is important to flag that protection of peatland in Scotland is furthered by newly announced limitations on agri-environmental funding available for peatland, where activities such as ploughing, applying fertilisers, or other activities that may damage or expose the peat will not be funded.[873]

In England, currently specific licences are required for muirburn on deep peat (over 40 centimetres) when located in a protected site, with multiple exceptions.[874] This leaves vulnerable to muirburn a substantial portion of England's upland peat, an issue highlighted by a recent Defra consultation.[875] This also reinforces concerns raised by interviewees that peatland on unprotected sites remains vulnerable to degradation through a lack of legal controls. However, this position will be subject to change later this year following Defra's responses to consultation on further restrictions to muirburn permissions, reducing deep peat to 30 centimetres, and banning muirburn on upland blanket bog habitats unless under license.[876] Although not as restrictive as Scotland's licensing system, this still presents increased protections for peatland.

Wales also has a licensing system under legislation. This system has not been updated for some time, and is not as extensive as Scottish and English regulations. In Wales, upland and

866 For an overview see NatureScot, 'Muirburn Code' <www.nature.scot/muirburn-code> accessed 16 July 2025
867 Sarah Baker and others, 'Spikes in UK wildfire emissions driven by peatland fires in dry years' (February 2025) Environmental Research Letters, 20
868 Nick Hempe, 'Muirburn is a significant cause, not a solution, to wildfires' ParksWatchScotland (April 2025) <https://parkswatchscotland.co.uk/2025/04/16/muirburn-is-a-significant-cause-not-a-solution-to-wildfires/> accessed 17 July 2025
869 Wildlife Management and Muirburn (Scotland) Act 2024, s12
870 *Ibid,* 13
871 UK Government, Office for National Statistics, 'Scottish natural capital accounts: 2020' (March 2020), 31
872 Felix Meister, 'Muirburn Licences: Important Update' Game and Wildlife Conservation Trust (June 2025) <www.gwct.org.uk/blogs/news/2025/june/muirburn-licences-important-update/> accessed 20 July 2025
873 Scottish Government, 'Scottish Local Government Finance 'Green Book' for Grant Aided Expenditure and other allocations' (n267) and Scottish Government, 'Agricultural Reform Route Map' (226)
874 The Heather and Grass etc. Burning (England) Regulations 2021 s3; UK Government, Department for Environment, Food & Rural Affairs, Natural England, 'Heather and grass burning: rules and when you need a licence' (October 2014) <www.gov.uk/guidance/heather-and-grass-burning-apply-for-a-licence?> accessed 20 July 2025
875 UK Government, Department for Environment, Food & Rural Affairs, 'Heather and Grass Burning in England' (March 2025), 4-5
876 UK Government, Department for Environment, Food & Rural Affairs, 'Consultation outcome: Summary of responses and government response' (September 2025) <www.gov.uk/government/consultations/heather-and-grass-burning-in-england/outcome/summary-of-responses-and-government-response#overview-of-responses> accessed 20 July 2025

lowland peat bogs are recognised as sensitive habitats within The Heather and Grass Burning Code for Wales, with a presumption that sensitive habitats should be included in no-burn areas unless for agreed restoration purposes or under a management programme.[877] Although the Code creates a presumption against burning on peatland, there is no mention of peat in the underlying legislation,[878] including when a licence is required to burn on peatland.

Northern Ireland's regime is distinctly less developed, but the damage muirburn can cause to peat is recognised within Northern Ireland's draft Peatland Strategy.[879] Northern Ireland has no dedicated piece of legislation or licensing regime for the control of muirburn. Instead, very general rules (e.g., when muirburn is permitted throughout the year) are contained within the Cross-Compliance standards,[880] which is a set of requirements to which farmers must adhere to receive agri-environmental funding under various schemes going as far back as 2006.[881] More generally, certain protected areas may explicitly list burning as a notifiable operation, for example within Areas of Special Scientific Interest, where the intended operator requires permission from NIEA in order to undertake burning.[882] These protected areas may inadvertently include peatland; however, there is no explicit protection of peatland areas under current law, and the existing regime is disjointed in comparison to the centralised muirburn codes and licensing legislation available elsewhere in the UK., creating a more challenging environment for peatland restoration.

### *15.2.5 Windfarms and peatland*

As established throughout this report, there is a plethora of conflicting demands on UK land, many of which are inharmonious. One land use which is particularly relevant to peatland is onshore wind development, specifically in Scotland where the majority of the UK's onshore wind development has taken place.[883] One interviewee highlighted the challenge this creates for peatland,[884] as over 200 of Scotland's windfarms are located on peatland, and multiple windfarms are currently planned or consented for land which is Class 1 peat.[885] This is significant for peatland due to the fact that windfarm development necessitates extensive excavation of the land upon which it is built, which is an extreme concern for peatland areas.[886] Construction of renewable infrastructure on peatland can involve erosion, gullying, contamination, and overall loss of peat structure. The way law governs excavated peat differs depending on circumstances, however if the excavated peat does not have a specific

877 Welsh Assembly Government, 'The Heather and Grass Burning Code for Wales 2008', <www.gov.wales/sites/default/files/publications/2018-01/heather-and-grass-burning-code.pdf> accessed 21 July 2025, 9; for general licensing circumstances see The Heather and Grass etc. Burning (Wales) Regulations 2008

878 The Heather and Grass etc. Burning (Wales) Regulations 2008

879 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Peatland Strategy to 2040' (n818), 35

880 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Cross-Compliance Verifiable Standards' (January 2025), 76

881 Department of Agriculture, Environment and Rural Affairs, 'Environmentally Sensitive Areas Scheme (ESA) and Countryside Management Scheme (CMS)' <www.daera-ni.gov.uk/articles/environmentally-sensitive-areas-scheme-esa-and-countryside-management-scheme-cms> accessed 21 July 2025

882 DAERA may enter into management agreements with owners/occupiers of ASSI which may include restrictions on operations (The Environment (Northern Ireland) Order 2002); Department of Agriculture, Environment and Rural Affairs, 'ASSI notifiable operations' <www.daera-ni.gov.uk/articles/assi-notifiable-operations> accessed 17 July 2025

883 As of 2024, Scotland hosted 75% of the UK's total onshore wind project pipeline: Scottish Renewables, 'UK onshore wind project pipeline grows by more than 4 gigawatts in last 12 months' (September 2024) <www.scottishrenewables.com/news/1701-uk-onshore-wind-project-pipeline-grows-by-more-than-4-gigawatts-in-last-12-months> accessed 19 July 2025 – This is partly due to historic limitations on onshore development in England

884 Interview with Participant 9761265, IUCN UK Peatland Programme (online, 12 March 2025)

885 John Muir Trust, 'Submission to the Local Government, Planning and Housing Committee: Building huge windfarms on peatlands isn't going to help Scotland fulfil its net zero targets, protecting and restoring peatlands will.' (February 2024) <www.parliament.scot/-/media/files/committees/local-gov/correspondence/2024/npf4reviewjohnmuirtrust.pdf>

886 IUCN UK Peatland Programme, 'Development' <www.iucn-uk-peatlandprogramme.org/development> accessed 20 July 2025

designation for re-use either onsite or offsite, it will likely be processed for recycling or classified as a waste under applicable guidance and legislation.[887] The reuse of excavated peat is an area designated as an under-explored within Scotland, for example within the context of peatland restoration.[888]

For the purposes of planning onshore windfarm developments in Scotland, any project under 50 megawatts does not require consent from Scottish Ministers,[889] only from the local planning authority,[890] which is overall a less complex and onerous process for the developer. Certain measures within planning law provide checks and balances on developments located on peatland. The most recent National Planning Framework in Scotland requires a detailed site-specific assessment for proposed projects on peatland, and NatureScot specifies that EIAs for these developments should provide justification for the location on peatland and specify measures to minimise damage and restore peatland where necessary.[891] Habitat Management Plans are also requested by NatureScot.[892] Although these assessments and evidence criteria are quite extensive administratively, organisations opposed to windfarm construction on undegraded peat have found them to be insufficient as many windfarms are still considered and consented on undegraded peat.[893] Research on this topic delivers the stark message that windfarms such as these will not save more carbon through their renewable operations than that which has been lost through the peatland degradation onsite,[894] and calls to avoid the construction of windfarms on undegraded peat in Scotland have been published as early as 2012.[895] Recently however, there have been calls for NPF4 and future planning frameworks to place a stronger presumption against developments on peat unless they are essential infrastructure, particularly for specific needs of rural communities.[896] It remains to be seen how GGR activity and renewable energy development will co-exist going forwards, especially for scenarios where carbon savings from the undegraded peatland are identified as potentially exceed that of the development, however a lack of synergy between statutory conditions and policy priorities creates concern for those involved in peatland restoration.

887 For guidance on excavated peat, see: Scottish Environment Protection Agency, 'Developments on Peat and Off-Site Uses of Waste Peat' (May 2017) <www.sepa.org.uk/media/287064/wst-g-052-developments-on-peat-and-off-site-uses-of-waste-peat.pdf> accessed 20 July 2025; Relevant legislation includes (in Scotland) The Waste Management Licensing (Scotland) Regulations 2011; Environmental Protection Act 1990; Landfill (Scotland) Regulations 2003

888 See generally: Felicity Crotty and others, 'Reuse of excavated peat on wind farm development sites' Climate Xchange (January 2025)

889 Section 36 consent through Electricity Act 1989, s36

890 Town and Country Planning (Scotland) Act 1997

891 NatureScot, 'NatureScot pre-application guidance for onshore wind farms' (November 2024) <www.nature.scot/doc/naturescot-pre-application-guidance-onshore-wind-farms> accessed 22 July 2025

892 *ibid*

893 John Muir Trust, 'Submission to the Local Government, Planning and Housing Committee: Building huge windfarms on peatlands isn't going to help Scotland fulfil its net zero targets, protecting and restoring peatlands will.' (n885)

894 Jo Smith and others, 'Wind farms on undegraded peatlands are unlikely to reduce future carbon emissions' (March 2014) Energy Policy, Vol 66, 585-591, cited by IUCN Peatland Programme

895 Jo Smith and others, 'Avoid constructing wind farms on peat' (September 2025) Nature Correspondence, Vol 489, 33

896 John Muir Trust, 'Submission to the Local Government, Planning and Housing Committee: Building huge windfarms on peatlands isn't going to help Scotland fulfil its net zero targets, protecting and restoring peatlands will.' (n885)

## CHAPTER 15 – FINDINGS AND RECOMMENDATIONS

- ✓ Both peatland restoration and afforestation have ambitious targets in UK policy, however in comparison to forestry, peatland receives less dedicated support or a dedicated regulator to improve capacity in meeting targets
- ✓ Protected and designated sites are legally complex for peatland projects, however some regulators welcome the stringency of the laws governing protected areas so as to avoid unanticipated environmental damage from novel techniques (e.g. biochar usage on peat)
- ✓ The majority of UK peatlands are not within protected sites and require regulatory protection to prevent further damage or degradation
- ✓ Addition of biochar to peatland is in the early stages of research, however can be limited by waste law
- ✓ Water regulation can create a challenging environment for lowland peat restoration
- ✓ Abstraction licences can be difficult to utilise if there are other competing water interests, particularly in times of drought or dry weather
- ✓ The role of Internal Drainage Boards is not compatible with lowland peat restoration, and research in this area should continue to provide legal solutions
- ✓ Incoming strict muirburn licensing in Scotland will help to protect peatland, however other areas of the UK do not have the same legal standards, leaving peatland vulnerable
- ✓ Windfarm developments pose a risk to undegraded peatland and can potentially create emitting scenarios when developed on peatland, creating calls for a stronger presumption against developing on peat within planning frameworks

Figure 21: Chapter 15 Findings and Recommendations

# Chapter 16 – Marine GGRs

Unlike other GGRs analysed within this report, the full span of operations of marine GGR activities is harder to confine to specific systems boundaries or process diagrams, owing to the diversity and nascence of techniques available and how these may be deployed within the marine environment.[897] This chapter addresses operational challenges to marine GGR activities as experienced by interviewees, addressing the system boundaries present in these projects without stipulating a more general life cycle through diagrammatical means (which, through generalisation, would potentially omit key regulatory challenges).

Marine GGR techniques present a unique set of challenges in comparison to terrestrial-based GGR techniques. When referring to marine GGR techniques within this report, this refers primarily to ocean alkalinity enhancement (OAE)[898] and the exploration of novel direct ocean capture techniques,[899] as these are most relevant to current UK projects.[900] Globally, other marine GGR techniques include ocean fertilisation and marine biomass sinking.[901] These are all techniques which involve a technological process or element of engineering. There are also nature-based marine techniques such as the restoration of saltmarsh, seagrass, and seabed sediments. Akin to peatland restoration, there are varied research positions as to whether these nature-based marine activities can be rightfully designated GGR, as the evidence base to support factors such as additionality and true carbon sequestration potential is still in development.[902] Acknowledging this evidence gap, this chapter aligns with existing literature and thus adopts the more common term 'blue carbon'[903] to describe these nature-based marine techniques, as opposed to subsuming these methods into the more engineered category of 'marine GGR.'

For the purposes of this chapter, few marine GGR projects have taken place, with the UK hosting only two research and development marine GGR projects so far. There are multiple reasons why marine GGR is not more prevalent in the UK, with regulatory concerns forming one of those reasons, as explored below.[904]

897 For an overview of the diversity of ocean alkalinity enhancement techniques, see Matthew Eisaman and others, 'Assessing the technical aspects of ocean-alkalinity-enhancement approaches' State of the Planet (November 2023)

898 OAE involves the addition of alkaline materials to seawater to enhance carbon sequestration: Plymouth Marine Laboratory, 'What is ocean alkalinity enhancement and why is it important?' (August 2025) <https://pml.ac.uk/news/q-a-and-video-on-the-ocean-alkalinity-enhancement/> accessed 15 August 2025

899 Direct ocean capture involves the removal of dissolved inorganic carbon from seawater: Guy Hooper, 'Removal of dissolved inorganic carbon from seawater for climate mitigation: potential marine ecosystem impacts' (July 2025) Frontiers Climate, Vol 7

900 Two pilots in the UK, one operational (SeaCURE, https://sites.exeter.ac.uk/seacure/> accessed 15 August 2025) and one inactive (Planetary Technologies, 'Updated Company overview: Planetary in Cornwall' <www.planetarytech.com/updated-company-overview-planetary-in-cornwall/> accessed 15 July 2025)

901 For details on various techniques see generally: Romany Webb and Korey Silverman-Roati 'Ocean CDR Approaches' in Romany Webb and others (eds) *Ocean Carbon Dioxide Removal for Climate Mitigation: The Legal Framework* (Elgar Publishing 2023)

902 See generally Alex Houston and others, 'Blue carbon additionality: New insights from the radiocarbon content of saltmarsh soils and their respired CO2' (February 2024) Limnology and Oceanography, Vol 69, Issue 3, 548-561

903 For details on blue carbon see: Jonathan Wentworth, Euan Furness, 'Blue carbon' UK Parliament POSTnote 651 (September 2021); and Climate Change Committee, 'Briefing: Blue Carbon' (March 2022) <www.theccc.org.uk/wp-content/uploads/2022/03/CCC-Briefing-Blue-Carbon-FINAL.pdf> accessed 16 August 2025, 12-14

904 For an overview of other challenges facing marine GGRs in general, see: Andreas Oschlies and others, 'Perspectives and challenges of marine carbon dioxide removal' (January 2025) Frontiers Climate, Vol 6; and David T Ho and Laurent Bopp, 'Marine carbon dioxide removal may be a future climate solution' (November 2024) Dialogues on Climate Change, Vol 1, Issue 1

## 16.1 International Law

One of the legal features of marine GGR which sets it apart from other techniques is its direct regulation through international law. There are multiple international legal instruments which govern or influence aspects of marine GGR activities. A repeated regulatory uncertainty for marine GGRs which arose in interview with both regulators[905] and industry[906] was the crucial role of the London Convention and corresponding London Protocol (LC/LP), which in combination govern the dumping of wastes and other matter at sea.[907] This piece of international law is subject to multiple amendments, the most relevant of which for the purposes of marine GGR being the 2013 resolution to amend the LP to regulate ocean fertilisation activities and other 'marine geoengineering' activities.[908] The concept of marine geoengineering was first introduced in international law within the Convention on Biological Diversity in 2008, through non-binding decisions to request parties to prohibit ocean fertilisation activities[909] and other geoengineering activities.[910] The presence of geoengineering in international law has been explored at length and will not be repeated here.[911] The 2013 LC/LP amendment includes ocean fertilisation, together with the capacity for further geoengineering techniques to be built in to the framework when applicable in future.[912] In 2023, the Contracting Parties to the LC/LP adopted a subsequent statement on marine geoengineering which also included OAE, biomass cultivation, marine cloud brightening, and surface albedo enhancement, noting explicitly that marine carbon dioxide removal techniques are included within the scope of geoengineering.[913] Crucially, the 2013 resolution (and subsequent 2023 statement) which regulates marine 'geoengineering' activities has been adopted by contracting parties to the LC/LP, but not ratified. Ratification of an amendment to the LC/LP requires a two-thirds majority of contracting parties.[914] The UK is one of only six parties to have ratified so far.

Despite the amendments to geoengineering not being in force, the UK's ratification creates applicability of the LC/LP regulation, to which regulators within the UK adhere.[915] The importance of this for marine GGRs lies in the restriction of permitting geoengineering

905 Interview with Participant 1641451 and Participant 9341543, Environment Agency (online 3 March 2025); Interview with Participant 9550967, NatureScot (in person, 5 March 2025)
906 Interview with Participant 7750314, Cambridge Carbon Capture Ltd (online, 7 February 2025); Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025)
907 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) (adopted 29 December 1972, entered into force 30 August 1975) 1046 UNTS 120; and Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (adopted 7 November 1996, entered into force 24 March 2006) (London Protocol) (LC/LP)
908 Resolution LP.4(8) on the Amendment to the London Protocol to Regulate the Placement of matter for Ocean Fertilization and Other Marine Geoengineering Activities (adopted 18 October 2013)
909 Report of the Conference of the Parties to the Convention on Biological Diversity on the Work of its Ninth Meeting, Decision IX/16, art C(4) (2008)
910 Report of the Conference of the Parties to the Convention on Biological Diversity on the Work of its Tenth Meeting, Decision X/33, art 8 (2010)
911 For further information see: Romany Webb and others, 'International laws governing ocean CDR' in Romany Webb and other (eds) (n901), Chapter 5, section 2.3; Marine Geoengineering Amendments under the London Protocol
912 Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (adopted 7 November 1996, entered into force 24 March 2006), Art 22
913 LC 45/18, annex 4 Statement of the 45th Consultative Meeting of Contracting Parties to the London Convention and the 18th Meeting of Contracting Parties to the London Protocol (LC 45/LP 18)
914 Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (adopted 7 November 1996, entered into force 24 March 2006), Art 21(2)
915 When the 2013 amendments to the LP come into force, it is likely the Marine and Coastal Access Act 2009 will be the domestic legislation altered to reflect said amendments. This Act already contains the enacted provisions of the LC/LP

activities for "legitimate scientific research"[916] only, as opposed to commercial operation. This effectively prohibits marine GGR projects from scaling beyond scientific research stages if they are operating at sea, adopting a precautionary approach to geoengineering felt internationally. This bright line restriction is the primary consideration for industry and regulators when contemplating marine GGR in the UK.

However, for industry and research bodies undertaking marine GGRs such as OAE or direct ocean capture, the pivotal exemption to the LC/LP is that it only applies to the disposal of wastes or other matter from vessels or other structures at sea, not land or shore-based sources.[917] UK-based marine GGR projects have thus far utilised shore-based infrastructure, for example research facilities, or outflow or discharge infrastructure (operated by water companies) situated on land, which classifies as a land-based source, and therefore the LC/LP does not apply to such activity. This exemption has facilitated OAE activity for projects such as Planetary Technologies' pilot in Cornwall.[918]

Exemptions for land-based sources create options for project operators, but from the perspective of some industry representatives, vessel-based OAE would be more effective than utilising shore-based infrastructure.[919] Although the LC/LP restriction to research purposes is not necessarily a challenge at the nascent and pilot stages of these projects, one interviewee raised their concerns that to progress any further, for example to commercial pilot scale, these projects would require commercial finance or use of advance carbon credits, which would likely be construed under the LC/LP as commercial activity.[920] The lack of a clear way forward for projects will likely disincentivise prospective operators and investors in the UK. Therefore, it is crucial that contracting parties to the LC/LP progress the legal position of geoengineering and collectively address the scientific evidence gaps, in order to support an informed legal basis for geoengineering regulation going forwards.

## 16.2 Operational considerations

### *16.2.1 Permitting*

As with multiple GGR techniques, marine GGRs are not contained within a direct or specific legal regime, but rather across existing types of law.[921] Insights from industry into the compatibility and accessibility of existing regulation as it relates to marine GGRs are very limited, due to very few projects having operated in the UK so far. This necessitates a deep dive into existing projects, as explored in interview.[922] In relation to the legal procedure and regulatory process that marine GGR projects require to go through, those with experience in the area reported in interview that following regulatory pathways was straightforward, and OAE activity could be undertaken within the parameters of existing permits held by the

916 Resolution LP.4(8) (n908), Annex 4
917 London Convention (n917), Art III(1)(a) and (b)
918 Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025)
919 Interview with Participant 7750314, Cambridge Carbon Capture Ltd (online, 7 February 2025)
920 Interview with Participant 7750314, Cambridge Carbon Capture Ltd (online, 7 February 2025)
921 For a detailed overview of the law as applies to marine GGR techniques, see Catherine Redgwell, 'Domestic laws governing ocean CDR: United Kingdom' in Romany Webb and others (eds) *Ocean Carbon Dioxide Removal for Climate Mitigation* (Elgar Publishing 2023)
922 Specifically Planetary Technologies' project in Cornwall: Planetary Technologies, 'Updated Company Overview: Planetary in Cornwall' (November 2023) <www.planetarytech.com/updated-company-overview-planetary-in-cornwall/> accessed 20 August 2025

site operator (water company) as approved by the relevant regulator.[923] This is promising for projects at research and development scale, but it does not necessarily reflect accurately the full regulatory compliance a commercial-scale project would have to consider, which would likely include a separate permit for the project.

Permitting is crucial for marine GGRs, as all pipeline discharges to water bodies (including for example carbon-depleted water or alkaline material from a GGR project) require a permit.[924] Existing environmental permitting regimes across the UK are well-established and robust. This does not, however, mean existing permits are entirely suitable for novel technologies, a challenge discussed in detail at Chapter 7. Future marine GGR projects face uncertainty due to the fact that current limited research operations have fallen within existing permits. Industry suggests that a more specific permit for OAE would create more certainty for future operators, or carveouts to existing permits to accommodate OAE activities.[925]

From the perspective of other start-ups wishing to replicate the activities of predecessors, there is still a lack of legal facilitation for the scaling of shore-based OAE projects. Water companies across the UK have many legal obligations in relation to discharges to water systems (including coastal waters) such as pH, nutrient, heavy metal, and organic pollutant levels.[926] These obligations do not outline specifically any duty to remove or reduce $CO_2$ in the discharge water, which, from the perspective of some operators wishing to deploy OAE from these systems at scale, is a missed opportunity to provide incentive to water companies to pursue these GGR solutions.[927] On the other hand, at preliminary research levels, small concentrations of alkaline material used in OAE can assist water companies to balance pH of discharges; therefore, it does provide a mutually beneficial structure at the very early development stages of OAE projects.

### *16.2.2 Public perception*

One operational challenge which has been encountered by industry is the role of public perception. Although the role of public perception is a crucial element of GGR development,[928] it does not feature strongly in the legal narrative beyond planning law. The historic lack of public engagement by Government in marine GGR development (under the umbrella of geoengineering) has been noted, where the levels of international engagement, for example NGOs engaging with LC/LP deliberations, is disproportionately high compared to national engagement.[929] The issues faced by one marine GGR project demonstrated that regardless of a novel technique operating within existing legal limits, negative public perception can lead to multiple hurdles for both the operator and the regulator.[930] Firstly, from the perspective of

923 Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025); existing permitting would fall under Environmental Permitting (England and Wales) Regulations 2016 (E&W), however if the GGR operation is at sea, as opposed to land-based, this would fall under Marine Works (Environmental Impact Assessment) Regulation 2007 (E&W)
924 England and Wales: Environmental Permitting (England and Wales) Regulations 2016; Scotland: Water Environment (Controlled Activities) (Scotland) Regulations 2011; Northern Ireland: Water (Northern Ireland) Order 1999
925 Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025)
926 More details regarding these conditions as dictated by environmental permitting legislation and Urban Waste Water Treatment regulations for each UK nation (England and Wales: The Urban Waste Water Treatment (England and Wales) Regulations 1994; Scotland: The Urban Waste Water Treatment (Scotland) Regulations 1994; Northern Ireland: The Urban Waste Water Treatment Regulations (Northern Ireland) 2007
927 Interview with Participant 7750314, Cambridge Carbon Capture Ltd (online, 7 February 2025)
928 Laurie Waller and others, 'Carbon removal demonstrations and problems of public perception' (n105)
929 Catherine Redgwell, 'Domestic laws governing ocean CDR: United Kingdom' in Romany Webb and others (eds) *Ocean Carbon Dioxide Removal for Climate Mitigation* (Elgar Publishing 2023), 271
930 The project was Planetary's Cornwall pilot: BBC News, 'Protest calls for St Ives Bay chemical test delay' (April 2023) <www.bbc.co.uk/news/uk-england-cornwall-65293602> accessed 20 August 2025

a regulator, a challenge already exists to accrue knowledge for a new technology, which is then compounded by navigating public disapproval. Looking to future GGR projects, issues of public perception could threaten the ability of smaller regulators to create the capacity to manage the regulation of a new technology alongside any protest to said technology. Secondly, the negative public perception in the aforementioned project triggered an independent audit into the technology and risk profile of the project. It was necessitated that the project operator paid the cost of the audit, something which may be an unaffordable cost for small or start-up projects. Avoidance of negative public perception is a lesson learned at both industry and regulator levels. Research projects falling within the parameters of an existing permit may not seek engagement with the surrounding community as early as a project which requires its own permit, therefore it is important for projects of all sizes to consider community engagement practices, despite not being a legal obligation at this stage. Research in this area indicates that there may be more inherent challenges around overcoming the public acceptability of marine GGRs that may not be solvable by way of local engagement,[931] but it remains to be seen whether this will transpire in other UK-based marine GGR projects.

#### *16.2.3 Liability*

Considering other legal controls for marine GGR activities, marine licences govern discharges from boat, however this is likely to fall foul of the LC/LP, therefore marine licence processes are not an immediate hurdle or contemplation for marine GGR projects. Another legal consideration which has so far fallen beyond the scope of existing projects is the role of liability. In scenarios where a marine GGR operator is utilising a water company's existing infrastructure and permits, the water company's discharge and the GGR material exit from the same outflow. Should environmental or other damage occur, the question arises of attributing liability to the parties responsible for said damage. Water regulation is an increasing area of tension across the UK, particularly in England,[932] and recent case law and legislation highlights the overwhelming movement towards imposing stricter and more widely available recourse in the scenario of polluted water courses.[933] This question may be a consideration for future projects. In relation to GGR projects, operators recognise that at a practical level it falls to meticulous upstream and downstream monitoring to establish where any damage occurs and the source of that damage.[934] This has not happened in practice yet, however, and neither industry nor regulators have explored fully the delineations of mixing zones where the GGR product enters the sea and how to measure this process beyond the parameters of wastewater regulation.[935]

931 See generally: Emily Cox and others, 'Casting a Wider Net on Ocean NETs' (February 2021) Frontiers in Climate, Vol 3

932 E.g., Independent Water Commission, 'Final Report' (July 2025) <https://assets.publishing.service.gov.uk/media/687dfcc4312ee8a5f0806be6/Independent_Water_Commission_-_Final_Report_-_21_July.pdf> accessed 20 August 2025

933 *Manchester Ship Canal Company Ltd v United Utilities Water Ltd* [2024] UKSC 22 – this case established polluting discharges from water companies constituted nuisance and trespass (applies to private waterways); Water (Special Measures) Act 2025 established the ability in England and Wales to hold water company chief executives personally liable for failings to meet obligations in relation to certain pollution measures

934 Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025)

935 Interview with Participant 7605657, Planetary Technologies (online, 4 April 2025)

## 16.3 Marine GGR – positions across the UK

Due to the extreme nascence of marine GGR techniques, the stance of regulators throughout the UK is one of precaution, and for most, particularly in devolved nations, marine GGRs have not been contemplated in any detail at all due to a lack of project activity. Marine GGRs therefore form another demonstration of the Regulatory Paradox. The only nation in which marine GGR activity has taken place is England, therefore out of all regulators, the EA has had the greatest exposure to marine GGR activities.

Marine GGR techniques, unlike other GGRs, have not yet progressed beyond pilot stage, and therefore the evidence gaps are profound. Multiple interviewees vocalised the preference of a precautionary position to OAE and other marine GGR activity due to this lack of evidence and understanding of the wider ecological implications and ecosystem impacts. DESNZ echoed the sentiment that a long evidence-gathering process lies ahead before considering marine GGRs for governmental support.[936]

From the Welsh and Scottish perspectives, the lack of evidence and marine GGR industry activity within the respective nations means there is no demand for regulatory attention to be given to marine GGRs at this time, and therefore no capacity is dedicated to marine GGRs exists within the relevant regulators.[937] It is also yet to be considered the exact remit each regulator would have in relation to marine GGR activities in each nation across the UK more broadly. For any start-up project or small operator, this could pose a substantial barrier, as liaising with regulators and sourcing the correct support can be a costly and time-consuming exercise.

## 16.4 Blue carbon

### *16.4.1 Blue carbon development across the UK*

As noted above, there is a common distinction between the categorisation of marine GGRs (e.g. OAE) and 'blue carbon' activity. Similar to the evidence position of marine GGRs outlined above, there are large evidence gaps in blue carbon activities, recognised by each nation across the UK through a nationwide statement of evidence needs.[938] The governments of all four nations have created a Blue Carbon Evidence Partnership to address these evidence gaps at scale.[939]

From a research perspective, regulators are engaging with blue carbon activities. Various bodies exist to support this, such as the Scottish Blue Carbon Forum (SBCF), which supports the Scottish Government in providing evidence or identifying evidence gaps with regard to restoration and sequestration in blue carbon habitats.[940] The Scottish Government has

936 Interview with Participant 2750394, Department for Energy Security and Net Zero (online, 2 May 2025)
937 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025); Interview with Participant 3738675, Scottish Environment Protection Agency (online, 24 April 2025)
938 UK Blue Carbon Evidence Partnership, 'UKBCEP Evidence Needs Statement' (June 2023) <https://uk-bcep.org/evidence-needs-statement/> accessed 20 August 2025
939 UK Blue Carbon Evidence Partnership, <https://uk-bcep.org/> accessed 20 August 2025
940 UK Blue Carbon Forum, <www.ukbluecarbonforum.com/> accessed 20 August 2025

acknowledged the role blue carbon is set to play in UK carbon sequestration targets, and has stated it is in the process of developing a Blue Carbon Action Plan,[941] akin to one which exists in Northern Ireland. Northern Ireland's Blue Carbon Action Plan has been in place as of 2025, covering the period up to 2030.[942] This Plan has a combined purpose of increasing carbon sequestration and biodiversity, with a focus on closing the vast evidence gaps posed by blue carbon marine carbon sequestration activity.

In Wales, marine carbon has been considered at a scoping level,[943] but there is not currently a specific policy position or dedicated steering group for the purposes of marine carbon. England similarly lacks a policy position in this area. With the aforementioned knowledge-sharing networks in place for blue carbon across the UK, the policy developments in Scotland and Northern Ireland and findings from these Action Plans may assist blue carbon development across the UK more broadly.

### *16.4.2 Saltmarsh and seagrass*

Turning to specific blue carbon conservation and restoration techniques, saltmarsh and seagrass are of particular interest across research and policy. The consideration of saltmarsh restoration as a GGR activity was considered by the UK Government in 2021,[944] and subsequently the potential inclusion of saltmarsh into the UK Greenhouse Gas Inventory was contemplated in 2022, along with seagrass.[945] Within these research streams, the restoration and creation of blue carbon habitats was identified as providing a small but efficient carbon removal technique.[946] Although evidence is still required to assess the removal potential of these habitats,[947] for the sake of fullness, this report includes these marine activities within scope so as not to omit what may be useful for marine GGR regulation as a whole, especially considering that the IUCN is piloting a Saltmarsh Carbon Code,[948] and regulators in interview also voiced interest in the role of saltmarsh and ongoing research as to its carbon sequestration role.[949] These factors all indicate that it is relevant to consider how existing regulatory capacity and legislation could facilitate saltmarsh restoration activities in a GGR context. It is unclear, however, whether seagrass will receive the same attention saltmarsh is in a GGR context. Research has delved into the concept of a seagrass carbon code;[950] however, this has not yet progressed to the same level as saltmarsh research. Interviewees indicated that seagrass carbon removal is an area of interest for multiple nations across the UK, so it may be a GGR consideration of the future.[951]

941 Scottish Government, 'Scottish National Adaptation Plan 2024-2029' (September 2024), 50
942 Department of Agriculture, Environment and Rural Affairs, 'Northern Ireland Blue Carbon Action Plan 2025-2030' (April 2025) <www.daera-ni.gov.uk/publications/northern-ireland-blue-carbon-action-plan-2025-2030> accessed 20 August 2025
943 K Robbins and others, 'The Blue Carbon Potential of the Marine Protected Area Network in the Welsh Marine Environment' Natural Resources Wales Evidence Report No 361 (May 2022)
944 Element Energy, UK Centre for Ecology and Hydrology, 'Greenhouse gas removal methods and their potential UK deployment' (n128), 64
945 Climate Change Committee, 'Briefing: Blue Carbon' (n903); and The All-Party Parliamentary Group for the Ocean, 'The Ocean: Turning the Tide on Climate Change' (December 2022)
946 Climate Change Committee, 'Briefing: Blue Carbon' (n903), 24
947 M T Burrows and others, 'The United Kingdom's Blue Carbon Inventory: Assessment of Marine Carbon Storage and Sequestration Potential in UK Seas (Including Within Marine Protected Areas)' Scottish Association for Marine Science (2024); UK Blue Carbon Evidence Partnership, 'UKBCEP Evidence Needs Statement' (n938); The All-Party Parliamentary Group for the Ocean, 'The Ocean: Turning the Tide on Climate Change' (n945), 18;
948 IUCN UK Peatland Programme, 'Saltmarsh Carbon Code project' <https://iucn-nc.uk/projects/ncuk-expert-working-groups/erwg/saltmarsh-code-project/> accessed 21 August 2025
949 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025); Interview with Participant 9830922, Natural England (online, 16 April 2025)
950 John Lynch and others, 'A blue carbon code for UK seagrass' Agile Initiative Policy Brief, University of Oxford (November 2023)
951 Interview with Participant 2481829, Natural Resources Wales (online, 4 March 2025); Interview with Participant 1300336, Scottish Blue Carbon Forum (online, 26 February 2025)

At this early stage of scoping blue carbon activity, the most prevalent legal considerations are permitting and marine licences, and potential conflicts of coastal or shoreline use. From a licensing perspective, any deposit or construction on the seabed, or alteration to the environment, requires a marine licence.[952] For small-scale restoration activities, this administrative burden may be costly and disproportionate to the carbon sequestration potential of the project. Another complexity arises with navigating shorelines and coasts, which are complex areas due to the blend of regulation and ownership. Natural England highlighted the challenges that exist around managing shoreline management plans[953] and the mixture of regulatory authority between the Marine Management Organisation, Natural England, the EA and local authorities (in the context of England).[954] When approaching a blue carbon project, if the regulatory authority for the operator's chosen area is not clear, or there is regulator overlap, it will be a complex exercise for the operator to ascertain which regulators to approach and how to manage the varying priorities of those regulators. The UK also presents a vast number of protected marine areas, conservation zones, habitats and species which require to be taken into account for all marine GGRs.[955]

### *16.4.3 Blue carbon – regulatory position*

The concept of blue carbon is not currently represented directly within legislation or included in legal protections. Researchers in this area would like to see vulnerable blue carbon stores, such as seagrass and saltmarsh, brought into legislative frameworks explicitly within the context of their carbon benefit, and with adequate protection to defend their carbon sequestration potential.[956] Many blue carbon habitats fall inadvertently within marine protected areas and are therefore protected; for example, certain seagrass beds fall within Habitats Directives regulation,[957] and certain conservation zones, however, the blue carbon habitats are not protected solely for their own value. The first step to recognising the value and protective measures required for blue carbon habitats is establishing a sufficient evidence base to support inclusion of blue carbon into the UK's Greenhouse Gas Emission Inventory.[958] This will, in turn, drive the need for increased evidence and monitoring of these areas and catalyse carbon crediting mechanisms, enabling legal protections to be enacted where necessary and stimulating finance.

952 Marine and Coastal Access Act 2009
953 UK Government, Environment Agency, 'Shoreline management plans' (January 2024) <www.gov.uk/guidance/shoreline-management-plans> accessed 20 August 2025
954 Interview with Participant 9830922, Natural England (online, 16 April 2025)
955 Joint Nature Conservation Committee, 'MPA Mapper' <https://jncc.gov.uk/mpa-mapper> accessed 21 August 2025
956 Interview with Participant 1300336, Scottish Blue Carbon Forum (online, 26 February 2025)
957 E.g. Conservation of Habitats and Species Regulations 2017; Conservation (Natural Habitats, &c.) Regulations 1994
958 Interview with Participant 1300336, Scottish Blue Carbon Forum (online, 26 February 2025)

## CHAPTER 16 – FINDINGS AND RECOMMENDATIONS

- ✓ International law forms a primary barrier for scaling marine GGR, preventing sea or vessel-based projects from progressing beyond scientific research
- ✓ Shore-based structures can avoid the restrictions placed by international law, however there is potentially insufficient incentive to deploy GGR at these shore-based structures
- ✓ Small-scale research projects can utilise existing infrastructure permits, where approved by the regulator, creating a more streamlined pathway
- ✓ Commercial-scale projects require permits, which may not be suited to novel technologies: alterations to permitting tailored to marine GGRs could assist this process
- ✓ Public perception forms a major barrier to projects, which should be addressed at the outset of project planning to avoid capacity and cost challenges for both regulators and industry
- ✓ The liability framework for projects utilising water company discharges is not yet clear due to project inactivity, but should be explored further as water law becomes more stringent
- ✓ Most regulators do not have a focus or capacity dedicated to marine GGR due to evidence gaps and industry inactivity
- ✓ Blue carbon is an emerging area which may qualify as GGR should the evidence base be established
- ✓ Potential challenges to blue carbon scaling include navigation of complex licensing and mixed regulatory competence at coastlines and shorelines
- ✓ The inclusion of saltmarsh and seagrass to the UK Greenhouse Gas Inventory would facilitate enhanced monitoring and carbon crediting
- ✓ As the value of blue carbon is established it should be defined and protected within legislation

Figure 22: Chapter 16 Findings and Recommendations

# Conclusion

This report undertook a comprehensive and first-of-its-kind mapping of the greenhouse gas removal (GGR) regulatory landscape across the four distinct legal jurisdictions of the United Kingdom, drawing on qualitative and generative interviews with diverse stakeholders across industry, government, regulatory bodies, and the research community. A central finding is that as the existing legal framework is piecemeal and lacks GGR-specific legislation, it requires GGR developers of nascent technologies and regulators alike to navigate complex legal arrangements, leading to fragmentation, opacity and inefficiency. This regulatory uncertainty is frequently cited as a fundamental barrier to scaling and cost reduction for major GGR techniques.

The most significant systemic impediment identified is the 'Regulatory Paradox', an impasse where industry requires regulatory clarity and financial certainty to scale, yet regulators cannot update standards or provide support without robust evidence of technical viability and minimal environmental harm. Regulators are constrained by legal mandates, many of which centre around environmental protection, and also importantly the consideration of the precautionary principle, which currently limits their ability to facilitate innovative GGR pathways. Overcoming this requires both industry transparency and early knowledge-sharing, alongside regulatory shifts, such as adopting solutions from the Corry Review to reduce over-reliance on the precautionary principle and the creation of regulatory sandboxes to reduce regulatory burdens on innovative technologies and pilot projects. The development of regulator engagement, expertise, and capacity, will also assist in achieving these goals, as well as recognition of the differentiated hurdles which are present in each UK jurisdiction such as just transition principles and dependency on non-pipeline transport (NPT) of $CO_2$.

Across GGR techniques, crucial public law processes related to planning, consenting, and permitting are identified as ubiquitous challenges. These processes are often slow, lengthy, and administratively complex, especially for first-of-a-kind projects or large-scale infrastructure requiring a Development Consent Order (DCO). Litigation risk within planning law is also an important consideration. Furthermore, established law struggles to accommodate GGR-specific issues; for instance, many GGR projects face onerous burdens due to strict waste law definitions and the challenge of achieving "end-of-waste" status, a complexity particularly acute for biochar and certain BECCS EfW pathways. Similarly, land-based GGRs must navigate the complex interaction between net zero policy ambitions and the often inflexible

nature of private land law, including historic agricultural tenancy agreements which restrict land-use change.

Jurisdictional differences and GGR-specific hurdles add further layers of complexity. For marine GGRs, international law (specifically the London Convention/Protocol) acts as a primary barrier by restricting sea or vessel-based activities beyond scientific research. Meanwhile, technologies like enhanced rock weathering (ERW) operate largely within a regulatory vacuum, with no legislation explicitly addressing the spreading of rock dust to land, necessitating a precautionary approach by regulators until evidence is secured. Engineered pathways like DACCS and BECCS require accelerated development of financial support, such as their inclusion in the UK Emissions Trading Scheme (UK ETS) and the use of contracts for difference (CfDs), to secure investor certainty. The need for clarity on NPT is also critical for dispersed industry throughout the UK.

Ultimately, enabling the sustainable scaling of GGRs across the UK requires a concerted and coordinated effort. The prevailing piecemeal application of extant regulation is incompatible with the urgency of net zero goals. Progress depends on implementing flexible solutions, such as simplified permitting procedures for pilot projects, prioritising regulatory alignment between governmental departments and regulators, and supporting the creation of robust, quality-assured legal standards for nascent technologies. Addressing these fundamental challenges – systemic, financial, and legal – is crucial for transitioning GGRs from research and demonstration phases to deployable commercial solutions.

# ANNEXES

# Annex I – Interviewees and Consultees

| | |
|---|---|
| **Regulators, governmental departments, agencies and fora** | ▪ Environment Agency<br>▪ Natural Resources Wales<br>▪ Department for Energy Security and Net Zero, UK Government<br>▪ Scottish Blue Carbon Forum<br>▪ NatureScot<br>▪ Department for environment, food and rural affairs, UK Government<br>▪ Department of Agriculture, Environment and Rural Affairs, Northern Ireland<br>▪ Natural England<br>▪ Scottish Environment Protection Agency |
| **GGR-D projects** | ▪ GGR-Peat<br>▪ PBC4GGR<br>▪ Biochar Demonstrator<br>▪ Net Zero Plus |
| **Industry** | ▪ Ricardo (BIOCCUS)<br>▪ KEW Technology Ltd (BECCS)<br>▪ Planetary (marine)<br>▪ Equinor (DACCS)<br>▪ Drax (BECCS)<br>▪ CapChar Ltd (biochar)<br>▪ Environmental project developer (ERW + afforestation) (anonymised)<br>▪ Cambridge Carbon Capture Ltd (marine)<br>▪ Mission Zero Technologies (DACCS)<br>▪ Black Bull Biochar (biochar) |
| **Independent bodies** | ▪ National Farmers' Union<br>▪ IUCN UK Peatland Programme |
| **Consultees (not interviewed)** | ▪ Dr Mary Dobbs (Maynooth University)<br>▪ Dr Heather Plumpton (Green Alliance) |

All interviews were undertaken in line with the University of Edinburgh's Research Ethics Policy and data use consent was granted by all interviewees.

# Annex II – Figures and Tables

# Annex III – Table of Legislation

## Primary Legislation – UK

| |
|---|
| Agriculture Act 1970 |
| Agriculture Act 1986 |
| Agriculture Act 2020 |
| Agricultural Holdings Act 1986 |
| Climate Change Act 2008 |
| Control of Pollution (Amendment) Act 1989 |
| Electricity Act 1989 |
| Energy Act 2004 |
| Energy Act 2008 |
| Energy Act 2016 |
| Energy Act 2023 |
| Environment Act 1995 |
| Environment Act 2021 |
| Environmental Protection Act 1990 |
| European Union (Withdrawal) Act 2018 |
| Forestry Act 1919 |
| Forestry Act 1967 |
| Government of Wales Act 2006 |
| Human Rights Act 1998 |
| Land Drainage Act 1991 |
| Legislative and Regulatory Reform Act 2006 |
| Marine and Coastal Access Act 2009 |
| Northern Ireland Act 1998 |
| Natural Environment and Rural Communities Act 2006 |
| Planning Act 2008 |
| Pollution Prevention and Control Act 1999 |
| Retained EU Law (Revocation and Reform) Act 2023 |
| Scotland Act 1998 |
| Town and Country Planning Act 1990 |
| Water Act 2003 |
| Water Act 2014 |
| Water Resources Act 1991 |
| Wildlife and Countryside Act 1981 |
| The Windsor Framework (Plant Health) Regulations 2023 |

## Secondary Legislation – UK

| |
|---|
| Agriculture (Financial Assistance) Regulations 2021 |
| The Carbon Capture Revenue Support (Directions, Eligibility and Counterparty) Regulations 2024 |
| The Carbon Dioxide Transport and Storage Revenue Support (Directions and Counterparty) Regulations 2024 |
| Conservation (Natural Habitats, &c.) Regulations 1994 |
| Conservation of Habitats and Species Regulations 2017 |
| The Contracts for Difference (Miscellaneous Amendments) (No. 2) Regulations 2025 (draft statutory instrument) |
| Environmental Impact Assessment (Agriculture) (England) (No.2) Regulations 2006 |
| Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999 |
| Environmental Impact Assessment (Land Drainage Improvement Works) Regulations 1999 |
| Environmental Permitting (England and Wales) Regulations 2016 |
| The Environmental Permitting (England and Wales) (Amendment) Regulations 2018 |
| The Environmental Targets (Woodland and Trees Outside Woodland) (England) Regulations 2023 |
| The Fertilisers Regulations 1991 |
| The Fertilising Products Regulations 2020 |
| Forest Reproductive Material (Great Britain) Regulations 2002 |
| Forestry (Felling of trees) Regulations 1979 |
| Greenhouse Gas Emissions Trading Scheme Order 2020 (SI 2020/1265) |
| The Greenhouse Gas Emissions Trading Scheme (Withdrawal Agreement) (EU Exit) Regulations 2020 |
| The Greenhouse Gas Emissions Trading Scheme (Amendment) Order 2025 |
| Heather and Grass etc. Burning (England) Regulations 2007 |
| Heather and Grass etc. Burning (England) Regulations 2021 |
| Marine Works (Environmental Impact Assessment) Regulation 2007 |
| Notification of Cooling Towers and Evaporative Condensers Regulations 1992 |
| Official Controls (Plant Health and Genetically Modified Organisms) (England) Regulations 2019 |
| Plant Health (Fees) (Forestry) (England and Scotland) Regulations 2015 |
| Plant Health (Forestry) Order 2005 |
| Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 |
| The Renewable Transport Fuel Obligations Order 2007 |
| Renewable Transport Fuel Obligations (Sustainable Aviation Fuel) Order 2024 |
| Renewables Obligation Order 2015 |
| The Storage of Carbon Dioxide (Licensing etc.) Regulations 2010 |
| The Storage of Carbon Dioxide (Access to Infrastructure) Regulations 2011 |
| Town and Country Planning (Environmental Impact Assessment) Regulations 2017 |
| Town and Country Planning (General Permitted Development) (Scotland) Order 1992 |
| Urban Waste Water Treatment (England and Wales) Regulations 1994 |
| The Waste and Agriculture (Legislative Functions) Regulations 2022 |
| The Waste (England and Wales) Regulations 2011 |
| Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 |
| Water Resources (Environmental Impact Assessment) (England and Wales) Regulations 2003 |
| Windsor Framework (Constitutional Status of Northern Ireland) Regulations 2024 |

## Acts of the Scottish Parliament

| |
|---|
| Agriculture and Rural Communities (Scotland) Act 2024 |
| Agricultural Holdings (Scotland) Act 1991 |
| Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 |
| Climate Change (Emissions Reduction Targets) (Scotland) Act 2024 |
| Climate Change (Scotland) Act 2009 |
| Community Empowerment (Scotland) Act 2015 |
| European Union (Continuity) (Scotland) Act 2021 |
| Forestry and Land Management (Scotland) Act 2018 |
| Planning etc. (Scotland) Act 2006 |
| Regulatory Reform (Scotland) Act 2014 |
| Rural Communities (Scotland) Act 2024 |
| Town and Country Planning (Scotland) Act 1997 |
| Water Environment and Water Services (Scotland) Act 2003 |
| Wildlife and Natural Environment (Scotland) Act 2011 |
| Wildlife Management and Muirburn (Scotland) Act 2024 |

## Secondary Legislation – Scotland

| |
|---|
| The Classification, Labelling and Packaging of Chemicals (Amendments to Secondary Legislation) Regulations 2015 |
| The Control of Major Accident Hazards Regulations 2015 |
| Control of Substances Hazardous to Health (COSHH) Regulations SI |
| Environmental Authorisations (Scotland) Regulations 2018 |
| The Environment (EU Exit) (Scotland) (Amendment etc.) Regulations 2019 |
| Environmental Liability (Scotland) Regulations 2009 |
| Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017 |
| The Forestry (Exemptions) (Scotland) Regulations 2019 |
| The Forestry (Exemptions) (Scotland) Amendment Regulations 2021 |
| Landfill (Scotland) Regulations 2003 |
| Pollution Prevention and Control (Scotland) Regulations 2012 |
| The REACH etc. (Amendment) Regulations 2021 |
| The Pollution Prevention and Control (Scotland) Amendment Regulations 2017 |
| The Renewables Obligation (Scotland) Order 2009 |
| Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 |
| Urban Waste Water Treatment (Scotland) Regulations 1994 |
| Waste Management Licensing (Scotland) Regulations 2011 |
| Water Environment (Controlled Activities) (Scotland) Regulations 2011 |
| The Wildlife Management and Muirburn (Scotland) Act 2024 (Commencement No. 1) Regulations 2024 |

## Acts of the Senedd Cymru (Welsh Assembly)

| |
|---|
| Agriculture (Wales) Act 2023 |
| Environment (Wales) Act 2016 |
| Planning (Wales) Act 2015 |
| Well-being of Future Generations (Wales) Act 2015 |
| Wildlife and Countryside Act 1981 |

## Secondary Legislation - Wales

| |
|---|
| Carbon Accounting (Wales) Regulations 2018 |
| Climate Change (Wales) Regulations 2021 |
| The Climate Change (Carbon Budgets) (Wales) Regulations 2018 |
| The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 |
| Environmental Impact Assessment (Agriculture) (Wales) Regulations 2017 |
| The Environmental Impact Assessment (Forestry) (England and Wales) Regulations 1999 |
| Heather and Grass etc. Burning (Wales) Regulations 2008 |
| The Natural Resources Body for Wales (Establishment) Order 2012 |
| Plant Health (Forestry) (Amendment) (Wales) Order 2015 |
| Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017 |
| The Water Resources (Control of Agricultural Pollution) (Wales) Regulations 2021 |

## Acts of the Northern Ireland Assembly

| |
|---|
| Climate Change Act (Northern Ireland) 2022 |
| Environmental Better Regulation Act (Northern Ireland) 2016 |
| Forestry Act (Northern Ireland) 2010 |
| Planning Act (Northern Ireland) 2011 |

## Secondary Legislation - Northern Ireland

| |
|---|
| Control of Pollution (Applications and Registers) Regulations (Northern Ireland) 2001 |
| Environment (Northern Ireland) Order 2002 |
| Environmental Impact Assessment (Forestry) Regulations (Northern Ireland) 2006 |
| Environmental Liability (Prevention and Remediation) Regulations (Northern Ireland) 2009 |
| Groundwater Regulations (Northern Ireland) 2009 |
| Industrial Pollution Control (Northern Ireland) Order 1997 |
| Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 1999 |
| Planning (Environmental Impact Assessment) Regulations (Northern Ireland) 2017 |
| Pollution Prevention and Control (Industrial Emissions) Regulations (Northern Ireland) 2013 |
| Pollution Prevention and Control (Industrial Emissions) (Amendment) Regulations (Northern Ireland) 2016 |
| Pollution Prevention and Control (Industrial Emissions) (Amendment) Regulations (Northern Ireland) 2018 |
| Pollution Prevention (Industrial Emissions) (Amendment) Regulations (Northern Ireland) 2014 |
| The Renewables Obligation Order (Northern Ireland) 2009 |
| Urban Waste Water Treatment Regulations (Northern Ireland) 2007 |
| Waste (Northern Ireland) Regulations 2011 |
| Water (Northern Ireland) Order 1999 |
| Water Abstraction and Impoundment (Licensing) Regulations (Northern Ireland) 2006 |
| Waste and Contaminated Land (Northern Ireland) Order 1997 |
| The Water Environment (Water Framework Directive) Regulations (Northern Ireland) 2017 |
| Waterways (Environmental Impact Assessment) Regulations (Northern Ireland) 2019 |
| Water Supply (Water Quality) Regulations (Northern Ireland) 2017 |

## EU Legislation and Instruments

| |
|---|
| Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community [2019] OJ C 144I/01 |
| Consolidated Version of the Treaty on the Functioning of the European Union (2016) C202/47 |
| Decision 2015/1814 concerning the establishment and operation of a market stability reserve for the Union greenhouse gas emission trading system |
| Directive (EU) 2023/2413 of the European Parliament and of the Council of 18 October 2023 amending Directive (EU) 2018/2001, Regulation (EU) 2018/1999 and Directive 98/70/EC as regards the promotion of energy from renewable sources (RED III) |
| Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (recast) |
| Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment |
| Directive 2023/959 of the European Parliament and of the Council of 10 May 2023 amending Directive 2003/87/EC establishing a system for greenhouse gas emission allowance trading within the Union |
| Directive 2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment Environmental Impact Assessment Directive) |
| Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (2008/56/EC) |
| Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003 [2019] OJ L 170/1 (Fertilising Products Regulation) |
| Regulation 2019/1009 on the making available on the market of EU fertilising products |
| Regulation (EU) 2024/3012 of the European Parliament and of the Council of 27 November 2024 establishing a Union certification framework for permanent carbon removals, carbon farming and carbon storage in products (CRCF) |
| Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources |
| Directive (EU) 2015/2193 of the European Parliament and of the Council of 25 November 2015 on the limitation of emissions of certain pollutants into the air from medium combustion plants (Medium Combustion Plant Directive) |
| Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide |
| Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives [2008] OJ L 312/3 with amendments (Waste Framework Directive) |
| Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy. (Water Framework Directive) |
| Commission Delegated Regulation (EU) 2021/2088 of 7 July 2021 amending Annexes II, III and IV to Regulation (EU) 2019/1009 of the European Parliament and of the Council for the purpose of adding pyrolysis and gasification materials as a component material category in EU fertilising products |

## International Legislation

| |
|---|
| Environment Protection Act (LBK No. 5 of 2023) (Denmark) |

## International Instruments

| |
|---|
| Convention on Biological Diversity (adopted 5 June 1992, entered into force 29 December 1993) 1760 UNTS 79 |
| Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Convention) (adopted 29 December 1972, entered into force 30 August 1975) 1046 UNTS 120 |
| European Convention on Human Rights (ECHR) (1950) 213 UNTS 222 |
| Paris Agreement to the United Nations Framework Convention on Climate Change (adopted 12 December 2015, entered into force 4 November 2016) TIAS No 16-1104, 3156 UNTS |
| Protocol to the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (adopted 7 November 1996, entered into force 24 March 2006) |
| Rio Declaration on Environment and Development (adopted 14 June 1992) UN Doc A/CONF.151/26 (Vol I) 31 ILM 874) |

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*R (on the application of Finch on behalf of the Weald Action Group) v Surrey County Council* UKSC 20

*R (Rights: Community: Action Ltd) v Secretary of State for Housing, Communities and Local Government* [2025] EWCA Civ 990


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# Greenhouse Gas Removals Regulatory Review:

## Mapping a Novel Legal Landscape by Stakeholder Interviewing

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