BB-REG-NET

Addressing the UK's polysemous bioeconomy

A call for policy cohesion

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01 Executive Summary

The UK's bioeconomy is inherently polysemous, meaning it encompasses multiple, overlapping definitions and sectors, from biotechnology and bio-based manufacturing to sustainable agriculture and circular economy principles. While this diversity presents opportunities for innovation and economic growth, it also creates challenges in policy alignment, investment allocation, and strategic focus. Without a clear and unified framework, efforts across different industries risk becoming fragmented, limiting the overall impact of bio-based solutions on sustainability, economic resilience, and global competitiveness.

The term "bioeconomy" carries multiple meanings, reflecting a broader lack of visionary consensus. This ambiguity has led to disjointed efforts, inefficient resource allocation, and missed opportunities to maximise the societal, economic, and environmental benefits that a well-structured bioeconomy can deliver. To foster effective bioeconomy development, it is essential to challenge entrenched assumptions, encourage cross-sector collaboration, and establish a dedicated forum for open debate and collective action.

The UK's bioeconomy—a sector encompassing the sustainable production of renewable biological resources and their conversion into food, energy, and other products—relies on the coordinated efforts of multiple government departments, notably the Department for Environment, Food & Rural Affairs (DEFRA), the Department for Science, Innovation & Technology (DSIT), and the Department for Energy Security & Net Zero (DESNZ).

DEFRA oversees policies related to the environment, agriculture, and rural communities. It plays a pivotal role in promoting sustainable agricultural practices and environmental stewardship, which are foundational to the bioeconomy. DSIT is tasked with positioning the UK as a global leader in science and technology. It focuses on driving growth through innovation, supporting research and development, and fostering technological advancements that can enhance bio-based industries. DESNZ, is responsible for net zero policy and energy security, DESNZ supports the development of sustainable energy solutions. Its initiatives are crucial for integrating bio-based energy into the UK's energy mix, thereby contributing to the bioeconomy's expansion.

The involvement of multiple departments in the bioeconomy necessitates cohesive policymaking. However, misalignment and conflicting policies are hindering progress. The lack of a cohesive and well-integrated policy for the bioeconomy poses a significant barrier to its growth and potential impact. Without a unified strategy, fragmented policies create inefficiencies, hinder investment, and slow innovation. A disconnected approach also limits the ability to address pressing challenges such as climate change, food security, and sustainable resource management.

To unlock the full potential of the bioeconomy, the UK must develop a comprehensive and coordinated policy framework that aligns industry, research, and government efforts. This would not only drive economic growth but also support the transition to a more sustainable and resilient economy. Without such action, the UK risks falling behind global competitors in a sector that is crucial for the future.

To mitigate these challenges, it's essential for DEFRA, DSIT, DESNZ, and other relevant bodies to collaborate closely, ensuring that policies are harmonized and collectively support the growth of the UK's bioeconomy.

The newly formed regulatory network, BB-REG-NET, offers a critical mechanism to bridge these gaps by bringing together policymakers with diverse perspectives on the bioeconomy. Through this platform, BB-REG-NET aims to facilitate dialogue, enhance cooperation, and drive more cohesive and forward-thinking policy development.

02 Background

It has long been known that moving away from an oil-based society, to a bio-based one, could have significant economic and environmental benefits[1], however, 'Business as usual' growth in bio-based products (3.6% CAGR) is too slow to meet demand and counter petrochemical investment[2].

Supportive policy and regulation are needed[3].The EU is adopting comprehensive policies to meet this gap and foster growth of the bio-based industry, including the Bioeconomy Strategy and Action Plan[4], Chemical Strategy for Sustainability, Biodegradable and Compostable Plastics Policy Framework[5], Clean Industrial Deal[6], and in its Vision for Agriculture and Food.[7]

The UK risks falling behind— policy sometimes supports the bioeconomy at a high level, but action is insufficient and translation into regulations has been mixed and often detrimental to the sector[8]. There is an urgent need to address the fragmented and siloed approach to bioeconomy policymaking in the UK.

In 2018 the UK government published a Bioeconomy Strategy[9], it laid out the approach that government, industry and the research community would take to harness the power of bioscience and biotechnology. Although grounded in research and technology, the Bioeconomy Strategy had the aspiration to make the UK a global leader in developing, manufacturing, using and exporting bio-based solutions, strengthening the UK economy and moving towards a low carbon future.

At the same time, in 2018, the UK Industrial Biotechnology Leadership Forum (IBLF) published 'Growing the UK Industrial Biotechnology Base: A National Industrial Biotechnology Strategy to 2030'[10], with an ambitious vision and roadmap for the UK industrial biotechnology sector from 2018 to 2030. It focused on fostering innovation, scaling up biomanufacturing, and improving policy coordination to maximize the economic and environmental benefits of biotechnology.

However, in less than three years the Bioeconomy Strategy was withdrawn and the National Industrial Biotechnology Strategy to 2030 failed to generate significant Government support. In withdrawing the Bioeconomy Strategy, the government cited a change in the UK's economic environment, bringing new opportunities and challenges for UK businesses. The strategy was supplanted by the 2021 Innovation Strategy[11] and other government strategies supporting Net Zero Strategy[12] objectives.

Beyond the government's stated reason for the withdrawal of the Bioeconomy Strategy, stakeholders have put forward several other explanations for its cancellation[13]. Reasons include the complexity of the strategy, the number of market sectors and value chains covered, and importantly a failure to align the vision and policy requirements of multiple government departments, whether the focus be environmental or economic, or both.

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[1] OECD, The Bioeconomy to 2030 designing a policy agenda, 2009.
[2] Green Alliance, A new formula: cutting the UK chemical industry's climate impact, 2023.
[3] J. Spekreijse, T. Lammens, C. Parisi, T. Ronzon, M. Vis Insights into the European market for bio-based chemicals. JRC Publications Repository, 2019, doi:10.2760/18942.
[4] European Commission, Bioeconomy Strategy, Accessed 27 February 2025
[5] European Commission, Communication – EU policy framework on biobased, biodegradable and compostable plastics, 2022.
[6] European Commission, Clean Industrial Deal, 2025.
[7] European Commissions, Vision for Agriculture and Food, 2025.
[8] BBIA, UK Bioplastic Policy: Government Policy Relative to the Development of the Bio-Based and Biodegradable Industries Sector in the UK. (2022)
[9] Department for Business, Energy & Industrial Strategy, Bioeconomy strategy: 2018 to 2030, 2018.
[10] Industrial Biotechnology Leadership Forum, A National Industrial Biotechnology Strategy to 2030, 2018.
[11] Department for Science, Innovation and Technology and Department for Business, Energy & Industrial Strategy, UK Innovation Strategy: leading the future by creating it, 2021.
[12] Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, Net Zero Strategy: Build Back Greener, 2021.
[13] Personal communications to authors

The emphasis on UK bio-based manufacturing, which is predicated on a supply of biomass, was also lost in the subsequent Innovation Strategy, with biomass not discussed in depth. The Innovation Strategy places an emphasis on technology, stating that "*engineering biology will help lessen our dependence on fossil fuels and simplify global supply chains, shifting us from an oil-based economy towards a bio-based economy. Where fossil-derived fuels or plastics are required, biomanufacturing will deliver biobased and waste-derived alternatives in 80% of the cases by 2035". So far, this Strategy has not driven significant policy changes to support the commercialization of bio-based chemicals and materials. While the Engineering Biology Vision has the potential to aid in scaling up these products, market demand remains constrained by a lack a strategy and actions to create market pull.*

Although the Net Zero Strategy makes extensive reference to the role of biomass, this is restricted to its place in bioenergy provision and therefore fails to fill the manufacturing policy gaps left by the withdrawal of the Bioeconomy Strategy.

The lack of a unified vision and cohesive strategy goes beyond a singular Bioeconomy Strategy and impacts on a range of policies related to the bioeconomy. The absence of policy clarity ultimately stifles innovation and prevents a full realisation of the bioeconomy's potential benefits.

03 Introduction

To be successful, innovation - whether social, environmental, business or technological – requires an effective ecosystem of stakeholders, efficient mechanisms to connect them and provide the resources they need, and an arena where the innovation can be adopted.[14,15]

Additionally, innovation requires a 'direction of travel', a strategic orientation with clear objectives to guide research programs and projects. This direction is crucial because innovation is not inherently neutral - it reflects societal values, priorities, and interests. How and what innovation is supported shapes its effects on economies, environments, and societies.

Public support for innovation is based on addressing often pressing societal challenges, such as economic development, climate change, environmental pollution, public health, and socioeconomic inequalities.

At its core, the bioeconomy is based on the sustainable utilisation of biological resources to drive sustainable development. It offers the promise of a more sustainable future and yet its development is fraught by concerns over ecological conflicts and irreconcilable social and environmental trade-offs. Debate and challenge on issues ranging from the use of genetically modified organisms through to the impact of biomass policies on food security, and bioenergy development on biodiversity, all have an inhibitory effect on bioeconomy development.

The unresolved sustainability debate surrounding bioeconomic development is often considered as disagreements between bioeconomy proponents and detractors. However, given the actors and the organisations involved it can also be positioned as a difference of views between communities within the bioeconomy space.

Although often presented as a singular model, the bioeconomy is actually polysemous in nature, with multiple and interconnected meanings making it simultaneously dynamic and complex.

These multiple concepts give rise to the potential for multiple directions of travel which in turn lead to conflicts in vision and priorities for action. Understanding the multifaceted nature of the bioeconomy is crucial in realising its potential and addressing its inherent challenges.

[14] M.P. Hekkert, R.A.A. Suurs, S.O. Negro, S. Kuhlmann, R.E.H.M. Smits, Functions of innovation systems: A new approach for analysing technological change, Technological Forecasting and Social Change, Volume 74, Issue 4, 2007, ISSN 0040-1625,
[15] NNFCC, Bioeconomy Innovation – More than just technology development, 2017.

The lack of an overarching industrial or bioeconomy strategy, has led to disconnected departmental policies that hinders the commercialisation of products from biomass, and regulations that favour fossil-based incumbents.

The policy and regulatory landscape encompassing the bioeconomy is complex and spans several Government departments. In fact, 56 of the total 606 Government departments, agencies and public bodies are involved in the bioeconomy, and the products it provides[16]. This has led to conflicting policies and regulations that hinder commercialisation of this vital sector.

04 Short History of the Bioeconomy

The history and multi-perspectivity of the bioeconomy are discussed in detail by Vivien and co-workers in their paper titled 'The Hijacking of the Bioeconomy'[17].

The authors describe three predominant stakeholder views of the bioeconomy, namely 1) an economy existing within the constraints of the natural world, 2) an economy capitalising on the use of biological tools and processes, and 3) an economy utilising biomass as a raw material for economic activity.

The term 'bio-economics' is believed to date back to the 1920s being used by Russian biologist Fedor Ilyich Baranov in the context of fishery economics[18]. Of course, the bioeconomy was in existence well before then. Pre-1850, and before the discovery of oil, the world was, indeed, powered by nature. Chemicals and materials came from wood, cotton, hemp, flax, and wool. Energy came from biomass, water, and wind. We lived in a bio-based world, whether we realised it or not.

From the 1950's, 'bioeconomics' was increasingly used when discussing increasing economic pressures on renewable resource, particularly fish stocks. Bioeconomics brought together research efforts focussed on determining the quantity of a biological resource that can be exploited without threatening its capacity to reproduce, i.e. a maximum sustainable yield.

In the 1960-70s, economist Nicholas Georgescu-Roegen used the term in his work discussing the interplay of economy, society and the environment[19]. He combined theories on economic activity, the natural environment and the concept of thermodynamics, focussing on entropy and resource depletion. Georgescu-Rogen's bioeconomic theories centred on the biological basis of economy, and the human problems associated with a limited availability of resources that are unevenly located and unequally accessible. His views that the fossil fuels required for modern human life will inevitably be depleted led to work on areas such as economic degrowth, solar technology and to the prospects for a 'new age' of wood.

During the 1990's a new perspective on the bioeconomy developed out of the prospects for a new industrial technology based on an increasing understanding of biology. The idea that bioscience could transform traditional manufacturing through the deployment of modern industrial biotechnology gave rise to the knowledge-based bioeconomy[20].

[16] BB-REG-NET, Bio-based-and-Biodegradable-Materials-Regulatory-Science-Network_Discovery-Phase_Report-v2a.pdf, 2024
[17] F.-D. Vivien, M. Nieddu, N. Befort, R. Debref, M. Giampietro, The Hijacking of the Bioeconomy, Ecological Economics, Volume 159, 2019, Pages 189-197, ISSN 0921-8009.
[18] Quoted in F.-D. Vivien, M. Nieddu, N. Befort, R. Debref, M. Giampietro, The Hijacking of the Bioeconomy, Ecological Economics, Volume 159, 2019, Pages 189-197, ISSN 0921-8009, https://doi.org/10.1016/j.ecolecon.2019.01.027.
[19] K. Mayumi, The Origins of Ecological Economics The Bioeconomics of Georgescu-Roegen, 2001, ISBN 9780415638111,
[20] M. Kircher, K-H. Maurer, D Herzberg, KBBE: The knowledge-based bioeconomy: Concept, status and future prospects, EFB Bioeconomy Journal, Volume 2, 2022, 100034, ISSN 2667-0410.

This perspective has been championed by the OECD and is summed up in a statement from 2009[21], *"The concept of a "bioeconomy" invites the reader to think about the global challenges of the future and how the biological sciences may contribute to solving these complex problems."*

Proponents saw the potential for industrial biotechnology to provide significant global economic, social and environmental benefits. The perspective is attractive based on the ability of a biotechnology to cut across multiple challenges with benefits anticipated across environmental issues including climate change, and in healthcare, agriculture and food, fuel supply and chemical production.

A third perspective on the bioeconomy views it as the use of biological resources to produce food, feed, chemicals, materials, energy and services. This view is demonstrated by the EU bioeconomy strategy[22]. This defines the bioeconomy as encompassing all sectors and systems that depend on biological resources and the services they provide, including both land and marine ecosystems. It covers primary production sectors generating or using biological resources, e.g. agriculture, forestry, fisheries, and aquaculture, and downstream industries producing food, feed, bio-based products, energy, and services. This third perspective attempts to balance the economic demand for biomass, the use of varying technologies including biotechnology, and ecological constraints).

While these differing bioeconomy concepts are clearly linked (summarised in Figure 1, they differ in their focus and primary intentions. The ecological perspective looks to the natural world to provide the boundaries for economic activities, the biotechnology perspective sees an opportunity for economic growth from new scientific understanding, while the biomass perspective is based on the economic use of biological raw materials with the intent to provide social, economic and environmental benefits.

Although all stakeholders would undoubtedly state that sustainability is central to their view and purpose, differing views on what sustainability looks like, result in disagreement and divergence of approaches.

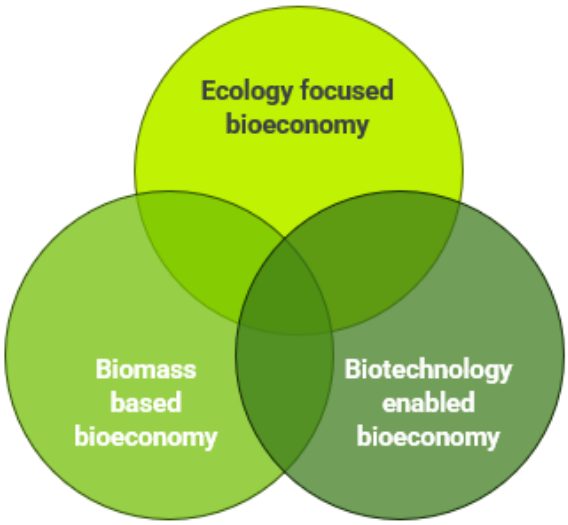

Figure 1. Bioeconomy concepts

Within an ecology focussed bioeconomy, sustainability risk is likely to be managed based on the precautionary principle - if it is possible that an action might cause harm to the environment, the action in question should not be carried out. Overcoming this position requires evidence and a scientific consensus, showing the potential for harm is within acceptable limits.

The biotechnology enabled and biomass-based bioeconomy's are more likely to address risk based on a proactive approach, accepting that calculated risk-taking is essential to social, environmental and economic development.

[21] OECD, The Bioeconomy to 2030 designing a policy agenda, 2009.
[22] European Commission: Directorate-General for Research and Innovation, Innovating for sustainable growth – A bioeconomy for Europe, Publications Office, 2012.

05 Bioeconomy Policy Siloed by Competing Agendas

The bioeconomy touches on the policy agendas of many government departments, however the three core protagonists in the UK are the Department for Energy Security and Net Zero (DESNZ), the Department for Science, Innovation and Technology (DSIT) and the Department for the Environment and Rural Affairs (DEFRA). The Department for Transport is also a key government stakeholder, aligned alongside DESNZ in the use of biomass in bioenergy applications i.e. transport biofuels, (Figure 2).

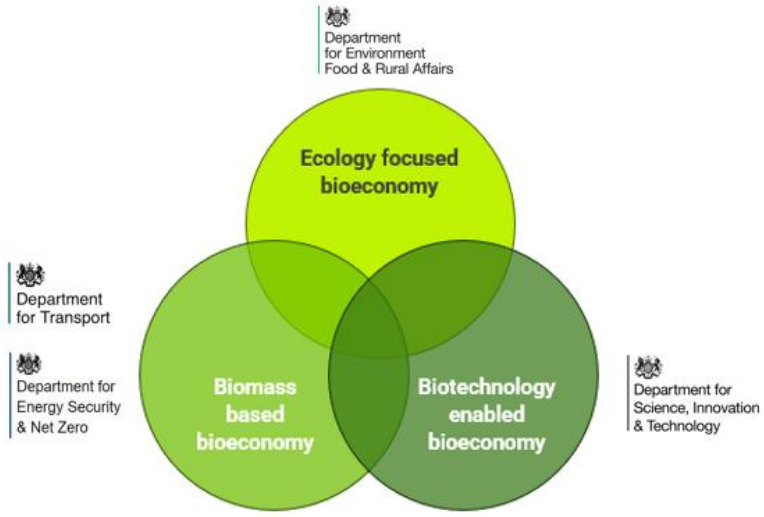

Figure 2. Alignment of UK government departments to bioeconomy concepts

It is reasonable that individuals would define and interpret bioeconomy concepts based on their personal values, beliefs, ethics, perceptions of (and actual) need, and scientific understanding. This could lead to unconscious bias being present in key stakeholder organisations which in turn creates barriers to the development of a singular, cross-departmental government bioeconomy vision.

DEFRA and the Environment

DEFRA's 25 Year Environment Plan[23] details the Government's strategy to halt the decline in biodiversity and improve the quality of the environment in England. The plan describes the approach to protecting and enhancing England's ecology and therefore has a significant role in steering the direction and setting the boundaries for the bioeconomy. Although the plan has a focus on England it has implication for the entirety of the UK.

Elements of the plan influence the use of biotechnology and the availability of biomass resource. The aim to improve wastewater treatment processes and ensure the use of sustainable agricultural practices will to a degree depend on the development of new biotechnology. The plan recognises the need for a 'Land Use Framework' in order to balance the multiple demands on land, which in turn will influence the availability of biomass. This sits alongside the aim to build a sustainable and long-term supply of UK timber, directly feeding the biomass-based bioeconomy.

However, the Plan does not explicitly integrate either the potential of biotechnology or the use of biomass into its proposed actions. The term 'bioeconomy' only appears 3 times in the Plan (each time referring to a planned bioeconomy strategy), 'biotechnology' appears once in relation to the bioeconomy strategy, and 'biomass' doesn't appear in the plan.

[23] Department for Environment, Food & Rural Affairs, 25 Year Environment Plan, 2018.

DSIT and Engineering Biology

The National Vision for Engineering Biology[24] describes UKs aspiration for engineering biology and its position within an innovative bioeconomy. The vision plays on engineering biology as an underpinning technology capable of driving innovation in multiple sectors from agriculture (development of new pesticides that reduce environmental harm) and the chemical industry, through to healthcare and defence. As would be expected from a department responsible for science and innovation, the vision focusses on innovation needs (the term 'innovation' appears 97 times) rather than on the need for biomass as a UK resource, the term 'biomass' appears 3 times, referring the Biomass Strategy and how sustainable biomass can be used to reduce the carbon emissions of the chemicals sector. Therefore, from a manufacturing perspective the vision is largely agnostic in respect to where products are produced with no significant emphasis placed on UK production.

DESNZ and The Biomass Strategy

The Biomass Strategy[25] published in 2023 describes the role that sustainable biomass can play in reaching net zero. As the name suggests the strategy is myopic - focussing solely on biomass supply - in its vision and is not intended to replace the withdrawn 2018 Bioeconomy Strategy.

The Strategy has a strong emphasis on biomass sustainability and the avoidance of negative environmental and ecological consequences. It is heavily focussed on the supply of bioenergy although it does recognise the potential of biobased construction materials and biobased chemicals in achieving net zero objectives. The potential for Engineering Biology is discussed within the strategy, with the term engineering biology appearing 12 times in one specific section under non-energy uses of biomass. However, its positioning is hardly in line with engineering biology being a strategic technology priority within the UK's ambition to be a global science and technology superpower. The strategy concedes that 'non-energy uses of biomass present real economic and job opportunities', however it states, 'there is significant uncertainty on the potential demand these end uses generate for biomass, the size of these markets, and the GHG emissions reductions some of these uses will offer in the future'. The strategy makes little connection with biotechnology, the term appears 5 times but only once in the body of the text, in comparison 'environment' appears 132 times. There are several other policies, regulations and voluntary pacts that impact the bioeconomy, as shown in figure 3, which shows DEFRA are mainly involved when it comes to land use, farming and end-of-life/waste, DESNZ/DFT are involved in biomass utilisation, and DSIT are involved in scaling up R&D for bio-based products.

In the last 5 years DSIT, via Innovate UK and UKRI, and private investors, have heavily invested both taxpayers (over £450 million) and private (£517 million) money into the development of bioeconomy processes and products[26] (Figures 4 & 5).

However, this is at odds with other policies and regulations implemented by government departments, which have created barriers to these products entering the UK market (Figure 3 & 6). These policies developed in departmental silos have led to significant policy disconnects.

[24] Department for Science, Innovation & Technology, National vision for engineering biology, 2023,
[25] Department for Energy Security and Net Zero, Biomass Strategy 2023, 2023.
[26] Department for Energy Security and Net Zero, Project contract PS22436 - Economic and climate benefits to the UK of an increased use of bio-based chemicals (RAF097/2223) 2024, unpublished

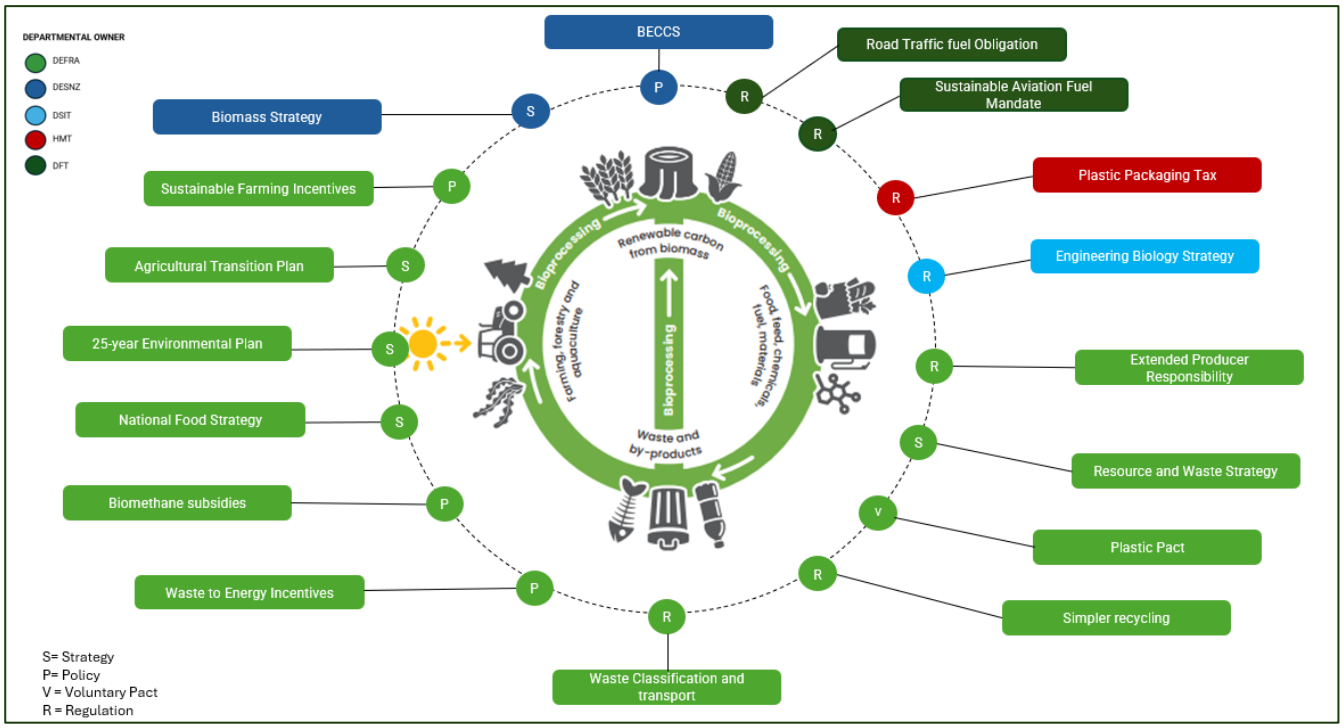

Figure 3. UK polices relevant to bioeconomy development and responsible departments.

For example, DfT policies inhibit bio-based product development due to concerns about biomass availability. This competition arises because the same feedstocks are also used for liquid biofuel production under the Renewable Transport Fuel Obligation (RTFO) [27] scheme and the Sustainable Aviation Fuel (SAF) mandate[28].

Policies and regulations from DEFRA have also hindered market penetration for bio-based, biodegradable and compostable materials. For example, the Extended Producer Responsibility Scheme (EPR)[29], via DEFRA's Recycling Assessment Methodology (RAM)[30] has labelled compostable packaging 'RED', meaning compostable packaging placed on the market is subject to higher fees than other types of packaging. In addition, via the Simpler Recycling Policy[31], compostable materials are likely to be labelled 'do not recycle', instead of 'dispose with food waste'. In doing so, these regulations favour established materials and hinder the development and deployment of novel products.

[27] Department for Transport, Renewable Transport Fuel Obligation (RTFO) scheme, Accessed 27 February 2025.
[28] Department for Transport, Guidance: About the SAF Mandate, Accessed 27 February 2025.
[29] Department for Environment, Food & Rural Affairs and Environment Agency, Extended producer responsibility for packaging: who is affected and what to do, Accessed 27 February 2025..
[30] Department for Environment, Food & Rural Affairs, Environment Agency and Natural Resources Wales, Guidance: Recyclability assessment methodology: how to assess your packaging waste, Accessed 27 February 2025..
[31] Department for Environment, Food & Rural Affairs, Policy Paper: Simpler Recycling in England: policy update, 2024.

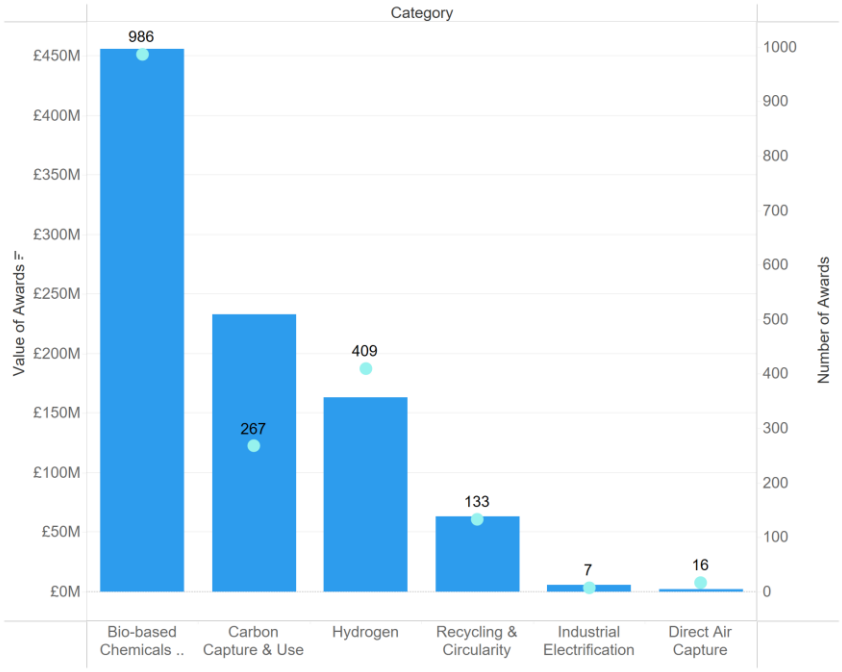

Figure 4. Public spending on bio-based products 2018-2023

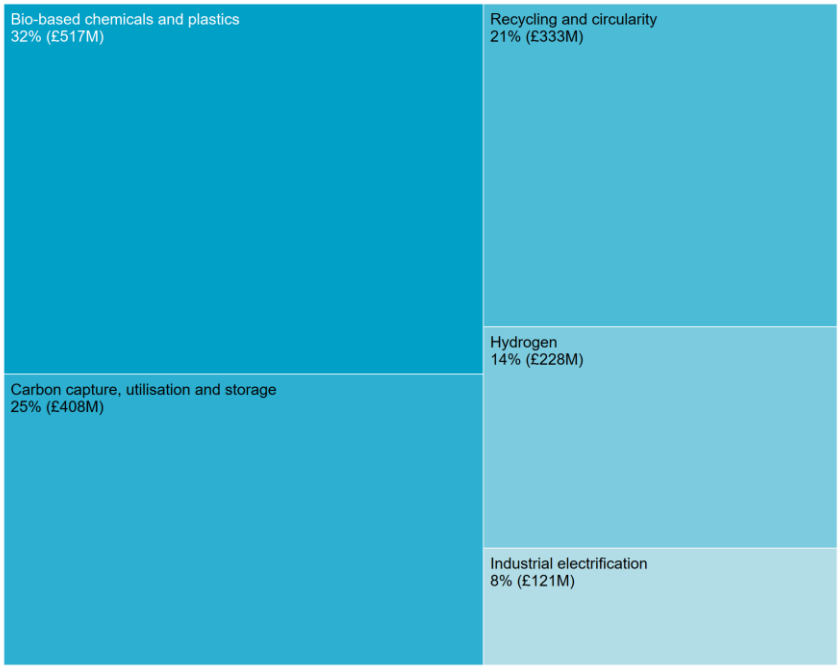

Figure 5. Private investment into bio-based products 2018-2023

A final complication lies within intra-governmental department terminologies for technologies and products. For example, DSIT and UKRI have different definitions of the term Engineering Biology.

Government defines engineering biology as “the design, scaling and commercialisation of biology-derived products and services that can transform sectors or produce existing products more sustainably. It draws on the tools of synthetic biology to create the next wave of innovation in the bioeconomy[32].” Here the focus is on sustainable products – which would include non-genetically engineered bio-based products.

[32] Department for Science, Innovation and Technology, National vision for engineering biology, 2023.

UKRI define Engineering biology is the “application of rigorous engineering principles to the design and fabrication of biological components and systems, from modifications of natural systems to new forms of artificial biology. It encompasses the entire innovation ecosystem, from breakthrough synthetic biology research to translation and application[33].” Here the focus is on engineered products, implying that bio-based products that have not been engineered are out of scope.

The outcome of the conflicting policies between departments means that significant amounts of research funding are flowing into the sector, but society does not benefit from the development of novel products, with potential to provide significant economic and environmental benefits to the UK.

The need for cross departmental working groups is well known and widely recognised at bioeconomy meetings and conferences. However, there is a general agreement among industrial stakeholders, who point to slow policy development or inconsistencies across existing policies, that there remains the need for greater collaboration and consensus on approaches to determining sustainable bioeconomy development.

06 Impacts on UK Sustainable Economic and Environmental Development

Without a clear vision and direction, the UK’s bioeconomy risks stagnation, as limited financial resources, time, and effort are spread too thinly across disconnected initiatives. This fragmentation leads to incomplete research and underdeveloped technologies, preventing promising innovations from reaching commercial viability. The lack of a coordinated approach also means that key stakeholders—including investors, businesses, researchers, and policymakers—struggle to work within a functional innovation ecosystem, reducing the effectiveness of collaboration and slowing the pace of progress (Figure 6).

For example, developers of bio-based chemicals face uncertainty due to the absence of a clear strategy for biomass provision, making it difficult to secure reliable feedstock supplies. Similarly, aspirations in engineering biology are constrained by insufficient funding for chemical and process engineering support, which are crucial for scaling up production. Additionally, delays in biotechnology and biomass-based manufacturing slow down the adoption of environmentally beneficial products and processes, ultimately undermining the UK’s sustainability goals.

In contrast, other nations have implemented structured policies that actively support their bioeconomy. The United States' BioPreferred Program[34], led by the U.S. Department of Agriculture (USDA), promotes the use of biobased products by creating a federal procurement preference for certified biobased goods. This initiative has stimulated market demand for bioproducts, encouraged private sector investment, and provided businesses with a clear route to commercialisation. Similarly, France’s policy on bio-based materials in construction, RE2020[35] mandates the increased use of sustainable, renewable materials in buildings. By integrating bio-based insulation, wood-based materials, and other green innovations into national construction standards, France has created a stable market for biobased industries, driving both investment and industrial scale-up.

[33] UK Research and Innovation, Engineering Biology Missions Hubs and Mission Awards, 2023.
[34] United States Department of Agriculture, BioPreferred Program, Accessed 27 February 2025.
[35] France Ministries Regional Planning Ecological Transition, Environmental regulation RE2020 https://www.ecologie.gouv.fr/politiques-publiques/reglementation-environnementale-re2020, Accessed 27 February 2025.

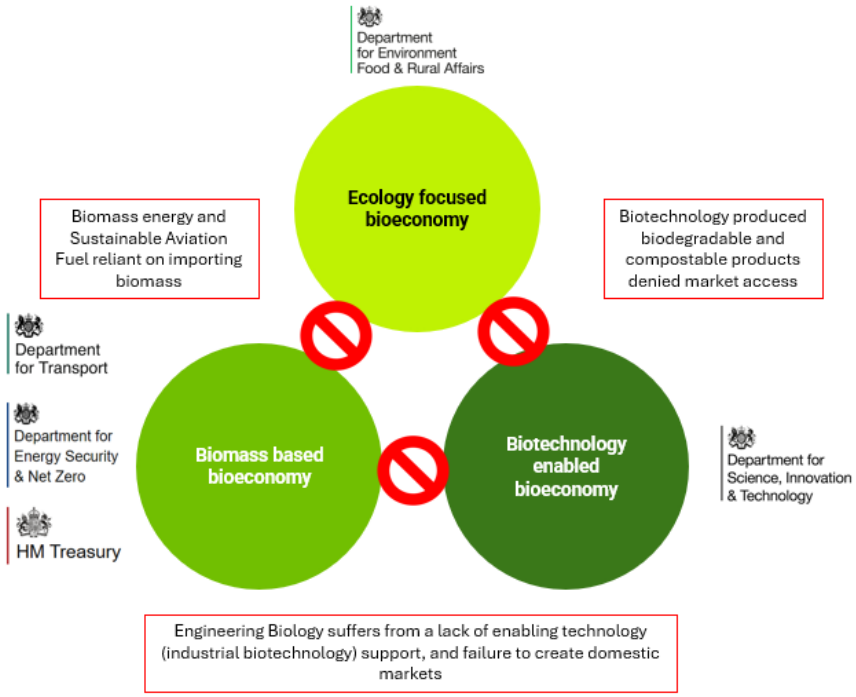

Figure 6. Example impacts of misaligned UK bioeconomy policies

In the absence of a shared vision for the UK's bioeconomy, innovation and market development will remain fragmented and inefficient. These risks preventing high-potential technologies from scaling up and reaching their full economic and environmental impact. Furthermore, without a supportive policy framework, UK-based companies may seek to establish their manufacturing assets in other countries with more favourable regulatory and investment conditions, leading to a loss of jobs, expertise, and economic benefits.

The lack of a cohesive and well-integrated policy poses a serious barrier to the UK's bioeconomy, limiting its potential to drive sustainable growth, job creation, and global competitiveness. Without a unified strategy, inefficiencies persist, investment is discouraged, and innovation is stifled. Moreover, the absence of a coordinated approach hinders the UK's ability to tackle critical challenges such as climate change, food security, and resource sustainability.

To fully realize the potential of the bioeconomy, the UK must develop a comprehensive and coordinated policy framework that brings together industry, academia, and government. Such a framework should prioritize long-term investment, streamline regulatory processes, and ensure that financial and technical resources are effectively allocated.

By fostering an environment where innovation can thrive and businesses can scale efficiently, the UK can position itself as a global leader in sustainable biomanufacturing, securing both economic resilience and environmental sustainability. Without decisive action, the UK risks falling behind international competitors in a sector that is vital for the future.

07 A way forward

The UK stands at the threshold of a transformative opportunity. By transitioning to bio-based and biodegradable solutions, we can generate upward of £204 billion in annual revenue whilst significantly advancing our Net Zero goals. Evidence has shown that starting with the adoption of just fifteen high-potential bio-based chemicals will achieve more than 5.2 million-tonnes CO_2eq GHG-savings annually[36]. This is greater than the CO_2eq GHG-savings generated through the Road Traffic Fuel Obligation in 2021[37].

The very nature of biomass means that rurally based businesses and communities can use local biomass — agricultural crop residues, non-agricultural organic waste, and forest products — to create bio-based chemicals and materials, reducing transport emissions and creating local value chains. In addition, this can encourage farmers to adopt sustainable farming techniques like agroforestry, crop rotation, and using composts and/or digestates. These techniques can enhance soil fertility, biodiversity and carbon sequestration. By "thinking global" in terms of adopting the overarching goals of sustainability and a circular bioeconomy, and "acting local" through targeted initiatives using local resources, the bioeconomy can drive rural regeneration.

The UK has a sustained record of global academic excellence in bio-based chemicals research, underpinning the potential for UK businesses to be industrial leaders in this space. Other areas of the world are already implementing policies to drive bio-based sectors forward but the UK risks losing its competitive advantage if action is not taken soon.

Addressing segmentation and siloed thinking requires challenge, collaboration and a forum to support debate and agree actions. BB-REG-NET[38] is a pioneering network that draws together experts from academia, industry, policy, regulatory and NGOs. Its work will encourage bioeconomy development by providing information and clarity around the quality, performance and environmental and economic impact of bio-based, biodegradable and compostable chemicals and materials. BB-REG-Net's vision is to establish the UK as a global leader in developing, manufacturing, using and exporting sustainable materials solutions, creating a resilient engine for green growth and innovation[25].

The bio-based, biodegradable and compostable chemicals and materials sector is nascent, meaning large databases of data and evidence are not always available. However, evidence-informed policymaking should not be at odds with innovation. Where evidence is limited, it is essential to assess current efforts, explore novel ways to realise the benefits, and pilot new policies – in turn generating evidence for future policy decisions.

The evidence provided from BB-REG-NET will allow policymakers to better assess the risk-benefit of creating new policies and making alterations to existing ones.

Through the provision of evidence gathering, engagement and dissemination activities, the network can bring together policymakers with differing bioeconomy perspectives, drive collaboration and support more cohesive bioeconomy policy making.

[36] DESNZ: Project contract PS22436 - Economic and climate benefits to the UK of an increased use of bio-based chemicals (RAF097/2223) 2024, unpublished
[37] Department for Transport, Renewable Transport Fuel Obligation (RTFO) scheme, Accessed 27 February 2025.
[38] BB-REG-NET, Shaping the future of sustainable chemicals and materials in the UK
Developing standards and building networks for the circular economy, Accessed 27 February 2025.