



## AMBER Submission to Public Consultation on Bioeconomy Action Plan

January 2023

### **Background**

Established in 2013, AMBER is the Science Foundation Ireland (SFI) Research Centre for Advanced Materials and BioEngineering Research hosted by Trinity College, University of Dublin, with researchers in 8 additional partner institution around Ireland: RCSI, UCC, Tyndall, DCU, University of Galway, University of Limerick, TUS and UCD.

The AMBER mission is 'to partner with our member companies to deliver world-class materials innovations and translate these into impacts for economic, environmental, health and societal impacts, providing solutions through collaborative research'

### AMBER mission

The Centre's strategy reflects the three main pillars:

- I. World-class materials innovation resulting from the excellence of our research which underpins everything we do,
- II. Partnership and engagement with industry not only on collaborative research, but also to contribute to the ethos of the centre in terms of governance & strategy, emerging research challenges and researcher development, and
- III. Impact with a focus on ensuring efficient translation of our research for economic, environmental, health and societal impacts.

We are at the forefront of driving advances in materials science and bioengineering and translating research excellence into new discoveries and devices. Our research develops technology to address industrial and global challenges from novel data processing and memory applications, energy storage and energy-efficient devices, regenerative medicine, and drug delivery systems through to plastics sustainability and supporting key national targets such as our zero-carbon 2050 target.

AMBER delivers a unique, integrated capability for materials research to accelerate innovation:

- Brings together Irelands leading researchers across nine higher education institutions
- Provides access to advanced facilities
- Provides a gateway to significant European funding
- Has a team of professional supports to scope, build, and ensure completion of projects to the highest standards, with IP and knowledge transfer capability.

## Introduction

AMBER has a strong interest in the bioeconomy and in particular where the bioeconomy intersects the technosphere, i.e. development of new materials from biomass. We also have strong interest in where the bioeconomy can help deliver sustainability for the materials and manufacturing sectors. An area we have centred work on is the need for Irish industry to move from fossil fuel chemicals and materials towards biomass (renewable materials). We work closely with companies such as PepsiCo in delivering sustainable and biomaterial solutions for translation of their materials needs from petrochemical derived sources and primary materials. AMBER led the NXTGENWOOD DAFM funded research platform for development of new materials from forestry. We also work on DAFM funded projects looking at sustainable bio-based food packaging. We closely align with work programmes in the SFI BioOrbic centre on bioplastics and development of a biocircular approach to materials, agriculture, and forestry. We lead Irish efforts in developing international (ISO), European (CEN) and national (NSAI) standards for the circular economy. We have expertise in measuring and assessing the circular economy and the use of tools such as life-cycle analysis. We have strongly recommended the use of system-thinking approach to examine the role of the bioeconomy in Ireland and identification where we can deliver greatest value.

### 1. Are you satisfied the outlined Pillars represent the structure of the Irish bioeconomy?

The first thing that needs to be pointed out is that the pillars reflect aspirations of the Irish bioeconomy rather than a structure. The activity needs to be translated into demonstratable impacts before this could be determined as a structure.

Within the pillars are some misconceptions which need addressing:

- a) The bioeconomy is defined as:

**Biobased economy, bioeconomy or biotechnomy** is economic activity involving the use of [biotechnology](#) and [biomass](#) in the production of goods, services, or energy.

The bioeconomy is defined in the document as a 'catch-all' where bio-based processes can be used to raise value. However, two distinct aspects of the bioeconomy need to be captured. That is the conventional markets (agriculture, forestry etc.) and the bio-based economy that raises value through technical use of biomass as a resource. Whilst the industry and enterprise pillar balances the more traditional agriculture pillar how these relate to one another is critical. E.g. if we switch to a protein manufacturing process rather than animal sourced, how does agriculture feed into this? It may be better to integrate these pillars rather than separate them.

- b) The pillar labelled nature, climate and circular is more nuanced than a single pillar. Biodiversity and climate may be intimately linked as environmental issues and results of poor behaviour. Circularity is a proposed solution to those issues. It would be better to have an additional pillar called sustainability and circularity

### 2. Are there specific key performance indicators and/or targets the bioeconomy should be setting out to achieve to measure its implementation?

*A major focus of our reply to this consultation is that the bioeconomy sector outside traditional agriculture etc. is not mature or understood well enough to answer many of these questions. There*

*has been insufficient systems analysis of what the bioeconomy could deliver and where it would bring the most significant impacts. If we pursue a bio-refinery strategy, do we have resources to fulfil needs? Can we make products at scale and consistent with planning and regulation? What are the barriers (e.g. planning permission, environmental impact assessments etc.)?*

Thus it is hard to address KPIs before quantitative data on what might be achieved are provided. The KPIs should be driven by values across economic, social, and environmental. But how are these values measured? What are the important indicators and how do we rate them?

E.g. is it economic value per kg of biomass or is it an economic growth rate whilst improving a secondary indicator? It is easy to e.g. say a KPI is increased GDP % but is this a target?

Many indicators will need development, so it is not possible to choose them.

We would note that there are no societal goals besides increased national employment. This needs careful consideration and thought. The value of jobs and access to recreational spaces are important. These are not well developed and finding indicators for Ireland's bioeconomy will be challenging.

### **3. What other key issues should the Governance Pillar deal with?**

The governance issues are well laid out. The bioeconomy-legislation-regulation interface is critical as there must be incentives to encourage good bioeconomy actions. Similarly developing information led policy in the bioeconomy is critical. A major challenge for the Irish bioeconomy is that many of the expectations are not informed by quantitative data. There is an important need to drive a scientific led measurement and assessment of what a bioeconomy might deliver.

### **4. What key issues should the Research, Development & Innovation Pillar deal with?**

There are a number of critically important actions before and major R&D investment in specific projects is made.

- a) The bioeconomy might deliver a range of benefits but what are they, how important are they, what is their magnitude and what is the cost? The first thing that is needed are scientific studies that adopt a system-thinking approach to where the bioeconomy might make most impacts.
- b) This will require measurement and assessment of various sectors, strategies and alternatives. Definitions and indicator research is needed.
- c) One a detailed assessment done determine a comprehensive set of research/innovation priorities

### **5. How could the RD&I bioeconomy approach be best structured to support the enhancement, application and scaling-up of biological knowledge and bioeconomy solutions?**

As question 4, proper and robust assessment of the bioeconomy is needed.

## **6. What key issues should the Nature, Climate & Circular Pillar deal with?**

Briefly:

- a) Biodiversity
- b) Natural capital
- c) Contribution to climate
- d) Other environmental impacts (emissions to land, water and air)

The circularity piece should look at proper definition of renewable which encompasses regeneration. This includes what indicators might be used or developed. Identify minimum circularity targets.

## **7. What key issues concerning consumption patterns need to be examined to close the gap between sustainable supply of biological resources and demand?**

This is impossible to answer because there is not enough data on resource availability nor is there the required understanding of priorities for those resources. A critical question is how we translate an Irish economy from petroleum based (transport, energy, industry) to renewable based. Ireland's reliance on aviation will require bio-kerosene and industries such as cement manufacture and glass manufacture also require furnace/kiln temperatures above renewable electricity. There are also chemical and plastic based industries reliant on fossil fuels (even if important). What segment of these sectors should be targeted? This is perhaps the most important issue to consider.

## **8. What key issues should the Agriculture, Food & the Marine Pillar deal with?**

These are largely associated with environmental issues emissions and climate.

## **9. What key issues should the Communities Pillar deal with?**

- Employment and quality of jobs
- Rural employment
- Meeting rural needs
- Sustainability in rural centres
- Self-reliance in rural centres

## **10. Are local and regional policies ensuring the consideration of bioeconomy opportunities are in scope, and are coordinated approaches on such services in place at regional assembly and local authority level?**

NO. Whilst some regions are aware of opportunities some are not. Lack of joined up thinking. Little direction from Government. National priorities would lead regional decision making but clear policy is missing. Again, lack of proper data and assessment is a major roadblock. How do regional bodies progress if there is no data on potential return on investment in terms of social, economic and environmental benefits?

### **11. What key issues should the Industry & Enterprise Pillar deal with?**

- What sectors are prime targets?
- What sectors will bring most impact?
- What does industry want from the bioeconomy. It is facile to think that a thriving bioeconomy will be driven bottom-up via SMEs and start-ups. What do existing manufacturer's want or need? E.g. what is the role of biomass resources in green cement manufacture? There must be an appraisal of where the bioeconomy intersects existing industry. E.g. is wool a high value product in construction products? Can we have smart agriculture that encompasses industry needs for natural products such as reeds?
- Again proper, independent analysis is required across a range of sectors.

### **12. What lead market initiatives could support entrepreneurship, development, innovation and the commercialisation of bio-based products, processes, information, and services?**

Deep analysis is needed. This includes everything from resource availability, limitations on processing, market size, capital investment.

The one area that needs immediate investment is waste valorisation e.g. into chemicals and plastics. Proper accounting is needed to determine specific targets.

### **13. Due to the requirement for capital and operational investment what innovations aimed at financing infrastructures and technical and economic evaluation of innovation are necessary to scale up the bioeconomy?**

Financing will be an issue because of the lack of maturity unless we are importing proven technology such as modern pyrolysis plants which need little research and innovation. This is probably fundable with private investment coupled to Government co-funding etc.

For new technologies, Government must be prepared to fund across innovation and technology development. That will require dedicated investment at low TRL levels through to higher levels and pilot scale. Lisheen can provide some of these but is limited.

Can this be funded through current mechanisms without disturbing the research/innovation ecosystem?

### **14. What key issues should the Knowledge & Skills Pillar deal with?**

There are key knowledge/skills/training gaps

Few research opportunities particularly at higher TRL levels. Complete lack of biochemical engineers to translate research into products via scaled production.

Shortage of post-doctoral researchers and PhD students in many sectors. The bio-refinery is probably well developed but we have no scaled support of forestry research and no dedicated centre. This is a gap considering the active afforestation programme and a particular need if we are to take advantage of a sizeable resource.

Lack of detailed knowledge on life cycle and circularity measurement and assessment in the bioeconomy. This relates to the data shortage highlighted elsewhere.

Training related to apprentices etc needs to be examined.

Modernisation of second level courses to account for changing sectorial requirements.

**15. Can the regional skills and regional enterprise approaches better support bioeconomy development?**

Yes, but only when priorities determined.

**16. An important part of developing the bioeconomy is to determine the most appropriate practices, treatments, technologies, logistics and business models to valorise ecosystem services, primary and secondary biomass resources. What role do advisory systems play in addressing this challenge?**

As above, this advice is urgently needed. We have little idea where these practices might bring impact be that environmental and social. Urgently need to fund research in these areas to ensure the advice is sound.

**17. Are there any further Pillars/Issues which this Action Plan should address?**

**18. Indicate what the top five priorities for action in the bioeconomy over the next three years should be?**

- Determine the potential contribution of the bioeconomy to Ireland: It is uncertain if we have available bioresources to make a significant contribution. Various sources are identified but how might they be best used. Whilst the bioeconomy is seen as potentially important in Ireland. There is little quantitative evidence for this. Can the bioeconomy produce products at the required scale and intensity (footprint) to make a difference? The bioeconomy is talked about as a valuable contributor but is this true? There needs to be a systems analysis of the bioeconomy in terms of the value it might deliver.
- Which of the potential areas the bioeconomy might address might have biggest impact? E.g. whilst we are researching biofuels, could these be produced in enough quantity to make a significant contribution to economy or sustainability (climate, environmental impact)? Should we focus on biodegradable plastics which are only a small improvement on incineration or land-fill?
- Develop circular bioeconomic strategies. I.e. bioeconomic technologies that are circular. This needs to be defined but should centre on reducing resource use and regenerating natural capital.
- Develop quantitative measurement and assessment for the bioeconomy. How circular is the bioeconomy (product, system, strategy)? What is the economic and environmental value? Developing greater measures of natural capital impact is critical. Life cycle assessment is not a comprehensive method for assessment and needs additional data and proper reporting.
- Address how industry and especially current industry sectors could take advantage of the bioeconomy and its products.