

Teagasc Contribution to the National Bioeconomy Action Plan 2023-2025

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1. Introduction

This document outlines Teagasc’s planned contribution to the Irish Bioeconomy Action Plan 2023-2025. It includes commitments as part of current research projects and work programmes, new initiatives and new ways of organising activities internally so as to bring more bioeconomy-related research and innovation into practice. It aims to make the bioeconomy more relevant to our stakeholders by making it more visible across the activities of our directorates, internally as well as externally.

2. Context

Following a government commitment to developing the bioeconomy as documented in the 2016 Action Plan for Jobs and the 2017 Rural Development Action Plan, the National Bioeconomy Policy Statement was launched by government in March 2018. It highlighted the opportunities the bioeconomy could provide for rural areas, job creation and primary producers. The government has since committed to developing a Bioeconomy Action Plan (BeAP) as documented in Action 434 of the Climate Action Plan 2021. This commitment requires the Department of Agriculture, Food and the Marine (DAFM), the Department of the Environment, Climate and Communications (DECC), and the wider High-Level Bioeconomy Implementation Group (BIG) to progress beyond implementation of the policy statement through a detailed and tailored three-year Bioeconomy Action Plan for the period 2023 to 2025. The guidance document provided to government departments and state agencies in making their contribution to the BAP states “The Bioeconomy, if sufficiently supported, has the potential to assist all of us in realising our climate objective of being a carbon neutral society by 2050”. The process by which this plan is being developed is outlined in Figure 1 below. As a state agency under the aegis of DAFM, and a role in research & development, education and advice in key sectors of relevance to the bioeconomy, Teagasc is an important contributor to the BeAP.

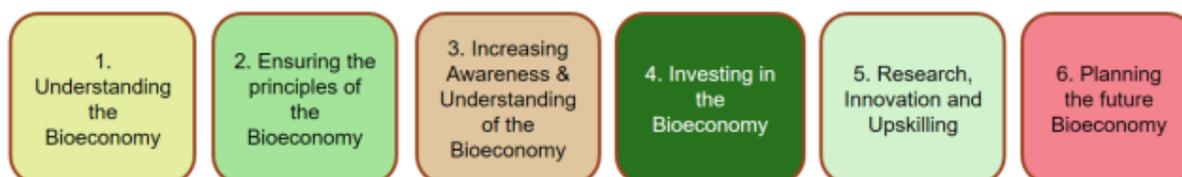


Source: DAFM/DECC

Figure 1: Process for developing the Bioeconomy Action Plan

3. Organising and documenting Teagasc's contribution

Following a bilateral meeting between Teagasc and DECC, the Teagasc Senior Management Group (SMG) requested the Teagasc Bioeconomy Working Group to scope the organisation's current and potential future contributions to the plan. Following the framework provided by DECC, which was based on identified needs as outlined in Figure 2, Teagasc have developed this document to represent the agreed contribution of Teagasc to bioeconomy development for the period 2023 to 2025.



Source: DAFM/DECC

Figure 2: Bioeconomy needs identified by DAFM/DECC

4. Teagasc's Contribution

Teagasc has been active in the bioeconomy for many years, including activities relating to research, industry engagement, and farm advisory services on potential bioeconomy opportunities. Furthermore, it made a significant contribution to the development of the Bioeconomy Policy Statement and continues to support its implementation. The organisation's large programmes on climate/carbon neutrality have also directly and indirectly contributed to the bioeconomy. It is now timely to document this current and future planned activity to support further development of the bioeconomy in a highly visible manner.

In this regard, Teagasc's contribution will focus on **using lead bioeconomy projects as a research and innovation base to develop enabling activities** in four key areas:

1. Awareness;
2. Education, advisory, training & skills;
3. Scaling-up & demonstrating innovation & business models in technical/operational settings
4. Evaluation & Monitoring

Whilst acknowledging the large number of current and planned bioeconomy-related projects, it was recognised that there is a need to provide a focus for the period of the plan (2023 to 2025) on topical themes/themes likely to attract interest/discussion to address the four key areas in a visible and coordinated manner. Therefore, lead bioeconomy projects that will function as a research and innovation base have been selected based on two thematic areas:

- **Alternative sources of protein and land/sea-use**
 - **Plant-based protein.** Several projects, that are either led by Teagasc or in which Teagasc researchers have a leadership role, are in this area – [U-Protein](#), [ValPro Path](#), [BiOrbic](#)/BiOrbic 2, Protein-I. They will enable new farming enterprises and provide opportunities for processors through valorisation of plants to deliver ingredients (e.g.,

protein, carbohydrates, fibre etc.) for a wide range of food and beverage applications for the global marketplace.

- **Beef systems considering Integrated Anaerobic Digester & Grass Biorefining.** Leveraging the existing infrastructure of a demonstrator Anaerobic Digester established at Teagasc Grange following a €1 million investment, a research officer will be recruited in 2023 to develop a programme in this area. The initial focus for the AD plant will be to produce bio-methane with minimal Carbon emissions (e.g. during feedstock production) so that the resultant methane meets the regulatory standard to be considered a 'renewable' energy source. For this reason, crops like red clover silage would be prioritised. Another focus will be capture of CO₂ from the biogas and valorising this for industrial use given the shortage of CO₂ in industry. In parallel with this, the feasibility of establishing Zero C Farm for a beef system will be explored, and progressed if deemed feasible.
 - **Seaweeds, seaweed ingredients and other products as solutions to enteric methane.** The bioeconomy has many ways to help address climate targets in the medium term, one of which is use of feed additives and ingredients to reduce methane emissions. Examples of current projects in this area include [Seasolutions](#) and [Methabate](#).
 - **Circularity for waste valorisation:** Value addition to waste, developing zero-waste approach and up-cycling of food processing co-streams. Production of protein and high value ingredients from seafood side streams, valorisation of food processing wastewater e.g. dairy, marine for production of duckweed, microalgae. Valorisation of side streams from seafood sectors for chitosans, proteins, and lipids, e.g. IMPRESSIVE, Duck-Feed, Enhancemicroalgae, BiOrbic 2.
- **Alternative sources of inputs into agri-food systems**
 - **Biopesticides and biostimulants.** EU policies as reflected in the Farm to Fork strategy within the European Green Deal have ambitious targets of reducing the overall use and risk of chemical pesticides by 50% and the use of more hazardous pesticides by 50% by 2030. Bio-based alternatives are integral to this strategy. Current projects in this area include [BioCrop](#) (aims to produce new algal and fungal derived biopesticides and biostimulants while engaging with industry and collaborators to test existing biofertilisers (algal and bacterial based) and BIOTA which is examining specific microbial biostimulants for efficacy.
 - **Biofertilisers.** Similar to biopesticides and biostimulants, bio-based alternatives to synthetic fertilisers are required given finite resources and high costs e.g. [Nutri2Cycle](#), and [NOVAFERT](#).
 - **Alternatives to Peat.** The extraction of peat for any purpose is of significant concern to environmental agencies and consumers interested in sustainability credentials of products. This creates significant difficulties for high value sectors such as horticulture, where peat is an important input. Finding alternative growing media to peat is thus an increasing priority of horticultural research in Teagasc. Current projects include [Beyond Peat](#) / STransit.
 - **More sustainable processing to reduce food waste** (bioprocessing to promote circular economy); separation and drying technologies for development of food ingredients; diversify functional foods, e.g., oats; generation of non-food applications from biomass, e.g., micro plastics, fibres etc. eco-friendly packaging- recyclable, compostable or biodegradable packaging.
 - **Sustainable Packaging and food waste reduction.** The National Prepared Consumer Food Centre, established at Teagasc Ashtown, is supporting a programme of research focused on optimising food-packaging performance while minimising product spoilage and wastage. New sustainable packaging materials have been designed from food waste, which are currently under evaluation. Teagasc will continue to innovate in this area,

developing opportunities for circularity within the food system. SFI have funded a €2 million programme, Leaf No Waste, to develop novel solutions that have the potential to address food waste by combining plant fortification with sustainable compostable packaging to enhance the shelf life of fresh produce.

- **Clean processes and technologies:** Advanced energy efficient processing and valorisation technologies, elimination of harmful chemicals employed for valorisation of biomass. Plasma technologies to replace chlorine usage in the food industry, plasma activated water as a source of water treatment and fertiliser for seed germination, e.g. PASTE, HortAssure, CDA PlasmaFilm, BIOCAR-FOOD, WASTE2FUEL

4.1. Awareness

Teagasc will continue its contributions to the national Bioeconomy Week, including its daily map series as part of the [week](#). In addition, it will leverage the communication, dissemination and engagement activities relating to the above projects to raise awareness of the bioeconomy internally and externally.

4.2. Education, Advisory, training & skills

- Teagasc programmes offered at both Level 5 and Level 6 relating to agriculture, horticulture and forestry will be reviewed to integrate the circular bioeconomy to curricula where relevant. The recent appointment of a Curriculum Development Climate specialist (within Education) will expedite this process. Through our established links with Universities and Institute of Technology, courses/modules are offered to approx. 5000 learners per annum. Teagasc will continue to contribute to the post-graduate diploma Bioeconomy with Business, offered by UCD and MTU.
- Bioeconomy related research and innovation projects that aim to produce technologies that could be adopted on-farm to address climate challenges will be reviewed to determine which technologies could be adopted specifically by farmers who are part of the Signpost Programme¹. A selection of these will be demonstrated in fora appropriate to their readiness to be put into practice (e.g. research farm, Signpost farm) as part of an annual Signpost Programme initiative that would be closely aligned with National Bioeconomy Week.
- Teagasc will proactively promote the range of initiatives in the Forestry Programme 2023-2027 and support (through research, advice and training) optimising forest's potential in relation to carbon sequestration, storage and the displacement of carbon intensive products and fossil fuels.

4.3 Scaling-up & demonstrating innovation & business models in technical/operational settings

- Teagasc Technology Transfer Office and Research Support Office in conjunction with Teagasc Bioeconomy Working Group will periodically examine the current list of projects in Teagasc's annual work programme to identify opportunities to partner with industry to scale and demonstrate bioeconomy in operational settings and to promote such opportunities to PIs:–

¹ The Teagasc-led Signpost Programme is a multi-annual campaign to lead climate action by all Irish farmers. It consists of both a Demonstration Farm network and Signpost Advisory Programme.

engage with industry partners through individual companies / Meat Technology Ireland / Dairy Processing Technology Centre / BiOrbic / VistaMilk / Food for Health Ireland / other clusters/hubs/identify opportunities for funding through national/EU research & innovation funding

- To complement existing facilities, business cases will be developed, and associated funding sought, to enable upgrading and expansion of infrastructure, and recruitment of associated staff, to support the development of high value food/nutritional-food/medical-food ingredients. This will include supporting fermentation technologies to move from lab screening to pilot scale fermentation to demonstration/commercial scale. This will build on Moorepark Technology Ltd. (MTL) as a key strength where we can (i) locate pilot-scale fermenters that are supported and maintained in a commercial pilot plant and (ii) exploit the customer relationship network that MTL has developed over many years.
- Teagasc, through participatory research methods in projects such as Protein-I and BiOrbic 2, will stimulate the development of bio-based clusters in rural areas.
- Strategic developments, including the new Virtual Climate Research Centre, will bring together our bioeconomy research programme and assist its development.
- A new bio-process innovation suite has been established at Teagasc Food Research Centre Moorepark for biotransformation of food biomass into ingredients and non-food materials. The unit is part of a unique capability, incorporating sequencing of microorganisms, fermentation of food biomass and characterisation of the target value adding compounds (from the fermentation process). The facility is adjacent to a new separations unit to further valorise the different streams coming from the biotransformation process. State of the art extraction technologies, located at the Teagasc Food Research Centre Ashtown, complete the capability for extraction, fractionation and drying of value streams from any food biomass including waste material from existing food production systems.
- Ensuring the food safety, nutrition and quality of “climate-friendly” foods
 - Molecular based methodologies to measure microbiological quality across the food supply chain.
 - Impact of food system (production/ food manufacturing) changes on the microbiome and chemical residue content of consumer foods.

4.4 Evaluation and Monitoring

The need to measure and monitor the bioeconomy to support industrial development, the design of supporting policies and to have a clearer role on how the bioeconomy affects our lives has been recognised at EU level with the development of the [EU Bioeconomy Monitoring System](#) and funding provided to projects such as [BioMonitor](#). As the bioeconomy is different in each country, Ireland needs to develop its own evaluation and monitoring framework. Teagasc is leveraging [INFORMBIO](#) and [EXPECT](#) to:

- Map, measure and profile available feedstocks at various scales
- Identify mechanisms to integrate with the following:
 - Marginal Abatement Cost Curve (MACC) development in a circular economy system, drawing on examples such as the [marginal abatement cost of co-producing biomethane, food and biofertiliser in a circular economy system](#) developed by MaREI.
 - Teagasc National Farm Survey
 - Rural Development & Diversification

5. Conclusion

Teagasc is committed to supporting the development of the bioeconomy in Ireland. It recognises its potential to address climate change, enhance the sustainability of agriculture, food and forestry and to contribute to the future of rural areas. Through the actions outlined above, and aligned initiatives undertaken as part of Teagasc's Climate Strategy², it will take a cross-organisational approach to support its strategic development. Additional supports, e.g. in relation to additional infrastructure as outlined above, will enhance the organisation's capacity to deliver on the potential of the bioeconomy in Ireland.

² Launched 1st of December 2022.