CAP NETWORK IRELAND BIOECONOMY IN ACTION

A collection of case studies highlighting bioeconomy projects from across Ireland.

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Dr Helena McMahon Circular Bioeconomy Research Group, MTU

About the **Bioeconomy**

The bioeconomy is a new approach to utilising products, services, wastes and side-streams from sectors such as agri-food, forestry, fisheries, and aquaculture more sustainably. It offers opportunities to reduce GHG emissions in the agri-food system by replacing fossil-based resources with biological ones, from biofertilisers and biopesticides, to new food sources, bio-plastics and textiles, and biological waste management. It is a key element in our transition to climate neutrality.

The bioeconomy brings 'exciting' new employment opportunities to rural Ireland, having a nature-based economy built on a strong agricultural sector, we have huge potential to capitalise on growth in this area. There is an extensive amount happening to develop the bioeconomy in Ireland already, we in MTU are working in partnership with industry to develop new cutting edge technologies, products and processes, and making sure they have the skills, talent and knowledge to implement these innovative solutions as agriculture transitions to a low carbon model.



CAP Network

Ireland

James Claffey Project Manager

Welcome from CAP Network Ireland

As Ireland continues to chart its course towards achieving the goals set by the Climate Action Plan and other sustainability frameworks, the bioeconomy will be central to ensuring a balanced approach to economic growth and environmental stewardship. This Bioeconomy Booklet is part of CAP Network Ireland's ongoing efforts to raise awareness, foster knowledge-sharing, and inspire action at all levels of society.

This Bioeconomy Booklet is a resource aimed at engaging communities, farmers, local enterprises, and entrepreneurs. By breaking down complex ideas into practical examples, the booklet provides guidance on how individuals and businesses can become active participants in the bioeconomy. From farm-based bioenergy projects to community-led circular economy initiatives, the booklet shows how everyone has a role to play.

Case Studies Overview

AlgaeBrew

Unlocking the potential of microalgae for the valorisation of brewery waste products into omega-3 rich animal feed and fertilisers.

Beyond Peat

Utilising organic bio-resources and novel technologies to develop specifically designed and sustainable peat replacements for professional horticultural crop production.

BIOS4Grass

Biostimulants for grass production.

CABBBIE

Developing Cascading Biomethane Biochemicals and Biofertiliser Systems for a Circular Bioeconomy in Ireland.

CircBioCityWaste

Converting urban waste streams into value-added products.

CirCoVal

Circular Bovine and Ovine Co-Product Valorisation.

NXTGENWOOD

Development of an Ecosystem for Delivery of Next Generation Wood Products.

Rural BioRefarmeries

Small scale circular green biorefineries for increasing farmer sustainability and competitiveness and building resilient rural areas.

SPRINGWOOL

Removing bottlenecks and providing a springboard for innovation in the Irish Grown Wool sector.

U-Protein

Unlocking Protein Resource Opportunities to evolve Ireland's nutrition.

Data icons



NXTGENWOOD



AlgaeBrew



Beer production generates large amounts of wastewater, the conventional linear "collect-treat-discharge" way of handling waste is costly and unsustainable. Algaebrew will use microalgal biotechnology to convert these wastes into useful products, thereby creating new revenue streams for breweries, decreasing their environmental impacts, and promoting a circular bioeconomy. By recapturing waste nutrients, microalgae can help breweries treat their waste products while producing sustainable Eicosapentaenoic fatty acid (EPA), which is essential for the immune system and widely used in dietary supplements for humans and animals. This will be a win-win solution for both breweries and EPA producers. International cooperation funded under Algaebrew will address technical challenges associated with microalgae Nannochloropsis cultivation on brewery waste, EPA extraction, feed formulation, and socio-economic analysis. Partners outside Ireland: 7 universities, a beer and animal feed (Lambers Seghers). Countries: Belgium, Italy. producer Romania, Morocco, Turkey, and UK. Total funding €1,713,000.



Beyond Peat



Peat has become an essential component in the production of plants and mushrooms in professional horticulture, due to its favourable physical, chemical and biological characteristics.

However there is a pressing need to evaluate and develop alternatives which have a favourable environmental profile while also maintaining crop yield and quality.

'Beyond Peat' will assess current, available alternative growth and casing materials across five key sub-sectors of horticulture while also developing advanced growing media utilising new technologies to transform organic wastes into materials with favourable physical characteristics for plant and mushroom performance.

Independent assessment of the agronomic and economic implications of alternative growing and casing materials will inform national policy while supporting the professional horticultural sector as it transitions from peat, where achievable in a sustainable manner.



BIOS4Grass



BIOS4Grass is an All-Ireland project jointly supported by the Department of Agriculture, Food and the Marine (DAFM) and the Department of Agriculture, Environment and Rural Affairs (DAERA, Northern Ireland).

BIOS4Grass aims to develop innovative solutions, in the form of biostimulants (seaweed extracts, beneficial bacteria and fungi) that farmers can co-apply with conventional fertilisers in order to reduce the amount of chemical fertiliser usage on farms, while also improving soil health and reducing greenhouse gas emissions.

The research is led by University College Dublin (UCD), and involves Munster Technological University (MTU), Teagasc, AgriFood and Biosciences Institute (AFBI, Northern Ireland), and will also involve industry (Brandon Bioscience, Kerry Agri Business, J Grennan & Sons, CropBiome), and farmers.



CABBBIE



Upgrading photosynthetic biogas using nature's own "bio-factories", microalgae, may overcome the economic & environmental obstacles of biomethane production. Co-producing biomethane and biofertiliser with other bio-products via a Cascading Algal Biomethane Biorefinery System is still a nascent technology. Significant research is required to scale-up & optimise the process, particularly with a focus on the Irish bioeconomy. Further research may also be necessary to determine the actual costs as well as the social & environmental impact of such systems. Cascading Biomethane Biochemicals & Biofertiliser Systems for a Circular Bioeconomy in Ireland (CABBBIE), is supported with financial contribution from SEAI & DAFM under the SEAI Research, Development & Demonstration Funding Programme 2022. Grant number 22/RDD/819. Developed by engaging in deep science & broader engagement with project partners Dingle Hub, CABBBIE aims to provide a comprehensive pathway to commercialise photosynthetic biogas upgrading technology for an adaptive, flexible & secure Irish bioeconomy by 2050.



CircBioCityWaste



CircBioCityWaste is an innovative project focusing on developing and implementing a biorefinery using the cascading principle. Employing an end-of-waste approach to organic waste streams, it is producing agroproducts like bio-stimulants, biofertilisers, and soil conditioners. The process utilizes sludge and/or digestates from dairy and municipal wastewater treatment plants to produce agrochemicals by employing advanced technologies such as ultrasound and microwave.

The residue is further thermochemically converted into biochar and energy. The socio-economic impact spans over farmers, dairy processors, waste management companies, and the environment, promoting circular economy principles and bio-based industrial development. Funding support from EPA & DAFM facilitated the transition from basic to applied research and proof-of-concept validation. Once mature, this technology can be adopted by wastewater treatment and anaerobic digestion facilities across the nation for bio-based agrochemical production.



CirCoVal



The project will enhance the value of low-cost by-products from cattle and sheep, such as cartilage, hides, low-grade tallow, meat and bone meal (MBM), and blood.

The main goal is to scale up, integrate and demonstrate, at a minimum of 1000L volume, a number of biorefinery processes that convert the byproducts into raw materials for cosmetics, nutritional supplements, and produces biodiesel. In a truly circular manner, the project will address not only the valorisation of a low-value meat co-products but will design their production processes to achieve a zero-effluent and zero-emissions standard assessed and tested using novel sensor devices. Additionally, the project will treat wastewater from abattoirs to produce biogas, fertilisers and clean water by fostering the growth of algae and duckweed, which will in-turn be used to create fertilizers, and bioplastics. This initiative will establish a circular bio-economy model, yielding economic. environmental. and social benefits while addressing sustainability challenges in the meat industry.



NXTGENWOOD



Wood is a critical material for Ireland's economy and particularly its circular bioeconomy. Forests are critical for sequestration of carbon dioxide from the atmosphere and timber products store carbon dioxide for many years. Renewable sourced wood products can substitute for carbon intensive fossil fuel-based alternatives. NXTGENWOOD is a DAFM funded research project and network to drive new wood product and processing innovation in Ireland.

The DAFM funding of \in 3m enables a collaboration between Irish universities, foresters, wood processors and Irish industry in generation of high value and high (climate) impactful products. Research spans new environmentally friendly bioprocesses and materials for chemicals, energy, health, housing and plastics. This will allow the development of new materials, products and technologies as well as information that will lead to more climate friendly products. The information will help us make informed policy changes on our route to a net-zero economy.



Rural BioRefarmeries



Funded by EU's Circular Biobased Europe Joint Undertaking, this project supports the implementation of Ireland's first grass biorefinery & anaerobic digestion plant. Building on the work of projects like Biorefinery Glas and Farm Zero C, the project provides resources needed to operationalise a biorefinery and AD plant in a farm-based environment. The plant infrastructure was funded by DAFM in 2023 & demonstrates a small-scale green biorefinery & anaerobic digestion plant that refines additional products from grass. From fresh grass, clover & other green biomass, a silage-like fibre pulp for cattle feed is co-produced alongside a green juice fraction containing proteins, minerals & sugars. The pulp is fed to cows, the green juice, further processed to multiple products, (protein for pigs, poultry and even human consumption). The residual brown juice can be further converted to produce fatty acids, to make flavours, antimicrobial additives, biomethane & fertilisers. The approach allows grassland farmers to enhance revenue streams from their biomass while helping to address sectoral & national emissions challenges.

SPRINGWOOL			
	€		
MTU	€574,863	TUS, ATU, UCD	DAFM
The SPRINGWOOL project aims to remove bottlenecks and provide a			

Wool is significantly undervalued in Ireland; farmers currently lose money on every sheep they shear.

springboard for innovation in the Irish Grown Wool sector.

Scouring is an essential cleaning step of wool, there is no scouring facility in Ireland. This project will develop more efficient wastewater treatment for scouring, supporting the development of small scale on-island facilities.

It will develop a standardised compost recipe for wool, with associated plant growth trials and will develop a 'wool biorefinery', extracting ceramides and keratin from the wool and testing their application in higher value applications in cosmetics and medical device sectors. Byproducts from this biorefinery will be developed into a range of material and textile products.



U-PROTEIN



U-Protein (Unlocking Protein Resource Opportunities To Evolve Ireland's Nutrition) is a multi-disciplinary collaboration between Teagasc, University College Cork, NUI Maynooth, University of Galway, University of Limerick and Queens University Belfast, as well as industry partners. Protein is a very important macronutrient for growth; it provides essential amino acids that are required by the body to maintain bone, muscle and tissue and to produce vital components such as hormones, enzymes and immunoglobulins, required for health.

Ireland has a well-established meat and dairy sector that provides a high quality dietary source of protein. To support further nutritional and economic diversification of Ireland's food sector, U-protein explores sustainable crop and marine-based protein alternatives, particularly through innovative methods in food technology and agriculture. These resources have the potential to provide high quality nutrition to the consumer while also developing an alternative, economically viable and sustainable agricultural enterprise for Ireland.

Create your Sustainable, Circular & Regenerative Bioeocnomy

- Recycling
- Composting
- Grow own food
- Cook in bulk
- Don't overfill kettles
- Keep lids on pots
- Keep oven closed
- Don't over buy
- Don't over consume

ATHOME

ATWORK

- Set up recycling stations
- Reduce use of disposables
- Car pool

- Use public transport
- Recycling stations
- Shop local

2 OUR COMMUNIT

 Buy less packaged goods



Glossary of terms

BIOECONOMY

The Bioeconomy is the production of renewable biological resources from waste streams and other resources into value added products, such as food, feed, energy and bio-based products (European Commission 2012). The bioeconomy covers all sectors and systems that rely on biological resources (animals, plants, micro-organisms and derived biomass, including organic waste). It includes and interlinks land and marine ecosystems and the services they provide, all primary production sectors that use and produce biological resources (agriculture, forestry, fisheries and aquaculture) and all economic and industrial sectors that use biological resources and processes to produce food, feed, bio-based products, energy and services.

BIOMASS

Biomass is plant or animal material used for food, feed and energy production, and in various industrial bioprocesses as a raw substance. Bio-based chemicals, materials and fuels come from organic material such as harvest residues, crops and organic waste from our homes, businesses and farms.

BIO-BASED

Derived from biomass.



Glossary of terms

BIO-BASED PRODUCT

Product wholly or partly derived from biomass.

BIOREFINERY

TA biorefinery is a facility that integrates biomass separation and conversion processes and equipment to produce value added food, feed, chemicals, materials, fuels and power from biomass.

BIOBASED MATERIALS

Fibres that are made from materials of biological origin.

BIOBASED CHEMICALS

Chemical products that are wholly or partly derived from materials of biological origin.

BIOACTIVE

Compounds extracted from a biological origin that provide nutritional or health and well-being benefits for plants, animals and humans.

BIOENERGY

Bioenergy is a form of renewable energy generated from burning biomass fuel.



Glossary of terms

BIOGAS

Biogas is a renewable, carbon-neutral gas generated from biological processes. The biogas is extracted from organic material such as food waste, animal slurries, and biodegradable material and can be harnessed for heat, electricity and transport.

CIRCULAR ECONOMY

The Circular Economy is where the value of products, materials and resources is maintained in the economy for as long as possible, and the generation of waste minimised (European Commission 2015).

CIRCULAR BIOECONOMY

The Circular Bioeconomy put simply is the intersection of bioeconomy and circular economy. The circular bioeconomy promotes principles of renewable energy, circularity, and prioritising the use of biomass for socially preferable sustainable biobased products, notably food, feed, materials, chemicals and energy in integrated, multiproduct production chains optimising the value of sustainable biomass and making use of residues and waste.



BIOECONOMY IN ACTION

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An Roinn Talmhaíochta, Bia agus Mara Department of Agriculture, Food and the Marine



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