IEA Bioenergy
Technology Collaboration Programme

Country Report - Ireland

Status, July 2023

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UCD DUBLIN

Renewable Gas Forum Ireland

UNIVERSITY OF LIMERICK OLLSCOIL LUIMNIGH

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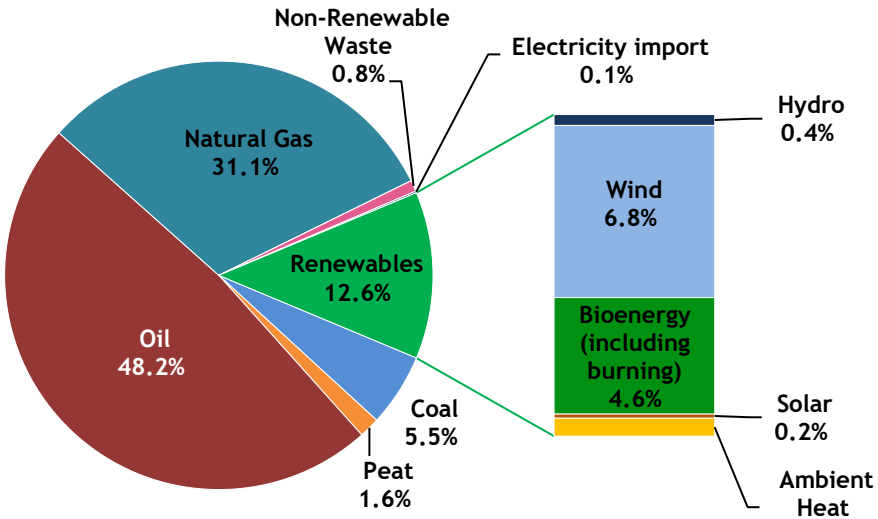
Sources

1. Total primary energy supply (TPES) and contribution bioenergy: current status and expected evolution

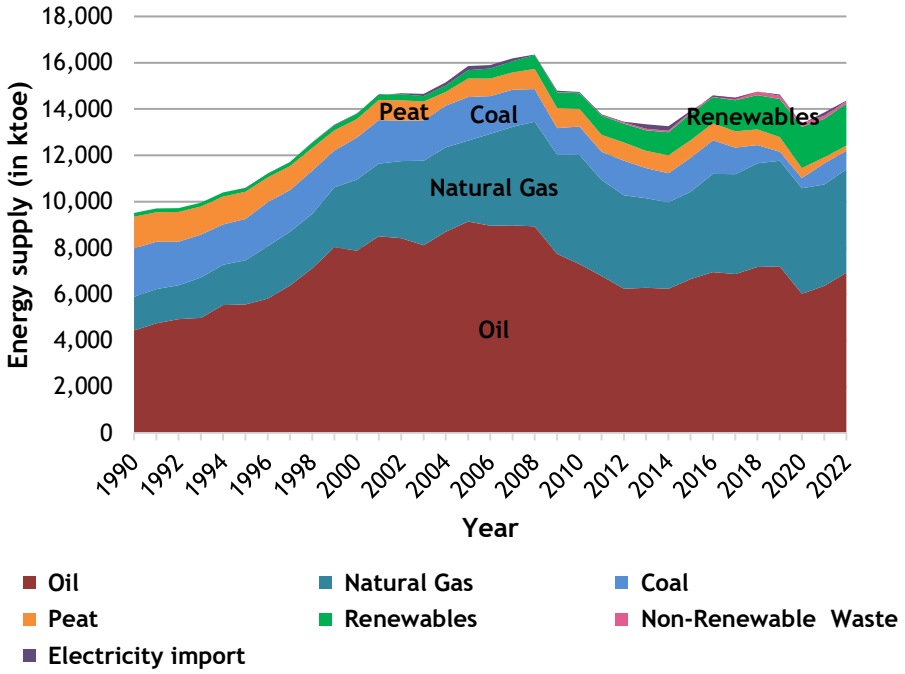
1.1 Total primary energy supply (TPES)

Energy supply in 2022



Total : 14,359 ktoe

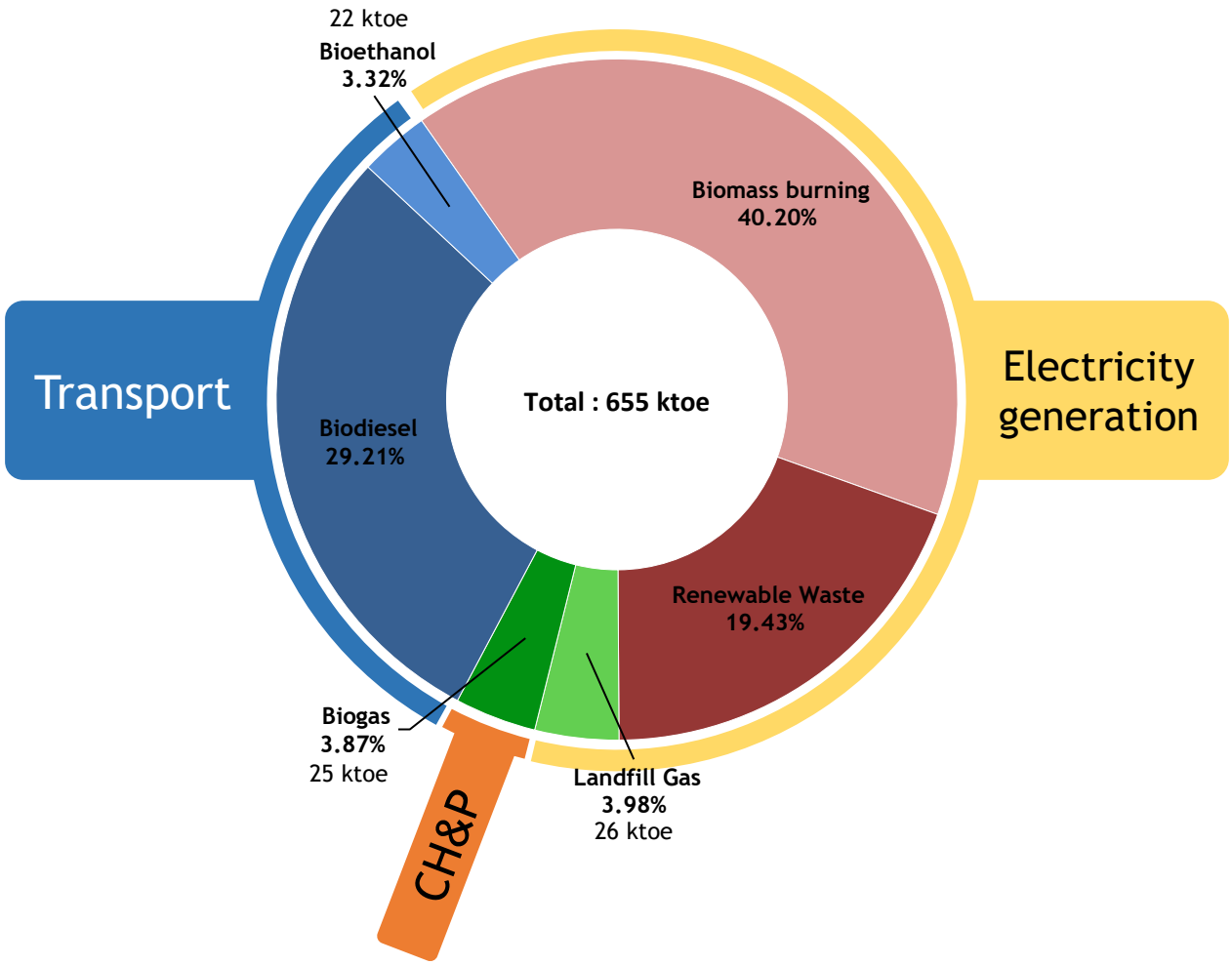
Evolution of Energy Supply (in ktoe)



Source : SEAI-National Energy Balance [online] view on 09/05/2023 www.seai.ie/data-and-insights/seai-statistics/key-publications/national-energy-balance/

1.2 Bioenergy supply

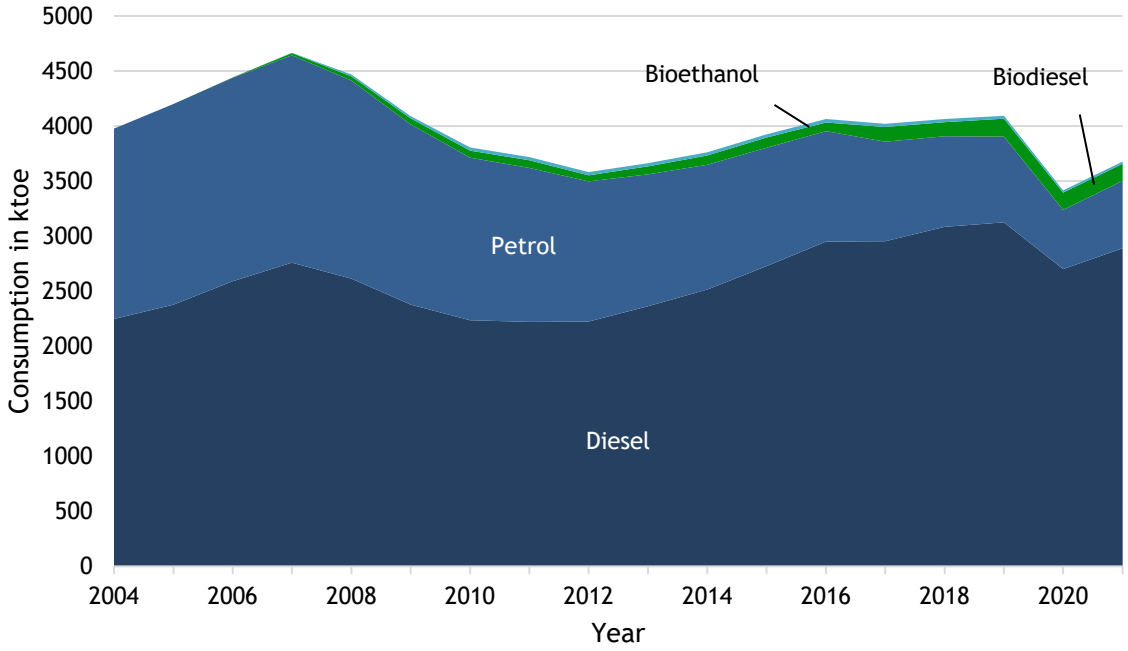
Share of energy produced from biomass in 2022



Source : SEAI-National Energy Balance [online] view on 09/05/2023 www.seai.ie/data-and-insights/seai-statistics/key-publications/national-energy-balance/

1.2 Bioenergy in transport

Consumption of motor fuel



Energy in transport by fuel in 2021

	Quantity (ktoe)	Share
Diesel	2,891	69.6%
Petrol	613	14.7%
Jet kerosene	446	10.7%
Fuel oil	0	0.0%
LPG	1	0.0%
Natural gas	17	0.4%
Electricity	10	0.2%
Biodiesel	158	3.8%
Bioethanol	20	0.5%
Total liquid biofuels	**178**	**4.3%**
Total	4,156	

Biodiesel is blended with diesel and bioethanol is blended with petrol

Biofuel import in 2022

	Import
Biodiesel	56%
Bioethanol	85%

Source : SEAI-National Energy Balance [online] view on 09/05/2023 www.seai.ie/data-and-insights/seai-statistics/key-publications/national-energy-balance/

2. Biomass use for non-energetic purposes

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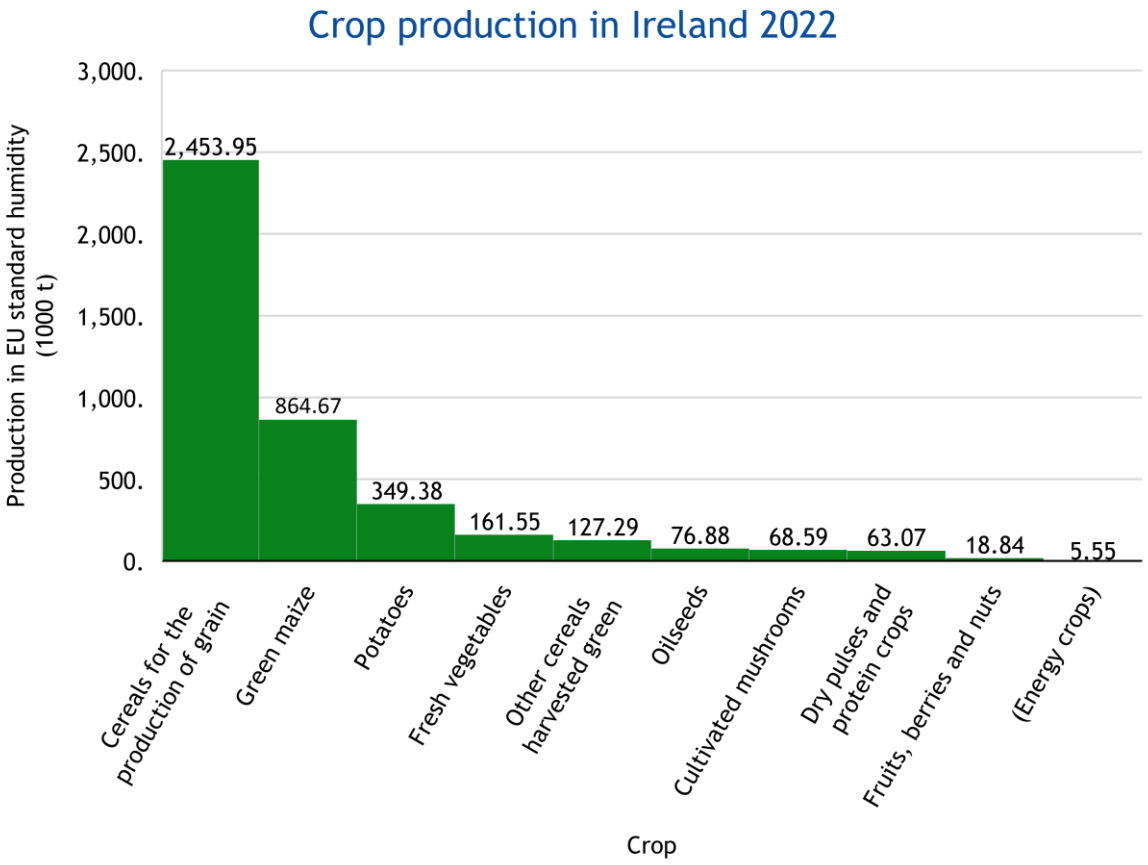
- 92% of the agricultural area is grassland (4,151,456 ha), mainly used for grazing. (2020 data)



In 2021 :

Production of 4,300,000 cubic metres of roundwood.

Source : Central Statistics Office www.cso.ie/en/releasesandpublications/ep/p-coa/censusofagriculture2020-preliminaryresults/landutilisation/
EUROSTAT ec.europa.eu/eurostat/databrowser/view/APRO_CPSH1__custom_6615291/default/table?lang=en
CSO www.cso.ie/en/releasesandpublications/ep/p-fwr/forestwoodremovals2021/

2. Biomass use for non-energetic purposes

NutraMara

ALGARAN

Feed supplement

Feedstock: Seaweeds

Self-care products

Fertilizer

Source : Arramara Teoranta www.arramara.ie
Bio-Marine Ingredients Ireland www.biomarine.ie/bio-fertiliser/

Source : Nutramara nutramara.com/
Algaran Seaweed www.seaweedproducts.ie/about-us/

3.Bioenergy policies and status of implementation

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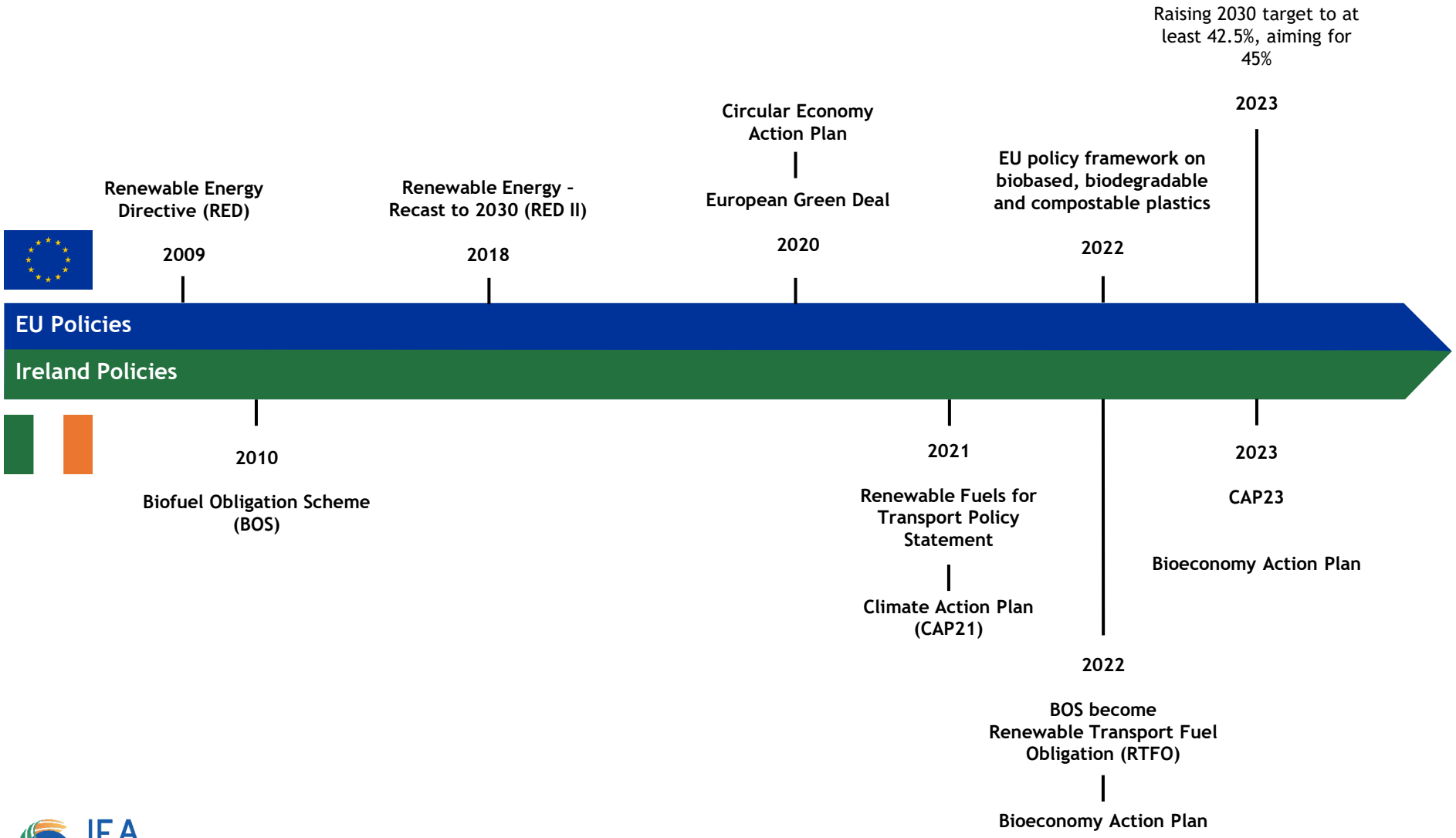

3.1. EU bioenergy policies

Renewable Energy Directive (RED)- 2009

- Objective of 20% of the EU final energy consumption produced from renewable energy sources by 2020.
- Introduction of ILUC Directive in 2015 ('Indirect Land Use Change') to avoid the agricultural expansion on lands with high carbon stock which would lead to additional GHG emissions.

Revised Renewable Energy Directive (RED II) - 2018

- The EU target for renewable energy sources consumption by 2030 has been raised to **32%**.
- Member States must require fuel suppliers to supply a minimum of **14%** of the energy consumed in road and rail **transport** by 2030 as renewable energy. A series of sustainability and GHG emission criteria have been defined so that bioliquids used in transport must comply with to be counted towards the overall 14% target
- Limits have been set for high-risk **ILUC** biofuels. These limits consist of a freeze at 2019 levels for the period 2021-2023, which will gradually decrease from the end of 2023 to zero by 2030.
- **Advanced biofuels** shall represent at least 1% of final energy consumption in 2025 and at least **3,5% in 2030**. Advanced biofuels are biofuels produced from the feedstock listed in Part A of Annex IX of the directive (mainly wastes and by-products).
- The share of biofuels and biogas produced from the feedstock listed in Part B of Annex IX (ie. UCO and tallow) shall be limited to **1,7%** of the energy content of transport fuels supplied.
- The share of biofuels and biogas for transport produced from the feedstock listed in Annex IX may be considered to be twice its energy content.
- The share of biofuels and bioliquids, as well as of biomass fuels consumed in transport, where produced from food and feed crops, shall be no more than one percentage point higher than the share of such fuels in the final consumption of energy in the road and rail transport sectors in 2020 in that Member State, with a maximum of 7 % of final consumption of energy in the road and rail transport sectors in that Member State. Where that share is below 1 % in a Member State, it may be increased to a maximum of 2 % of the final consumption of energy in the road and rail transport sectors (which is the case in Ireland).
- On 30 March 2023, a provisional agreement was reached, for a binding target for 2030 of at least **42.5%**, but aiming for **45%**. Once this process is completed, the new legislation will be formally adopted and enter into force.

Source : European Commission joint-research-centre.ec.europa.eu/welcome-jec-website/reference-regulatory-framework/renewable-energy-recast-2030-red-ii_en

3.1. EU bioenergy policies

European Green Deal -2020

- Aim of no net emissions of greenhouse gases by 2050
- Reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels
- 55% reduction of emissions from cars by 2030. In addition, from 2026, road transport will be covered by emissions trading, putting a price on pollution, stimulating cleaner fuel use, and re-investing in clean technologies.
- New renewable energy target for 2030 : **40%**

Source : European Commission commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal/delivering-european-green-deal_en

Bioeconomy Action Plan – 2018 and Circular Economy Action Plan - 2020

- Strengthen and scale up the biobased sectors, unlock investments and markets : facilitate the deployment of new sustainable biorefineries and develop substitutes to fossil-based materials that are biobased, recyclable and marine biodegradable.
- Deploy local bioeconomies rapidly across the whole of Europe.
- Understand the ecological boundaries of the bioeconomy.

Source : European Commission research-and-innovation.ec.europa.eu/research-area/environment/bioeconomy/bioeconomy-strategy_en
environment.ec.europa.eu/strategy/circular-economy-action-plan_en

EU policy framework on biobased, biodegradable and compostable plastics - 2022

- There is currently no mandatory minimum biobased content nor agreed certification scheme or label for a plastic product to be labelled as biobased.
- In line with the circular economy principles, producers should prioritise the use of organic waste and by-products as feedstock.
- Biomass used to produce biobased plastics must meet the EU sustainability criteria for bioenergy (REDII).
- In line with the cascading use of biomass principle, biomass should be preferably used to produce materials, including plastics, and only in subsidiary order, as a source of bioenergy.

Source : European Commission environment.ec.europa.eu/system/files/2022-12/COM_2022_682_1_EN_ACT_part1_v4.pdf

3.2. Ireland Policies

Renewable Transport Fuel Obligation RTFO (previously Biofuel Obligation Scheme BOS)

- BOS was introduced in 2010 and is administered by **the National Oil Reserves Agency** (NORA). It sets out an obligation that suppliers of road transport fuels must include a certain percentage of environmentally sustainable biofuels across their general fuel mix. It represents the application of the RED and RED II directives in Ireland.
- The scheme works by ensuring that each supplier fulfils their requirement by having the necessary number of biofuel certificates required. This level of obligation has increased over time from an initial rate of 4%.
- Now the obligation is set at **16.985%** of petroleum-based motor fuel (by energy content).
- Since 2022, BOS has become RTFO. The RTFO includes an additional obligation for 'advanced biofuels' and a cap on fuels produced from food and feed crops. 3 types of certificate may be awarded depending on the feedstock used for biofuel production:
  - -Green Certificates for biofuel produced from feedstocks listed in Annex IX Part A of RED II (Advanced biofuels). **0.3%** of the petroleum-based motor fuel placed on the market must be advanced biofuel (advanced biofuel obligation).
  - -Red Certificates for biofuel produce from food and feed. Red Certs are limited to no more than 2 percentage points of an Obligated Party's renewable transport fuel obligation (crop cap).
  - -Orange Certificates for other biofuels.
- There is also a limit on biofuel produced from high ILUC-risk feedstocks. Only those companies that placed high ILUC-risk biofuel on the market in 2019 may do so and the amount is limited to that placed on the market in 2019.
- Two BOS Certs per litre may be claimed for biofuel produced from feedstocks listed in Annex IX of RED II.

Sources: Department of the Environment, Climate and Communications www.gov.ie/en/publication/91f03c-biofuels/
NORA www.nora.ie/rtfo www.nora.ie/administration-of-rtfo www.nora.ie/background-on-the-rtfo

3.2. Ireland Policies

Renewable Fuels for Transport Policy Statement 2021-2023

The Renewable Transport Fuel Policy sets out the pathway for delivery of biofuel targets in Ireland's Climate Action Plan for the transport sector. Rules of RTFO have been driven by this policy statement. The other actions which should be implanted are:

- Ensure that the supply of indigenous and imported biofuels undergoes a rigorous assessment on full life-cycle greenhouse gas emissions reduction and ensure strengthened supervision concerning of the origin of feedstocks for renewable fuels.
- Examine the availability of the UCO and Category 1 and 2 Animal Fats feedstocks, including Ireland's share of international stocks, and consider whether to seek European approval to raise the 1.7% limit.
- Incentivise the transition to E10.
- Expand the biofuel obligation to the rail sector from 2024.
- Support the deployment of alternative fuels such as CNG, LNG, LPG and green hydrogen : develop CNG fuelling network (Causeway and Green Connect projects), Alternatively Fuelled Heavy-Duty Vehicle (AFHDV) grant, expansion of the Accelerated Capital Allowance scheme for natural gas propelled vehicles and related equipment to include hydrogen vehicles and equipment.
- A category for certain renewable fuels called 'Development Renewable Fuels' will be added to the scheme and multiple credit will be awarded to incentivise their deployment Green Hydrogen x4, Biomethane x1.5x, Hydrotreated Vegetable Oil/Hydro processed Esters and Fatty Acids (HVO/HEFA) and other approved sustainable aviation fuels x1.5, Renewable Fuels of Non-Biological Origin (RFNBOs) and certain other renewable fuels used in the aviation or maritime sectors x1.2).

Sources: Department of Transport www.gov.ie/en/policy-information/168c6-renewable-fuels-for-transport-policy-statement/

Consultation on the Draft Renewable Transport Fuel Policy Statement 2023-2025

- The consultation is being reviewed and concerns the supply of renewable transport fuels and a suite of proposed actions over the next two years concerning the renewable transport fuel obligation (RTFO)

Source: Department of Transport www.gov.ie/en/consultation/7bd61-consultation-on-the-draft-renewable-transport-fuel-policy-statement-2023-2025/

3.2. Ireland Policies

Climate Action Plan (CAP) – 2019, 2021 and 2023

- The first CAP was published in 2019 and has been updated twice, in 2021 and 2023, they provide a detailed plan for taking decisive action to achieve a 51% (relative to 2018 levels) reduction in overall greenhouse gas emissions by 2030 and reach net zero no later than 2050.
- Objective of 10% of bioethanol blended into petrol (E10) and 12% of biodiesel in diesel (B12) in 2025 (share in volume). E10 and B20 for 2030. Now the share in volume is 7% of biodiesel and 5% of bioethanol.
- Develop the indigenous biomethane sector through anaerobic digestion, with the aim of producing 1 TWh of biomethane by 2025 and 5.7 TWh of biomethane by 2030.

Sources: Department of the Environment, Climate and Communications www.gov.ie/en/publication/7bd8c-climate-action-plan-2023/

Bioeconomy Action Plan 2023-2025

- A national action plan for the bioeconomy for the period 2023-2025 is currently being prepared. A stakeholder consultation has taken place and the plan is in preparation.

Sources: Department of the Environment, Climate and Communications www.gov.ie/en/consultation/fd200-bioeconomy-action-plan-consultation/

Impact of RED II on Ireland

- RED II sets a limit of 1.7% for biofuels produced from UCO and tallow, but almost all biodiesel is produced from these feedstocks in Ireland. The Department of Transport is asking the European Commission for a derogation from this limit.

Sources: A Review of Requirements and Constraints on Biofuels in Ireland Arising from RED II and National Targets assets.gov.ie/236620/2bc87dee-edf4-45e6-a342-b74cf71d5e21.pdf

Public Consultation on the Renewable Fuels for Transport Policy www.gov.ie/en/consultation/334b9-consultation-on-the-renewable-fuels-for-transport-policy/

4. Research focus related to bioenergy and biorefining

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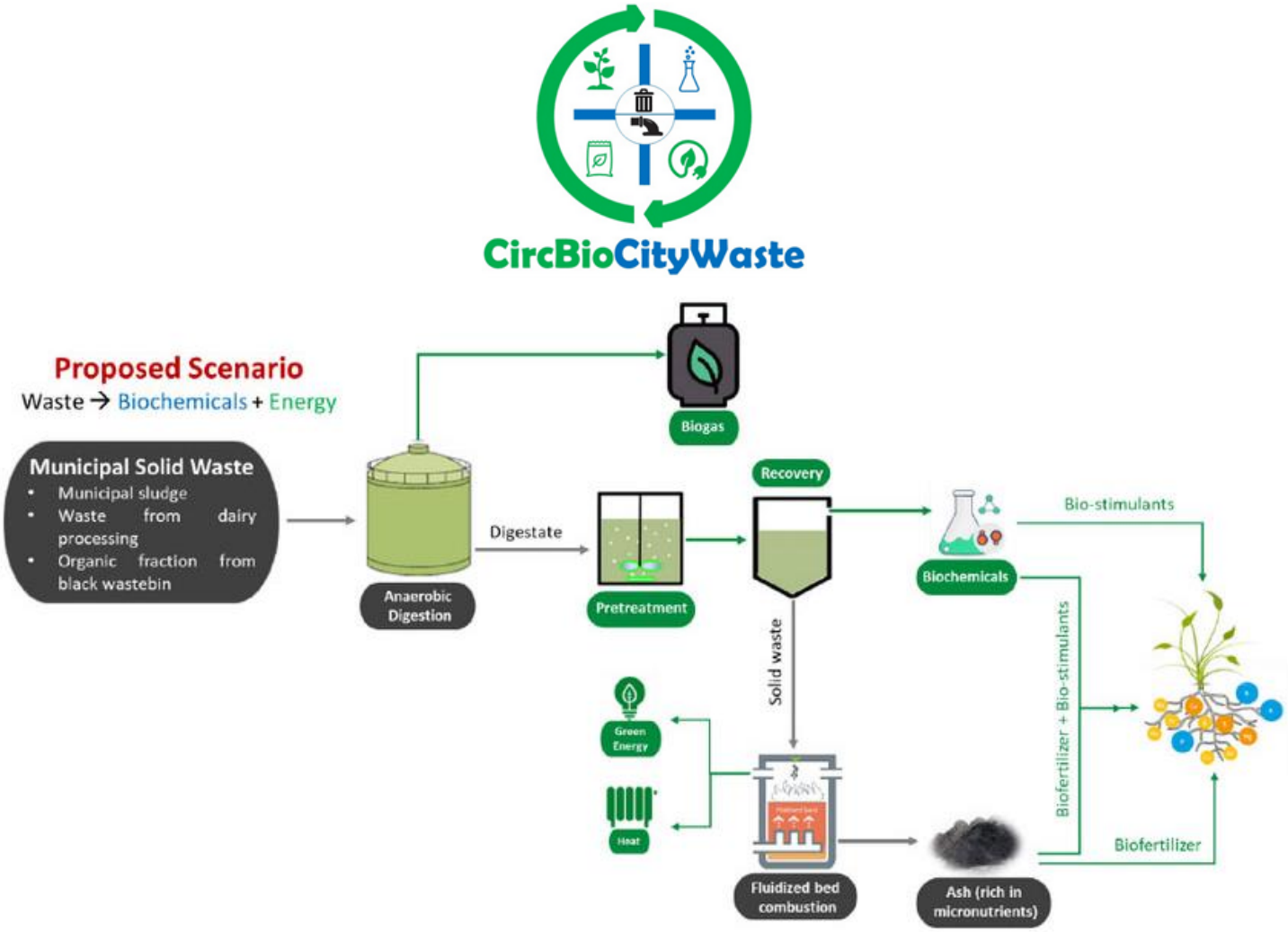


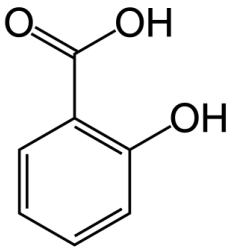
Source: CIRCBIO circbio.ie/projects/national/circbiocitywaste/

4. Research focus related to bioenergy and biorefining

Interreg North-West Europe BIOWILL
European Regional Development Fund

Willow

Bark



Medical applications

Salicylates

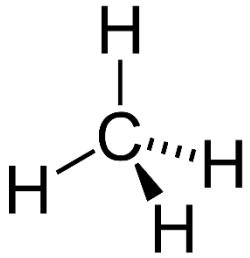
Bark residue and bark-free pulp

Packaging material

Hydrolysis

Anaerobic digestion

Biogas



Heating applications

Source: MaREI www.marei.ie/project/biowill/

4. Research focus related to bioenergy and biorefining

Project name	Description	Funding Source	Coordinator
CircBioCityWaste	AD Use of city waste as feedstock for producing biogas and fertilizer	(EPA) Environmental Protection Agency and Department of Food, Agriculture and the Marine	CIRCBIO
BioWILL	Use of willow bark to produces salicylates anf biomaterial for packaging	EU Funding	University College Cork
EXPECT	Two-stage AD for production of volatil fatty acids and biomethane	Teagasc	Teagasc
OF-PYR	Use of oganic Fraction Municipal Solid Waste (OFMSW) and sewage sludge for production of syngas and char by pyrolysis	EPA	tcbb RESOURCE
Sustainable Nitrogen	Investigate specific technology adaptations required to optimise energy recovery from nitrogen-charged solids via anaerobic digestion (AD) or advanced thermal technologies and investigate measures required to convert recovered nitrogen and phosphorus (P) into fertilisers	EPA	tcbb RESOURCE and NUI Galway
Graze Project	Central grid injection of biomethane	(DECC) Department of the Environment, Climate and Communications	Gas Networks Ireland
Grow Green, Burn Blue	Production of intermediate bioenergy carriers from Irish non-forestry biomass for use in renewable district heating systems, and value-added co-products using a novel continuous pyrolysis process	SEAI (Sustainable Energy Authority Of Ireland)	CIRCBIO

Sources at the end of the report

5. Biorefining related funding

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SEAI (Sustainable Energy Authority of Ireland)**:** Around €55 million in funding for energy research (including biorefining) and 200 innovative projects between 2018 and 2022.

Source: SEAI www.seai.ie/grants/research-funding/research-development-and-demonstration-fund/Webinar-2023-Call-Launch-Wednesday-April-5th-2023.pdf

SFI-BiOrbic (Science Fundation Ireland-Bioeconomy Research Centre)

SFI- MAREI(Marine and Renewable Energy Research)

tcbb RESOURCE

EPA (Environmental Protection Agency): €13.6M project funding divided into 4 main themes including “Circular Economy” (€2.5M) in 2022.

Source: EPA www.epa.ie/publications/research/epa-research-2030/EPA-Research-2030_Action-Plan-2023.pdf

6. Commercial biorefineries

6.1 Commercial biorefineries : Biodiesel production

Biodiesel

Feedstock: Mainly Used cooking oil and tallow.

Usual by-Product: Glycerine and Fertilizer.

GREEN BIOFUELS IRELAND
Creating Positive Energy

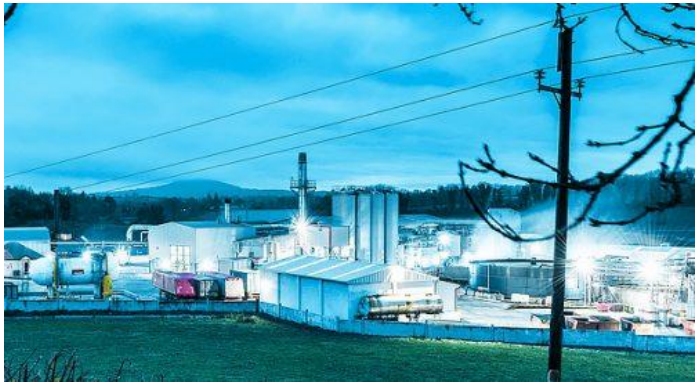
New Ross, Co. Wexford

Production: 40m litres/year (≈31 ktoe/year)

college GROUP

Nobber, Co. Meath

Production: 30m litres/year (≈23 ktoe/year)



6.2 Commercial biorefineries : Bioethanol production

Bioethanol

CARBERY

Production: 12 million litres/year
(≈6 ktoe/year)

Feedstock: Whey permeate

Usual by-Product: Organic Fertiliser (15,000 tonnes/year)

Location: Ballineen, Co. Cork

Source : Carbery www.carbery.com/sustainability/our-environment/

6.3 Commercial biorefineries : Biogas production

Biogas

Usual by-Product: Organic Fertiliser

Biogas for electricity production

Company	Feedstock	Location
Greenville Energy LTD	Waste	Newtownstewart, Omagh (Nothern Ireland)
Ormonde Organics	Waste	Portlaw, Co. Waterford Ireland
Stream Bioenergy	Domestic/commercial food waste, industrial organics from the food and beverage processing industry, sewage sludge from municipal wastewater treatment plants, garden waste, and organic residues and animal manures/slurries	Ballymena (Northern Ireland)
Glenmore farming group	Food waste dairy waste and animal manures	Ballybofey, Co. Donegal
BEOFS	Agricultural Waste	Callan, Co. Kilkenny, Ireland.
Rockbrook A.D Limited	-	Ballyroan, Co. Laois
Biocore	Energy crops	Tibohine, Co Roscommon
Granville Ecopark Ltd	Waste	Tyrone, Northern Ireland

Biogas for other purposes

Company	Feedstock	Production	Location
Green Gas Generation	Agricultural (cattle and pig slurry, manure, feed waste and bedding) and food waste (Industrial, commercial and domestic). Crops (maize silage, grass silage and whole crop cereals)	Biomethane for injection into natural gas grid and electricity generation	Nurney, Co. Kildare
Genos Resources plc	Agricultural Waste	Green H2 and electricity production from biogas	Sandyford, Co. Dublin

Sources at the end of the report

7. Regional initiatives

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Project name	Description	Location
Moy Valley Biogas	AD plant	Swinford, Co.Mayo
Anaerobic Digestion Plant - Teagasc Grange	AD plant	Grange Farm, Co Meath
Small Biogas Demonstration Project	Stimulate the deployment of innovative on-farm small-scale biogas production by providing support and a capital contribution to three demonstration projects.	-

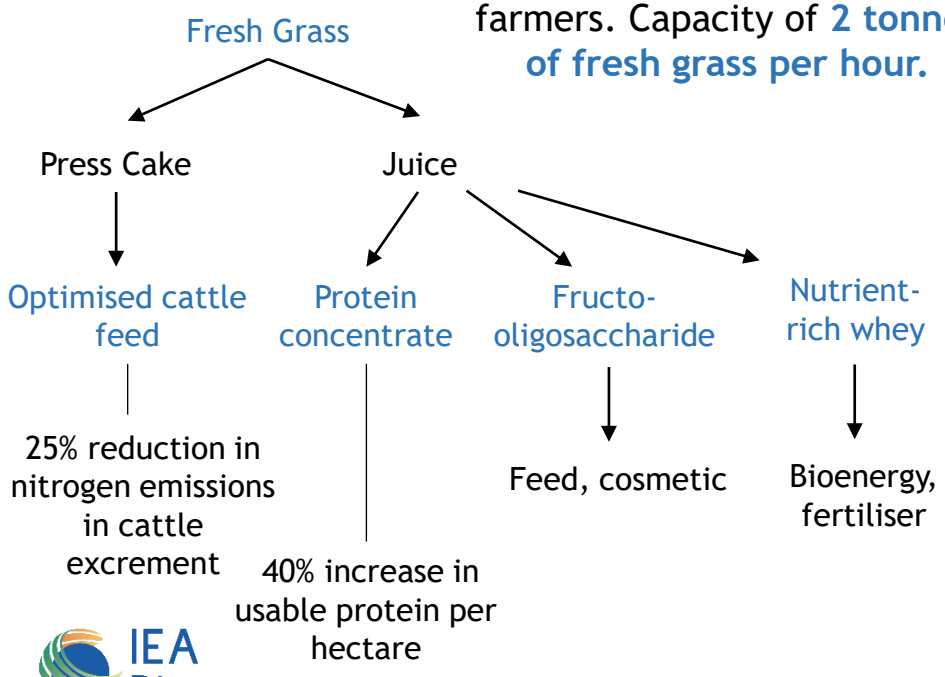
Sources at the end of the report

8. Demo/pilot plants

8. Demo/pilot plants

BIOREFINERY GLAS

Small-scale biorefinery for farmers. Capacity of **2 tonnes of fresh grass per hour.**

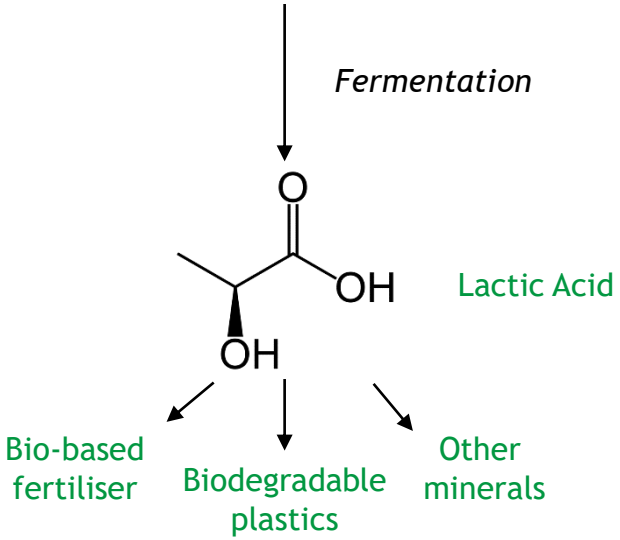


Source : Biorefinery Glas biorefineryglas.eu/

AgriChemWhey

Demo scale: **75 tons/year** capacity.
Objective: **20,000 /year** capacity.

Whey Permeate and De-lactosed Whey Permeate
(by-products of dairy processing)



Source : AgriChemWhey www.agrichemwhey.com/

8. Demo/pilot plants

Project name	Description
Biorefinery Glas	Small-scale biorefinery for farmers
AgriChemWhey	Use of dairy by-product (whey permeate and Delactosed whey permeate) for production of lactic acid.
H2AD (commissioned)	AD Uses of a semi-continuous flow process for biogas production. Reaction time shorter than 72 hours at low temperature (10 times faster than conventional AD processes)
SLURRES PILOT	Pyrolysis for production of syngas and biochar form slurry. Recovery of N and P.

Sources at the end of the report

9. Major innovation activities

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Project name	Description	Funding Source	Coordinator
Chemical conversion/applications of lactose	Use the milk sugar lactose, a low-value waste product of the dairy industry, to build chemicals that can support modern medicine.	BiOrbic Bioeconomy SFI Research Centre	University College Dublin
Carbon dioxide as feedstock		BiOrbic Bioeconomy SFI Research Centre	University College Dublin
Use of biomass-derived gases as feedstock materials forsynthetic chemistry	Investigate the use of CO2 and syngas (H2/CO) produced from biomass in metal-catalysed	BiOrbic Bioeconomy SFI Research Centre	University College Dublin
Bio-based and compostable polymer composites	Development of nano bio-based polymer	BiOrbic Bioeconomy SFI Research Centre	Trinity College Dublin
Biological conversion (systems and synthetic biology)		BiOrbic Bioeconomy SFI Research Centre	University College Dublin
Novel membrane fabrication for the upgrading of gasification products		BiOrbic Bioeconomy SFI Research Centre	Trinity College Dublin
Frontier technology for biomass pre-treatment to increase substrate availability for bioconversion processes		BiOrbic Bioeconomy SFI Research Centre	University College Dublin
Sustainable Nitrogen	Investigate specific technology adaptations required to optimise energy recovery from nitrogen-charged solids via anaerobic digestion (AD) or advanced thermal technologies and investigate measures required to convert recovered nitrogen and phosphorus (P) into fertilisers	EPA (Environmental Protection Agency)	tcbb RESOURCE and National University of Ireland, Galway
Newtrients		EPA	UCC

Sources at the end of the report

9. Major innovation activities

Project name	Description	Funding Source	Coordinator
CABBBIE : Developing Cascading Biomethane Biochemicals and Biofertiliser Systems for a Circular Bioeconomy in Ireland	Production of photosynthetic biogas by an algae : Cascading Algal Biomethane Biorefinery System (CABBS)	SEAI (Sustainable Energy Authority Of Ireland)	University College Cork
EirAlgae: Exploring the synergies between anaerobic digestion and microalgae for the development of energy independence, food security and carbon neutrality in Ireland	Using Nannochloropsis to valorise AD waste into ω-3 PUFAs and protein for feed application.	SEAI	University College Dublin
ADED: Integration of anaerobic digestion (AD) and electrodialysis (ED) for methane yield promotion and ammonia in-situ recovery	High methane recovery through electrodialysis technology	SEAI	National University of Ireland, Galway
A novel technology to maximise biofuel production efficiency.	Developement and implementation of an additive for ethanol manufacturing to ensure ethanol can be produced more cost effectively and with less environmental impact for applications in biofuel production	SEAI	Nektr technologies and University College Dublin
GEBTech Plus - Green Energy Boosting Technology for Sustainable Pig Production	Enhances the energy potential of stored pig manure and slurry when used as a feedstock for anaerobic digestion	SEAI	GlasPort Bio Limited
Developing an economically viable dark fermentation process for biohydrogen production from Irish whiskey distillery and dairy industry wastes.	Investigating dark fermentation	SEAI	University College Cork
Development of a novel methanogenic biotechnology incorporating conductive carriers for the efficient recovery of energy from wastewater	Developing a novel highly-efficient anaerobic methanogenic biotechnology	SEAI	National University of Ireland, Galway
STEAM: Sequential Temperature-phased Enhanced Anaerobic digestion using Microbes and Enzymes	Developing a cost-effective technology for the efficient conversion of farm-animal waste and surplus grass silage to biogas.	SEAI	University College Cork
Developing Economic solutions for on-farm Anaerobic Digestion technologies under Irish conditions (EcoAD)	Developing economic solutions for future on-farm anaerobic digestion technologies using typical Irish farm-based feedstocks	SEAI	University College Cork
GEBTechTM (Green Energy Boosting Technology): A novel treatment for farm slurries to reduce greenhouse gas emissions and to generate energy	Additive to reduce natural decomposition and methane emissions from stored slurry and manures, thus significantly increasing the energy potential of these materials when used as a feedstock for anaerobic digestion (AD).	SEAI	Westway Health
BIO-RPISM: biofuel production, digestate purification and CO2 sequestration with highly productive auto-floating microalgae technology	Developing novel microalgae derived biofuels technologies	SEAI	National University of Ireland Galway

10. Major stakeholders

10. Major stakeholders

Governmental organisations

Name	Website
SEAI	https://www.seai.ie/
EPA	https://www.epa.ie/
NORA	https://www.nora.ie/
Department of the Environment, Climate and Communications	https://www.gov.ie/en/organisation/department-of-the-environment-climate-and-communications/
Department of Transport	https://www.gov.ie/en/organisation/department-of-transport/
Department of Agriculture Food and the Marine	https://www.gov.ie/en/organisation/department-of-agriculture-food-and-the-marine/
Teagasc	https://www.teagasc.ie/

Non-governmental organisations

Name	Website
Irish Bioeconomy Foundation	https://bioeconomyfoundation.com/
Ireland Bioenergy Association	https://www.irbea.org/
tcbb RESOURCE	http://www.tcbbresource.ie/

Universities & Research Institutes

Name	Website
SFI-BiOrbic	https://biorbic.com/
SFI- MAREI	https://www.marei.ie/
University College Dublin	https://www.ucd.ie/
University College Cork	https://www.ucc.ie/en/
National University of Ireland, Galway	https://www.universityofgalway.ie/
Trinity College Dublin	https://www.tcd.ie/
University of Limerick	https://www.ul.ie/
CIRCBIO (Munster Technological University)	https://circbio.ie/

10. Major stakeholders

Companies

Name	Website
Green Biofuels Ireland	https://gbi.ie/
College Biofuels	http://collegegroup.ie/
Carbery	https://www.carbery.com/
Green Gas Generation	https://greengeneration.ie/
Genos Resources plc	https://www.genos.ie/
Greenville Energy LTD	https://greenvilleenergy.com/
Ormonde Organics	http://www.ormondeorganics.ie/
Stream Bioenergy	http://streambioenergy.ie/
Glenmore farming group	https://glenmoreestate.com/renewable-energy/
BEOFS	https://beofs.ie/
Rockbrook A.D Limited	https://www.ifsa.eu.com/rockbrook-ad-limited.html
Biocore	https://www.biocore.net/
Granville Ecopark Ltd	https://bio-capital.co.uk/portfolios/granville-eco-park/
Nutramara	https://nutramara.com/
Bio-Marine Ingredients Ireland	https://www.biomarine.ie/
Algaran Seaweed	https://www.seaweedproducts.ie/about-us/
Arramara Teoranta	https://www.arramara.ie/

Sources

Sources of slide 20 (4. Research focus…)

Project name	Source
CircBioCityWaste	https://circbio.ie/projects/national/circbiocitywaste/
BioWILL	https://www.marei.ie/project/biowill/ https://www.nweurope.eu/projects/project-search/biowill/#tab-1
EXPECT	https://www.marei.ie/project/expect/
OF-PYR	http://www.tcbbresource.ie/of-pyr-project
Sustainable Nitrogen	http://www.tcbbresource.ie/sustainable-nitrogen
Graze Project	https://www.gasnetworks.ie/business/renewable-gas/mitchelstown/
Grow Green, Burn Blue	https://circbio.ie/projects/national/grow-green-burn-blue/

Sources of slide 26 (6.3 Commercial biorefineries : Biogas production)

Biogas for electricity production

Company	Sources
Greenville Energy LTD	https://greenvilleenergy.com/
Ormonde Organics	http://www.ormondeorganics.ie/
Stream Bioenergy	http://streambioenergy.ie/
Glenmore farming group	https://glenmoreestate.com/renewable-energy/
BEOFS	https://beofs.ie/
Rockbrook A.D Limited	https://www.ifsa.eu.com/rockbrook-ad-limited.html
Biocore	https://www.biocore.net/
Granville Ecopark Ltd	https://greenvilleenergy.com/

Biogas for other purposes

Company	Sources
Green Gas Generation	https://greengeneration.ie/
Genos Resources plc	https://www.genos.ie/

Sources of slide 28 (7. Regional initiatives)

Project name	Sources
Moy Valley Biogas	https://agribiogas.ie/
Anaerobic Digestion Plant - Teagasc Grange	https://www.teagasc.ie/animals/beef/grange/beef2022-open-day/anaerobic-digestion-plant-/
Small Biogas Demonstration Project	https://www.irbea.org/farmbiogas/

Sources of slide 31 (8. Demo/pilot plants)

Project name	Sources
Biorefinery Glas	biorefineryglas.eu/
AgriChemWhey	ww.agrichemwhey.com/
H2AD (commissioned)	https://h2ad.org.uk/ https://www.irbea.org/h2ad-project/
SLURRES PILOT	www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/slurres-pilot http://www.tcbbresource.ie/slurres-pilot

Sources at the end of the report

Sources of slide 33 (9. Major innovation activities)

Project name	Sources
Chemical conversion/applications of lactose	https://biorbic.com/research/
Carbon dioxide as feedstock	https://biorbic.com/research/
Use of biomass-derived gases as feedstock materials forsynthetic chemistry	https://biorbic.com/research/
Bio-based and compostable polymer composites	https://biorbic.com/research/
Biological conversion (systems and synthetic biology)	https://biorbic.com/research/
Novel membrane fabrication for the upgrading of gasification products	https://biorbic.com/research/
Frontier technology for biomass pre-treatment to increase substrate availability for bioconversion processes	https://biorbic.com/research/
Sustainable Nitrogen	http://www.tcbbresource.ie/sustainable-nitrogen
Newtrients	https://www.ucc.ie/en/newtrients/about/ https://www.epa.ie/publications/research/circular-economy/research-411-innovative-valorisation-of-dairy-processing-wastewater-using-a-circular-economy-approach-newtrients.php

Sources of slide 34 (9. Major innovation activities)

Project name	Sources
CABBBIE : Developing Cascading Biomethane Biochemicals and Biofertiliser Systems for a Circular Bioeconomy in Ireland	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/developing-cascading-biomethane-biochemicals-and-biofertiliser-systems-for-a-circular-bioeconomy-in-ireland-cabbbie#project-description
EirAlgae: Exploring the synergies between anaerobic digestion and microalgae for the development of energy independence, food security and carbon neutrality in Ireland	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/eiralgae:-exploring-the-synergies-between-anaerobic-digestion-and-microalgae-for-the-development-of-energy-independence,-food-security-and-carbon-neutrality-in-ireland
ADED: Integration of anaerobic digestion (AD) and electrodialysis (ED) for methane yield promotion and ammonia in-situ recovery	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/aded:-integration-of-anaerobic-digestion-ad-and-electrodialysis-ed-for-methane-yield-promotion-and-ammonia-insitu-recovery
A novel technology to maximise biofuel production efficiency.	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/a-novel-technology-to-maximise-biofuel-production-efficiency
GEBTech Plus - Green Energy Boosting Technology for Sustainable Pig Production	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/gebtech-plus--green-energy-boosting-technology-for-sustainable-pig-production
Developing an economically viable dark fermentation process for biohydrogen production from Irish whiskey distillery and dairy industry wastes.	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/developing-an-economically-viable-dark-fermentation-process-for-biohydrogen-production-from-irish-whiskey-distillery-and-dairy-industry-wastes
Development of a novel methanogenic biotechnology incorporating conductive carriers for the efficient recovery of energy from wastewater	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/development-of-a-novel-methanogenic-biotechnology-incorporating-conductive-carriers-for-the-efficient-recovery-of-energy-from-wastewater
STEAM: Sequential Temperature-phased Enhanced Anaerobic digestion using Microbes and Enzymes	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/sequential-temperaturephased-enhanced-anaerobic-digestion-using-microbes-and-enzymes-steame
Developing Economic solutions for on-farm Anaerobic Digestion technologies under Irish conditions (EcoAD)	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/developing-economic-solutions-for-onfarm-anaerobic-digestion-technologies-under-irish-conditions-ecoad
GEBTechTM (Green Energy Boosting Technology): A novel treatment for farm slurries to reduce greenhouse gas emissions and to generate energy	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/gebtechtm-green-energy-boosting-technology:-a-novel-treatment-for-farm-slurries-to-reduce-greenhouse-gas-emissions-and-to-generate-energy
BIO-RPISM: biofuel production, digestate purification and CO2 sequestration with highly productive auto-floating microalgae technology	https://www.seai.ie/data-and-insights/seai-research/research-database/research-projects/details/biorpism:-biofuel-production,-digestate-purification-and-co2-sequestration-with-highly-productive-autofloating-microalgae-technology

Thank you to all those who helped supply the information contained in this report.

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