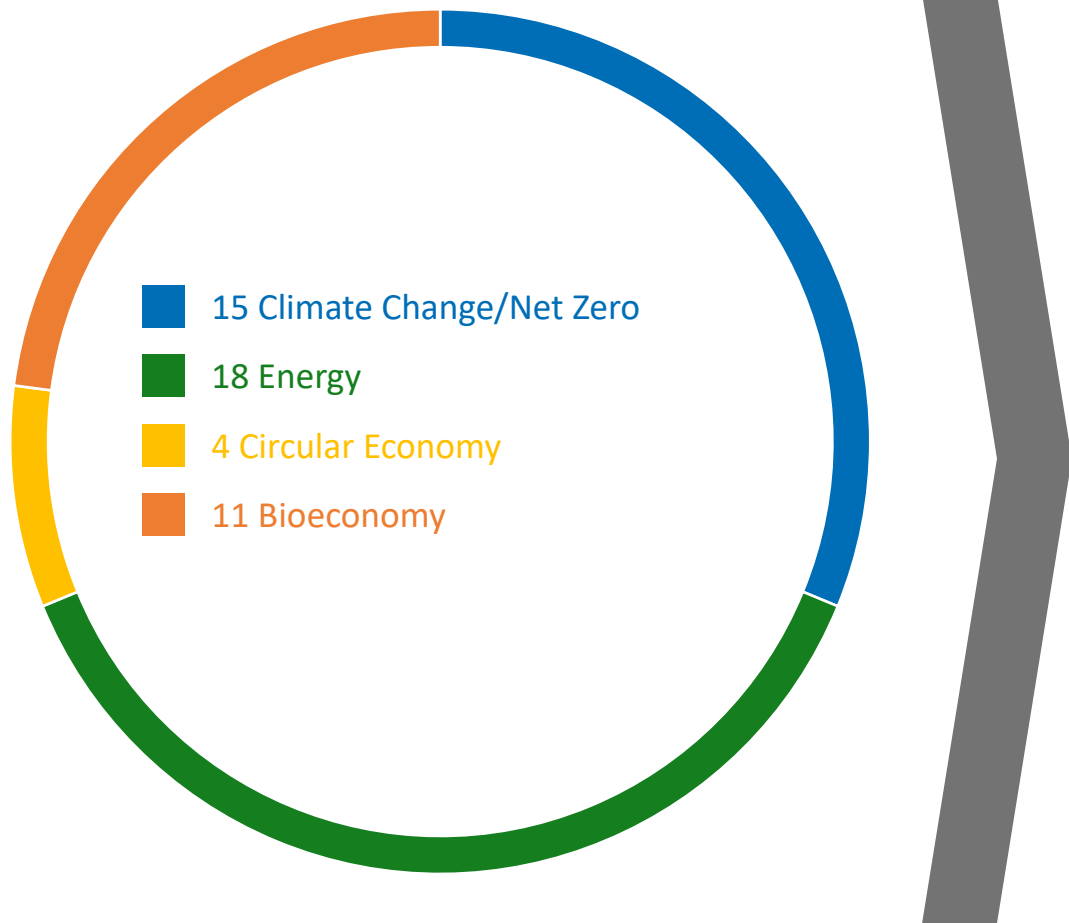








MISSION
INNOVATION

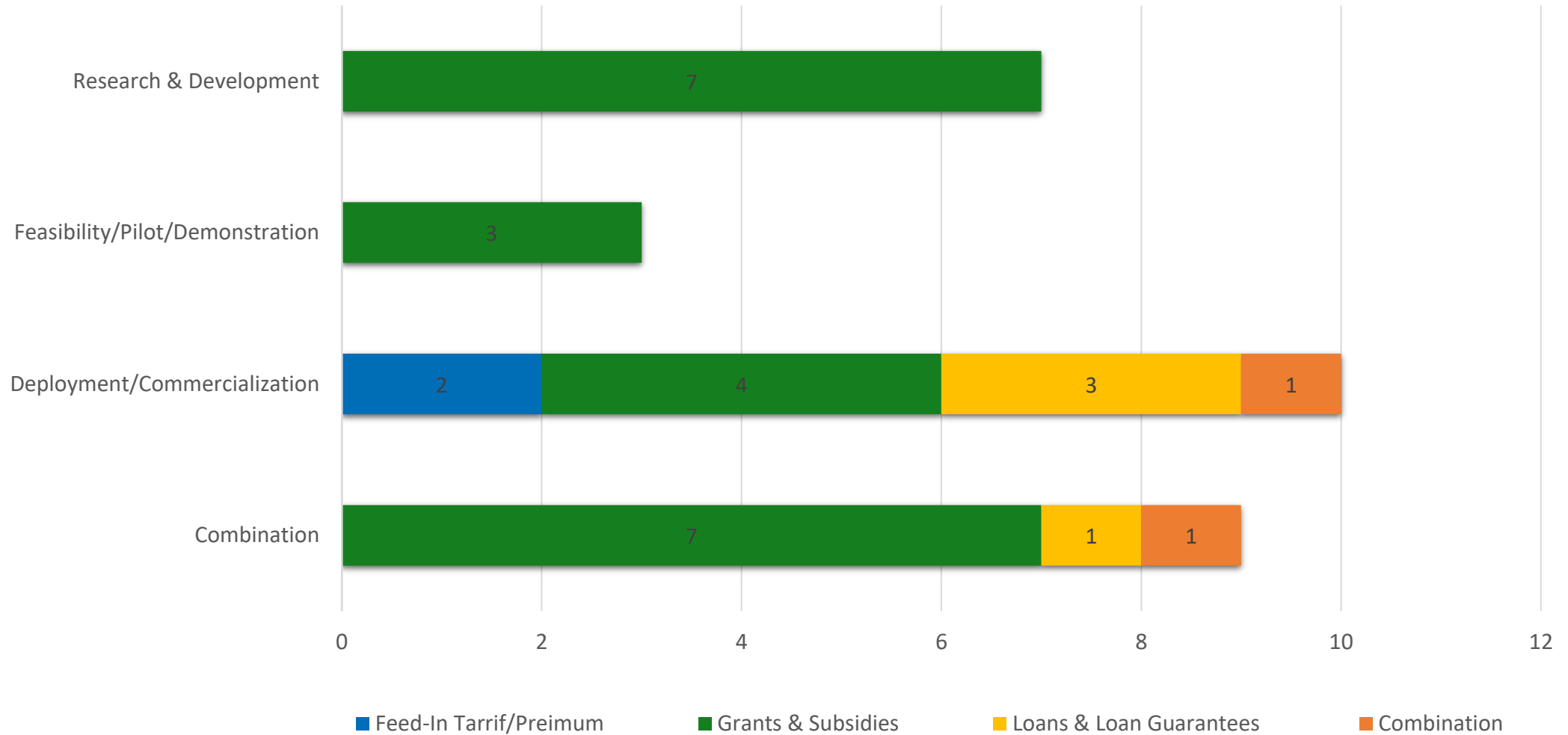
Integrated Biorefineries Mapping Results

National Policies



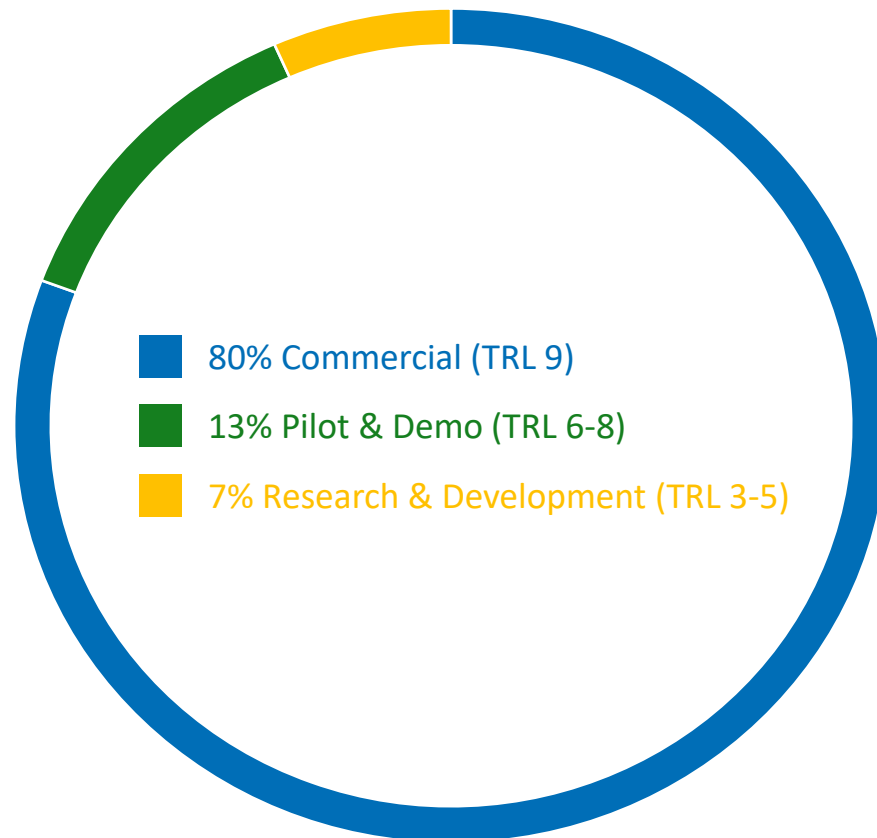
	Climate Change/Net Zero National policies and legislation acknowledging climate change and targeting Net Zero emissions by 2050
	Energy Most energy policies focusing on low carbon/clean fuels (i.e. transportation, industry, hydrogen, low-carbon fuels)
	Circular Economy Focus primarily on reducing waste and acknowledge importance of sustainable materials.
	Bioeconomy Focus on use of biomass broadly to decarbonize energy, materials and chemicals, while acknowledging sustainable limits to biomass use.

National Programs



National Pilot/Demo/Commercial Projects

Total Number of Projects: 1,492



Projects by the Numbers

1,200
Commercial

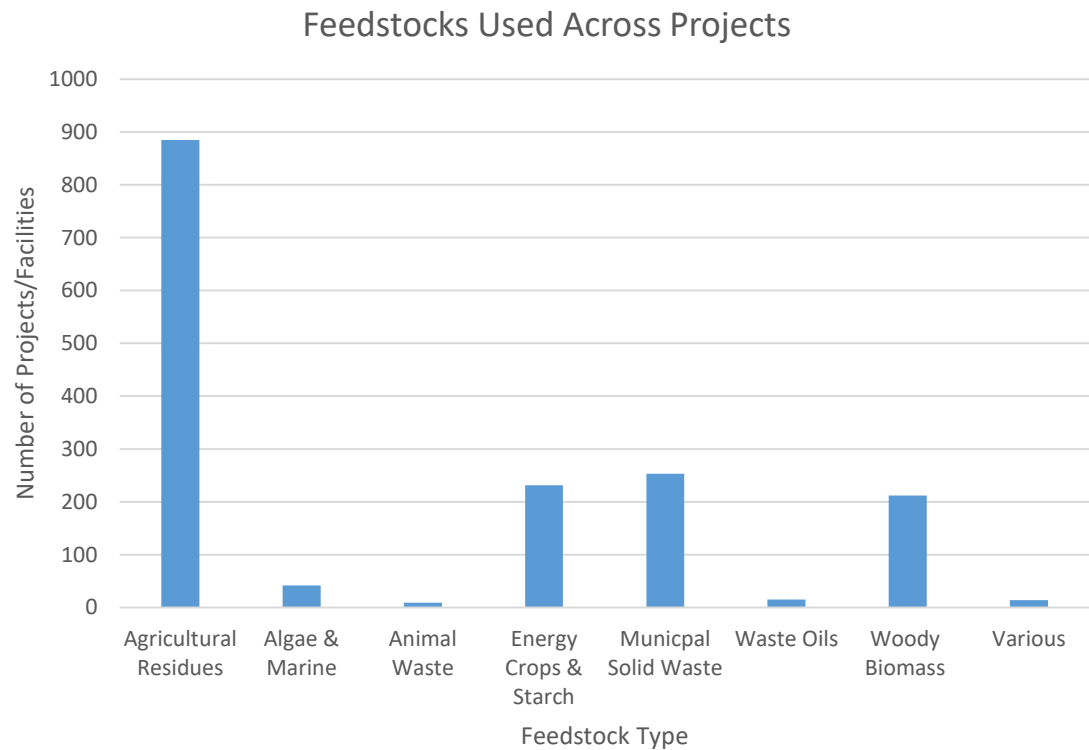
189
Pilot & Demo

103
R&D

Executive Summary

- Commercial projects primarily EU based.
- Pilot and demo projects primarily in India, Canada, Brazil.
- UK projects primarily research & development.
- Similar number of research and development projects across all member countries.

Overview: Feedstocks Used Across Projects



Agricultural Residues

Combination of biofuels (e.g. ethanol) and biochemicals (i.e. range of chemicals for bioplastics)

Energy Crops

Combination of biofuels (i.e. ethanol & methanol) and biochemicals (i.e. range of chemicals for plastics and fertilizer)

Municipal Solid Waste

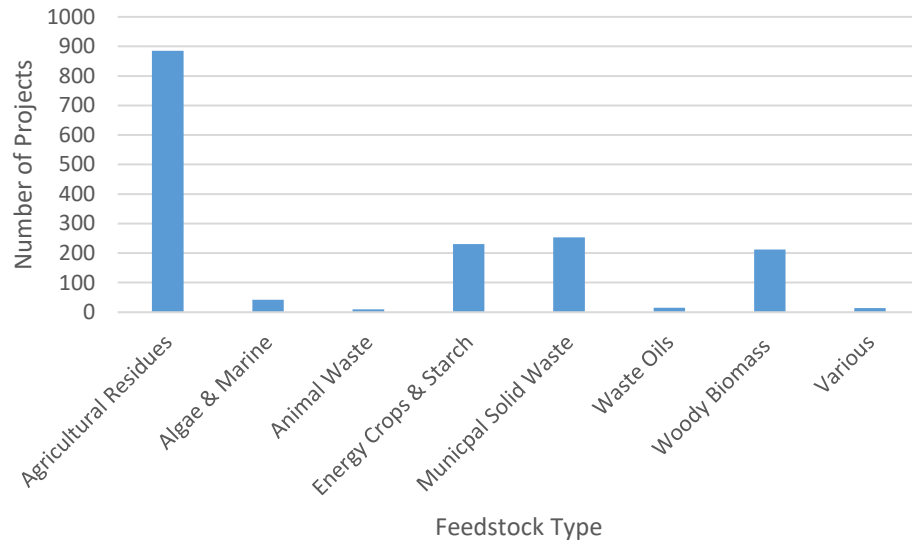
Combination of biofuels (i.e. ethanol & methanol) and biochemicals (i.e. range of chemicals for plastics and fertilizer)

Woody Biomass

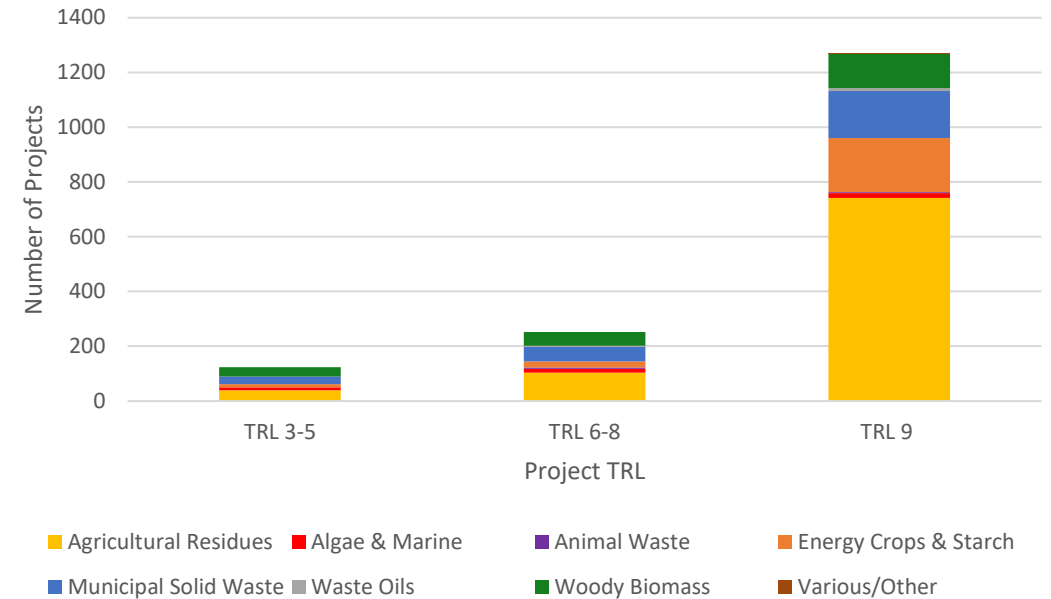
Primarily biofuels with some higher value biochemicals and biomaterials

Feedstocks Used Across Projects

Feedstocks Used Across Projects



Feedstocks Used Across Projects by TRL



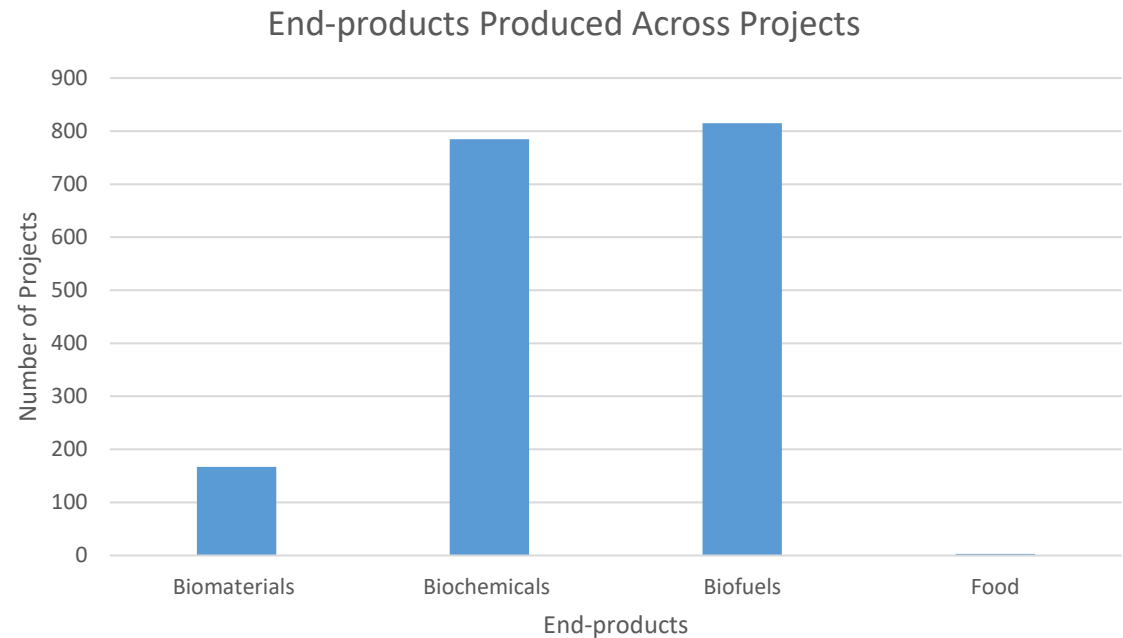
Highlights

- Agricultural residues account for 53% of feedstock used in projects.
- Municipal solid waste, energy crops, and woody biomass make up 42% of feedstock used in projects.

Highlights

- Agriculture residues make up largest share of feedstock used across all projects (31-58%).
- Municipal solid waste, energy crops and woody biomass are next largest groups of feedstocks used across all projects, with variation in use depending on TRL.
- Animal waste least used feedstock across all projects.

Overview: End-products Produced Across Projects



Biomaterials

Primarily fibres for use in packaging (e.g. food packaging, fibre-based single-use paper plates)

Biochemicals

Primarily chemicals for use in plastic production (e.g. Ethylene, Furandicarboxylic acid, Xylose, Benzene)

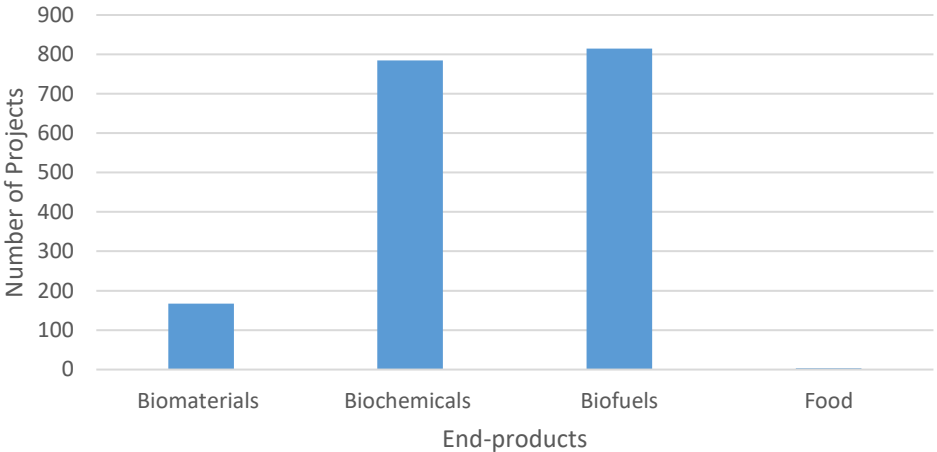
Biofuels

Split between liquid and gaseous fuels:

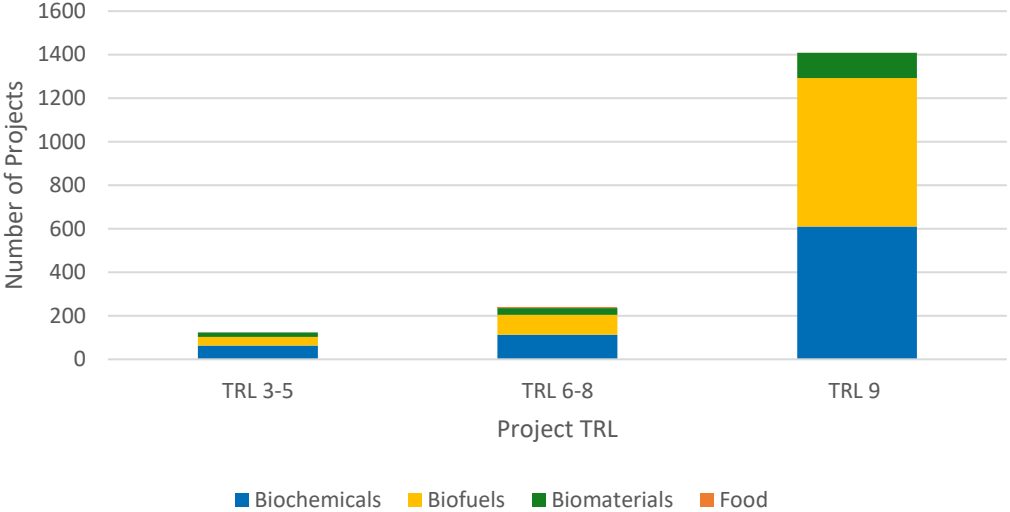
- Liquid fuels consist primarily of ethanol, renewable diesel and SAF.
- Gaseous fuels consists primarily of biomethane.

End-products Produced Across Projects

End-products Produced Across Projects



End-products Produced Across Project TRL



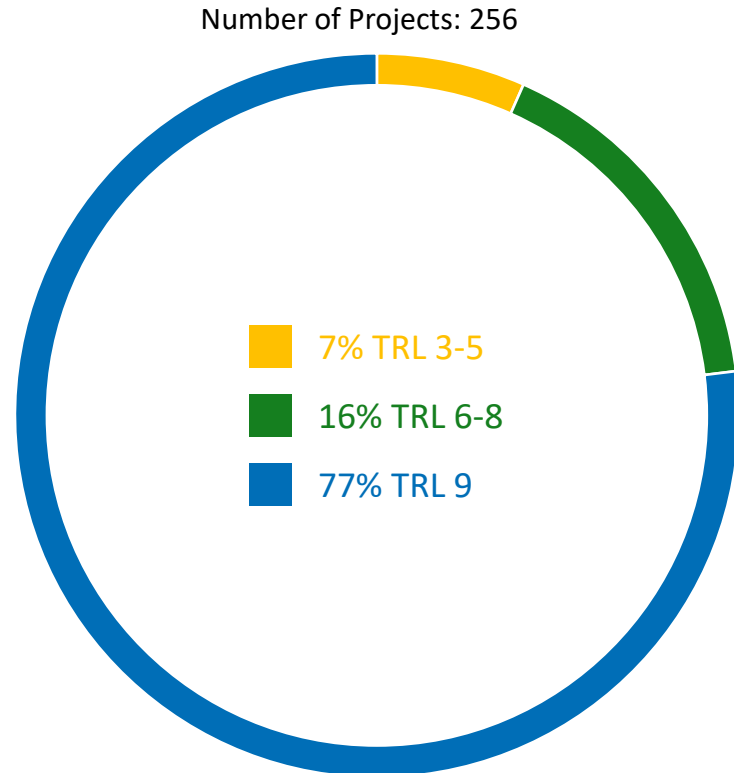
Highlights

- Biofuels (46%) and biochemicals (44%) make up almost all end-products produced.
- Biomaterials remaining 10% of end-products produced.

Highlights

- Biofuels and biochemicals make up majority of end-products across all projects.
 - Biofuels make up largest share (49%) in TRL 9 projects.
 - Biochemicals make up largest share in TRL 6-8 (47%) & 3-5 projects (52%).
- Biomaterials under 1/5 of end-products produced across each TRL.

Overview: Co-production Projects



*Producing two or more different end-products (i.e. biofuel, biochemical, biomaterial, food)



Projects by the Numbers

197
Commercial

42
Pilot & Demo

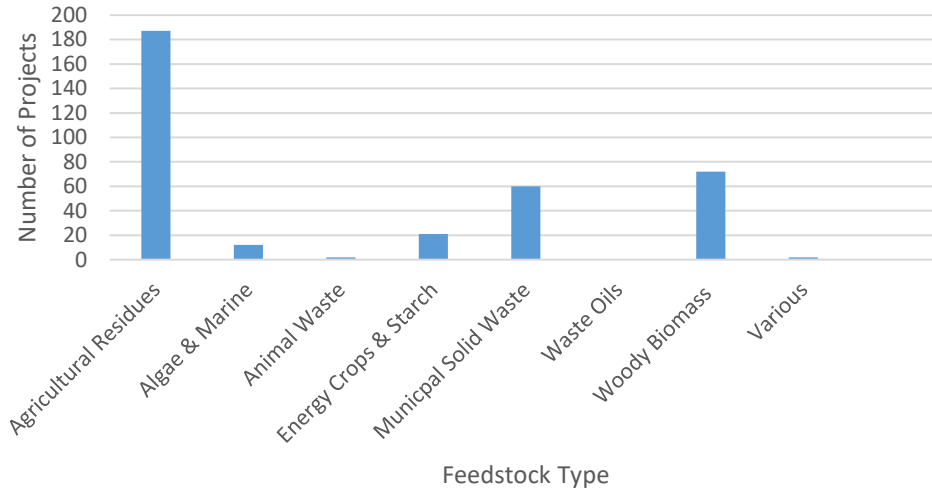
17
R&D

Executive Summary

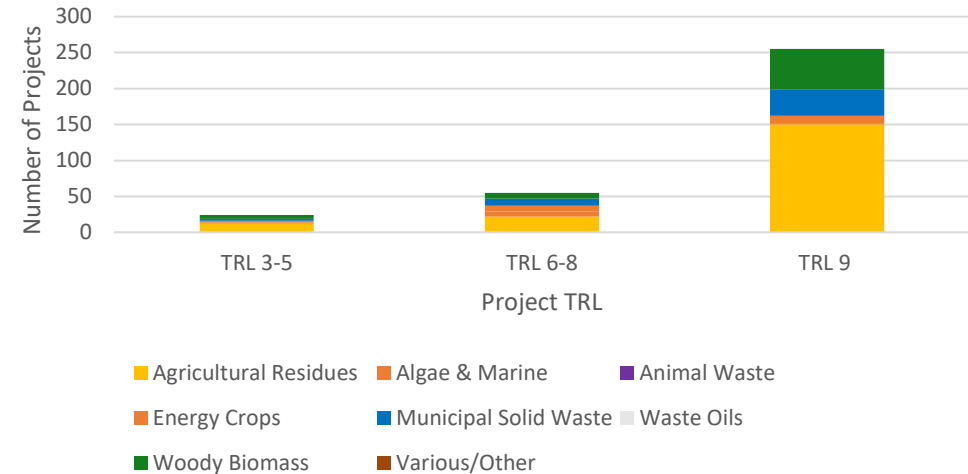
- 95% of co-production projects Europe-based.
- Largest share of co-producing projects at TRL 6-8 in non-European Union countries located in Canada and India.
- Largest share of co-producing projects at TRL 3-5 in non-European Union countries located in the United Kingdom.

Co-production Projects by Feedstock

Feedstocks Used Across Co-production Projects



Feedstocks Used Across Co-production Projects by TRL



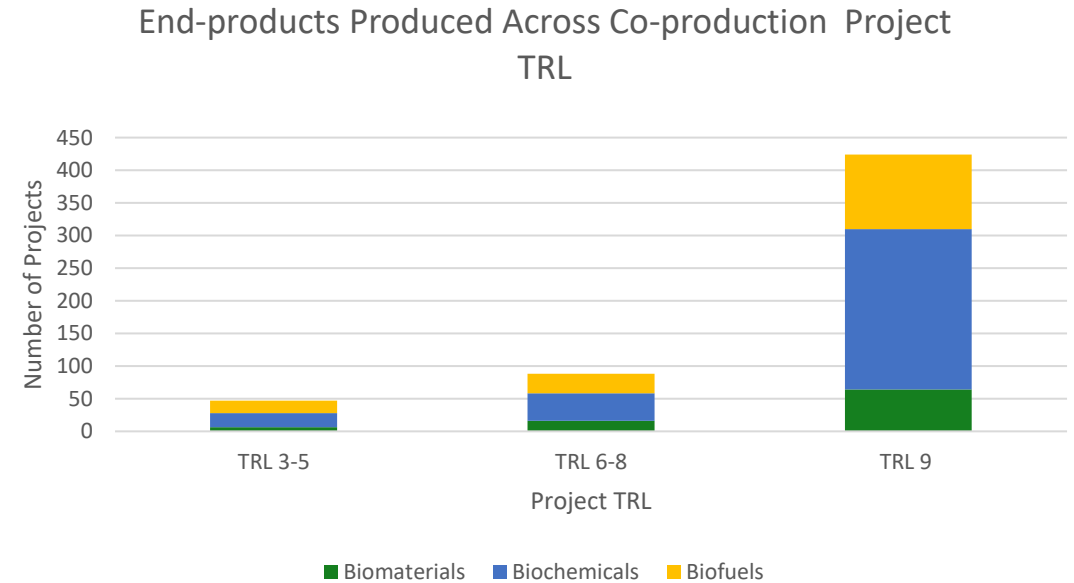
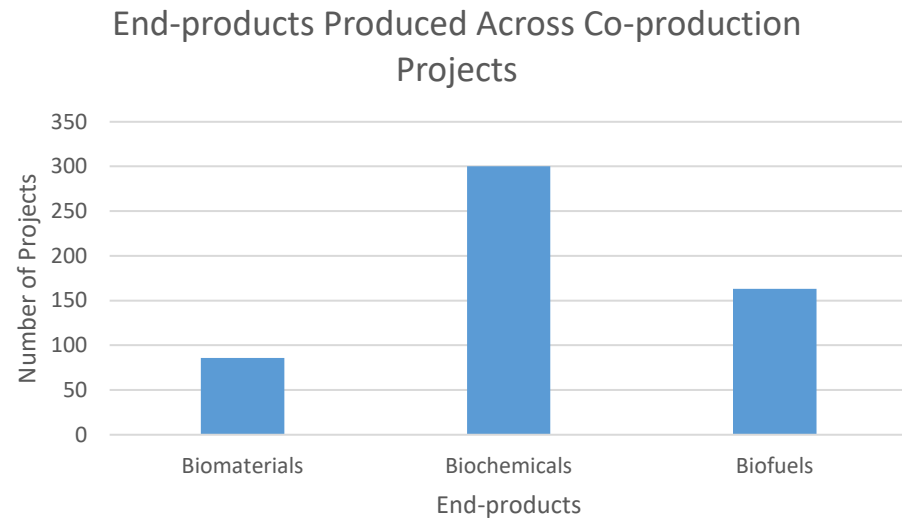
Highlights

- Agricultural residues make up majority of feedstocks used (53%), followed by woody biomass (20%) and municipal solid waste (17%).
- Animal waste and algae and marine feedstocks the least used feedstocks overall (4%).

Highlights

- Agricultural residues make up largest share of feedstocks used across all projects (40-53%).
- Woody biomass and municipal solid waste next largest groups of feedstock used across all projects.
- Energy crops and algae and marine feedstocks most used in pilot and demo (15% & 13%)

Co-production Projects by End-Product



Highlights

- Biochemicals (53%) make up the majority of end-products produced at co-production projects.
- Biofuels (30%) and biomaterials (17%) make up just under half of end-products produced.

Highlights

- Biochemicals make up majority of end-products produced at TRL 9 co-production projects (58%), but under half in TRL 6-8 and 3-5 co-production projects.
- Biofuels make up a greater share of end-products in TRL 6-8 (30%) and 3-5 (40%) co-production projects.
- Biomaterials largest share in end-products is in TRL 6-8 co-production projects (18%).

Overview: Total Projects by Country



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The Netherlands

Total Projects: 71



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India

Total Projects: 13



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Brazil

Total Projects: 4



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Canada

Total Projects: 37



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The United Kingdom

Total Projects: 24



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The European Union

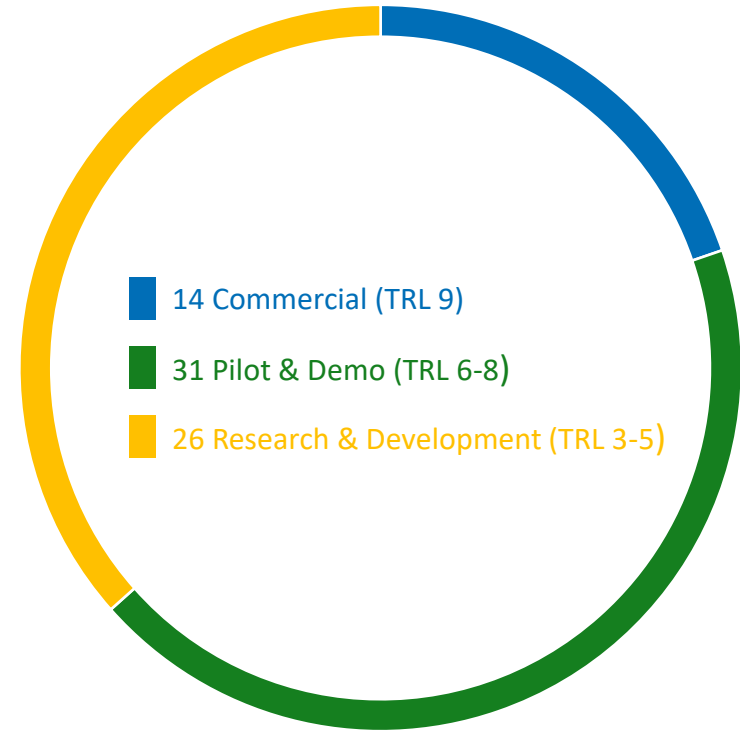
Total Projects: 1,336

Overview: The Netherlands



Total Projects: 71

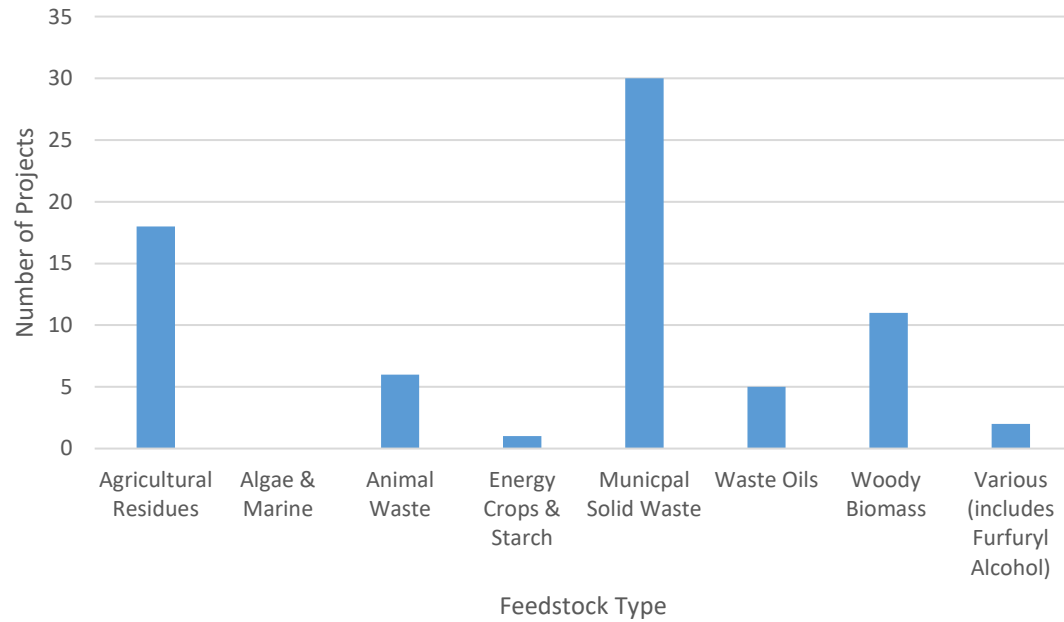
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*22 co-producing projects

The Netherlands: Projects, Feedstocks & End-products

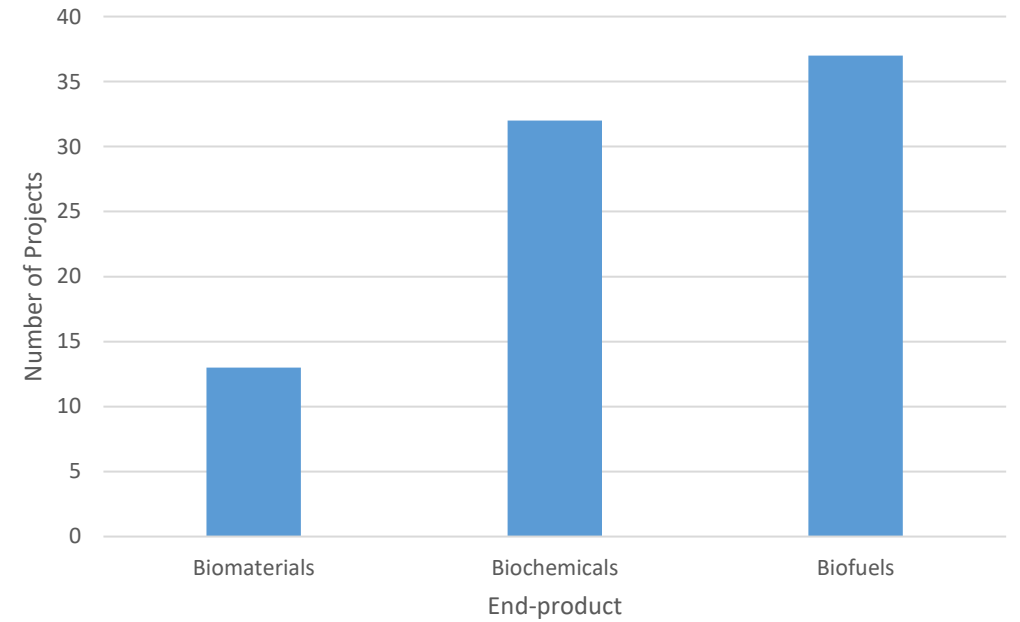
Feedstocks Used Across Projects



Highlights

- Municipal solid waste primary feedstock used (41%), followed by agricultural residues (25%).
- Energy crops least used feedstock (1%).

End-products Produced Across Projects



Highlights

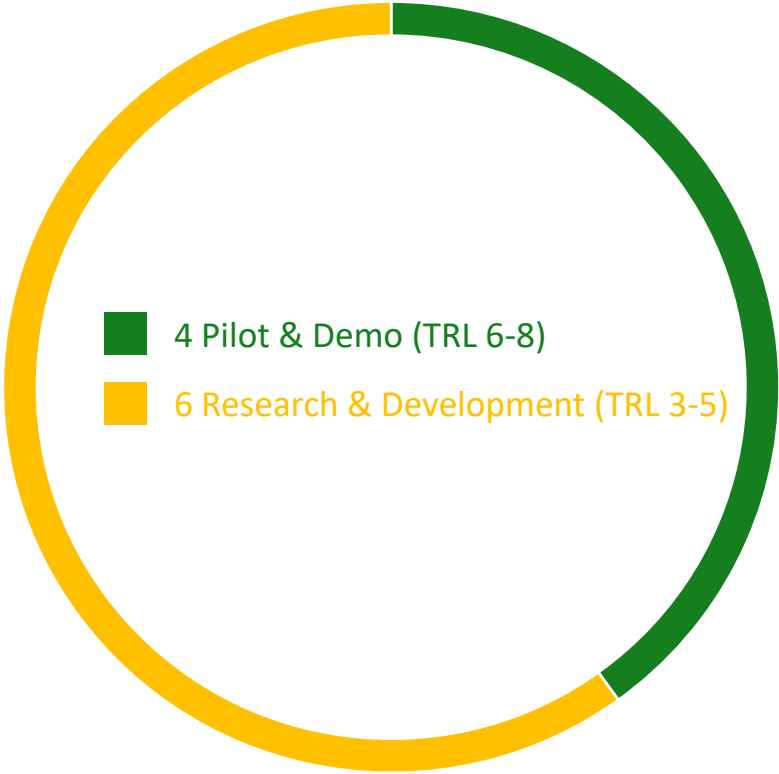
- Biofuels (46%) and biochemicals (44%) make up almost all end-products produced.
- Biomaterials remaining 10% of end-products produced.

Overview: India



Total Projects: 10

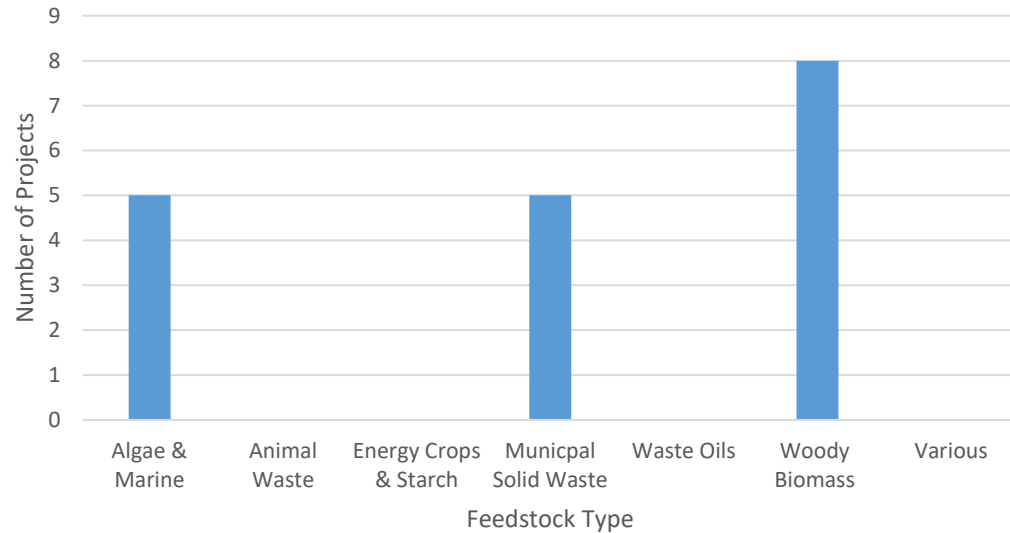
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*1 co-producing project

India: Projects, Feedstocks & End-products

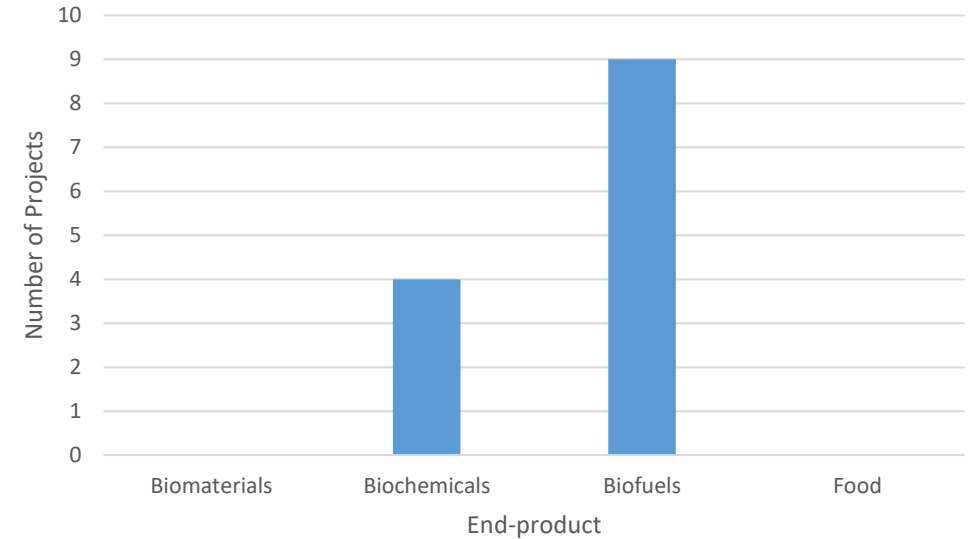
Feedstocks Used Across Projects



Highlights

- Woody biomass primary feedstock used (44%), followed by municipal solid waste and algae (28% each).

End-products Produced Across Projects



Highlights

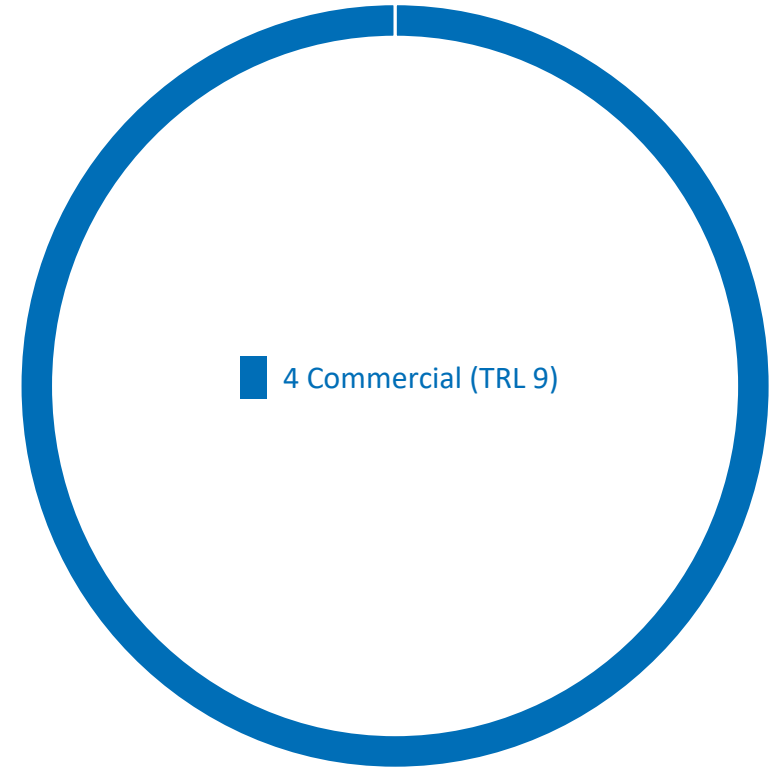
- Biofuels make up majority of end-products produced (64%)

Overview: Brazil

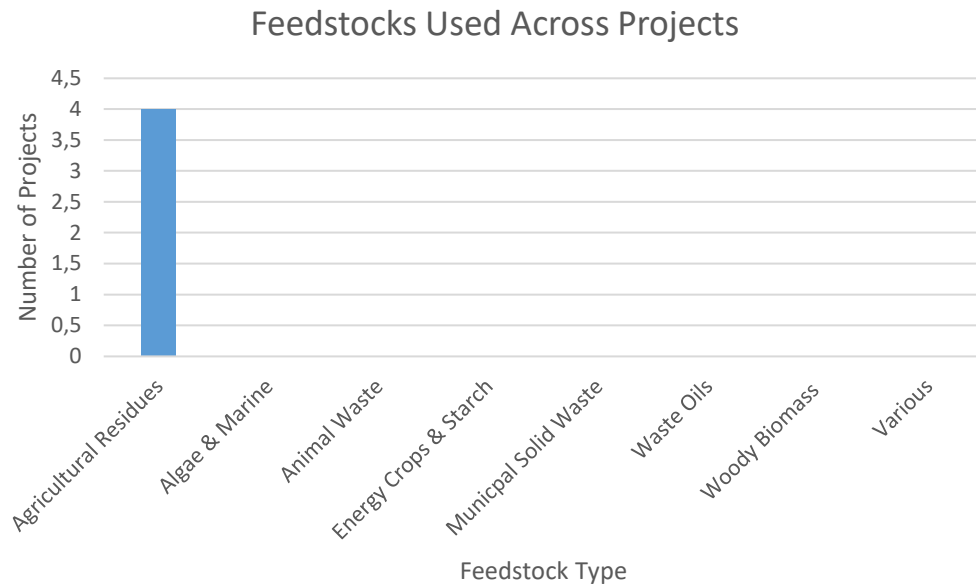


Total Projects: 4

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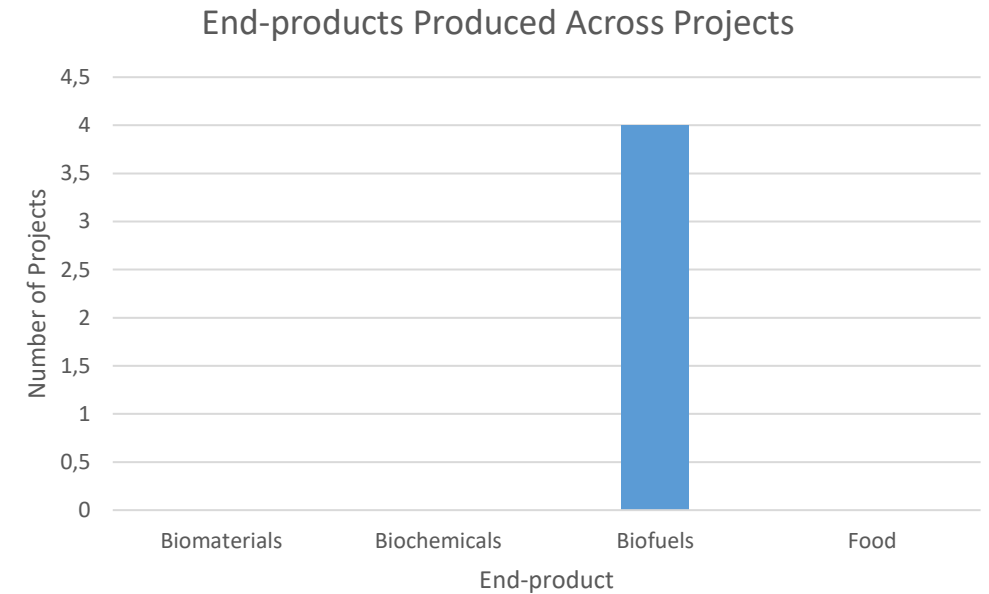


Brazil: Projects, Feedstocks & End-products



Highlights

- Agricultural residues used in all projects.



Highlights

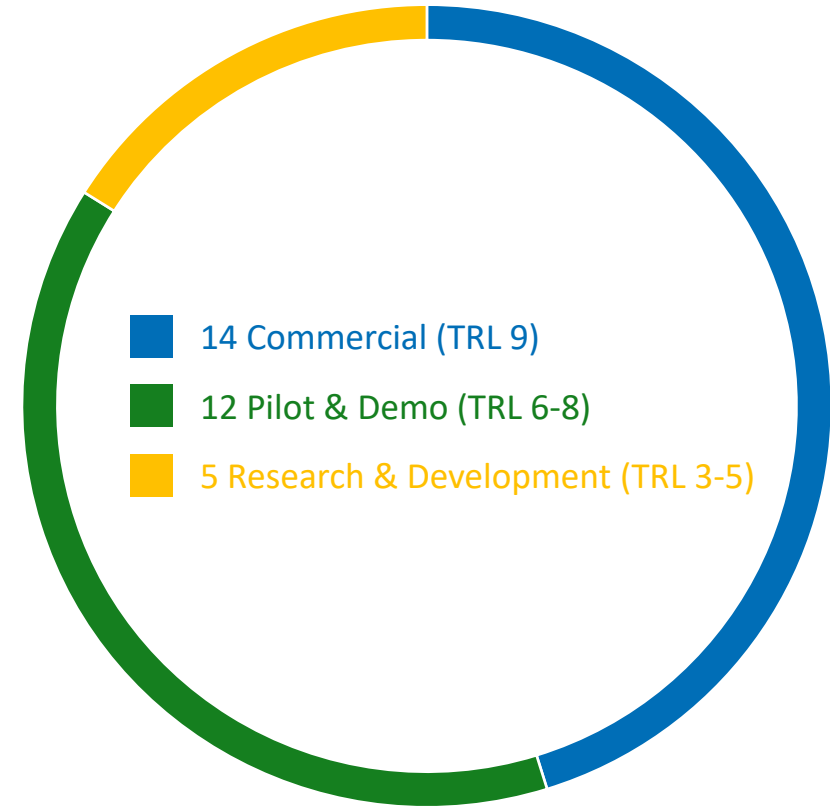
- Biofuels only end-product produced.

Overview: Canada



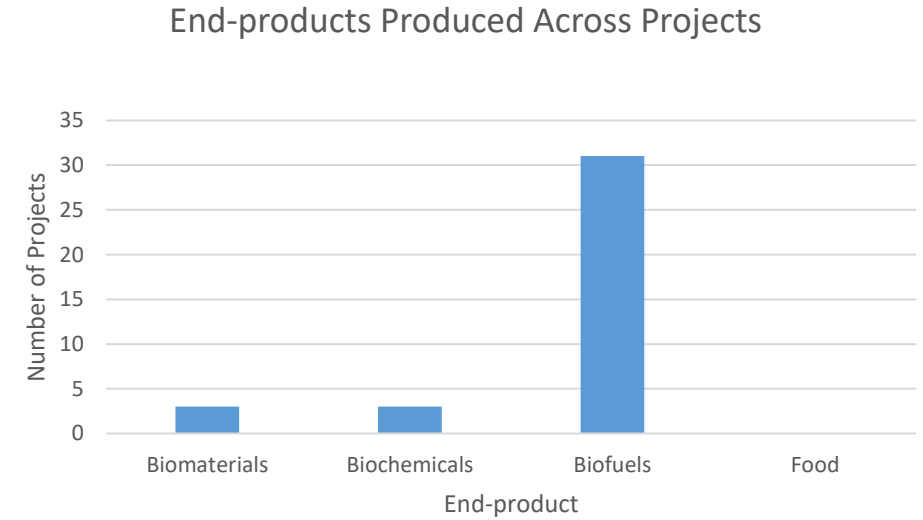
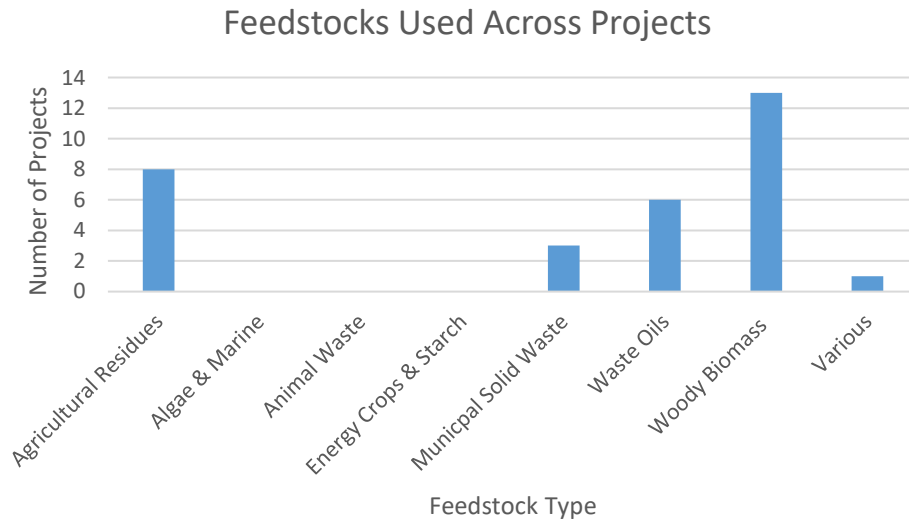
Total Projects: 37

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*4 co-producing projects

Canada: Projects, Feedstocks & End-products



Highlights

- Woody biomass primary feedstock used (42%), followed by agricultural residues (26%) and waste oils (19%)
- Municipal solid waste and various least used feedstock (13%).

Highlights

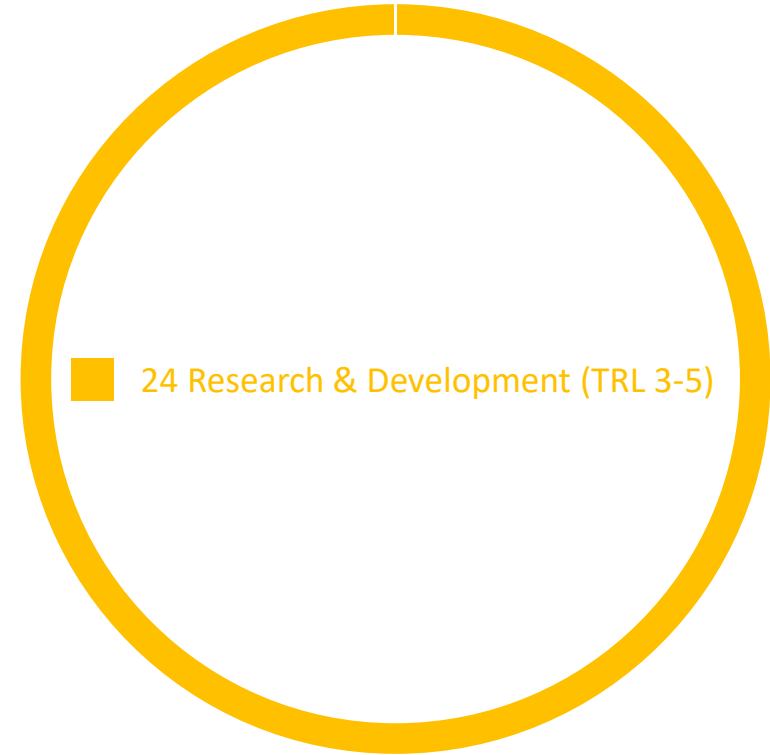
- Biofuels make up majority (84%) of end-products produced.

Overview: The United Kingdom



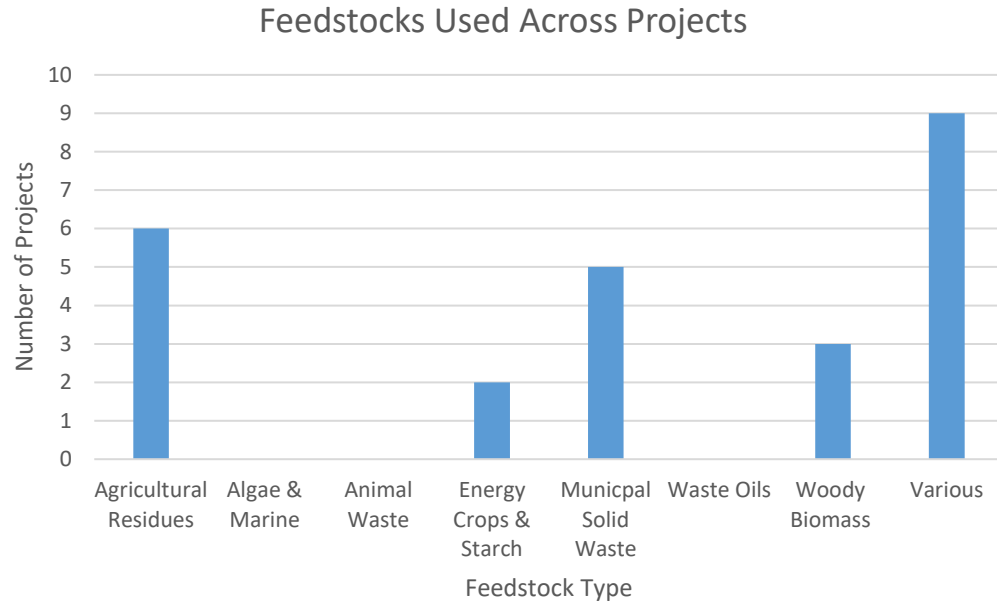
Total Projects: 24

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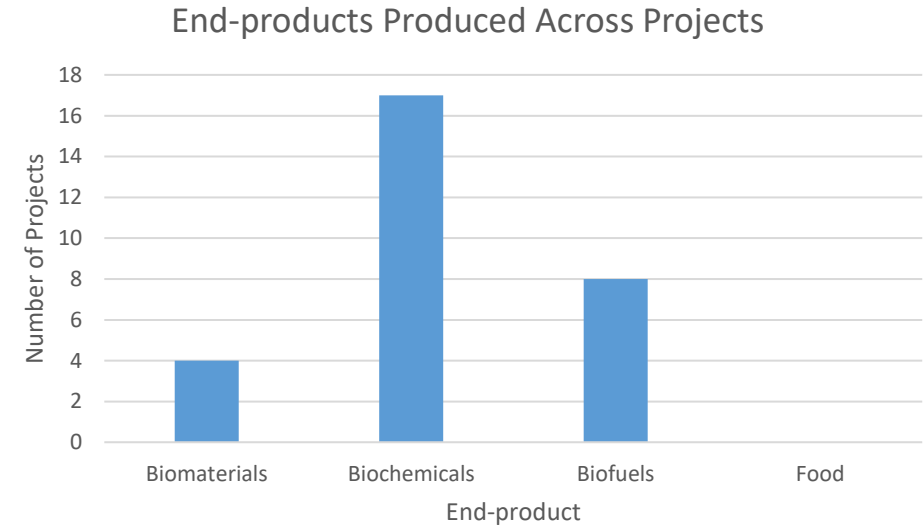
*6 co-producing projects

The United Kingdom: Projects, Feedstocks & End-products



Highlights

- Combined feedstocks (i.e. various) largest share of feedstocks used (36%), followed by agricultural residues (24%) and municipal solid waste (20%).
- Energy crops least used feedstock (8%).



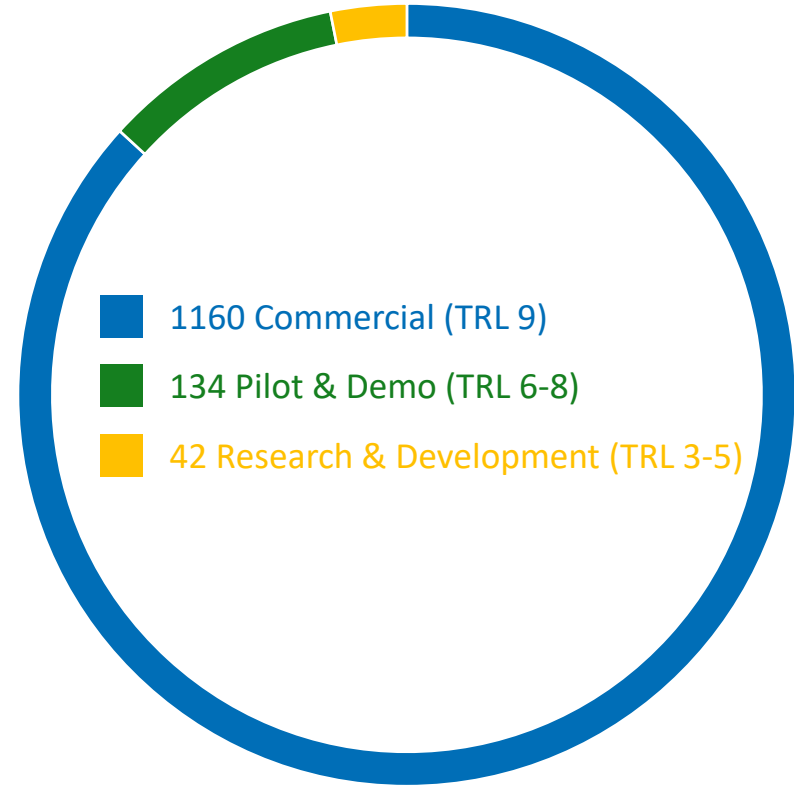
Highlights

- Biochemicals majority of end-products intended to be produced from research projects (59%).

Overview: The European Union



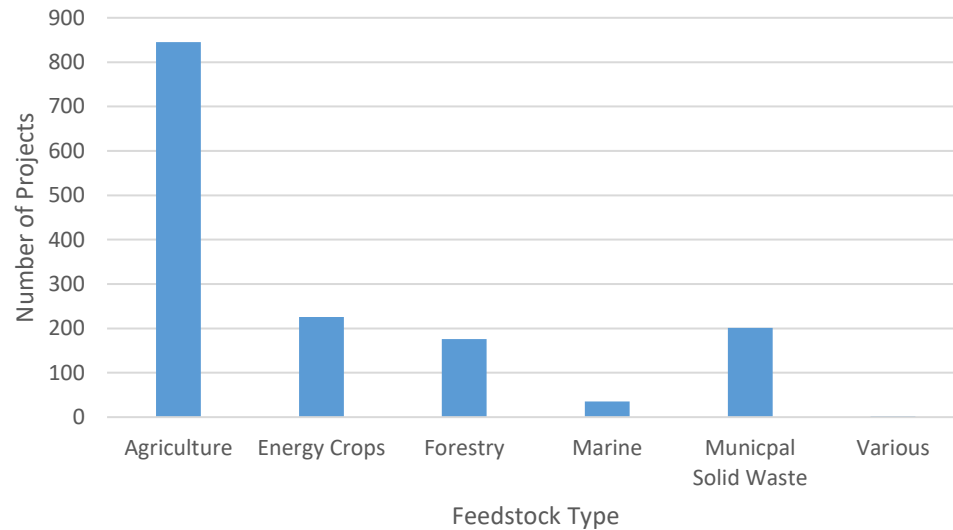
Total Projects: 1,336



*240 co-producing projects

The European Union: Projects, Feedstocks & End-products

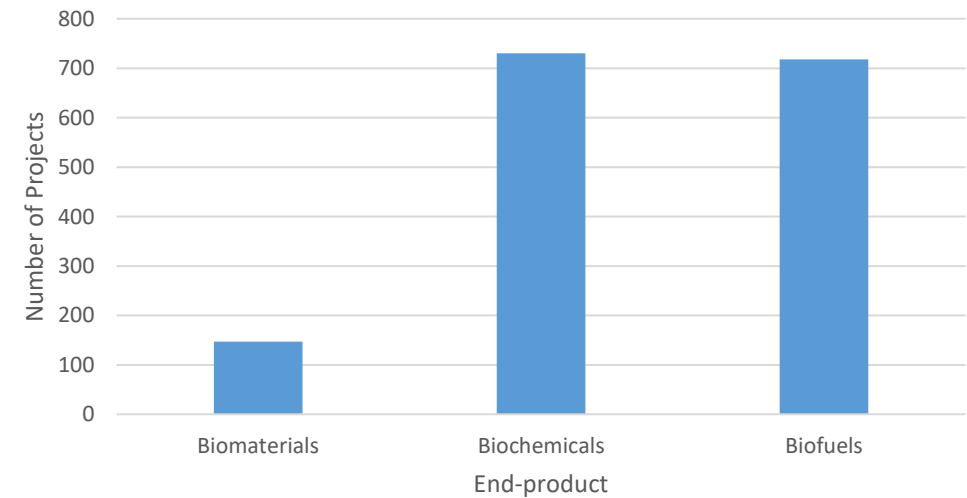
Feedstocks Used Across Projects



Highlights

- Agricultural residues majority of feedstock used (57%), followed by energy crops (15%) and municipal solid waste (14%).
- Marine feedstocks and combined feedstocks (i.e. various) least used feedstocks (2%).

End-products Produced Across Projects



Highlights

- Biochemicals (46%) and biofuels (45%) majority of end-products produced.

Key Findings

1

Policies

- National policies and strategies primarily support Net Zero/Climate Change and the Energy Transition
- Circular economy policies/strategies focus primarily on waste reduction and plastics
- Bioeconomy policies/strategies well rounded, focusing on supply, use and, sustainability

2

Programs

- Grant and subsidies primary policy instrument used to support biorefining initiatives
- Loans and loan guarantees used to primarily to support commercialization
- Programs support most of the value chain with limited support for pilot and demonstration

3

Projects

- Significant number of commercial projects, but spread across a number of EU countries.
- Pilot and demo projects found primarily among other member countries.
- Agricultural residues make up majority of feedstocks used regardless of TRL.
- Biochemicals and biofuels make up majority of end-products.