EuChemS

European Chemical Society

Biorefineries for the chemical industries

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Joint
Research
Centre

Overview

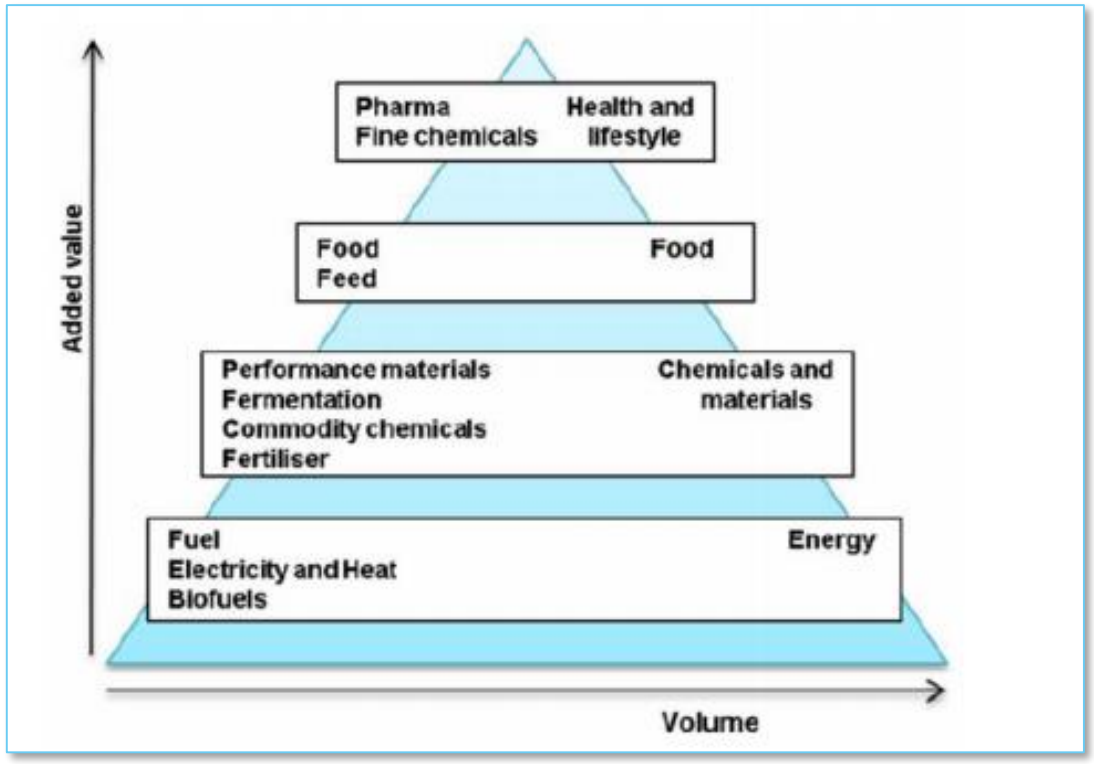
- Green Deal and related policy initiatives with focus on sustainability (on chemical products and biorefineries)
- The challenge of data availability
- Bio-based chemicals in the bioeconomy
- Markets for bio-based chemical
- Chemical and material driven biorefineries
- An outlook

Introduction: Green Deal and bio-based chemical industry

"The next era of industry will be one where the physical, digital and biological worlds are coming together."

(A New Industrial Strategy for Europe, March 2020)

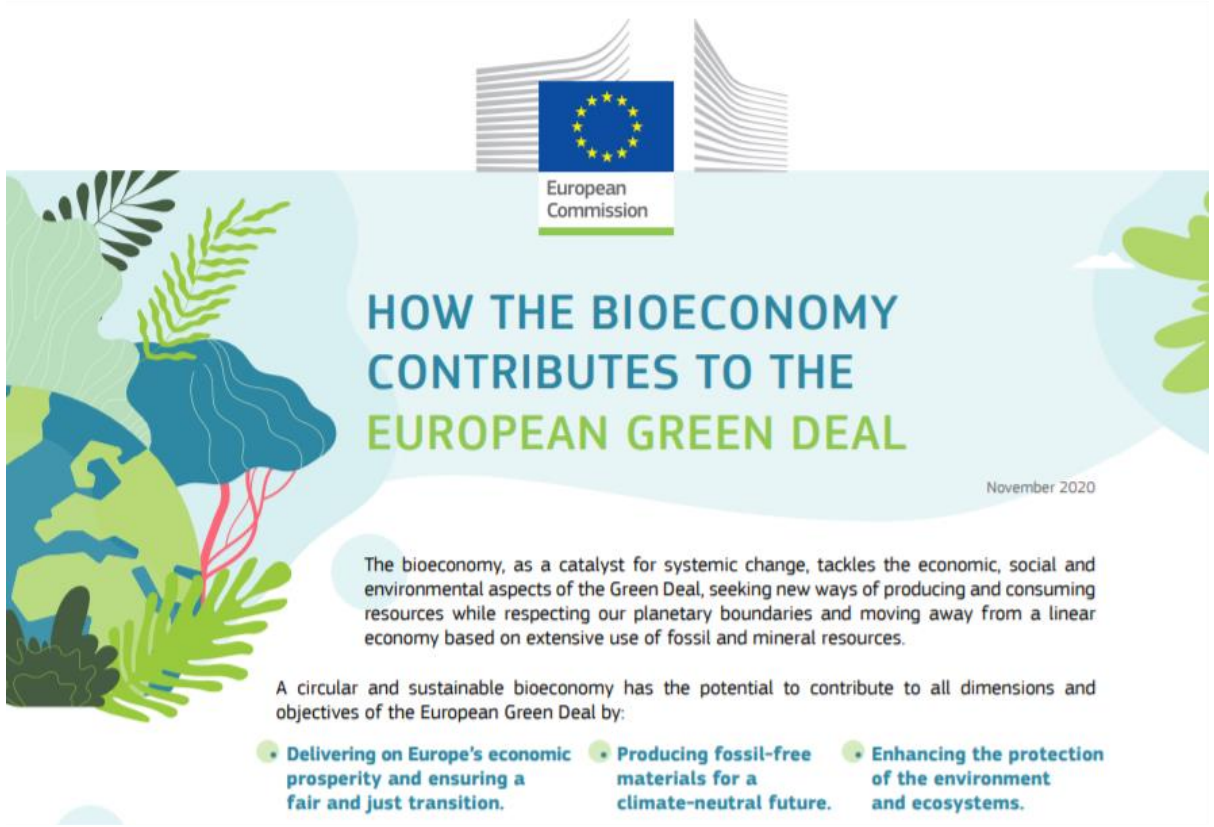
The biomass value triangle



Source: European Commission (2017), Bioeconomy development in EU regions, https://ec.europa.eu/research/bioeconomy/pdf/publications/bioeconomy_development_in_eu_regions.pdf , p.23

European Commission

Bio-based products in recent policy initiatives: Bioeconomy



EXAMPLES OF HOW THE BIOECONOMY CONTRIBUTES TO THE EUROPEAN GREEN DEAL:

STRIVING FOR GREENER INDUSTRY

Circular use of biomass **promotes resource efficiency and stimulates the production of high added-value products from side and waste streams.** Bark residues, e.g. can be used for extraction of protective compounds used for non-toxic treatment of wood-based construction materials[4].

ELIMINATING POLLUTION

Circular bioeconomy maximises the use of side and residual streams from agriculture, food-processing and forest-based industries, **thus reducing the amount of landfilled waste.**

Moreover, the use of bio-fertilisers, bio-pesticides and bio-based pest control can contribute towards achieving the Farm to Fork and Biodiversity Strategy's objectives of **reducing fertiliser and pesticide use and risk.**

ENSURING JUST TRANSITION FOR ALL

The bioeconomy can **create 400 000 new green jobs by 2035[5] in particular in rural and coastal areas** if supported and deployed by regional and national strategies. Many bioeconomy opportunities also exist in urban and peri-urban areas.

Source: https://ec.europa.eu/info/sites/info/files/research_and_innovation/research_by_area/documents/ec_rtd_greendeal-bioeconomy.pdf

Bio-based products in recent policy initiatives: Circular economy

EUROPEAN
COMMISSION

Brussels, 11.3.2020
SWD(2020) 100 final

COMMISSION STAFF WORKING DOCUMENT

Leading the way to a global circular economy: state of play and outlook

The bioeconomy plays a key role in this by stimulating sustainable, innovative use of biological resources that support local economies. Its three pillars on strengthening the bio-based sectors, deploying local bioeconomies around Europe and understanding the ecological bounderies adress the environmental, economic and social challenges that we face[90]. Sustainable biorefineries[91] can represent a key element in this transformation, making the EU a global front-runner.

Bio-based products in recent policy initiatives: Chemicals Strategy, Organic Production action plan

EUROPEAN COMMISSION

Brussels, 14.10.2020
COM(2020) 667 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

Chemicals Strategy for Sustainability
Towards a Toxic-Free Environment

{SWD(2020) 225 final} - {SWD(2020) 247 final} - {SWD(2020) 248 final} - {SWD(2020) 249 final} - {SWD(2020) 250 final} - {SWD(2020) 251 final}

Regulatory tools[22] need to be exploited to **drive and reward** the production and use of safe and sustainable chemicals. It is particularly important to incentivise industry to prioritise innovation for substituting, as far as possible, substances of concern[23]. Moving to safe and sustainable-by-design chemicals, including to sustainable bio-based chemicals[24], and investing in finding alternatives to substances of concern is crucial for human health and the environment, as well as an important precondition for reaching a clean circular economy.

EUROPEAN COMMISSION

Brussels, 25.3.2021
COM(2021) 141 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

ON AN ACTION PLAN FOR THE DEVELOPMENT OF ORGANIC PRODUCTION

{SWD(2021) 65 final}

Action 22: *The Commission intends to:*

- *adopt a Framework on bio-based, compostable and biodegradable plastic[34], which will include principles and criteria under which the use of sustainable bio-based materials that are easily bio-degradable in natural conditions is beneficial to the environment. The Framework will cover all plastics, including for uses in all types of agriculture, and will therefore also be highly relevant for organic farming leading the way in terms of sustainability.*

Sustainable Finance and EU Taxonomy

PRESS RELEASE | 21 April 2021

Sustainable Finance and EU Taxonomy: Commission takes further steps to channel money towards sustainable activities

The European Commission has today adopted an ambitious and comprehensive package of measures to help improve the flow of money towards sustainable activities across the European Union.

Manufacturing

Feedback mostly focused on the criteria for the manufacture of iron and steel, aluminium, plastics, chemicals and other low carbon technologies. Notably, upon reflection, the use of EU emissions trading scheme (ETS) benchmarks was confirmed, in the absence of objective alternatives to ensure environmental ambition. Future revisions of the criteria will examine whether the technical screening criteria should be based on other relevant standards, considering life-cycle emissions and technological developments. Adjustments were introduced, for example, to better recognise different manufacturing processes and delineate distinct activities, widen the scope of some activities e.g. revise the emissions threshold for the production of hydrogen and allow sustainably sourced food and feed crops in the manufacturing of plastics and organic chemicals.

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The challenge of data availability

Renewable and Sustainable Energy Reviews
Volume 143, June 2021, 110895

Getting your hands dirty: A data digging exercise to unearth the EU's bio-based chemical sector

Edoardo Baldoni [a], George Philippidis [a, b], Jurjen Spekreijse [c], Patricia Gurría [a], Tijs Lammens [c], Claudia Parisi [a], Tévécia Ronzon [a], Martijn Vis [c], Robert M'Barek [a]

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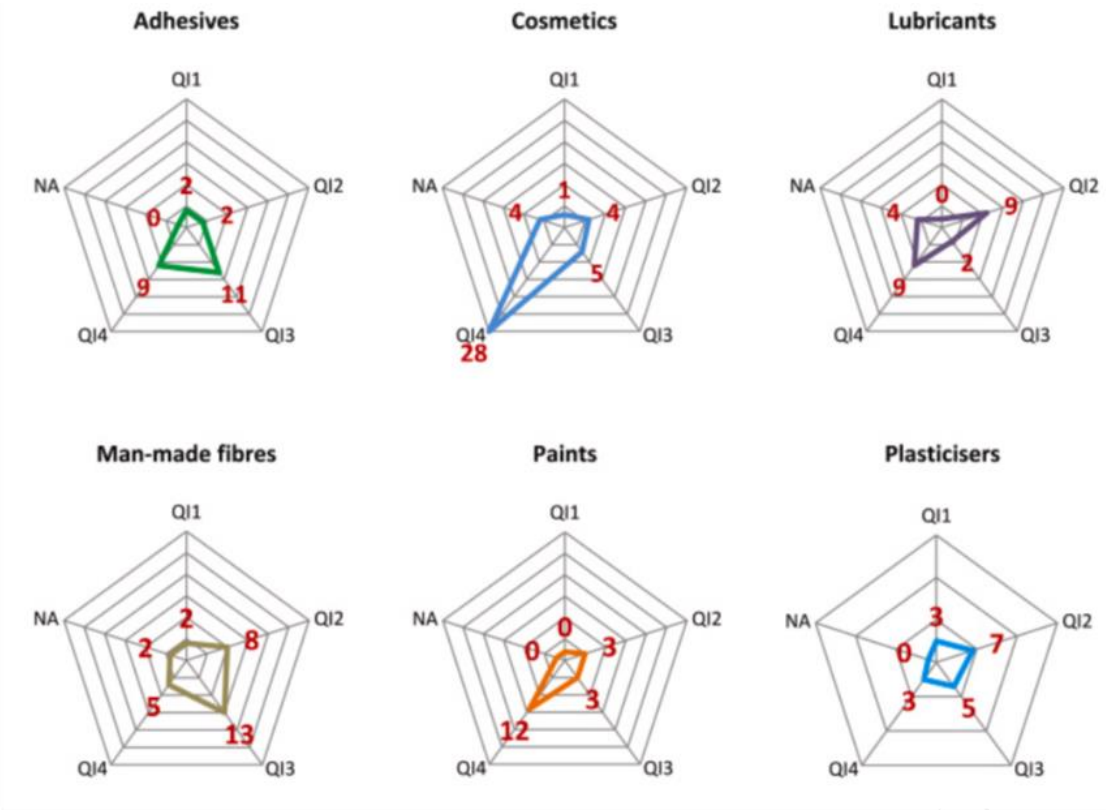
Reliability of results by indicator and application category - Data quality index



Link:
https://www.sciencedirect.com/science/article/pii/S1364032121001891?via%3Dihub

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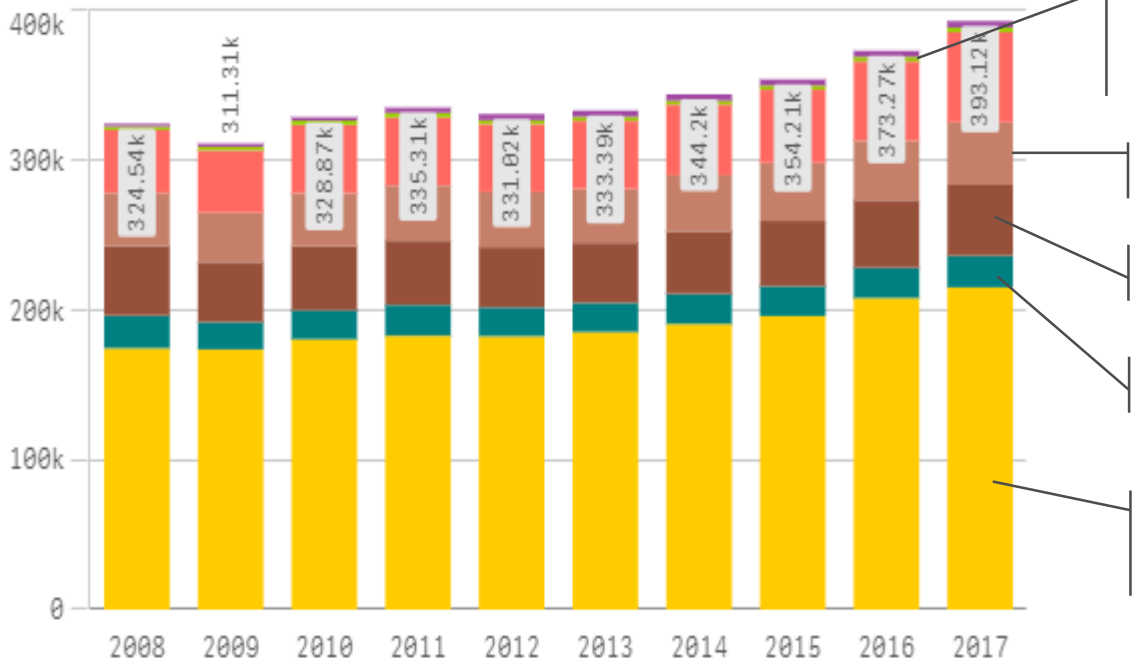
Growing importance of **bio-based industries** in the Bioeconomy

Development of value added growth in the bio-based industries between 2008 and 2017 in EU27 (mio €)



Bio-based chemicals (9.6 bn €)
pharmaceuticals (46.6 bn €)
plastics and rubber (4.1 bn €)

Paper

Wood products and furniture

Bio-based textile

Food, beverage and tobacco

BB industries in EU*

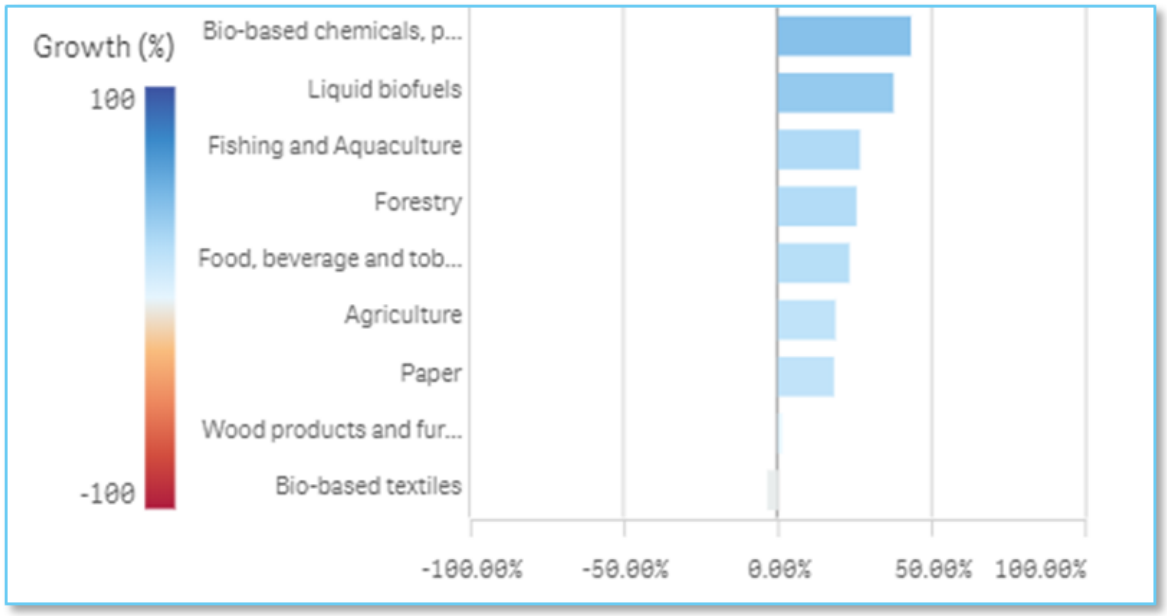
- 7.55 million workers
- €393 billion of value added
- 5.3% growth from 2016 to 2017

*Construction and waste treatment are not accounted for

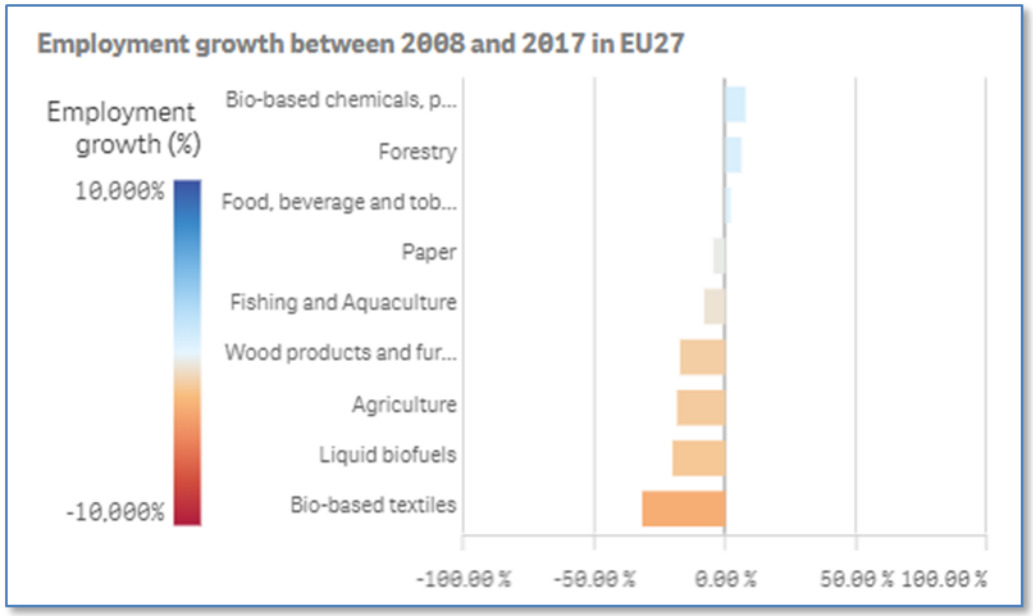
Source: https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html

Bio-based sectors growth in value added and jobs

Value added growth in the bioeconomy between 2008 and 2017 in EU27 (2017)



Employment growth between 2008 and 2017 in EU27



Source: https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html

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Bio-based markets

“Bio-based value chains for chemicals, plastics and pharmaceuticals”

Spekreijse, J., Vikla, K., Vis, M., Boysen-Urban, K., Philippidis, G. and M’barek, R., Bio-based value chains for chemicals, plastics and pharmaceuticals, EUR 30653 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-32459-1, doi:10.2760/712499, JRC124141.

https://ec.europa.eu/jrc/en/publication/bio-based-value-chains-chemicals-plastics-and-pharmaceuticals

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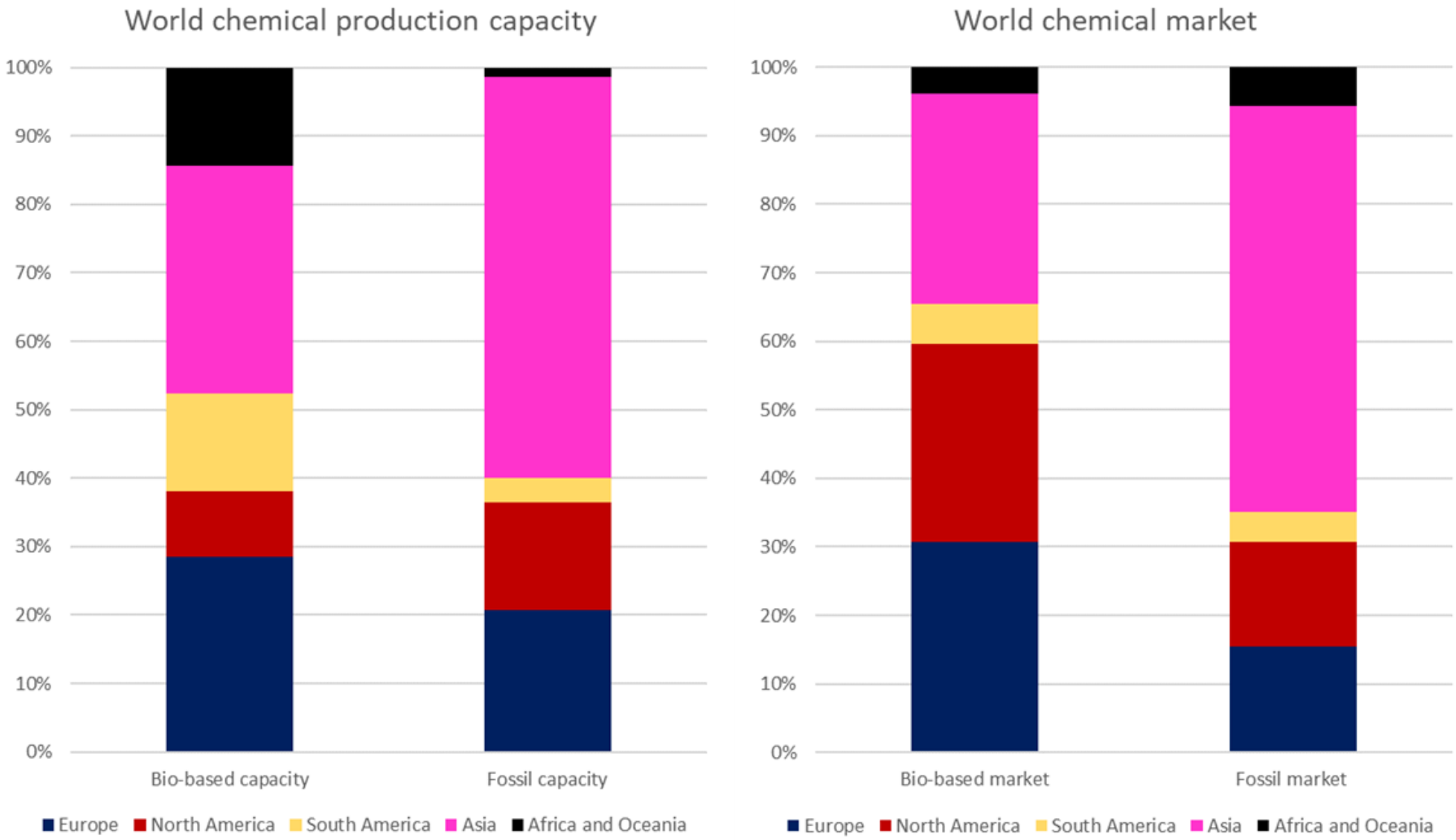
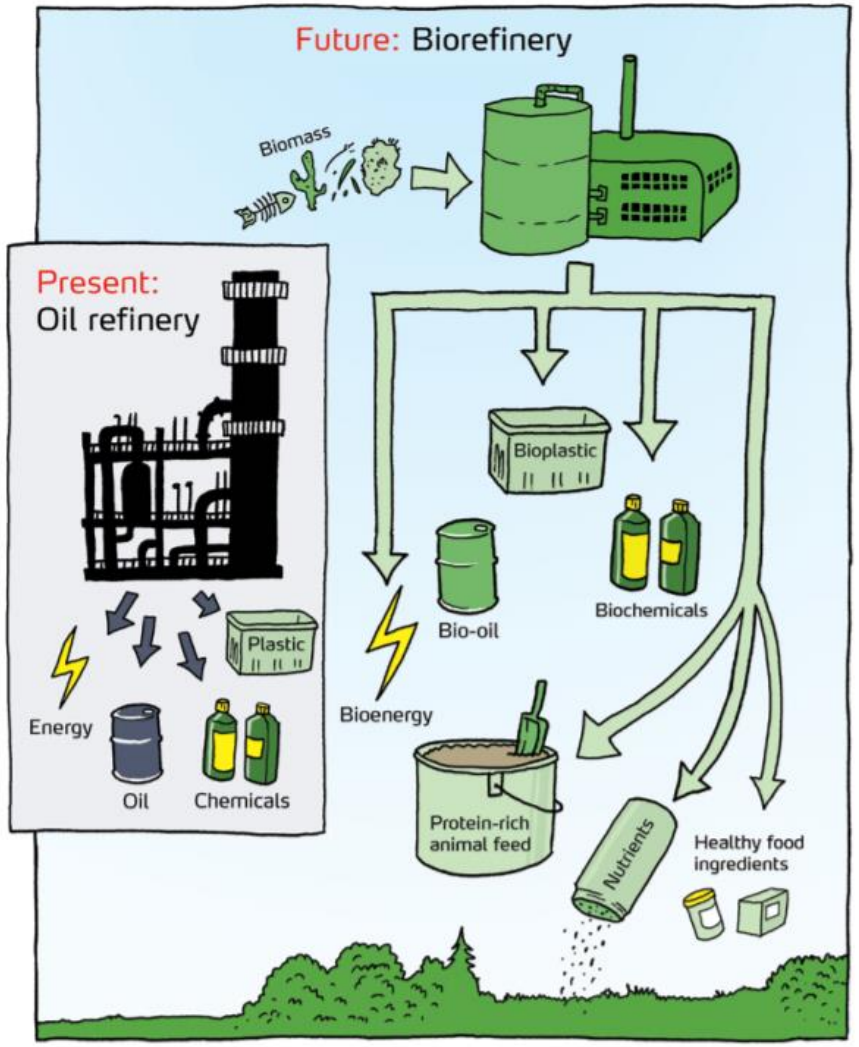
Bio-based markets

Estimate of the share for the production (based on ktonnes/year) and markets (€m/y) of fossil and bio-based chemicals.



Source: https://ec.europa.eu/jrc/en/publication/bio-based-value-chains-chemicals-plastics-and-pharmaceuticals

Biorefineries as one solution towards a climate-neutral economy

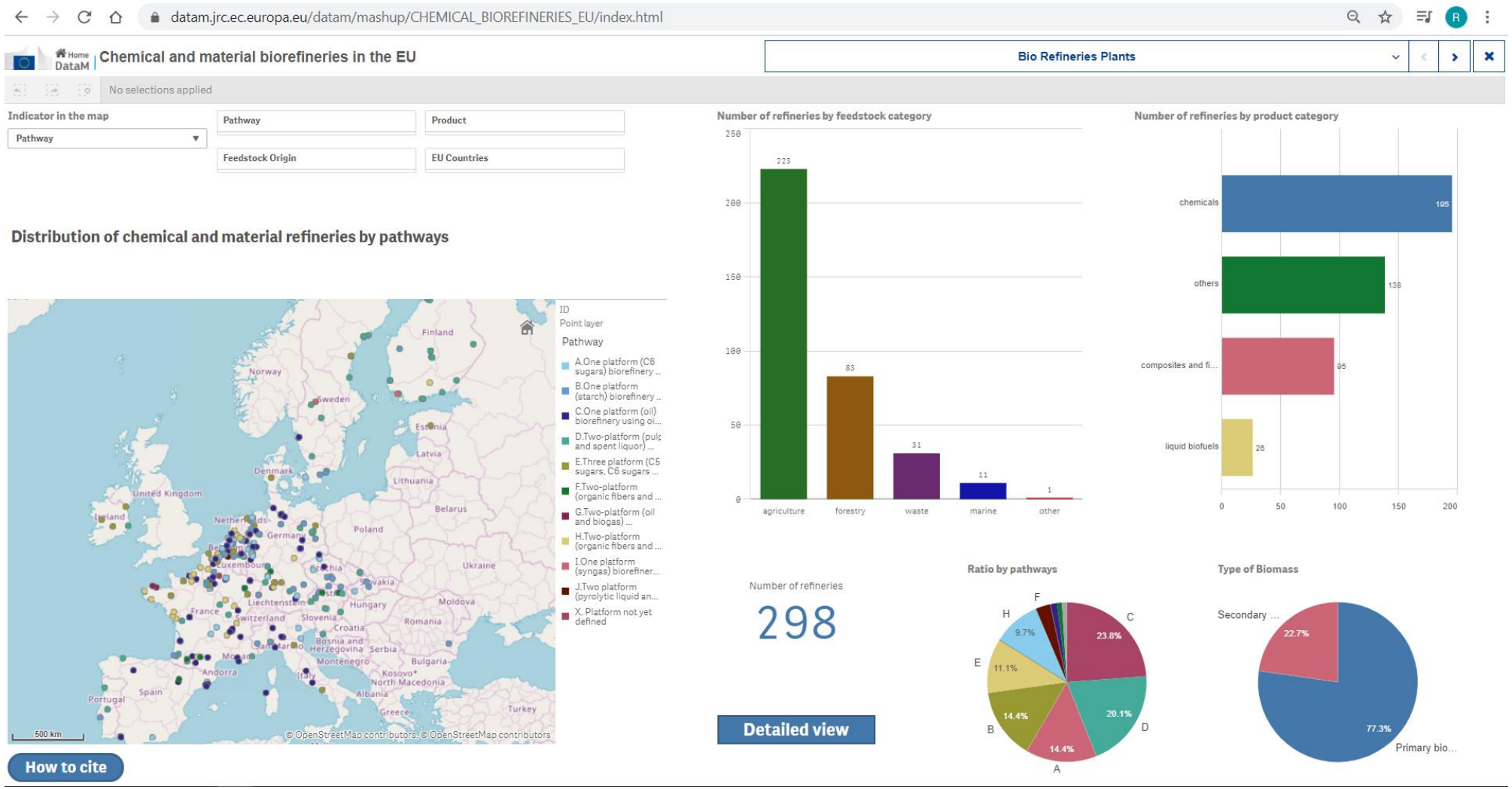


Sustainable biorefineries

- Using biomass and in particular food waste and residues
- Replacing fossil-fuels
- Creating growth and jobs up- and downstream in rural areas
- Resulting products with smaller environmental footprints
- Important element in various Green Deal initiatives

Source: Lange, L., & Lindedam, J. (2016). The Fundamentals Of Bioeconomy The Biobased Society. United Federation of Danish Workers 3F.

Dashboard of chemical and material driven biorefineries



https://datam.jrc.ec.europa.eu/datam/mashup/CHEMICAL_BIOREFINERIES_EU

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Dashboard of chemical and material driven biorefineries

Distribution of chemical and material refineries by products

The grey points on the map indicate that the refinery has more than one product related.

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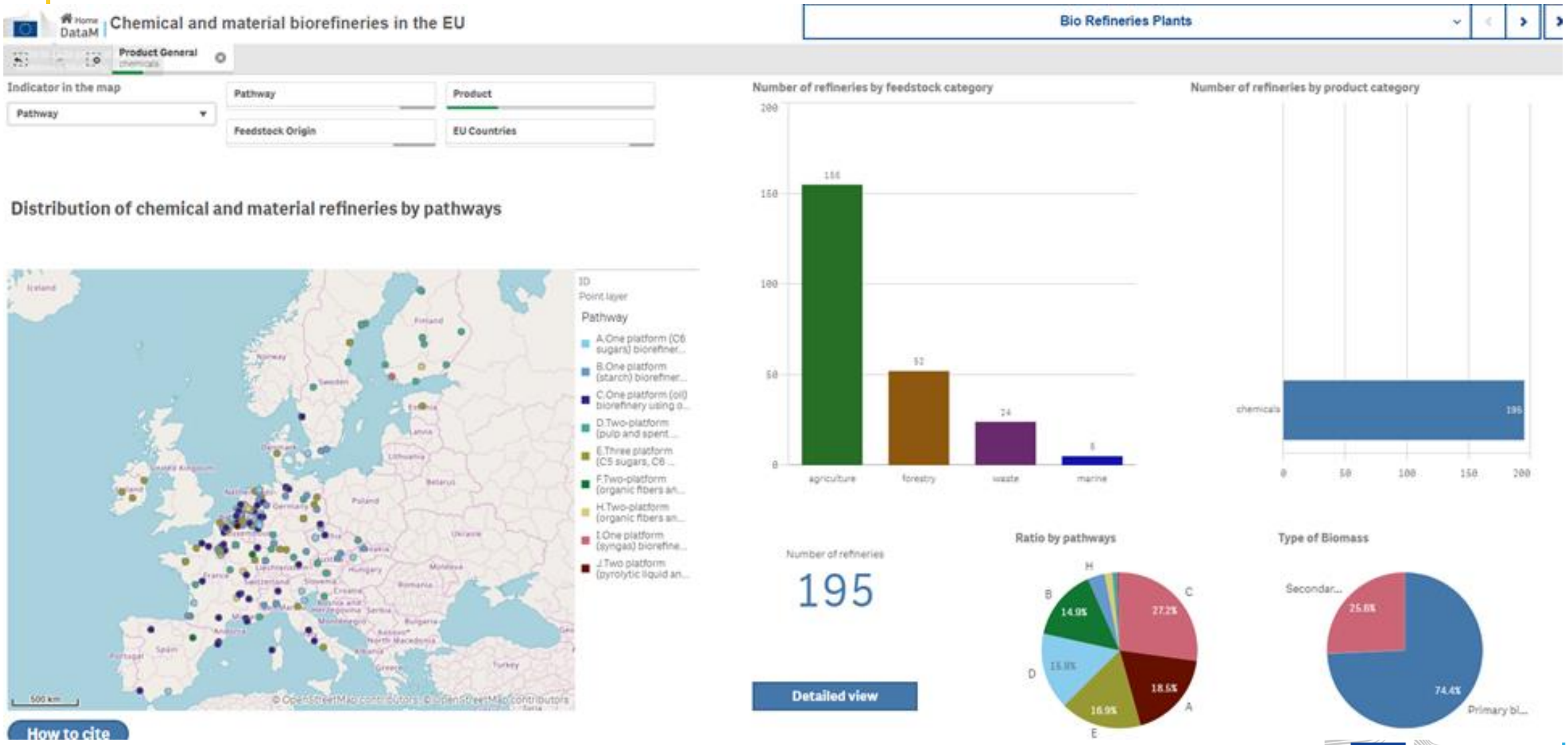
Dashboard of chemical and material driven biorefineries



https://datam.jrc.ec.europa.eu/datam/mashup/CHEMICAL_BIOREFINERIES_EU

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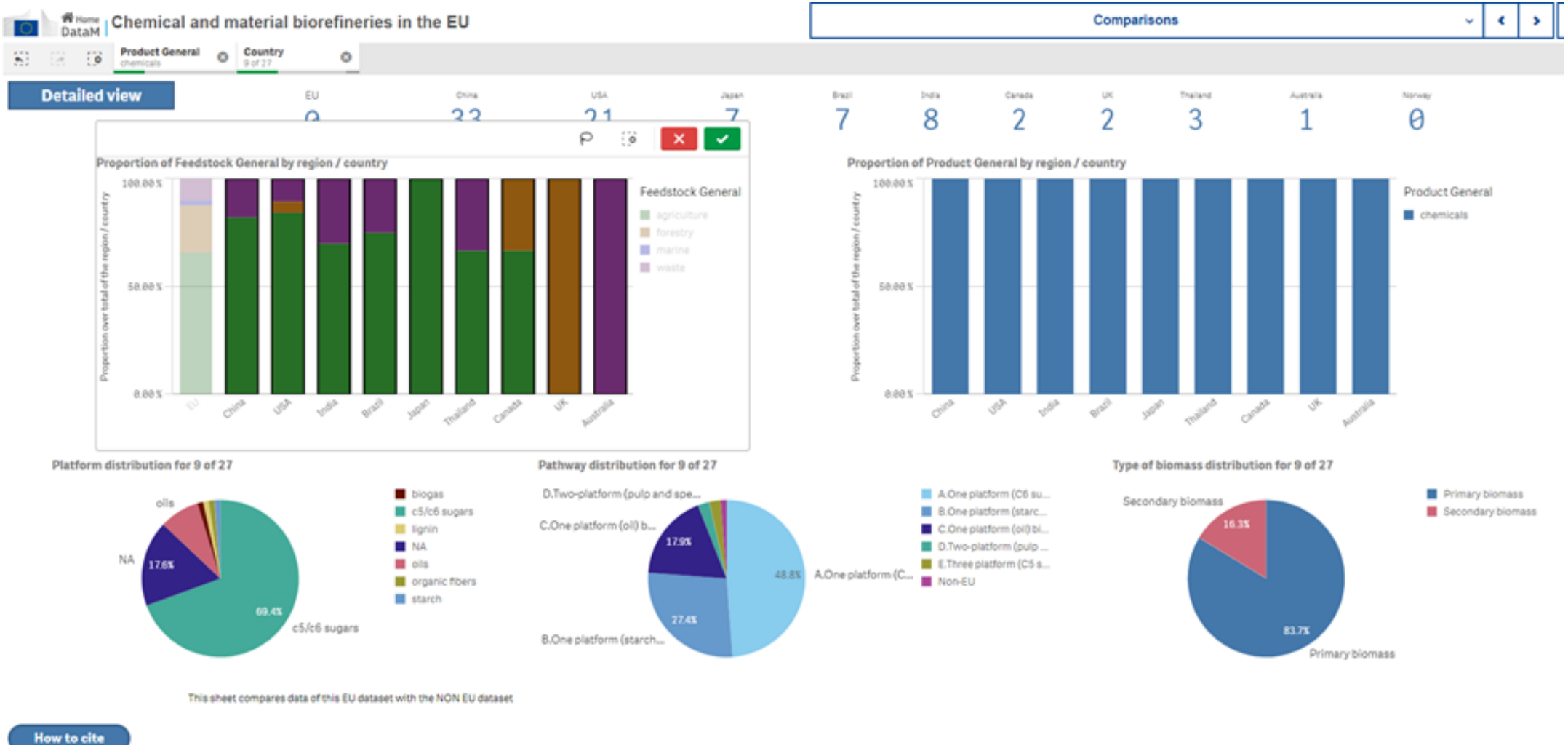
Comparing EU with non-EU



https://datam.jrc.ec.europa.eu/datam/mashup/CHEMICAL_BIOREFINERIES_EU

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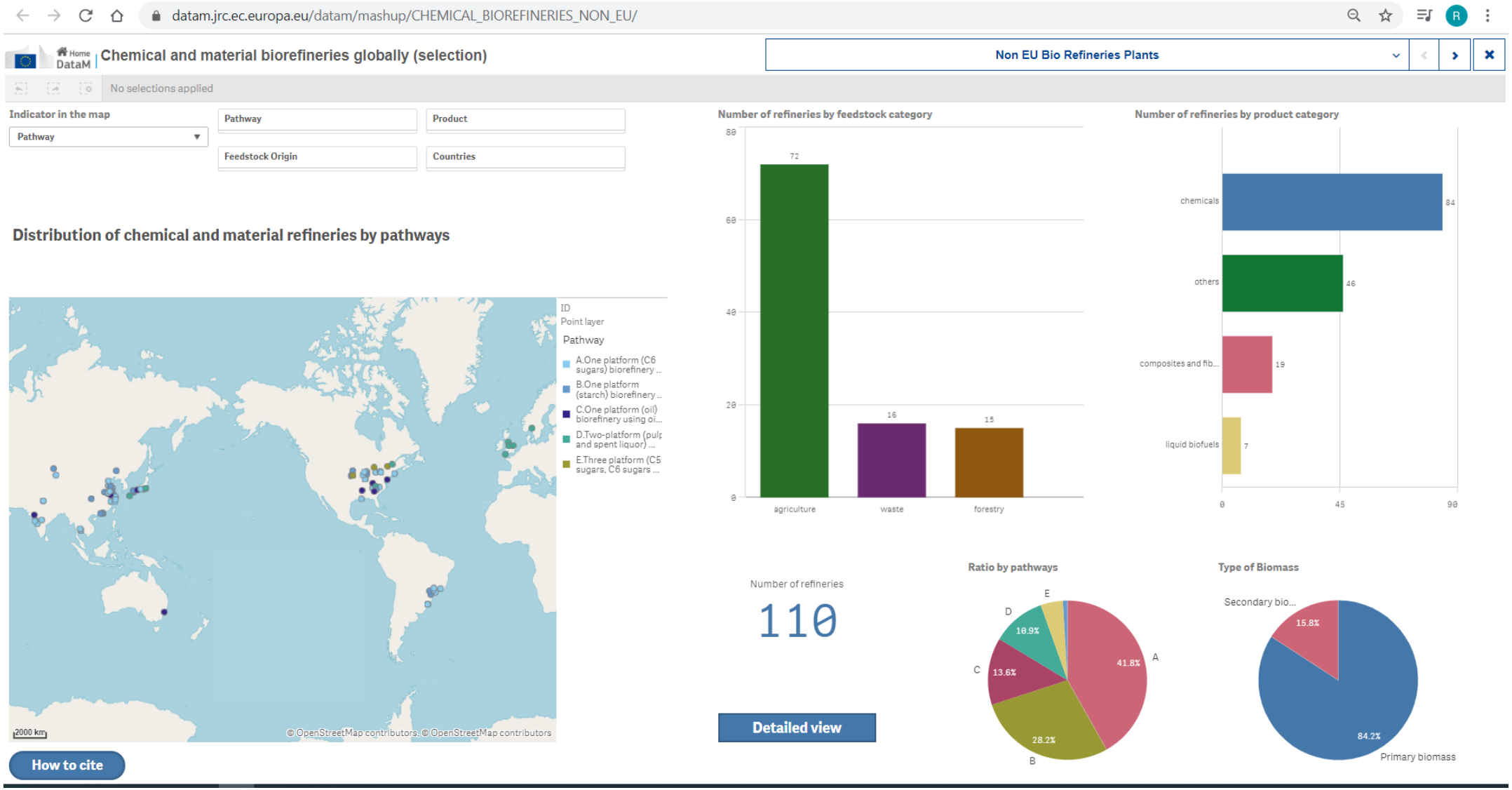
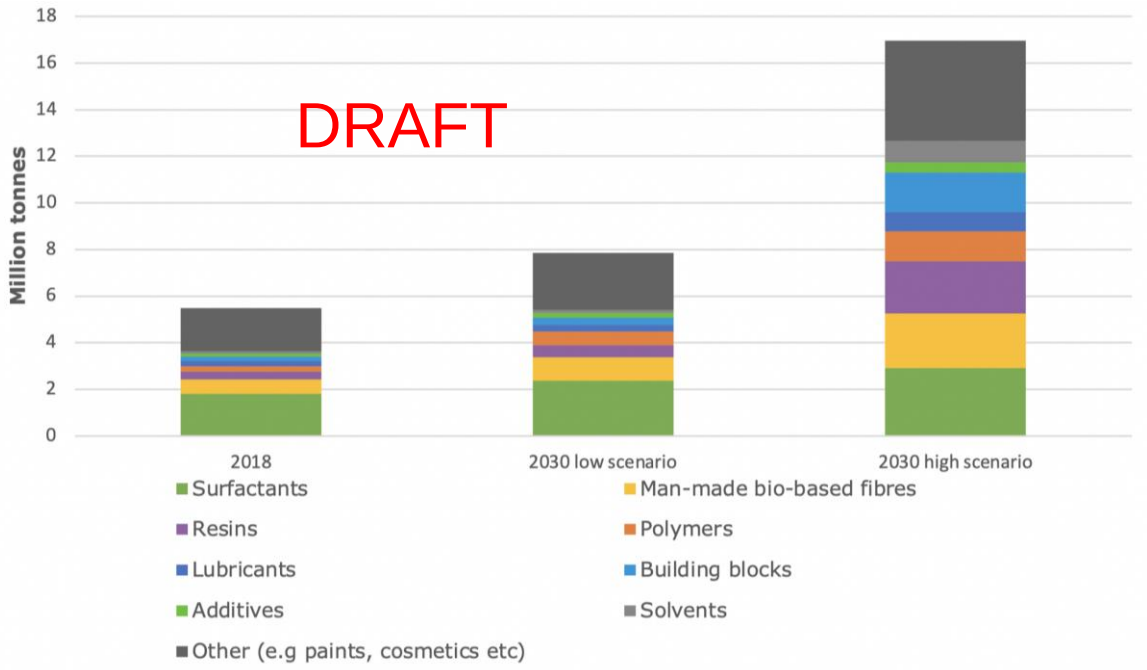
Non-EU biorefineries



https://datam.jrc.ec.europa.eu/datam/mashup/CHEMICAL_BIOREFINERIES_NON_EU/

Demand for bio-based products 2019, and 2030 low- and high scenario: demand could triple by 2030

See forthcoming study Platt et al. 2021 www.e4tech.com/biorefinery-outlook.php



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Resources

Knowledge Centre for Bioeconomy https://knowledge4policy.ec.europa.eu/bioeconomy_en

Article on data for bio-based chemical markets
https://www.sciencedirect.com/science/article/pii/S1364032121001891?via%3Dihub

Value added and jobs for bio-based chemicals
https://datam.jrc.ec.europa.eu/datam/mashup/BIOECONOMICS/index.html

Dashboards for chemical and material biorefineries in the EU
https://datam.jrc.ec.europa.eu/datam/mashup/CHEMICAL_BIOREFINERIES_EU

Dashboards for chemical and material biorefineries in non-EU countries
https://datam.jrc.ec.europa.eu/datam/mashup/CHEMICAL_BIOREFINERIES_NON_EU/

Report on bio-based value chains chemicals, plastics and pharmaceuticals
https://ec.europa.eu/jrc/en/publication/bio-based-value-chains-chemicals-plastics-and-pharmaceuticals

Report on biorefinery outlook (forthcoming) www.e4tech.com/biorefinery-outlook.php

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