



IEA Bioenergy
Technology Collaboration Programme



Biomass Supply Chains in the EU - Advanced biofuels

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Task 40 Deployment of Biogenic Value Chains and Carbon Management

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Platform Bio-Economie, RVO / IEA Bioenergy

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IEA Bioenergy Task 40 Deployment of Biogenic Value Chains and Carbon Management

- **Members:** Denmark (Ea Energy), Germany (DBFZ), Netherlands (UU, RWE), Switzerland (ETH), Sweden (RISE), United States (Idaho National Laboratory)
- **Objectives:**
 - **Scale Biobased-Value Chains:** Promote efficient, bankable, and sustainable biobased systems.
 - **Analyze Markets & Trade:** Monitor international biomass markets, logistics, and global trade frameworks.
 - **Advance Carbon Management:** Assess the integration of BECCUS options for net-zero.
 - **Inform Policy:** Provide reliable data and guidance for policymakers and industry stakeholders.

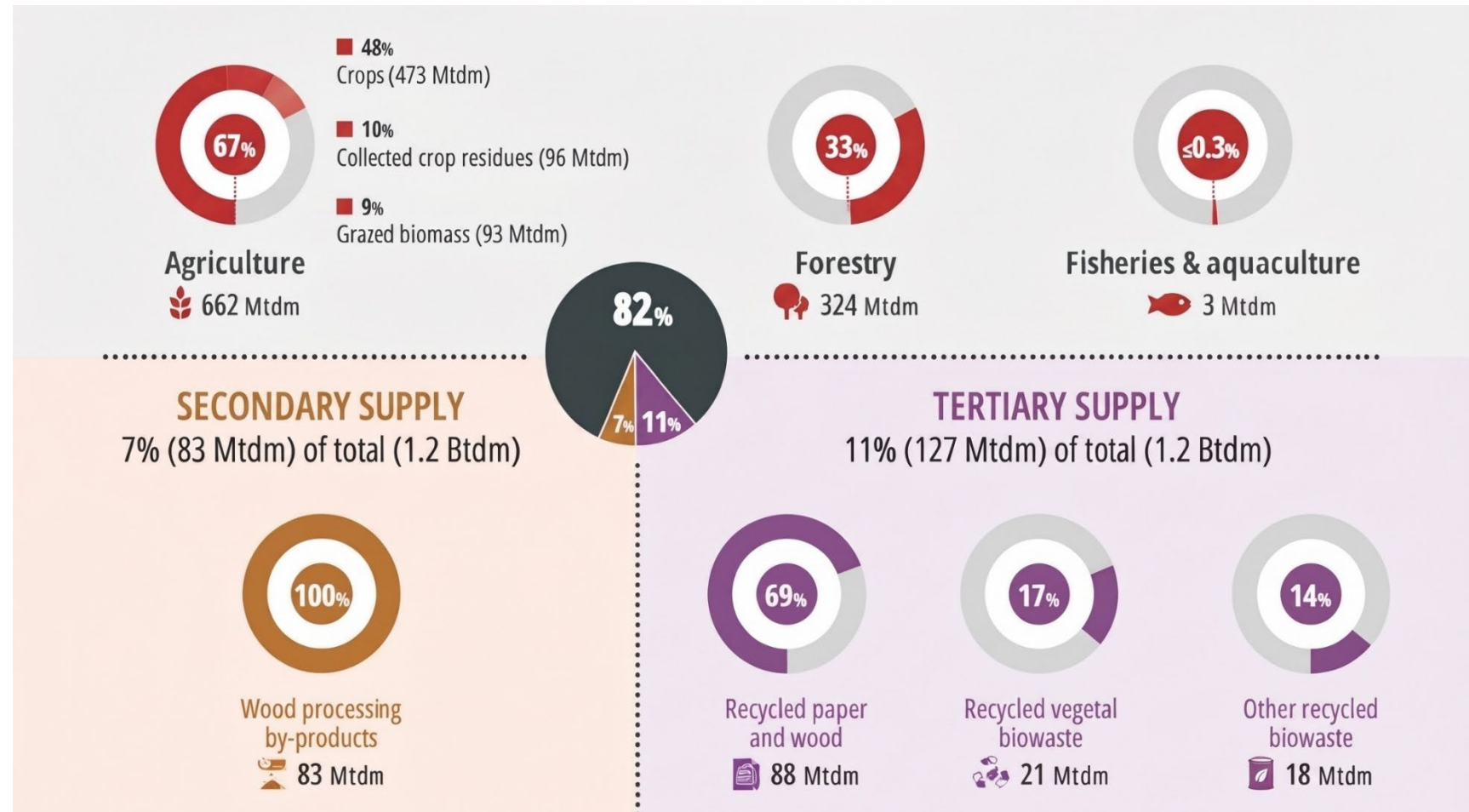


Task 40 Meeting DBFZ Leipzig (14 – 15 September 2026)

EU biomass supply in 2022

- Total: 1.2 billion tons dry matter (Btdm), net imports 0.02 Btdm (1.8%)
- Trade flows contribute substantially more: 5% - 16%* is supplied from imported resources
- The import dependency for bioenergy is ~5%:
 - >14% for liquid biofuels
 - 3.5% for solid biomass

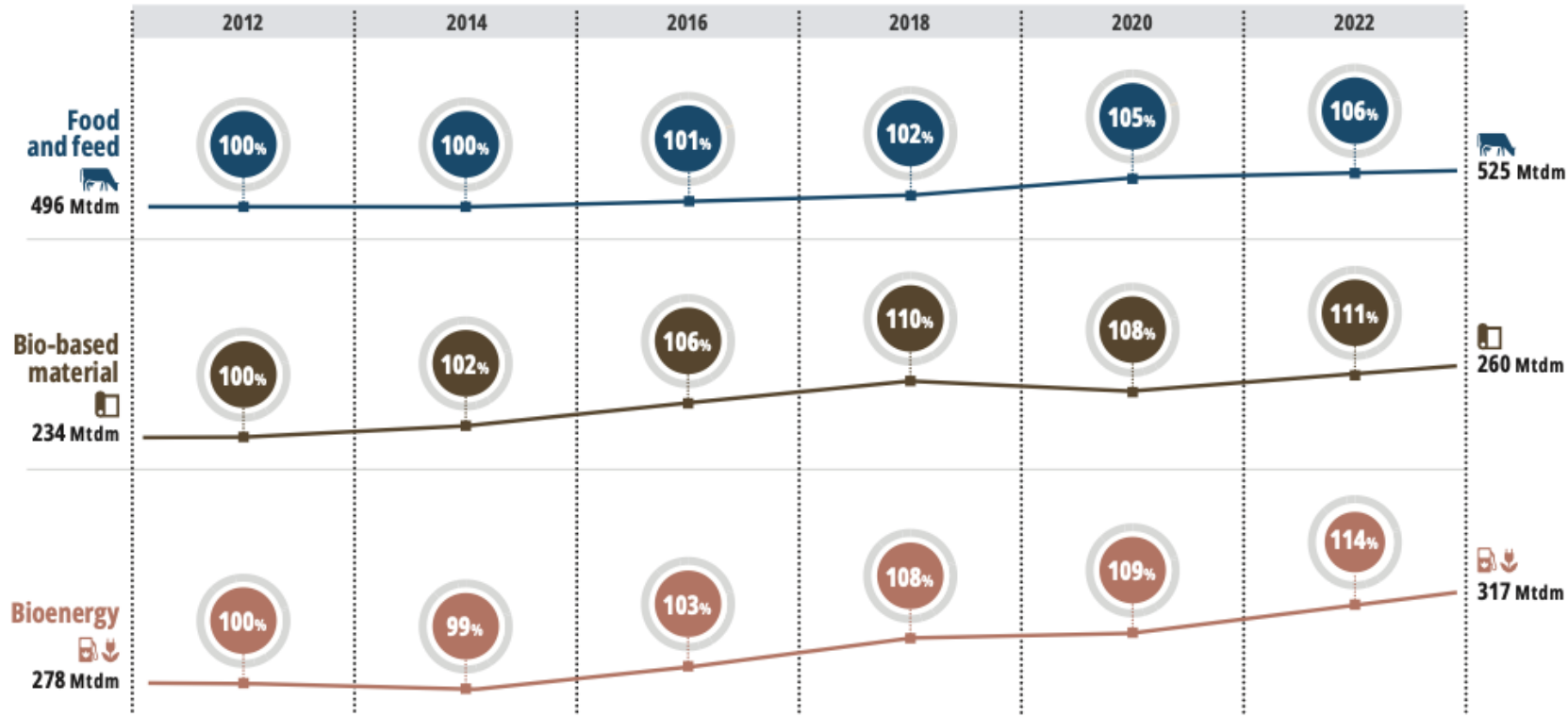
*) including indirect imports (embedded biomass)



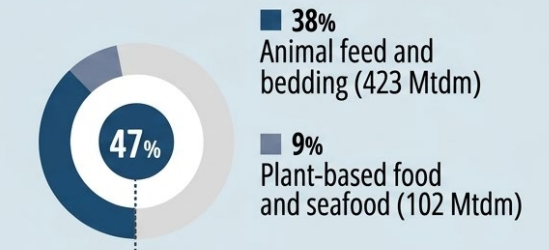
Sources:

- Camia, a., Cazzaniga, n., Tandetzki, j., Magnolfi, v., & Gurria, p. (JRC 2025). Biomass supply and demand in the EU 2012-2022.
- Lühmann, M. (2021). Sustaining the European bioeconomy: the material base and extractive relations of a bio-based EU-economy. In Bioeconomy and Global Inequalities: Socio-Ecological Perspectives on Biomass Sourcing and Production (pp. 287-307). Cham: Springer International Publishing.

EU biomass demand in 2022

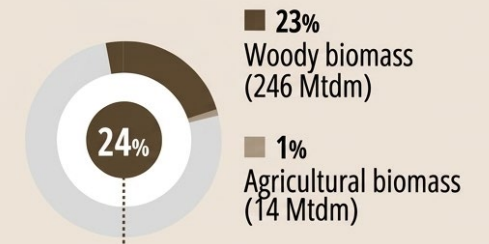


- Total demand (categorized by JRC) increased by 9% to 94 Mtdm to 1.1 Btdm (2012 – 2022)
- Bioenergy (14%) and bio-based materials (11%) are the main drivers for this growth
- ~70% of total bioenergy demand is supplied from forestry biomass



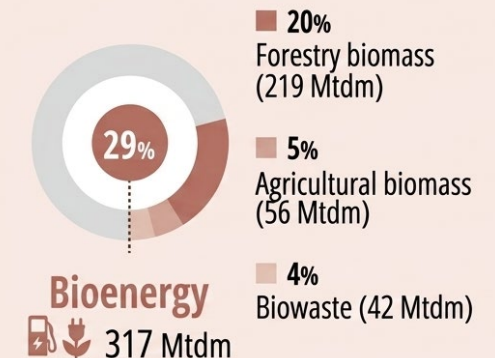
Food and feed

525 Mtdm



Bio-based material

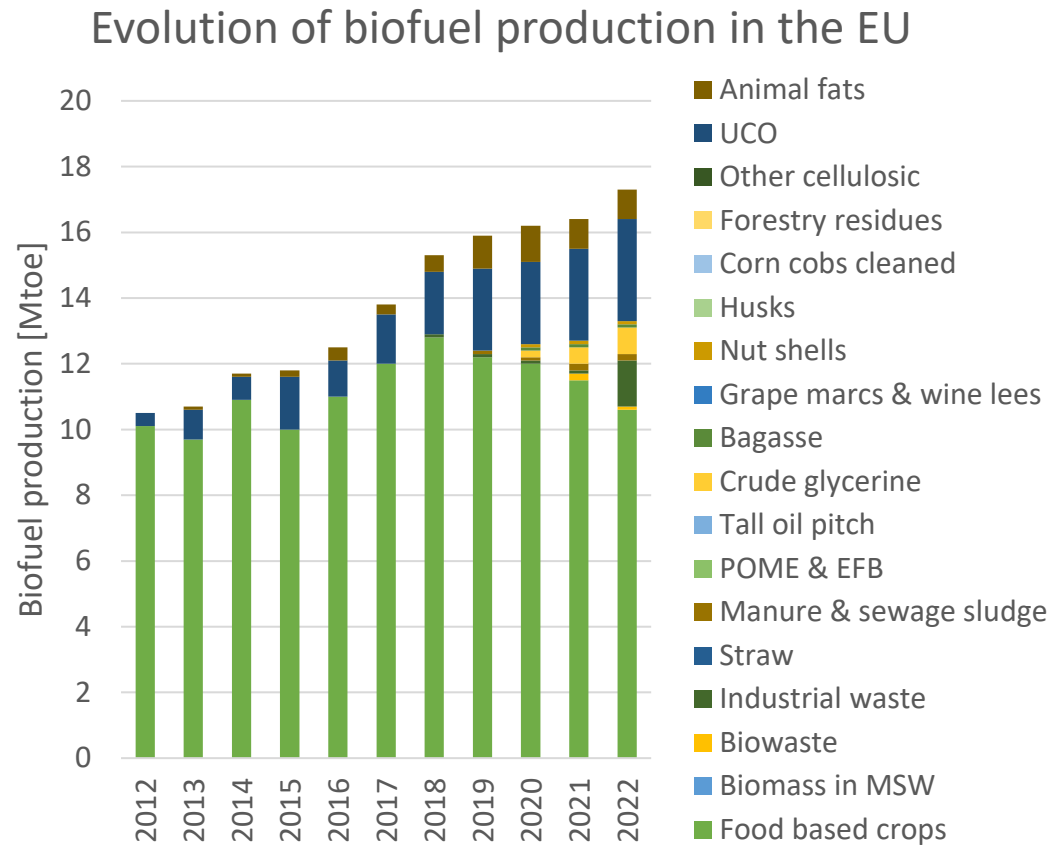
260 Mtdm



Bioenergy

317 Mtdm

Transport as a driver of future bioenergy growth

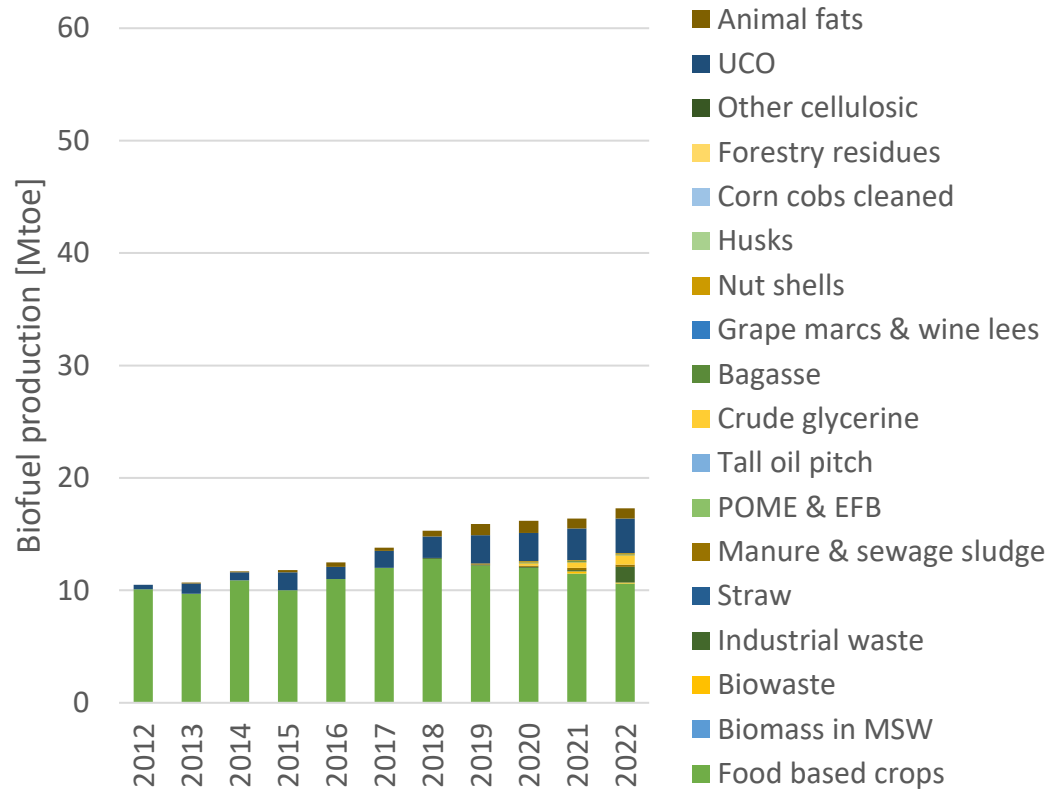


Source: EU JRC (2025)

- Biofuels are still produced mostly from food and feed crops, but have declined after the implementation of the RED II
- Growth mainly from HVO/HEFA made from UCO, animal fats, etc.

Transport as a driver of future bioenergy growth

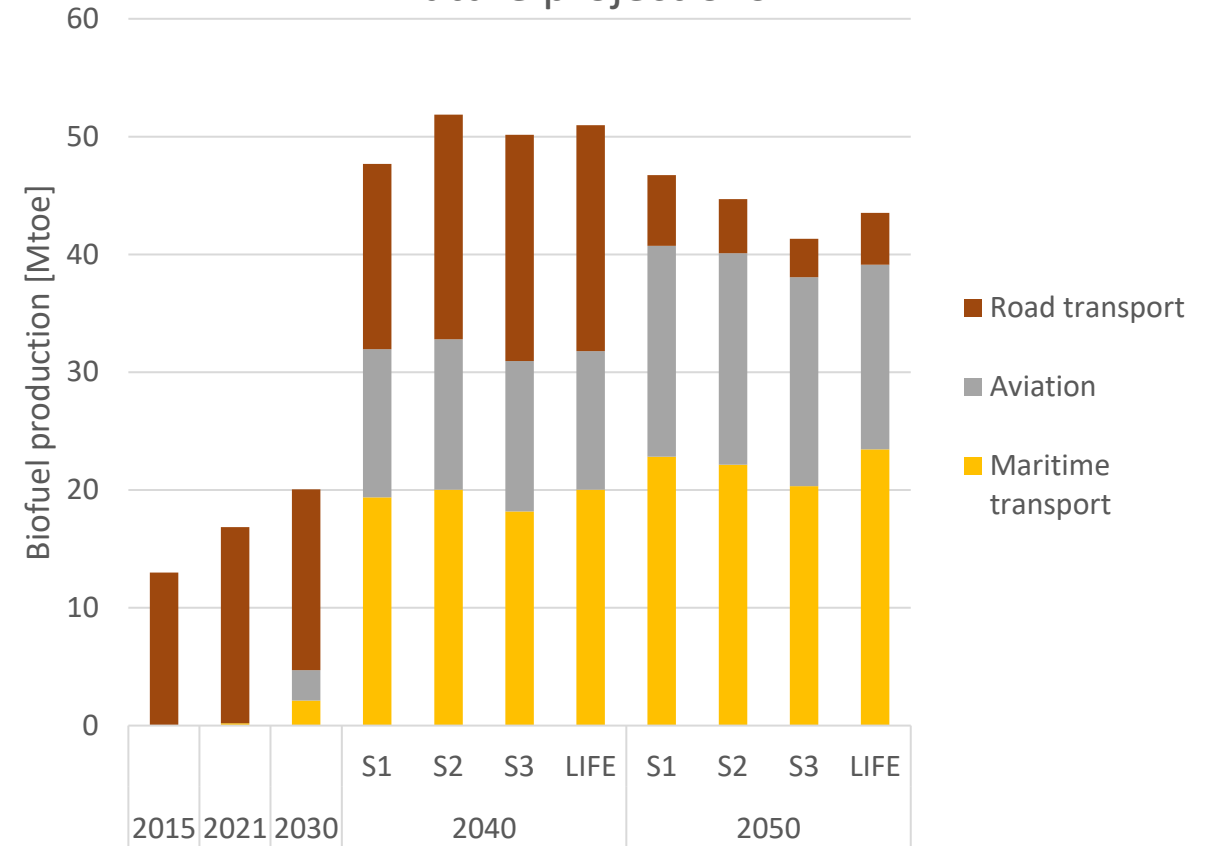
Evolution of biofuel production in the EU



Source: EU JRC (2025)

- Biofuels are still produced mostly from food and feed crops, but have declined after the implementation of the RED II
- Growth mainly from HVO/HEFA made from UCO, animal fats, etc.

Future projections

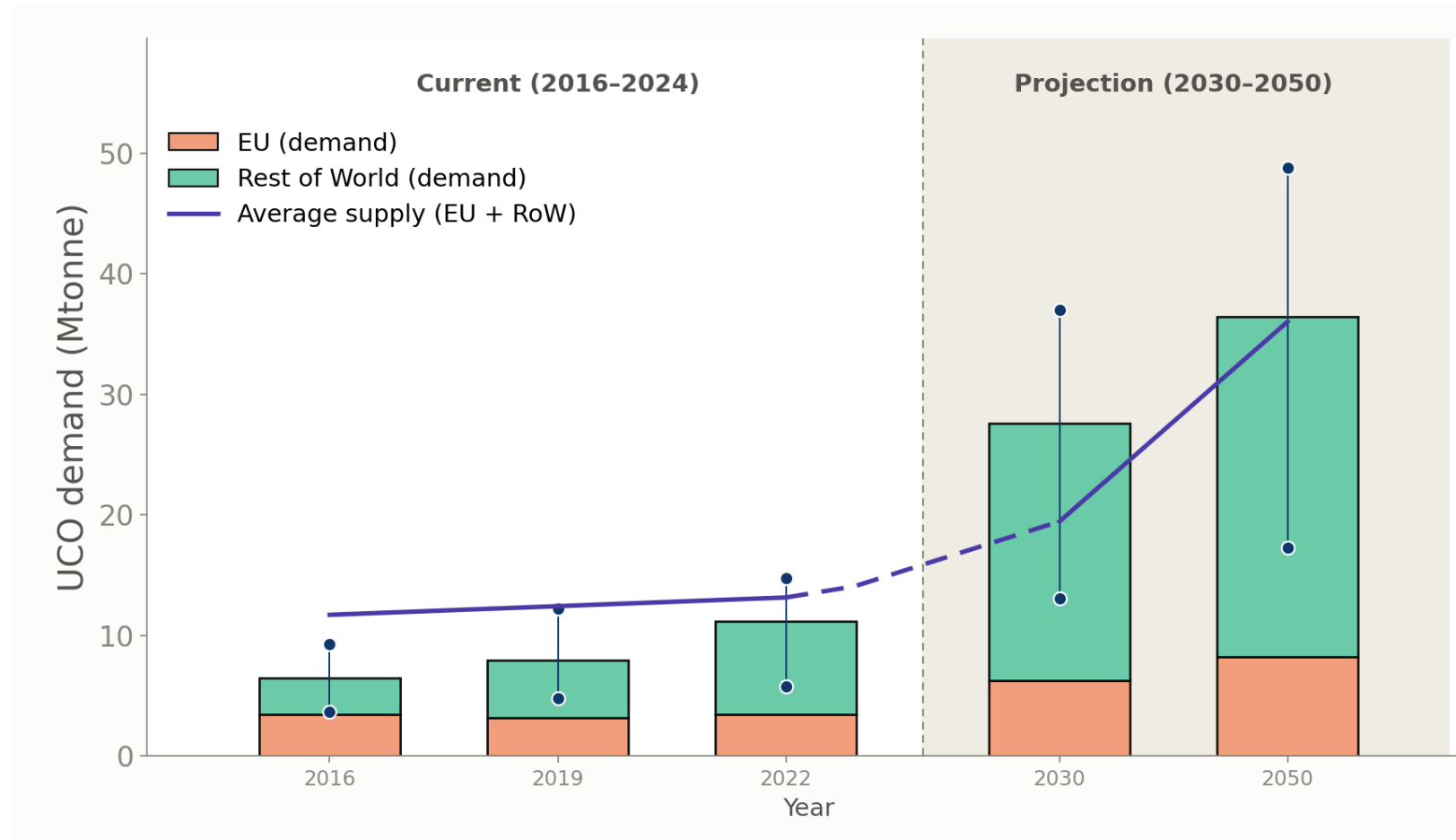


Source: EU SWD/2024/63

- Growth through 2040 driven by aviation and maritime sectors, with a post-2040 decline.
- What feedstock can deliver this scale-up sustainably?

Used Cooking Oil (UCO) could reach a tipping point soon

- Very high demand = saturated market
- Tipping point around 2030 -> **demand $\geq$ supply**
- 2050 demand: 36.5 Mt on average (range 18 – 49 Mt)
- Demand in the EU increases, as well as in other markets
- The dominant market is fuels (road/aviation), but also attractive as an oleochemical feedstock for chemicals/materials

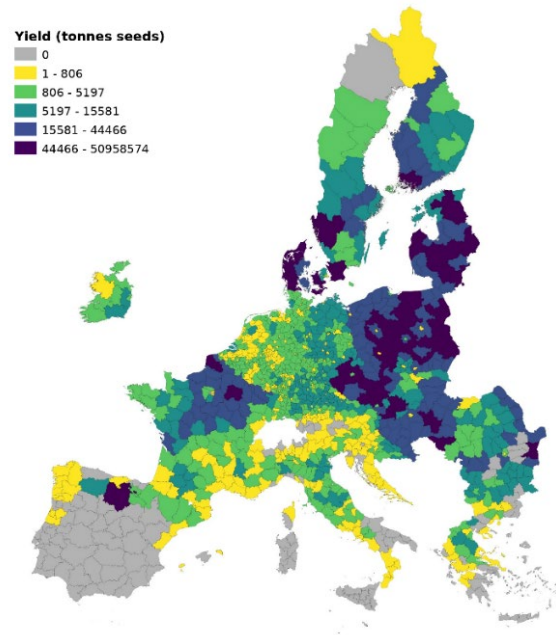


Source: Gerald Daniel (2026). Market Assessment CIRCUIROAD

Intermediate oil crop potential (summer and winter)

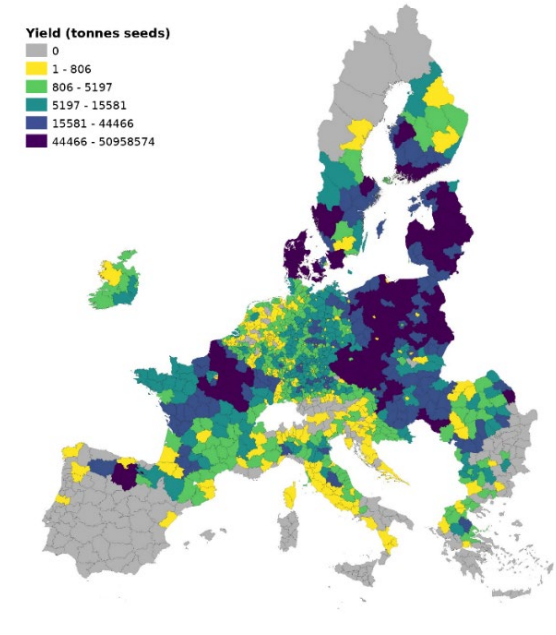
- Can have a positive environmental impact if grown under the right conditions
- Intermediate oil crop potential estimated at around 4.7 Mtoe
- Biomass availability during winter is significantly restricted
- Strongly constrained by their long growing periods

Current Oilseed yield summer intermediate (tonnes seeds)



2020: 9.7 mln ton seeds
(3.45 Mtoe) (from 26% of
available fallow land)

SSP1-2.6 2050 Oilseed yield summer intermediate (tonnes)

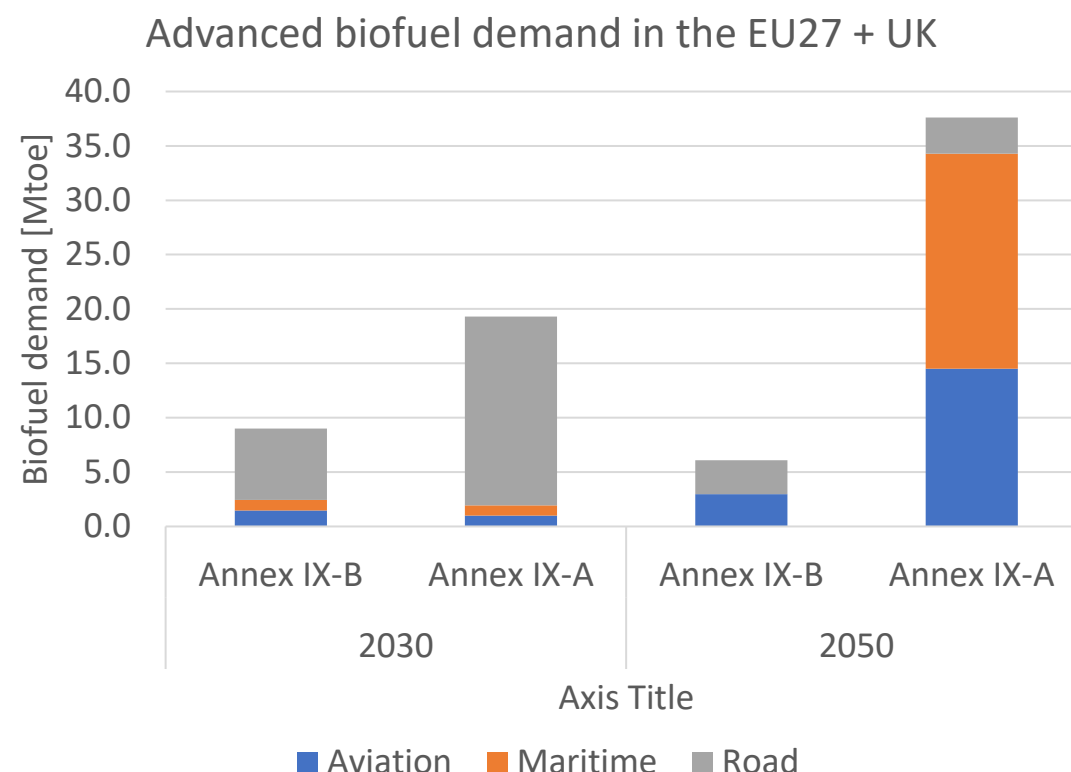


2050: High transition (mild
climate change (SSP1-2.4)
scenario: 13.2 mln tdm (4.68
Mtoe (from 25% of available
fallow land)

Source: Elbersen et al. (2026). Availability Potential of Intermediate Crops in the EU to 2050. Concawe Reports no. 6/26

Sustainable biofuel scale-up, thus requires biomass diversification beyond fats and oils

- LD Scenario 2050, 90% domestic production: 33.9 Mtoe adv. Biofuel
- Considering competing uses of solid biomass for heat/electricity
- Drop-in fuels produced in thermochemical biorefineries: Fischer-Tropsch (GFT), Hydrothermal liquefaction (HTL)
- More scenarios and detailed supply cost analysis are available in the CONCAWE report

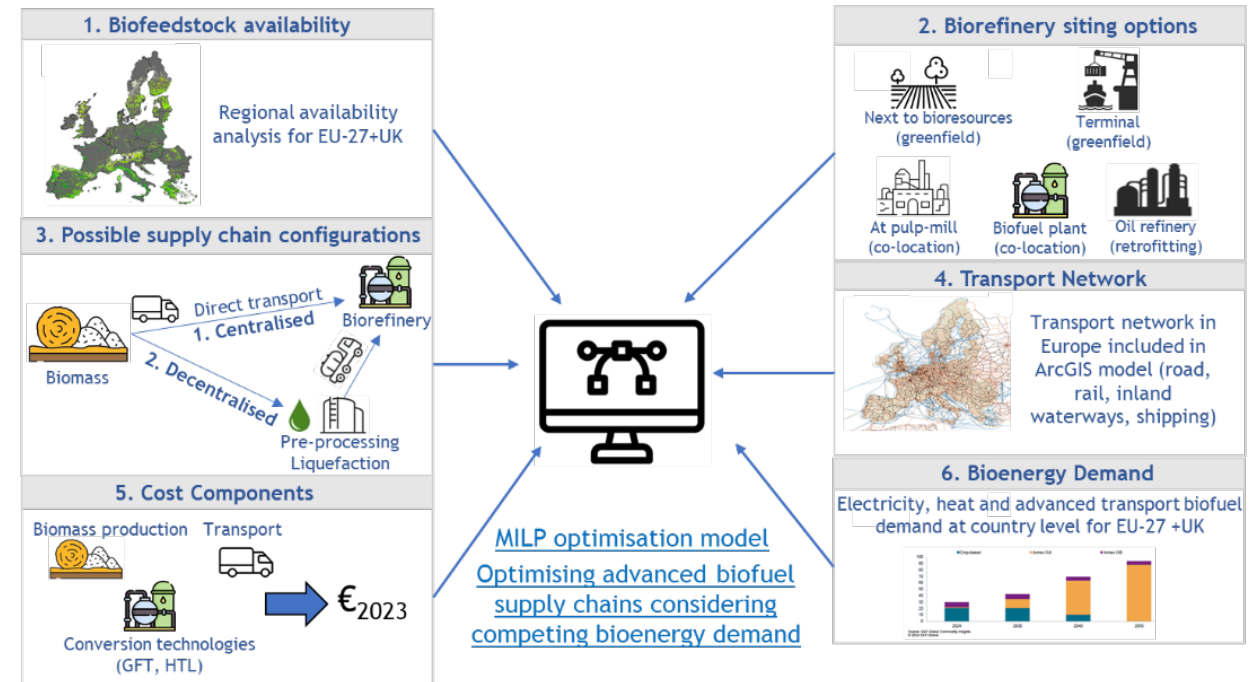
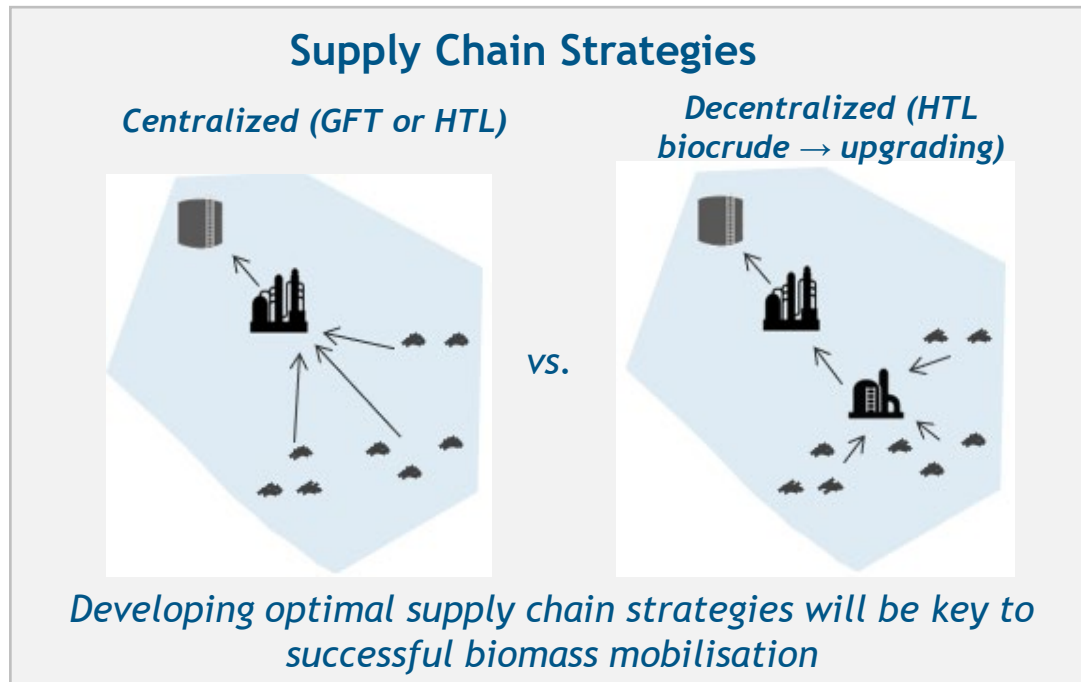


Source: Hoefnagels, R., Kwakernaak, S., van der Hilst, F., Junginger, M., Vera, I., & Neokosmidis, T. (2025). Sustainable biofeedstock supply chains for advanced biofuels in Europe towards 2050. CONCAWE Reports, 25(10), 1-110.

Biomass Supply Chains for Advanced Biofuels and competing bioenergy demand in the EU towards 2050

Objective: Determine economically optimal biomass supply chains for advanced biofuels (EU-27+UK, 2030 & 2050) under different availability and demand scenarios

Method: Detailed GIS mapping of biomass feedstock supply (1) and logistic infrastructure (4), co-location benefits (2) at brownfield locations, MILP supply chain optimization for advanced biofuel and competing bioenergy demand scenarios (6).



Selected insights and results

LD Scenario 2050: 33.9 Mtoe adv. biofuel

Centralised vs. Decentralised Biorefineries:

- Large-scale biorefineries (GFT) integrated with existing industrial sites and (oil refineries) are more cost-effective under biomass sufficiency conditions
- Under high-demand/low-availability conditions, decentralised HTL with upgrading at refineries, becomes more efficient, enabling the use of dispersed or remote biomass

Geographical patterns and trade:

- Geography is decisive for the optimal supply chain configuration. For example:
- North-Western Europe: key hub for importing biocrude from Scandinavia and Iberian Peninsula and upgrading it due to its strong port and refinery network

Biomass availability vs. demand:

- Europe's domestic biomass could be largely sufficient to meet demand
- By 2050, biomass availability to demand tightens; hence, improvements in biomass management practices and innovations to increase biomass availability are essential
- Next to biomass, access to (green) hydrogen could become a decisive location factor (future work)

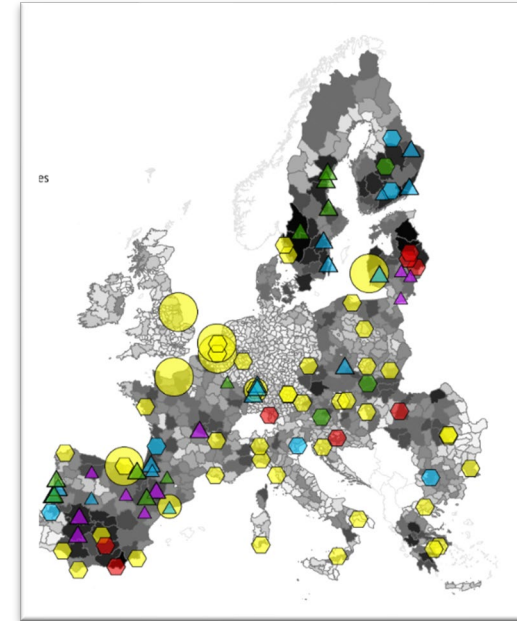
Spatial distribution of biorefineries (LD 2050)

Plant type (number, output capacity)

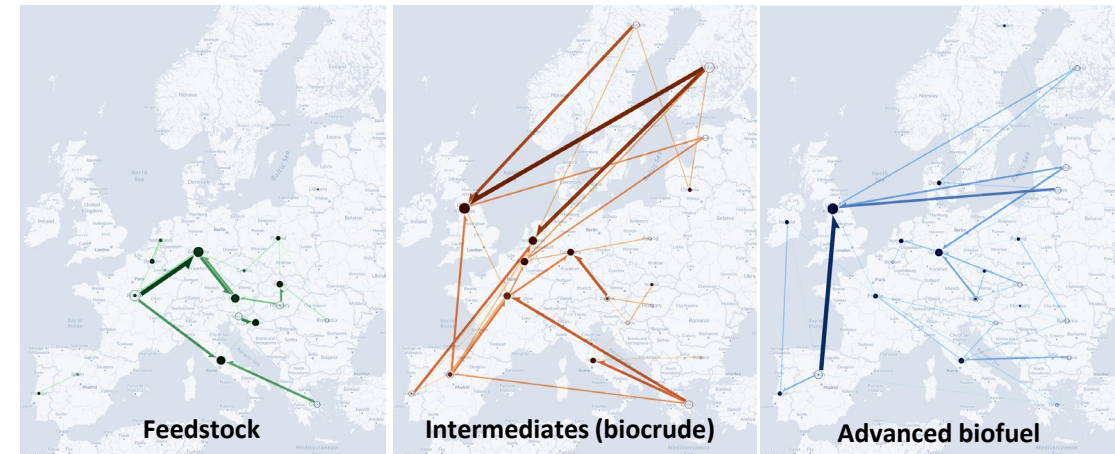
- △ HTL biocrude (37, 10.5 Mtoe)
- Biocrude upgrading (8, 11,6 Mtoe)
- ⬡ GFT (56, 22.3 Mtoe)

Location (number, output capacity)

- Greenfield (10, 2.3 Mtoe)
- At oil refinery (47, 27,1 Mtoe)
- At pulp mill (13, 4.3 Mtoe)
- At intermodal term. (8, 3.2 Mtoe)
- At existing biofuel plant (23, 7.5 Mtoe)



Trade among countries in the EU-27+UK (LD 2050)



Conclusions

- Recent biomass demand growth has been primarily driven by bioenergy and bio-based materials.
- Biofuels will continue to experience substantial growth driven by aviation and maritime sectors, despite the ongoing electrification of road transport.
- Scaling up advanced biofuels sustainably requires moving beyond fats and oils.
- While the EU could remain largely self-sufficient, specific sectors like biofuels and countries like the Netherlands exhibit higher trade.
- Sustainability extends beyond the choice of feedstock; it demands an end-to-end supply chain perspective that ensures sustainability at every stage and location of the supply chain.

Thank you

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