FEBRUARI

19

COMMODITIES

THEORIE IN DE PRAKTIJK

Utrecht University
Utrecht | 13:00 - 17:00 uur

IEA Bioenergy
Technology Collaboration Programme

Rijksdienst voor Ondernemend Nederland

Ministerie van Klimaat en Groene Groei

PLATFORM BIO ECONOMIE

TASK 40

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IEA Task 40
Deployment of biogenic value chains and carbon management

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IEA Bioenergy
Technology Collaboration Programme

Bron: NRC 2 juni 2012

IEA Bioenergy Task 40

Regionalization or commoditization?

Supply chains and future markets

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Commodities: Theorie in de Praktijk

Universiteit Utrecht Woensdag 19 februari 2025

Agenda

- IEA Bioenergy Task 40
- Globalization and regionalization strategies
- The Regional Transitions 2.0 Project
- Conclusions

IEA Bioenergy Task 40

Deployment of biogenic value chains and carbon management

- **Members**: Denmark, Germany, Netherlands, Sweden, Switzerland, United States
- **Objective**: to support the deployment of viable, efficient, and profitable biobased value chains and their respective system services and value created in the context of:
  - Sustainable, regional, national and international markets, including trade issues;
  - Reflecting on policy developments and economic aspects as carbon markets; and
  - Long-term climate and sustainability requirements.

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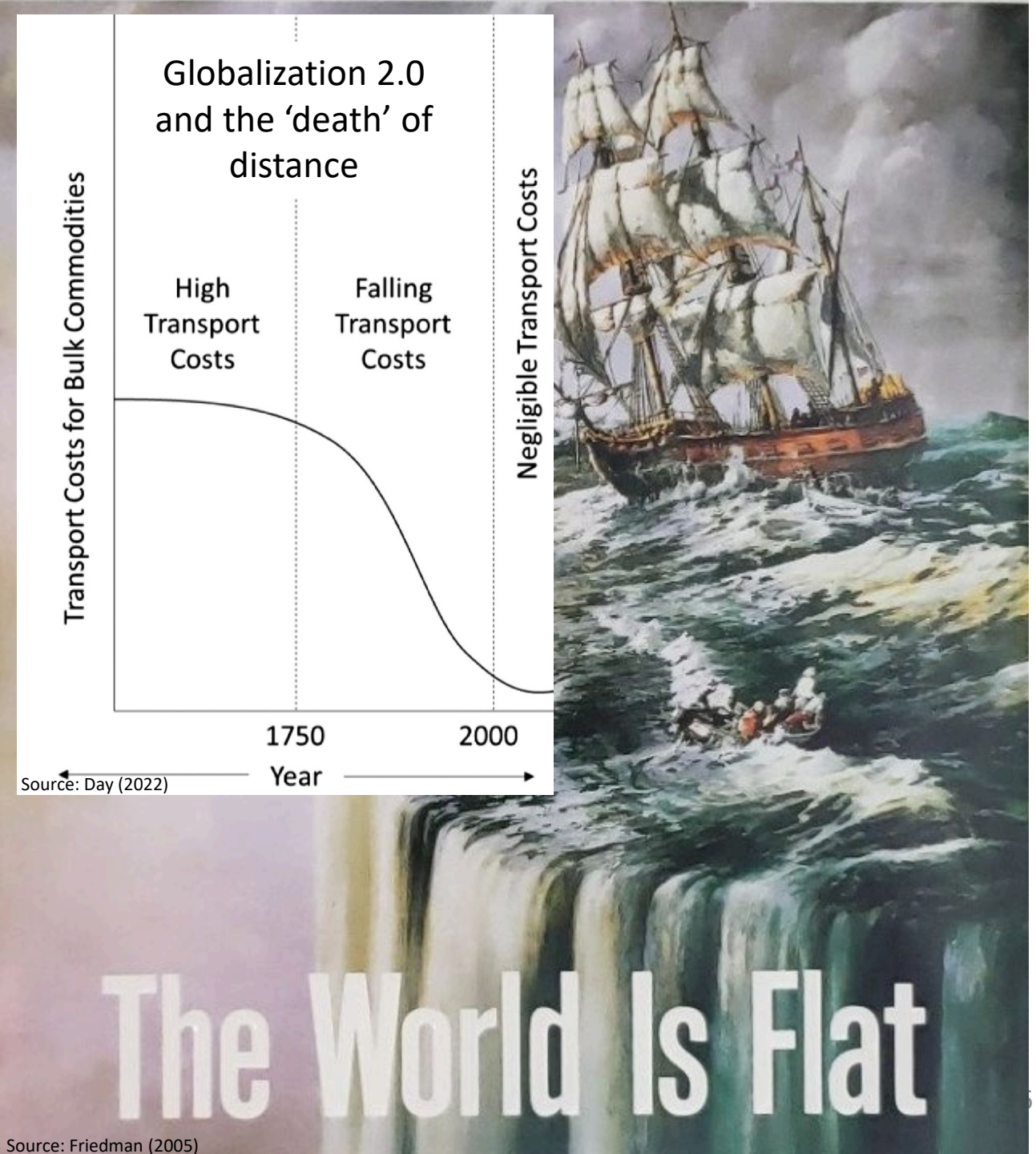
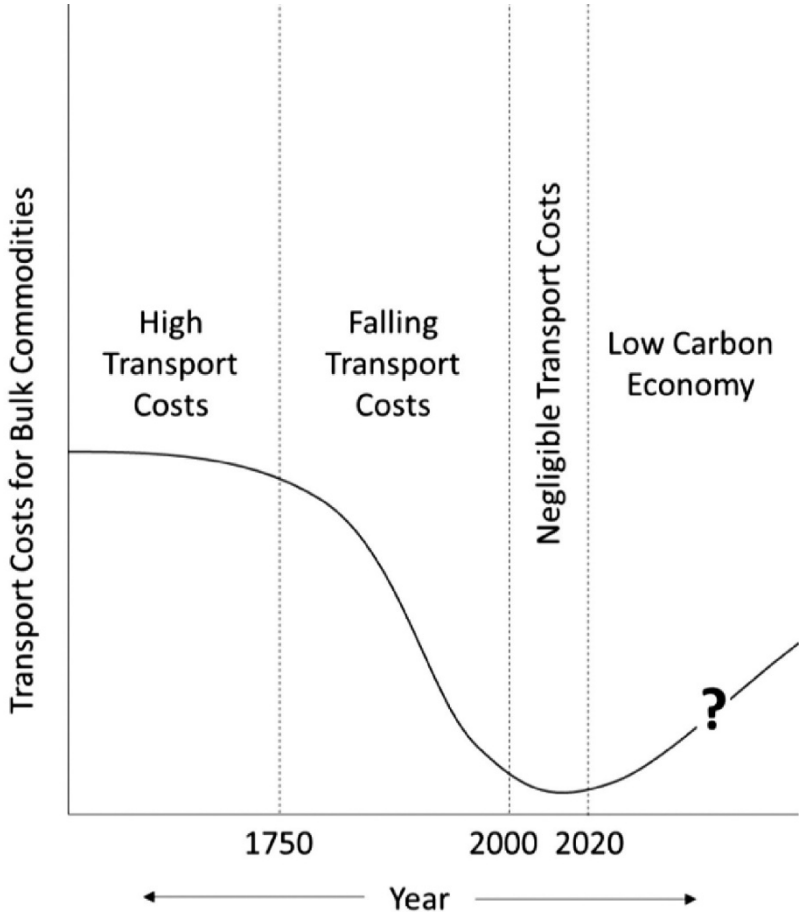


An increasingly 'flat' world (Friedman 2005)

- Globalization 1.0 (1492 - 1800):
  - Era when the world "shrunk" from a size large to a size medium, because nations and empires started to integrate through global trade and conquest.
- Globalization 2.0 (1800 - 2000)
  - From medium to small, connected, but not completely flat (yet)
  - The rise of multinational corporations and global markets with increased economic interdependence between countries
  - **The rise of agglomerations and lower transport costs have facilitated the creation of major industrial hubs.**
  - This concentration allowed for more significant economies of scale and increased competitiveness in global markets.
- Globalization 3.0 (2000 – 'today')
  - The world has "shrunk" from **small** to **tiny** in this phase, becoming **flat**
  - **Outsourcing**, **offshoring**, and **global supply chains** are now accessible even to small firms or individuals.
  - The rise of **freelancing**, **remote work**, and **gig economies**
  - **Collaboration tools** like open-source software, shared online platforms, and digital ecosystems
- Future……?

Sources:
- The World Is Flat: A Brief History of the Twenty-First Century (2005) Thomas L. Friedman
- Day, Christopher James. "Why industrial location matters in a low-carbon economy." *Structural Change and Economic Dynamics* 63 (2022): 283-292..

The re-emergence of distance and regionalization in a low carbon economy



Source: Day, Christopher James. "Why industrial location matters in a low-carbon economy." *Structural Change and Economic Dynamics* 63 (2022): 283-292.

Bioenergy

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Towards a driver framework for regional bioenergy pathways

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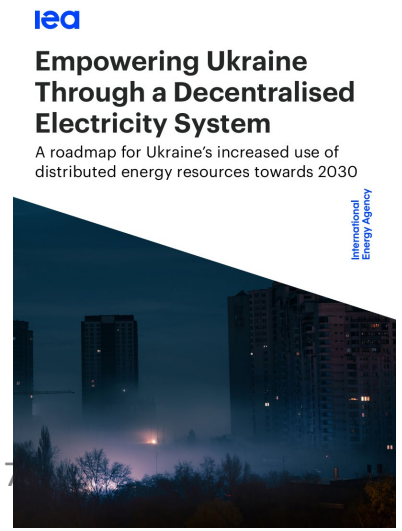
ABSTRACT

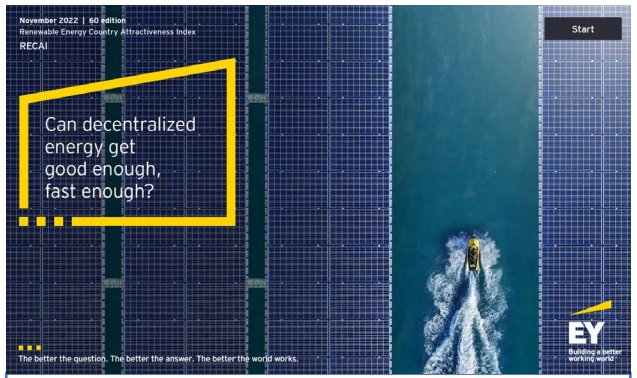
Bioenergy is currently under diversified pressure to re-assess its compliance with sustainable development strategies and criteria and thereby ensure that the sector delivers a long-term contribution to renewable energy transition. With a view to promoting sustainable regional development this inquiry investigates whether a reframing of bioenergy supply chain design can allow sustainable regional development targets to feature as integral supply chain components and both help upgrade existing bioenergy processes and initiate new bioenergy value chains. Following a critical survey of classic supply chain management we use a Total Quality Management approach to operationalize the concept of regional energy and pilot the development of sustainable bioenergy pathways within North European regional settings. We argue that a methodical enhancement of supply chain design can help overcome the challenges facing bioenergy and at the same time provide a blueprint for pioneering feasible regional energy initiatives as alternatives to conventional energy processes. From an initially sectoral perspective the study seeks to support the integration of regional development goals into energy transition policy.

Concerns:

- Longer (international) supply chains could lead to higher emissions/impacts than regional supply chains.
- It could reduce the role of local biomass producers to that of a materials supplier, with wealth generation transferred elsewhere across global value chains.
- It could favor large utilities for cost-effectiveness and re-centralize the energy supply chain.
- Subsidy-based supply chains that lack anchorage or orientation in a regional setting are vulnerable.

Electricity





EY (2022): A global shift away from centralized energy generation toward decentralized distributed energy systems is underway.

IEA Bioenergy

Regional transitions in existing bioenergy markets 2.0

- Regional Transitions 2.0: aims to demonstrate that regionalization and commoditization strategies **are not mutually exclusive** to the energy transition.
- The **regional context** is important for the sustainability performance of regional and international bioenergy supply chains.

Case studies:

- Regionalization of biobased value chains
  - An evaluation of integrating bioenergy communities for the production of renewable natural gas in Austria (TU Wien, Austria)
  - Ecosystem of innovation in the region - Bio-based innovations from Central Germany (DBFZ, Germany)
- Regional (mobilization) strategies for commoditized supply chains
  - The role of sugar depots in enabling regionalized supply with commoditized intermediates for commercial-scale biorefineries (Idaho National Laboratory, US)
  - Cost-effective supply chain configurations for the production of bioelectro- and electrofuels – the case of Sweden(RISE, Sweden).
  - **Location factors of the future rollout of advanced biorefineries in (Northwestern) Europe (UU, Netherlands)**

Case study and synthesis reports will be published in May 2025

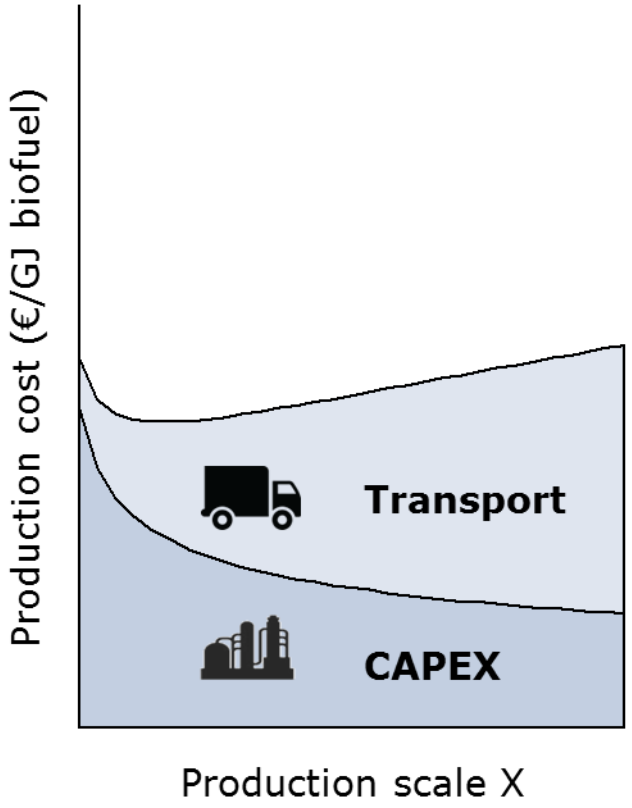
Economies of scales can be achieved with (intermediate) biomass commodities, but transport is important (re-emergence of distance)

Oil industry

Bigger is better

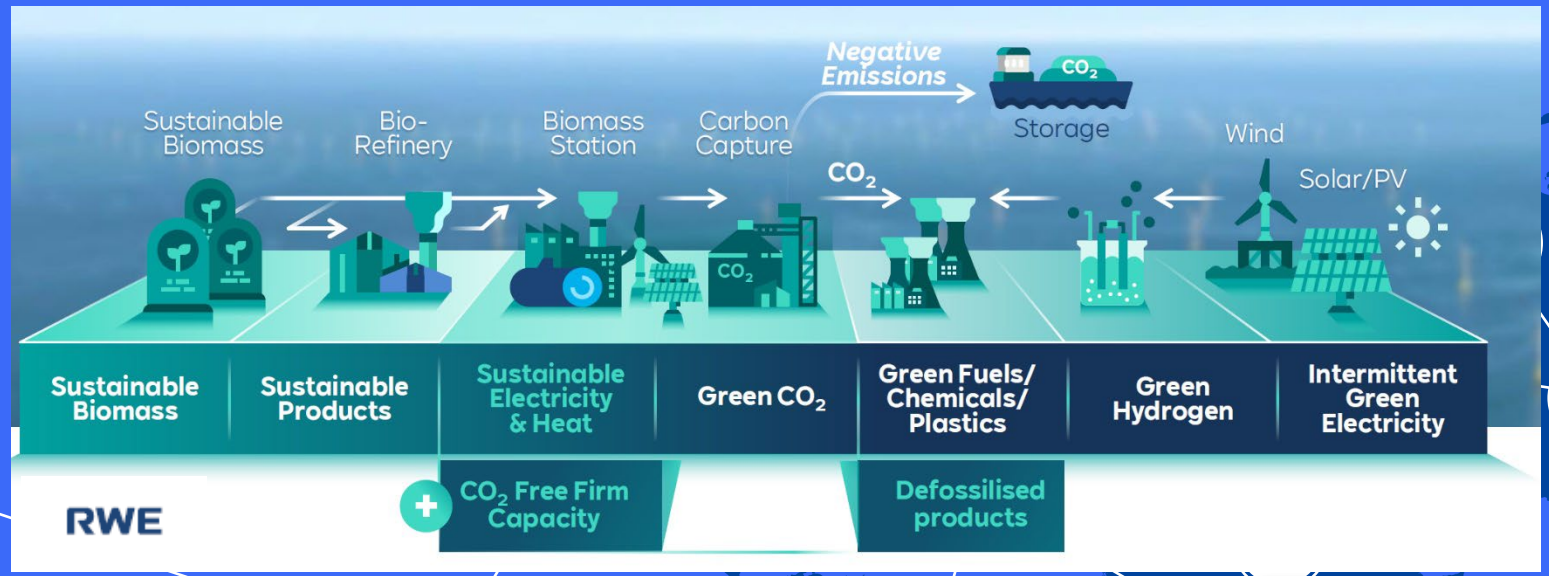
Bioenergy

There's a trade-off



Source: de Jong, Sierk, et al. "Cost optimization of biofuel production–The impact of scale, integration, transport and supply chain configurations." Applied energy 195 (2017): 1055-1070.

There are many other factors that play a role



- Complex networks of connected nodes with many variables shaped by transport and energy infrastructure
- Interplay with:
  - other biobased sectors
  - Other renewable energy sources
  - E.g., H_2 synergies and competition

RWE: https://benelux.rwe.com/pers/2022-12-12-rwe-lanceert-project-beccus-voor-grootschalige-afvang-en-opslag-van-co/

Universiteit Utrecht

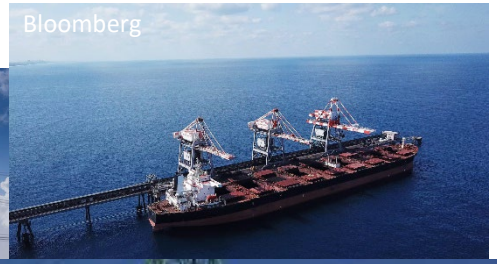
Infrastructure determines accessibility

Transport infrastructures: the fixed components of the transport system.

It consists of ports, harbors and airports, road, rail and pipeline networks, the depots and facilities associated with these networks and the public and private transport services that operate on them (Taylor, 2021).

Energy infrastructure: an extensive, complex energy delivery system.

It consists of transport networks, including pipelines, power transmission lines, road, rail, and shipping networks, and storage and handling facilities that contribute to reliable and affordable access to energy sources (IEA, 2022).



Challenge of the **energy transition**: future uncertainty of markets is a major barrier to long-term investments in **infrastructure**. Decisions cannot be changed easily and development takes time.

Access to infrastructure, example: Rotterdam

Economically optimal supply chain routes and cost-supply curve*

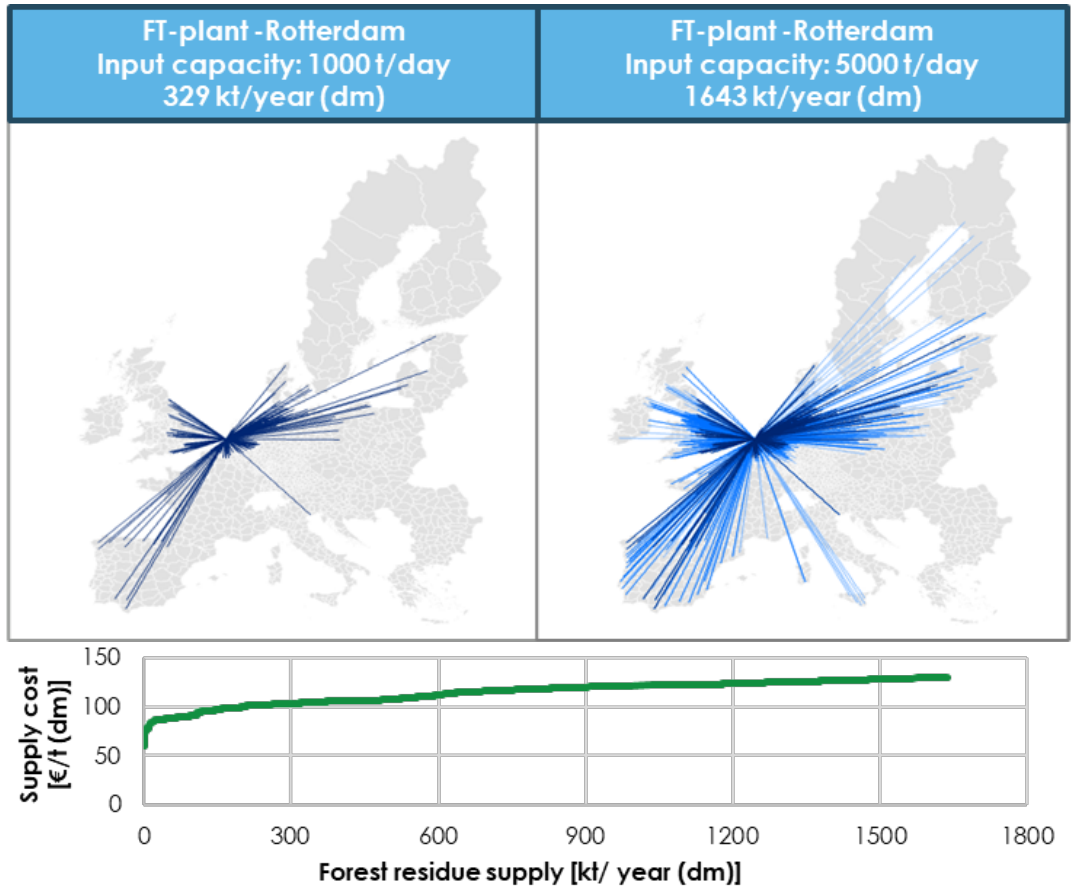


Figure. A visualisation of the locations from where forest residues are sourced and the respective supply-cost curve. Each line on the map represents an actual least-cost route between origin and destination, calculated using an intermodal transport model

For a small biorefinery scale:

- Supplying biomass **in the proximity of the biorefinery via road transport is the most cost-effective** method

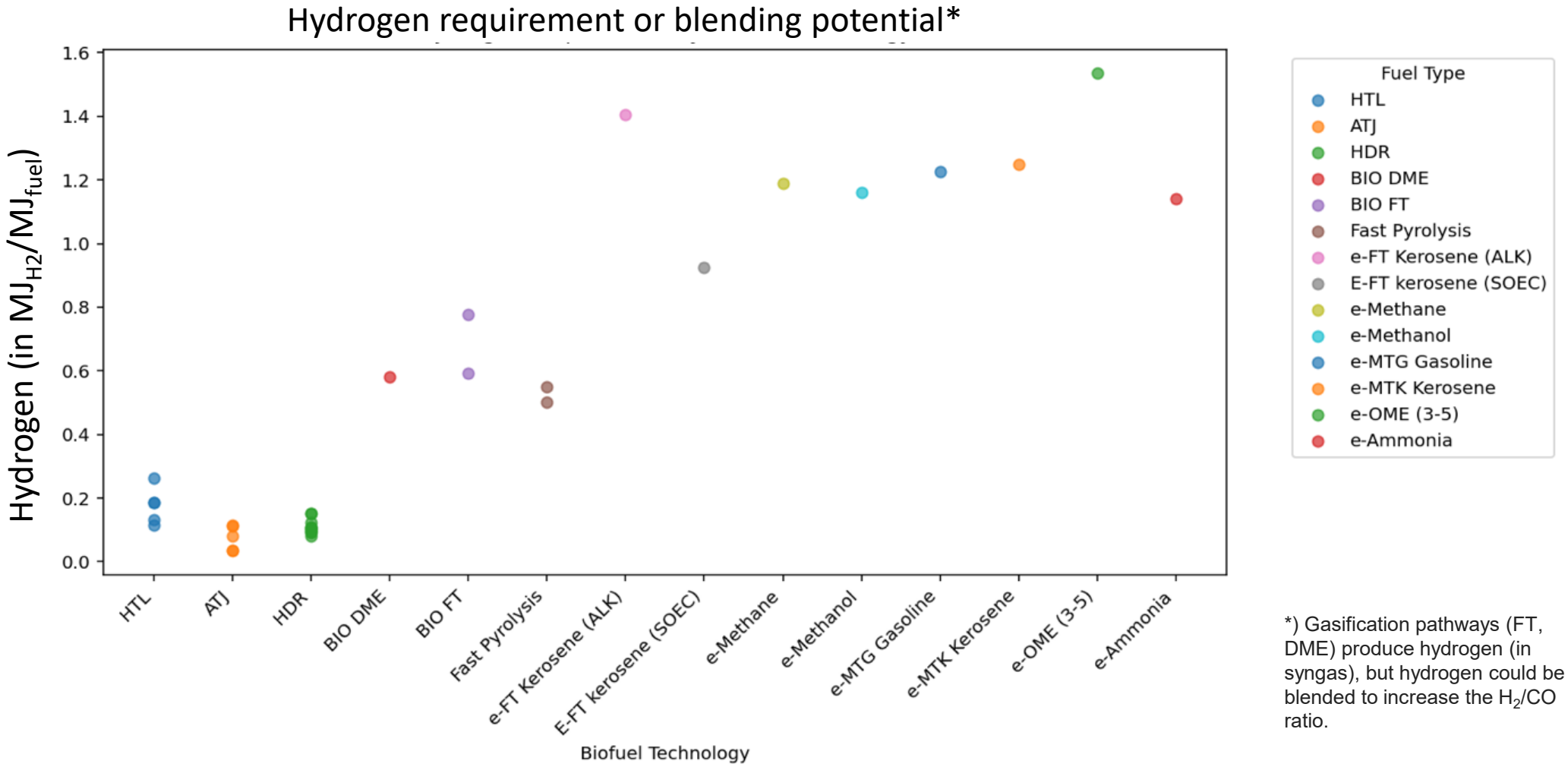
For a large biorefinery scale:

- Additional biomass needs to be sourced from more distant locations - **a plateau in the supply cost gradually forms** due to the economic benefit of intermodal transport (low-cost shipping)
- **Using intermodal transport (road plus sea transport) to supply biomass is economically favoured** as sea transport is the least expensive mode for long distances

*A single plant that can access 10% of the EU available biomass –the total EU demand

Source: Developed by UU for CONCAWE (T. Neokosmidis, 2024). Sustainable biomass feedstock supply chains for advanced biofuels. Presented at the EUBCE 25th of June 2024 -Marseille

E-Fuels vs. Biofuels: The Crucial Role of Hydrogen Accessibility in Future Liquid Fuel Deployment



*) Gasification pathways (FT, DME) produce hydrogen (in syngas), but hydrogen could be blended to increase the H_2/CO ratio.

Source: Bertram Alempiew (2024). Understanding The Synergies Between Green Hydrogen Supply and Liquid Fuels of Biological and Non-biological Origins (Master's thesis, UU Energy Science).

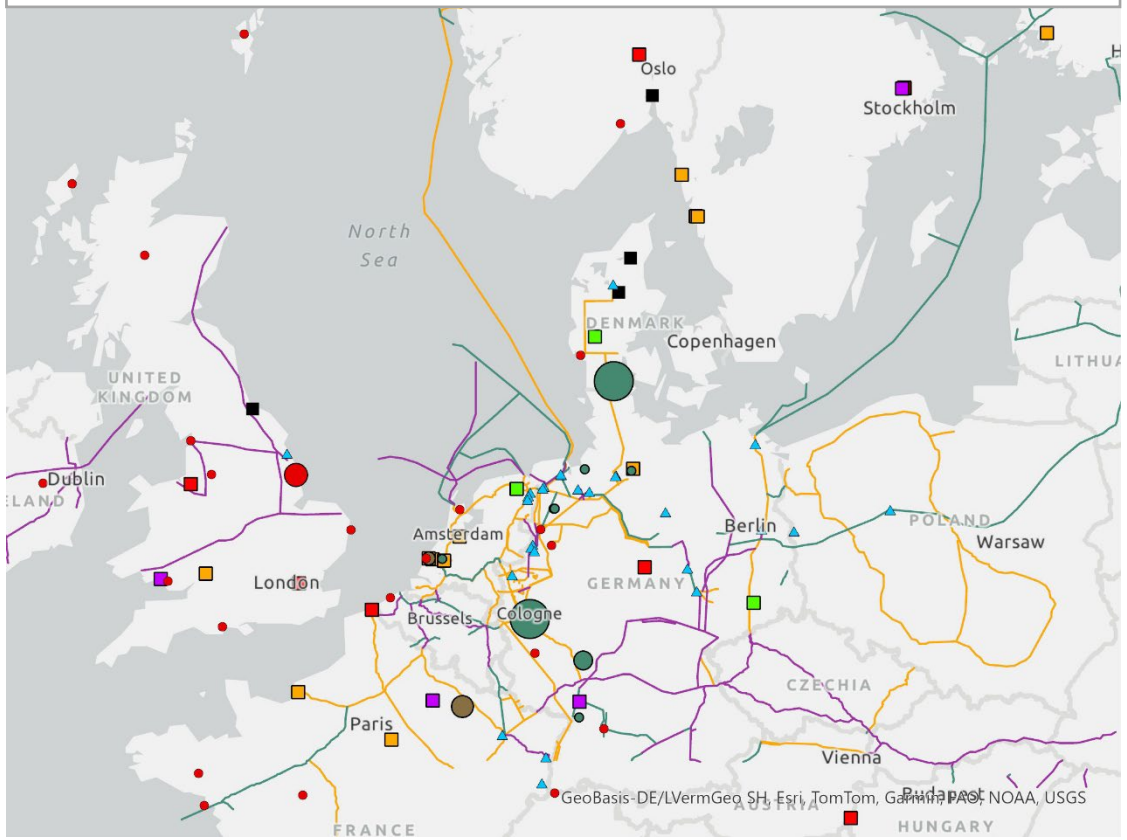
Green hydrogen

Northwestern Europe:

- A potentially ‘dense’ hydrogen infrastructure
- Next to well-developed transport infrastructure that provides access to (international) biomass commodities
- This could create opportunities for advanced biorefineries

Hydrogen infrastructure, dedicated biofuel and E-fuel electrolyzers and advanced biofuel plants

Status: in operation, under construction, planned



Source: Bertram Alempiew (2024). Understanding The Synergies Between Green Hydrogen Supply and Liquid Fuels of Biological and Non-biological Origins (Master’s thesis, UU Energy Science).

Conclusions

- Sustainable, reliable and consistent feedstock supply chains are essential for the market rollout of modern bioenergy and advanced materials (chemicals, plastics) needed to meet climate targets.
- Commoditization (and international trade) is both an enabler and risk for the development of biobased value chains. Strong anchorage and orientation in a regional setting are important.
- An integrated supply chain perspective is needed, that considers both regional and international factors, as well as competition and synergies with hydrogen markets and other renewable energy sources.

Thank you for your attention

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