The Transition to Green Energy for the Fishing Fleet and Its Ports

Nordic Energy Research

Ditte Stougaard Stiler

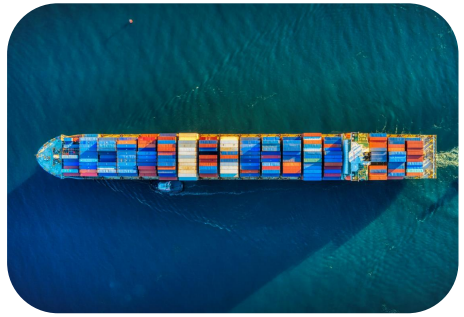
Date: 13.09.2023

Agenda

- The Transition to Green Energy
- The Nordic Fishing Fleet
- Electricity and Alternative Fuels
- Port Infrastructure

Nordic Energy Research

The platform for cooperative energy research and policy development under the auspices of the Nordic Council of Ministers



Funding research

Analytical function

Secretarial support

Promoting Nordic co-operation

Background

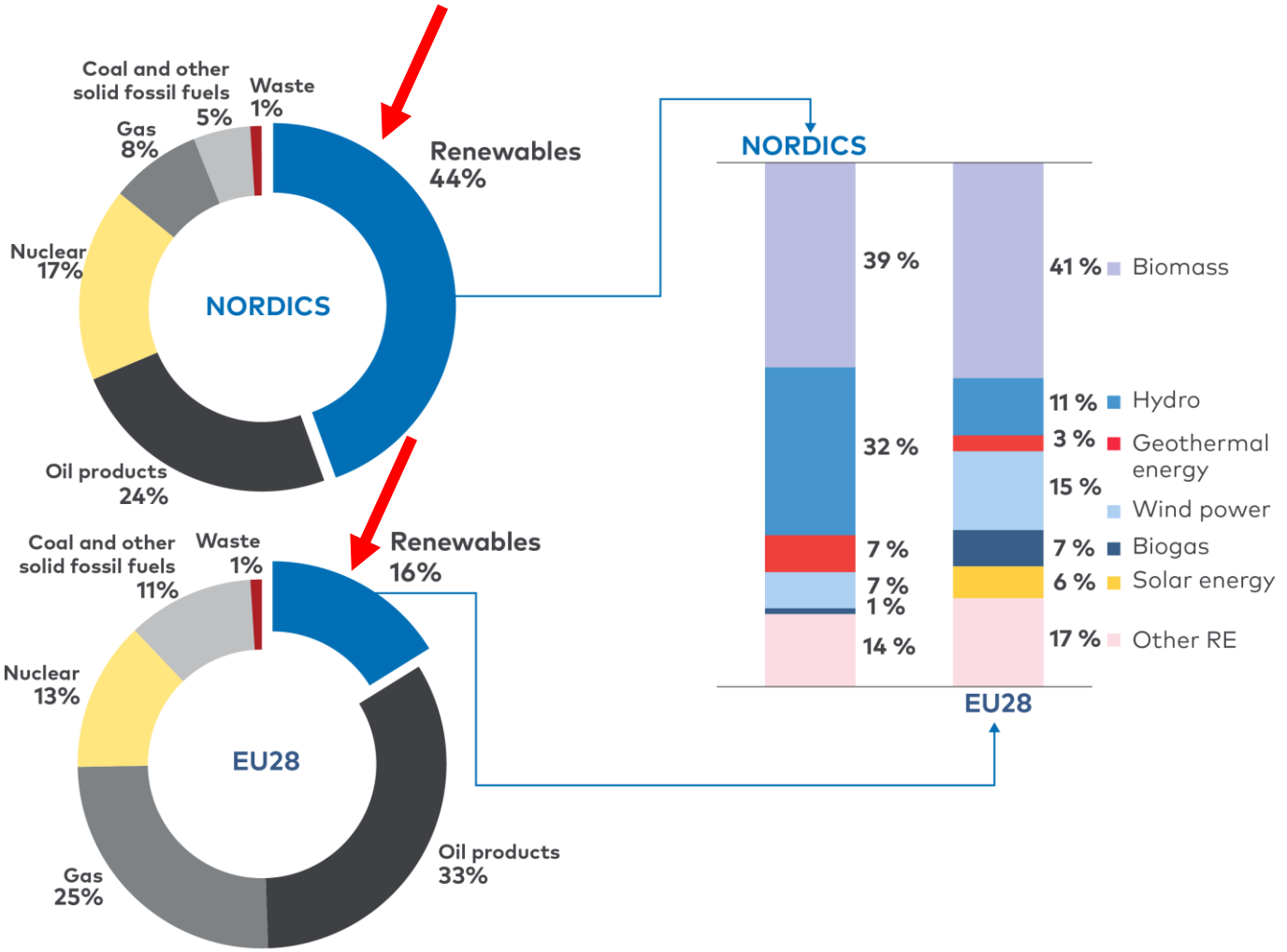
The Working Group for Fisheries (AG-Fisk) for the Nordic Council of Ministers has invited us

Net zero emissions fisheries and aquaculture sector by 2050 target by the EU

- Energy efficiency
- Cleaner energy sources
- Low-carbon power sources

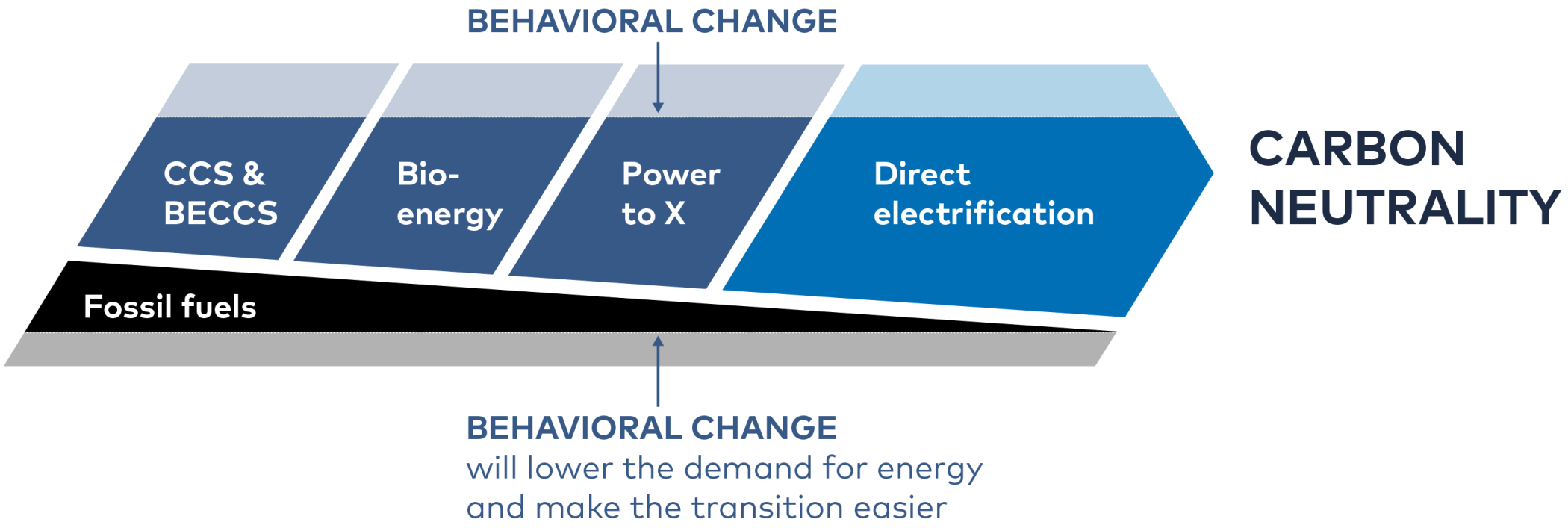
Norwegian Artificial Intelligence Research Consortium (2023)

Total Primary Energy in the Nordics



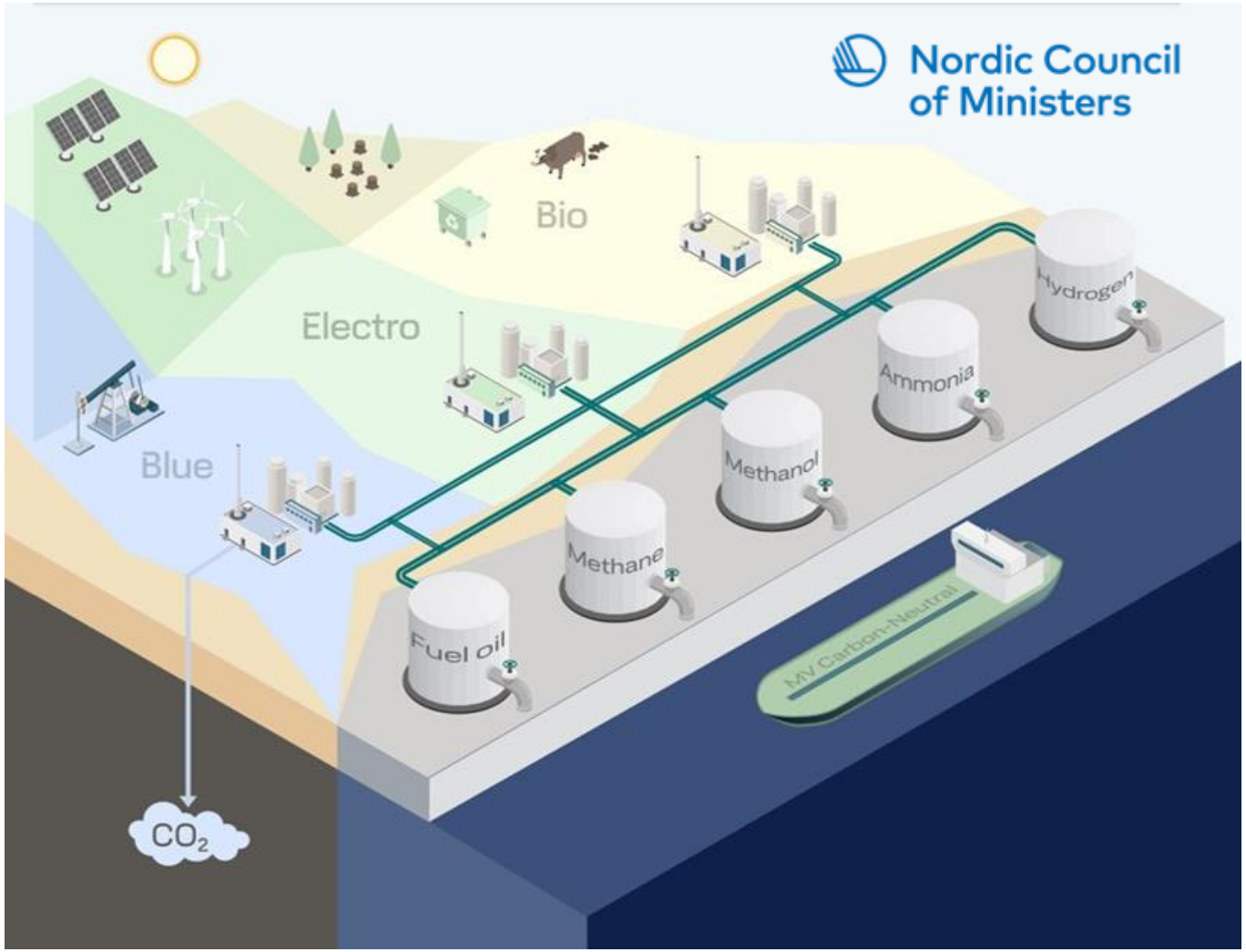
Nordic Clean Energy Scenarios –Solutions for Carbon Neutrality, Nordic Energy Research (2021)

The Transition of the Nordic Energy System



Nordic Clean Energy Scenarios –Solutions for Carbon Neutrality, Nordic Energy Research (2021)

Alternative Energy for Fishing Vessels



The Nordic Roadmap, DNV (2023)

Today:

Fuel oil

Alternatives:

Electricity

Bioenergy

Hydrogen

Methanol

Ammonia

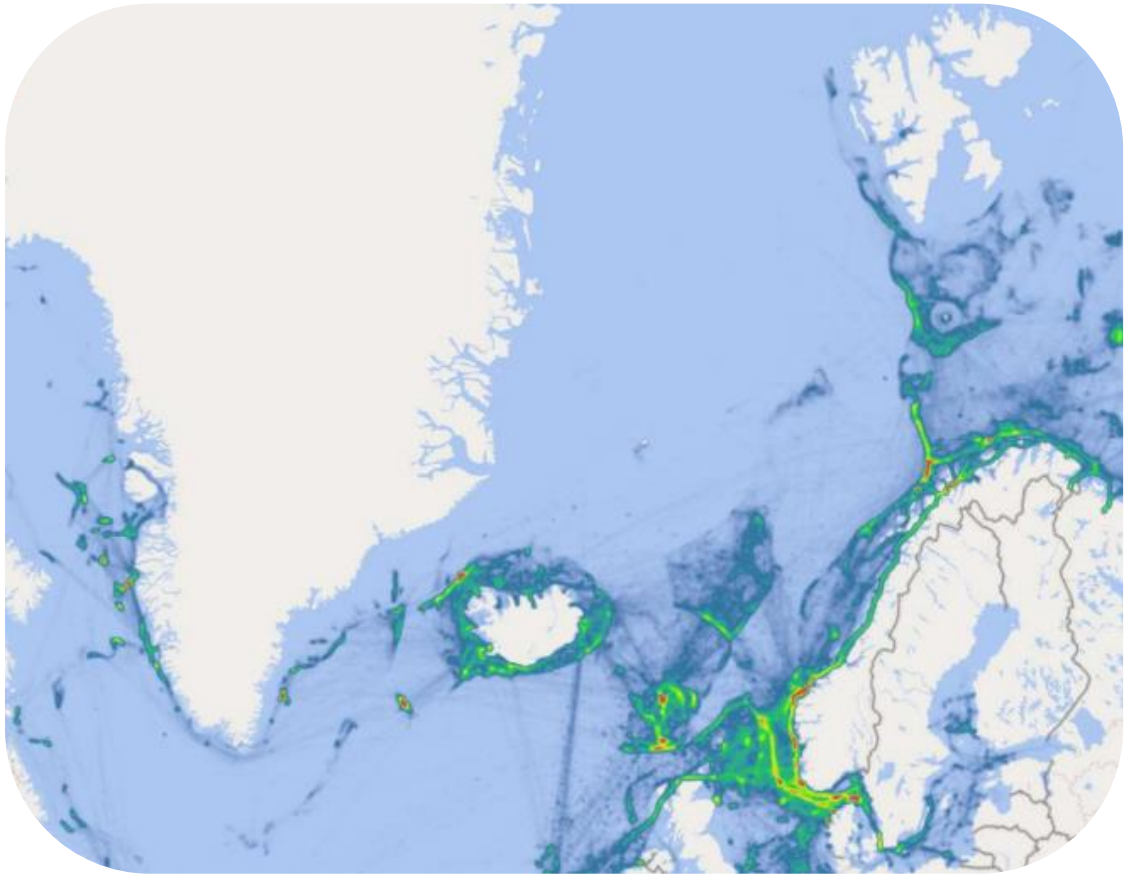
Nordic Fishing Traffic

Fishing Vessels:

- 83% domestic voyages
- 15% of total fuel consumption

Aquaculture vessels operate domestically as well

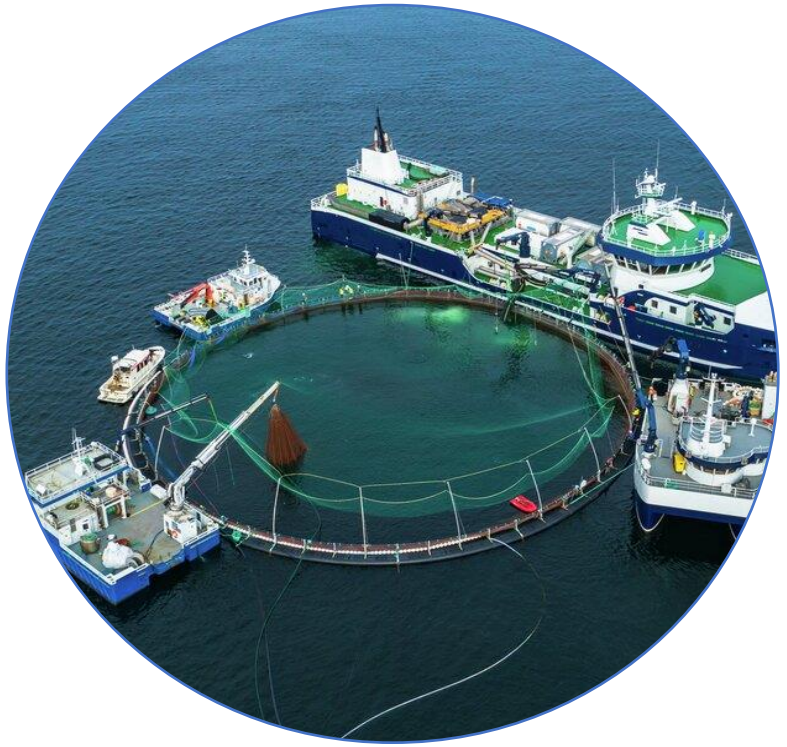
Fuel Consumption Density of Nordic Fishing Vessels



Rivedal et.al. (2022)

Fuel or Powertrain?

- Operational Profile
- Distance
- Engine Power
- Speed
- Weather Conditions



Electricity

Grønarók – Electric Catamaran Workboat (the Faroe Islands)

Baird Maritime (2022)

Fully Electric

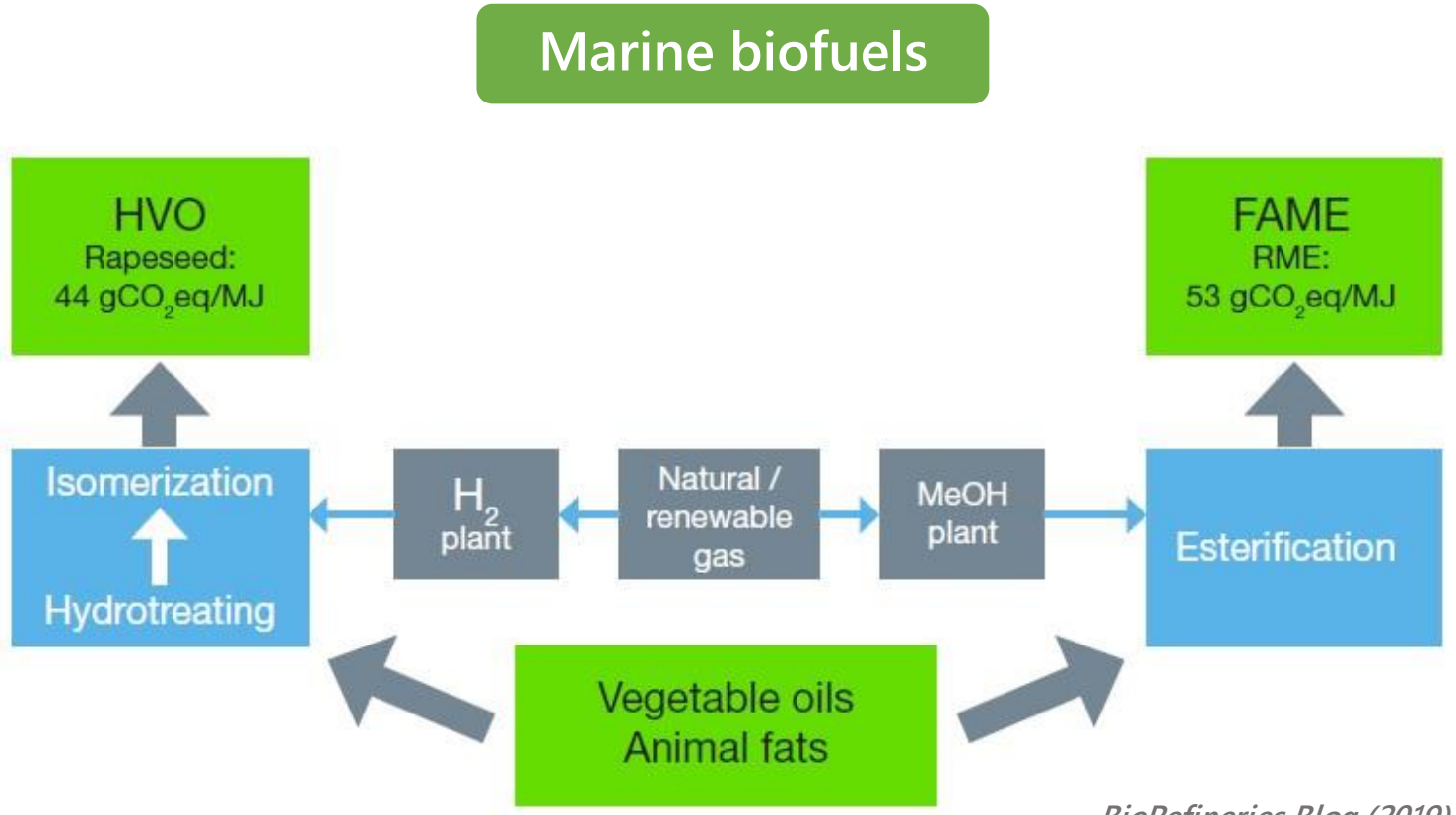
- Coastal fishing

Hybrid-electric

- Provides greater flexibility

Bioenergy

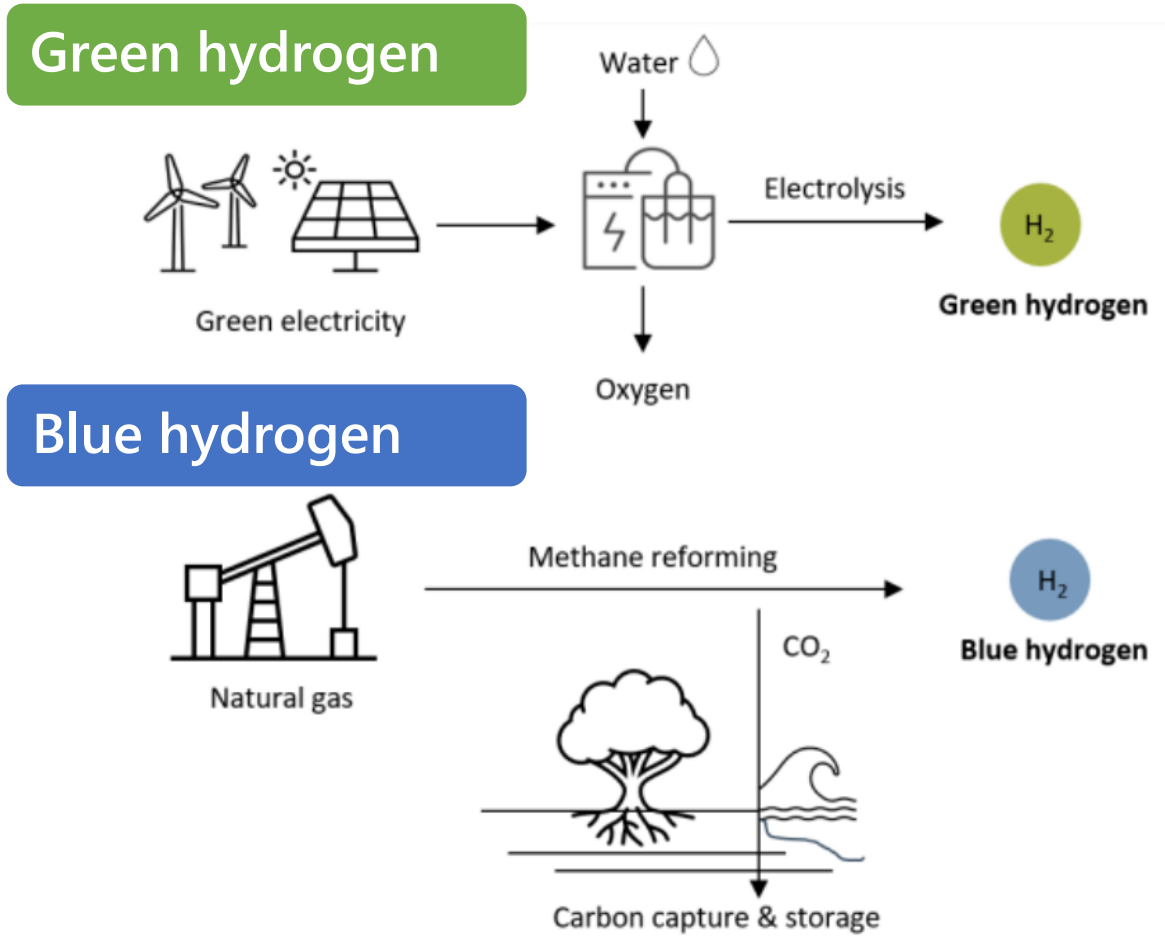
- Mature technology
- Small- and large vessels
- Blend in or 100% biofuel
- Feedstock availability



BioRefineries Blog (2019)

Hydrogen

- Small-scale potentials
- Small fishing vessels
- Lack of technical maturity
- Lack of carbon-neutral supply chains



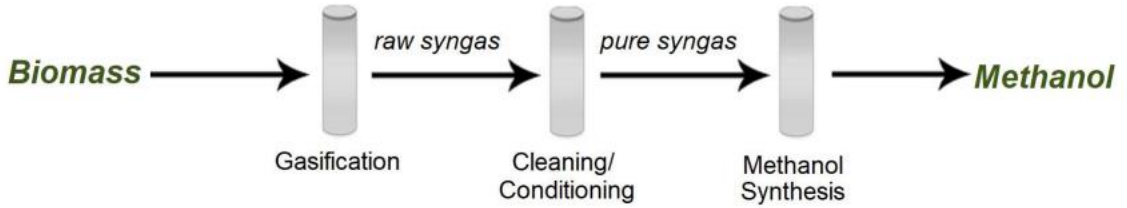
Winje E. et.al. (2022)

Methanol

- Large-scale potentials
- Medium and large fishing vessels
- Technical maturity
- Relies on a carbon source

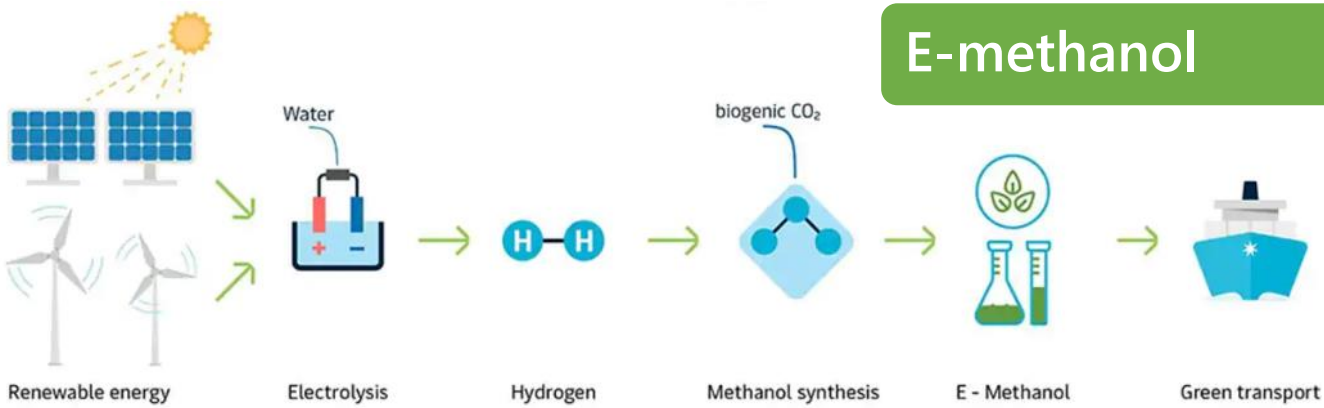
Blue hydrogen + CCUS → **Blue methanol**

Bio-methanol



Zeuthen & Gamborg (2021)

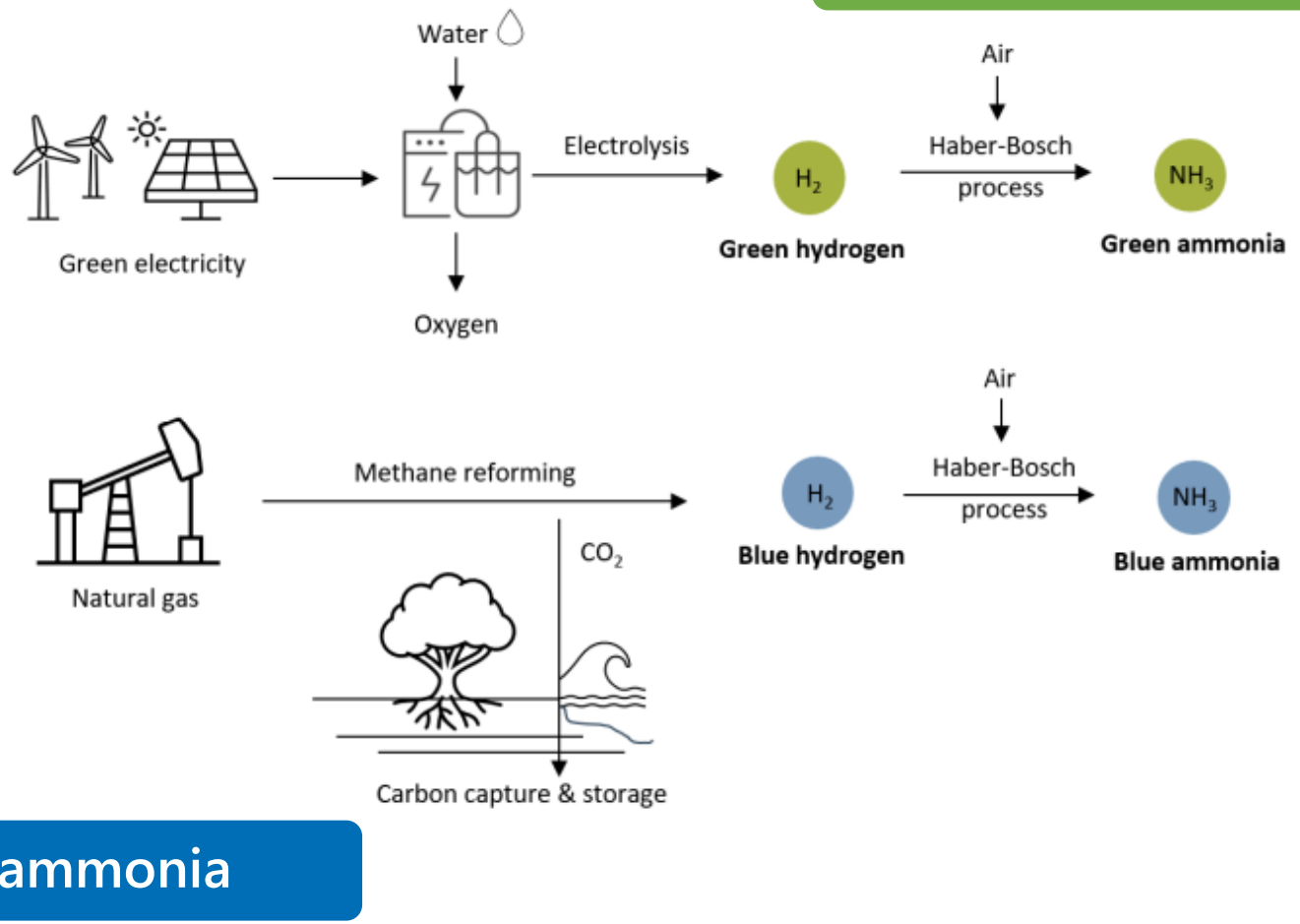
E-methanol



Dahl & Linnet (2021)

Ammonia

- Potentials similar to methanol
- Lack of technical maturity
- Higher safety risks



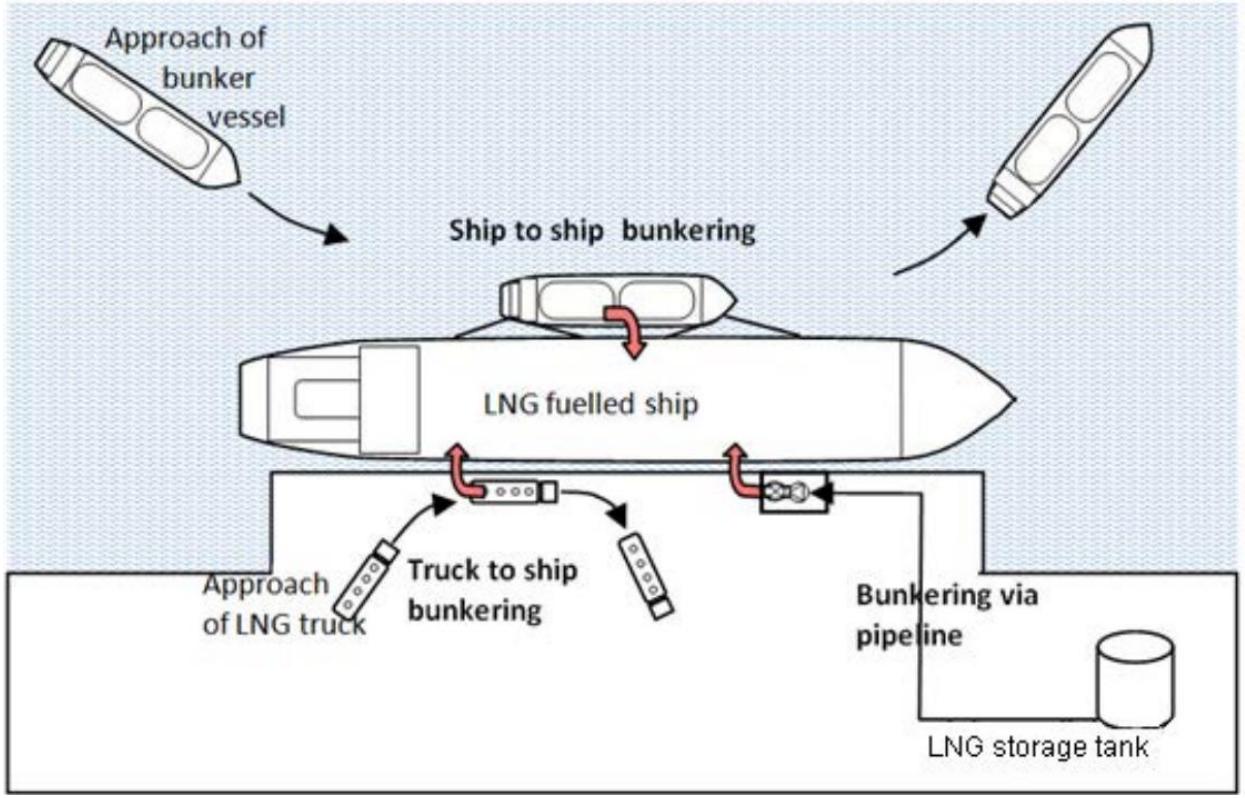
Winje E. et.al. (2022)

Bunkering Infrastructure in Ports

1. Pipeline-to-ship
2. Truck-to-ship
3. Ship-to-ship

Bunkering time:

- Powertrain: Battery capacity and onboard connector
- Fuels: Flow rate and fuel carriage capacity

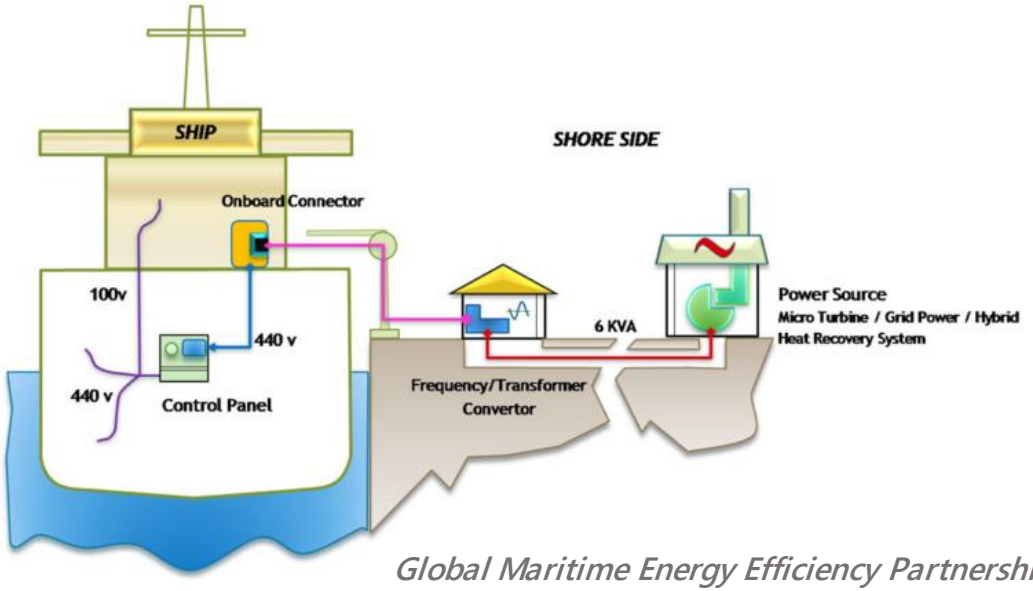


(Danish Maritime Authority (2012)

Electricity

- All major ports in the EU must by 2030 provide onshore power

- Needed power rating depends on:
  - Number and onboard battery capacity
  - Time laying in port
  - Charging system



Global Maritime Energy Efficiency Partnerships (n.d.)

Fishing Vessel Segments:

- Small fishing vessels <1 000 GT: 3-phase 400V AC
- Larger ships require upgraded grid capacity and power converters

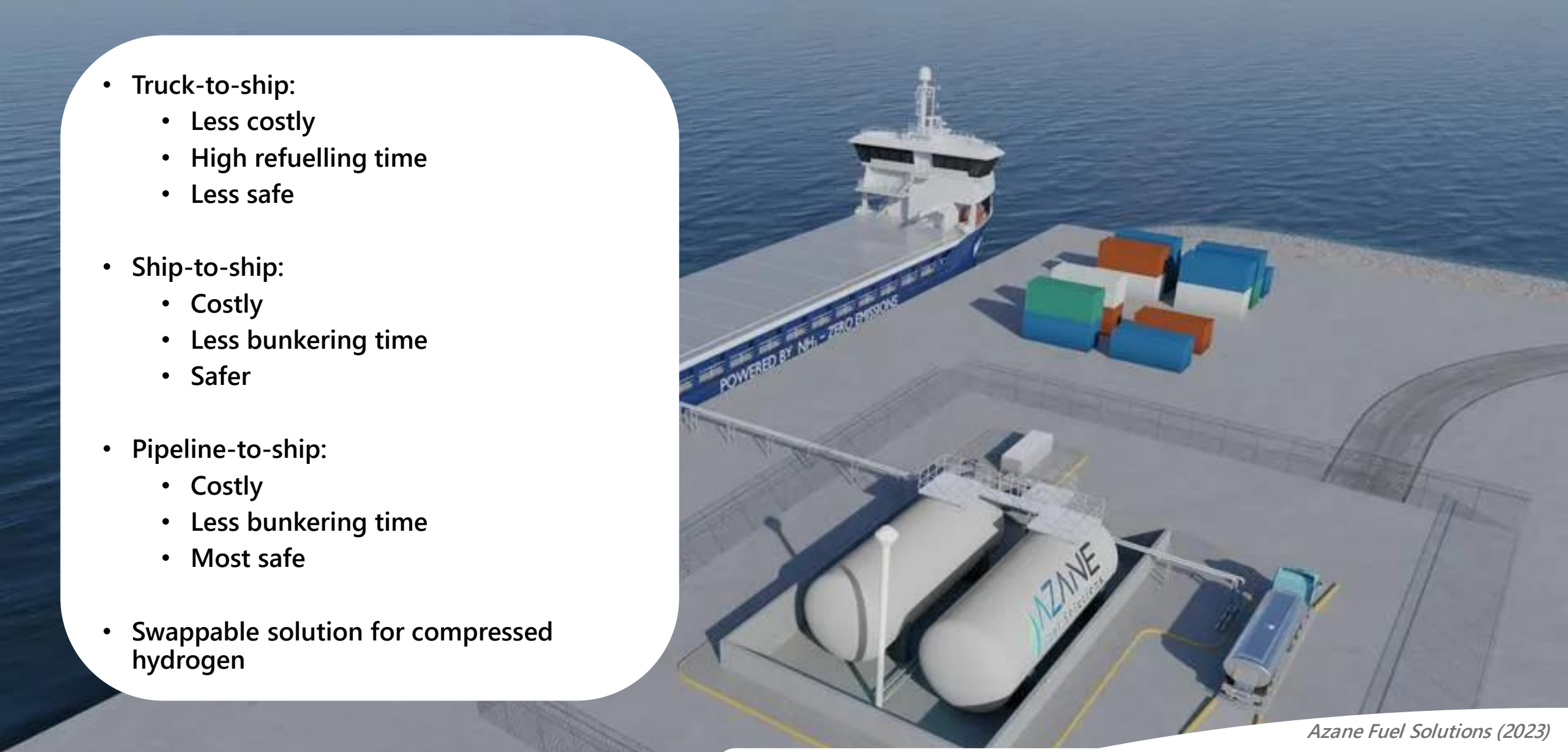
Bioenergy and Methanol

Valeur (2023)

- Technical maturity of biofuel bunkering
- Insufficient infrastructure and uncertainty related to scalability

- Some ports offer bunkering of methanol:
  - Ship-to-ship and truck-to-ship
- Insufficient infrastructure in the Nordics
- Technical maturity

- Truck-to-ship:
  - Less costly
  - High refuelling time
  - Less safe
- Ship-to-ship:
  - Costly
  - Less bunkering time
  - Safer
- Pipeline-to-ship:
  - Costly
  - Less bunkering time
  - Most safe
- Swappable solution for compressed hydrogen



Azane Fuel Solutions (2023)

Hydrogen and Ammonia

Where does this leave us?

- Upscaling of Renewable Energy Production and Infrastructure
- Business case and financial support
- Rules and regulation
  - Measures to push the development
  - Safety measures
- Who takes the lead? Ships or ports?

Thank You for Your Attention

Feel welcome to contact:

Higher Executive Officer

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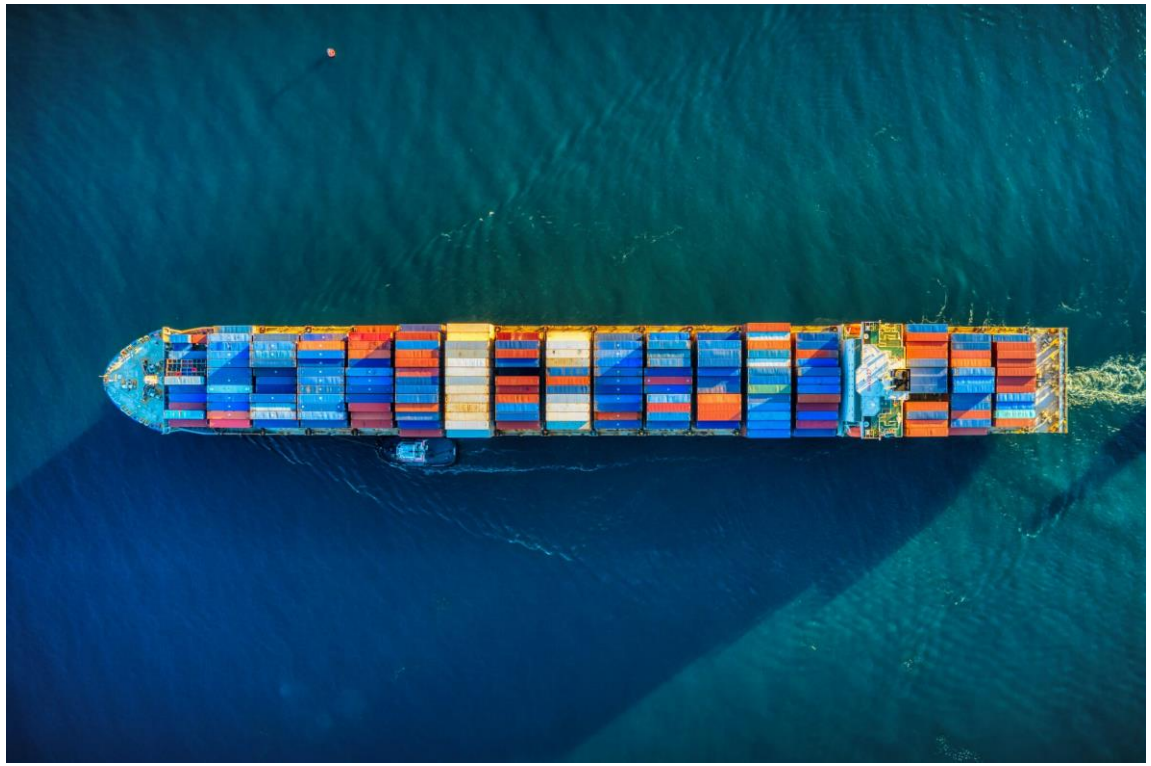
Nordic Maritime Transport and Energy Research Programme (II)



https://www.nordicenergy.org/programme/nordic-maritime-transport-and-energy-research-programme/

Nordic Roadmap Invitation

DNV

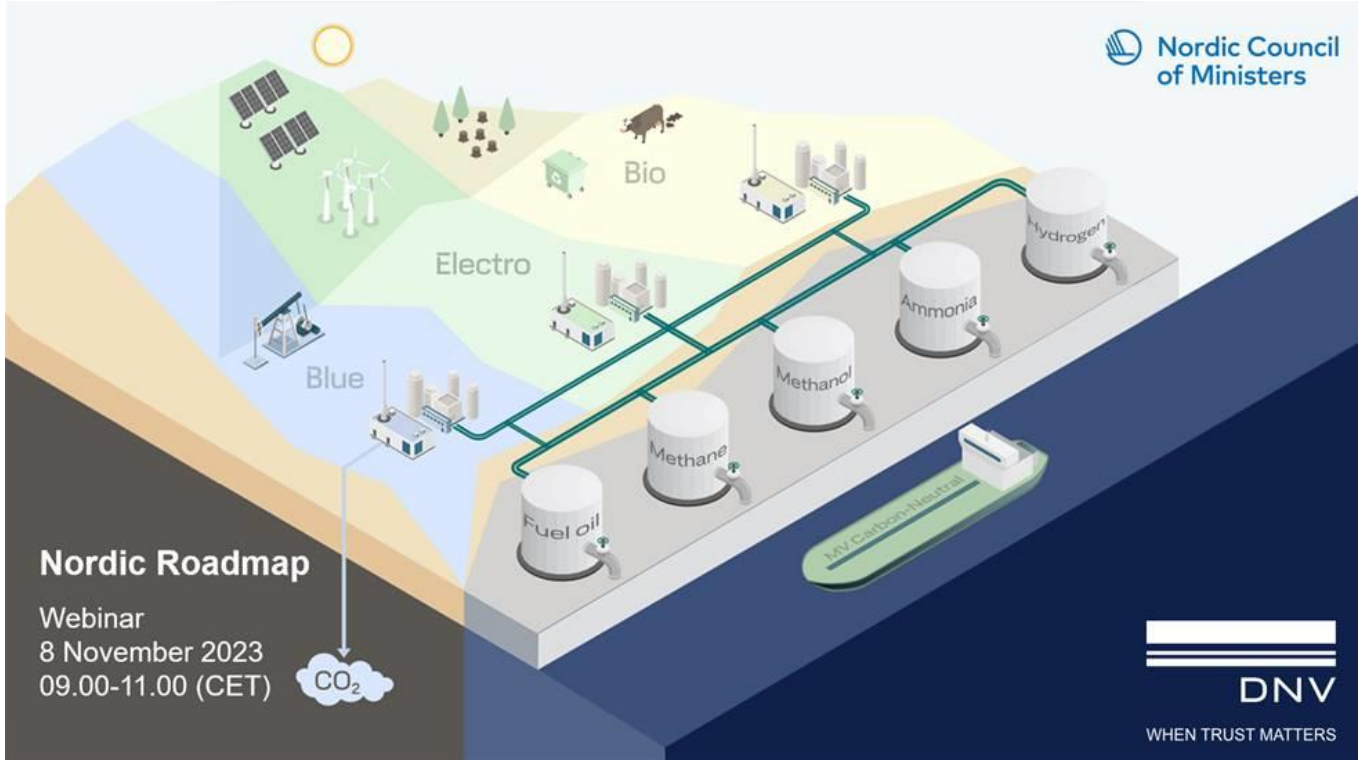
Nordic Council of Ministers

Date: October 3rd

Location: Nautholl, Nauthólsvegur 106, 101 Reykjavik, Iceland

Register here:

cdn.forms-content.sg-form.com/f8692786-368f-11ee-b2a8-9ae53f85e4b2



Sources

Primary Scientific Literature:

Danish Energy Agency (2017), *"Technology Data – Renewable fuels"*, Report, Version no. 0011: https://ens.dk/sites/ens.dk/files/Analyser/technology_data_for_renewable_fuels.pdf

DNV Maritime (2023), *"Use of biofuels in international shipping"*, Article, Website: dnv.com: https://www.dnv.com/news/use-of-biofuels-in-international-shipping-240298

DNV B. V. (2021), *"External safety study - bunkering of alternative marine fuel for seagoing vessels"*, Report, no. 10288905, customer: Port of Amsterdam: https://sustainableworldports.org/wp-content/uploads/DNV-POA-Final-Report_External-safety-study-bunkering-of-alternative-marine-fuels-for-seagoing-vessels_Rev0_2021-04-19.pdf

Ivl Swedish Environmental Research Institute (2023), *"HOPE – Hydrogen fuel cells solutions in Nordic Shipping"*, Project summary: A Nordic Maritime Transport and Energy Research Programme Project by Nordic Energy Research: https://www.ivl.se/projektwebbar/hope.html

Basso M. et. al. (2022), *"TASK 2B – Infrastructure and bunkering challenges for zero-carbon fuels"*, Report, Project: the Nordic Roadmap, the Nordic Council of Ministers, prepared by: Menon Economics etc.: https://futurefuelsnordic.com/wp-content/uploads/2023/02/Task-2B_final-version-feb-2023.pdf

Rivedal N. et. al.(2022), *"AIS Analysis of Nordic Ship Traffic"*, Report, Project: The Nordic Roadmap, the Nordic Council of Ministers, prepared by DNV: https://futurefuelsnordic.com/ais-analysis-of-the-nordic-ship-traffic-and-energy-use/

Nordic Energy Research (2021), *"Nordic Clean Energy Scenarios –Solutions for Carbon Neutrality"*, Report: https://pub.norden.org/nordicenergyresearch2021-01/#73543

Winje E. et. al. (2022), *"TASK 1A – Screening of sustainable zero-carbon fuels"*, Report, Project: The Nordic Roadmap, the Nordic Council of Ministers, prepared by Menon Economics etc.: https://futurefuelsnordic.com/wp-content/uploads/2022/11/Screening-of-Sustainable-Zero-carbon-fuels.pdf

Sources

Pictures/figures:

Azane Fuel Solutions (2023), *"Onshore Bunkering Terminal"*, website: azanefs.com: https://www.azanefs.com/shore

Baird Maritime (2022), *"Vessel Review | Grønarók – Electric Catamaran Workboat For Faroese Fish Farming Company"*, Article, website: bairdmaritime.com: VESSEL REVIEW | Grønarók – Electric catamaran workboat for Faroese fish farming company - Baird Maritime

Biorefineries Blog (2019), *"Hydrotreating (HVO) – Advantages over FAME and properties"*, Article, website: bioreffineria.blogspot.com: https://biorrefineria.blogspot.com/2019/11/hydrotreating-hvo-renewable-diesel-advantages-over-fame-properties.html

Dahl R. & Linnet M. (2021), *"Maersk secures green e-methanol for the world's first container vessel operating on carbon neutral fuel"*, Press release, website: maersk.com: https://www.maersk.com/news/articles/2021/08/18/maersk-secures-green-e-methanol

Danish Maritime Authority (2012), *"North European LNG Infrastructure Project – A feasibility study for an LNG filling station infrastructure and test of recommendations"*, Summary Report: https://www.energigas.se/library/2061/north-european-lng-infrastructure-project-summary-report.pdf

DNV (2023), *"the Nordic Roadmap – Future Fuels for Shipping"*, Project, Nordic Council of Ministers, website: futurefuelsnordic.com: https://futurefuelsnordic.com/about-us/

Global maritime energy efficiency partnerships (n.d.), *"Shore Power"*, Article, website: glomeep.imo.org: https://glomeep.imo.org/technology/shore-power/

Norwegian Artificial Intelligence Research Consortium (2023), *"FishAI: Sustainable Commercial Fishing"*, Article, website: nora.ai: https://www.nora.ai/competition/sustainable-fishing.html

Valeur I. T. (2023), *"New climate rules certain to trigger scramble for biofuel"*, Article, website: shippingwatch.com: https://shippingwatch.com/regulation/article15799308.ece

Zeuthen J. H. & Gamborg F. (2018), *"97 Methanol from Biomass Gasification"*, Chapter in; *"Technology Data – Renewable Fuels"*, Danish Energy Agency: https://ens.dk/sites/ens.dk/files/Analyser/technology_data_for_renewable_fuels.pdf