



INFRASTRUCTURE AND BUNKERING CHALLENGES FOR FUTURE FUELS

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Menon Economics



NORDIC ROADMAP FOR THE INTRODUCTION OF SUSTAINABLE ZERO-CARBON FUELS IN SHIPPING

TASK 1A – SCREENING OF SUSTAINABLE ZERO-CARBON FUELS

The Norwegian Ministry of Climate and Environment on behalf of the Nordic Council of Ministers



MENON-PUBLICATION NO. 116/2022

By: Maren Nygård Basso, Serri Abrahamoglu, Henrik Fossid, Piotr Spiewanowski, Even Winje and Erik Jakobsen

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NORDIC ROADMAP FOR THE INTRODUCTION OF SUSTAINABLE ZERO-CARBON FUELS IN SHIPPING

TASK 2B – INFRASTRUCTURE AND BUNKERING CHALLENGES FOR ZERO-CARBON FUELS

The Norwegian Ministry of Climate and Environment on behalf of the Nordic Council of Ministers



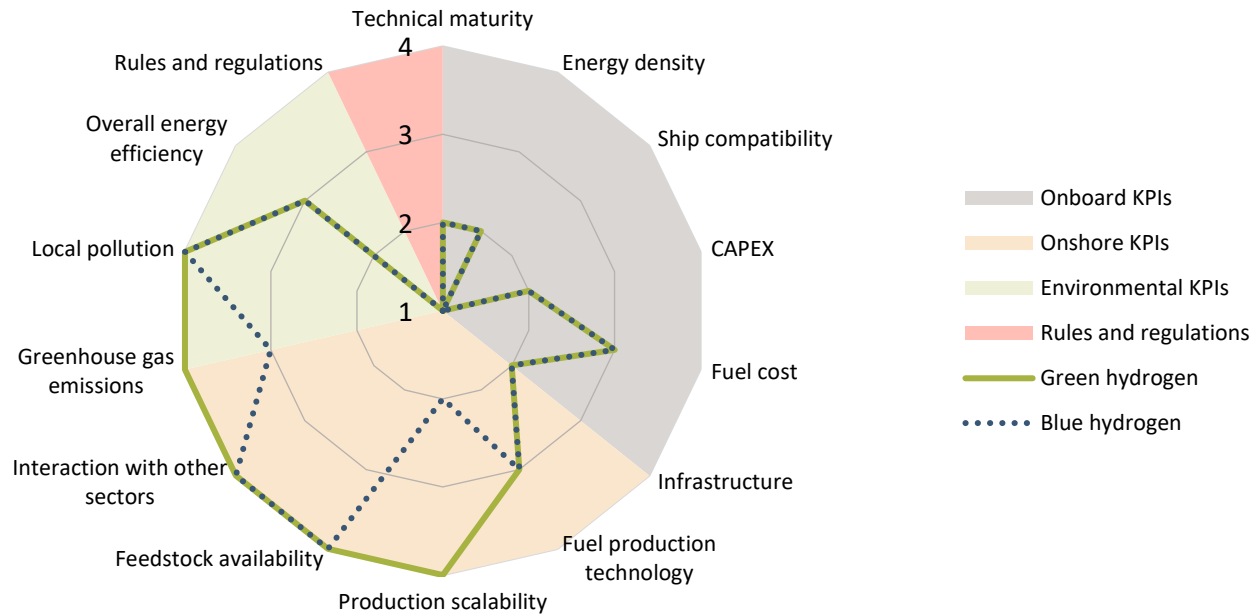
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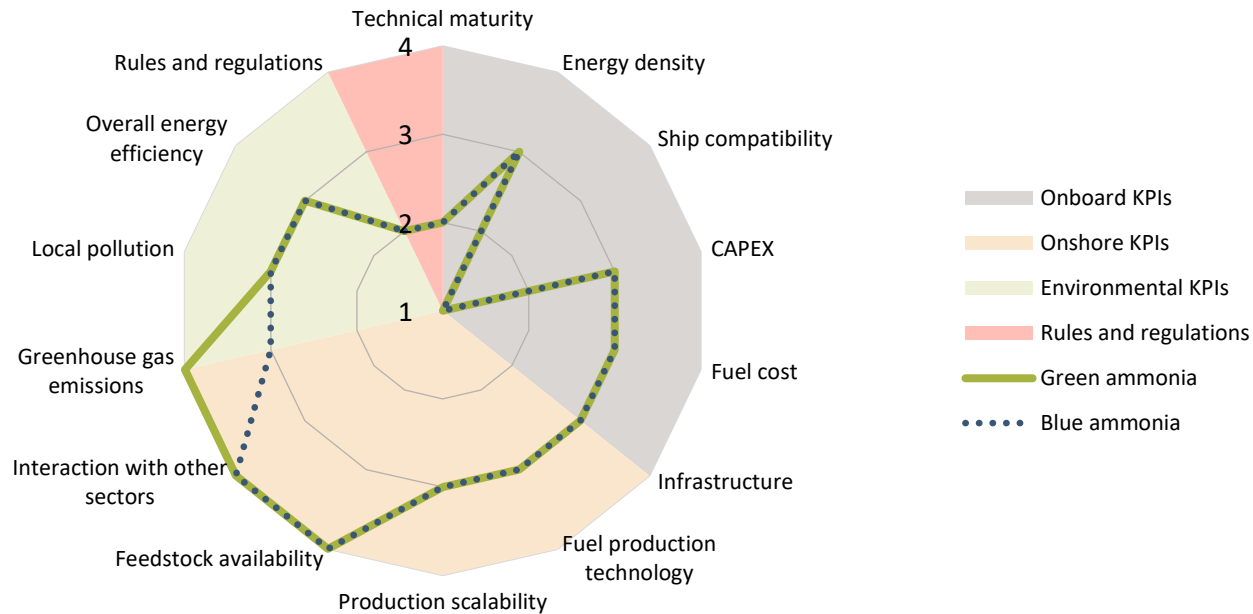
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KPIs for hydrogen as a marine fuel



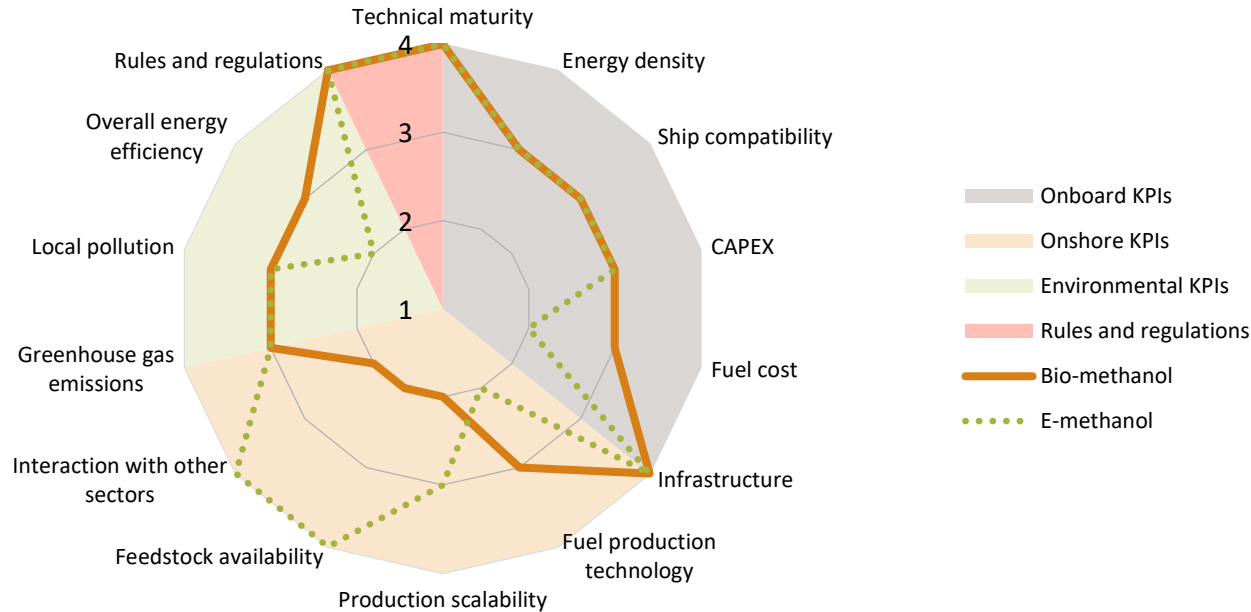
Scoring of onboard, onshore, environmental and rules and regulations related KPIs for both green and blue hydrogen. Source: Menon Economics

KPIs for ammonia as a marine fuel



Scoring of onboard, onshore, environmental and rules and regulations related KPIs for both green and blue ammonia.
Source: Menon Economics

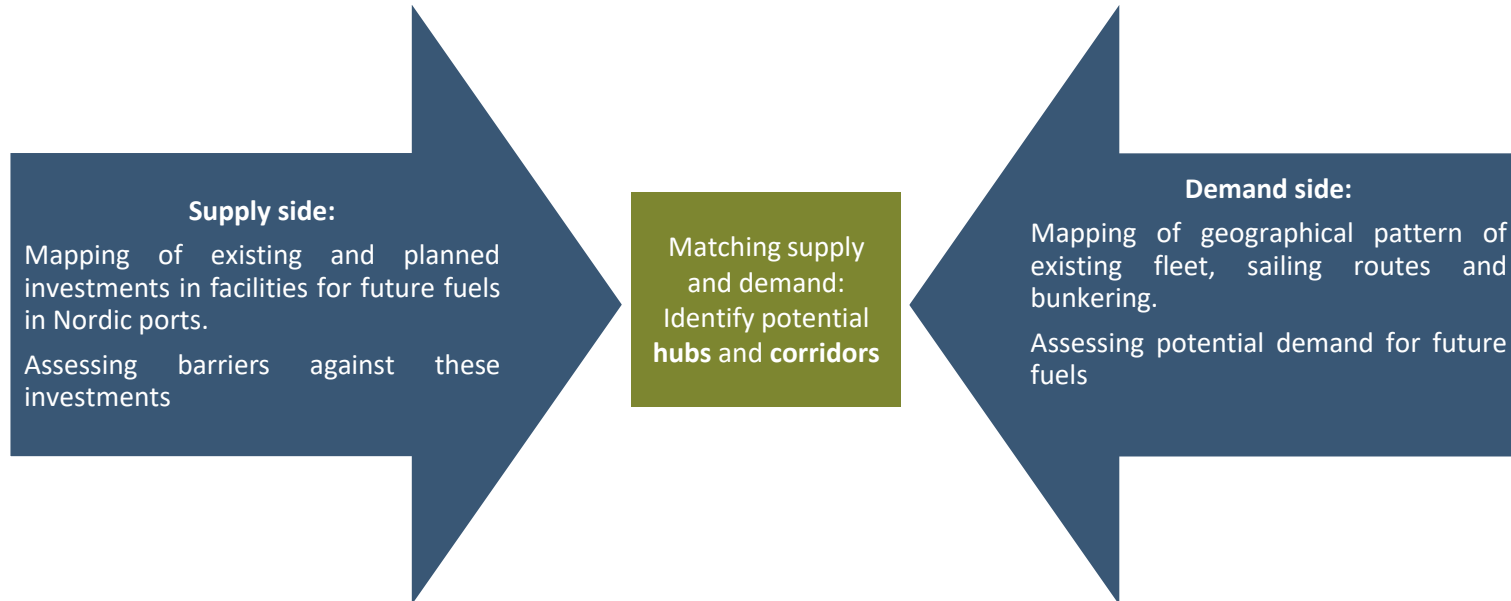
KPIs for **methanol** as a marine fuel



Scoring of onboard, onshore, environmental and rules and regulations related KPIs for both **bio- and e-methane**.
Source: Menon Economics

Purpose of the second report:

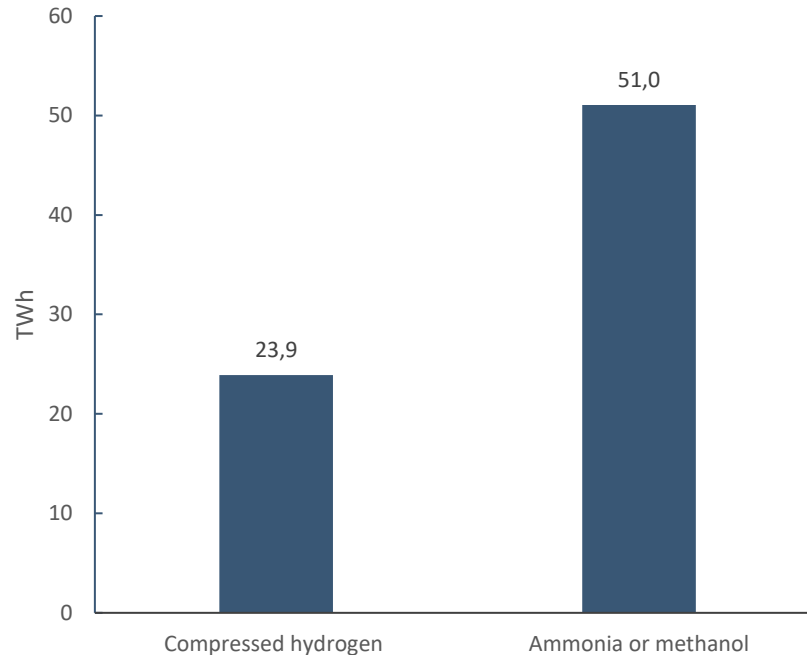
Identify potential hubs and corridors – by matching supply and demand of selected fuels – and assessing infrastructure and bunkering barriers



Potential demand for the three fuels

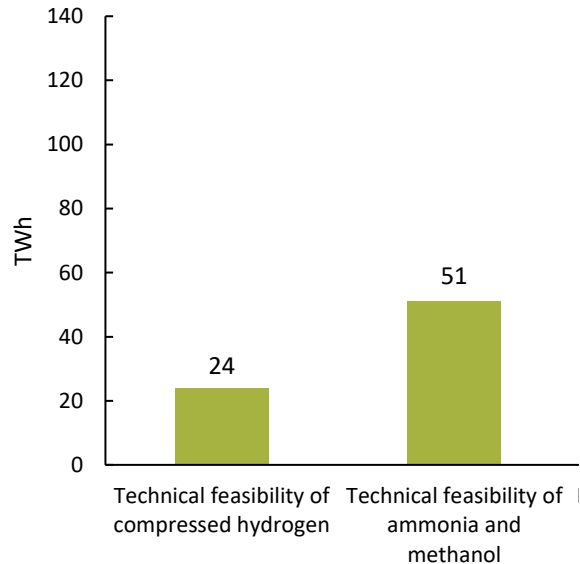
The most important barriers against scaling demand from the shipowners perspective:

- Technological uncertainty
- Capital Expenditures in newbuilding or conversions
- Availability of fuels
- Fuel price – predictability is crucial
- Regulations/safety issues



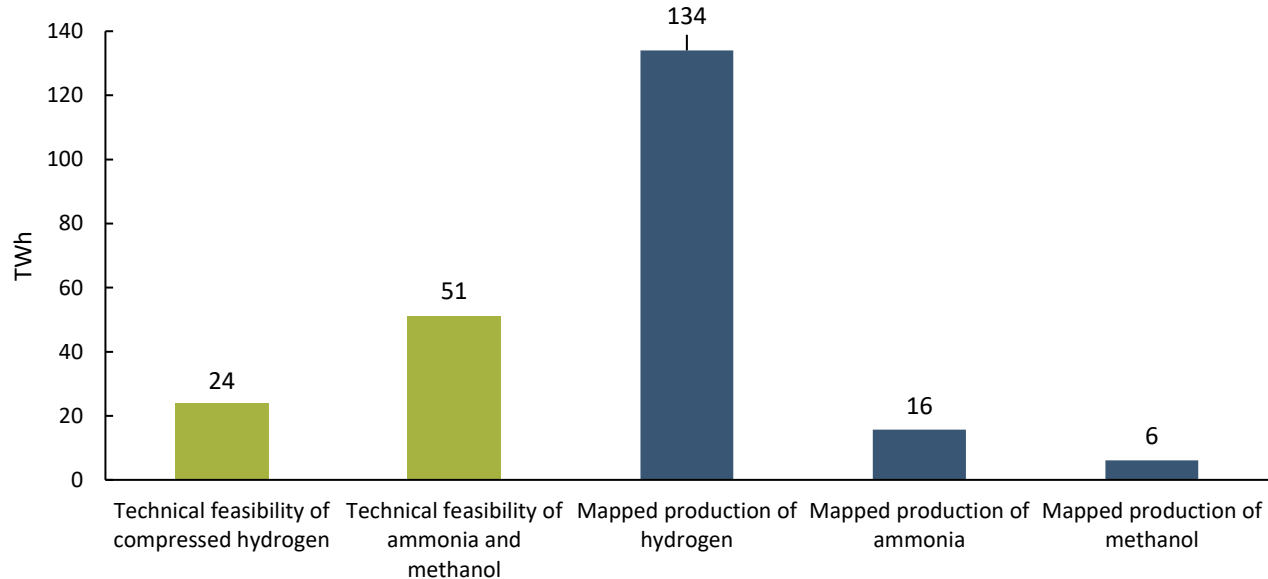
Amount of hydrogen, ammonia or methanol needed to cover the expected demand, given the fuels' feasibility assessment from the AIS-report. Source: DNV, 2022

The plans for production of hydrogen is significantly higher than potential demand from the Nordic ship traffic, however the opposite is true for ammonia and methanol



Aligning supply and demand.
Demand based on 2019 fuel
consumption; production is the
expected supply within 2030.
Source: Menon Economics, DNV
(2022a)

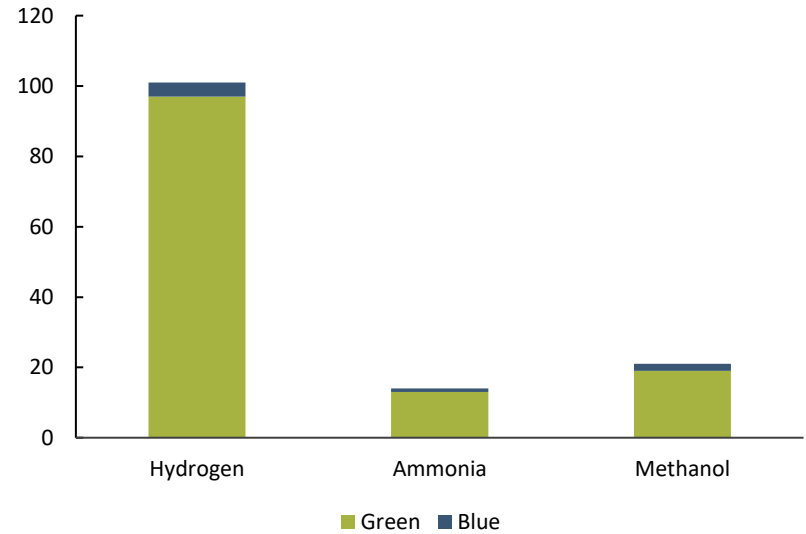
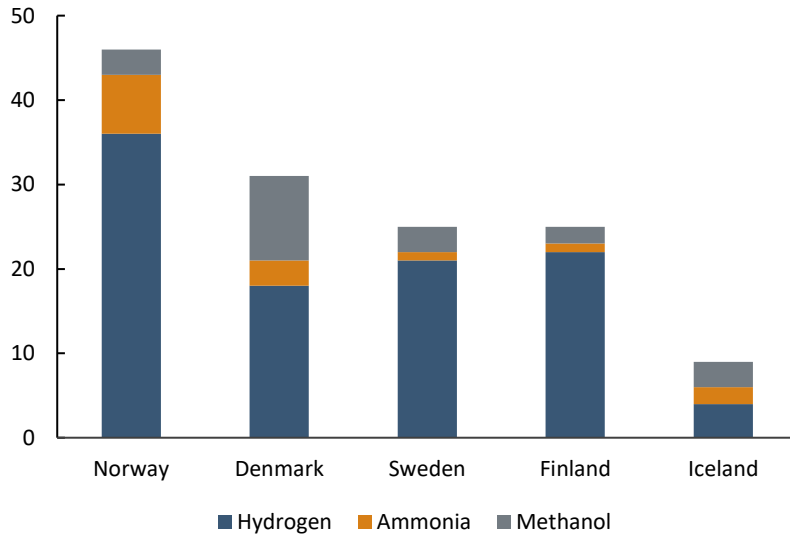
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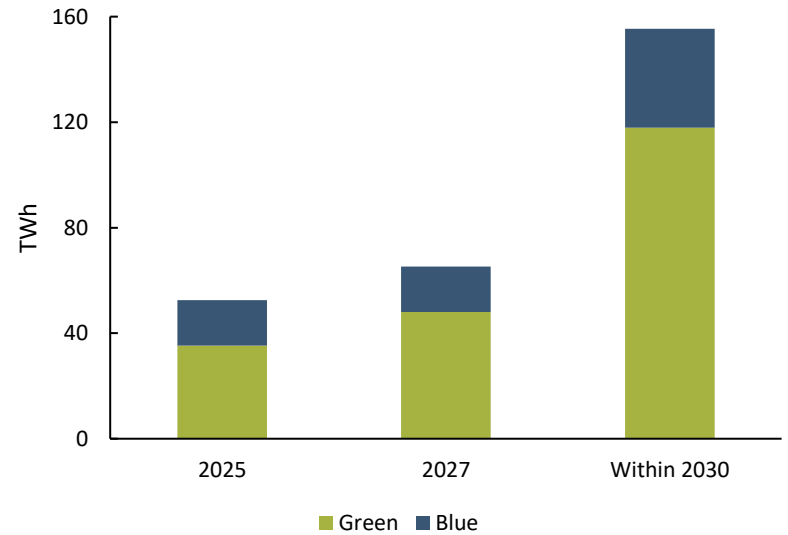
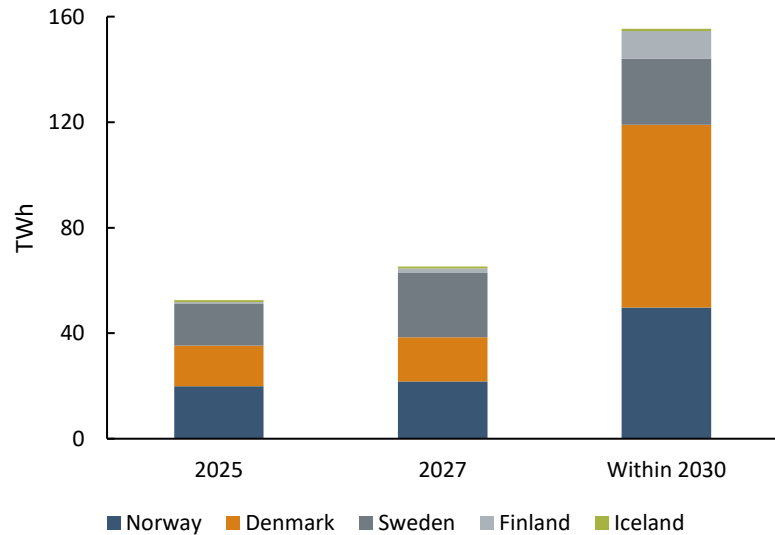
In total 140 projects identified related to the production of either hydrogen, ammonia or methanol

To the left: **Number of mapped projects** related to production of hydrogen, ammonia, and methanol in the Nordic countries . To the right: Number of mapped projects split between green and blue production method. Source: Menon Economics



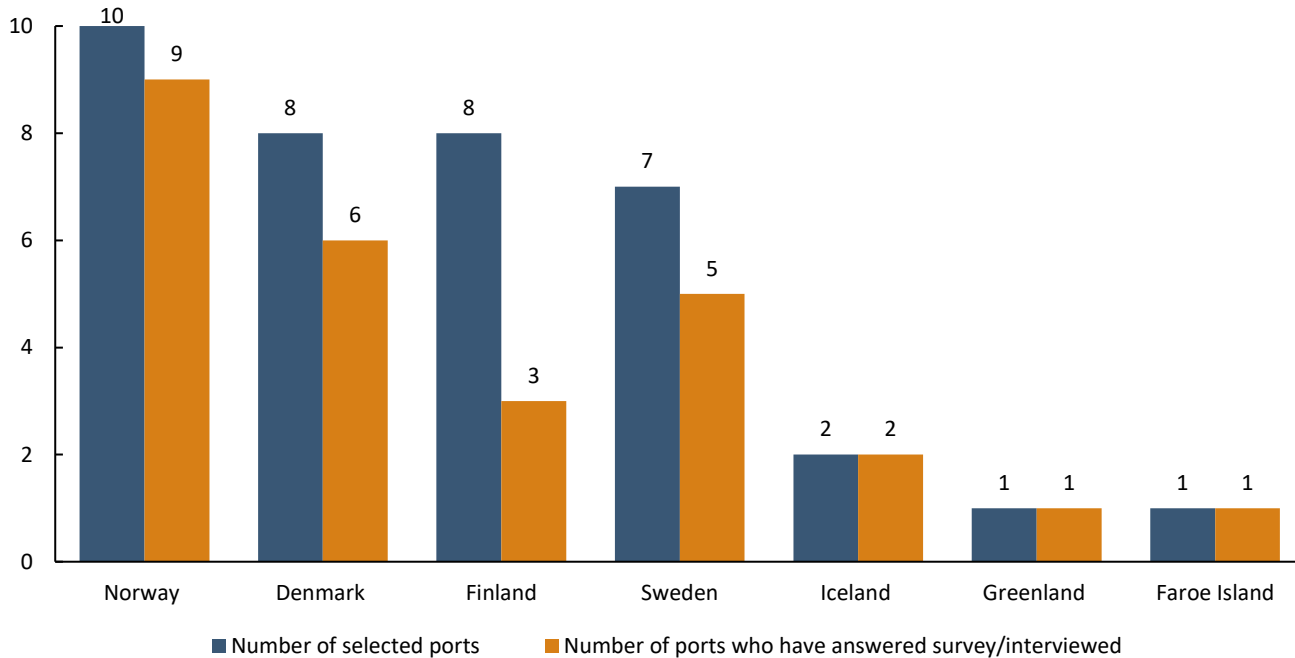
Expected production of renewable hydrogen, ammonia and methanol will increase towards 2030

Potential production output of renewable hydrogen, methanol, and ammonia in TWh per year within 2030, split between countries (to the left) and production method (to the right). Source: Menon Economics



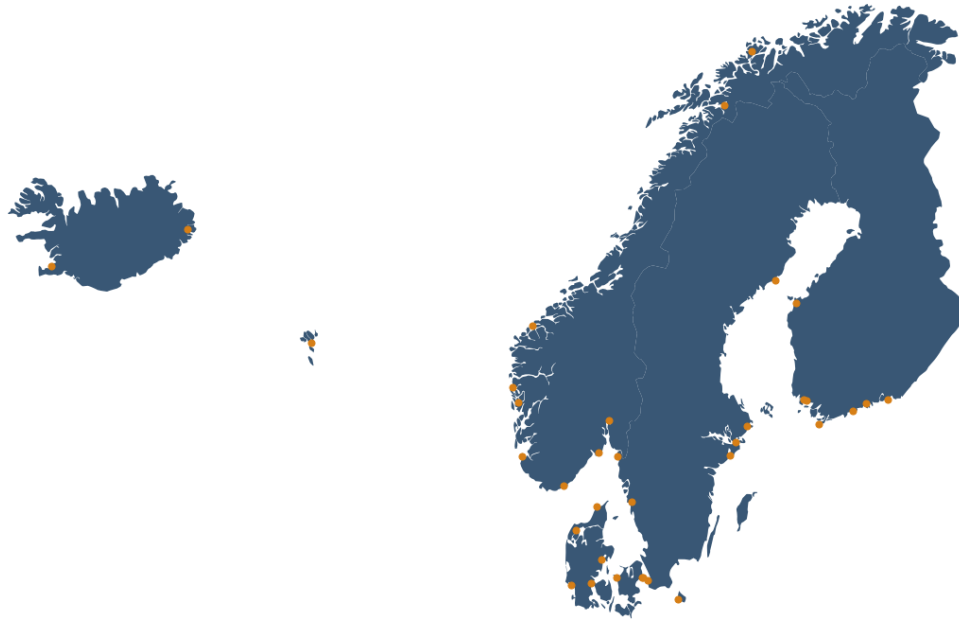
**Planned production, distribution and bunkering
of future fuels in Nordic ports and
Barriers against supplying the three fuels in the
selected ports**

37 ports selected for analysis of plans and barriers against supply of hydrogen, ammonia and methanol



Number of ports selected and the number of respondents in the survey questionnaire and/or interview

The 37 ports are clustered in relatively small geographical areas, in particular around metropolitan areas like Stockholm and Copenhagen

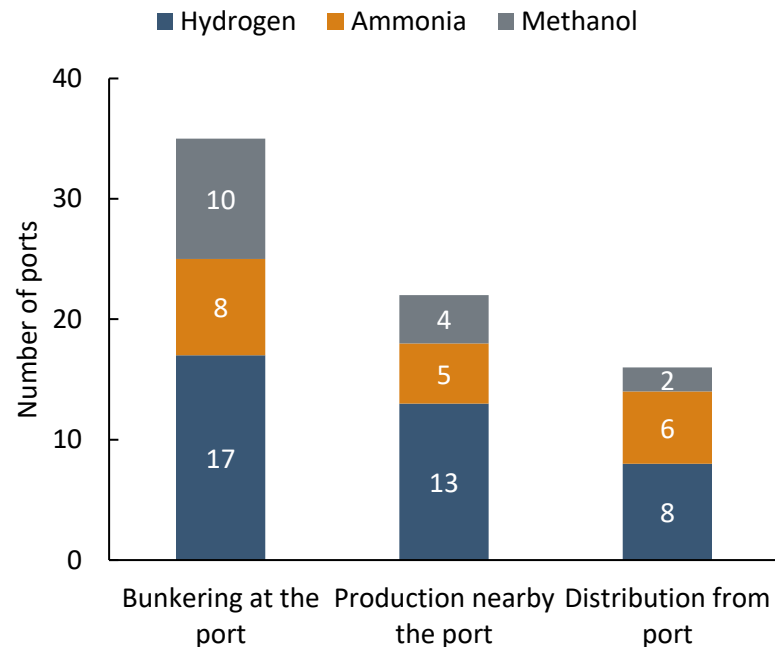


17 of the ports are planning to enable bunkering of at least one of the three fuel – all of them planning to enable bunkering of hydrogen

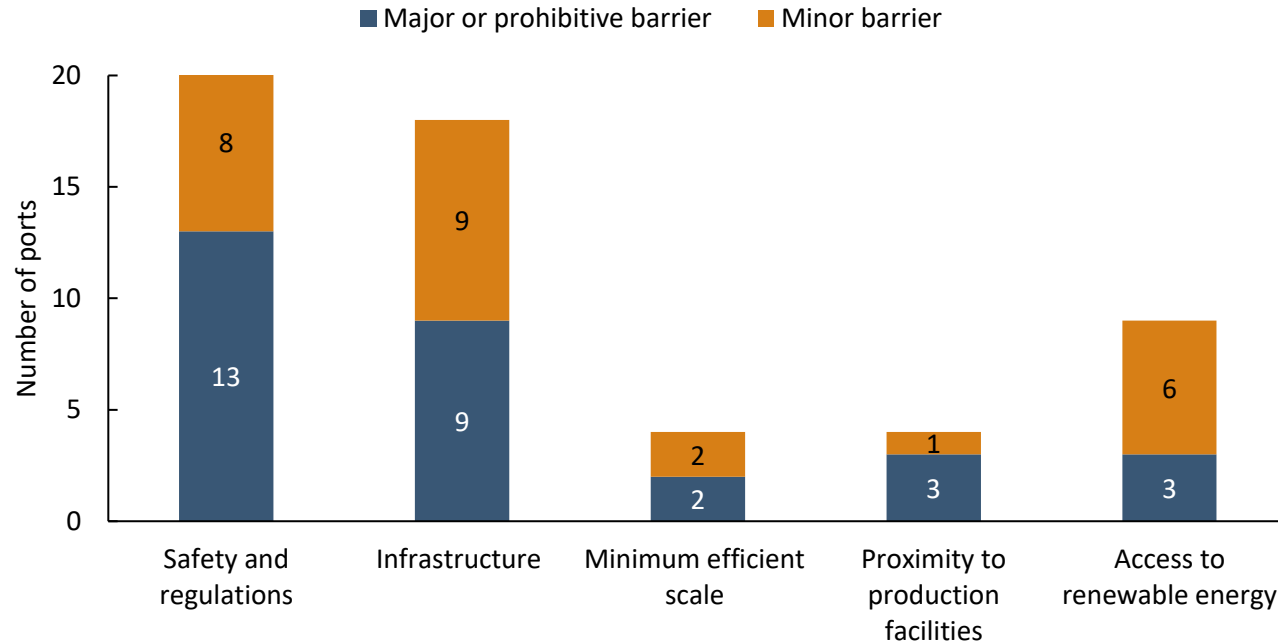
The ports were asked to answer whether they believe:

- ✓ it will be possible to bunker either hydrogen, ammonia and/or methanol in their port in the near future
- ✓ that they will be a distribution point for either of the three fuels
- ✓ that some of the fuels will be produced in their port or the vicinity of the port.

We received answers from 27 ports

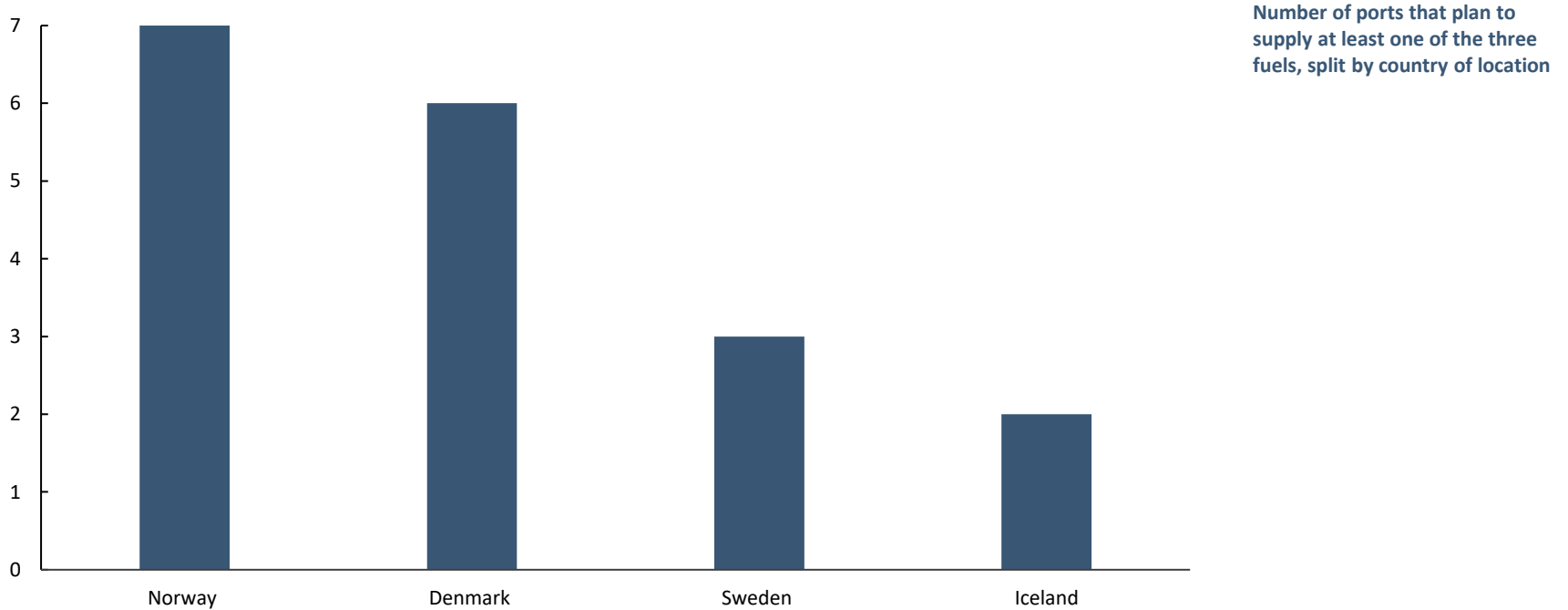


Several barriers that needs to be taken into consideration in order for the ports to achieve their plans



Assessment of different types of barriers against providing bunkering of hydrogen, ammonia and methanol in Nordic ports. N=27

Ports planning to supply at least one of the three fuels in the Nordic countries



Port	Production	Distribution	Bunkering	Timeline bunkering
Denmark				
Port 1	Hydrogen, ammonia, methanol	Hydrogen, ammonia	Hydrogen, ammonia, methanol	Hydrogen: before 2025 Ammonia: 2025-2030 Methanol: before 2025
Port 2	Hydrogen	TBD	Hydrogen, methanol	Hydrogen: 2025-2030 Methanol: 2025-2030
Port 3	Hydrogen, methanol	Hydrogen, methanol	Hydrogen methanol	Hydrogen: 2027 Methanol: 2027
Port 4	Hydrogen, ammonia methanol	TBD	Hydrogen, ammonia methanol	Hydrogen: 2025-2030 Ammonia: 2031-2035 Methanol: 2025-2030
Port 5	Methanol	Methanol	Methanol, possibly hydrogen	Methanol: 2025-2030
Port 6	Not interviewed	Not interviewed	Not interviewed	Not interviewed
Iceland				
Port 7	Hydrogen ammonia	Hydrogen ammonia	Hydrogen, ammonia methanol	Hydrogen: 2025-2030 Ammonia: 2025-2030 Methanol: 2025-2030
Port 8	Hydrogen ammonia	Hydrogen ammonia	Hydrogen	Not sure
Norway				
Port 9	No	No	Hydrogen	Hydrogen: 2025-2030
Port 10	Hydrogen,	Hydrogen (possibly)	Hydrogen, ammonia (possibly)	Not sure
Port 11	Hydrogen	Hydrogen	Hydrogen	Hydrogen: 2025-2030
Port 12	Hydrogen	Hydrogen ammonia	Hydrogen	Hydrogen: 2025
Port 13	No	Not sure	Hydrogen (compressed)	Hydrogen: 2024
Port 14	No	possible	Hydrogen ammonia, possibly methanol	Not sure
Port 15	Ammonia	Ammonia	Hydrogen ammonia	Hydrogen: 2025 Ammonia: 2025
Sweden				
Port 16	Hydrogen	Hydrogen	Hydrogen, ammonia methanol	Hydrogen: Not sure Ammonia: 2026+ Methanol: Since 2015
Port 17	Hydrogen	Yes	Hydrogen, possibly ammonia, methanol	For all three: 2025 (dependent on demand)
Port 18	Hydrogen	N/A	Hydrogen, possibly ammonia, methanol	Hydrogen: 2025-2030 Ammonia: Not sure Methanol: Not sure



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