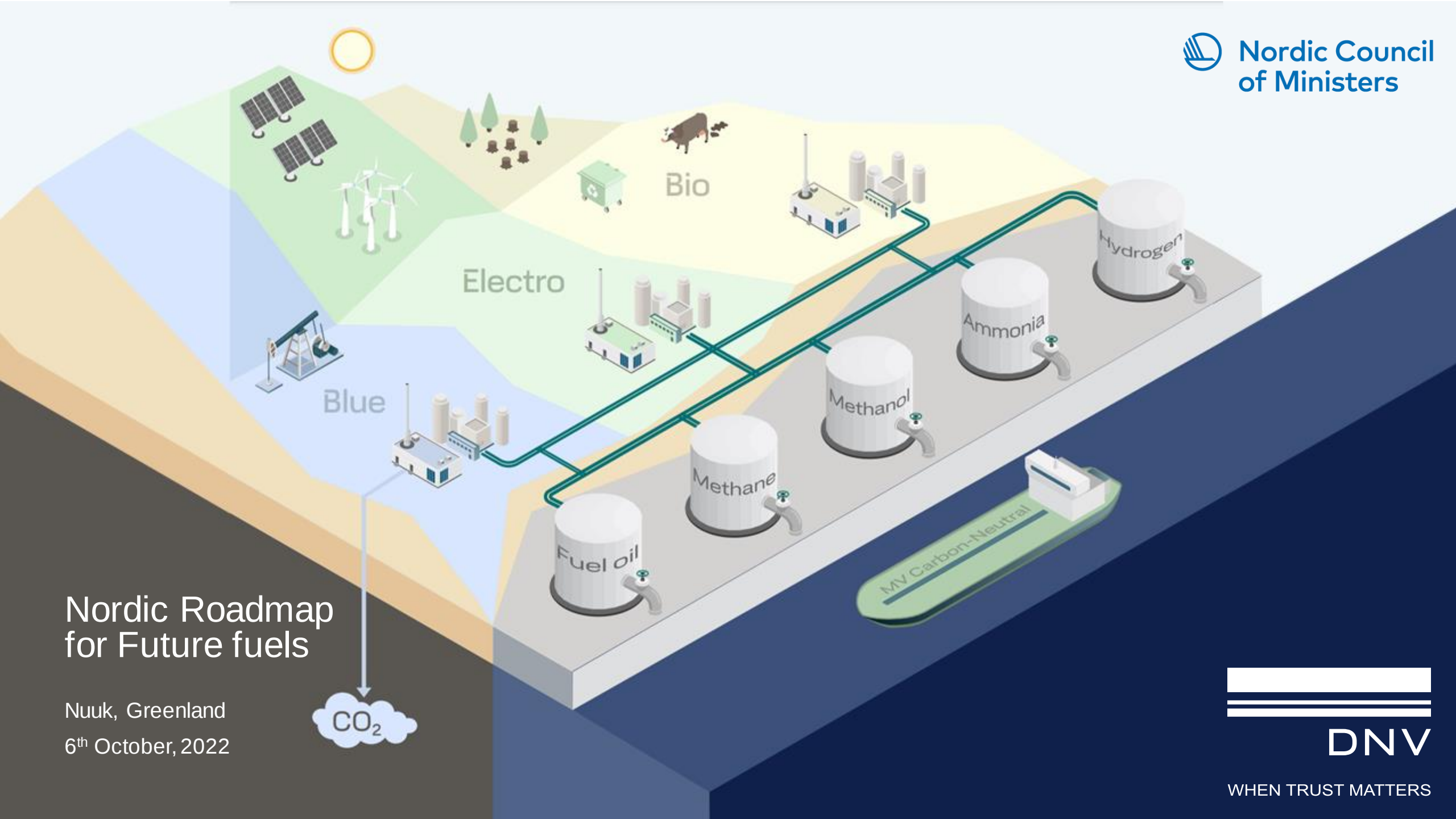




Nordic Roadmap for Future fuels

Nuuk, Greenland
6th October, 2022

Nathaniel Frithiof

Quick facts

- Born in Copenhagen
- Raised in Stockholm
- Lives in Oslo with my girlfriend
- 33 years old.

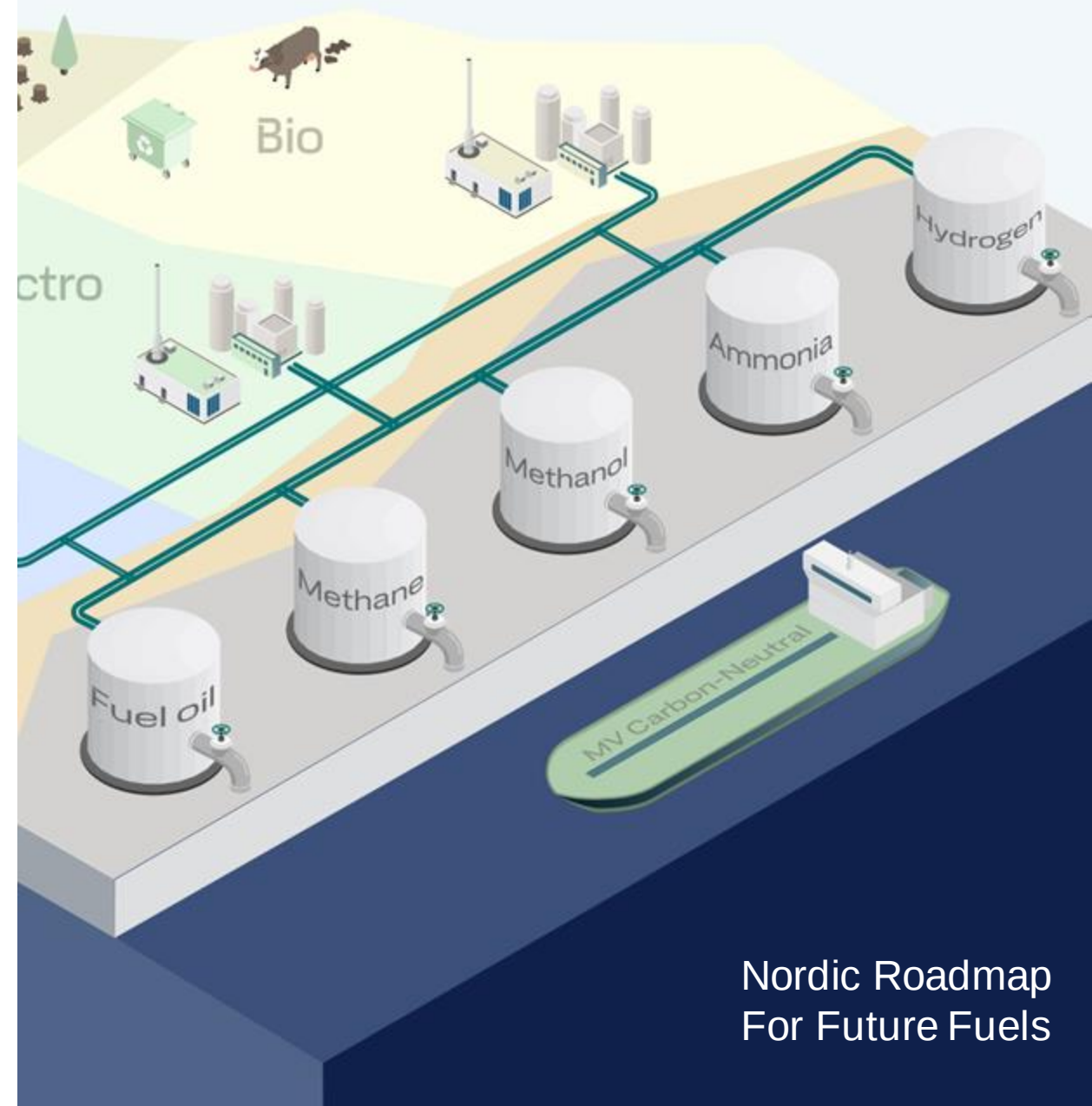
... but I became this guy



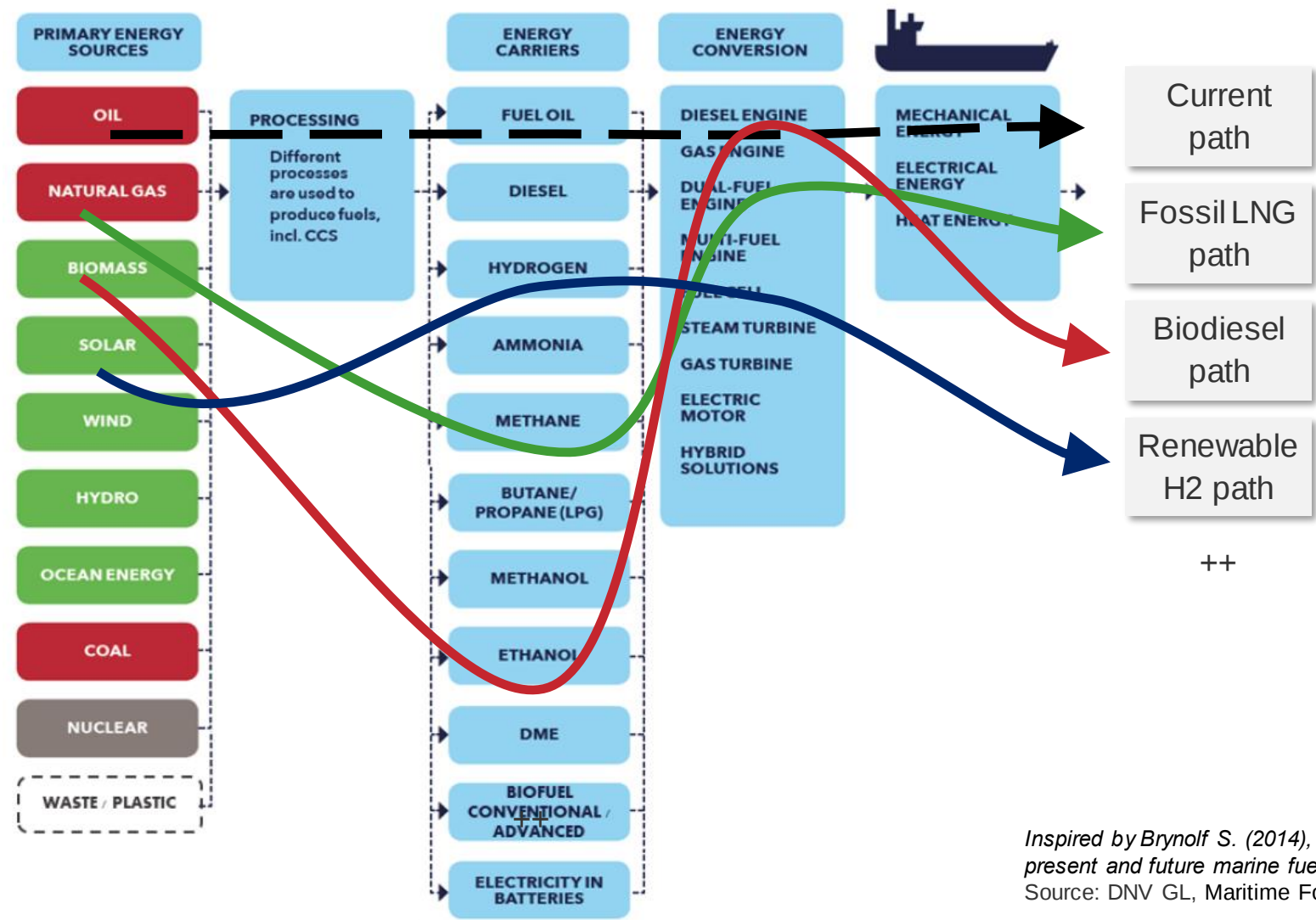
As a kid I practiced to become this guy

Content

- ✓ A Nordic Roadmap, project background
- ✓ AIS and traffic analysis for Nordic trade
 - Vessels operating in Greenland ports
 - Emissions from vessels operating in Greenland ports
 - Regional connections with Greenland, weighted by energy demand.
- ✓ Fuel potential for ships operating in Greenland ports
 - Batteries,
 - Hydrogen, &
 - Methanol (or Ammonia).
- ✓ Preliminary findings



Primary energy sources for decarbonizing shipping



++

Inspired by Brynolf S. (2014), 'Environmental assessment of present and future marine fuels'
Source: DNV GL, Maritime Forecast to 2050, DNV GL 2018.

A Nordic Roadmap for the introduction of Sustainable Zero-carbon* fuels

Technical deliveries

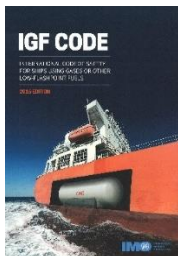
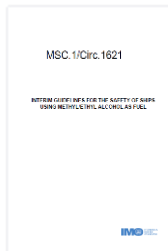
Fuel scorecard

Identify relevant fuels:
Ammonia, Hydrogen, Methanol

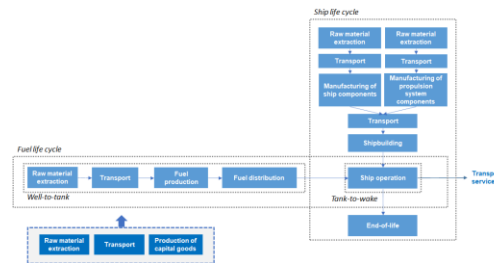
Develop KPIs

Evaluate KPIs for each fuel

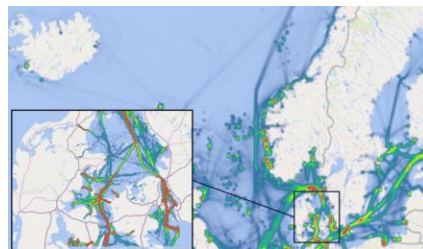
Regulatory framework



Life-Cycle Assessment



Traffic & infrastructure



Co-operation platform

Join us today at: futurefuelsnordic.com



Contributing partners:



Supporting partners:



*The term sustainable zero-carbon fuels are used to indicate fuels with potential zero climate impact throughout their lifecycle.

AIS Analysis of Nordic Ship Traffic – Why?

A Baseline for the Nordic Roadmap

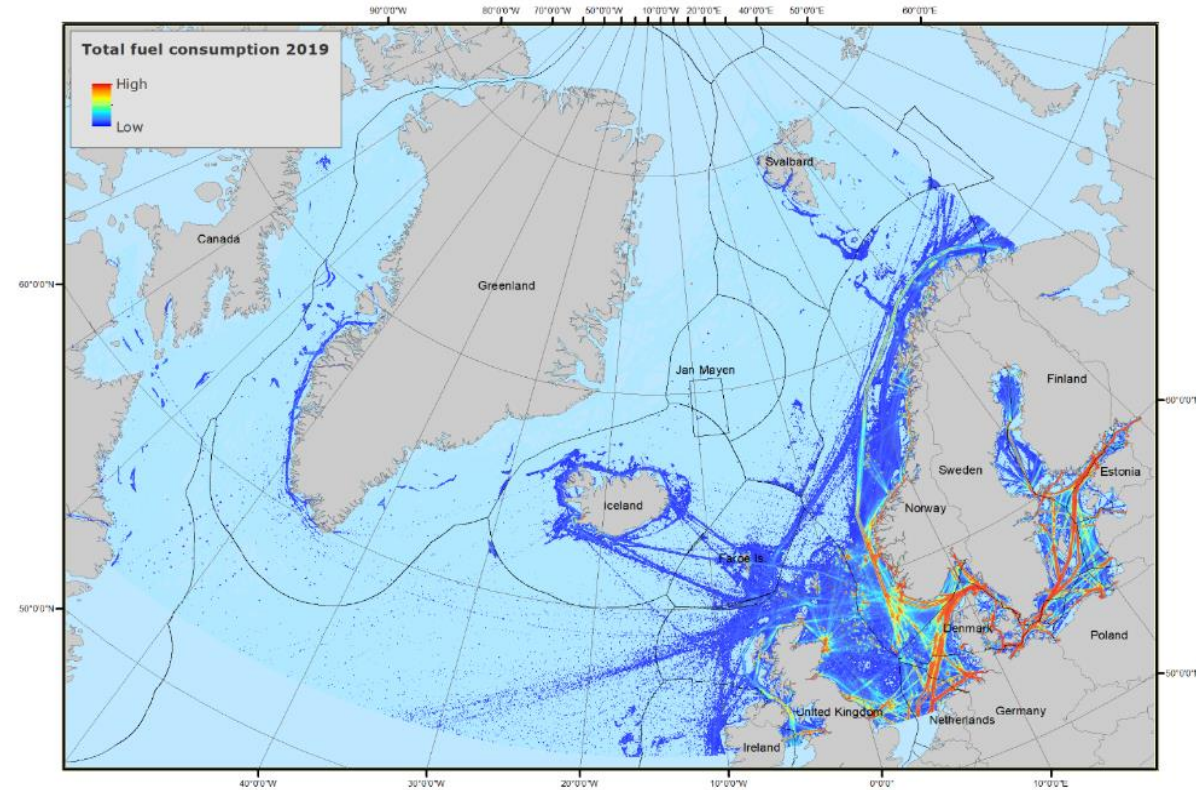
It shall provide a foundation that parts of the roadmap can build on:

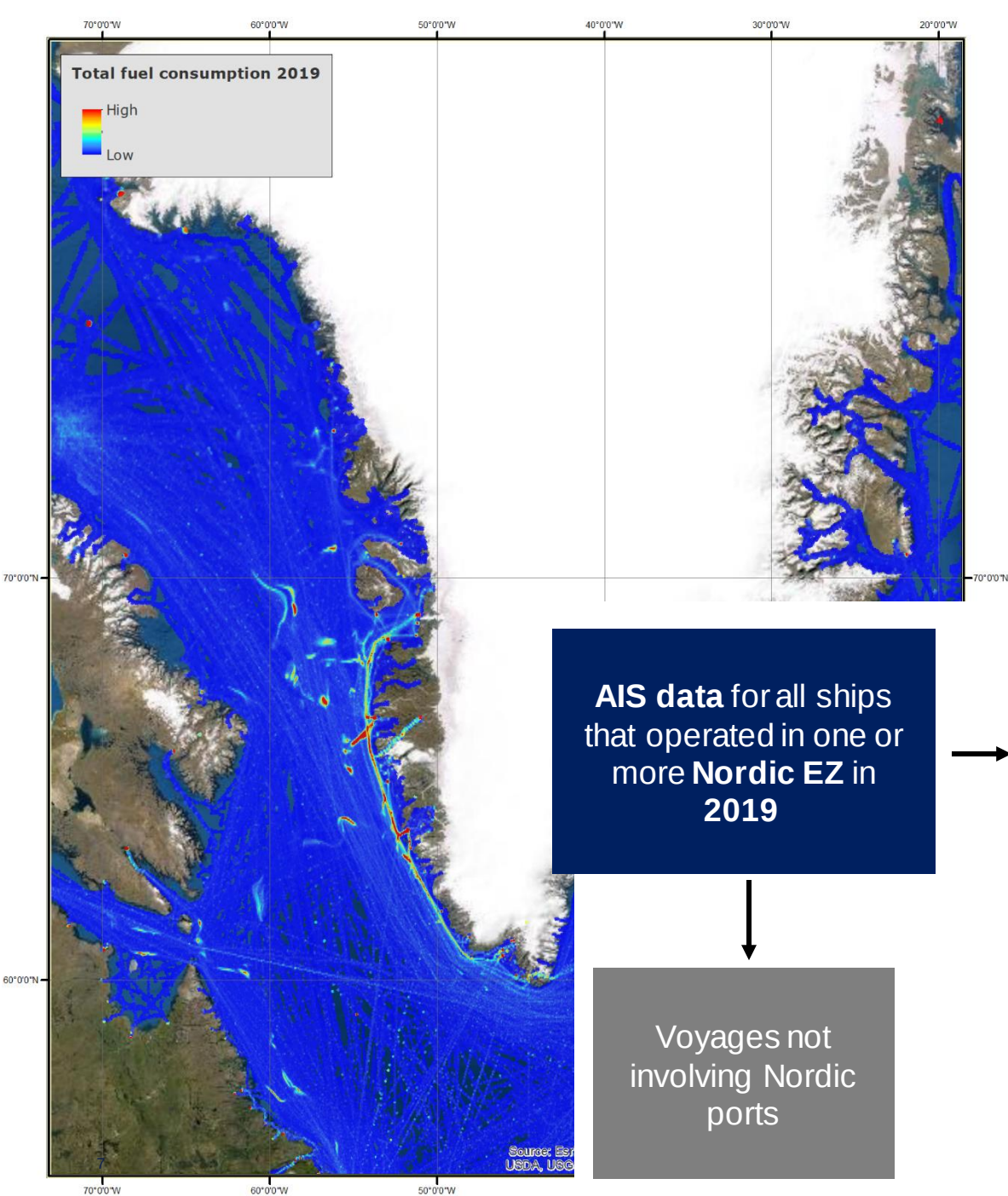
- What is the totality of energy demand and emissions from Nordic ship activity?
- What are the dominating traffic patterns, traffic types (e.g. domestic, intra-Nordic, international) and ship types, and where are they operating?

Estimate energy demand and infrastructure need, divided by:

- Geography & ports
- Fuel types

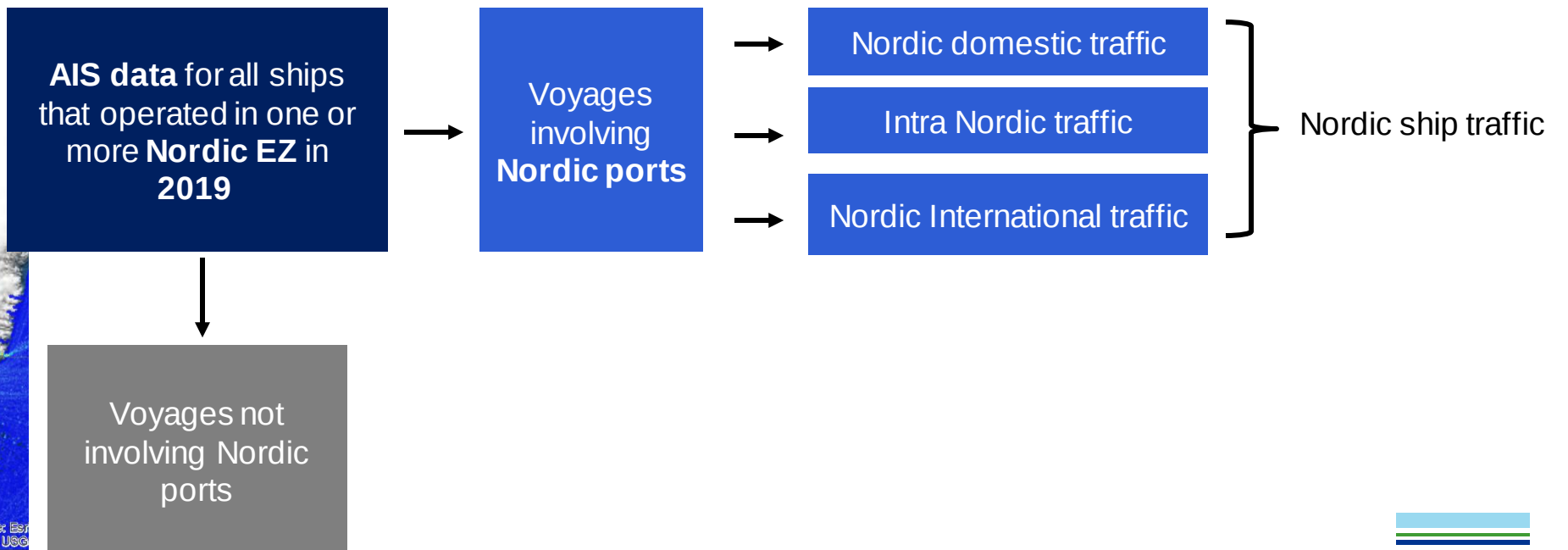
Will provide a tool and framework to identify potential Green Shipping Corridors, and potential energy hubs.



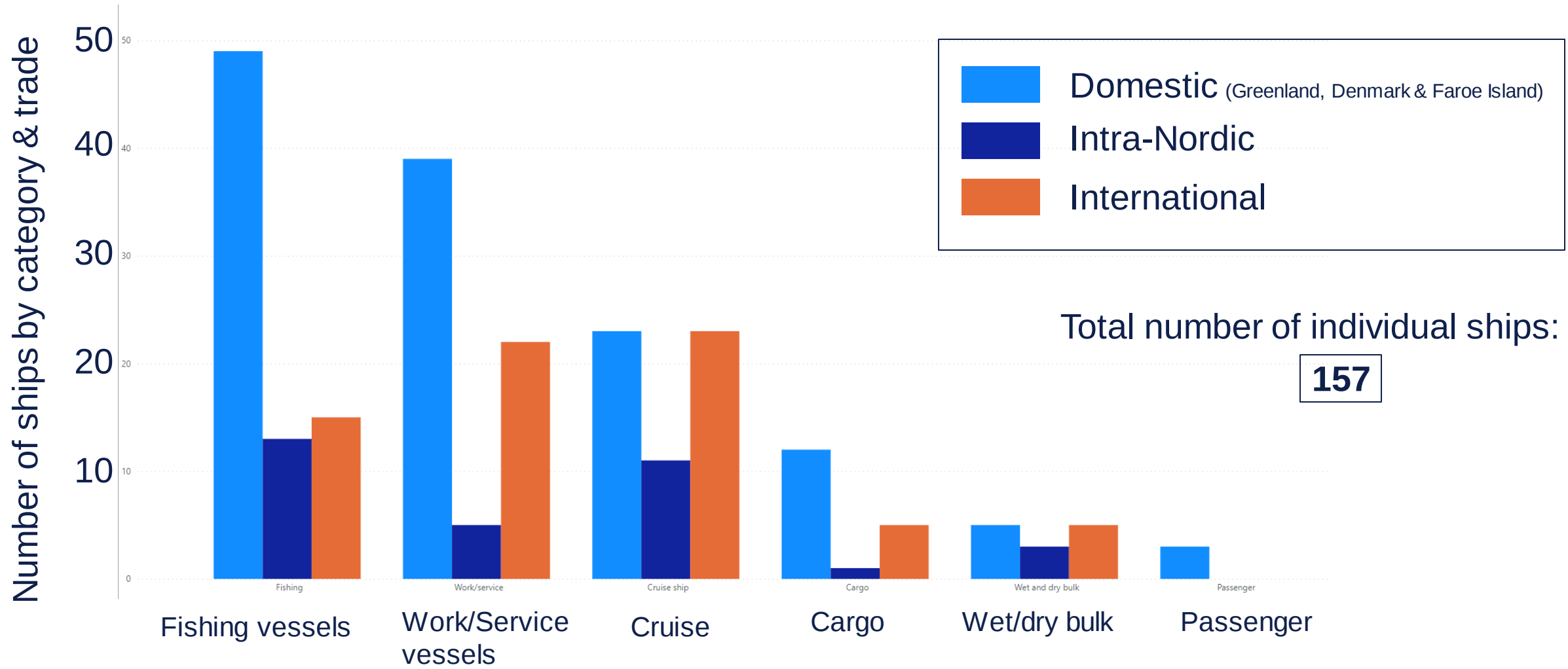


AIS Analysis: Identifying Nordic Ship Traffic

- We use the DNV's *MASTER Model* and *Green Shipping Corridor Model*.
- We calculate energy consumption on ship level, and map it geographically



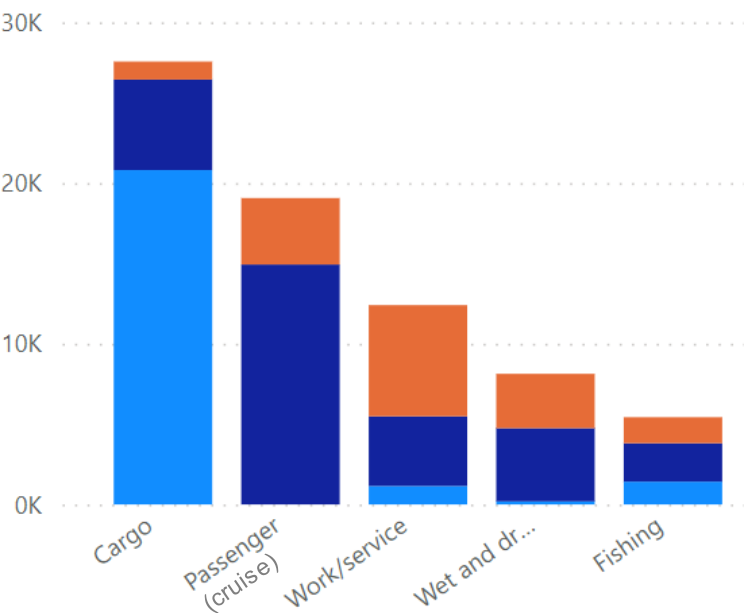
Ships identified active in Greenland ports



Emissions from Greenland ship traffic

Inbound trade

CO2 emissions by ship type/category (tonnes)

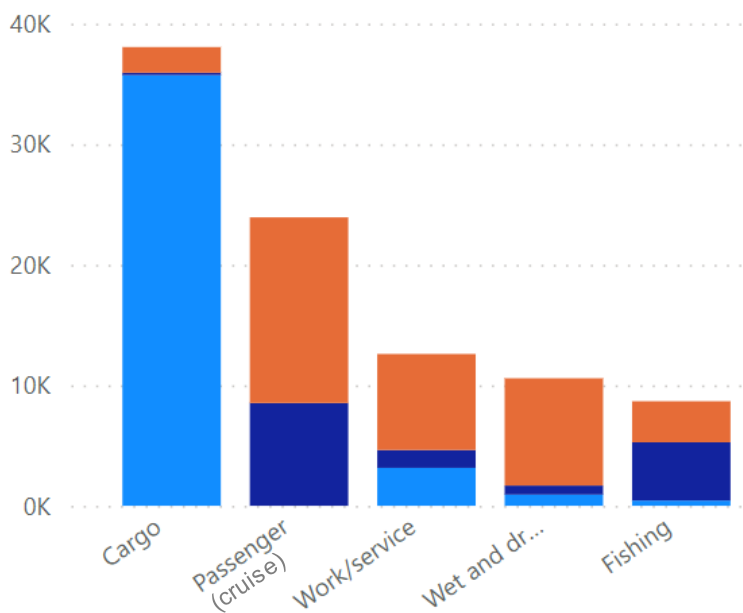


Domestic Nordic (Denmark + Faroe Island) Intra Nordic Nordic International

73 kt CO₂

Outbound trade

CO2 emissions by ship type/category (tonnes)

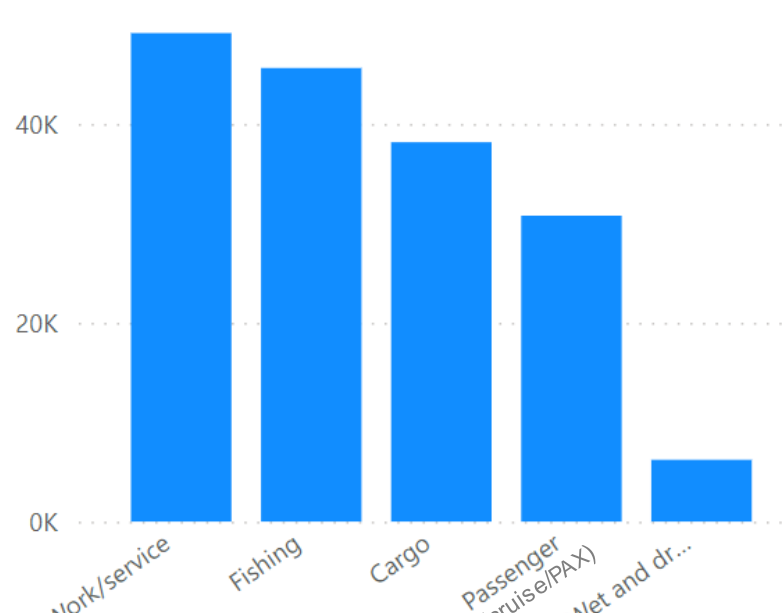


Domestic Nordic (Denmark + Faroe Island) Intra Nordic Nordic International

94 kt CO₂

Intra-Greenland trade

CO2 emissions by ship type/category (tonnes)

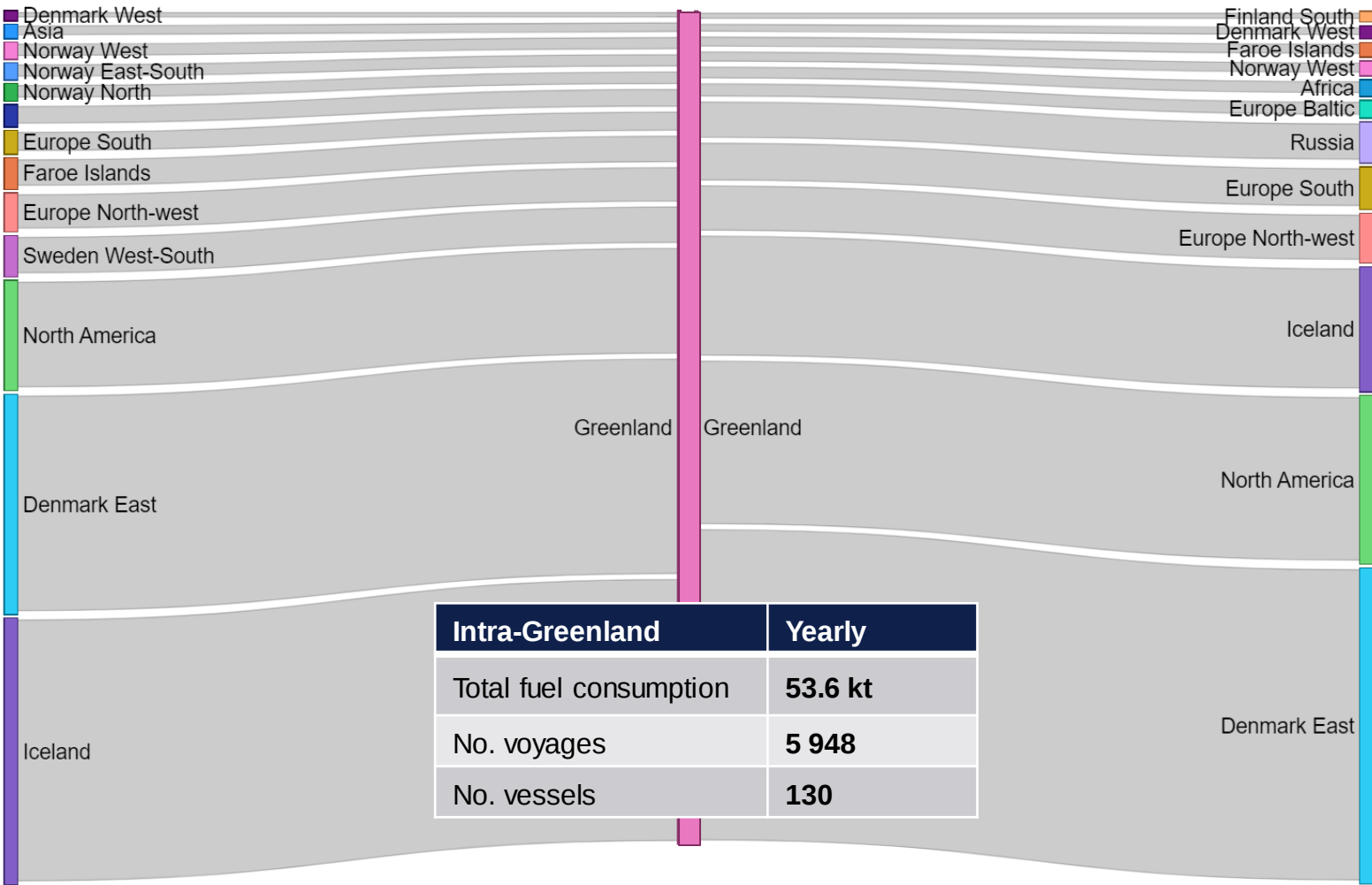


Domestic Nordic (Greenland)

170 kt CO₂

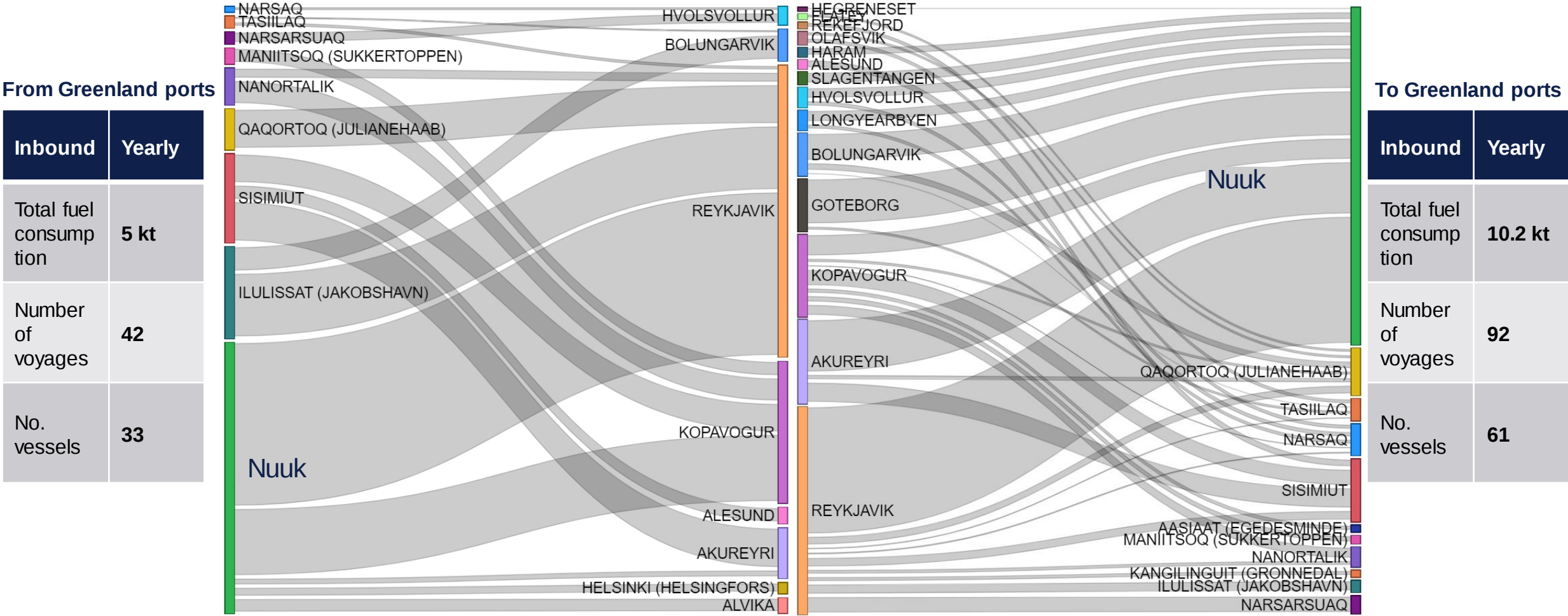
Regional voyage connections with Greenland

Inbound	Yearly
Total fuel consumption	23.1 kt
No. voyages	222
No. vessels	120



Outbound	Yearly
Total fuel consumption	29.9 kt
No. voyages	200
No. vessels	117

Port connections to Greenland ports



The figures illustrates port-to-port intra-Nordic ship traffic from/to Greenland ports. The width of lines represents the relative weight of fuel consumption in port connected voyages, and the width of the coloured boxes represents the weight of fuel consumption of all voyages from (left) and to (right) the respective ports.

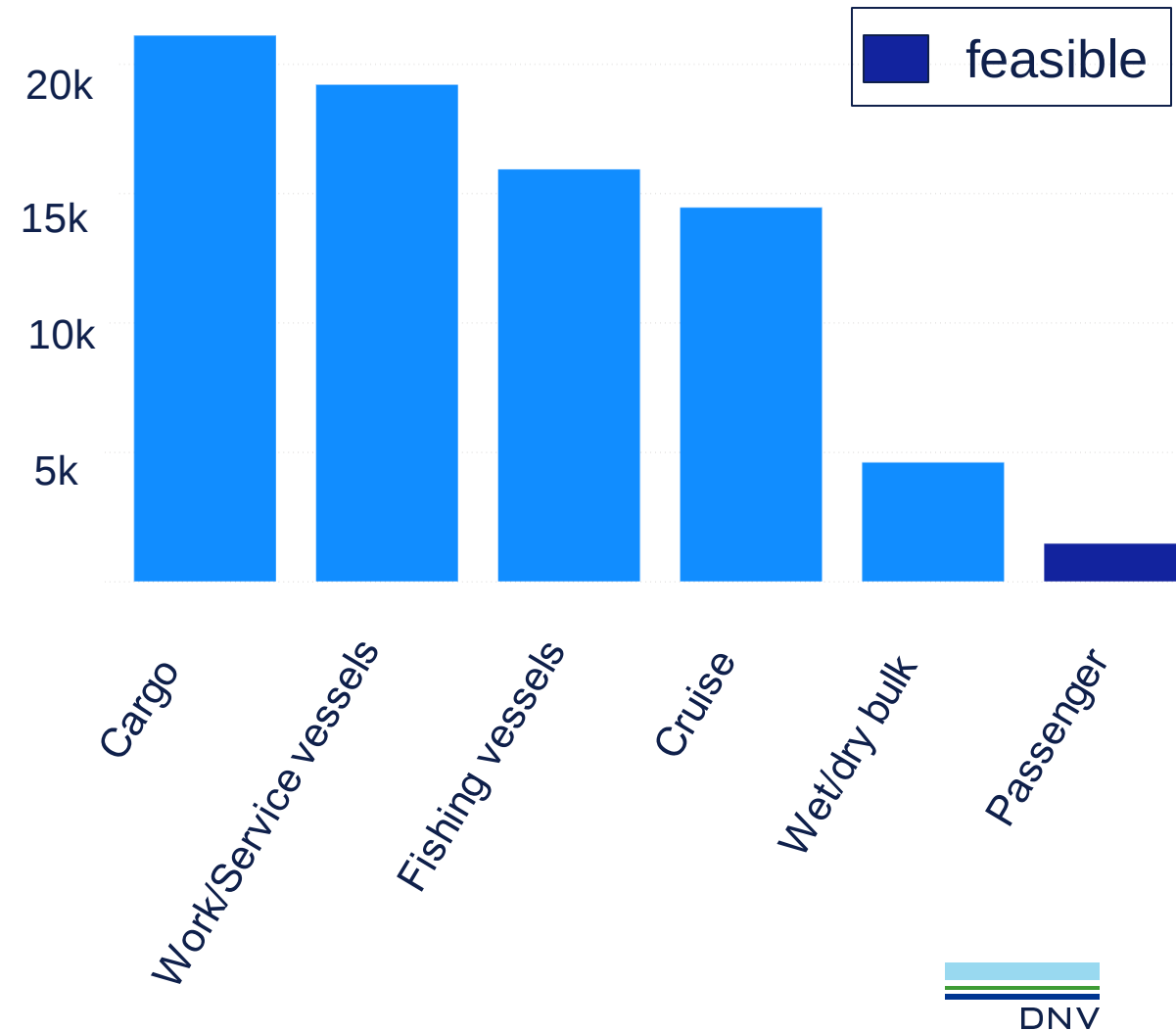
Fuel potential

- All vessels leaving Greenland ports are analysed.
- The longest route (highest energy demand) per identified vessel will determine fuel feasibility.
- The fuel compatibility is determined for comparable vessel categories.

Battery

Nordic Roadmap
For Future Fuels

Outbound Fuel Consumption, in metric tons



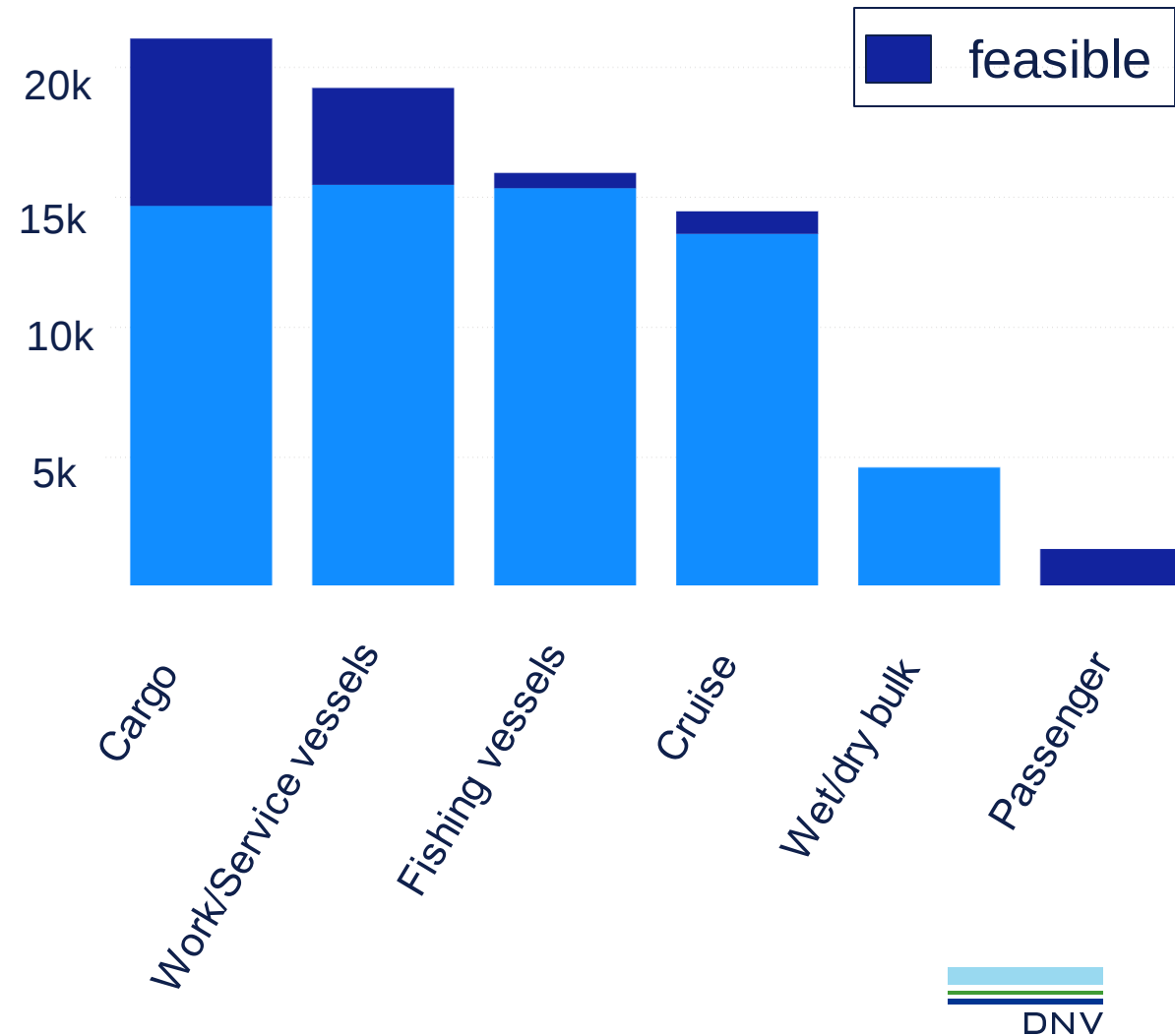
Fuel potential

- All vessels leaving Greenland ports are analysed.
- The longest route (highest energy demand) per identified vessel will determine fuel feasibility.
- The fuel compatibility is determined for comparable vessel categories.

Hydrogen

Nordic Roadmap
For Future Fuels

Outbound Fuel Consumption, in metric tons

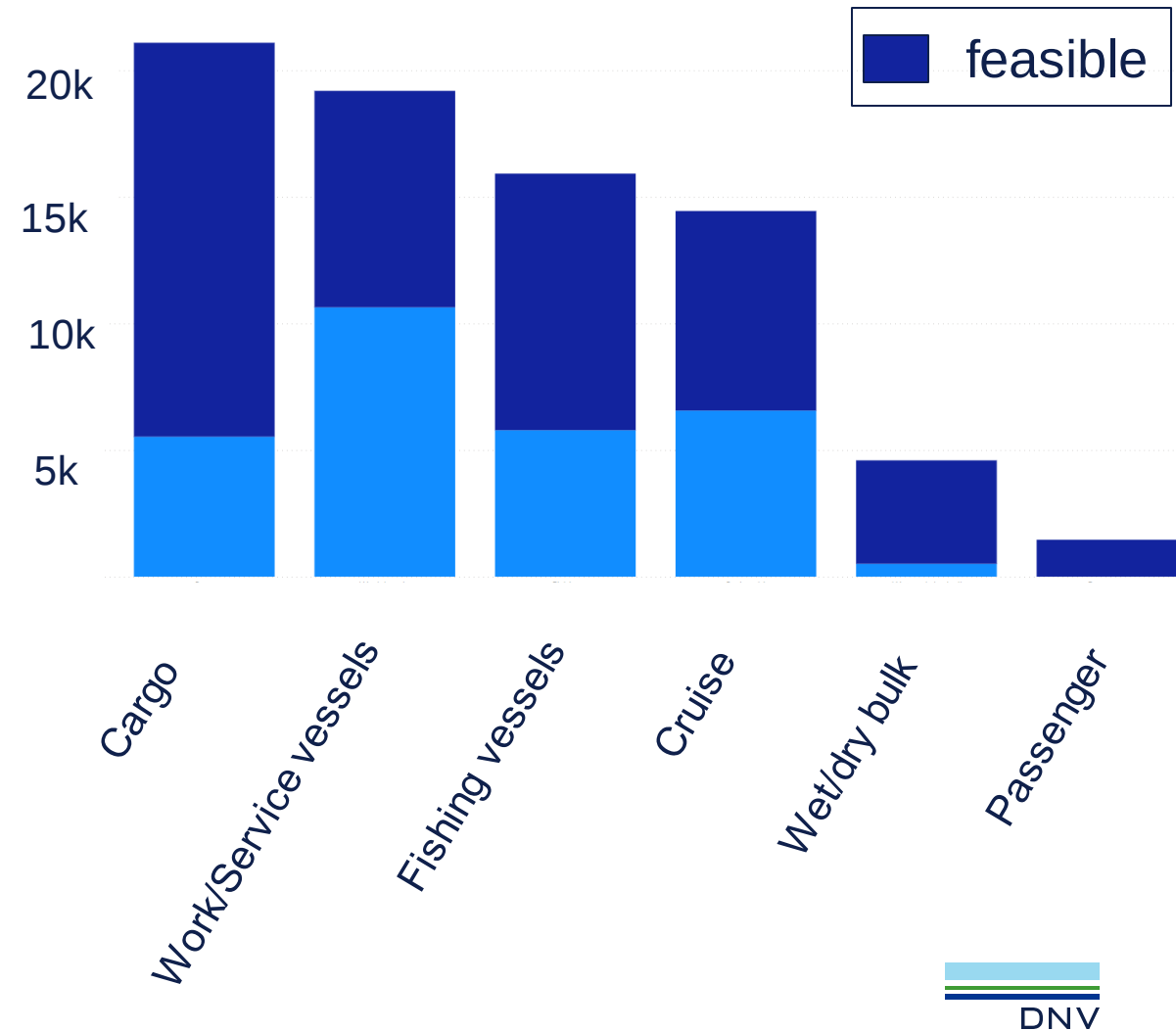


Fuel potential

- All vessels leaving Greenland ports are analysed.
- The longest route (highest energy demand) per identified vessel will determine fuel feasibility.
- The fuel compatibility is determined for comparable vessel categories.

Methanol (or Ammonia)

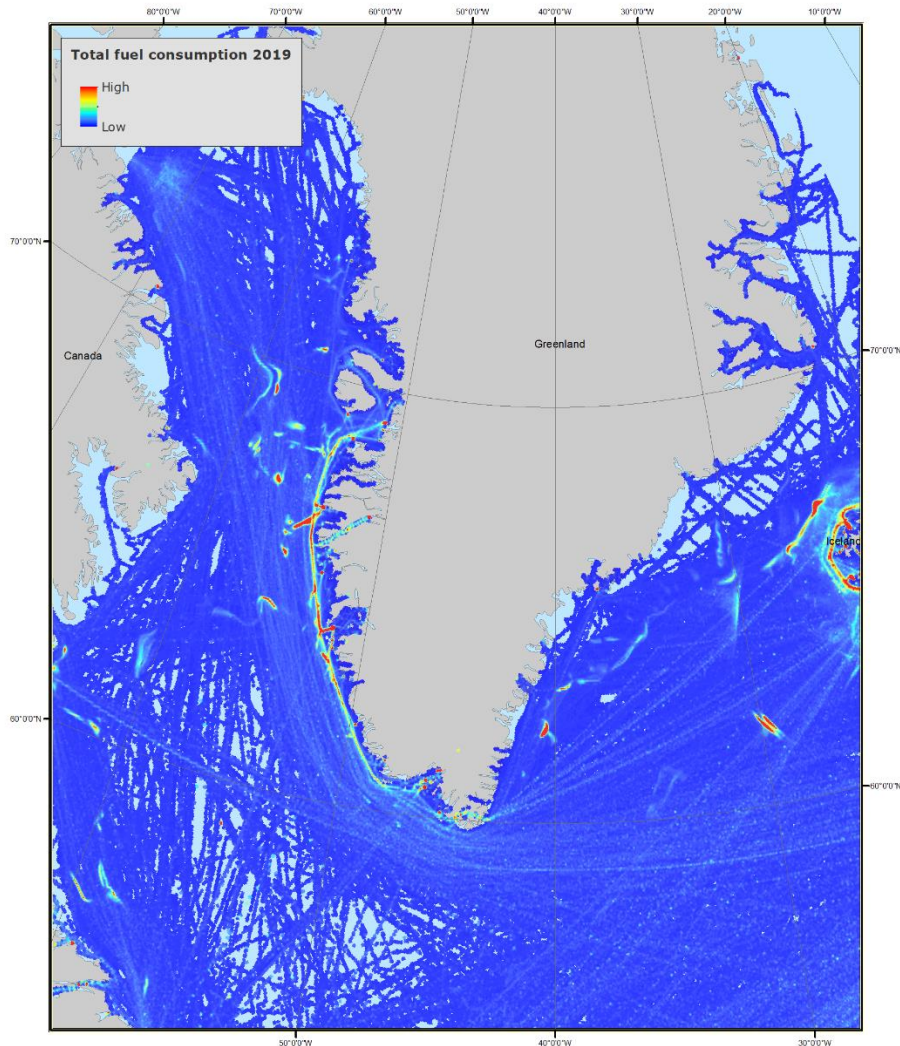
Outbound Fuel Consumption, in metric tons



Preliminary findings from the AIS and traffic analysis

- **Ship type focus:** Container ships, Fishing vessels, Cruise ships and aquaculture boats with demanding operations dominate the fuel consumption in the region.
- **Fuel choice:** Limited potential for battery electric operations with today's fleet. Methanol (and ammonia) has the potential to penetrate all major ship segments.
- **Trade patterns:** Greenland has a mixed trading pattern amongst visiting vessels, with some vessels spending the majority of their time in the region (fishing and aquaculture) while other vessels only spend a limited time in the region (cruise ships).
- **Energy hub potential:** Nuuk holds a unique position in the region in terms of energy demand for visiting vessels.
- **Green Shipping Corridor potential:** Greenland can look to both local green shipping corridors to service the intra-Greenland trade and to major routes (Iceland or Denmark) for intra-Nordic Green Shipping Corridors. However, today's ship traffic in the region is relatively low, and more detailed analyses and barrier study will be needed to map the full potential of Green Shipping Corridors to Greenland.

We are looking for additional supporting partners



- Visit the project website to read more *futurefuelsnordic.com*



- Contact: Nathaniel Frithiof
E-mail: nathaniel.frithiof@dnv.com
Mobile: +47 90122802
- First Nordic Roadmap Conference: **15th November, Oslo.**

WHEN TRUST MATTERS

www.dnv.com

