Nordic Hydrogen Hubs – Roadmaps towards 2030 and 2040 (NordicH2ubs)

Sigrid Lædre
SINTEF

Nordic Energy Research

Nordic Hydrogen Valleys as Energy Hubs

NordicH$_2$ubs

Nordic Hydrogen Hubs – Roadmaps towards 2030 and 2040

Nordic Energy Research

Trondheim, April 28th 2026

NordicH2ubs

- Nordic Hydrogen Hubs - Roadmaps towards 2030 and 2040
- August 1st 2023 to August 31st 2026
- The project is working to:
  - Connect the Nordic countries
  - Cover multiple markets and sectors
  - Find synergies between both countries and sectors

- https://nordich2ubs.com/

Main findings and recommendations

- There is great potential in the Nordics for formation of hydrogen valleys, infrastructure and transport of hydrogen, and it has already started
- There is still a need for research into safety and development of standards
- There are big differences between the Nordic Countries when it comes to job creation within hydrogen as well as policies related to hydrogen
- Hydrogen will play a role in the future Nordic energy system, but how and in which sectors, will differ between the countries and depend on other fuels
- Hydrogen uptake will also differ between the countries and for different applications, but Sweden and Norway has the highest potential
- For all of the above we need clearer policies and better collaborations between the Nordic Countries

Case studies

1. Cross-sectoral H2 value chains in Finland

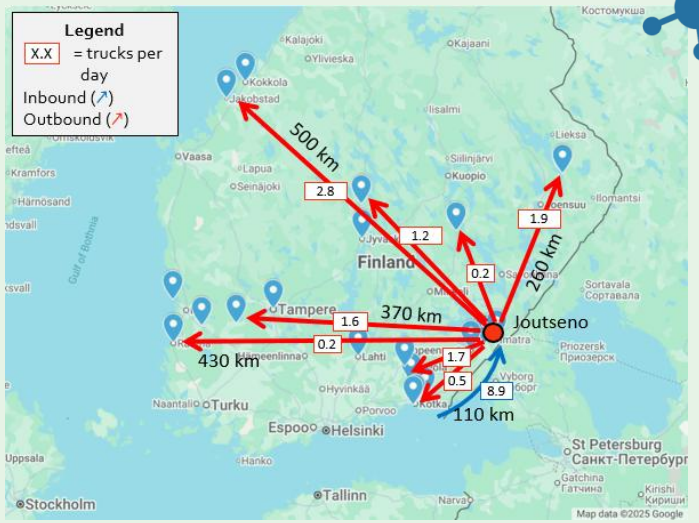
2. Mid Sweden Hydrogen valley

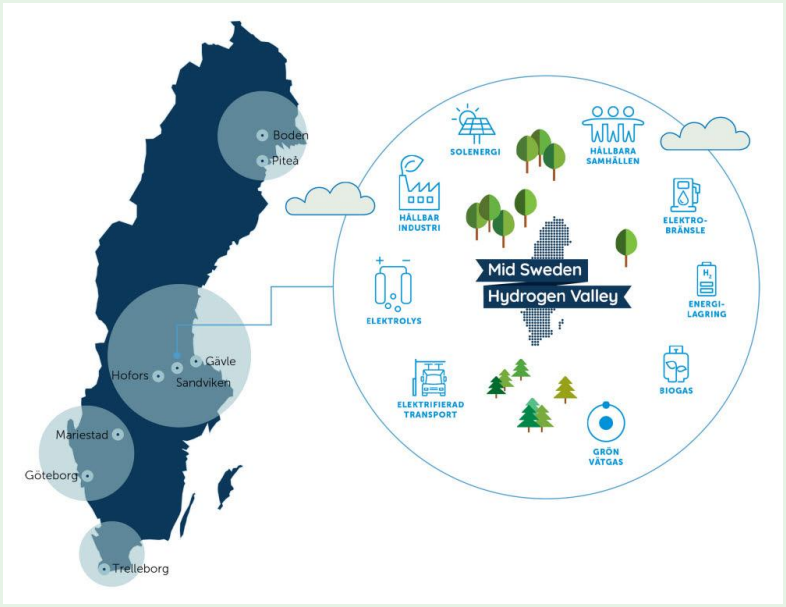
3. H2 infrastructure at ports

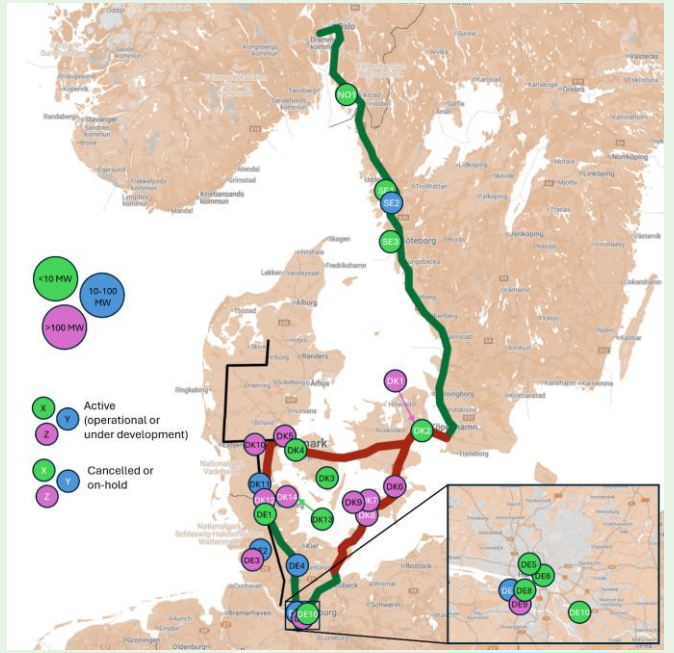
4. H2 in road transport

5a. Oxygen by-product

5b. Heat by-product



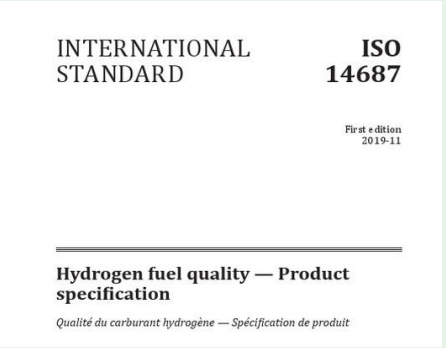




Safety and standardization

1. Safety analysis of HRS with large gaseous and liquid hydrogen storage by use of Phast analytical tool
   - Human factors could play an important role.
   - Harbour areas may face challenges can increase the chance of errors.

2. Mapping of the approval processes of vessels in Norway
   - First movers suffer as the process is costly and takes time
   - Not ideal that first movers cover this extra cost, need government involvement and funding


INTERNATIONAL STANDARD

ISO 14687

First edition 2019-11

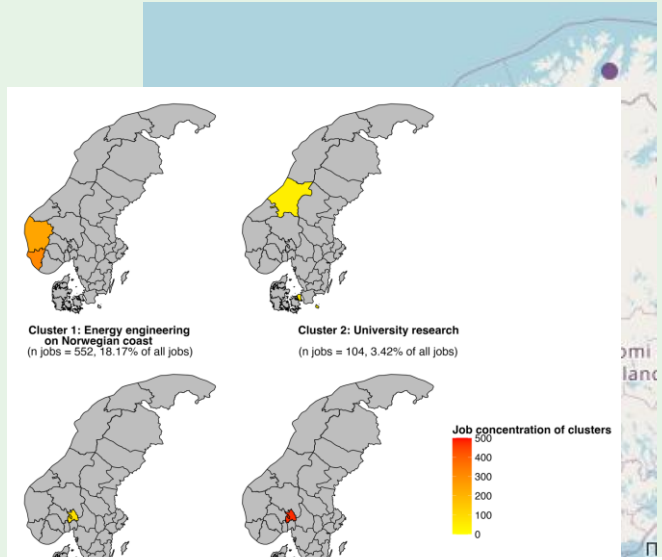
Hydrogen fuel quality — Product specification

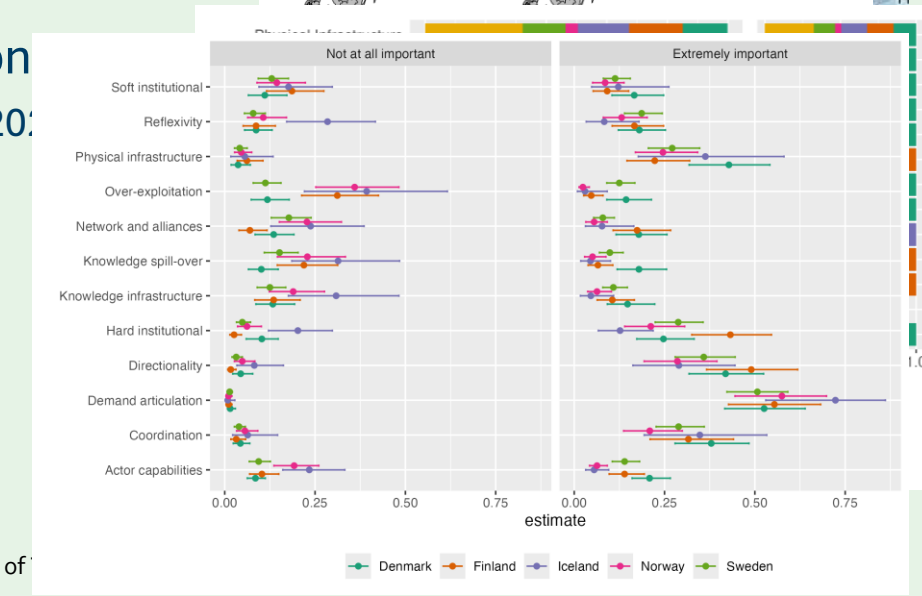
Qualité du carburant hydrogène — Spécification de produit

3. The development of H2 purification and quality assurance methods for hydrogen used in transportation applications in the Nordic countries will follow recommendations from ISO 14687:2019 standard.
   - MicroGC seems to be a good solution for basic (N_2, O_2, CO_2) quality measurement of H_2 from sodium chlorate ($NaClO_3$) production.
   - A quality of H_2 from $NaClO_3$ production, purified by usual industry methods, seems to have better quality than previously estimated.

Socio economic barriers

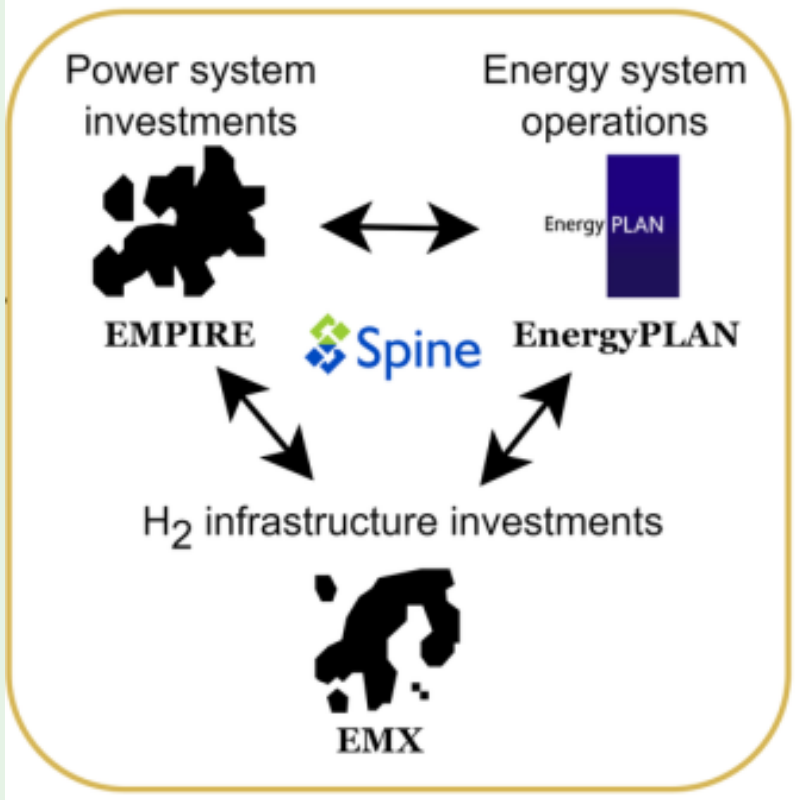
- Visualization of actor-networks and associated technological trajectories
  - *https://uujzwk-hans-hellsmark.shinyapps.io/NordicH2ubs/*
- Analysis competence needs in emerging Nordic hydrogen value chains
  - 2023-2024
  - Takeaway: Close links to existing industries: Offshore (NO), research/innovation (DK), utility integration (SE)
- Identify barriers and solutions to fostering early market formation
  - Document analysis: Where are the missing pieces in 70 policy documents (202
  - Survey: Across all 5 Nordic countries identifying barriers and solutions
- Inform policy regarding measures to foster hydrogen valleys

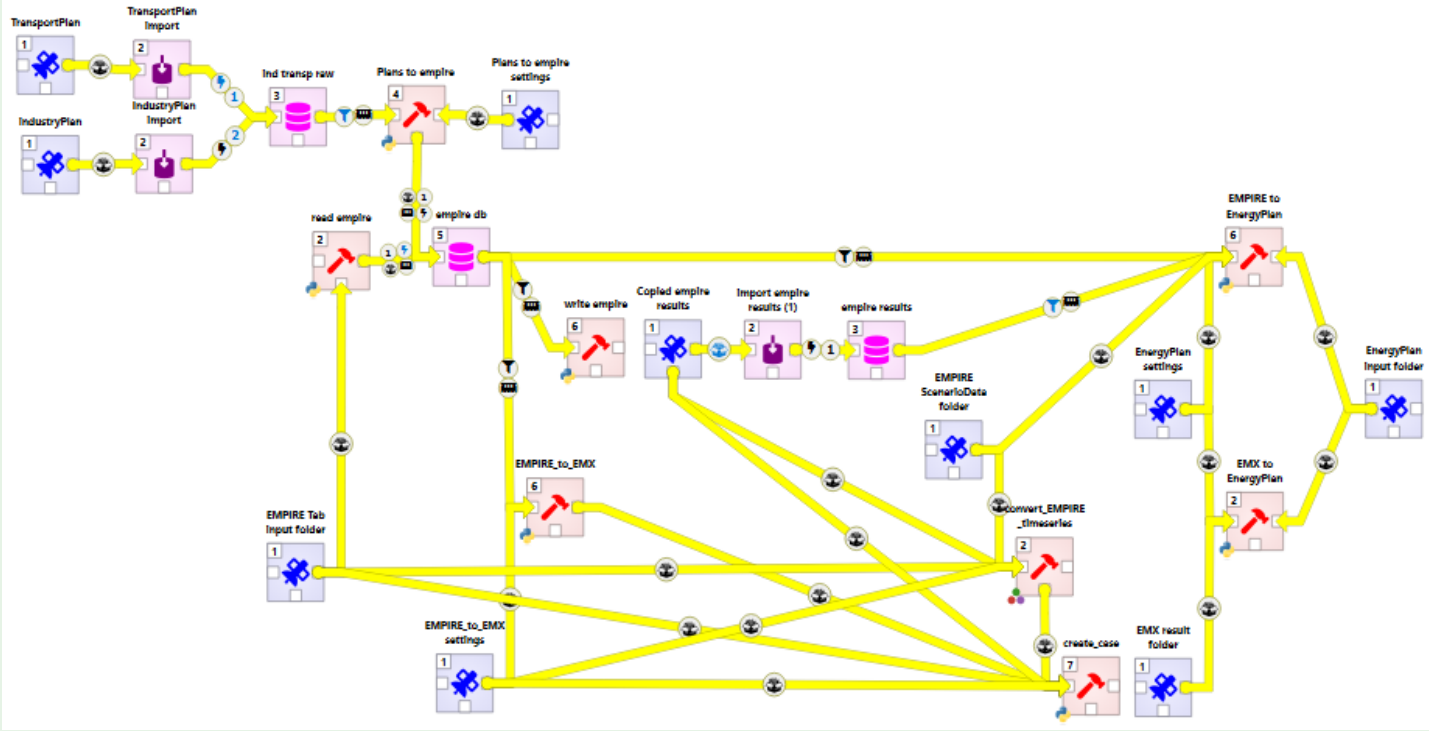




Modelling activities

- Linking of three complementary energy system models
- Using the Spine Toolbox workflow and data management environment.





Scenarios and energy system analysis

3 demand scenarios were created:

1. Hydrogen dominant

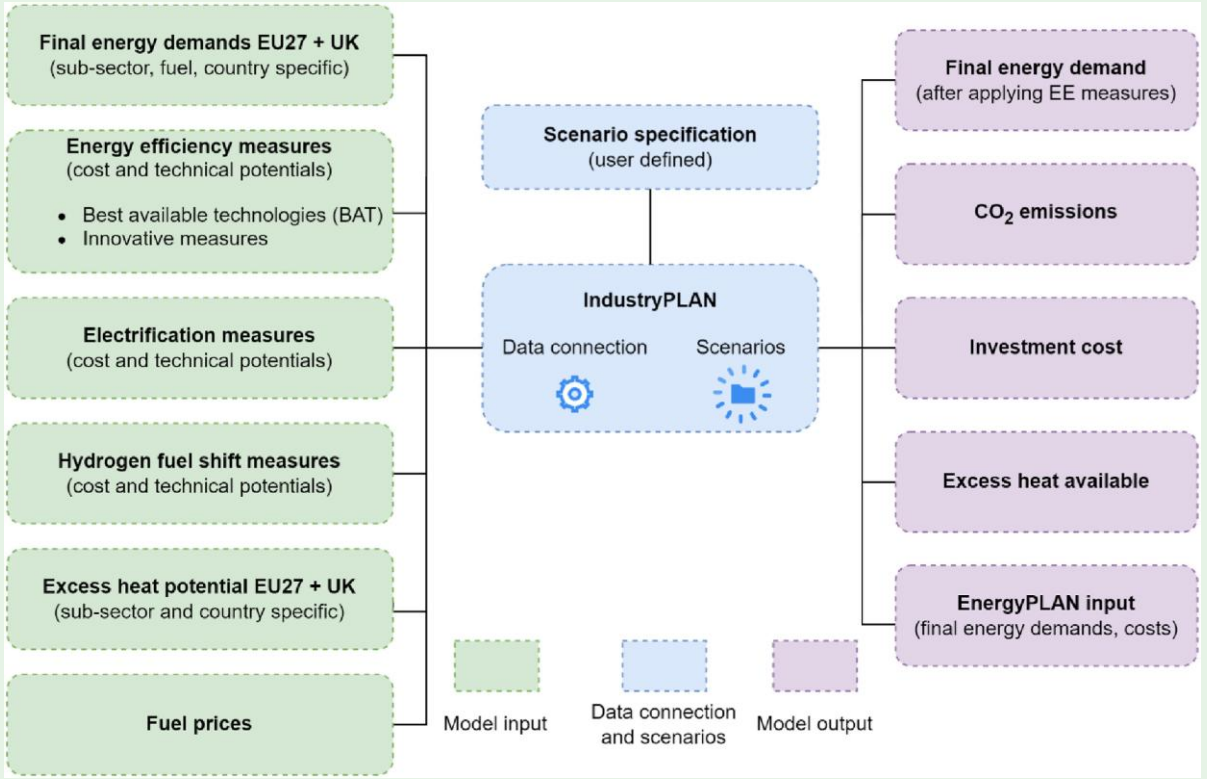
   assuming broad substitution of fossil fuels with hydrogen across industrial processes and transport.

1. Biofuel dominant

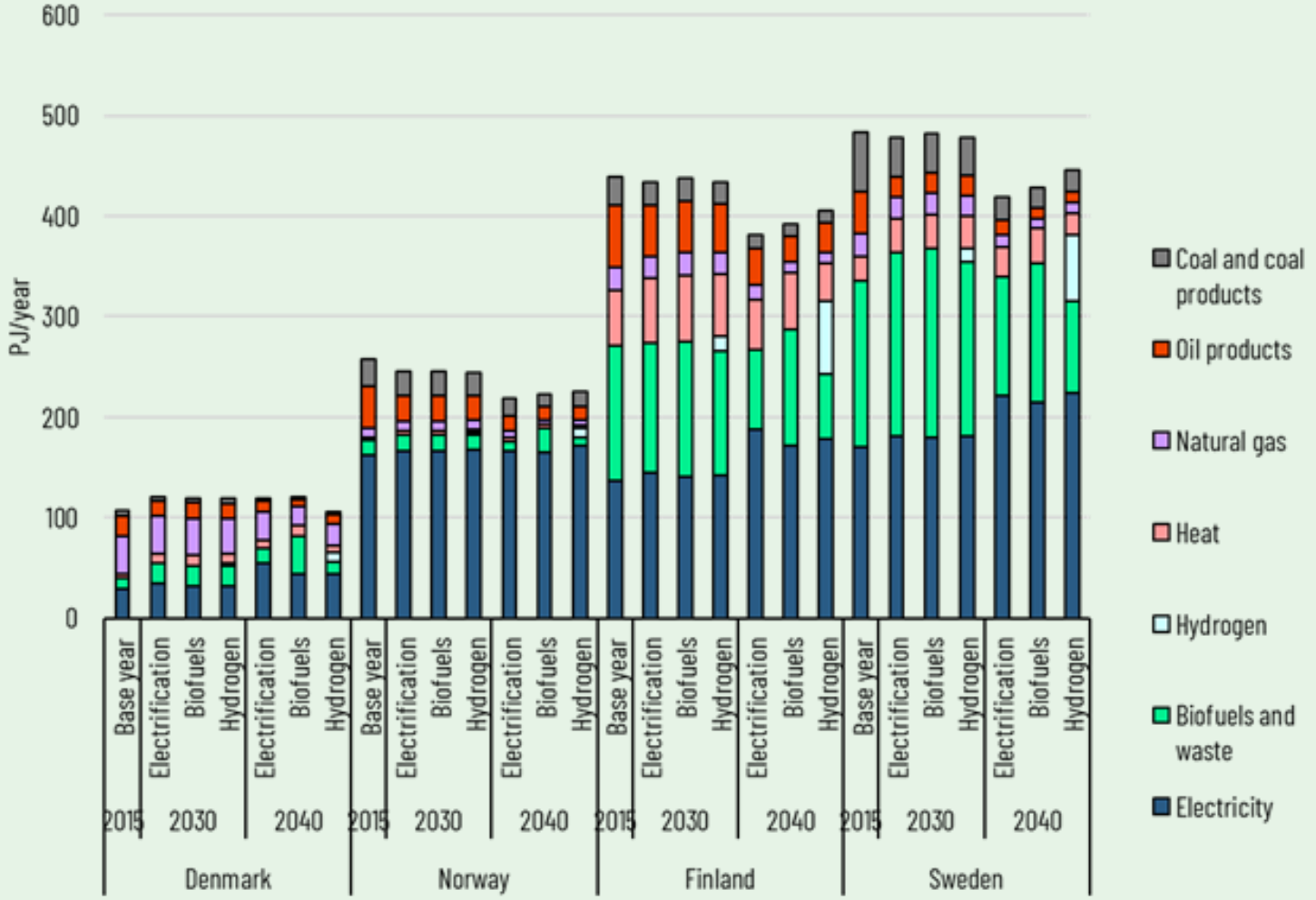
   assuming broad substitution of fossil fuels with biomass-based fuels across industry and transport.

2. Electrification

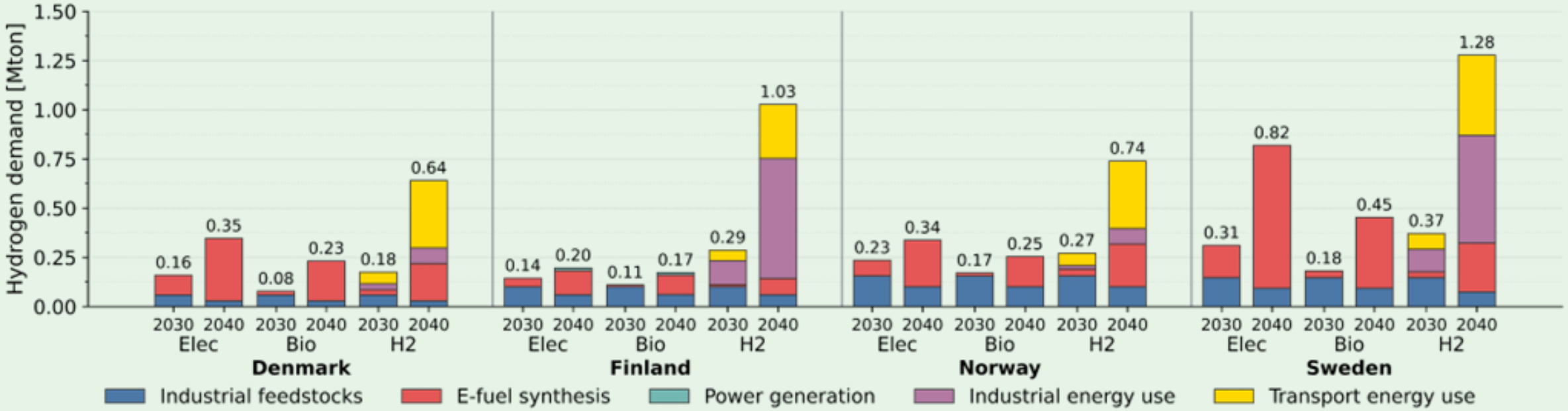
   prioritizing energy-efficiency improvements and direct electrification in industry, direct electrification of passenger and freight transport and e-fuels in aviation and marine.



Demand Scenarious for industry sector across the Nordic Countries



Hydrogen uptake across the Nordic countries



Lessons learned so far

- Several differences between the Nordic countries, but also great premises for cooperation and learning from one another
- The European and Nordic Hydrogen marked is changing relatively fast, and thus some task in the project has been adapted to make sure the outcome is relevant
- Both an advantage and a challenge to have so many aspects of the hydrogen value chains gathered in one project
- There is a clear need for regulations and clear aligned pathways from the Nordic Governments in order to establish value chains for hydrogen and hydrogen derivatives

This project is part of the

Nordic Hydrogen Valleys as Energy Hubs Programme

Nordic Energy Research

Nordic Hydrogen Valleys as Energy Hubs

Thank you for your attention

rannís

BUSINESS FINLAND

Swedish Energy Agency

Innovation Fund Denmark

Forskningsrådet