Pre-study on transition to hydrogen economy, specifically in Northern Ostrobothnia

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Pre-study on transition to hydrogen economy, specifically in Northern Ostrobothnia

Main objective: Evaluate conditions and create scenarios for hydrogen economy in Northern Ostrobothnia by mapping current and upcoming hydrogen-related activities and politics & regulations and by conducting preliminary techno-economic evaluations and stakeholder interviews

Schedule: Aug/2022-Feb/2023

Total budget: 55 k€

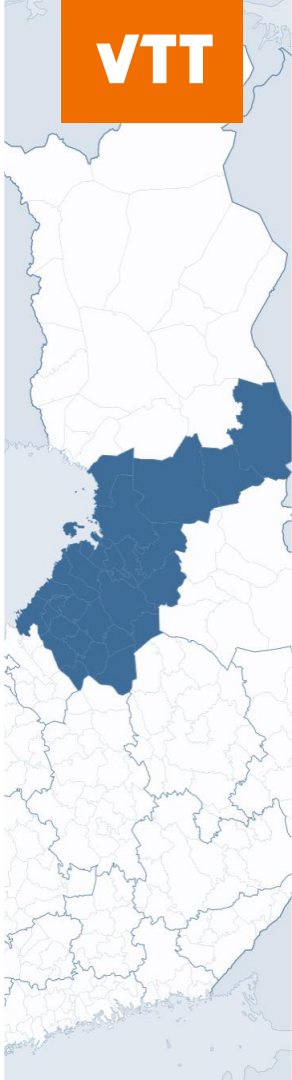
Funders: Two projects managed by Raahe Region Development:

National Hydrogen Network (Kansallinen vetyverkosto)

R4H2 – REACTions for Hydrogen

Project members: Kirsikka Kiviranta, Jeremias Hopsu, Tiia Kanto, Janne Kärki, Juha Lehtonen, Aleksandra Saarikoski

Final report: 3/2023



Pre-study on transition to hydrogen economy, specifically in Northern Ostrobothnia

1

Mapping recent and on-going hydrogen-related activities and actors in Finland, with special focus in Northern Ostrobothnia

2

Mapping existing and forthcoming politics & regulations in relation to hydrogen infrastructure in Finland

Conducting preliminary techno-economic evaluations on hydrogen production and transmission in Northern Ostrobothnia

3

Engaging stakeholders via interviews and a workshop

Creating scenarios for hydrogen production and transmission in Northern Ostrobothnia

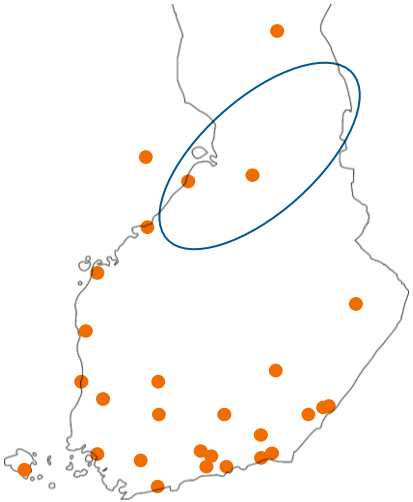
4

Project management, dissemination, networking

Key considerations

Public on-going commercial hydrogen projects in Northern Ostrobothnia

- Most of the hydrogen-related projects and investments in Finland are located further south than Northern Ostrobothnia
- Currently on-going public commercial hydrogen-related projects in Northern Ostrobothnia are:
  - Vierivoima project, Utajärvi (Skarta)
    - *Ongoing project in Utajärvi for solar and wind production with near term plans also for hydrogen production, storage and fueling station*
    - HYBRIT project, Raahe (SSAB, LKAB, Vattenfall)
    - *Technology development for hydrogen-based iron- and steelmaking*
    - Halla project, Bothnia Bay (OX2)
    - *Investigating the possibility to produce electrolytic hydrogen in offshore wind park Halla in Gulf of Bothnia next to Oulu and Raahe*
- The visioned cross-border hydrogen pipeline will partly lay on coastline of Northern Ostrobothnia



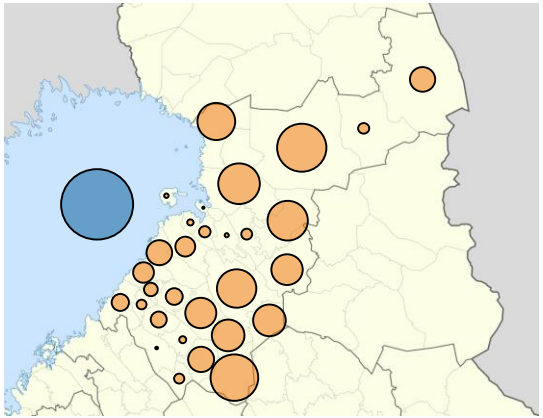
Locations of current plans and projects related to hydrogen economy in Finland.

The envisioned cross-border hydrogen pipeline. The pipeline is estimated to be in operation by 2030 [1].

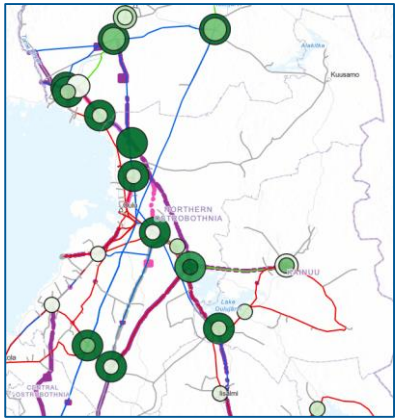
[1] Nordic Hydrogen Route. 2022. Media. Available: https://nordichydrogenroute.com/media/

Wind power in Northern Ostrobothnia

- Wind power capacity is increasing rapidly: majority of new wind power projects in Finland are located in Northern Ostrobothnia
  - Estimated increase from 2.3 GW (2021) to ~ 6-25 GW* (2030)
- Total access capacity to Fingrid's main grid in 2030 in the region is estimated to be 6.3 GW
- The access capacity to the grid is limited if the projected wind power plants in Northern Ostrobothnia (6-25 GW by 2030) are connected to Fingrid's main grid
  - Food-for-thought: hydrogen pipeline from the coast to northeast part of Northern Ostrobothnia?
  - This could avoid that grid capacity would become a constraint for renewable energy production in the area in the future



Upcoming wind power projects by municipality in Northern Ostrobothnia.



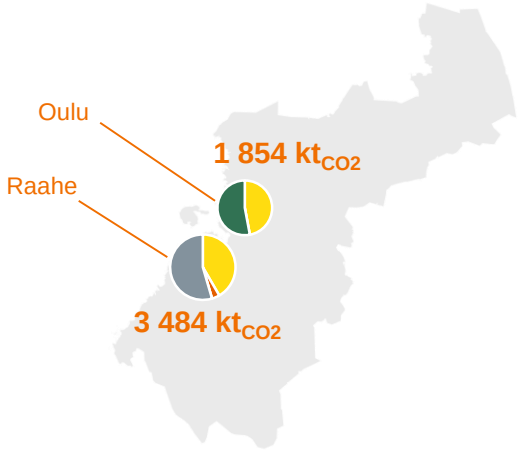
Access capacity to Fingrid's main grid by 2030 [1]

**The large range in 2030 values is due to big spread in the minimum and maximum capacities for each reported upcoming wind power project. The actual capacity is affected for example by the result of EIA.*

[1] Fingrid, 2022 (data read in 18.11.2022). Tarkastele liityntämahdollisuuksia. Available: https://www.fingrid.fi/kantaverkko/liitynta-kantaverkkoon/verkkokiikari/

Evaluating future hydrogen demand in Northern Ostrobothnia

- A potential sector for industrial hydrogen utilization in the region is P2X production
  - In addition to availability of low-cost hydrogen, availability of low-cost point source CO_2 streams is an important parameter when choosing the most promising location for P2X production
- A potential large-scale hydrogen user in Northern Ostrobothnia is steel industry
  - SSAB Raahe steel mill has publicly communicated that the blast furnaces at the mill will be replaced with electric arc furnaces during 2030-2040
  - However, there is a possibility that the reduction of iron ore with fossil-free hydrogen will not take place in Raahe
- Exporting hydrogen via pipeline possible when pipeline is commissioned
- Other potential industrial plants with large-scale hydrogen demand for the region are evaluated during the study



Main point sources and quantities of available CO_2 in Northern Ostrobothnia are mapped and used to evaluate potential demand for electrolytic hydrogen for P2X processes. Adapted from [1].

[1] EEA, 2022.

Next steps

- Stakeholder interview analysis when all interviews are completed
  - So far, the interviewed stakeholders are: OX2, SSAB, Oulun Energia, Hycamite TCD Technologies
- Workshop on drivers and barriers for hydrogen economy in Northern Ostrobothnia with local actors on Thu 26.1.2023
- Formulation of hydrogen scenarios for Northern Ostrobothnia by combining the current findings on:
  - Current and upcoming hydrogen-related activities
  - Preliminary techno-economic evaluations
  - Stakeholder interviews and workshop
- **Final report by 3/2023**

Thank you!

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