

BUILDING HYDROGEN PRODUCTION AND BUNKERING HUBS IN NORWAY

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ABSTRACT

GreenH philosophy to establish hydrogen production in a developing early market.

A major challenge in transitioning to green energy within transportation and industry is the high cost associated with the green hydrogen value chain. Hydrogen production is energy-intensive and involves efficiency losses. While large-scale production can reduce costs, these facilities are often planned away from consumption points, leading to expensive transportation or inefficient service to multiple consumers. The GreenH model addresses this by finding locations where various consumption types are closely clustered, eliminating the need for costly hydrogen transport in tanks. By localizing consumption of green hydrogen produced at a nearby node, additional CO₂ savings are achieved by avoiding emissions from the transport of the energy carrier.

The modular nature of electrolysis technology allows for scalable hydrogen production tailored to local needs over time. This flexibility fosters cost advantages that could accelerate hydrogen deployment in Norway. The project leverages the proximity between production and consumption to use short pipelines for distributing LH₂, GH₂, surplus heat, residual cold, and oxygen, enhancing overall energy efficiency and minimizing transport losses.

Impact and Benefits

The model promises substantial societal benefits by demonstrating a new model for establishing hydrogen hubs, enabling significant cost reductions and early market entry. The model also shows how to achieve better energy efficiency and lower CO₂ emissions, influencing future decisions on hydrogen production site selection and hub development. Expected impacts include:

1. Reduction in CO₂ emissions beyond those from hydrogen use alone.
2. Higher energy efficiency using residual products and elimination of transport.
3. Cost reductions making hydrogen accessible to more users and an earlier market start.
4. Economic value creation from operation and establishment, with additional ripple effects due to the hub's central location.

Projects

The GreenH philosophy is to establish a national infrastructure of hydrogen hubs close to the market. The first project being developed from this model is the GreenH Bodø project.

The project is situated in Bodø Municipality in the northern region of Norway and is in close proximity to offtakes of both H₂, O₂ and residual heat allowing for reduced cost benefits and increased energy efficiency for the project.

The facility is directly in the maritime traffic route to Bodø harbor with more than 9000 port calls passing by the facility every year.¹ The first confirmed off-taker will be the Vestfjorden ferry connection operated by the ferry company Torghatten Nord. The ferry will be one of the first large passenger ferry operated on compressed gaseous hydrogen and will start operations in 2026 from Bodø to the Lofoten islands. The facility develops direct bunkering of compressed gaseous hydrogen directly from the facility to the ferry through a high-speed bunkering solution based on the cascade principle.

The Bodø location is ~500 meters from the Bodø airport. GreenH has, together with SINTEF ENERGY, investigated how the facility can distribute LH₂ through pipeline to the airport minimizing efficiency losses by reuse of boil off and exploiting residual cold.

The Bodø City central heat system grid is passing ~100 meters from the hydrogen facility. GreenH has together with BE Varme AS and SINTEF Energi AS investigated how to exploit the residual heat from the hydrogen production to heat the new airport and city.

Lastly the project is situated close to land-based fish farming facilities in need of oxygen. The project has, together with SINTEF Energi AS and local partners, investigated how a local value chain exploiting the oxygen from the facility can be utilized.



Conclusion

The GreenH Bodø project represents a significant step towards efficient hydrogen distribution and consumption, potentially setting a precedent for hydrogen infrastructure development both in Norway and globally. By addressing the high costs and inefficiencies associated with hydrogen transport and production, the project aims to facilitate a quicker and more effective transition to a hydrogen-based economy.

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¹ AIS data analysis of fleet movements in Bodø harbour CY 2021 conducted by GreenH AS