

The hydrogen blueprint

by Ewa Kočańska

The **Roadmap of Local Green Hydrogen-Based Fuels in the Umeå Region**, report of the EU-backed **Blue Supply Chains** project, outlines an ambitious yet balanced strategy to decarbonise port and industrial activities. Led by the goal of achieving climate neutrality by 2040, the *Roadmap* details a framework for developing a localised electro-fuel production framework centred on green hydrogen. The proposed multifaceted approach – infrastructure readiness, fuel compatibility, environmental regulations, and financial responsibility – provides a flexible methodology that other port regions in the Baltic can, too, utilise.

The shipping industry is under pressure to reduce its heavy reliance on fossil fuels, which still account for almost all of its energy use – far behind other sectors in decarbonisation efforts. As global shipping is still responsible for nearly 3% of all greenhouse gas (GHG) emissions, this lag could seriously undermine international climate targets. Ports have a vital role to play in this shift – not just as logistics hubs but as key drivers of change by supporting the adoption of alternative fuels and green technologies across the maritime sector.

The Umeå region is particularly well-positioned to become a northern European epicentre for green hydrogen-derived fuels. Substantial, dependable supplies of renewable electricity, particularly hydropower, dominate the area's energy profile. In addition, Umeå has access to clean water for electrolysis, bio-based carbon dioxide suitable for synthetic fuel production, and a well-developed industrial base. Designated as the primary site for fuel production in the region is the Dåva Eco-Industrial Park. Equipped with district heating infrastructure and situated near robust rail & road networks, Dåva's location makes it convenient for both domestic use and export opportunities. Umeå has already been taking an active

role in renewable energy projects (e-methanol), showing its consistent resolve to environmental sustainability.

Becoming climate neutral in six steps

The foundation of the *Umeå Roadmap* is a six-step methodology. First, define the objective and timeframe; second, map the present; third, assess the future; fourth, understand technological developments; fifth, explore pathways, actors, and measures; finally, plan for realisation, follow-up, and evaluation.

The process begins with picking strategic goals – such as that by 2040 Umeå aims to produce enough green electro-fuels for maritime and port activities to cut GHG emissions throughout the logistics chain. Next, the report takes a snapshot of the current situation, including strengths and weaknesses in Umeå's energy, transport, and industrial infrastructure. For example, the Port of Umeå currently hosts over 800 ship calls annually and supports significant freight operations but lacks the refuelling and support systems necessary for hydrogen-based fuels. Still, the presence of industrial emitters producing biogenic CO₂ and a stable energy grid form a solid foundation to continue with the next steps.

Central to the goal of Umeå being climate neutral before long are the future fuel supply and demand projections. The *Roadmap* estimates the Dåva site could support the production of up to 110,000 tonnes of e-methanol annually. This fuel, alongside hydrogen and ammonia, has emerged as a leading candidate for maritime decarbonisation due to its energy density and growing market availability. The transitional pathway described in the *Roadmap* illustrates milestones such as constructing hydrogen infrastructure, implementing carbon capture, and retrofitting port operations and vessels with fuel-flexible or zero-emission tech solutions.

Technology-wise, the *Roadmap* emphasises that there's no single one-size-fits-all fuel or technology. Instead, a diverse mix – including hydrogen, methanol, ammonia, batteries, and wind-assisted propulsion – must be deployed concurrently. This is because of the complexity of the maritime sector, where different vessel types and travel routes demand different energy solutions. In terms of the economics of alternative fuels, the report offers detailed comparative cost analyses. At the moment, hydrogen, methanol, and ammonia are more expensive to produce and distribute



Photo: Belatchew

– largely because electrolysis requires heavy investment while supply chains are still developing. That said, falling costs in electrolyser technology, increasing system efficiencies, and the expanding carbon pricing regimes in the EU are projected to significantly close the gap by 2030-40. Green hydrogen costs, currently estimated at \$4.0-9.0 per kg, are expected to decline to \$1.0-3.0/kg through technological advancement and economies of scale.

Collaborative & cross-sectoral

The report also stresses the role of EU policies (FuelEU Maritime and the Alternative Fuels Infrastructure Regulation) that incentivise/mandate the use of renewable fuels in shipping and port operations. Sweden's national policy is also moving towards aligning with the block's climate targets, although not without some regulatory uncertainty – particularly around hydrogen storage, fuel classification, and CO₂ capture and storage permits. The *Roadmap* identifies these gaps and calls for harmonised standards to facilitate market development.

The governance structure proposed in the *Roadmap* is collaborative and cross-sectoral, bringing together municipal bodies, energy providers, port authorities, private companies, and logistics operators.

The Municipality of Umeå and the Port of Umeå are tasked with steering coordination efforts supported by commercial stakeholders, including Umeå Energy, Liquid Wind, and INAB. Implementation is tracked through a dedicated oversight system that includes performance indicators, pilot project evaluations, and adaptive strategy reviews. This governance model ensures that institutional momentum is maintained over the long timeframe required for full transition while allowing flexibility to incorporate new technologies or policy changes.

Blueprint for a green future

The *Roadmap of Local Green Hydrogen-Based Fuels in the Umeå Region* also outlines an integrated system that leverages existing infrastructure whilst preparing for new investment. The Dåva facility is envisioned as a production and distribution hub, using excess renewable electricity for electrolysis, captured biogenic CO₂ from local industries, and thermal integration with the district heating grid to increase overall energy efficiency.

Green hydrogen is expected to serve both as a direct fuel and a feedstock for methanol synthesis, with planned port storage and bunkering facilities. Additional seaport upgrades – such as shore power systems, ammonia-compatible fuelling stations, and

rail-port connectors – will align with the broader digital and environmental modernisation of logistics systems.

Additionally, 'trickle-down' economic and regional benefits are forecasted. The development of green hydrogen and e-fuel capacity is expected to spur job creation, innovation, and regional competitiveness. Synergies with other future-oriented industries in northern Sweden – like battery production and green steel manufacturing – enhance the region's appeal as a centre for sustainable industrial growth. The export potential of e-fuels, particularly as global shipping regulations tighten, positions Umeå as a strategic player in the international maritime decarbonisation sector.

The charted *Roadmap* represents a comprehensive blueprint for transforming Umeå into a model region for green hydrogen-based fuel production and utilisation. Through detailed analysis of economic, technical, policy, and governance dimensions, the report outlines a clear path towards a zero-emission maritime future. By capitalising on local strengths – renewable energy, industrial readiness, and political will – Umeå is set to lead Sweden and the wider Baltic region in implementing a sustainable and economically viable energy transition. ■