Economic Assessment of “Waste-to-H_2” Projects

Executive summary – December 2025

Background and objectives

As part of its role in structuring and promoting the renewable hydrogen sector in Brittany, Bretagne Next commissioned a techno-economic study on the “Waste-to-H_2” model, i.e. the production of hydrogen from waste through energy-recovery processes. The technologies assessed in this study include biomethane reforming and pyrogasification of biomass or residual waste.

This study forms part of the operational implementation of the Regional Renewable Hydrogen Roadmap led by the Brittany Regional Authority. It aims at structuring an ecosystem of energy-transition projects based on the valorisation of local resources, particularly organic and industrial waste, while leveraging port infrastructures and territorial microgrids.

Launched in September 2025, the study was carried out by EY’s teams specialized in energy-transition markets, with final deliverables submitted in December 2025.

The “Waste to H2” study, led by the regional economic development agency Bretagne Next, was conducted as part of the REDII-Ports project and co-financed by Interreg Nord-Ouest funds. It was carried out in partnership with the Brittany Region, BrestPort, GRDF, and H2X Ecosystems.

Scope of work

The work was structured around three main pillars: (i) an analysis of the regulatory framework applicable to Waste-to-H_2 value chains; (ii) the assessment of a practical case study at the Port of Brest; and (iii) an analysis of the replicability of such projects across other territorial ecosystems.

These analyses were informed by approximately thirty interviews conducted with value-chain stakeholders and territorial actors potentially interested in deploying such projects, both in Brittany and across other European port ecosystems involved in the Red-II Port project.

Regulatory framework analysis for Waste-to-H_2 value chains

The regulatory analysis covered several dimensions, including the application of the ICPE regulatory framework, the legal status of waste and of the hydrogen produced, in particular the recognition of the renewable or low-carbon nature of the hydrogen depending on production pathways and feedstocks used. Particular attention was paid to the interpretation of the waste-management hierarchy (material vs. energy recovery) as applied to this type of project.

Case study – BrestPort H2 loop

A project example was analysed at the Port of Brest, covering two alternative hydrogen production configurations: (i) reforming of biomethane, with and without valorisation of the co-produced CO_2 and (ii) pyrogasification of B-grade wood.

A cross-analysis of local hydrogen demand, opportunities for co-product use, feedstock availability (notably B-grade wood), and the technical characteristics of the required equipment led to sizing assumptions for each configuration.

The configurations analysed correspond to minimum hydrogen production capacities of 1.5 tonnes/day for the pyrogasification option and 3 tonnes/day for the reforming option.

The assumptions used to model asset profitability were derived from the consolidation of data collected from project developers and technology providers interviewed during the study, all of whom are among the most mature and experienced players in the market. The results therefore provide robust orders of magnitude, although further refinement would be required on a case-by-case basis depending on the specific technologies selected.

In both configurations, diversification of hydrogen end-uses enhances the robustness of the business case. The envisaged uses include land and maritime mobility, as well as the use of hydrogen as an energy-storage vector.

The latter use case requires the deployment of an electricity flexibility hub, whose value proposition is to supply decarbonised electricity at an optimised cost by continuously arbitrating between hydrogen conversion and electricity grid offtake. The hub comprises several components: a hydrogen storage tank, a fuel cell converting hydrogen into electricity, a battery to store the generated electricity, and a power converter to inject alternating current into the grid. The operation of this hub also generates co-products, notably water and heat, resulting from hydrogen conversion.

The profitability of this flexibility hub was also modelled, based on assumptions regarding daily electricity price volatility.

Replicability analysis

An assessment of the replication potential of this type of project was conducted through interviews with representatives from other Breton territories and European port ecosystems.

This analysis confirmed the interest of several territories in such projects - some of which have already initiated concrete démarches with project developers - and enabled the identification of key success factors for anticipating the relevance of Waste-to-H_2 projects at the territorial scale.

Key findings

The study highlights several key insights:

- While electrolysis has attracted most of the support for low-carbon hydrogen development in recent years, biomethane steam reforming and waste pyrogasification emerge as credible alternative pathways that are less water-intensive and less exposed to electricity price volatility.
- These solutions align with a territorial regenerative-loop approach by offering local valorisation pathways for locally generated waste streams, such as B-grade wood, a significant share of which is currently exported from Breton ports for energy recovery abroad.
- The development of future projects will require additional studies to confirm control over environmental impacts, particularly compliance with regulatory thresholds for atmospheric pollutant emissions.
- Financing such projects requires the long-term securing of feedstock supply and offtake agreements for the valorisation of produced gases.
- These projects demonstrate profitability potential (positive Net Present Value) with hydrogen sales prices below €8/kg excl. VAT, or even lower under certain scenarios.

The valorisation of co-products (CO_2, heat) makes a significant contribution to overall asset profitability.

- Profitability could be further enhanced in the future, for instance if captured and utilised CO_2 becomes monetised through carbon-credit mechanisms.
- The use of green or low-carbon hydrogen as an energy-storage vector and local electricity-flexibility solution represents a novel and promising use case, in a context of increasing intra-day electricity price volatility.
- This use case also supports the broader challenge of electrifying port and industrial environments.

Conclusion and next steps

The work carried out identified the key success factors for the implementation of territorial Waste-to-H_2 projects and confirmed both their profitability potential and the strong interest expressed by territorial partners and prospective customers.

Continued dialogue between project developers and territorial stakeholders, particularly at the Port of Brest, will be essential to confirm the techno-economic conditions required to validate end-user interest, advance selected projects, and demonstrate these technologies under real-world conditions, in support of the development of the Waste-to-H_2 value chain.