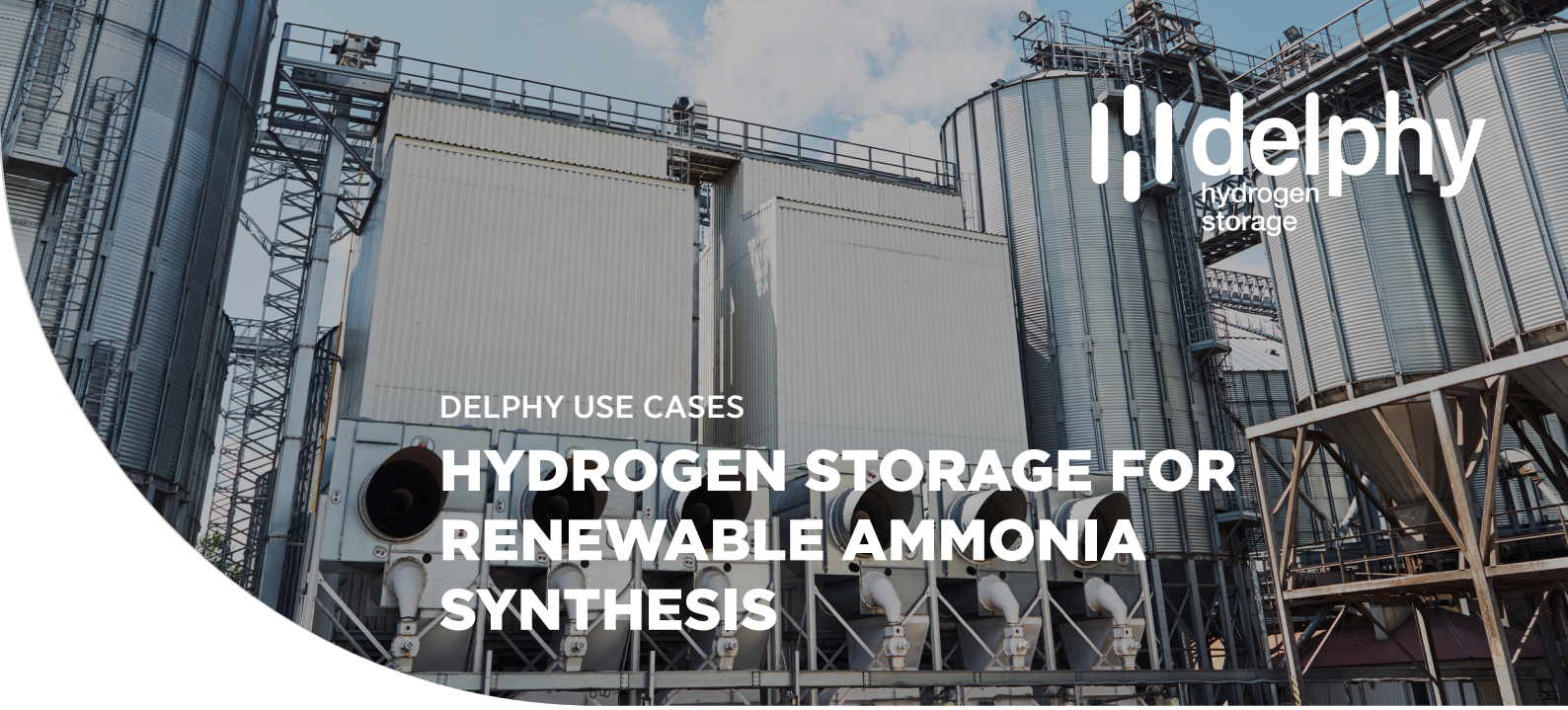

delphy hydrogen storage

DELPHY USE CASES

HYDROGEN STORAGE FOR RENEWABLE AMMONIA SYNTHESIS

Overview

Green ammonia: a game-changer for global energy

Ammonia is the world's second most-produced chemical, with about 70% used in fertilizers and the rest in chemicals, explosives, refrigeration, and emerging energy applications. Its production accounts for 1.3–1.8% of global CO_2 emissions and 2% of final energy consumption, making it a critical target for decarbonization.

Green ammonia is becoming a cornerstone of the energy transition, enabling deep decarbonization across fertilizers, chemicals, shipping, and power generation. Numerous green ammonia projects are underway worldwide, but key challenges remain.

Green ammonia is produced by synthesizing nitrogen (from air) and green hydrogen (from water electrolysis powered by renewables) via the Haber-Bosch process. This eliminates fossil feedstocks and drastically reduces lifecycle greenhouse gas emissions. Facilities range from pilot plants to gigawatt-scale industrial clusters, often located near abundant renewable resources.

Key figures

185 MTPA
ammonia production in 2020

1.3 - 1.8%
of global CO_2 emissions come from ammonia production

$310 - 610/t
projected green ammonia costs in 2050

4 - 12 hours
typical green hydrogen storage needs for large-scale green ammonia projects

15%
potential reduction of levelized cost of ammonia with the integration of Delphy

Challenges

Challenges of green ammonia production

- **Continuous production**
  The Haber-Bosch process needs a steady hydrogen supply, but green hydrogen is intermittent. Buffer storage is critical to ensure supply, requiring robust solutions for 4–12 hours.
- **Cost competitiveness**
  Green ammonia currently carries a higher production cost than its CO_2-intensive alternatives—a premium that some end-users may struggle to absorb.
- **Safety**
  Green ammonia facilities handle large volumes of hazardous chemicals, primarily hydrogen and ammonia. Applying best practices and ensuring rigorous safety measures is paramount.

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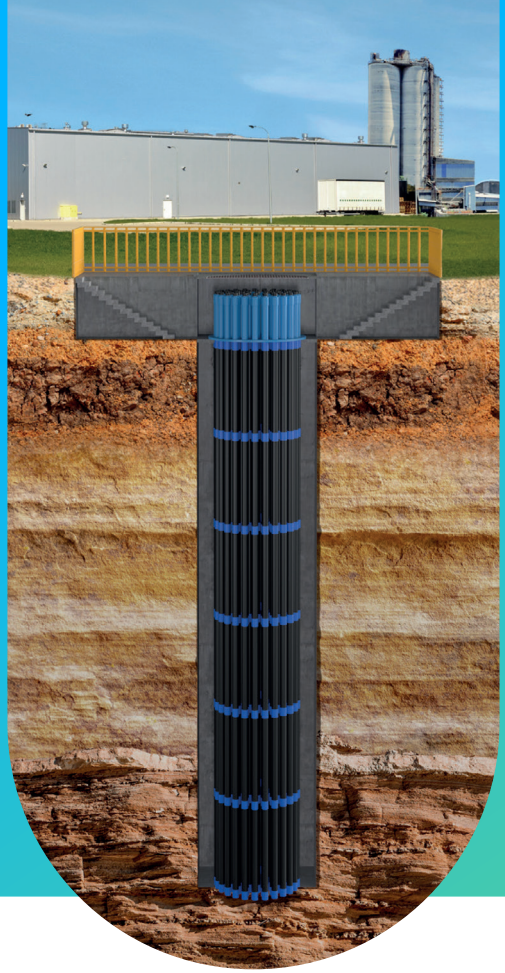

Delphy

Optimizing hydrogen storage for green ammonia

Optimal storage capacity depends on electrolyzer power and ammonia plant production patterns. For example, a green ammonia project producing 320 tons/day, supplied by a 140 MW electrolyzer (≈70 tons/day output), may require 12–35 tons of hydrogen storage for 4–12 hours of autonomy. Since ammonia loops operate at 150–250 bar, storage at similar or higher pressure is ideal.

Such capacity brings challenges—safety, space, and permitting—especially in land-constrained industrial areas. Delphy is designed for these cases:

- **Modular design:** 1–100 tons at 200–350 bar
- **Space efficiency:** up to 30x smaller footprint than above-ground storage
- **Optimized safety:** set-back distances halved vs. conventional storage

By enabling large-scale storage, Delphy secures supply, optimizes energy costs, and delivers an attractive return on investment—sometimes in as little as two years.

Real-life case study

End-to-end optimization

A comprehensive techno-economic assessment was carried out to evaluate the integration of Delphy with **NextChem**'s proprietary green ammonia synthesis technology.

Simulations showed that this integrated Power-to-X configuration enables continuous and safe operation of the ammonia synthesis facility, even when directly connected to intermittent renewable energy sources. This approach enhances operational resilience and plant uptime while **reducing the projected levelized cost of ammonia (LCOA) by up to 15%** compared to a conventional configuration.

Market ready

Following a rigorous technology qualification process with **DNV** and **Bureau Veritas**, Delphy is fully certified and ready to support customers. Delphy is delivered as a turnkey hydrogen storage solution, backed by comprehensive lifetime service offerings to ensure reliability and performance.

"The integration of the two technologies – Delphy hydrogen storage and ammonia synthesis – is an essential building block allowing green ammonia production to better cope with intermittent renewable power."

MOHAMMED NAFID, CEO OF NEXTCHEM TECH

Interested in the Delphy hydrogen storage solution?

Vallourec's team of specialists can help with:

- *Technical consultations and system sizing*
- *Custom configuration development*
- *Detailed CAPEX/OPEX analysis*

Contact us at delphy@vallourec.com

SCAN THE QR CODE TO FIND OUT MORE ABOUT DELPHY

This technical analysis examines the implementation of large-scale hydrogen storage systems for green ammonia production. While based on current industry data and research, the performance metrics and economic projections should be considered indicative. Specific project implementations require detailed technical and financial evaluation. All cited information is properly referenced, with full acknowledgment of intellectual property rights.