

DELPHY USE CASES

HYDROGEN STORAGE FOR GREEN STEEL PRODUCTION

Overview

Green steel: a key lever for industrial decarbonization

Steel production is among the world's most carbon-intensive industries, accounting for approximately 7-9% of global CO₂ emissions.

Today, around 70% of steel is produced via coal-based blast furnace routes, generating roughly 2.18 tons of CO₂ per ton of steel. By contrast, hydrogen-based direct reduced iron (DRI) can cut emissions by 85-95% when powered by renewable electricity.

Driven by regulations such as the EU Emissions Trading System (ETS) and Carbon Border Adjustment Mechanism (CBAM), growing customer demand, and corporate decarbonization targets, the shift toward green steel is gaining momentum. However, scaling the technologies needed to support this transition remains a major capital investment challenge.

Key figures

7% - 9%

of global CO₂ emissions come from steel

~2.0-2.5

tCO₂/t steel (BF-BOF)

0.1 - 0.3

tCO₂/t steel (H₂-DRI)

~120 kt

H₂/year for a 2 Mt DRI plant

2 - 6 h

of storage required

Challenges

- **Cost competitiveness**

Hydrogen-based steel production remains significantly more expensive than conventional routes.

- **High capital requirements**

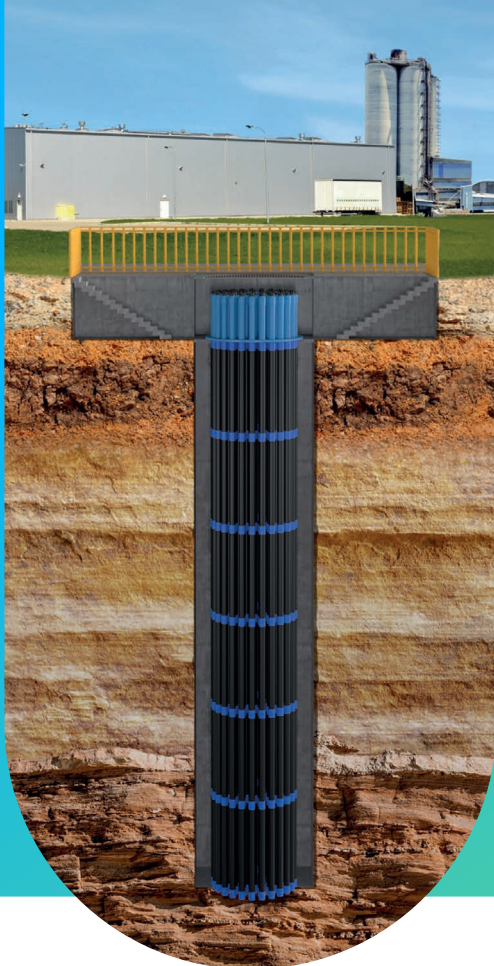
Large-scale investment is needed in electrolysis capacity, DRI plants, and supporting infrastructure.

- **Continuous operation demands**

Steelmaking requires a reliable, uninterrupted hydrogen supply to support 24/7 production.

- **Renewable energy variability**

Intermittent renewable power generation can create imbalances between hydrogen production and demand.



Delphy

Optimizing hydrogen storage for green steel

Delphy enables the decoupling of intermittent hydrogen production from the continuous demands of steelmaking.

- A 1.75 Mt/year DRI plant may require 25 to 30 tons of hydrogen storage to ensure just three hours of operational autonomy.
- At this scale, conventional high-pressure storage solutions require extensive safety setbacks, robust containment systems, and rigorous risk management measures. They also often entail large surface footprints and complex permitting processes.
- Delphy addresses these challenges with a modular, large-scale hydrogen storage solution featuring a footprint up to 30 times smaller than conventional alternatives.
- Its subsurface design enhances safety while easing integration into steelmaking environments and ensuring a reliable hydrogen supply to support continuous steel production.

Real-life case study

Bringing value to green steel projects

PROJECT DESCRIPTION:

- 1.75 Mt/year DRI production
- 700 MW electrolysis
- 24 tons H₂ storage (~3h autonomy) at 325 bar

PARAMETERS CONSIDERED:

- Electricity price variation: -4 to 128 €/MWh
- Project Life: 25 years

PAYBACK PERIOD: 3 YEARS

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.

References

- [1] World Steel Association, World Steel in Figures, 2024
- [2] BloombergNEF (BNEF) - Global Green Steel Status 2025
- [3] DNV - Energy Transition Outlook 2026 - Hydrogen Forecast
- [4] IEA, Emissions Measurement and Data Collection for a Net Zero Steel Industry, 2023
- [5] IEA, Global Hydrogen Review 2026 / Iron and Steel Technology Roadmap
- [7] OECD - Steel Outlook 2025 / Hydrogen in Steel
- [6] U.S. Department of Energy / NREL - Hydrogen Infrastructure & Storage Considerations for Iron & Steel

All figures in this business case are representative of a typical world-scale PtL (Power-to-Liquid) SAF plant. Annual savings and payback calculations are based on conservative assumptions for grid arbitrage, outage avoidance and peak sales, as modeled in real projects. Our team can support you in assessing optimal storage level and associated value.

“Hydrogen-based steelmaking requires a hydrogen system capable of delivering reliable supply 24 hours a day. Buffer storage is therefore critical to secure DRI uptime and make green steel projects operationally robust.”

EUROPEAN GREEN STEEL PROJECT DEVELOPER



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
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