



Case Study

Delivering 100 MW of Green Hydrogen at Industrial Scale

Galp Sines Refinery | Portugal

Project Snapshot

Customer: Galp

Technology Provider: Plug Power

Location: Sines Refinery, Portugal

Industry: Downstream refining and low-carbon fuels

Capacity: 100 MW PEM electrolysis

Configuration: Ten Plug Power GenEco™ 10 MW electrolyzer modules

Current Status: Installation complete; commissioning underway

Expected Start of Operations: Second half of 2026

Annual Hydrogen Output: Up to 15,000 tonnes

Hydrogen Impact: Expected to replace up to 20% of the refinery's current hydrogen demand

Emissions Reduction: Approximately 110,000 tonnes of CO₂e annually (Scope 1 and 2)

Investment Context: Part of Galp's €650 million low-carbon fuels investment program

Industrial Hydrogen Enters a New Era

Hydrogen has powered refineries for decades, but until now, nearly all of that hydrogen has been produced from fossil fuels.

Today, the refining industry is reaching a pivotal moment. As governments, customers, and investors accelerate efforts to reduce industrial emissions, refiners are seeking ways to decarbonize existing operations without compromising reliability, throughput, or competitiveness.

At Galp's Sines Refinery in Portugal, Plug Power is helping demonstrate what this transition looks like in practice. The 100 MW GenEco™ electrolyzer system represents one of Europe's largest industrial green hydrogen projects and serves as a blueprint for integrating renewable hydrogen into active refinery operations at commercial scale. More than an equipment installation, Sines demonstrates how modular electrolyzer technology can accelerate industrial decarbonization while strengthening energy security, supporting domestic fuel production, and enabling the next generation of low-carbon manufacturing.

The Challenge

Galp set out to decarbonize core refinery operations while maintaining the performance, reliability, and production levels expected from one of Europe's major energy facilities.

Hydrogen is not a future fuel at Sines. It is a critical raw material used every day for hydroprocessing and desulfurization, processes essential to producing cleaner transportation fuels. Replacing conventional grey hydrogen with renewable hydrogen required introducing entirely new production infrastructure into an operating refinery without disrupting day-to-day operations.

This challenge extends well beyond a single project.

Refining remains one of the world's largest consumers of hydrogen, yet the overwhelming majority is still produced through carbon-intensive steam methane reforming. As industrial sectors work toward lower emissions, they require hydrogen systems capable of operating continuously, integrating with existing infrastructure, and scaling to meet commercial production demands.

Galp's objective was to replace a meaningful portion of its existing grey hydrogen with renewable hydrogen produced on site while creating a scalable model for future industrial decarbonization.

Achieving that vision required more than delivering electrolyzers. It demanded a partner capable of executing across manufacturing, global logistics, installation, and commissioning inside one of Europe's most complex industrial environments.

The Solution and Execution

Plug Power supplied the project with its GenEco™ PEM electrolyzer platform, delivering ten standardized 10 MW modules engineered for repeatable deployment at industrial scale. Together, the modules form a fully integrated 100 MW green hydrogen production system designed to operate seamlessly within Galp's existing refinery infrastructure. Each GenEco™ module, weighing approximately 42 tonnes, was manufactured in Plug's electrolyzer manufacturing facility in the United Arab Emirates before being transported by sea to Portugal. The project showcased Plug's vertically integrated manufacturing capabilities and global supply chain, enabling large-scale equipment delivery across multiple continents.

Once on site, the project shifted from logistics to disciplined execution.

Installation followed a standardized methodology designed to maximize efficiency, consistency, and safety. Using a guided rail system inside the electrolyzer building, each module was positioned precisely on its foundation before mechanical and electrical integration.

As installation teams refined procedures and standardized workflows, deployment became increasingly efficient.

Project highlights included:

- Rail system setup completed in approximately one day
- Final placement of each 10 MW electrolyzer completed in approximately 15 to 20 minutes
- All ten electrolyzer modules successfully installed without incident

On January 16, 2026, Plug completed installation of the tenth and final GenEco™ module, marking completion of the full 100 MW electrolyzer system. With installation complete, the project has advanced into mechanical completion and commissioning activities ahead of planned startup during the second half of 2026.

The milestone demonstrates that large-scale electrolyzer deployment can be executed efficiently and safely, even within complex, operating industrial facilities.

The Results

- 100 MW GenEco™ electrolyzer installation completed
- Ten standardized 10 MW modules successfully manufactured, shipped, and installed
- Project advanced into commissioning following completion of installation
- Up to 15,000 tonnes of renewable hydrogen expected annually
- Approximately 20% of the refinery's conventional hydrogen demand expected to transition to renewable hydrogen
- Approximately 110,000 tonnes of annual CO₂ emissions expected to be avoided
- Positioned to become one of Europe's largest operating green hydrogen production facilities upon commercial startup

Beyond these project milestones, Sines demonstrates that industrial-scale green hydrogen infrastructure can move from concept to execution inside active, mission-critical industrial operations.

Why It Matters

The Sines project represents far more than the deployment of a 100 MW electrolyzer system.

It marks an important step in the evolution of industrial hydrogen.

For years, renewable hydrogen has been viewed as a promising solution for decarbonizing hard-to-abate industries. Today, projects like Sines demonstrate that the transition is no longer theoretical. Industrial-scale green hydrogen is being integrated into existing facilities where hydrogen has long been an essential part of daily operations.

The implications extend well beyond refining.

Industries including chemicals, ammonia, sustainable aviation fuel, e-fuels, methanol, and maritime fuels all require reliable, large-scale hydrogen production to achieve their decarbonization goals. Success depends not only on electrolyzer performance, but on the ability to deploy systems quickly, integrate with existing infrastructure, and scale as demand grows.

Modular electrolyzer platforms offer a repeatable pathway for reducing deployment risk, accelerating construction schedules, and simplifying future expansion.

For Europe, projects like Sines also strengthen energy resilience by increasing domestic renewable hydrogen production, reducing dependence on imported fossil fuels, and supporting the development of regional clean energy ecosystems.

For Plug, Sines validates the company's ability to deliver more than electrolyzers. It demonstrates complete industrial execution, from manufacturing and global logistics to installation, commissioning, and long-term project support.

Setting the Standard for Industrial Hydrogen

Every emerging energy technology reaches a point where discussion shifts from possibility to execution.

For renewable hydrogen, that moment has arrived.

As governments and industry continue investing in energy security, industrial competitiveness, and lower-carbon manufacturing, hydrogen projects are growing from demonstration facilities into critical infrastructure measured in hundreds of megawatts.

Large industrial customers increasingly require partners capable of delivering standardized technology, proven manufacturing capacity, global project execution, and long-term operational support.

The Sines Refinery demonstrates how modular electrolyzer systems can reduce project complexity while enabling repeatable deployment at industrial scale. As additional projects move toward final investment decisions around the world, this model provides a blueprint for accelerating hydrogen adoption across multiple sectors and geographies.

Executive Perspective

“This installation demonstrates that large-scale green hydrogen is not just possible, it is happening today, and Plug is instrumental in making it a reality.”

Jose Luis Crespo, Chief Executive Officer, Plug Power

“With this pioneering project, Galp is closer to producing green hydrogen at industrial scale, a historic moment for European refining.”

Ronald Doesburg Executive Board Member, Industrial Activities, Galp

Looking Ahead

With installation complete and commissioning underway, the Sines project enters its next phase: bringing one of Europe's largest renewable hydrogen production facilities into commercial operation.

Once operational, the system will produce up to 15,000 tonnes of renewable hydrogen annually, replacing a significant portion of conventional refinery hydrogen while supporting the production of lower-carbon transportation fuels.

More importantly, Sines establishes a repeatable model for future industrial hydrogen projects.

As industries around the world pursue decarbonization while strengthening energy security and domestic manufacturing, projects of this scale will increasingly define how the next generation of industrial infrastructure is built.

The Galp Sines Refinery stands as proof that industrial hydrogen is no longer an emerging concept. It is becoming a commercially deployable solution that is reshaping how the world's most energy-intensive industries produce, operate, and grow.