Hydrogeninsight

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Green hydrogen economics: Why O&M deserves early-on attention

CAPEX and electricity costs dominate green hydrogen economics, but they miss a critical lever. Operations & Maintenance, though often understated, play a decisive role in plant availability, reliability, and lowering the Levelised Cost of Hydrogen (LCOH).

In green hydrogen projects today, early-stage decisions are dominated by two parameters: CAPEX and the cost of electricity. This is logical, as in the Levelised Cost of Hydrogen (LCOH) breakdown - as shown in Figure 1 - electricity constitutes the largest recurring expense, while CAPEX covers the initial investment in plant assets, including the electrolyser. OPEX accounts for only 11% of the LCOH and is often presented as a combined category covering Operations & Maintenance (O&M), insurance, and other items. However, this simplified view significantly underplays the true impact of O&M on reducing the overall cost of hydrogen.



Figure 1: Indicative LCOH breakdown for a GH2 project in a European Context. Photo: Rely.

O&M, the hidden positive influencer of LCOH

Unlike CAPEX, which is fixed at investment, O&M is not just a cost component, but is a continuous driver of plant reliability, availability, and cost control. Unplanned downtime resulting from component failures reduces hydrogen output immediately and increases LCOH. Common LCOH calculations assume fixed values for availability and efficiency, including degradation; however, these parameters are directly influenced by O&M quality and execution.

Plants operating with robust preventive and predictive maintenance achieve higher effective availability and more stable efficiency profiles than plants with fragmented or reactive maintenance. This reveals a direct relationship: better O&M leads to better availability and performance which leads to lower LCOH and thus better project economics.

Relationship of LCOH with plant availability and CAPEX

How much exactly does improving plant availability affect project economics? Rely conducted a sensitivity analysis to evaluate the impact of improving key variables upon LCOH reduction. The analysis shows that plant availability has the most impact, with a 1% increase in plant availability lowering LCOH by about 0.7%. In comparison, reducing electricity prices by 1% cuts LCOH by only 0.5%, while a 1% reduction in CAPEX brings just a 0.35% decrease, and a 1% change in bare OPEX costs (of which O&M is just one component) barely moves the needle at 0.1%.

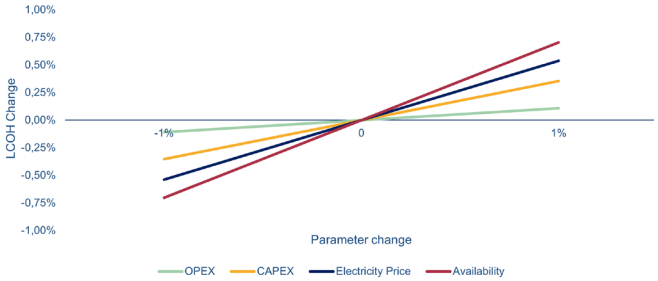

Figure 2: Comparative elasticity of LCOH with respect to OPEX, CAPEX, electricity price, and availability. For availability, elasticity is normally negative; however, the sign has been inverted here to improve readability. Photo: Rely.

Furthermore, reducing bare O&M costs can start negatively influencing availability and plant performance, thus doing more harm than good. This makes one thing clear: operations and maintenance should not be treated as just a cost component, but a strategic priority from the very start of project design and economic planning.

Benefits of system-level O&M

Green hydrogen plants are complex systems due to the integration of the electrolyser with power conversion, purification and drying units, utilities, and control systems. To manage this risk, many developers sign Long-Term Service Agreements (LTSA) for specific equipment, such as the stack and selected associated services, leaving significant portions of the balance of plant without comprehensive coverage. Minor issues can escalate into system-level failures and a maintenance contract on one part may not sufficiently cover impact on the whole system. In some cases, multiple fragmented LTSAs are pursued to fill in the gaps; however, this patchwork approach may obscure risk accountability and can be insufficient to secure system-wide reliability.

Rely's integrated O&M approach

Rely aims to address this gap by offering a comprehensive, integrated O&M offering. This approach combines OEM technology knowledge with system engineering and plant design expertise to address the entire production system, including the balance of plant. Rely brings together the deep electrolyser expertise of John Cockerill Hydrogen and the engineering and plant design capabilities of Technip Energies. This synergy builds on decades of operational excellence across complex industrial facilities, enabling solutions that are technically robust, bankable, and future-ready.

In Rely's 100 MW green hydrogen plant-as-a-product, the Clear100⁺, maintainability is integrated from design phase. As the integrator, Rely has unique knowledge on plant design and engineering studies which allows us to pre-engineer maintenance activities and spare parts lists; deploy digital tools for remote monitoring; and provide global systems-wide operational assistance. Because the Clear100⁺ is composed of scalable 20 MW blocks, the maintenance plan can also be scaled accordingly, saving time and offering better cost estimates; the clarity gained from day one is an easy win on the business plan.

Rely's service model, building out the Rely ecosystem

As a one-stop shop, Rely aims to offer products and services to support clients from end-to-end of their green hydrogen Power-to-X project. Aligned with this approach, Rely offers a first package, the Essential LTSA model: Long term Availability & Degradation Guarantees, comprising of comprehensive coverage of core equipment (electrolyser, power conversion, purification and drying units), combined with operational assistance, remote monitoring, and anomaly detection. Availability and degradation guarantees cover major site equipment, supporting bankability and financing conditions.

To further support developers and investors, Rely is also working on a full-scope solution for the longer term. This solution would strengthen Rely's ecosystem in accompanying clients from project design and conception to the end of plant life and bring value through our unique technology and engineering expertise, extended performance guarantees, and strong focus on safety and performance.

Risk mitigation opportunities

Integrated O&M contributes to risk mitigation in three principal categories:

- **Financial risk –** higher availability reduces unplanned downtime and stabilises revenue streams.
- **Technology risk –** system-level understanding enables proactive prevention of failures across the balance of plant.
- **Bankability –** contractual performance guarantees reduce perceived technology risk and can facilitate financing decisions.

Rely's O&M – securing your plant's future

O&M should be viewed as a central element of green hydrogen project economics. By embedding maintainability in design, coordinating system-level maintenance engineering, and employing digital tools for monitoring and analytics, operators can achieve higher availability and improved lifecycle performance. In an environment where electricity prices and CAPEX receive primary attention, comprehensive O&M strategies provide a decisive contribution to LCOH optimisation and long-term project success.

Contact Rely to secure your project with the Rely ecosystem.
Visit the Rely website to learn more.

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