



The Hydrogen Project Risk Assessment Toolkit

A guide to evaluate electrolyser supplier readiness, and **reduce the execution risk** of Hydrogen Projects.



The Hydrogen Project Risk Assessment Toolkit

Industrial hydrogen projects are becoming larger, more complex, and more integrated into existing industrial plants. Success depends on selecting the right technology and systematic management of technical, commercial, engineering, and execution risks. This workbook provides practical frameworks, checklists, and assessment tools developed around industry best practices to **help EPC teams make more informed decisions**.

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About Stargate Hydrogen

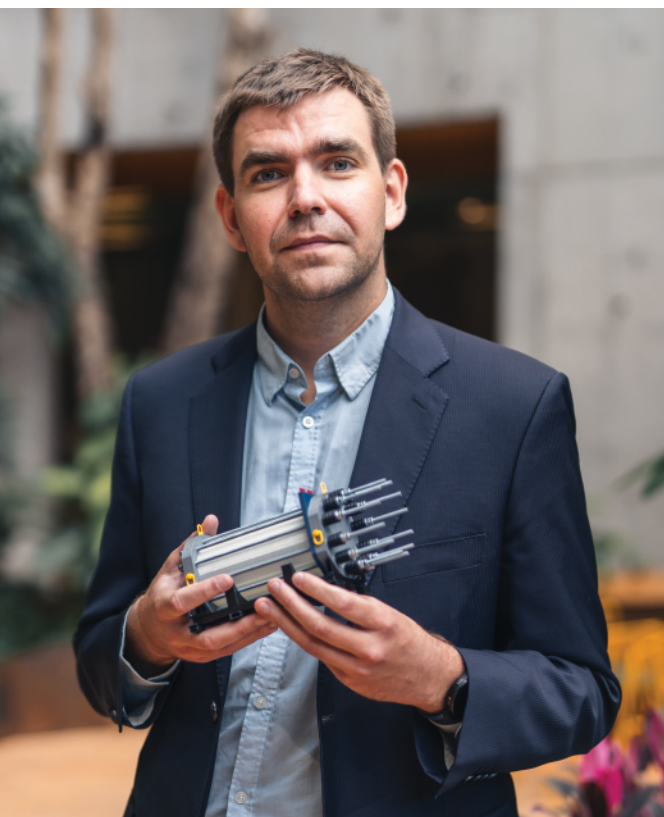
Stargate Hydrogen is a **European electrolyser technology company** developing industrial hydrogen production systems for infrastructure and energy resilience projects.

The company deploys its **alkaline electrolysers which are free from precious metals**, in energy-intensive industries, that are transitioning away from grey hydrogen, such as refining, ammonia, methanol, e-methane and steel.

With IPCEI status, the company is among a select group **backed by the European Union to deliver large-scale cross-border projects** that support innovation, sustainability, and Europe's industrial competitiveness.

Stargate Hydrogen is backed by **committed investors such as Repsol, and trusted by clients including Fortum, Utilitas, ABB, and Rockfin**, among many others across Europe, Turkey, and India.

By prioritizing robustness, transparency, and hands-on partnership, **Stargate Hydrogen eliminates technical uncertainty and enables confident electrolyser deployment** from pre-FEED through commissioning and beyond.



“Success in our industry hinges upon the careful selection of partners . Our ability to deliver **cutting-edge, efficient, and reliable technology** depends on collaborating with experts. Choosing partners who share our commitment to innovation and quality ensures seamless integration and paves the way for a **sustainable Green Hydrogen future.**”

Marko Virkebau
The CEO of Stargate Hydrogen

Why Hydrogen Projects Fail

Projects rarely fail because of a single technical issue. **They fail because dozens of small assumptions stay unresolved** until engineering, procurement, or commissioning. OEM selection is important, but many of the risks that ultimately affect project cost, schedule and performance **originate much earlier, during the Pre-FEED and FEED phases.**

Common causes failure

- Unclear status of utility availability
- Lack of supplier engineering support
- Poor commissioning preparation
- Undefined system interfaces
- Late engineering changes
- Incomplete technical documentation
- Poor coordination between suppliers
- Unclear commissioning responsibilities
- Decisions based solely on CAPEX
- Insufficient operational planning

Enabling risk mitigation

Successful projects typically share a different approach. They validate the technology selection, operating philosophy, performance guarantees, and equipment sizing, assess manufacturing capability, quality systems, engineering support, confirm procurement packages, FAT plans, logistics, installation strategy, commissioning procedures, and much more. **All in early stages, during Pre-FEED and FEED sessions.**



Hydrogen Project Risk Landscape

The majority of hydrogen project risks can be reduced by addressing these five areas before procurement begins. **Early engineering alignment between the EPC and the electrolyser supplier** is one of the most effective ways to improve project certainty and reduce execution risk.

Risk areas and its ideal mitigation approach

Risk Area	Suggested mitigation approach	Section
 Technology & Performance	Validate the technology selection, operating philosophy, performance guarantees, and equipment sizing during Pre-FEED and FEED.	Project Risk Gates, Index and Heat Maps
 Engineering & Interface Definition	Complete process design, utility balances, layouts, electrical integration, battery limits, and interface responsibilities before design freeze.	FEED Readiness Checklist
 Supplier Capability & Documents	Assess manufacturing capability, quality systems, engineering support, and the supplier's complete FEED and procurement documentation.	Supplier Evaluation Framework
 Project Execution Readiness	Confirm procurement packages, FAT plans, logistics, installation strategy, commissioning procedures, responsibilities before execution.	Risk Index & Procurement Red Flags
 Operations & Lifecycle Support	Define maintenance philosophy, spare parts strategy, operator training, and long-term support for reliable operation after handover.	Project Readiness & Support Checklist

Understanding risk categories provides a common framework for finding potential issues early. Managing these risks systematically is often more important than optimizing a single technical parameter.

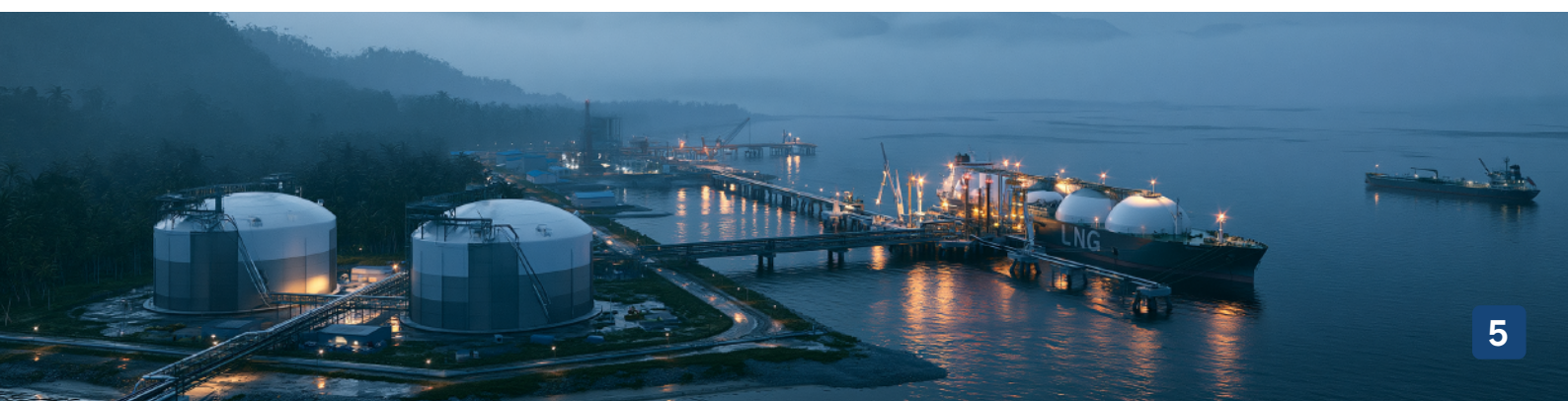
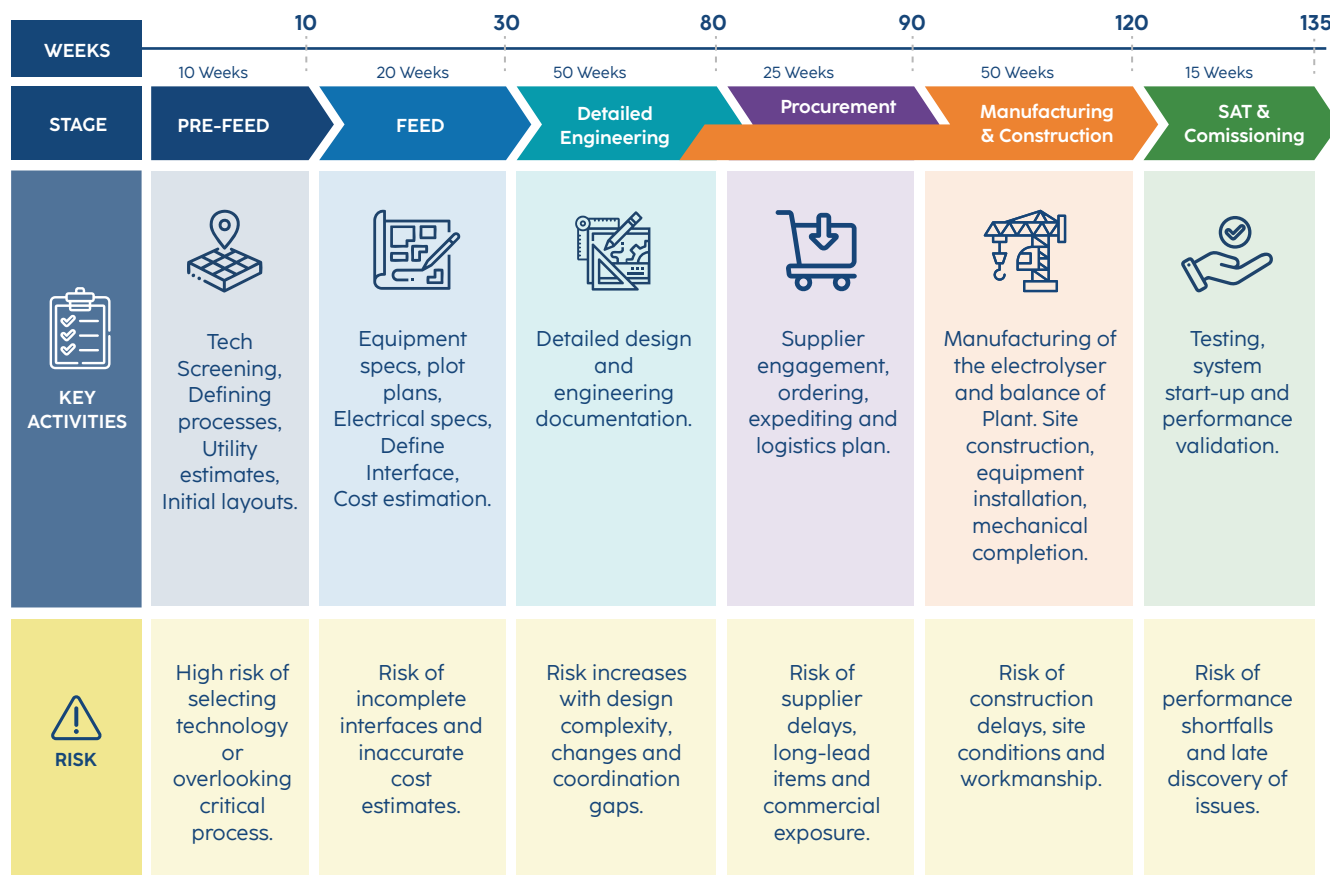


Hydrogen Project Lifecycle

Every stage of a hydrogen project introduces distinct **technical, commercial, and execution risks**. The timeline below represents an example **scenario of a 10 MW hydrogen project** and it highlights most common risks, key decisions, and recommended actions in each phase of the project lifecycle.



135 WEEKS - Hydrogen project development timeline



Hydrogen Project Risk Gates

EPC teams set up project gates where readiness is reviewed against objective evidence. Every project gate should answer: **Do we have evidence that the project is ready to move forward?**

Gate 1 Pre-FEED Complete



Evidence required:

- Hydrogen demand confirmed
- Process requirements defined
- Technology options evaluated
- Initial utility balance completed
- Operating philosophy documented
- Understand local regulations and codes.

Gate 2 FEED Complete



Evidence required:

- All key OEM selected
- Performance assumptions defined
- Plot plan reviewed
- Interfaces identified
- Initial supplier documentation received

Gate 3 Engineering Ready



Evidence required:

- P&IDs completed
- All interfaces, foundations, mechanical and construction design approved
- All Electrical diagrams approved

Gate 4 Procurement Ready



Evidence required:

- Data sheets approved
- Equipment specifications frozen
- Vendor documentation complete
- FAT strategy agreed

Gate 5 Manufacturing Ready



Evidence required:

- Electrolyser pre-assembled
- Factory Acceptance Test completed
- Electrolyser and BOP Logistics to site planned and approved

Gate 6 Construction Site Ready



Evidence required:

- Foundations complete
- Utilities available
- Health and Safety plan in place

Gate 7 Commissioning



Evidence required:

- Site Acceptance Test completed
- Trial run & Performance validation done
- Operators trained completed
- Service contract in place

Hydrogen Project Risk Index

This self-assessment is designed to help evaluate the current state of their project before further decisions are made. Evaluate each risk category and assign a score from 1 to 5, where 1 represents a high level of risk or significant concerns and 5 represents a low level of risk and strong project readiness. Once all nine categories have been assessed, add the individual scores to calculate the Total Risk Index Score.

RISK CATEGORY	WHAT IT COVERS	RISK SCORE (1 - 5)
 Technical Risk	Technology maturity, electrolyser performance, integration complexity.	
 Engineering Risk	Design completeness, general interfaces, FEED quality.	
 Supplier Risk	Supplier maturity, Financial stability, success track record.	
 Schedule Risk	Project duration, critical path, Realism of schedule.	
 Commercial Risk	Contract model, price certainty, change exposure.	
 Execution Risk	Construction complexity, available resources on site readiness.	
 Compliance Risk	Regulatory, permits, environmental, HSE requirements.	
 Operational Risk	General operability, maintenance plan, Support & training.	
 External Risk	Market, Permitting, grid, geopolitical, weather, stakeholders.	
TOTAL RISK SCORE (max. 45)		

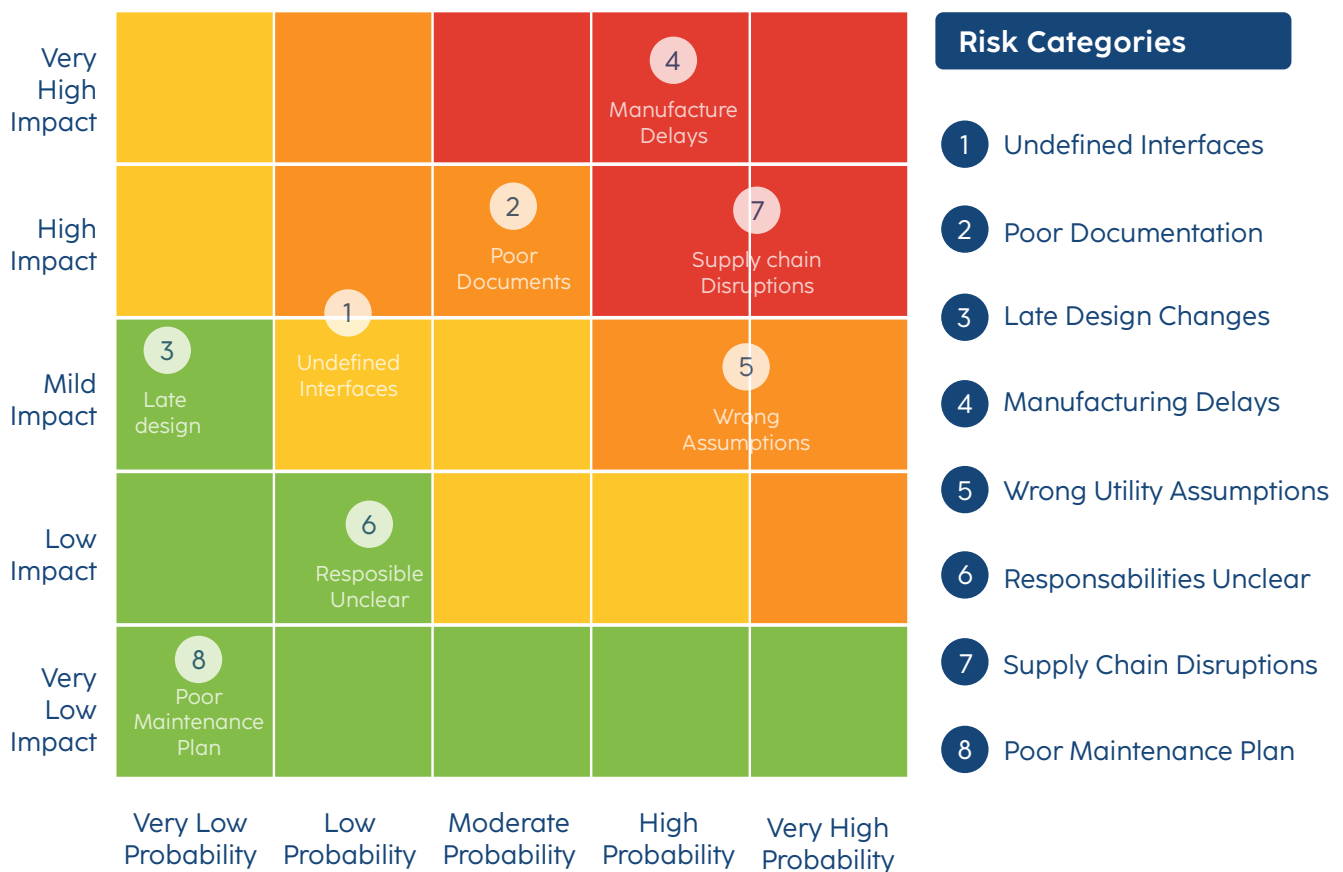
SCORE	RISK LEVEL	INTERPRETATION GUIDE
40 - 45	 Minimum Risk	Demonstrates an elevated level of technical, engineering, execution, and technology readiness. Suitable for detailed commercial negotiations.
34 - 39	 Low Risk	Strong overall capability with only minor clarifications recommended before contract award.
28 - 33	 Moderate Risk	Meets many project requirements, but several areas should be reviewed and strengthened before supplier selection.
20 - 27	 Elevated Risk	Significant technical or execution gaps require mitigation before proceeding. Additional evidence or engineering reviews recommended.
<20	 High Risk	Supplier presents substantial project risk. Selection should only proceed after major concerns have been resolved.

Hydrogen Project Risk Heat Map

The risk map below illustrates common risks encountered in hydrogen projects, indicating when they are most likely to occur and suggesting practical mitigation measures. Used as part of regular project reviews, it can **help teams allocate resources more effectively and reduce execution uncertainty** before issues escalate.

Over the heat map below you will see In white color an example of a risk placement.

5x5 Risk Matrix: Probability vs. Impact



How to use the matrix & pro tip

Divide your project's identified risks by category and place them in the matrix accordingly. Focus on risks in the red and orange zones first. Move risks toward the green zone by reducing the probability and / or impact through proactive mitigation. **High impact and high probability risks require immediate attention and structured mitigation plans.** Learn more about mitigation plans in the next chapters.

Hydrogen Project Readiness Checklist

Before committing to an electrolyser supplier choice or moving into the next project phase, it is essential to confirm that the key technical, operational, and commercial foundations are in place. **This checklist is designed as a practical review tool for teams to support internal decision-making and identify potential gaps before they become project risks.**



Process

- ☐ Hydrogen demand defined
- ☐ Operating philosophy approved
- ☐ Process simulations completed

Site

- ☐ Water infrastructure confirmed
- ☐ Electrical infrastructure confirmed
- ☐ Plot space validated

Technical Documentation

- ☐ Preliminary GA Drawings
- ☐ Utility Requirements
- ☐ Control Philosophy

Commercial

- ☐ Warranty understood
- ☐ Delivery schedule reviewed
- ☐ Payment milestones aligned

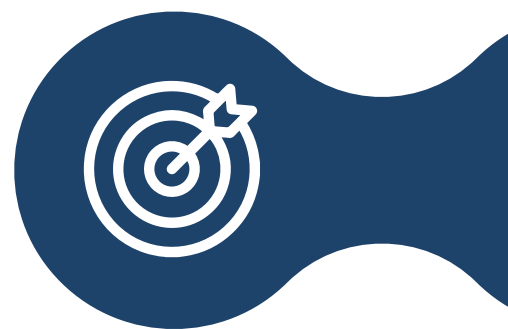
Risks

- ☐ Top project risks identified
- ☐ Mitigation owners assigned
- ☐ Contingency plans documented



Supplier Evaluation Framework

Successful project delivery also depends on factors such as engineering support, documentation quality, manufacturing capability, and lifecycle service. The framework below provides a structured approach to evaluating suppliers objectively, helping teams **compare options consistently and identify risks before they affect the project.**



Cheat Sheet: The key focus points per category

Category	Why It Matters	Questions to ask	Warning Signs
Technology Maturity	Reduces implementation risk	What commercial references exist?	Only laboratory validation
Documentation	Supports engineering	Documentation ready pre purchasing?	Documentation is delivered late
Engineering Support	Reduces design iterations	Where are products manufactured?	Limited engineering resources
Quality Management	Consistency	Which quality standards are used?	No visible production capability
Certification	Compliance	Which certifications apply?	Undefined QA process
FAT Support	Reduces on site unexpected surprises	Can EPC witness testing?	FAT scope undefined
Commissioning	Project starts producing early	Who supports commissioning?	Responsibilities unclear
Service	Long-term reliability	Spare parts strategy?	Reactive support only
Financial Stability	Long-term partnership	Can supplier support warranties?	Limited visibility



Supplier Evaluation **Essential** info

The quality of a supplier evaluation depends largely on the information available before discussions begin. Requesting key engineering, manufacturing, and lifecycle documentation in advance allows teams to **focus meetings on technical decisions, clarify potential risks, and compare suppliers on a consistent basis.**

The list below highlights the essential information that should be requested to support a productive and well-informed evaluation.

Before Your Next Supplier Meeting request these:

- Process Flow Diagram (PFD)
- Piping & Instrumentation Diagram (P&ID)
- General Arrangement (GA) Drawings
- Battery Limits (Scope of Supply)
- Utility Requirements (Power, Water, Cooling, Air)
- Equipment Datasheets
- Engineering Deliverables List
- Design Codes, Standards, and Applicable Certifications
- Factory Acceptance Test (FAT) Procedure
- Commissioning Scope and Responsibilities
- Typical Project Schedule and Lead Times
- Manufacturing Capability Overview
- Recommended Spare Parts List
- Operation & Maintenance (O&M) Philosophy
- Warranty Terms and Long-Term Service Strategy



The Supplier Comparison Scorecard

This scorecard provides a structured framework for comparing suppliers.

Evaluate each supplier against the criteria below. Assign a score from 1 to

5 for each category. Add the individual scores to calculate the Total

Supplier Score. Compare the total score with the interpretation guide.



 TECHNICAL CRITERIA	Supplier A	Supplier B	Supplier C
 Technology Maturity			
 Pre-FEED & FEED Support			
 Overall Engineering Support			
 Documentation Quality			
 Manufacturing Capability			
 Quality & Certifications			
 FAT Support			
 Commissioning support			
 Service & Spare Parts			
 Bankability			
TOTAL SCORE (max. 50)			

SCORE	RISK LEVEL	INTERPRETATION GUIDE
40>	 Minimum Risk	Demonstrates an elevated level of technical, engineering, execution, and technology readiness. Suitable for detailed commercial negotiations.
34 - 39	 Low Risk	Strong overall capability with only minor clarifications recommended before contract award.
27 - 33	 Moderate Risk	Meets many project requirements, but several areas should be reviewed and strengthened before supplier selection.
18 - 26	 Elevated Risk	Significant technical or execution gaps require mitigation before proceeding. Additional evidence or engineering reviews recommended.
18<	 High Risk	Supplier presents substantial project risk. Selection should only proceed after major concerns have been resolved.

Key Procurement **Red Flags**



Warning signs when evaluating suppliers

1

Unproven Technology

Limited operating history or lack of successful projects.



2

Poor technical Information

Inconsistent data has a direct impact on the trust factor



3

Over promise Performance

Not verified by third party & unrealistic performance data.



4

No Support Engineering

Unclear support on pre-feed stages are a bad sign.



5

Unclear Documents

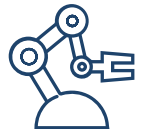
Poorly written or missing documents means re-work.



6

Manufacture Concerns

Insufficient capacity or over-reliance in subcontractors.



7

Gaps on the Quality System

No Relevant certifications such as ISO 9001, 3834.



8

Poor FAT Preparedness

Reluctancy to allow witnesses during the key procedures



9

No Support Commission

Limited experience personnel & unclear scope at any stage.



10

No Spare Part Strategy

Unclear plan for after sales support or no local crew.



11

Questionable Bancability

Recent losses, weak financial or stock price capitulation.



12

Compliance Concerns

Poor safety record, no alignment with global standards.



13

Performance Guarantees

No performance data validated by third party.



14

Excessive Assumptions

Do not build a plan on guesses instead of proven acts.



RED FLAGS?
INVESTIGATE
EARLY!

Hydrogen Project Responsibility Matrix

Without clearly defined roles, decisions can be delayed, critical tasks may be overlooked, and accountability can become unclear. The **RACI matrix** (The acronym stands for **R**esponsible, **A**ccountable, **C**onsulted, and **I**nformed.) provides a simple framework for assigning ownership, clarifying expectations, and improving coordination throughout the project lifecycle.

Description of the defined roles

- **Responsible** - Persons that carry out the activity and produces the deliverable.
- **Accountable** - Single party answerable for ensuring the activity is completed.
- **Consulted** - Parties whose knowledge is needed before decisions are made.
- **Informed** - Parties who need visibility of decisions but are not involved in the work.

The Responsibility Matrix

Activity	EPC	Electrolyser OEM	Owner
Process Design	Responsible	Consulted	Accountable
Equipment Design	Consulted	Responsible	Informed
Interface Definition	Accountable	Responsible	Consulted
Manufacturing	Informed	Responsible	Informed
FAT	Accountable	Responsible	Informed
Delivery	Consulted	Responsible	Informed
Installation	Responsible	Consulted	Informed
Commissioning	Responsible	Responsible	Accountable
Training	Consulted	Responsible	Informed
Operations Support	Informed	Responsible	Accountable





Stargate's Engineering Delivery Package

- Clear battery limits for seamless EPC integration.
- Interface definition (mechanical, electrical, controls, civil).
- Project-specific design basis and operating envelope.
- Performance curves and defined guarantees.
- PFDs, HMBs for key operating modes.
- P&IDs and operating philosophy.
- Utility requirement lists.
- General arrangement and layout data.
- Electrical integration package: SLD, auxiliaries and rectifier requirements.
- Controls integration package: I/O signals list, communication protocols.
- HSE and compliance inputs: area classification, CE/PED/ATEX requirements, HAZOP/HAZID study.
- Execution support: Schedule, FAT/SAT procedures, operating manual, spare parts & maintenance concepts.

The Stargate **de-risked** approach:



Bankable projects

- IPCEI Status (European Union Program).
- Tier-1 Investors, such as Repsol and Skeleton.
- **€52M funded to date.**



Reliable operations

- Remote monitoring & predictive maintenance.
- Full service with defined response times.
- Serviceable design for on-site maintenance.



Shared risk

- From Pre-FEED to commissioning to after-sales.
- Dedicated team during all project phases.
- Full Accountability for the OEM scope.

Supporting EPC Success

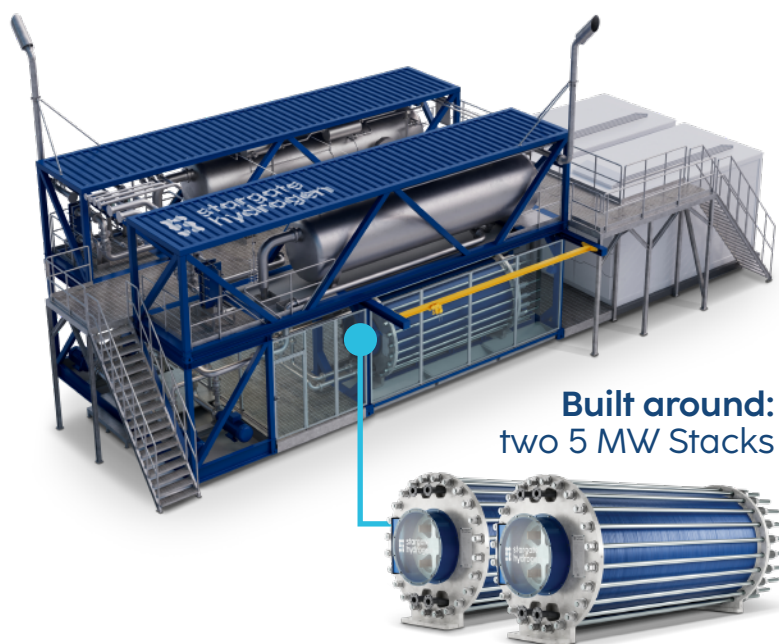
aurora
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10 MW Modular Electrolyser Systems Optimised for EPCs

 **10MW**

The Aurora Electrolyser System 10MW is Stargate Hydrogen's largest and most advanced alkaline electrolysis module built around two Starbase 5MW stacks, the system is engineered for fully outdoor-capability and high-efficiency hydrogen production in industrial-scale applications in the hard to decarbonise sectors.




Made in
Europe


Energy
resilience


Built for
industries


Validated by
third party


Trusted
by **clients**


Optimised
for **EPCs**

Final Considerations

We hope this guide has helped you to navigate this transformative industry confidently. At Stargate Hydrogen, **we understand the intricacies of green hydrogen projects**, and that is why we are the right partner to equip your company with the knowledge and necessary tools for a successful journey.

Ready to embark on the decarbonisation journey?

Contact Stargate Hydrogen today and unlock tailored solutions and expert consultations that will de-risk your hydrogen project.

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