An Investigation into Subsea Hydrogen Production

Brian Clohissey

Eiredyne | 19 November 2026

Why produce hydrogen offshore?

Onshore electrolysis

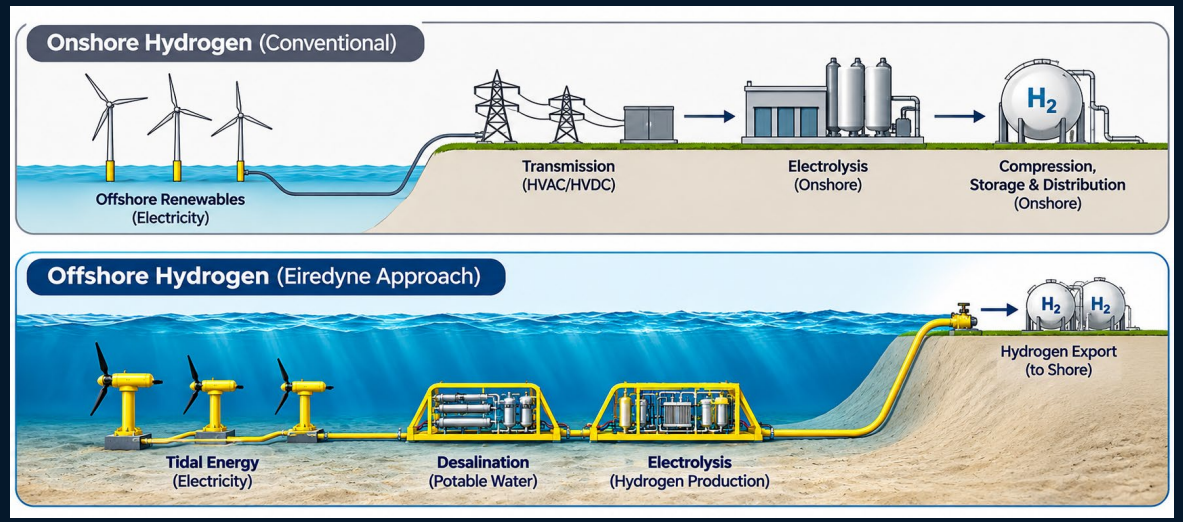
Accessible equipment; simpler maintenance.

Offshore production

Useful where power export is constrained.

Subsea production

Seabed integration; more complex intervention.



Compare delivered hydrogen cost, not feasibility alone.

The original 2014 concept

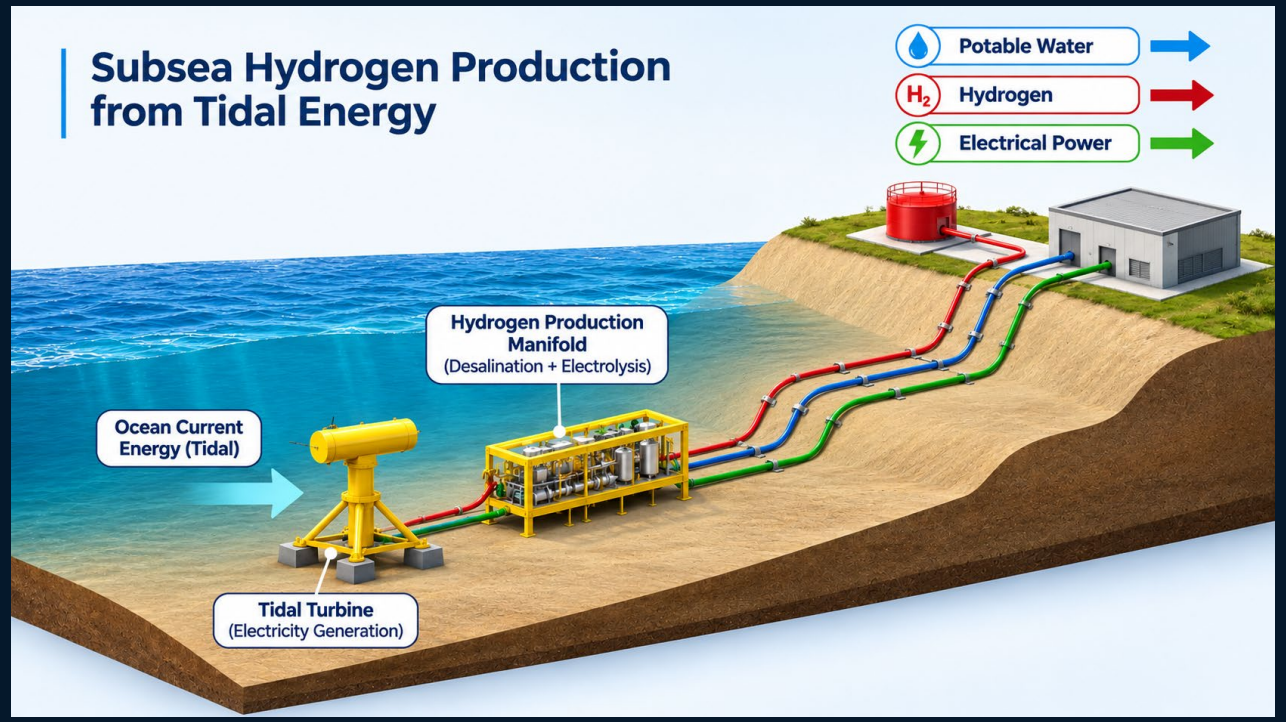
Tidal power → Water treatment → Electrolysis → Hydrogen

Subsea engineering approach

Apply established subsea installation and intervention methods.

Electrical down-rating

Assess the value of unexported electricity.



[1]

2014 concept only; no subsea plant demonstrated.

Ireland’s developing hydrogen opportunity

National Hydrogen Strategy

For industry, security and energy storage.

Renewable infrastructure

Offshore wind and integrated energy projects.

Hydrogen must justify conversion and infrastructure costs.

[2]

PosHYdon: offshore hydrogen in practice



[3]

1 MW offshore pilot

Seawater treatment and PEM electrolysis on Q13a-A.

Important distinction

Above-water installation using existing offshore infrastructure.

Would seabed integration improve overall economics?

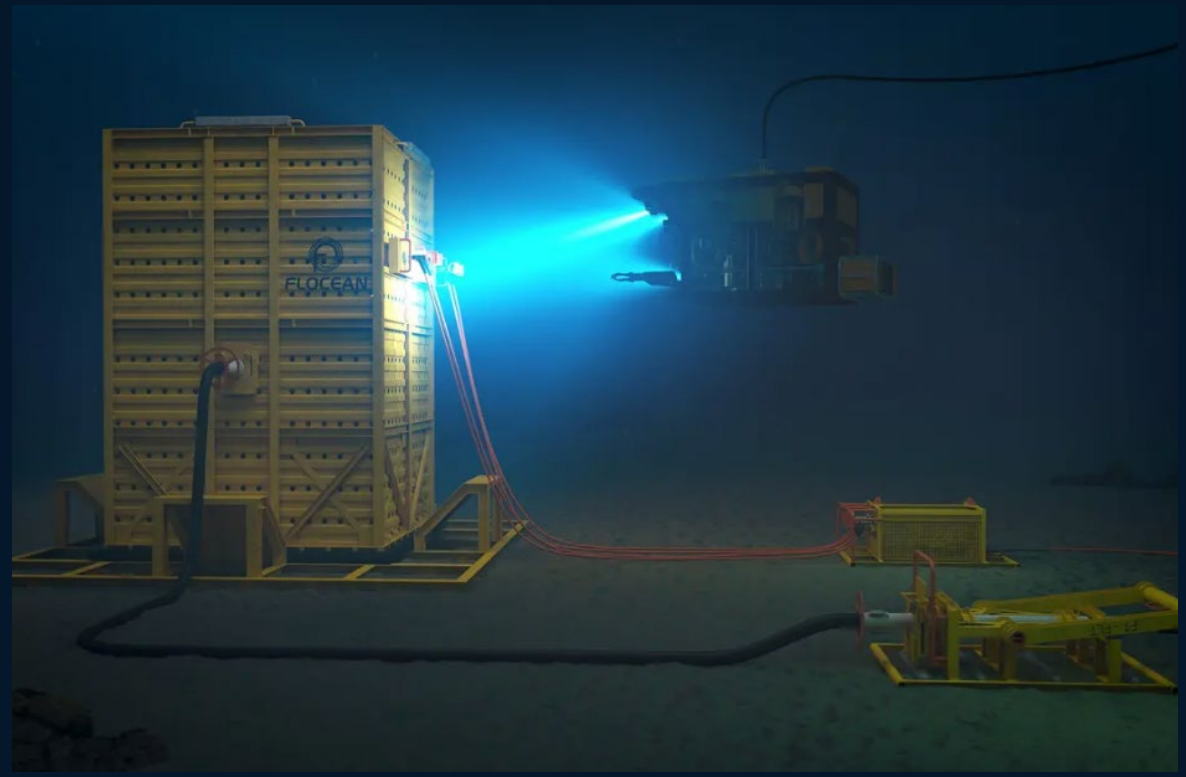
Flocean: subsea desalination

Subsea reverse osmosis

Depth-assisted reverse osmosis; Mongstad production reported in 2026.

Engineering qualifications

Assess freshwater lift, reject handling and polishing.



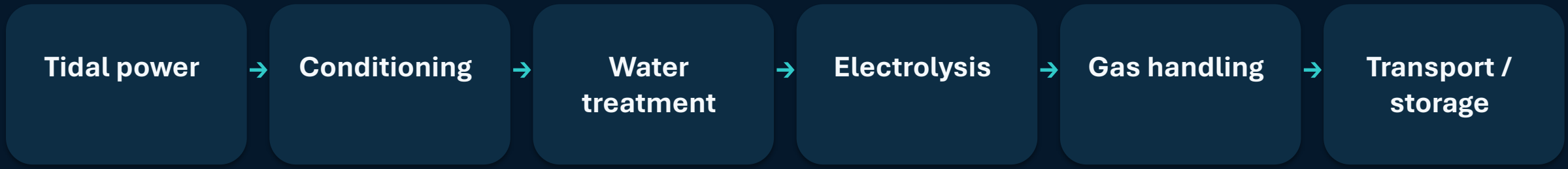
Subsea desalination does not demonstrate subsea electrolysis.

Zhang et al. (2025): subsea electrolysis merits investigation; deep-water findings are not directly transferable. [5]

[4, 5]

SYSTEM BOUNDARY

The integrated hydrogen production process



Whole-system assessment

Include water purification, conversion, compression, transport, maintenance and co-products.

Hydrogen-compatible piping and connections must be qualified for subsea service. [7]

Hydrogen storage: Ireland’s geological opportunity

Depleted gas reservoirs

Potential offshore gas storage, including Southwest Kinsale.

Salt caverns

Potential Irish Sea / Kish Basin option.

Containment, suitability and economics require assessment.

[6]

The missing link: cost of the electricity

Predictable resource

Forecastable tidal cycles can inform flexible demand.

Cost challenges

Installation, electrical infrastructure, vessels and maintenance.

Hydrogen cost depends on lifetime electricity costs.

Tidal energy: proven generation, difficult economics







References: Proteus marine renewables, Nova Innovation, Orbital

Different designs; shared challenges: cost, reliability, intervention.

Eiredyne: a different economic proposition

- Twin co-rotating, bidirectional rotors
- Fixed-pitch, direct-drive generation
- Recoverable nacelle; standardised subsea interfaces
- Maintenance designed in from the outset



Performance and cost benefits remain unvalidated.

One vessel, an entire array

Common recovery tooling

Proposed shared A-frame and Cursor recovery tooling.

Exchange, then service ashore

Replace the nacelle; service the original ashore.



Hypothesis: fewer mobilisations and shorter downtime.

Can technology expand the exploitable tidal resource?

Physical resource

Energy present in tidal flows.

Technical resource

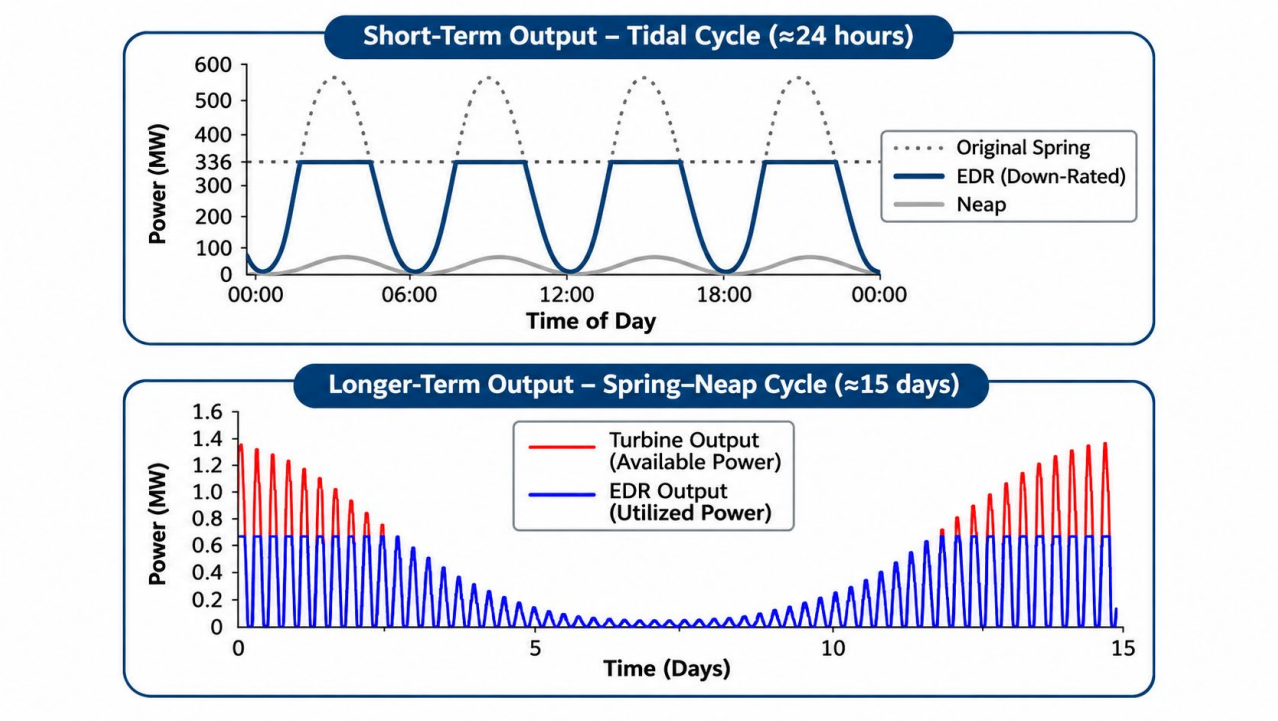
Energy capturable within engineering and environmental limits.

Economic resource

Energy deliverable at acceptable lifetime cost.

Technology influences the economically exploitable resource.

Electrical down-rating and hydrogen



Down-rating

Lower rating may reduce electrical costs but sacrifices peak capture.

Hydrogen opportunity

Electrolysis can use generated, unexported electricity not uncaptured energy.

Optimise generation, export and flexible demand together.

[14-15]

Electricity and hydrogen: one economic model

Generator

Rating and energy capture

Export

Cable and grid capacity

Electrolyser

Sizing and utilisation

Dispatch

Electricity versus hydrogen value

Occasional surplus may not justify electrolyser investment.

Toward modular subsea hydrogen infrastructure

Common subsea platform

Shared foundations, interfaces and recovery systems.

Future applications

Water treatment, electrolysis and oxygen recovery.

Pressure, gas safety, corrosion and maintainability remain challenging.



Flexible hydrogen jumpers → manifolds → collection trunks; dynamic risers require separate qualification. [7–11]

Thermoplastics experience: Connabride Plastics | H_2 permeation • end fittings • pressure cycling • fatigue

[7–11]

The question worth answering

Can recoverable offshore infrastructure improve renewable energy economics and support viable subsea hydrogen?

Opportunity to collaborate: Brian.Clohissey@Eiredyne.ie

Testing • Validation • Modelling • Collaboration

Thank you

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