

Case study: Navigate Regulatory Frameworks for Subsurface Energy Storage

Hydrogen salt caverns | Offshore environmental licensing strategy | Integration of engineering, environmental, and policy considerations | Regulatory risk assessment | Strategic recommendations

Project: Gateway Hydrogen Storage Project – Brine Discharge Licensing & Environmental Compliance

Client: dCarbonX via University of Edinburgh SCCS

Role: Independent Regulatory & Environmental Researcher

Challenge

In the current uncertain geopolitical situation, the UK increasingly requires more strategic energy storage - at present this is among the lowest, relative to need, in Europe. And the energy transition creates a demand for increased longer term energy storage, to manage the natural fluctuation in the production of renewable energy.

The Gateway hydrogen storage programme, offshore in the Irish Sea, will address this need at a much greater scale than at present - it should double the UK's existing strategic energy storage capacity. It involves the creation of salt caverns under the sea bed, which will be used to store hydrogen produced with electricity from nearby wind farms. This can then be accessed when the energy is required, buffering the gap between variable energy production and cyclical consumer demand.

Creating the salt caverns involves dissolution of deep underground salt deposits. This generates large volumes of concentrated brine requiring environmentally acceptable disposal. It is expected that this will be discharged to the sea local to the construction area. With discharge rates of up to 750 m³/hour and salt concentrations nearing saturation (250 g/l, about 8 times the receiving seawater concentration), the programme could face significant environmental scrutiny.



This commission was to identify and understand the regulatory framework around the discharge of concentrated brine to sea, to evaluate the likelihood of the existing discharge proposals - based on work carried out 12 years previously - to receive regulatory consent now, and to identify engineering solutions which might reduce the impact and improve the chances of obtaining consent.

Approach

I conducted a targeted regulatory and technical assessment to de-risk the licensing pathway for brine discharge.

- **Jurisdictional Mapping:** Mapped cavern locations against the 12 nm boundary between territorial waters and Exclusive Economic Zone (EEZ) to determine the correct licensing authority and applicable discharge standards.
- **Historical Data Validation:** Reviewed legacy FEED reports and 2013 MMO licensing decisions to assess the validity of previous dispersal modelling under current policy.
- **Comparative Benchmarking:** Conducted a high level comparison with the Islandmagee Salt Cavern Project in Northern Ireland to establish a precedent for successful brine discharge licensing in similar geological and marine contexts.
- **Hypothetical licence application system:** I progressed a simulated application through the MMO website, up to the point of submission, to help understand the nature of the licence procedure.
- **Strategic Scenario Planning:** I assessed the potential benefits of relocating caverns and / or discharge points to the offshore side of the territorial waters boundary to potentially leverage different regulatory thresholds.

Key Insights

My analysis identified gaps between the legacy project design and the current regulatory Requirements, allowing the development of a clear path forward:

- **Jurisdictional nuance:** Confirmed that while the MMO holds primary jurisdiction, the 12 nm boundary might create a potential divergence in acceptable impact standards. Repositioning discharge points to the offshore side of the boundary could offer a strategic advantage. I found that realignment of some planned cavern locations would probably be needed anyway, due to license block differences.
- **Legacy licence validity:** Determined that while the 2013 discharge model was technically sound, the 2021 Marine Management Plan introduces new criteria (e.g., cumulative effects, climate resilience) that require fresh confirmation from the MMO.
- **Precedent success:** The successful licensing of the similar Islandmagee project in 2021 provides a regulatory precedent, lowering the perceived risk of rejection for Gateway; while the two regulators are different, the near shore nature of the Islandmagee project discharge suggests that that project would be assessed against stricter environmentally standards.
- **Crown estate alignment:** Identified the need to align with the Crown Estate's new "Whole of Seabed" programme, which explicitly incorporates assessment of the impact on nature into seabed permitting - a factor not present in 2013.
- **Presumption of support:** I identified that, due to environmental and employment benefits, the project is likely to be viewed positively under the Marine Management Plan.

Impact

This provided dCarbonX with confidence around the regulatory issues and risks around their project, reducing uncertainty in planning their investment in nationally significant hydrogen infrastructure.

Key advisory input: Construction and regulatory interaction and optimisation, Licensing strategy, Technical and regulatory due diligence, Stakeholder management, Reducing uncertainty and optimising investment planning.

Consultant Profile - Dr. John M. Low

I am an independent energy transition advisor, specialising in energy transition and decarbonisation strategy and targeted research in sustainable fuel systems and projects. I am a chartered engineer, with a background spanning management, strategy and engineering positions in the utilities and subsurface petroleum industries, and a PhD investigating infrastructure issues around hydrogen, renewable fuels, and the wider energy transition.

Let's discuss how we can navigate the regulatory complexities and reduce risk in your energy transition projects.

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