

CASE STUDY

Offshore, Less is More:

Simplified Platform Design for CO² Injection



Location

North Sea

Client

Major North Sea
Operator

Product

Concept
Engineering Study

Project Overview

As carbon capture and storage continues to shift from ambition to delivery, a major global offshore operator has set out to unlock large-scale CO₂ storage in depleted gas reservoirs in the North Sea. The challenge was to create offshore infrastructure that could **enable safe, reliable injection while reducing emissions, complexity and cost.**

The result was an innovative, **minimal-facilities, and renewable-led** platform concept, designed to simplify operations and strengthen project economics. The study also validated feasibility, constructability and a clear pathway into FEED, **establishing a new benchmark** for future carbon storage developments.



Challenge

From the outset, the project demanded a departure from conventional offshore platform design. The challenge was not simply enabling CO₂ injection, but doing so through a **low-cost, low-carbon** solution that could operate reliably with **minimal weight, minimal complexity and minimal offshore intervention.**

The solution needed to:

- Operate **unmanned and remotely**, reducing offshore exposure and operating costs
- Maintain high availability and reliability with **minimal operational intervention**
- Minimise **topsides weight, complexity, and OPEX**
- **Integrate renewable power generation** offshore, with limited reliance on diesel
- Remain **constructible, transportable, and installation-ready** within offshore constraints
- Provide **safe access** arrangements, including walk-to-work capability

At concept stage, this also meant balancing robustness and safety against the need for an **ultra-lean, minimalistic design**, while ensuring the platform could form a credible foundation for future FEED development.



Our Solution

Aquaterra Energy utilised our long-standing **intelligent engineering philosophy and conventional offshore design experience**, focusing on autonomy, simplicity and low-carbon operation. The concept was engineered from the ground up to **minimise weight and complexity**, reduce offshore intervention, and embed constructability and future FEED development into the earliest design decisions.

Built for purpose: a new standard in platform architecture

The solution centres on a lightweight, jacket-based structure supporting a streamlined topside layout, designed around function and operability.

Key features include:

- **Four-legged jacket** optimised for offshore installation
- **Three-deck topside** arrangement:
 - Cellar Deck – well access and structural interface
 - Weather Deck – process equipment, filtration, metering and well control
 - Solar Deck – renewable power generation
- Capacity for **three CO² injection wells** and **one monitoring well**
- Digital instrumentation enabling **remote monitoring and control**

The layout **minimised footprint and weight** while maintaining safe access and clear constructability.



Designing out diesel through hybrid renewable power

To reduce emissions and reliance on offshore diesel, a **hybrid renewable power system** was developed and validated through power modelling.

The system comprises:

- Two wind turbines
- Solar PV arrays
- Li-ion and NiCad battery storage
- Diesel generator for backup only

With a continuous power demand of approximately 3 kW, modelling demonstrated that the platform could operate predominantly on renewable energy.

Installation-led structural design for confident offshore delivery

Structural design was driven by transport, installation and offshore execution constraints, ensuring the concept was realistic and buildable.

Key outcomes included:

- Topsides lift weight: ~350 te
- Jacket lift weight: ~1,600 te
- Total installed weight: ~1,950 te
- Compliance with environmental and vessel-impact criteria
- Installation validated using heavy-lift vessel methodology

Areas requiring further optimisation were clearly identified and carried forward into FEED planning.



Results

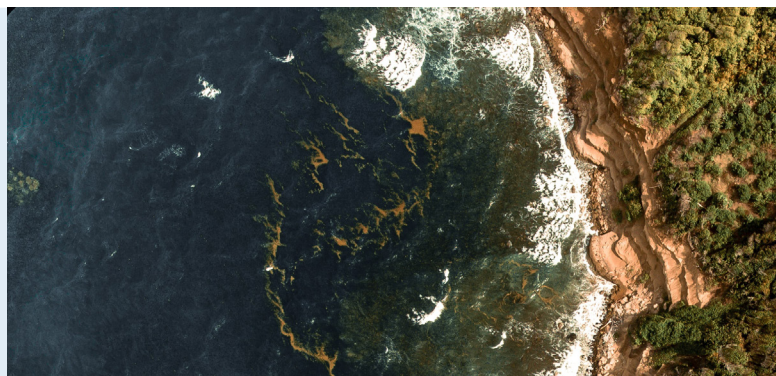
This Concept Study confirmed that a **minimal-facilities, renewable-led offshore platform can meet the safety, reliability and availability requirements of large-scale CO₂ injection.**

The study translated early ambition into a technically credible, integrated platform concept, giving our client **confidence to progress** the development.

Through cross-discipline validation of structural configuration, power demand, operability and installation methodology, the study **reduced technical uncertainty** and demonstrated that the platform **could operate reliably with minimal intervention and reduced emissions.**

Key outcomes included:

- Validation of an **integrated, minimalistic CO₂ injection platform** designed for unmanned operation
- Demonstration that **renewable-led** power generation could meet defined operational demand, significantly reducing diesel reliance
- Confirmation of **constructability and installation feasibility**, including heavy-lift vessel installation
- Reduced operational complexity, supporting **low-OPEX, low-intervention** lifecycle performance



Proving what's possible for low-carbon offshore injection

The study also established a clear pathway into FEED, defining design boundaries and **de-risking key development areas** including seismic monitoring loads, riser alignment, venting strategy and targeted structural optimisation.

Beyond the technical outcomes, the project exemplifies Aquaterra Energy's role as an **engineering partner**, not just a solution provider. By cutting through complexity at an early stage, applying intelligent, solution-led engineering, and embedding constructability and lifecycle thinking from concept onward, our dedicated team helped **reduce project risk, strengthen economics and set the project up for long-term success.**

CCS solutions, intelligently engineered

See how Aquaterra Energy's platform solutions are helping operators unlock value, reduce complexity and accelerate offshore energy developments.

