

CASE STUDY

Minimum facility, Maximum agility:

Delivering a lightweight CCS topside optimised
for integration with legacy jackets



Location

Dutch North Sea

Client

Major North Sea
Operator

Product

Concept Study

Project Overview

As carbon capture and storage (CCS) developments move from concept to execution, a major offshore operator faced the challenge of delivering new infrastructure within the constraints of existing assets.

Rather than starting from a blank sheet, the solution had to **work within an existing legacy jacket**, with fixed interfaces and strict limits on weight, footprint and centre of gravity.

Aquaterra Energy carried out a focused **Value Engineering (VE)** study, building on earlier concept work to re-think the topside around **simplicity, efficiency and operability**. By reducing power demand and stripping out **unnecessary complexity** while maintaining full structural compatibility, the study delivered a **lighter, lower-complexity** design, with a clear, de-risked pathway into FEED.



Challenge

The platform upgrade required the design of an entirely **new topside facility to be installed on an existing jacket that had already been developed to FEED level**. This imposed non-negotiable constraints, including fixed structural interfaces, limited allowable weights and strict centre-of-gravity limits.

At the same time, the project needed to:

- **Reduce topside weight** while preserving structural integrity
- **Minimise CAPEX** through simplification of systems and layouts
- Improve **operability, access and maintainability** without altering jacket geometry
- Reduce electrical demand to support a **renewable power philosophy**
- Provide a **fabrication and installation-ready** solution within brownfield constraints

The challenge was therefore not just to redesign the topside, but to **engineer out unnecessary complexity** while maintaining full compatibility with the existing asset and reducing risk ahead of FEED.

Our Solution

Aquaterra Energy approached the study by taking the earlier concept as a starting point and pushing it further, refining and maturing the design to reach **Class 3 cost estimate level while preserving its core principles of simplicity and low weight**. Rather than reinventing the solution, the focus was on intelligently evolving it to meet the specific demands of the development.

A targeted **Value Engineering** study was conducted to optimise a new topside design within the fixed geometry of the existing jacket. The layout was reconfigured to maximise functionality while **reducing weight, footprint and system complexity**.

Key measures included:

- Re-optimised equipment layout to **improve access, lifting and maintainability** within the fixed footprint
- Simplified process configuration aligned to **CO₂ injection requirements**
- Introduction of **double-block-and-bleed (DBB)** valves, reducing pipework, valve count and maintenance burden
- Rationalised mechanical and process systems to **lower overall CAPEX and complexity**

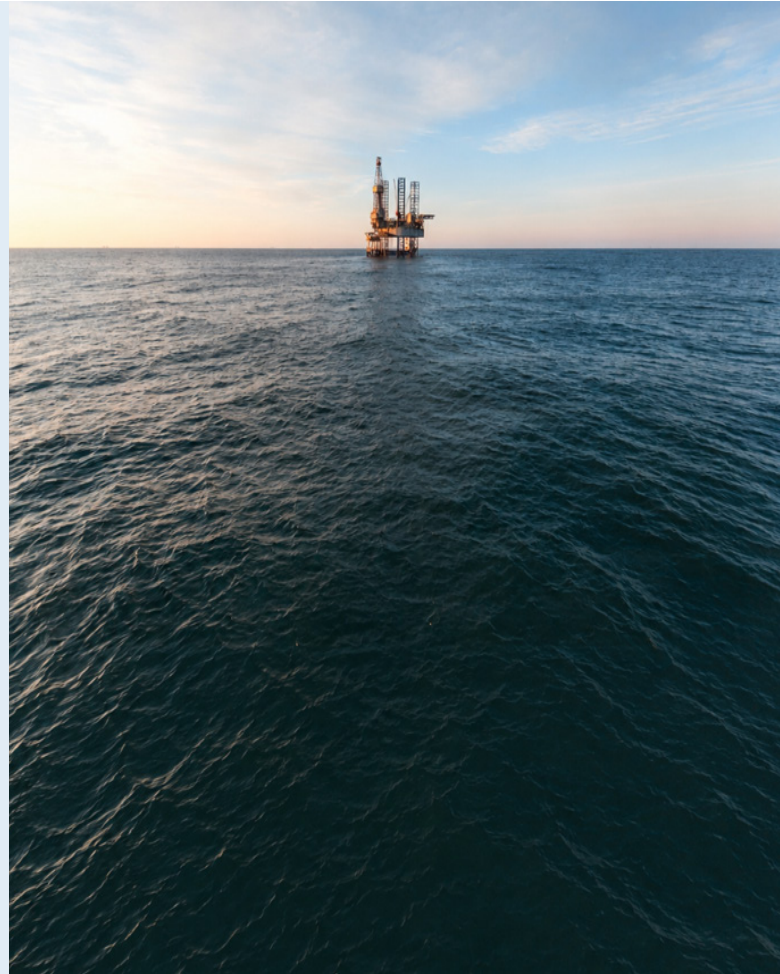
Designing within the limits of a legacy jacket

Structural design focused on ensuring the new topside could be installed on the existing jacket without modification or overloading legacy members.

Structural outcomes included:

- Alignment of primary structural framing with **existing jacket connection points**
- Removal of non-essential steelwork to **minimise weight**
- **Controlled weight and centre of gravity** within allowable limits
- Verification of lifting and in-place load cases to support **safe installation**

This approach delivered a lighter topside while preserving structural integrity and constructability.



Optimising power systems for a lower-carbon operating model

The Value Engineering phase reduced overall platform electrical demand, enabling simplification of the power system and supporting a renewable operating philosophy.

Key decisions included:

- Selection of a diesel-powered crane, **removing high electrical crane loads**
- Consolidation of electrical consumers and **reduced peak demand**
- **Downsizing of renewable generation** and energy storage systems
- Retention of **diesel generation as low-use maintenance** and emergency backup
- Installation considerations **embedded throughout design** to maintain brownfield constructability

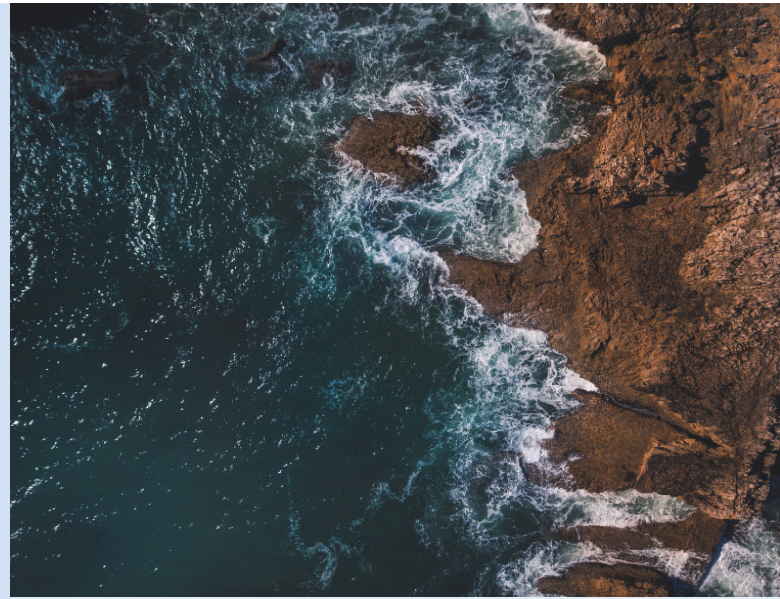
This increased level of design maturity helped provide a **clear, low-risk pathway into FEED**.

Results

The Value Engineering study confirmed that a **new, simplified topside could be safely installed** on the existing jacket without structural modification, achieving both technical and commercial objectives.

Key outcomes included:

- Topside weights **maintained within existing jacket limits**:
 - Dry lift weight: ~333 te
 - In-place dry weight: ~335 te
 - In-place wet weight: ~356 te
- Reduced electrical demand, **enabling a smaller renewable power system**
- Improved **layout, access and maintainability** within the constrained footprint
- Elimination **of the need for jacket strengthening** or modification
- A robust Class 3 cost estimate, **reducing cost and schedule uncertainty**
- A **well-defined, de-risked pathway** into FEED



A lighter, low-risk solution with measurable impact

The study demonstrated the value of **experience-led optimisation**, showing how targeted engineering interventions can **unlock significant savings while improving operability and reducing lifecycle risk**—particularly for brownfield CCS developments with legacy infrastructure constraints.

CCS solutions, intelligently engineered

Discover how we deliver efficient, lower-complexity solutions for operators' new and existing offshore CCS developments.

