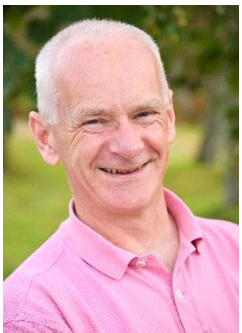


Pale Blue Dot.



Re-using offshore infrastructure – some things to consider



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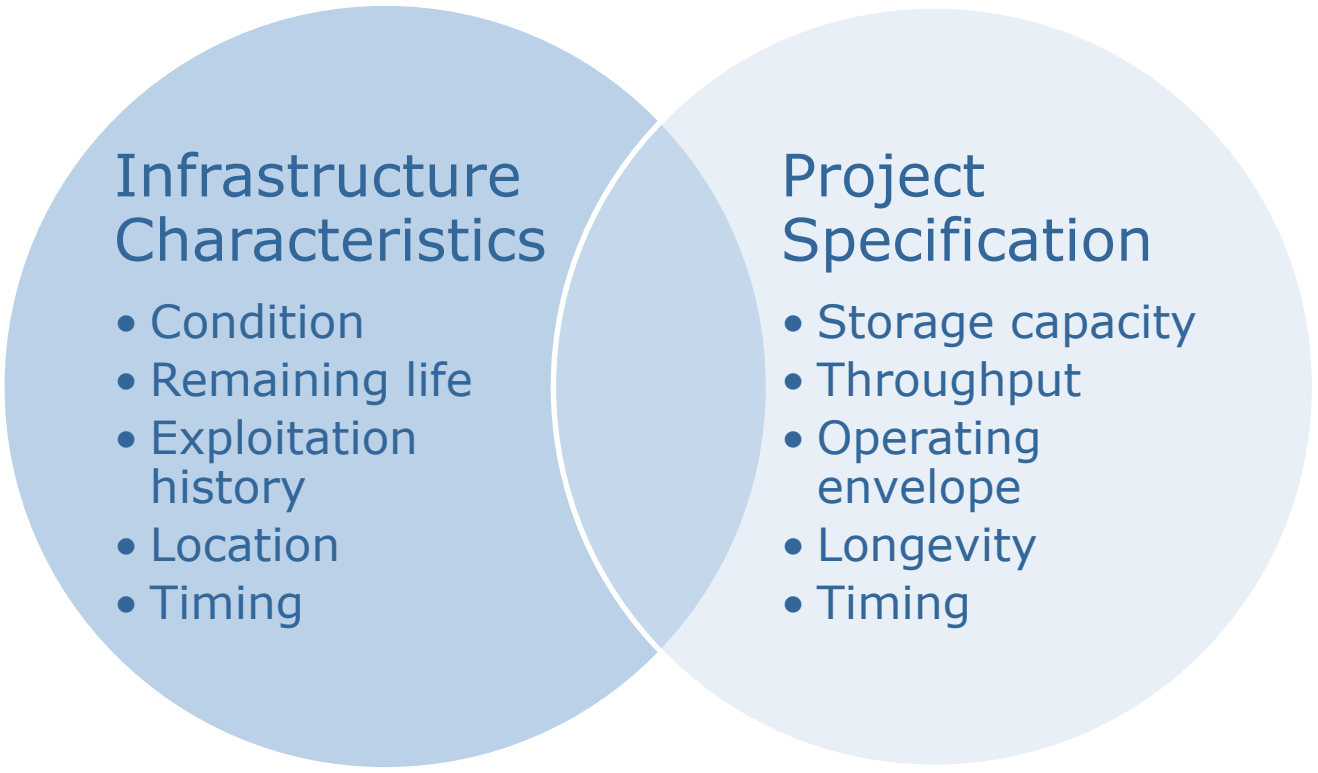
May 3rd 2018

Agenda

- Introduction
- Infrastructure
- Case study
- Insights

Introduction

The reuse opportunity



Infrastructure Characteristics

- Condition
- Remaining life
- Exploitation history
- Location
- Timing

Project Specification

- Storage capacity
- Throughput
- Operating envelope
- Longevity
- Timing

Infrastructure

CO₂ transportation and storage business “limits”



Infrastructure

CO₂ transport & storage – a functional spec

- Reservoir
 - Sufficient pore space & pressure margin to meet needs of project
 - CO₂ containment
 - Jacket & Topsides
 - Minimal facilities - receive CO₂ & distribute it to wells
 - Different operational hazards – CO₂ is denser than air
 - Pipelines
 - > 120 – 140 bar rating throughout life
 - Metallurgy
 - Wells
 - Bottom-hole location as an injection point
 - Casing design, materials and CO₂
 - Subsea Infrastructure
 - Suitability of subsea valves
 - Capability of umbilical
-

Infrastructure Platforms

- Aims
 - Safe operations
 - Reduce development and operations cost
- Implications
 - Minimal facilities - receive CO₂ & distribute it to wells
 - Different operational hazards
 - Brown-field modifications project
- Considerations
 - Structural integrity
 - Life extension requirements
 - Equipment replacement & removal
 - Suitability of wells & well bay area



Infrastructure

Pipelines

○ Aims

- Maximise throughput by transporting in dense phase
- Minimise offshore facilities by transporting above required injection pressure

○ Implications

- > 120 – 140 bar rating throughout life
- 0 – 10°C

○ Considerations

- Corrosion, particulates
- Hydrates
- Free-spans
- Remaining design life
- Throughput capacity

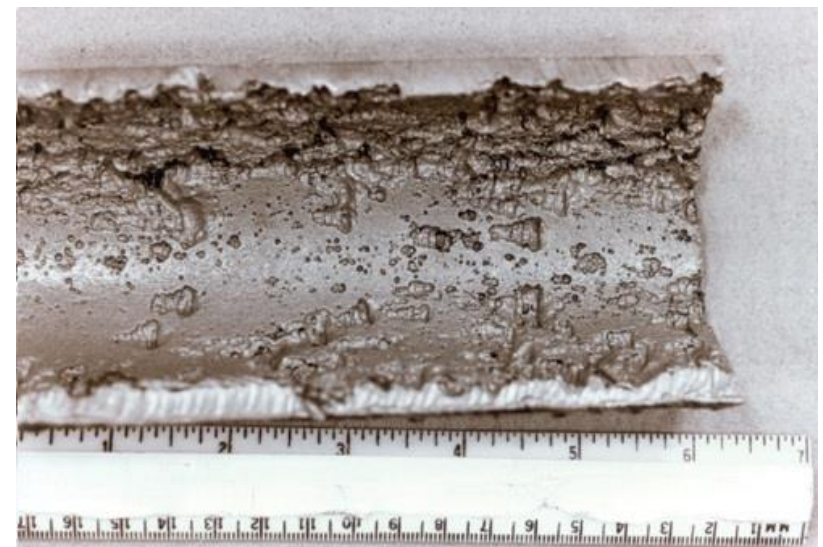
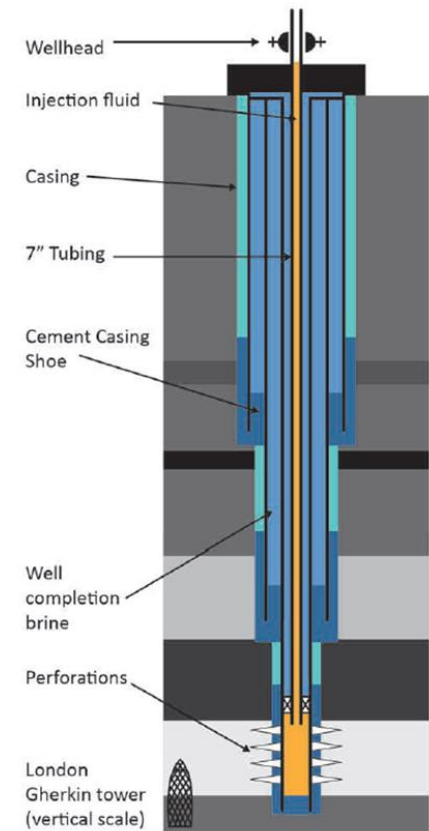


Photo courtesy Himipex Oil

Infrastructure

Wells

- Aims
 - Inject at desired rate for appropriate period
 - Not be a significant potential leakage pathway
- Implications
 - Long life required
 - Xmas tree, completion tubing and equipment unsuitable
- Considerations
 - Bottom-hole location as an injection point
 - Casing design & constraints on tubing size
 - Casing materials and CO₂
 - Integrity of cement bonds to CO₂



Infrastructure

Subsea

- Aims
 - Power, control and monitor operations
- Implications
 - Long life required
 - Xmas trees unsuitable
- Considerations
 - Design life
 - Suitability of subsea valves
 - Capability of umbilical

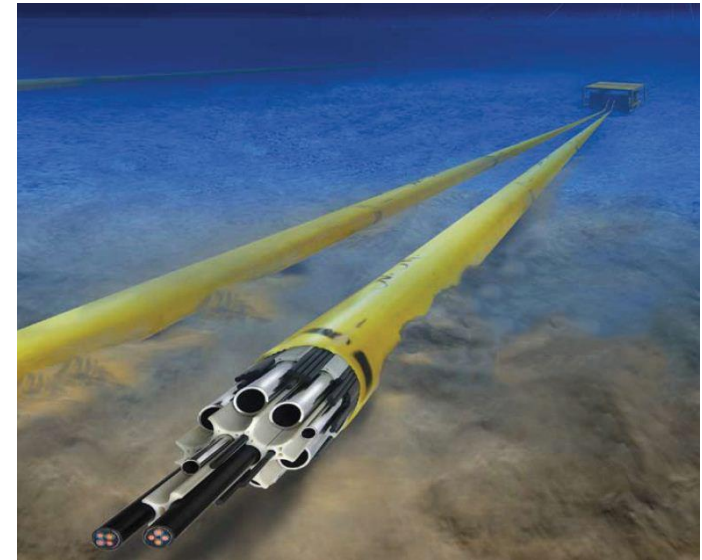


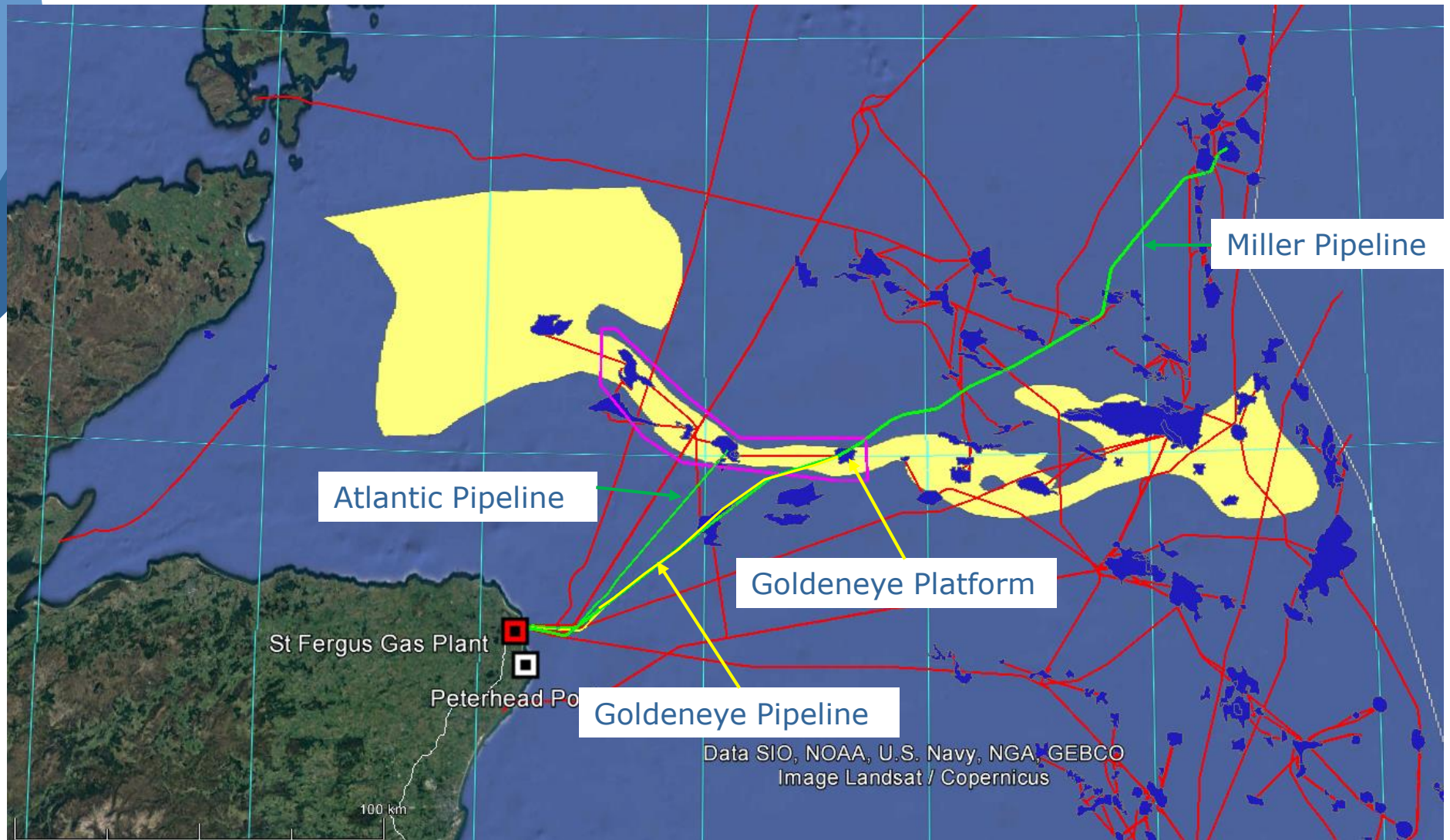
Photo courtesy Aker Solutions

Acorn Case study Overview



Acorn Case Study

Infrastructure re-use options



Acorn Case Study

Facility screening – location & required capability

○ Platform

- Located at eastern edge of storage area
 - Implications for pressure management of store
- Modifications (£61m ex wells)
 - Life extension – minor structural work
 - Capability - CO₂ filters, pipework, methanol
- Overall considered more costly
- Decommissioning cost

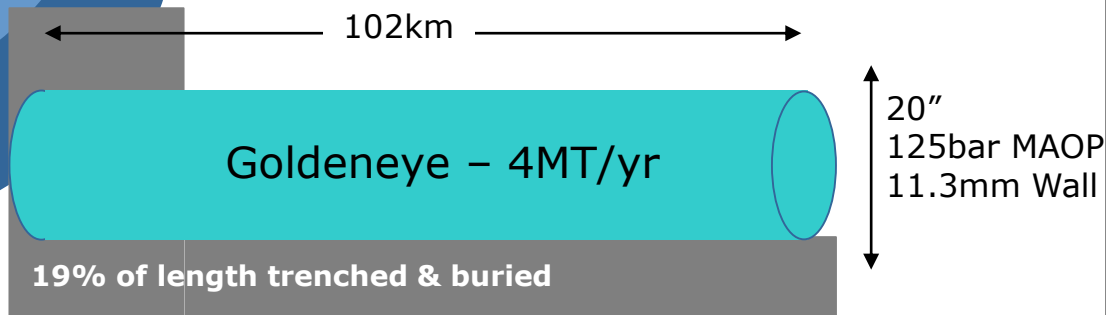
○ Subsea

- Location flexible
- Minimal facilities required – protection, control, manifold
- No filters required
- Lower decommissioning cost
- No liabilities inherited from previous hydrocarbon activity

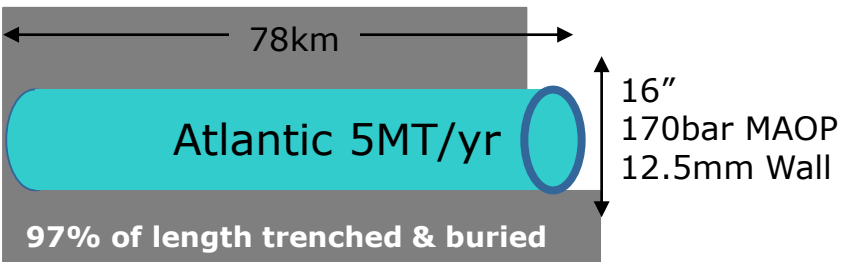
Acorn Case study

Pipeline screening of integrity & throughput

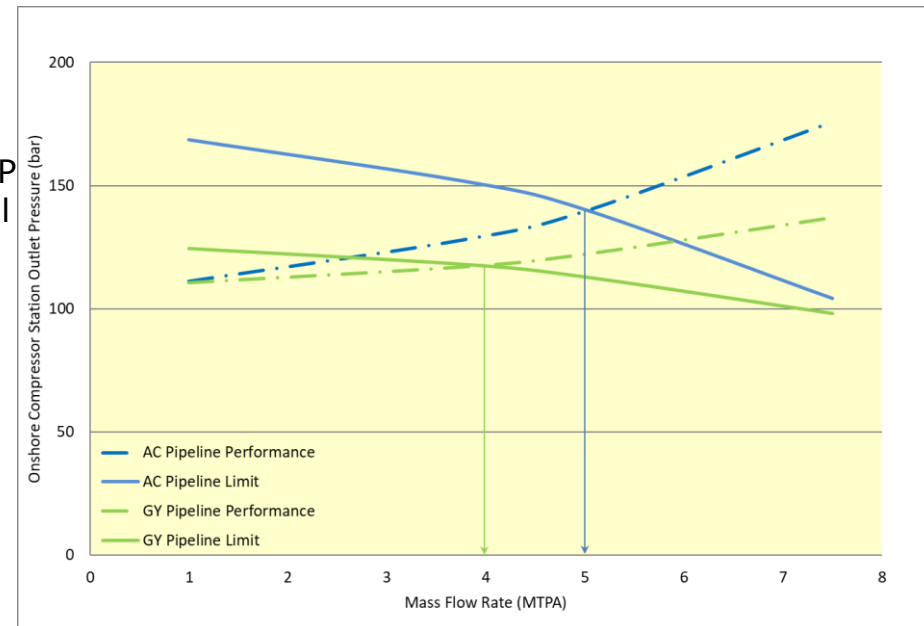
Atlantic pipeline has a thicker wall than Goldeneye, but slightly smaller diameter. This means that Atlantic operating pressure is higher and has slightly greater throughput capacity than Goldeneye due to its higher pressure rating



Laid on the seabed from 19.4 km to Goldeneye

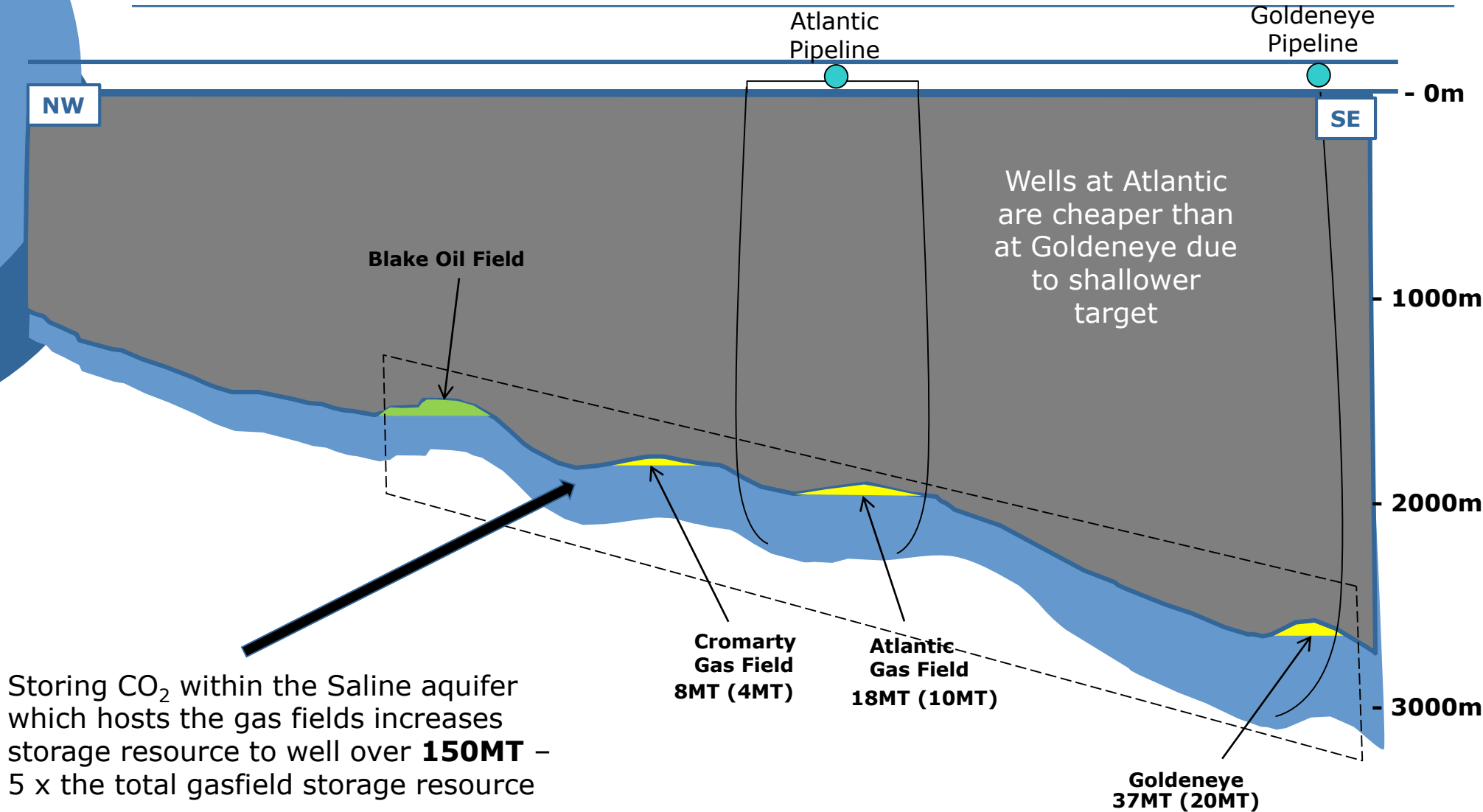


Trenched and buried apart from 2.5km near shore section at 50m manifold approach



Acorn Case study

Reservoir screening of access & capacity



Key Findings

Insights

- Re-purposing oil & gas infrastructure is suitable for some CO₂ operations
 - Involves cost and risk
- Understanding functional requirements of CO₂ transportation & storage project is key
 - Safety, longevity, location
- Pipelines are more likely to be re-used than platforms

Contact Information

- Register for ACT Acorn Webinar on 20th June 2018

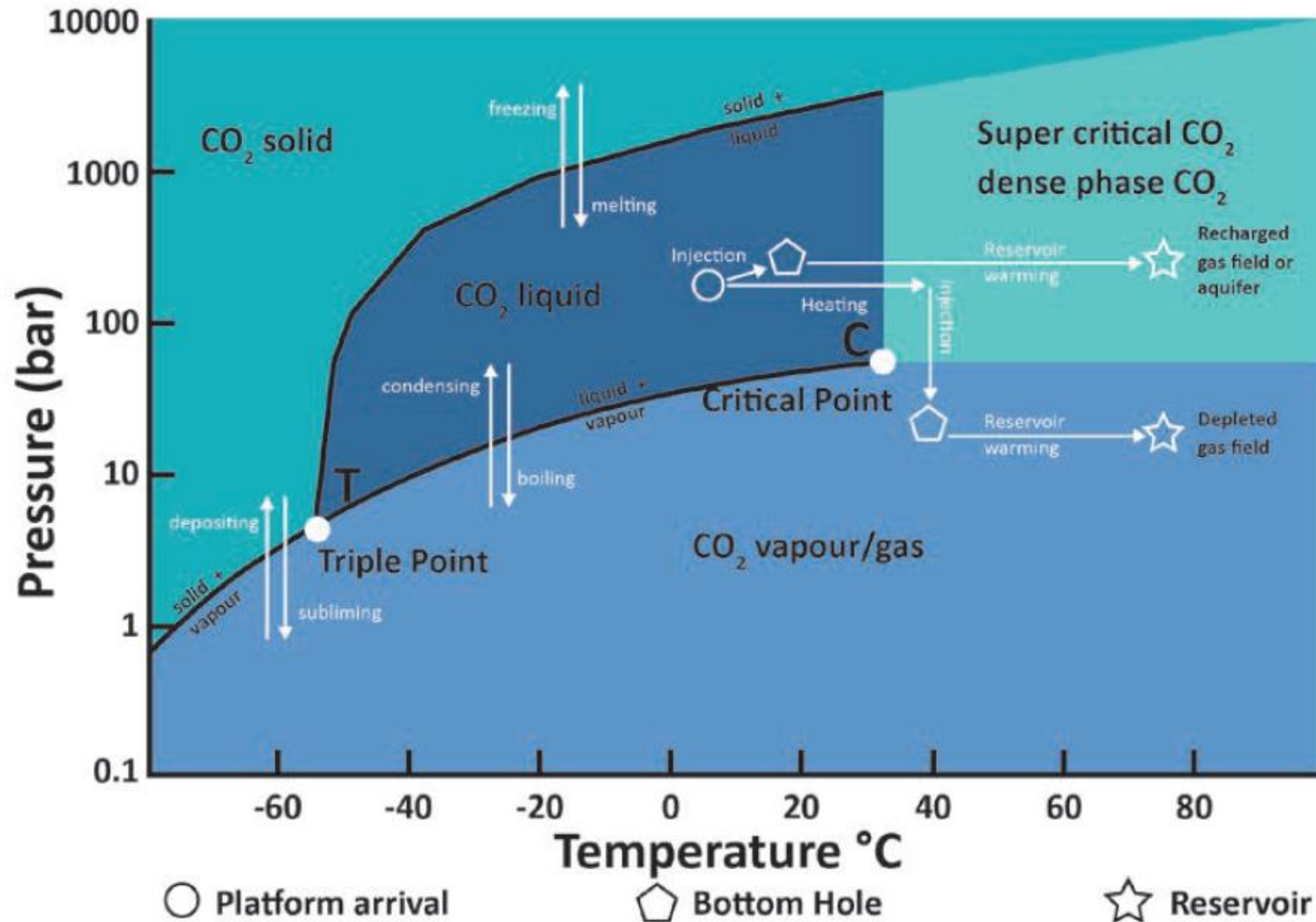
Acorn 2025: a pathway to decarbonisation, will explore the options being developed for building out from the initial stages of Acorn, in a future where hydrogen use and CO₂ utilisation gain momentum.



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Reference

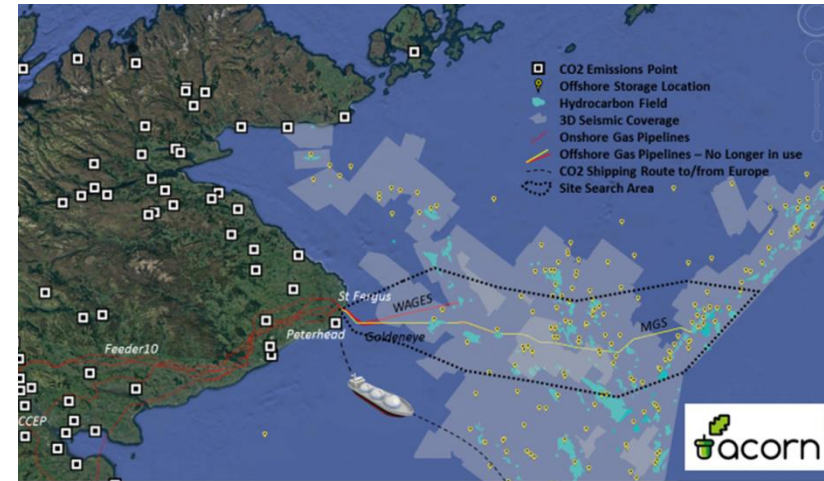
CO₂ Phase Management



Reference

ACT Acorn Programme

- St Fergus CO₂ hub design
- Twin storage site selection
- Expansion scenarios
- Full chain business case
- Novel geomech & shallow seismic supporting integrity assessment
- Storage development plan
- Lifecycle assessment including “Just Transition”



Significant coastal emissions point

Existing transport infrastructure options

Well qualified choice of storage sites

Reference Infrastructure

