Morecambe Net Zero Cluster Project & Subsurface Overview

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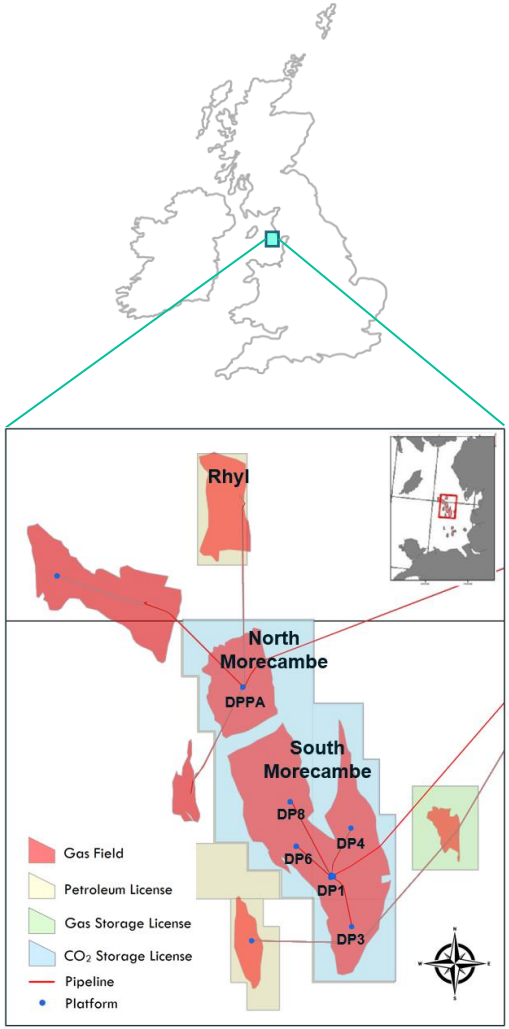
Tom Calder – Senior Reservoir Engineer

SPIRIT ENERGY

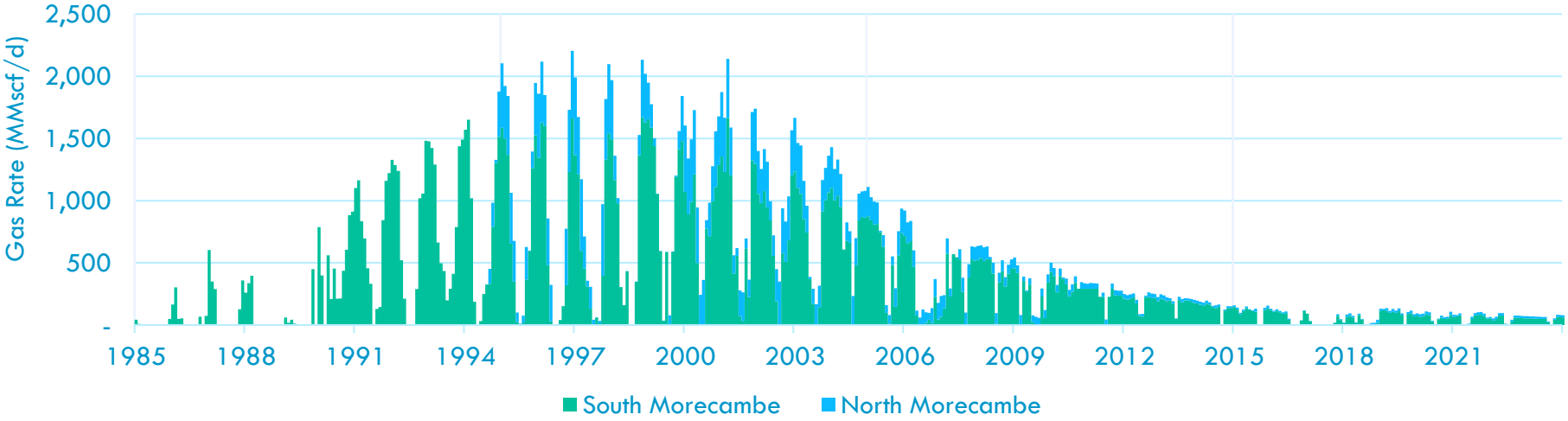
Morecambe Hub – Historical Overview

- The Morecambe Hub is a cluster of gas fields under the East Irish Sea approximately 25 km west of Barrow-in-Furness
- Gas from the offshore fields is transported by pipeline to Barrow Terminal for processing and export to the UK gas grid
- Spirit Energy holds 100% equity in the North & South Morecambe and Rhyl fields
  - South discovered in 1974, North in 1976 & Rhyl in 2009
- Third party production processed via Spirit Energy owned infrastructure
- Carbon Storage Licence CS010 awarded in 2023 UK licensing round



Morecambe Production – Facts & Figures

- South Morecambe and North Morecambe first gas achieved in 1985 and 1994 respectively
- Over 6.6 tcf of natural gas produced to date
  - 5.4 tcf from South Morecambe
  - 1.2 tcf from North Morecambe
- Highly productive wells
- Single hydrodynamic units with high connectivity between wells
- Recovery factors over 90%



MNZ Cluster

The project provides a solution for emitting industry to tackle their carbon emissions while also securing jobs across the UK that are reliant on them

Transport by pipeline, ship and rail

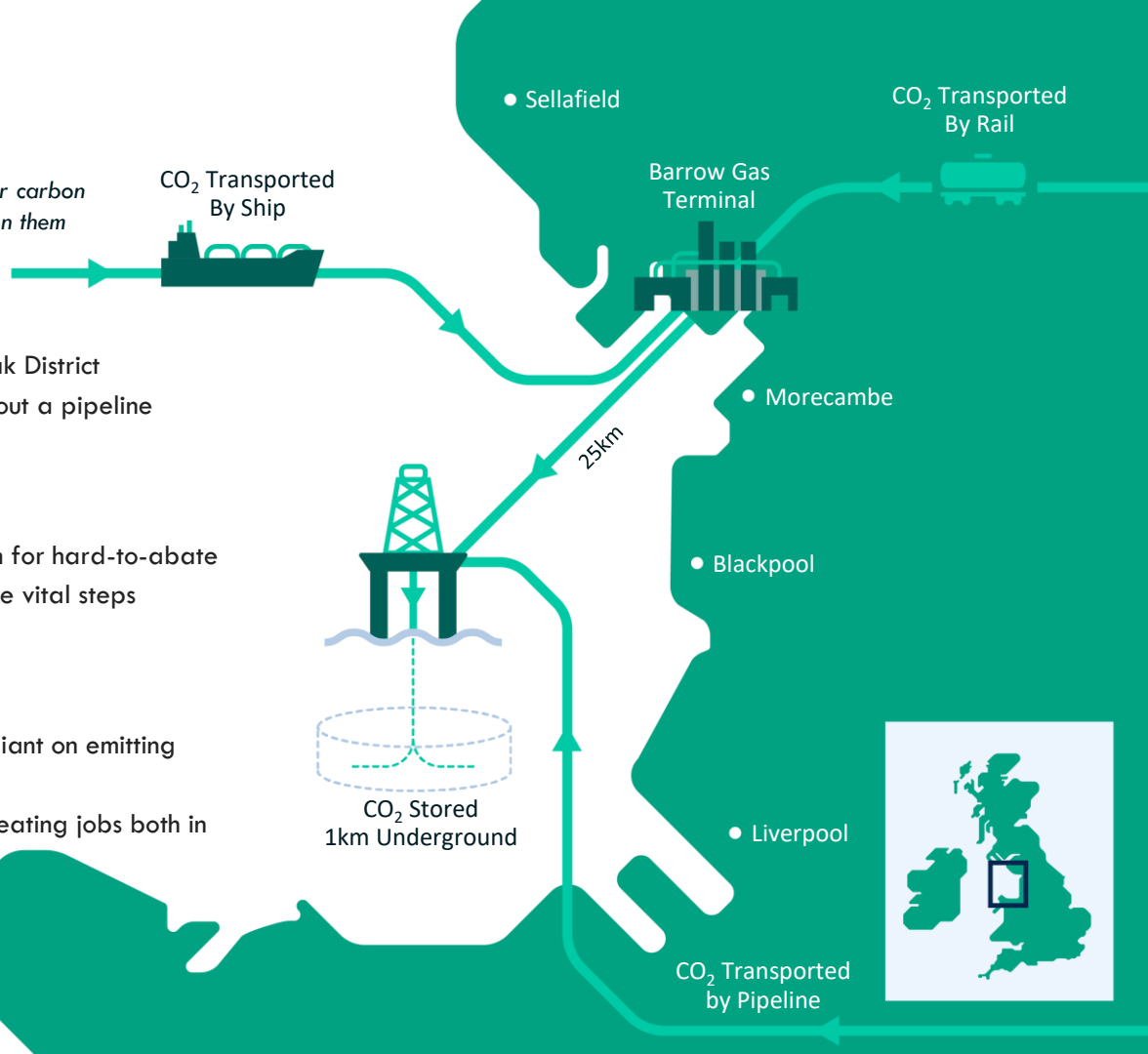
- CO2 pipeline from multiple large emitters in the Peak District
- Shipping and rail will enable stranded emitters without a pipeline connection to access carbon storage

Providing a pathway to Net Zero

- Our project provides a feasible and realistic solution for hard-to-abate industries to tackle their industrial emissions and make vital steps forward on the path to Net Zero

Supporting & creating jobs

- Thousands of jobs across the whole of the UK are reliant on emitting industries
- The project attracts investment to the North West, creating jobs both in the region and across the UK



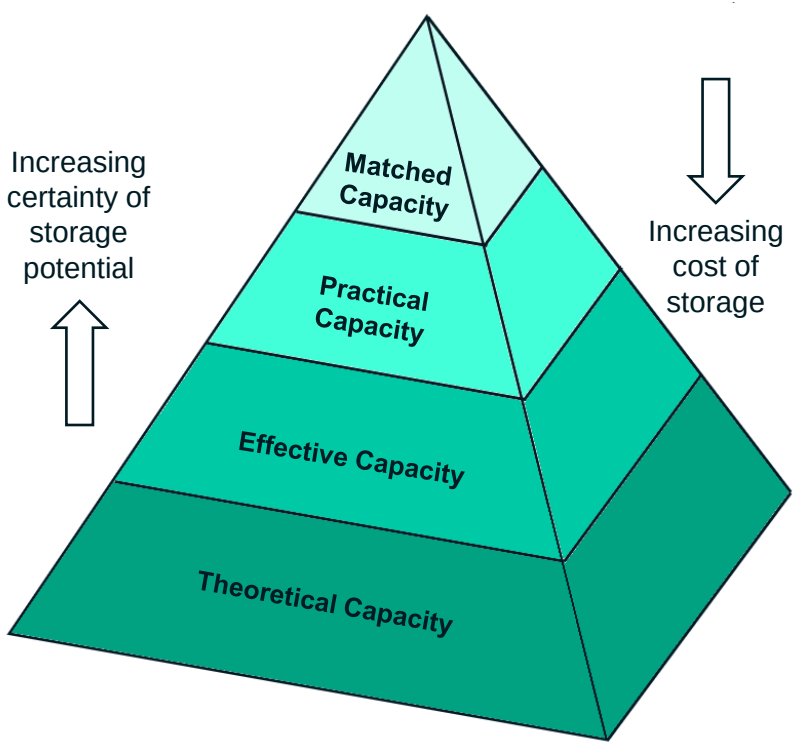
EU CCS Directive

- At a high level, CO_2 storage options need to satisfy three principle requirements[1]:
  - **Capacity** – sufficient storage volume is available, or can be engineered to be available;
  - **Integrity** – confidence that the site is secure with no significant risk of leakage;
  - **Injectivity** – suitable reservoir properties exist allowing sustained injection at industrial supply rates into the geological formations.

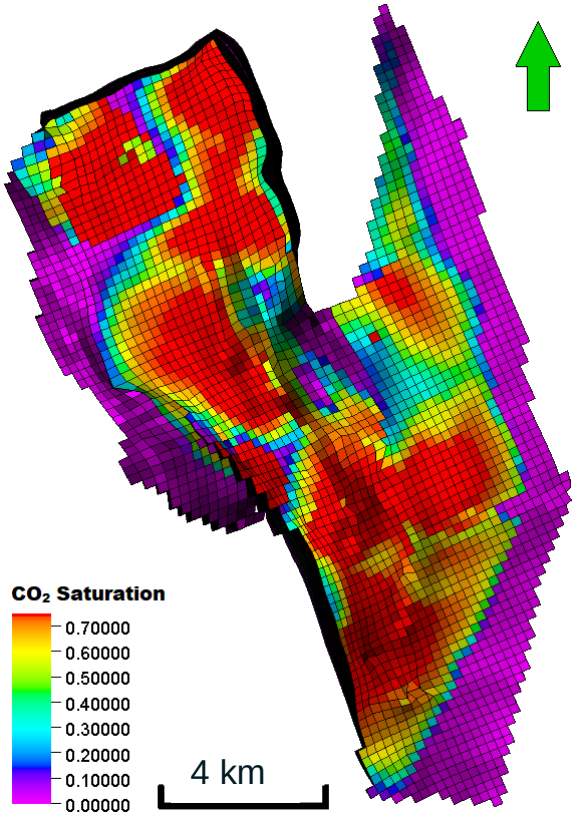
[1] Directive 2009/31/EC, Guidance Document 1

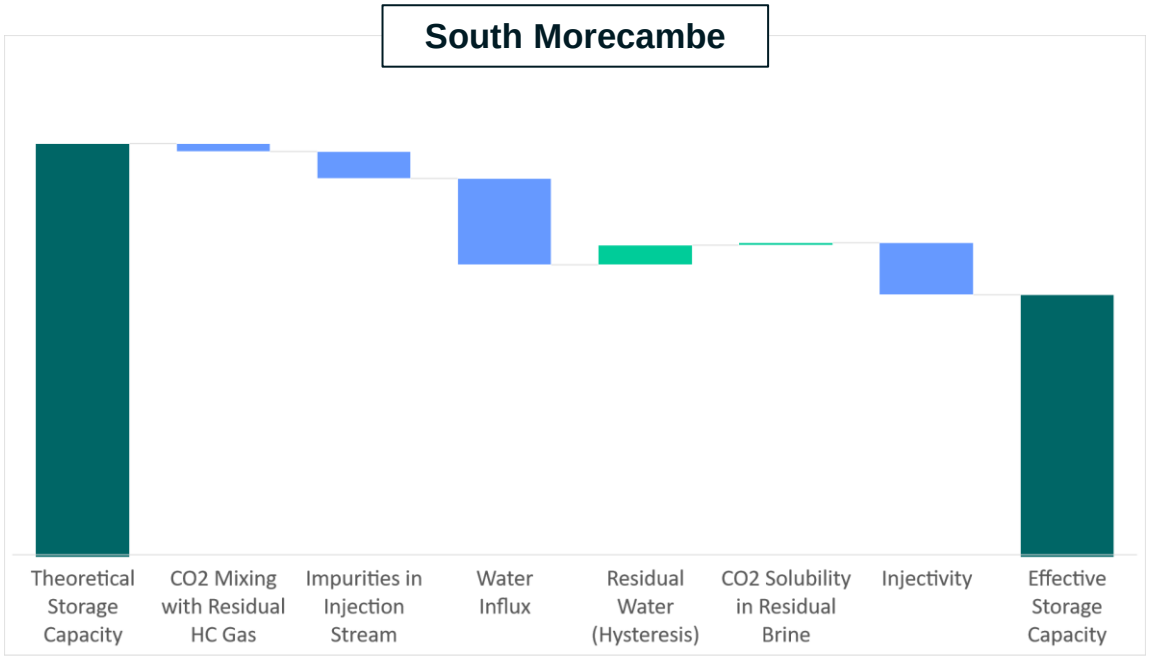
Capacity – Theoretical to Effective

- Theoretical CO_2 capacity of depleted gas reservoirs
  - Estimated using methodology proposed by Bachu et al. (2007) based on produced gas
  - Assumes depleted gas reservoir is refilled by CO_2 to initial pressure
- CO_2 storage potential of Morecambe fields:
  - South Morecambe: 851 MT
  - North Morecambe: 199 MT
  - Total: 1050 MT
- Reality is somewhat more complex!



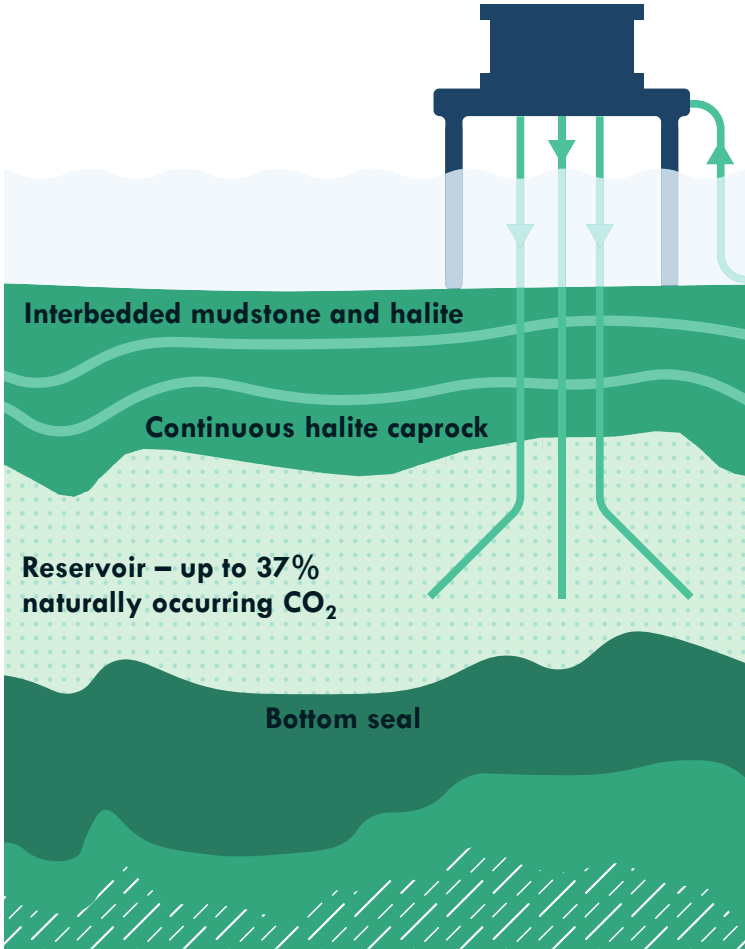
Capacity – Theoretical to Effective





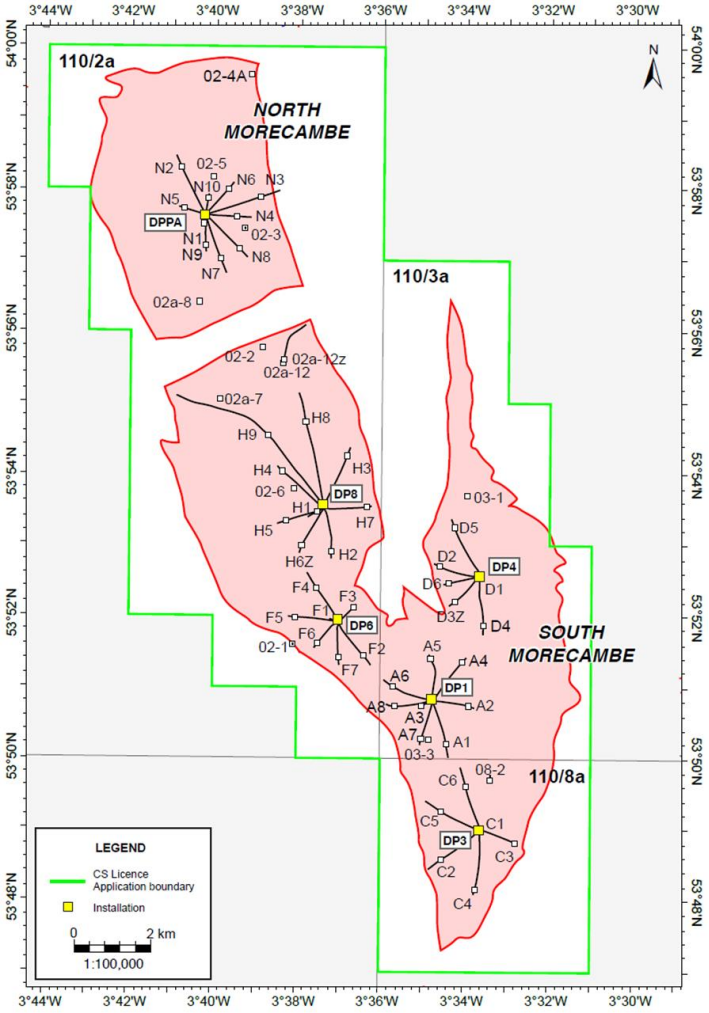
Seal Integrity

- Proven seal formed by thick sequences of halite and interbedded mudstone
- Immediate caprock is a well-defined halite sequence
  - Continuous over storage complex
  - Has supported large gas columns
- Successfully trapped hydrocarbons and naturally occurring CO_2 over geological time
  - North Morecambe – 6 mol% CO_2
  - Rhyl – 37 mol% CO_2
- Geomechanical analysis shows no reactivation of faults and top seal integrity is maintained over full pressure cycle



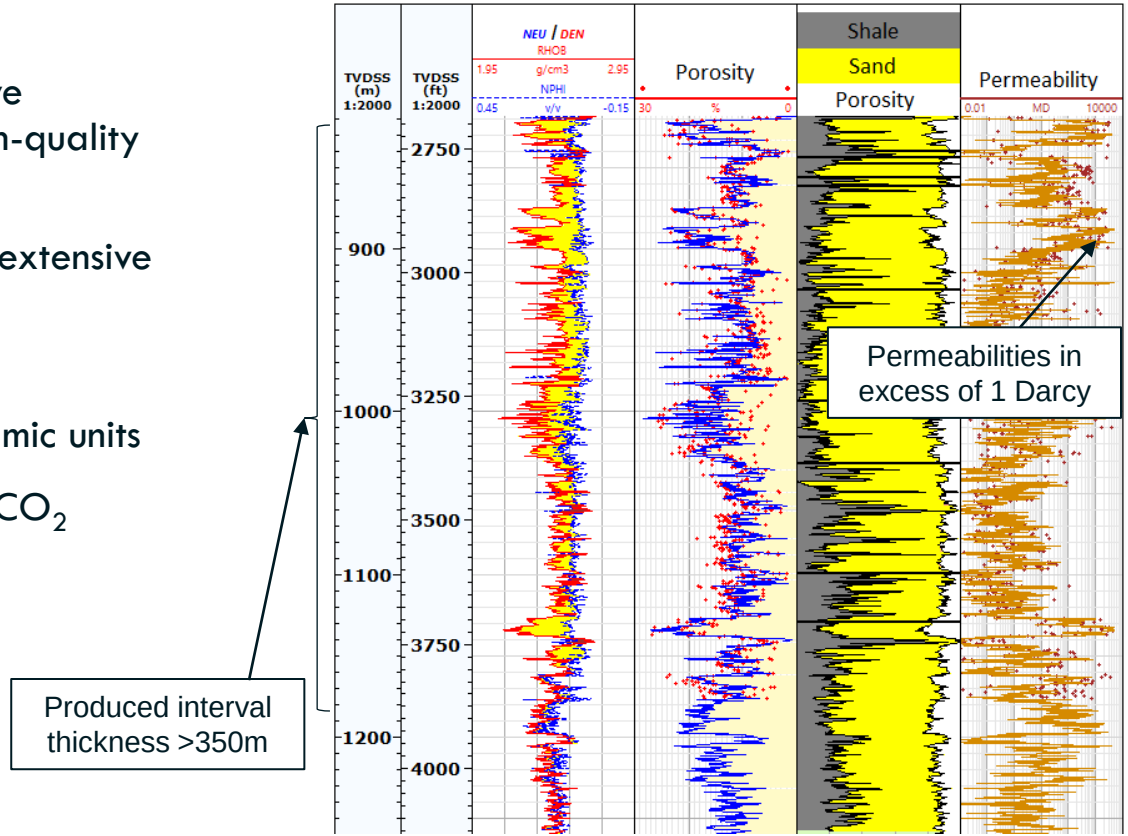
Well Integrity

- Well integrity studies completed to date support very low risk of leakage
  - Quantitative & qualitative
  - Internal & external
- Large well database over storage complex
  - Owned and operated by Spirit Energy (and predecessors) over full life of fields
- Legacy wellstock
  - 46 development wells (12 abandoned)
  - 12 exploration & appraisal wells (all abandoned)
- Further studies planned
  - Opportunity for wells to form part of CO_2 monitoring plan



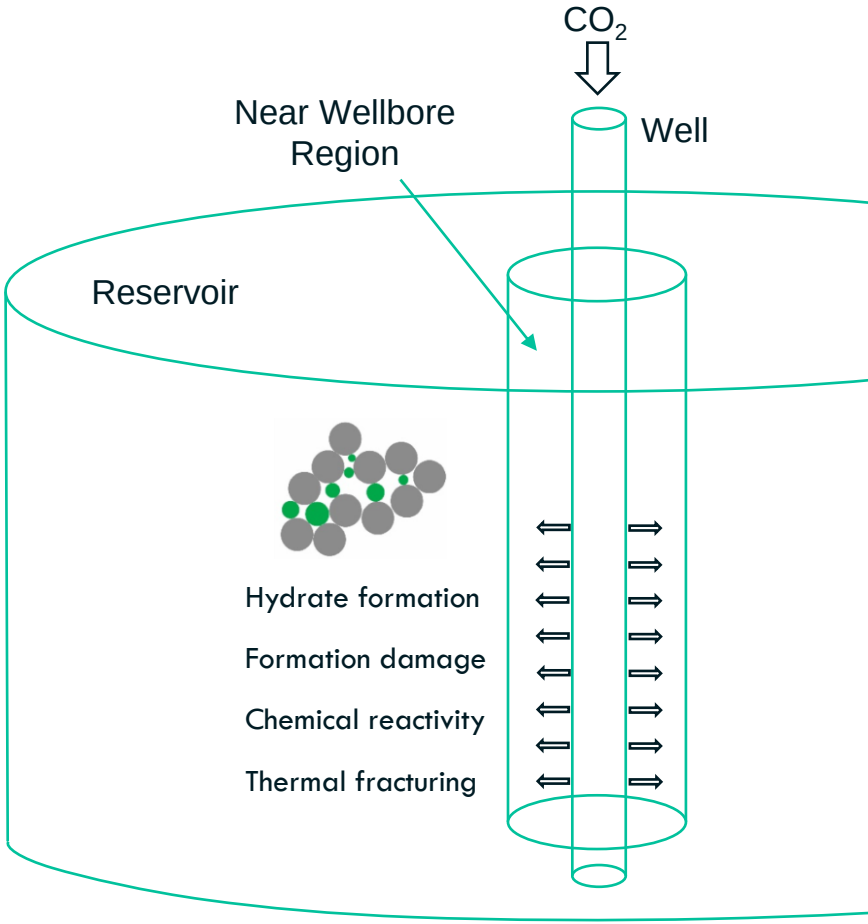
Productivity to Injectivity

- Morecambe fields are highly productive reservoirs, with laterally extensive, high-quality producing zones
- Heterogeneity well understood due to extensive well coverage and data availability
- Field-wide connectivity observed
  - Large, well-connected hydrodynamic units
- But are hydrocarbon productivity and CO_2 injectivity the same thing?



CO_2 Injectivity

- Morecambe fields exhibit excellent productivity
- CO_2 injectivity is more complex
- Joule Thomson cooling will occur, with highest impact in near-wellbore region
- Numerous processes with potential impact:
  - Hydrate formation
  - Ice formation
  - Chemical reactions
  - Thermally induced fracturing
- Extensive injectivity study underway to reduce uncertainty and guide development strategy
- Spirit Energy involved in industry JIP's investigating multiple aspects of CO_2 injectivity

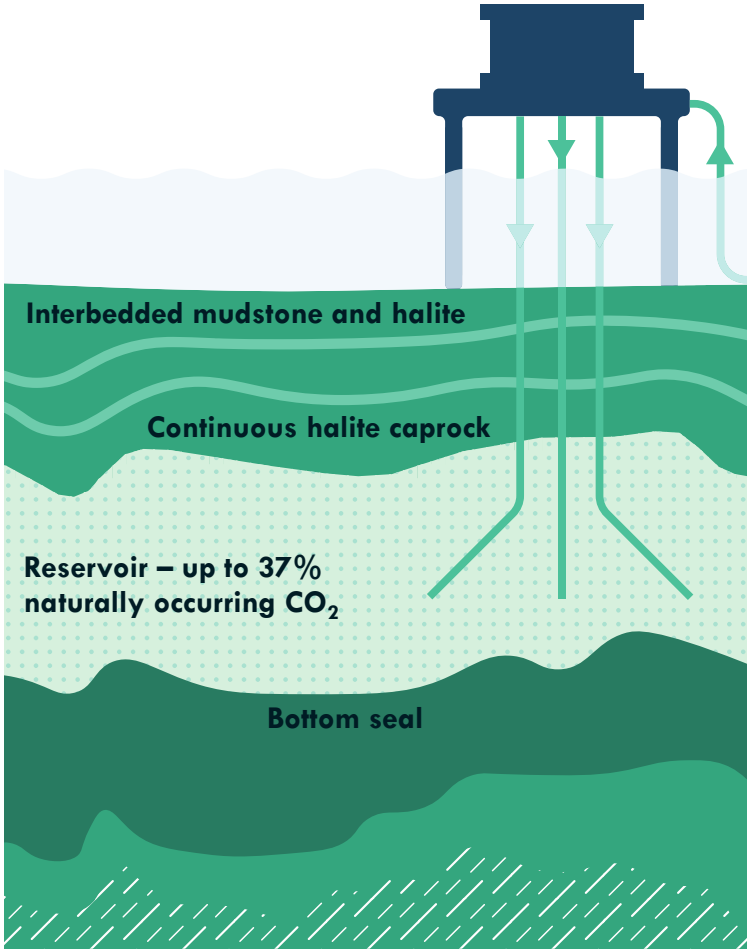


Morecambe Carbon Stores

High capacity, high rate, secure storage

- **Capacity** – Large well-defined geological storage sites
- **Integrity** – Interbedded halite (salt) and mudstones form an impermeable barrier to CO_2
- **Injectivity** – High quality, well-connected sandstone reservoirs capable of high rate deliverability

- Long gas production history under single Spirit Energy ownership, supported by significant data and understanding



Morecambe Net Zero Cluster

Storage at scale by 2030

- **Scale** – One gigaton of CO_2 storage capacity
- **Geology** – well characterized natural gas reservoir with proven seal
- **Location** – ideally placed to serve the Peak Cluster, South Wales and Ireland
- **Diversity** – transport by pipeline, ship and rail
- **Infrastructure** – re-use of natural gas pipelines and onshore gas terminal
- **Socio-economic benefit** – just transition, investment, and levelling up