

Flexible CCS network development – learning from the FleCCSnet project

Enabling transport and storage networks to serve distributed
capture projects – the missing link?

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Studying flexibility

CO₂ source (power plants)

- Load
- Efficiency
- Operation

CO₂ source (industrial sites)

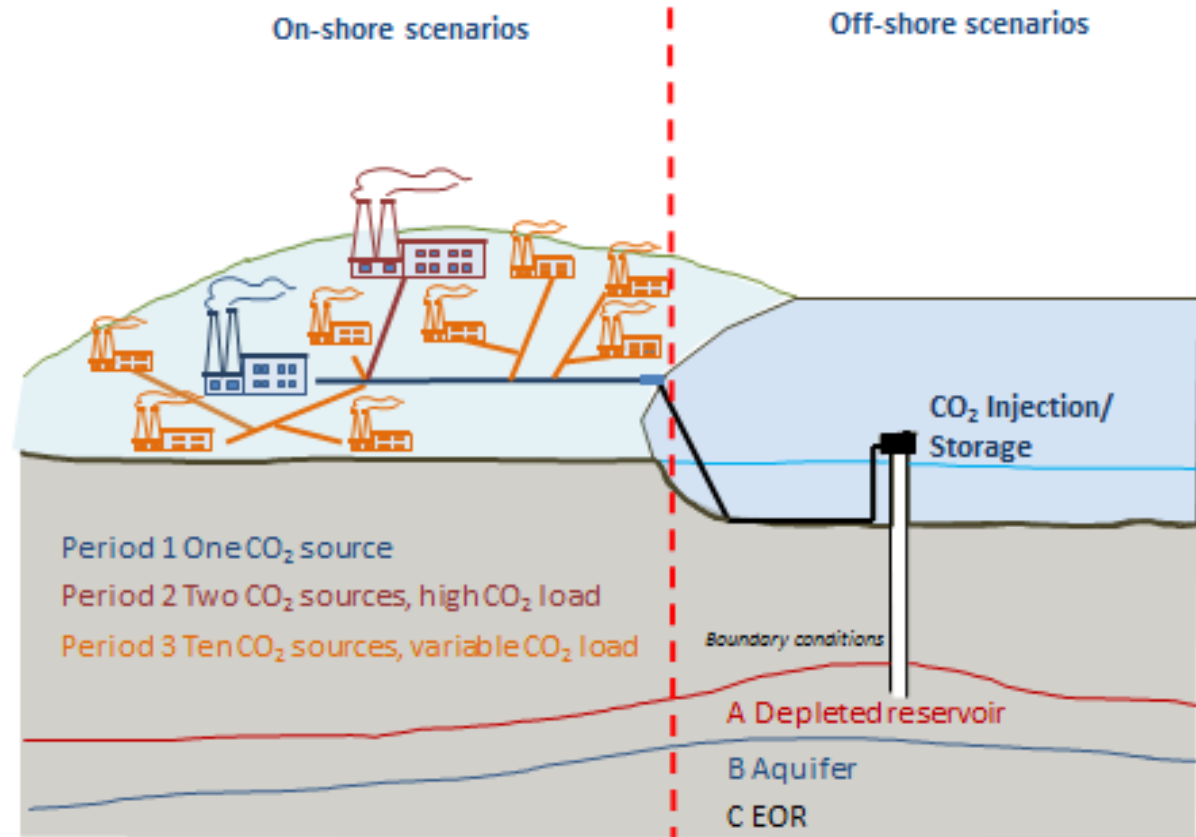
- Operation

Transport system

- Avoiding two phase flow
- Linepacking time

CO₂ sink

- Well pressure and permeability
- Store properties
 - Subsurface conditions
 - Relative permeability
 - Store capacity
 - Change in delivery pressure



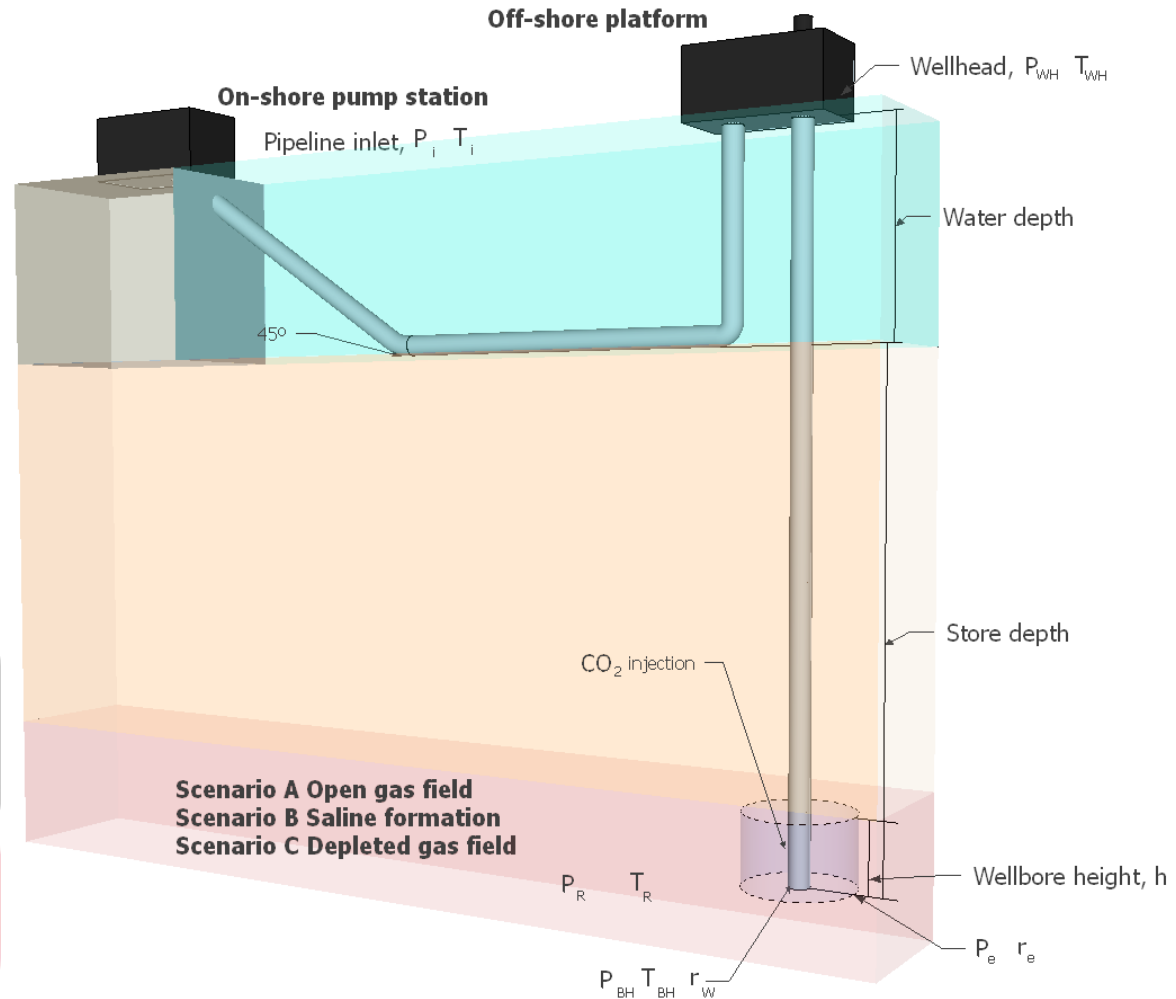
FleCCSnet workshop material available at: <https://ukccsrc.ac.uk/resources/ccs-projects-directory/flexible-ccs-network-development-fleccsnet>

Research questions

1. At which conditions of **mass flow rate**, **inlet temperature**, **reservoir pressure**, does **two phase flow** occur in the pipeline?
2. What are the **general conditions** for operation of a CCS system?
3. What differs when operating in **partial load**?
4. What happens when applying **load changes**?
5. How much flexibility can be accommodated in the **compressors**?
6. For how long can a pipeline be **linepacked** in the event of a plant upset condition?
7. What are the effects of **uncertainties** in the store properties on the transportation system?

Pipeline & well geometry

- Need to consider this whole system together in flexibility studies
- For example:
 - What is the impact of subsurface conditions on delivery conditions?
 - What is the impact of store permeability on delivery conditions?
 - What is the impact of pressure response to CO₂ injection
- Flow analysis of the effects of store performance can act as a screening tool for store appraisal



References FleCCSnet



Workshops and UKCCSRC blog:

- Developing CO₂ networks: Key lessons learnt from the first Flexible CCS Network Development (FleCCSnet) project workshop. Report from the first Flexible CCS Network Development (FleCCSnet) project workshop, Edinburgh, 30 April 2014
- Enhanced operating flexibility and optimised off-design operation of coal plants with post-combustion capture. Paper presented at GHGT-12, Oct 2014 and published in Energy Procedia 63
- Flexibility Issues in CCS Networks: Initial Findings from the FleCCSnet Project. Project update presented by Hamed Aghajani, Newcastle University, at the UKCCSRC Cranfield Biannual Meeting, 22 April 2015

Journal publications:

- Operational flexibility options in power plants with integrated post-combustion capture. Paper published in the International Journal of Greenhouse Gas Control, in print Jan 2016, online 12 February 2016
- Impacts of geological store uncertainties on the design and operation of flexible CCS offshore pipeline infrastructure. 2016. Int. Journal of Greenhouse Gas Control. Submitted for publication.

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