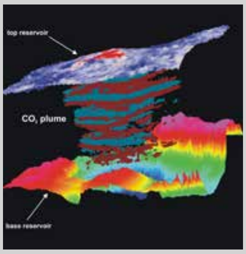
Carbon Capture & Storage

Scotland's offshore geology coupled with its existing oil and gas infrastructure provides an opportunity to store millions of tonnes of the greenhouse gas, carbon dioxide. A chain of technologies being developed has the potential to capture high volumes of CO_2, created by burning fossil fuels for power generation and industrial processes, and store it deep below ground in geological formations. World-class research into carbon capture and storage (CCS) is under way at ETP universities across Scotland.

The Full Chain

CCS involves three distinct operations – CO_2 capture, transportation and injection into geological formations for long-term storage. Researchers at ETP universities across Scotland are engaged in interdisciplinary projects, which feed into global efforts to see CCS operating at commercial scale.

A pool of expertise and state-of-the-art research facilities are being employed to develop close-to-commercial and next-generation capture materials and processes. Safe and efficient transportation, suitable storage sites, monitoring methods and the economics of CCS are also being explored alongside policy, public engagement and the regulatory environment.



Scottish Carbon Capture & Storage (SCCS)

Scotland is home to the UK's largest CCS research and development group, comprising a network of universities and institutions with experience and expertise across the full CCS chain. SCCS is a single point of coordination between academia, industry and government. Its chief aim is to promote the global development and commercialisation of CCS as a climate change mitigation technology. Funded by ETP and the Scottish Funding Council, the partnership undertakes strategic research, often with industry partners, in the UK, Europe and further afield.

Carbon Capture & Storage

Summary of Carbon Capture and Storage expertise in ETP

Capture technologies

Carbon capture has been operating for several decades in certain sectors, including natural gas production. Capture methods include the use of chemical solutions, such as amines and ammonia, or solid membranes. Recovery of CO_2 at power plants adds to costs and reduces generation efficiency, so ETP researchers are aiming to improve the capture process as well as reduce costs. "Green" capture materials are being developed which use less energy and resources. Chemical modelling of capture plants and processes is also under way, including evaluating performance and flexibility.

Transportation

Carrying large volumes of CO_2 from capture plant to storage site will involve compressing the gas to form a supercritical fluid as well as the development of safe and efficient pipeline networks. ETP research in this area includes the modelling of transport networks and leakage scenarios, reducing energy usage for compression and evaluating pipeline sensors and measurement systems. The impact of impurities in CO_2 on pipeline integrity is also being studied.

Storage and monitoring

Selecting the right geological site for CO_2 storage is critical to ensure that, firstly, it has adequate capacity and, secondly, CO_2 does not leak back into the environment. The development of storage sites must also be economically feasible. Research at ETP universities has involved modifying petroleum and hydrocarbon geoscience (from geology and geo-engineering to subsurface fluid flow) and includes borehole design, injection technology, assessing potential risks posed by multiple users and the equipment and methods needed for long-term monitoring.

Enhanced oil recovery

The use of CO_2 in enhanced oil recovery provides an opportunity to put the greenhouse gas, captured at facilities fed by fossil fuels, back underground. In order to do so, developers must understand how the CO_2 will behave after injection. Laboratory facilities are being used for reservoir modelling, high pressure flow simulation and the evaluation of different injection strategies.

Regulatory framework

Few commercial-scale CCS projects currently exist and a lack of experience in regulatory matters could create delays for demonstration and full-scale projects in the UK. ETP researchers have been working with the UK's Department of Energy and Climate Change, the Scottish Government and others to develop and test guidance for project developers. Work within ETP universities continues on providing analysis for the development of a national regulatory process for CCS.

The Scottish Energy Laboratory (SEL)

Energy sector test facilities have been brought together under the Scottish Energy Laboratory (SEL) umbrella. Facilities of particular relevance to the ccs sector include:

- Carbon Capture Test Facility - Doosan Babcock
- Flow Pressure Test Facility - IPE Heriot-Watt University
- Membrane Characterisation - University of Edinburgh
- Solid Absorbent Characterisation - University of Edinburgh
- Chemical looping – CFB & Bubbling Bed - IPE Heriot-Watt University
- High pressure/high Temperature Multiphase CO_2 Flow Rig - University of Edinburgh
- High pressure/high t emperature Test Facility - Aberdeen University
- National Flow Measurement Test Facility - NEL
- Centre for Enhanced Oil recovery and CO_2 Solutions - IPE Heriot-Watt University
- Adsorption Process Modelling - University of Edinburgh

Find out more about CCS research facilities by visiting www.scottishenergylaboratory.com and www.sccs.org.uk

For further information please email: ccs@etp-scotland.ac.uk or visit: www.sccs.org.uk