Carbon Capture & Storage in a Just Transition

SCCS evidence to the Just Transition Commission

18 September 2019, Rebecca Bell & Dr Peter Brownsort

1 CCS in a just transition

Scotland needs to plan for a just transition for workers in the oil and gas industry. At the same time, the oil and gas industry has a crucial role to play in enabling a just transition for workers in other parts of the Scottish economy.

The future of the oil and gas industry in a net-zero world is inextricably linked to carbon capture and storage (CCS).

- The oil and gas industry needs CCS to be operational in order to allow continued use of its products.
- CCS deployment needs the knowledge, skills, experience and assets in the oil and gas industry to make it happen.

Geographically, the oil and gas industry and CCS operate in the same place: the sedimentary basins where oil and gas have been produced in the UK offshore areas hold the depleted oil and gas fields and saline aquifers that make the most suitable sites for securely storing carbon dioxide (CO_2) deep under the offshore subsurface.

2 CCS – a necessity, not an option

Carbon capture and storage involves a suite of technologies to separate CO_2 from other gases (for example the flue gases from a steel plant), compress and transport the CO_2, and then inject it into offshore geological formations, where it is trapped permanently[1]. In this way, CCS prevents greenhouse gas emissions reaching the atmosphere.

Emissions from industry account for around 20% of Scotland's greenhouse gas emissions.[2]

Industry accounts for 21% of Scotland's gas use, 4% of its petroleum use and 70% of its solid fuel use.[3]

[1] For more information, see the SCCS briefing, *What is CCS?*
[2] Scottish greenhouse gas emissions 2017, Table B1: https://www.gov.scot/publications/scottish-greenhouse-gas-emissions-2017/pages/3/
[3] Department of Business, Energy and Industrial Strategy (2019) *Digest of United Kingdom Energy Statistics 2019* (Table 1D). Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/822305/DUKES_2019_MASTER_COPY.pdf

Some industries might be able to switch to renewable electricity to replace fossil fuels or, once it becomes available, to hydrogen: both of these options would enable the industry to keep producing goods but without (or with much reduced) CO_2 emissions.

However, this will not be an option for many industries. For those that have a high heat demand that can only be practically met by fossil fuels, or that have CO_2 emissions as an unavoidable part of the process – such as cement manufacture, CCS is the only option for decarbonising.

Without CCS, these industries will not be able to operate in a net-zero world, so would have to cease production. This would affect not only those directly employed, but those in supply chain and other induced jobs as well.[4]

The Committee on Climate Change described CCS as "a necessity, not an option". Part of the reason the CCC recommended that Scotland set a target for net-zero emissions by 2045 is its CO_2 storage potential.[5]

2.1 Capture rates

CCS can capture close to 100% of emissions from a particular source. This may come as a surprise to many people, as a capture rate of 90% is often quoted. However, 90% is just a figure that was felt to hit a balance between efficiency and cost of capture – in fact, near-100% capture rates have always been possible, and recent research suggests that the additional cost of higher capture rates is much lower than previously thought.[6]

2.2 Security of storage

Researchers have built on the experience and data from Scotland's oil and gas industry to identified the best sites for geological CO_2 storage: porous, permeable rock; overlain with impermeable cap rock; at a depth which will keep CO_2 in a dense phase; without features that would allow the CO_2 to migrate to the surface.[7]

Geoscientists at the universities of Aberdeen and Edinburgh have modelled CO_2 storage using a worldwide database of information from natural CO_2 and methane accumulations and hydrocarbon industry experience, including engineered gas storage, decades of borehole injection, and laboratory experiments. They found that well-regulated storage[8] is extremely secure, more than meeting the IPCC's requirement of 99% security over 100 years.[9]

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[4] Turner, Karen and Alabi, Oluwafisayo and Low, Ragne and Race, Julia (2019) *Reframing the Value Case for CCUS: Evidence on the Economic Value Case for CCUS in Scotland and the UK (Technical Report)*. Available at: https://strathprints.strath.ac.uk/67391/

[5] Committee on Climate Change (2019*) Net Zero: The UK's contribution to stopping global warmin*g. Available at: https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/

[6] Feron et al (2019)*Towards Zero Emissions form Fossil Fuel Power Stations*. Available at: https://www.sciencedirect.com/science/article/pii/S1750583618308934

[7] ETI (2016) *Strategic UK CCS Storage Appraisal*. Available at: https://www.eti.co.uk/programmes/carbon-capture-storage/strategic-uk-ccs-storage-appraisal

[8] "Well regulated" means all abandoned wells are documented and is equivalent to the regulations in the North Sea or Texas, currently.

[9] Estimating geological CO2 storage security to deliver on climate mitigation, Juan Alcalde, Stephanie Flude, Mark Wilkinson, Gareth Johnson, Katriona Edlmann, Clare E. Bond, Vivian Scott, Stuart M. V. Gilfillan, Xènia Ogaya & R. Stuart Haszeldine https://www.nature.com/articles/s41467-018-04423-1

3 The role of CCS in a just transition

A just transition will be needed for workers in all high-emitting industries – not just oil and gas. Using CCS means that manufacturing industries can keep producing, reducing the impact on their workers of the requirement to reduce emissions.

CCS deployment will have immediate, direct benefits for workers:

- The roles and skills needed in CCS map very closely to those needed in the oil and gas industry, providing the opportunity for jobs with minimal need to re-train.
- By enabling high-emitting industries to continue production, CCS retains jobs in industry, and those in the supply chain and wider economy that support them.[10]

It also has indirect benefits:

- Once CCS infrastructure is in place, it allows for 'negative emissions' – capture and storage of CO_2 from biogenic sources, or even directly from the air. This means that emissions from other sectors – such as farming – can be offset, allowing production to continue.
- Having the ability to use CCS means that natural gas – methane – can be used to produce hydrogen, with the CO_2 by-product captured and stored. This hydrogen can then replace fossil fuels in heating and transport[11], as it does not produce CO_2 when it is burnt.
    - This means the potential for more home energy jobs, adapting gas boilers to accept hydrogen.
    - It also means there could be construction and engineering jobs in providing the infrastructure to distribute hydrogen for vehicles.
    - Having a ready supply of hydrogen allows decarbonisation of heavy transport vehicles, such as HGVs, trains and even ships.
    - It means a continuing market for natural gas, without entailing CO_2 emissions from its use.
- Having CCS infrastructure in place in an area would make it an attractive location for high-emitting industries to (re)locate, providing additional jobs in the area.

4 Scotland and CCS

Carbon capture can happen anywhere where there are CO_2 emissions. This means that any industry in the world could capture its carbon if it chose to – although the costs would vary greatly between operations.

[10] Turner, Karen and Alabi, Oluwafisayo and Low, Ragne and Race, Julia (2019) *Reframing the Value Case for CCUS: Evidence on the Economic Value Case for CCUS in Scotland and the UK (Technical Report)*. Available at: https://strathprints.strath.ac.uk/67391/

[11] Subject to the safety case being satisfactorily made, and to changes to regulations. See https://www.sgn.co.uk/about-us/more-than-pipes/future-of-gas/hydrogen/hydrogen-100 and https://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_10_BEIS_CCS_Inquiry_requested_evidence.pdf

However, CO_2 storage can only happen in certain locations, where the right rocks exist in the right formations – and fortunately Scotland is one of those locations.

The UK has approximately 30% of Europe's CO_2 storage capacity, and Scotland has the capacity to store an estimated 46Gt CO_2[12]. This implies two things:

- Scotland has a responsibility to make best use of its resources and its advantages over other countries to develop CO_2 storage as part of global efforts to achieve the ambitions of the Paris Agreement.
- Scotland has the opportunity to make its storage capacity available – at a fee – to other countries and other parts of the UK.

CCS means that Scotland's economy can flourish in a net-zero world, supporting existing industries and growing new ones.

4.1 Infrastructure

Scotland – particularly the North East – has a host of infrastructure from its oil and gas industry that can be re-purposed for CO_2 storage. This includes offshore pipelines, which can transport CO_2 to storage sites and onshore pipelines, such as Feeder 10, which can transport CO_2 from the central belt to St Fergus. Scotland also has ports such as Peterhead, which could be developed to receive CO_2 by ship from elsewhere in the UK and, in future, from elsewhere in Europe.[13]

5 UK policy on CCS

CCS is, essentially, a waste management operation – taking away a by-product that no-one wants and preventing it from causing environmental problems. Because it is the removal of a 'bad' rather than the provision of a product, there is no profit to be made in it, and therefore no incentive for the industry to invest. CCS deployment benefits governments, through enabling them to meet their climate objectives (and other objectives, such as employment and public health) and so will need government intervention to make it happen.[14]

The UK Government has re-affirmed its commitment to CCS[15] in a series of policy documents, most recently the CCUS Deployment Pathway Action Plan[16]. However, it has

[12] SCCS (2009) *Opportunities for CO_2 storage around Scotland – an integrated strategic research stu*dy. Available at: http://www.sccs.org.uk/images/expertise/reports/opportunities-for-co2/CO2-JointStudy-Full.pdf

[13] ACT Acorn (2019) D18 Expansion Option. Available at https://www.actacorn.eu/sites/default/files/ACT%20Acorn%20Expansion%20Options%20Report%201.0%20Rev_0.pdf

[14] Regulation or carbon pricing could also drive industries to invest in CCS, if capturing and storing CO_2 became cheaper than paying to emit, or became a legal requirement. However, there is a very high risk that companies currently located in Scotland could respond by moving their operations elsewhere in the world, meaning that as well as there being no reduction in CO_2 emissions, Scotland would lose the jobs.

[15] The "U" stands for utilisation, or usage: using captured CO_2 rather than storing it. There are very few instances where using CO_2 would result in it being kept out of the atmosphere permanently, so we do not advocate utilisation as a climate change mitigation solution, and keep our focus on geological storage.

[16] Available at: https://www.gov.uk/government/publications/the-uk-carbon-capture-usage-and-storage-ccus-deployment-pathway-an-action-plan

been criticised by the Committee on Climate Change for not acting more quickly on CCS and has so far failed to implement a number of the committee's recommendations.

While the UK Government's position on CCS is promising, and it has set a target for net-zero greenhouse gas emissions by 2050, there remains the risk that other political objectives will overtake support for CCS.

CCS is crucial for meeting Scotland's greenhouse gas emissions targets and for a just transition. The sooner CCS is deployed, the greater its climate impact, as the total CO_2 emitted to the atmosphere will be reduced by early action (this, of course, applies to all activities that reduce CO_2 emissions).

For these reasons, we suggest that the Scottish Government should have its own contingency plan for getting CCS up and running, in case UK Government support fails to be adequate. This could include measures to fund CCS deployment directly.

6 What can the Scottish Government do?

Some initial actions we would recommend for the Scottish Government include:

- Identify the industries and sectors that will become less viable as carbon prices rise, or as greenhouse gas emissions become otherwise constrained.
- Understand the sectors that will emerge and grow in a zero-carbon economy.
- Identify and support the development of the skills that will be needed in these sectors.

Once this analysis has been carried out, the Scottish Government should develop a strategy for CCS deployment, including how it could happen in Scotland in the absence of UK Government support. This strategy should enable the Scottish Government to identify where CCS should be deployed, and how this deployment should be phased, to have the maximum benefit both for Scotland's greenhouse gas emissions and for its workers. The strategy should identify a pipeline of projects – for CO_2 capture, transport and storage – and should ensure that government policies, particularly land-use and marine planning, are aligned with it.

Scottish Carbon Capture & Storage (SCCS) is a partnership of the British Geological Survey, Heriot-Watt University, the University of Aberdeen, the University of Edinburgh and the University of Strathclyde working together with universities across Scotland.

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