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Strategic Infrastructure Sector Plan

SCCS response to SEPA consultation

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Strategic Infrastructure Sector Plan

1 Key message

We recommend that the scope of the plan be widened to cover the carbon dioxide (CO_2) transport infrastructure that will be needed in coming decades as Scotland deploys carbon capture and storage (CCS) to decarbonise its industry. It is likely that this will include new and re-purposed onshore CO_2 pipelines, on land and across the foreshore - these would be expected to have the same impacts and issues as the other pipelines identified in the sector plan. Infrastructure associated with CCS is also likely to include compressors and gas collection facilities.

2 Background

CCS involves capturing CO_2 at source (e.g. separating it from the mix of flue gases at an industrial operation); transporting it; and then injecting it in deep offshore geological formations, where it is permanently stored, preventing it reaching the atmosphere and contributing to climate change. The transport of CO_2 from source to store can be done by pipeline (both on-and offshore), ship, road or rail, or a combination of these. While CO_2 capture will be done at individual sites, with the capture technology tailored to the industrial process it is applied to, the transport and storage elements are likely to involve shared infrastructure that can take CO_2 from any source. CO_2 transport infrastructure is therefore comparable to sewerage or waste management infrastructure.

CCS is the lowest cost route to decarbonisation of the economy[1] and is the currently the only way to make deep emissions reductions from industries that have process CO_2 emissions (such as cement and steel manufacture) or a heat demand that can only realistically be met by fossil fuels (such as glass production). Infrastructure to transport and store CO_2 enables the bulk production of low carbon hydrogen through methane reforming with CCS, which can be used to decarbonise hard-to-treat areas such as heat and transport[2]; it also enables "negative emissions": for example through bioenergy with CCS, or direct air capture (DAC).

The Intergovernmental Panel on Climate Change (IPCC)'s special report on 1.5°C found that CCS is necessary in almost all scenarios to meet the Paris ambition[3]. The Committee on Climate Change (CCC) advised the UK Government that it "should not plan to meet the 2050 target without CCS" and that it "should set out plans in 2018 that kick-start a UK CCS industry in the 2020s"[4]. Likewise, the CCC advised the Scottish Government that CCS would be "crucial to meet long-term emissions targets at reasonable cost, and to reach net-zero emissions.[5]"

[1] http://www.ccsassociation.org/news-and-events/reports-and-publications/parliamentary-advisory-group-on-ccs-report/
[2] Hydrogen can also be produced with electrolysis which, if using electricity from renewable sources, would entail no CO_2 emissions. However, it is currently not cost effective to produce sufficient quantities to kick-start a market for hydrogen for heat or transport. See Committee on Climate Change (2018) *Hydrogen in a low-carbon economy*, available at: https://www.theccc.org.uk/wp-content/uploads/2018/11/Hydrogen-in-a-low-carbon-economy.pdf
[3] https://www.ipcc.ch/sr15/chapter/summary-for-policy-makers/
[4] Committee on Climate Change (2018) *An Independent Assessment of the UK's Clean Growth Strategy*. Available at: https://www.theccc.org.uk/wp-content/uploads/2018/01/CCC-Independent-Assessment-of-UKs-Clean-Growth-Strategy-2018.pdf
[5] Committee on Climate Change (2017) *Advice on the new Scottish Climate Change Bill.* Available at: https://www.theccc.org.uk/wp-content/uploads/2017/03/Advice-to-Scottish-Government-on-Scottish-Climate-Change-Bill-Committee-on-Climate-Change-March-2017.pdf

The UK Government's Clean Growth Strategy stated the Government's ambition to deploy carbon capture, use and storage (CCUS) in the UK at scale in the 2030s, subject to costs coming down sufficiently. One of the actions in this strategy was to establish an industry-led CCUS Cost Challenge Task Force (CCTF), which reported in 2018 with a set of recommendations, most of which the Government took up in their CCUS Deployment Pathway Action Plan[6].

It is clear therefore that CCS will almost certainly be deployed in Scotland, so it is essential that SEPA is prepared to regulate it. Because CO_2 transport infrastructure it is a new form of development in Scotland, and the rest of the UK, there is also the potential for SEPA to engage with clients, developers and other regulators at a very early stage to make the most of CCS's potential to reduce emissions and support a low-carbon economy.

Both the CCC and the CCTF recommended that CCS deployment should begin in the 2020s, in order for it to be deployed at scale in the 2030s and onwards. The UK Government has indicated that a number of funding streams will be available to support the deployment of CCUS, including through decarbonising industrial clusters[7]. There is therefore a sense of urgency around early CCS deployment, and a need to ensure that the policy and regulatory landscape in Scotland is ready for the first projects.

We are keen to discuss this further, and to share the research and expertise that exists in the SCCS partnership with SEPA.

3 Responses to consultation questions

3.1 Do you agree with the scope we are proposing for the Sector Plan?

As indicated above, we consider that the scope should be broadened to cover CO_2 pipelines.

It is currently not clear who will regulate CO_2 transport in Scotland, but it is likely that the construction and decommissioning of any onshore pipelines will have comparable environmental impacts to any other pipelines, so should be covered in this sector plan.

3.2 Do you think that the vision we are proposing sets the right level of ambition for the sector? Is there anything that you think should be included or changed to improve this vision?

The proposed vision refers to strategic infrastructure which enables a low carbon economy. CO_2 transport infrastructure is a prime example of this: it enables low-carbon manufacture; the bulk production of low carbon hydrogen for heat and transport; and "negative emissions" either by capturing and storing CO_2 directly from the air, or from biogenic sources[8].

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

[7] https://www.gov.uk/government/news/world-first-carbon-net-zero-hub-of-heavy-industry-to-help-uk-seize-global-economic-opportunities-of-clean-growth, https://www.theccc.org.uk/2018/11/28/ccc-welcomes-governments-recommitment-to-carbon-capture-and-storage-technology/

[8] See SCCS paper on existing sources of biogenic CO_2 emissions in Scotland that could be captured and stored once the infrastructure is in place, enabling early deployment of negative emissions. http://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_08_Negative_Emission_Technology_in_Scotland.pdf

3.3 Does this narrative broadly set out the context for the strategic infrastructure sector in Scotland? Is there anything that is missing, or which should be changed?

The narrative refers to the Energy Strategy and Climate Change Plan, both of which set out the Scottish Government's ambitions in relation to CCS, yet the infrastructure that will be needed for this is not covered in the sector plan.

The narrative refers to "new infrastructure to enable the decarbonisation of heat, electricity and transport" – this should logically include CO_2 transport infrastructure: in a high electrification future, it is likely that there will be a role for some fossil fuel power generation; if hydrogen has a more prominent role then this grid balancing role is less crucial, but instead CCS will be needed to produce hydrogen in bulk.

It is increasingly likely that this new infrastructure will also need to include hydrogen pipelines. The upgrades to the gas network through the Iron Mains Risk Reduction Programme mean that much pipework is suitable for carrying hydrogen, either on its own, or blended with natural gas, but there is still likely to be a need for new pipes. It is not clear who would regulate hydrogen in the gas network, although we assume that this would fall under Ofgem.

Figure 4, the map of examples of strategic infrastructure projects, could include the Acorn project in St Fergus, small-scale full-chain CCS project, reusing existing infrastructure, that aims to be "a catalyst for low-cost, low-risk clean growth" by making its CO_2 transport and storage infrastructure available to CO_2 emitters elsewhere in the UK[9]. A subsequent phase of the project, CO_2SAPLING, has been designated a EU Project of Common Interest because it enables transboundary movement of CO_2 for permanent storage, and has been awarded Connecting Europe Facility funding[10]. The build-out of Acorn is likely to require CO_2 import equipment at Peterhead, compression equipment and a CO_2 pipeline from Peterhead to St Fergus.

There are many other potential sites for CO_2 capture in Scotland – around 80% of Scotland's high emitters are within 40km of Feeder 10, an onshore gas pipeline which is suitable to be repurposed for CO_2 transport.[11]

Figure 5 should include CO_2 transport.

3.4 Do you think we have identified the main environmental impacts of the sector in figure 6? Are there any other impacts that concern you that should be included?

One of the impacts identified in Figure 6 is the emissions to air from cement and concrete manufacture. These process CO_2 emissions (which make up around half the emissions from cement manufacture[12]) are currently unavoidable, but they can be prevented from reaching the atmosphere using CCS.

[9] https://actacorn.eu/news/act-acorn-catalyst-low-cost-low-risk-clean-growth
[10] https://pale-blu.com/co2-sapling/
[11] Brownsort et al (2016) *Reducing costs of carbon capture and storage by shared reuse of existing pipeline – Case study of a CO_2 capture cluster for industry and power in Scotland*. Available at: https://www.sciencedirect.com/science/article/pii/S1750583616302948?via%3Dihub
[12] http://www.zeroemissionsplatform.eu/news/news/1601-zep-publishes-key-report-on-ccs-in-eu-energy-intensive-industries.html

3.5 Have we described the regulation of the sector correctly? Are there any aspects that we have missed?

This section will need to be updated if/when CO_2 transport infrastructure is included in the Sector Plan. It should probably also include hydrogen pipelines. As previously stated, it is not clear who will regulate CO_2 transport or hydrogen in the gas network.

3.6 Do you think we have missed anyone from the list of key partners and influencers that we have identified who may be able to help us work to achieve our outcomes?

We would suggest the following:

- Oil and Gas Authority – for the interface between onshore CO_2 transport and offshore CO_2 transport and storage.
- Environment Agency – for the interface between CO_2 transport in England and Scotland. There is potential for CO_2 to be transported from sources in England to stores in Scotland, so it is possible that cross-border pipelines will be needed.

3.7 Have we identified the right issues which may impede compliance or uptake of beyond compliance opportunities, for the purposes of this plan?

CO_2 transport and storage will be a new sector for Scotland so it is to be expected that there will be a steep learning curve for early projects. However, there is learning to be had from international experience, and transferable knowledge and skills from the chemicals and oil and gas sectors.

3.8 The proposed aspirations are our initial thoughts for how we could help the sector go further. Do you think we have identified the right aspirations?

The *Energy* section states that "Strategic infrastructure currently being built was planned and financed years ago; this sector plan needs to aim its higher ambitions at the infrastructure that is currently being planned for, which may not start construction until 2021 or later." CO_2 pipelines fall into this category, and as CCS is an emerging set of technologies, this could be an ideal opportunity for SEPA to work closely with an industry to take it beyond compliance while it is still in its infancy.

This section addresses extending the life of existing infrastructure and assets: this is likely to apply to repurposing the gas grid for hydrogen, and potentially repurposing some onshore pipelines (such as Feeder 10 and Feeder 8) for CO_2 transport. Some offshore gas pipelines are also expected to be repurposed for CO_2 transport, although we understand these to be outside SEPA's regulatory remit.

The *Materials* section states that "Structural steel and aluminium are significant construction resources […] Both have high embodied carbon." The embodied carbon in steel can be significantly reduced by using CCS to capture and store the CO_2 emissions both from the fossil fuels used for heating, and from the manufacturing process itself. The same is true for cement, which is also a significant construction resource. The Industry-led CCUS Cost Challenge Taskforce[13] recommended

[13] https://www.gov.uk/government/publications/delivering-clean-growth-ccus-cost-challenge-taskforce-report

the development of a 'decarbonised product mark' to build low carbon standards in materials such as steel, cement, lime and chemicals. As well as encouraging the re-use of steel and aluminium, SEPA could work with partners to encourage the use of low-carbon steel and cement – i.e. produced using CCS – where virgin materials are needed. SEPA could also encourage the development and use of aggregates produced by mineralisation of captured CO_2.

3.9 Do you think these potential actions will help us achieve our aspirations and outcomes? If not, what actions should we include? Are there any actions you consider to be of the highest priority?

Under *Collaborative decision making*, there is an action to explore the potential of a regulatory hub. It would be useful if the scope of this hub included issues such as co-location of pipes, re-use of existing infrastructure, and a coordinated approach to installing energy and pipeline infrastructure minimises the amount of trenches that need to be dug.

Under *Investment planning and procurement*, as well as developing standards for recycled content, we suggest an action to contribute to developing standards for low-carbon materials and products produced using CCS. This issue goes beyond just materials needed for strategic infrastructure, and into the wider economy, but steel and cement could be good places to start.

Under *Consistency with other sector plans*: once CO_2 transport and storage infrastructure is in place, SEPA can update their sector plans for manufacturing sectors to encourage them to capture their CO_2 and use the transport and storage infrastructure to prevent it reaching the atmosphere. SEPA could also use its influence to encourage existing operations with biogenic CO_2 emissions – such as landfill, anaerobic digestion, distilleries, and breweries – to capture and store their emissions, resulting in "negative emissions" that can offset unavoidable emissions in other parts of the economy.

3.10 Have we identified the right outcomes? Do you think there are other outcomes we should consider?

We would suggest an additional outcome: "Scotland's infrastructure enables a low carbon economy." This would link back to the sector plan's vision and emphasise the important role of infrastructure in delivering environmental benefits, as well as being resilient to climate change.

One outcome appears twice in the diagram: "Scottish businesses benefit from the flow of valuable materials in the circular economy." We suggest that one instance of this could be replaced with "Scottish businesses benefit from a growing market for low-carbon materials and products."

4 Scottish Carbon Capture & Storage

Scottish Carbon Capture & Storage (SCCS) is a research partnership of the British Geological Survey (BGS), Heriot-Watt University, University of Aberdeen, the University of Edinburgh and the University of Strathclyde with associate member the University of St Andrews. SCCS researchers are engaged in innovative applied research and joint projects with industry and government to support the development and commercialisation of carbon capture and storage as a climate change mitigation technology.