Fourth National Planning Framework (NPF4) Evidence submitted to the Scottish Parliament

January 2022, SCCS

1 Introduction

SCCS is the largest CCS research group in the UK, providing a single point of coordination for CCS research, from capture engineering and geoscience to social perceptions and environmental impact through to law and petroleum economics.

Our internationally renowned researchers provide connected strength across the full CCS chain. With our unique position SCCS is able to act as the conduit between academia, industry and government.

SCCS has access to cutting-edge experimental and analytical facilities, expertise in field studies, modelling and simulation, key academic and research personnel to accelerate the development of CO_2 transportation, capture and subsurface storage. We undertake strategic fundamental research and are also available for consultancy. In addition, we perform a key role in providing impartial advice to industry, the public sector, government agencies, and policy makers.

Founded in 2005, SCCS is a partnership of the British Geological Survey, Heriot-Watt University, the University of Aberdeen, the University of Edinburgh, the University of Glasgow and the University of Strathclyde working together with universities across Scotland.

This submission does not necessarily represent the views of the individual members of the SCCS Directorate nor of the SCCS consortium partner institutes.

2 National Spatial Strategy

2.1 Sustainable Places

We welcome the intention that “every decision we make contributes to making Scotland a more sustainable place,” although it would be useful to know the decision-making criteria that underpin this.

We welcome the intention that Scotland will invest in reducing carbon emissions – investment is crucial to deliver the infrastructure we need for deep greenhouse gas reductions, such as carbon dioxide transport and storage, which enables carbon dioxide (CO_2) emitted from large point sources to be securely and permanently stored in rocks below the North Sea.

2.2 Productive Places

NPF4 should ensure that the infrastructure is in place to enable high-emitting industries to locate in Scotland and operate in a low-carbon way. This includes infrastructure for CO_2 transport and storage, providing a 'CO_2 takeaway' service for industries that capture their CO_2 at source before it is emitted to air. The existence of this infrastructure also allows the production of 'blue hydrogen' from methane, as well as negative emissions from the capture and storage of CO_2 from biogenic sources (BECCS), or directly from the air (DACCS).

This CO_2 transport and storage infrastructure should make the most of existing assets – particularly pipelines, ports and railways – but is likely to require both upgrades to these assets and the development of new infrastructure elements. The aim should be to provide a shared CO_2 transport and storage network that any industrial, manufacturing, heat, power, waste-to-energy or direct air capture site can use to dispose of CO_2 that it has captured from its operations.

SCCS is a partner in the Scotland's Net Zero Roadmap project, which is identifying decarbonisation pathways for a range of industrial sites in Scotland, and complements the work of the Acorn CCS and Hydrogen projects, and the Scottish Cluster. We are part of the secretariat of the European CCUS Projects Network, and a partner in numerous international projects that address CO_2 capture on a range of applications that are relevant for Scotland, and provide insight into spatial and policy planning for CO_2 transport and storage networks.

These include STRATEGY-CCUS, which takes a regional approach to planning for carbon capture, utilisation and storage (CCUS) based on existing assets in seven countries; REALISE-CCUS, which addresses CCUS applied to refineries; NEWEST-CCUS, which addresses CCUS application in the waste-to-energy sector; as well as projects such as LAUNCH, PilotSTRATEGY and HyStorPor, which address specific technological and geological issues around CCS and hydrogen storage.

Scotland has the geology, the research base and the industry skills, knowledge and expertise to deliver secure, permanent CO_2 storage in rocks deep below the North Sea – not just to store Scotland's own captured CO_2 emissions, but CO_2 captured from sites elsewhere in the UK and Europe. This makes CCS an economic growth area for Scotland, as well as essential infrastructure for decarbonising to net zero. As such, it is crucial that the NPF sets a framework that supports and enables the development of CCS, and there is alignment between land-use and marine planning to enable the on- and off-shore elements of CCS chains to connect.

2.3 Spatial principles for Scotland 2045

2.3.1 Conserving and recycling assets

We welcome the focus on "making productive use of existing buildings, places, infrastructure and services" – this must include repurposing these assets for new uses – such as re-using existing gas pipelines to transport CO_2 or hydrogen – and supplementing them with new infrastructure where needed.

2.3.2 Just transition

This is a valuable guiding principle, although it is not clear how NPF4 intends to apply it. The work of SNZR will provide practical suggestions for existing industries in Scotland to transition to net zero.

2.4 Action areas for Scotland 2045

2.4.1 North and west coastal innovation

Shetland and Orkney have strong links to the oil and gas industry, yet this section does not mention that at all. Three sites in Orkney and Shetland – Total Shetland Gas Plant, Engie FM Sullom Voe PS / CHP and Repsol Sinopec Flotta Oil Terminal – are in the top 25 point source CO_2 emitters in Scotland[1]. A just transition for oil gas workers will be crucial here, particularly as CO_2 transport and storage will be more expensive (although not impossible) at such dispersed sites outside of the Scottish cluster. Port upgrades could enable captured CO_2 to transported by ship for storage at St Fergus.

National Development 7 – Islands Hub for Net Zero – recognises the need for hydrogen and CO_2 transport and storage infrastructure, so we would expect to see that reflected in this section.

We strongly agree with the statement that "Collaboration and strong alignment of terrestrial and marine planning, at all levels, will also be needed." This is particularly the case for shared use of the sea bed, such as for fishing, offshore wind and CO_2 storage.

2.4.2 Northern revitalisation

We agree with the statement "new facilities and infrastructure will help ports to adapt, unlocking their potential to support the transition from fossil fuels through oil and gas decommissioning, renewable energy and low carbon hydrogen production and storage", but would add CCS, which will be needed for low-carbon hydrogen produced from natural gas.

2.4.3 North east transition

Given the Scottish Government's support of the Acorn CCS project and the Scottish Cluster[2], which are centred around St Fergus, it is strange that CCS, and particularly CO_2 storage, is not mentioned in this section.

We agree that "this area, along with the wider Moray and Cromarty Firths, has built on its oil and gas experience to pioneer new technologies. This makes it a uniquely investable proposition that could benefit Scotland as a whole." These technologies include CCS and low-carbon hydrogen – this area is expected to be a hub for both blue and green hydrogen production.

[1] Stevenson, R.L. (2020), *Scotland's industrial CO_2 emissions – 2018 baseline data and proposed industrial and geographic scope for phase 2*. Available at https://snzr.co.uk/phase-1/
[2] E.g. Scottish Government (2021), *Scottish Cluster: letter to UK government from Michael Matheson MSP*. Available at: https://www.gov.scot/publications/scottish-cluster-letter-to-uk-government-from-michael-matheson-msp/

CCS is crucial to the transition to net zero. There will be a need to re-purpose and enhance existing infrastructure to enable CO_2 and hydrogen transport and storage to be available to industries across Scotland and beyond, as well as to industries in the north east.

2.4.4 Central urban transformation

This section acknowledges that "Many of our largest emitters of greenhouse gas emissions are located in this area, including Grangemouth where industrial activity is concentrated, providing high value manufacturing, maintaining our resilience and providing employment. Other key sources include industrial, manufacturing and waste management sites and facilities". We would therefore expect the list of key actions for the area to include decarbonising existing industry and providing the infrastructure to draw in new industries with traditionally high emissions.

While the section "rediscover urban coast and waterfronts" includes an ambition for a low carbon manufacturing hub at Grangemouth, which is welcome, there are much wider applications of CCS at the site than just "bioenergy hydrogen production with CCS". There is the opportunity to put the CO_2 transport infrastructure in place both to decarbonise existing operations and support future low carbon manufacturing in the area.

The section mentions the potential for the Port of Leith to service the offshore energy sector. It could also play a role in transport of CO_2 by ship for storage.

Talks about the infrastructure first approach to housing development on brownfield sites – this also needs to apply to sites zoned for industrial use – make sure the CO_2 and hydrogen transport infrastructure is in place.

2.5 Other comments

There are several statements in the Central urban transformation section that could equally apply to other areas, so should be reflected in their statements:

The Central urban transformation section states that "The skills, knowledge and experience that is currently situated there for the petrochemicals sector is a prime resource for the transition to net zero." We agree with this, and that a similar statement in relation to the upstream oil and gas industry should be included in the *North and west coastal innovation* and *North east transition* sections.

Similarly, "repurposing of existing strategic and critical infrastructure such as pipelines" is an action that will cover much more of Scotland than just the central belt. Twenty local authorities are in the scope of the SNZR work on industrial decarbonisation, either because they have high-emitting industries or because the Feeder 10 pipeline, which has potential to be repurposed for CO_2 transport, crosses their area[3].

[3] Stevenson, R.L. (2020), *Scotland's industrial CO_2 emissions – 2018 baseline data and proposed industrial and geographic scope for phase 2*. Available at https://snzr.co.uk/phase-1/

"Development of ports on the east coast will also need to take account of the potential for a substantial increase in freight and passenger traffic between Scotland and continental Europe" – again, this needs to apply to the whole east coast, not just the central belt, and should include the transport of CO_2 from the rest of the UK and Europe for storage in Scotland.

3 National Developments

3.1 Islands Hub for Net Zero

The description of infrastructure under classes of development is somewhat unclear: "Infrastructure for the production, storage and transportation of low and zero-carbon fuels (that are not electricity or heat) including renewable hydrogen; and hydrogen production related chemicals including ammonia with appropriate carbon capture linked to transport and storage infrastructure."

3.2 Industrial Green Transition Zones

We strongly welcome this national development, which recognises that decarbonising industry is crucial to Scotland's net zero ambitions. Carbon capture and storage will have a crucial role in this by preventing CO_2 from industry reaching the atmosphere. CCS can be applied to industrial fossil fuel uses, process CO_2 emissions (such as from cement manufacture), hydrogen manufacture from natural gas and energy from waste plants. This is in addition to applications for fossil power generation, and greenhouse gas removals using BECCS or DACCS.

CCS is operational all over the world, and its deployment in the UK and Europe is accelerating. Scotland has a huge economic opportunity in its offshore geology to offer a secure, permanent CO_2 storage service for other countries' captured industrial CO_2 – the geology of the North Sea means that the UK, Norway and, to a lesser extent, the Netherlands, are unique in Europe in having vast, well characterised, offshore CO_2 storage resources.

Scotland has the capacity to securely and permanently store at least 5.7 Gt CO_2 and potentially 70 Gt CO_2[4] - at the lowest estimate, this is over 100 times Scotland's current annual greenhouse gas emissions. In addition, Scotland benefits from the knowledge, skills and expertise in Scotland's academic base and its oil and gas industry.

We agree that "The deployment of hydrogen and Carbon Capture Utilisation and Storage at these locations must demonstrate decarbonisation at pace and cannot be used to justify unsustainable levels of fossil fuel extraction or impede Scotland's just transition to Net Zero." The purpose of using CCS and hydrogen must be in order to reach net zero emissions, and should not be seen or used as a substitute for other climate action. Furthermore, Scotland's

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

vast CO_2 storage resource should not used as an opportunity to avoid direct emissions reductions at source: CCS should be used in line with a hierarchy of action which prefers avoidance and reduction of CO_2, where possible, over capturing and storing emissions (see diagram). Having said that, there will be a role for CCS in industries that are otherwise hard to decarbonise; in producing hydrogen from natural gas (which enables bulk supply of hydrogen to be guaranteed while the supply of hydrogen from electrolysis using renewable electricity grows), and in balancing residual emissions in the economy (such as from agriculture) using either biomass with CCS (capturing and storing CO_2 from processes such as bioenergy, anaerobic digestion and industrial scale fermentation) or direct air CO_2 capture and storage.

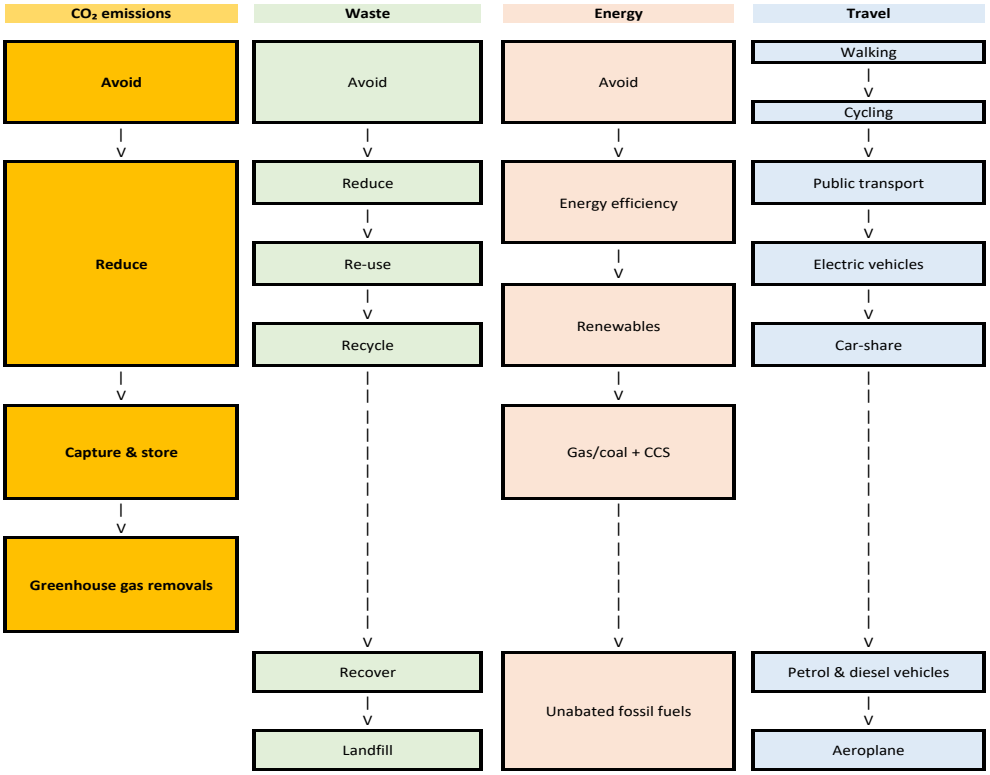

Figure 1 CO2 hierarchy compared with the waste, energy and transport hierarchies

We agree that where CCS is used, it should be with the highest possible capture rates. Research suggests that capture rates of 98% are possible[5] and that the use of biomass co-combustion with high capture rates could result in net zero emissions[6]. However, we would assume that this would be regulated under pollution prevention and control regulations rather than the land-use planning system.

[5] ION Clean Energy Inc (2021) ION Clean Energy Successfully Completes Six-month CO_2 Capture Campaign Demonstrating >98% Capture Rate at Industry-Leading Energy Requirements on Post-Combustion Natural Gas. Available at https://www.prnewswire.com/news-releases/ion-clean-energy-successfully-completes-six-month-co2-capture-campaign-demonstrating-98-capture-rate-at-industry-leading-energy-requirements-on-post-combustion-natural-gas-301409737.html

[6] IEAGHG (2019) Towards Zero Emissions CCS in Power Plants Using Higher Capture Rates or Biomass. Available at: https://ieaghg.org/publications/technical-reports/reports-list/9-technical-reports/951-2019-02-towards-zero-emissions

With regard to the Grangemouth Investment Zone, the draft document states that "it is a key location in the Scottish Cluster for carbon capture and storage": to be clear, while Grangemouth will be a key location for the capture of CO_2, and a hub for its transportation, in fact the storage would take place in the North Sea (initially using the Acorn Storage site, linked to St Fergus) and there will be a requirement for new or repurposed infrastructure to transport CO_2 from Grangemouth to St Fergus.

One of the classes of development listed here is "on or near-shore geological storage of hydrogen": we would draw your attention to the work of the HyStorPor project, which is investigating the potential to store hydrogen in porous rock.

3.3 Other comments

CO_2 transport and storage infrastructure is nationally important, so we are pleased to see it integrated into four national developments (Islands Hub for Net Zero, Industrial Green Transition Zones, Hunterston Strategic Asset, and Chapelcross Power Station Redevelopment).

4 National Planning Policies

4.1 Policy 1: Plan-led approach to sustainable development.

For this policy to be successful it will need to be supported by guidance, training and capacity building for all those involved in the planning system – particularly elected members and planning officials – to understand the opportunities and risks associated with these issues, and their role in addressing them.

4.2 Policy 2: Climate emergency

We welcome a specific policy addressing the climate emergency. However, for this policy to be successful it will need to be supported by guidance, training and capacity building for all those involved in the planning system – particularly elected members and planning officials – to understand the opportunities and risks associated with these issues, and their role in addressing them.

The policy could be supported and enhanced by the delivery of CO_2 transport and storage infrastructure, so that new industrial development that would otherwise have high CO_2 emissions can deploy carbon capture.

4.3 Policy 8: Infrastructure First

We support the infrastructure-first approach. Where appropriate, this should include CO_2 and hydrogen transport and storage infrastructure, to enable low-carbon industrial development and greenhouse gas removals.

4.4 Policy 10: Sustainable transport

We welcome the acknowledgment of hydrogen vehicles in this policy.

4.5 Policy 19: Green Energy

We strongly welcome the principle of this policy, particularly the requirement for a decarbonisation strategy for manufacturing or industrial developments. In section H we recommend that the phrase “major applications for energy generation from low carbon sources” should be replaced with “major applications for energy generation that would emit greenhouse gases.”

We recommend that section I should be expanded to include that proposals for CO_2 transport should be supported in principle, as well as proposals for negative emissions technologies and CO_2 capture.

4.6 Policy 20: Zero Waste

We welcome the requirement for new energy-from-waste plants to consider carbon capture and storage and to supply a decarbonisation strategy.

The NEWEST-CCUS project is exploring the use of CCS in the waste-to-energy sector and could help provide an evidence base to support determinations under this policy.