Second National Infrastructure Assessment: Baseline Report
Evidence to the National Infrastructure Commission

Rebecca Bell, Policy & Research Officer, SCCS. February 2022
Rebecca.Bell@sccs.org.uk

SCCS are pleased to submit evidence to the National Infrastructure Commission to support its second National Infrastructure Assessment. We are keen to discuss further any of the issues and research we have highlighted here.

Do the nine challenges identified by the Commission cover the most pressing issues that economic infrastructure will face over the next 30 years? If not, what other challenges should the Commission consider?

We are pleased to see the need for new networks for hydrogen and carbon capture and storage (CCS) recognised by the Commission, and the commitment to assess the hydrogen and CCS required across the economy, and the policy and funding frameworks needed to deliver it over the next 10-30 years.

Work on hydrogen and CCS will complement other key challenges, including:

- The electricity system must decarbonise fast to meet the sixth Carbon Budget
- Decarbonising heat will require major changes to the way people heat their homes

It will also contribute to the key themes of reaching net zero and supporting levelling up, by enabling a just transition for workers in oil and gas or high-emitting industries, and supporting new supply chain jobs.

Reaching Net Zero

Under the “reaching net zero” theme, the reports states that “the transition away from oil and gas may have the opposite effect [on the objective to support sustainable economic growth across all regions of the UK] in places where these industries are centred.”

This outcome is not inevitable: planning for a just transition would mean understanding the existing jobs and skills and how they can be used in the industries of the future. For example, CCS uses the skills from oil and gas extraction and chemical industries; the growth of blue hydrogen (produced from methane in conjunction with CCS) could also help maintain jobs in

the oil and gas sector. See our briefings on the role of CCS in a just transition[1] and post-covid recovery[2] for more information.

CO_2 storage projects are likely to be located in areas that are currently hubs for O&G production, so should contribute to economic growth in those areas as one industry displaces the other; CO_2 capture (supported by the provision of CO_2 transport and storage infrastructure) means that existing high-emitting industries can continue to operate, retaining jobs both directly and in the supply chain.

We agree with the text under the 'improved competitiveness' section: "the UK can and should transfer its advantages – which lie across a broad range of professional, financial, and engineering and design services - to emerging low carbon industries, such as carbon capture and storage".

The report states that "The Commission does not intend to take forward any further work during the second Assessment on the infrastructure required to decarbonise aviation and shipping" and that "The Commission has recommended that engineered greenhouse gas removals are developed in the UK to address emissions from this hard to abate sector." While we agree that greenhouse gas removals will be necessary, they are not the only way to reduce emissions from aviation and shipping, and particular focus should be given to reducing demand and, in the case of domestic aviation, improving rail and coach transport.

What are the greatest risks to security of supply in a decarbonised power system that meets government ambition for 2035 and what solutions exist to mitigate these risks?

The intermittency of renewable electricity generation creates a need for national-level energy storage. Energy storage in the form of hydrogen is likely to be significantly lower cost, and more resource efficient, than electric batteries.

SCCS members have undertaken surveys of geological hydrogen storage on land and offshore in Scotland and the rest of the UK. There is massive opportunity for hydrogen storage, many times more than annual need. This needs research support to continue evaluation, in partnership with UK industries and gas distribution companies

Work at The University of Edinburgh[3] indicates that we will need around 100TWH of annual hydrogen energy storage and that scale of storage can only be delivered by geological storage in depleted gas fields. As permitting a site for storage can take many years, we need to get a demonstration project for hydrogen storage in porous rocks underground operational as soon as possible.

Storage of hydrogen is envisaged as 30% of UK annual methane consumption. Such storage has not previously been needed, due to the ability to produce more methane, but for a manufactured energy vector such as hydrogen, big stores are essential.

[1] https://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2019_01_Just_Transition.pdf
[2] https://www.sccs.org.uk/images//expertise/reports/working-papers/EV_SCCS_2020-02_CCS_in_a_just_green_recovery.pdf
[3] https://blogs.ed.ac.uk/hystorpor/

Energy-from-waste plants are expected to be eligible for support under the government's industrial carbon capture business models. The NEWEST-CCUS[4] project is a three-year project to assess the scale of the European market for CCUS technologies in the waste-to-energy sector; it also explores the sector's potential for cumulative CO_2 removal from the atmosphere. The findings of this project are likely to be useful for the Commission.

What evidence do you have on the barriers to converting the existing gas grid to hydrogen, installing heat pumps in different types of properties, or rolling out low carbon heat networks? What are the potential solutions to these barriers?

There remains a lack of clarity on the regulatory regime for hydrogen in the gas grid. The government, in its Hydrogen Strategy, has undertaken to review the Gas Act 1896 and gas quality standards, but it is not clear when this will be complete, or when any new or amended legislation will be proposed. We set out a number of issues with the regulatory regime for hydrogen in requested evidence to the BEIS Committee in 2018[5].

Installation and maintenance of hydrogen appliances will, at minimum, require a programme of upskilling and training for existing gas services engineers.

What are the main barriers to delivering the carbon capture and storage networks required to support the transition to a net zero economy? What are the solutions to overcoming these barriers?

The main barriers to delivering CCS networks are financial, rather than technical. The government is developing proposals for business models to provide revenue support for CCUS projects. However, it is not clear whether these will be available to any CCUS project, or only those that are in Track-1 of the cluster sequencing programme. If the latter, then there is a significant risk of delay to the UK's most advanced CO_2 storage project – Acorn[6] – which forms part of the Scottish Cluster[7], which currently has reserve cluster status.

Domestic transport of hydrogen and CO_2 is likely to include pipeline, ship, road and rail transport. Cross-border transport will also be important, by ship or pipeline: for hydrogen, for example, the Scottish government has ambitions to become an exporter of hydrogen; whereas for CO_2, the UK is likely to offer a storage service for other countries.

Permanent, secure CO_2 storage will be in offshore geology, either in depleted oil and gas fields or saline aquifers. There may also be a need for temporary onshore storage of CO_2.

The HyStorPor[8] project is examining the potential for hydrogen storage in porous rocks; this could complement existing hydrogen storage capacity in salt caverns, both in terms of greater storage volume, and the availability of storage in a wider range of geographical locations.

[4] https://www.newestccus.eu/about-project
[5] https://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_10_BEIS_CCS_Inquiry_requested_evidence.pdf
[6] https://theacornproject.uk
[7] https://www.thescottishcluster.co.uk
[8] https://blogs.ed.ac.uk/hystorpor/

The Scottish Net Zero Roadmap[9] project covers 80% of industry in Scotland, and includes concept engineering of decarbonisation options including hydrogen, electrification, CCUS, and the infrastructure that supports them.

The STRATEGY-CCUS[10] project provides a blueprint for planning CCS networks to decarbonise industry and energy, with case studies from eight regions in Southern and Eastern Europe. Building on this, the PilotSTRATEGY[11] project aims to advance understanding of deep saline aquifers for geological CO_2 storage in five of the regions.

Scottish Carbon Capture & Storage

Scottish Carbon Capture & Storage (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.

[9] https://snzr.co.uk
[10] https://www.strategyccus.eu
[11] https://pilotstrategy.eu