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Clean Growth: Transforming Heating

SCCS Response to BEIS consultation

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Clean Growth: Transforming Heating

1 Introduction

SCCS is pleased to have the opportunity to comment on Clean Growth: Transforming Heating[1]. We agree with the report's finding that technologies using electricity, hydrogen and bioenergy all have the potential to make important contributions to the transition to low carbon heating. We welcome the report's commitment to delivering the actions in the CCUS Deployment Pathway Action Plan[2].

However, we are concerned that the report does not adequately consider the regulatory issues around use of hydrogen in the gas grid, and the urgency of making changes to legislation (specifically the Gas Safety (Management) Regulations and the Gas (Calculation of Thermal Energy) Regulations) to enable gas network companies to allocate funds for hydrogen conversion and blending in the next control period.

2 Responses to consultation questions

In this response, we address consultation questions (a), (b) and (d).

2.1 Do you agree that we have identified the most important issues to be addressed as we develop our thinking? Do you consider that there are important omissions?

We welcome the recognition of the key role of carbon capture and storage (CCS) in delivering hydrogen in bulk. This reinforces the importance of timely delivery of the actions in the CCUS Deployment Pathway Action Plan. It is also likely that increased reliance on electricity across the energy system would also be likely to need some peaking fossil fuel generation with CCS.

We are also pleased to see that the report distinguishes between carbon capture technology and carbon dioxide transport and storage infrastructure – this shared infrastructure will be crucial to support industry in a low carbon economy, and to enable the production of bulk hydrogen for use in heat and transport.

2.1.1 Strategic decision making

The report states that "the role of strategic decision making and planning in enabling the most cost-effective outcomes will need to be assessed." We consider that strategic decision-making and planning is **crucial** to an effective transition in heating. Use of hydrogen in the gas network, for example, will require new facilities for production, and for transport and storage both of hydrogen and of carbon dioxide (CO_2): these are strategic national land use planning issues. Furthermore, incentives and measures for development of low-carbon heat must align with, and complement, incentives and measures to encourage the deployment of CCS. The message from the Committee on Climate Change in response to the publication of CCUS deployment pathways is that action to

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/766109/decarbonising-heating.pdf
[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/759637/beis-ccus-action-plan.pdf

deploy CCS in the UK needs to be accelerated[3]. In the light of this urgency, and the Oxburgh report[4] on the role of CCS in lowest cost decarbonisation, we would say that the case for strategic decision making and planning has been made.

2.1.2 Hydrogen

The report appears to focus on the physical changes to the gas grid that would be necessary to enable the use of hydrogen for heating, either as part of a blend with natural gas or as 100% hydrogen. However, the report fails to address the pressing issue of the Gas Safety (Management) Regulations (GSMR) and Gas (Calculation of Thermal Energy) Regulations (CoTER), which control how much hydrogen can be incorporated into the gas supply. Government action is required in order to alter these regulations, and this needs to happen urgently to allow gas networks to allocate funds for hydrogen blending and conversion in their control period bids for 2021-2026 spending, which will become settled in late 2019.

The report states that "the prevalence of the gas grid presents a particular challenge to the UK in enabling the necessary shift to low carbon heat." We would argue that the prevalence of the gas grid is in fact an opportunity, since there is potential to repurpose the existing gas distribution network for transporting hydrogen, avoiding the need to build new infrastructure. Conversion to hydrogen is an opportunity to benefit from the significant sunk investment since 2000 through the Iron Mains Risk Reduction Programme.[5]

The report states that "electrification requires changes to all gas appliances […] hydrogen would also require replacement of all appliance". Our understanding is that it may be possible to adjust gas boilers to run on hydrogen, or a hydrogen blend, whereas electrification would require the replacement of gas appliances and wet heating systems.

2.1.3 Decarbonisation of industry

We agree with the statement that "A combination of technologies will be required to achieve deep decarbonisation of industry". Principal among these is CCS: as the report states, CCS would prevent the emissions from fossil fuels used in industry reaching the atmosphere, and enables the bulk production of hydrogen, which can be used as an alternative fuel in some applications. Not mentioned in the report is the role of CCS in removing CO_2 from process emissions which would exist regardless of the fuel used to provide heat: for example, around half of emissions from cement production are from the calcination of limestone[6].

2.2 Do you have any comments on the types of actions identified to meet these challenges? Do you have any other suggestions?

We welcome the commitment to developing a framework to support the decarbonisation of heavy industry, particularly the commitment to progressing the actions in the CCUS Deployment Pathway Action Plan, and to delivering the Clean Growth Grand Challenge Mission to establish the world's first net zero carbon industrial cluster.

We also welcome the commitment to consult on the Industrial Energy Transformation Fund. When this fund was announced in the 2018 budget, it appeared to be solely about energy efficiency, but it is clear from the Intergovernmental Panel on Climate Change that energy efficiency alone will not be enough to reduce industrial emissions consistent with the Paris Agreement: "in industry, emissions

[3] https://www.theccc.org.uk/2018/11/28/ccc-welcomes-governments-recommitment-to-carbon-capture-and-storage-te chnology/
[4] http://www.ccsassociation.org/news-and-events/reports-and-publications/parliamentary-advisory-group-on-ccs-report/
[5] For more detail, see http://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_10_BEIS_CCS_Inquiry_requested_evidence.pdf
[6] http://www.zeroemissionsplatform.eu/news/news/1601-zep-publishes-key-report-on-ccs-in-eu-energy-intensive-industries.html

reductions by energy and process efficiency by themselves are insufficient for limiting warming to 1.5°C with no or limited overshoot (high confidence).”[7] We would welcome a widening of the remit of the fund to cover all viable measures to reduce industrial emissions.

We welcome the commitment to developing a new policy framework for hydrogen for heat. We agree that the priorities identified are important, but in addition there needs to be action to reform the legislation that governs the gas mix. We recommend that this be taken up as a priority piece of work, in order to align with the investment timescales of the gas network operators.

2.2.1 Negative emissions

We are pleased that the report recognises that biogas combined with CCS could deliver ‘negative emissions.’ Applying CCS to existing biomass plants and other sources of biogenic CO_2 such as anaerobic digestion and fermentation would be a ‘quick win’ for the delivery of negative emissions. SCCS has carried out research on existing sources of significant biogenic CO_2 emissions in Scotland (including anaerobic digestion and landfill), which estimates total biogenic emission of 3.6MtCO_2/yr. The report suggests that there is the potential for negative emissions of 2.1 MtCO_2/yr from capturing and storing CO_2 from the larger sources where capture might be practical.[8]

Despite this potential for significant emissions reductions, there is currently no incentive for negative emissions: the CCC recommends, among other measures to ensure the most effective use of biomass, that “BEIS and HMT should develop support schemes (including carbon pricing) to ensure that removing CO_2 from the atmosphere and storing it for long time periods is valued alongside emissions reductions.”[9]

2.2.2 Buildings Mission

The report references the Buildings Mission, funded through the Transforming Construction Industrial Strategy Challenge Fund. We suggest that this Challenge should include the development of low-carbon building materials – for example cement and steel produced with CCS, or aggregates produced by mineralisation of waste CO_2 – and an exploration of the measures (such as through public procurement) needed to drive uptake of these materials in preference to materials produced with unabated emissions.

2.3 Do you have any views on priorities for further development and proving of emerging technologies with clear potential to provide strategically important options and benefits in relation to decarbonising heating? Please provide supporting argument for your views.

The report states that “beyond a certain point, reducing emissions from hydrogen production processes based on methane reformation with carbon capture and storage is likely to be practically very challenging, given current limitations to cost-effective carbon capture rates and the potential for supply chain emissions, for example from methane leakage.” Although CO_2 capture rates tend to be modelled at 90% in most integrated assessment models, higher capture rates are possible: a forthcoming report from the International Energy Agency Greenhouse Gas R&D Programme

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[7] Intergovernmental Panel on Climate Change (2018) *Special Report on Global Warming of 1.5°C. Summary for policymakers*, page 21 http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf
[8] Brownsort, P (2018), *Negative Emission Technology in Scotland: carbon capture and storage for biogenic CO2 emissions*, http://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_08_Negative_Emission_Technology_in_Scotland.pdf
[9] Committee on Climate Change (2018) *Biomass in a low-carbon economy*, https://www.theccc.org.uk/wp-content/uploads/2018/11/Biomass-in-a-low-carbon-economy-CCC-2018.pdf

(IEAGHG) suggest that capture rates could be increased to 99%, with a cost increase of around 5%.[10] In our evidence to the Business, Energy and Industrial Strategy Committee's inquiry on CCUS, we began to address the issue of "cost-effectiveness" of CCS by considering the metrics that could be used to make comparisons; a key message is that any assessment of costs depends strongly on the counterfactual against which costs are compared[11].

The report states that "Substantial investment in inter-seasonal hydrogen storage via salt caverns would be cost-optimal as it reduces the investment in methane reformation plants required." Storage of hydrogen underground is well established in caverns of halite (salt). A recent ETI report estimates that six sub-surface salt caverns in a deep field could store 0.5 TWh of hydrogen[12], which is comparable to the entire UK gas network linepack storage capacity. However, in the UK, suitable salt cavern geology is only found in Teesside and Cheshire, which would entail long and costly transport to consumers elsewhere in the country. Therefore, large-scale seasonal geological storage of hydrogen will need to be in subsurface porous formations with suitable geological traps and seals, such as depleted oil and gas reservoirs. If storage could be achieved locally, in porous sandstone rocks, then de-centralised local storage of large tonnages from renewable electricity, close to users, could be rapid and cost effective to develop and deploy. Hydrogen storage in deep geological formations has significant potential to deliver both the capacity and local positioning. Heinemann, Wilkinson and Edlmann at Edinburgh University[13] undertook an assessment of the potential for storage of hydrogen in porous subsurface formations within the Midland Valley of Scotland and concluded that there are suitable and sufficient sedimentary deposits of the Midland Valley that will make suitable hydrogen storage sites.

SCCS partner institutions have received the UK's first research award from EPSRC to investigate the fundamental science of enabling massive hydrogen storage at interseasonal scale, in deep subsurface sandstone geological media, dispersed around the UK. The overarching vision of the HyStorPor (HYdrogen interseasonal STORage in POROus rocks) project is to address the fundamental question of whether seasonal subsurface hydrogen storage can be efficient, with minimal losses between storage and withdrawal. The project will use state-of-the-art experimental investigations, up-scaled to the storage reservoir, coupled with public engagement, to set the scientific foundation for hydrogen storage and thus increase the possibility of a low/zero-carbon version of our current hydrocarbon-based energy system. HyStorPor is a collaborative project between the University of Edinburgh, which has substantial international expertise in geological storage and experimental investigations; Robert Gordon University (Aberdeen), international leaders in social acceptability understanding; Imperial College London, which has world-leading expertise in experimentation, imaging and fluid modelling; and Heriot-Watt University (Edinburgh), which has international expertise in upscaling and reservoir modelling.

Integral to the HyPorStor project is engagement with the public sector, academia and industry. Previous research by the HyStorPor team[14] into the relationship between energy infrastructure and the environment in fields such as CCS and nuclear indicates a breadth of ethical and cultural factors that inform stakeholder and societal responses. The HyStorPor project will elaborate what hydrogen storage means for the lived experience of the low-carbon transition, specifically on the immediate effect of technologies on the built environment, and the role of hydrogen storage in a just and managed low-carbon transition.

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[10] Source: IEAGHG webinar on the Paris rulebook, 10 January 2019.
[11] See SCCS WP 2018-06, http://www.sccs.org.uk/images/expertise/reports/working-papers/WP_SCCS_2018_06_Evidence_to_BEIS_Committee_on_CCUS.pdf
[12] https://d2umxnkyjne36n.cloudfront.net/insightReports/3380-ETI-Hydrogen-Insights-paper.pdf?mtime=20160908165800
[13] Heinemann N., Booth M., Haszeldine S., Wilkinson M., Edlmann, K., Scafidi J. 2018. Hydrogen storage in porous geological formations - Onshore play opportunities in the Midland Valley (Scotland, UK). Journal of Hydrogen Energy. https://doi.org/10.1016/j.ijhydene.2018.09.149
[14] Mabon, L., Shackley, S., 2015. Meeting the Targets or Re-Imagining Society? An Empirical Study into the Ethical Landscape of Carbon Dioxide Capture and Storage in Scotland. Environmental Values 24, 465–482.