

SCCS submission

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SCCS response to Energy and Climate Change Committee inquiry into 2020 renewable heat and transport targets

1 Identification

Scottish Carbon Capture & Storage (SCCS) is the largest Carbon Capture and Storage (CCS) research group in the UK. Our internationally renowned researchers work across the full CCS chain. Founded in 2005, we are a partnership of British Geological Survey, Heriot-Watt University, University of Aberdeen, the University of Edinburgh and the University of Strathclyde working together with universities across Scotland. SCCS is funded by the Scottish Funding Council.

2 Executive Summary

- The UK trajectory for decarbonisation has been predicated on the creation of very low-carbon electricity by 2030 and subsequent electrification of heat and transport. This seems increasingly unlikely to be delivered on time due to the very slow progress of CCS, slow progress on nuclear, uncertainty in future renewable electricity growth and underperforming demand reduction measures.
- In the UK, heat demand from gas supplies is about three times that of electricity demand. It is proposed that the UK should examine decarbonised heat much more closely. Instead of using electricity, heat can be provided by hydrogen. The least cost method of industrial hydrogen production is from gas or coal sources. Both these methods are very well proven. But both require CO₂ capture at centralised sites, which could commence at industrial complexes, such as Grangemouth or Teesside, and transport to secure storage sites.
- These transport networks can be synergistic with CO₂ transport to storage from industrial and power CCS projects. Hydrogen can be distributed locally through existing urban pipe networks where these have been upgraded to high standards. To enable this to operate as a market, the Renewable Heat Incentive needs to be adapted to admit heat derived from decarbonised fossil fuel, and not limited to renewables.

3 Context

3.1

Following the cancellation of the UK's Carbon Capture Storage (CCS) Commercialisation Programme in November 2015, CCS is extremely unlikely to contribute to UK decarbonisation of electricity by 2020. Furthermore, CCS is not a renewable technology eligible to contribute towards renewable targets, albeit that it might be applied to European Union 2030 renewable targets via the generation of power and heat from biomass and production of biofuels integrated with CCS (jointly referred to as bioenergy CCS).

3.2

However, CCS has a key role in retaining the option for fossil fuelled electricity generation in a low-carbon world and the currently untapped potential for decarbonising heat through combined heat and power and hydrogen, and decarbonising industrial processes. As such, we focus our response on **Question 3** and **Question 4** and consider the options beyond 2020.

4 To what extent is electrification of heat and transport a viable approach up to 2020 and beyond?

4.1

Electrification of heating and transport to decarbonise these sectors is reliant both on the decarbonisation of electricity generation and a substantial increase in low-carbon generation capacity – from renewables, nuclear, or CCS on fossil fuels. At present, delivery of all of these generation options at sufficient scales pre-2020 is very unlikely, and post-2020 is uncertain.

4.2

For transport, electrification appears to have current momentum but to cover all transportation will require the nationwide development of an immense network of charging stations and an expansion in the numbers and types of electric vehicles, from passenger cars to large freight vehicles. This will also require an unprecedented strengthening to add 20-50% to electrical grid delivery. It is not clear that this new infrastructure request has undergone a detailed costing or evaluation. Alternatively, biofuels might have a significant supporting role. It is clear that biomass is, and will be, in short supply globally to solve all aspects of the energy transition. Realising the full value of biofuels is the potential to combine their production with CCS leading to a zero or negative emissions fuel. The Archer-Daniels Midland bioethanol plant in Illinois, US, is fitted with CCS and is currently capturing and injecting up to 1 million tonnes of CO₂ per annum. Similar bio-refineries could be developed in the UK and EU.

4.3

Electrified transport may be able to have charging cycles optimised to draw power at lower periods of demand. However, the peak for heating demand is about three times that of electricity and only a part of that heat demand can be managed by shifting it to occur during off-peak renewable generation – in daily cycles (evening and morning peak heat demand), which might be addressed through electricity/heat storage. Here, CCS power generation, especially on gas, has the potential to provide a rapid response for low-carbon electricity that can backfill demand when renewable generation is low but demand is high for sustained periods (e.g. winter high pressure weather systems leading to minimal wind power across north west Europe¹). Additional heat vectors, such as hydrogen, could be stored to backfill heat demand when needed.

4.4

An alternative to the electrification of heating is the conversion of heating systems from natural gas to hydrogen. There is clear potential to decarbonise domestic and industrial heat using hydrogen as vector in certain regions, such as central Scotland and northern England. Two key positive points are, firstly, hydrogen processes and transport are well understood and already exist at industrial scale; secondly, the network of pipes to distribute hydrogen at low pressure within urban settings is believed to exist in some areas following the upgrading of the methane gas distribution grid. Thus a readymade local infrastructure already exists. The supply of hydrogen at commercial scale could be most rapidly provided from fossil fuels. The cleanest and most effective hydrogen supply with the lowest lifecycle emissions and lowest cost is the centralised conversion of natural gas to hydrogen by steam methane reforming. This is a well-established industrial process in petrochemical plant, which generates a high-concentration CO₂ waste stream that can be captured and stored via CCS. This results in a full-chain, low-carbon heat system. Carbon dioxide separation on hydrogen production with secure storage exists at industrial scale at two refinery facilities in North America (Air Products, Texas, US, where a second plant is being built, and Shell Quest, Alberta, Canada), and is under consideration at the UK BOC hydrogen production plant as part of the Teesside Industrial CCS cluster. In one case this is coupled to the sale of CO₂ for CO₂-Enhanced Oil Recovery as an income generation stream. As an alternative, new gasification plant using coal as a low-cost energy source could be constructed at Grangemouth (a development that DECC has provided design funding for) or at Teesside.

4.5

Industrial processes frequently require higher temperature input than domestic/commercial space heating. Here, combined heat and power is often the most effective and efficient option but one that remains a source of emissions unless the CHP facility can be fitted with CCS. Clusters of industry represent an opportunity to apply CCS across a range of emissions sources that can share transport infrastructure and, potentially, CO₂ processing facilities, in a manner analogous to the current sharing of heat across industrial complexes.

¹ See Grant Wilson, *The Conversation*, 2014, for example of demand variations, <https://theconversation.com/energy-efficient-homes-could-help-treasury-balance-the-books-27542>

4.6

Overall, it would be prudent for the UK to examine a wider spectrum of options for low-carbon transport and heat rather than solely focus on electrification. The electrification-only approach will be vulnerable to a dependency on the delivery of sufficient low-carbon electricity to meet increased demand. Here, we note the current uncertainty around new nuclear in the UK. Any failure of delivery and a possible higher carbon grid intensity – due to capacity replacement with unabated gas – could have a significant knock-on effect on the decarbonisation of multiple sectors, including heating and transportation

5 What are the challenges (regulatory, technological, behavioural and others) to decarbonising heat and transport over the longer term and how might these be overcome?

5.1

Currently, the UK Government has not presented a clear perspective on priorities with respect to the post-2020 decarbonisation of heat and transport. Following the imminent setting of the Fifth Carbon Budget, there will be an urgent need for the government to outline sectorial decarbonisation ambitions and present policies and corresponding investment support for their implementation. This is critical to rebuilding investor confidence following a period of reduction in or cancellation of support for both low-carbon energy sources, including renewables and CCS, and programmes to improve end-user efficiencies.

5.2

CCS has been assessed multiple times, including by the Committee on Climate Change in its recent Fifth Carbon Budget advice, as a crucial means of underpinning economy-wide decarbonisation through the decarbonisation of fossil fuel power generation; decarbonising heating; addressing industrial emissions; and potentially providing net negative emissions by combining with biomass to offset emissions which are difficult to directly mitigate.

5.3

In the absence of CCS, full decarbonisation of heating and transport consistent with the UK's Climate Change Act 2008, and the recently agreed ambition for net zero emissions in the UNFCCC Paris Agreement which UK ministers have endorsed, will likely be extremely difficult and costly to achieve.

5.4

To enable hydrogen delivery as a low-carbon heat vector, it is important that the Renewable Heat Incentive be adapted to include low-carbon heat originating from gas or coal sources, for instance through the application of CCS.

5.5

Provision of CCS requires government action to support delivery of CO₂ transport and storage infrastructures, connecting clusters of industrial emissions and demand for low-carbon heat to offshore CO₂ storage. This can be realised at least cost in the near term through re-use of existing oil and gas facilities (pipeline, platform and boreholes). Decommissioning of offshore infrastructure will increasingly reduce the opportunities for this cost-effective and timely delivery of transport and storage infrastructure, resulting in increased costs and further delay to delivery.
