

CCS IN SCOTLAND AND EUROPE: RESPONSE TO THE CONSULTATIVE COMMUNICATION ON THE FUTURE OF CCS IN EUROPE

Introduction: Scotland's contribution to the future of CCS in Europe

Scotland's view on the need for Carbon Capture and Storage (CCS)

Development of CCS is a key priority for the Scottish Government and Scottish Enterprise, based on the evidence that without CCS, renewable energy and carbon reduction targets are unlikely to be met¹. As noted in the CCS Consultative Communication, over 80% of global primary energy use is fossil fuel based and fossil fuels will remain important in the global energy mix for the foreseeable future.

With this in mind, the Scottish Government is clear in its view that we need clean thermal generation to help play its part in security of supply, reducing emissions and to allow use of natural resources, while continuing to expand and develop the renewable resources that we have. Indeed, CCS is required to meet Scottish Government targets for renewable energy² since fossil fuels – particularly gas – are expected to play a significant role in facilitating the desired levels of renewables penetration. Scotland's draft Electricity Generation Policy Statement³ recognises the need for a minimum of 2.5 GW thermal capacity.

At UK level, modelling by the [Energy Technologies Institute](#) estimates that without CCS, the cost of delivering a low carbon energy mix in 2050 would increase by £42bn per year. In the UK context 35GW of electricity capacity in the UK is due to close in the next decade, making this a crucial point to ensure a new generation of plants is CCS-ready.

In addition, as recognised in the European Commission Communication setting out an Energy Roadmap 2050, there is an increased need for CCS in the Industrial Sector. This will be increasingly important in avoiding carbon leakage and retaining jobs in Europe in CO₂ intensive industries, as the future price of carbon abatement rises.

The opportunity for Scotland

The economic opportunities from the development of CCS are considerable – it is estimated that the CCS market could generate more than £2bn in GVA and create more than 13,000 jobs in Scotland by 2025.

Coupled with Enhanced Oil Recovery, which is a commercial opportunity much stronger in the Central North Sea than elsewhere, the CCS industry could generate billions in additional tax revenue (initial estimates suggest up to £9bn) for Government over a number of decades.

Scotland's contribution to the future of CCS in Europe

Scotland has significant strengths: the North Sea offers huge capacity as natural and effective storage facilities for CO₂ in depleted hydrocarbon reservoirs and saline aquifers (as outlined below and in the enclosed recent report by Scottish Enterprise on a Central North Sea CO₂ Storage Hub); the presence of the 40 year old oil and gas industry with relevant skills and expertise, including companies such as Doosan Power Systems, Wood Group and Mott MacDonald with expertise in this area; world leading industrial research and academic institutions; and support from government and agencies.

¹ Scottish greenhouse gas emissions reduction targets are set at 42% by 2020 and 80% by 2050

² 100% gross annual electricity demand from renewables, at least 11% renewable heat and 10% in the transport sector by 2020

³ [Draft Electricity Generation Policy Statement for consultation](#) (March 2012)

Scotland is also engaged in the demonstration of full chain CCS at scale, including on an existing gas power station at Peterhead, Aberdeen. This project was ranked in the Reserve List in the first round of calls for the European Commission's NER 300 mechanism. The Captain Clean project in Grangemouth pursues full chain, commercial demonstration on a coal-fired plant. Further information on both projects is included in Annex.

Such projects provide crucial learning for the development of the sector, as shown by the Scottish Power led CCS demonstration project at Longannet Power station. The decision was taken by the UK Government and the Scottish Power consortium on 19 October 2011 not to proceed with the Longannet project as, despite all parties working extremely hard, a satisfactory deal for the UK's first CCS demonstration project could not be agreed.

Although this project did not succeed in bringing about the UK's first demonstration project the lessons learned⁴ have been absorbed worldwide and have contributed significantly to the on-going development of CCS. The FEED study completed for Longannet has yielded invaluable knowledge in areas such as cost, design, end-to-end CCS chain operation, health and safety, environment, consent and permitting, risk management, and lessons learnt. The complete FEED study has been published and made available to the worldwide CCS community to inform the decisions made on subsequent projects.

The Scottish Government believes that multiple, commercial scale CCS projects are required in the UK if there is to be a viable and vibrant CCS industry that can help us meet our challenging emissions reduction targets. We welcome the announcement from DECC that the Peterhead CCS project is a preferred bidder in the UK Government [CCS Commercialisation Programme](#) – the only entrant that involves gas combustion – but other projects like the Captain Clean Energy Project (and the other projects in England outside of the CCS Competition process) must be incentivised to proceed to Final Investment Decisions. The key incentive at UK level will be an appropriate level of operational support through a Contract for Difference as part of the UK Government's Electricity Market Reform process.

⁴ [UK CCS Demonstration Competition – Lessons Learned Report](#) (April 2011)

Responses on the future EU framework for CCS

Policy & regulatory measures

It is clear that whatever policy decisions are taken must be taken quickly for the CCS industry in Europe to succeed. Decisions must be made now in order for CCS to be deployed in sufficient amounts to meet the climate goals by 2030.

It is clear that current EU policies have not delivered CCS and there remains an urgent need to deploy across Europe. The development of an effective and clear regulatory regime that provides environmental protection without stifling innovation is one of the most important steps to enabling CCS.

The EU Emissions Trading Scheme (ETS) alone will not drive the development of CCS in the timeframe needed to meet CO₂ emissions targets. As suggested in the consultation document, we believe that some other form of operational support mechanism should be considered across Europe. Suggestions include;

- A mechanism such as the UK feed-in tariff with Contracts for Difference being developed as part of the UK Electricity Market Reform process.
- Establishment of a CCS fund with the sole objective of delivering an EU CCS programme. Key to this should be the strategic selection of projects that deliver CCS at scale and assurances that CCS equipped power plant will be dispatched over the lifetime of the project to ensure sufficient return.
- Certificates for CCS is also an option worth progressing and subject to the details of design may prove a successful mechanism in moving CCS forward in Europe.

It is important to view the commercial deployment of CCS within the context of the post-2020 EU Energy and Climate Change Framework and how policy and measures can be shaped to act as an appropriate incentive for CCS. While analysing the current 2020 package, the elements of success should be recognised. It is irrefutable that having both legally-binding targets for greenhouse gas reduction and increasing the share of renewable energy have sent clear signals to major emitters to invest in low carbon technologies.

The overabundance of allowances in the ETS and the subsequent lack of a sufficiently high carbon price to incentivise a shift to more low carbon technologies and practices have shown that the market is not yet mature enough to be led simply by a greenhouse gas reduction target alone.

In general, technology strategy should be shaped by the economic opportunity and potential for job creation. It is necessary to accommodate the full supply chain and potential for manufacturing and construction opportunities to maximise the economic advantage for Europe from increased penetration of low carbon energy technologies.

Appropriate governance structures are important at EU level to ensure progress in a coordinated plan for CCS demonstration and deployment. These must facilitate real cooperation and strong commitment from the public, private and academic sectors. Some areas will be taken forward by Government (regulatory framework and financing of early projects for example) while others will be driven largely by the private sector, such as development of future projects and supply chain opportunities, with help from the public sector as appropriate.

Major barriers to be addressed

A major issue is the level of risk and understanding of technology. This is a new industry emerging around a set of new technologies and market drivers. In that context, a supporting financial

infrastructure has to be developed alongside and in parallel with the industry. There is a need for continual development and updating of the evidence base for CCS, including on its economic impacts.

In terms of financing, funding for demonstration projects will initially need to come largely from public sources. In time, a business model for CCS should emerge when the technology is deemed viable and when the costs of CCS implementation fall, or the carbon price under the ETS rises, to the point that investment by the private sector is forthcoming. However it is clear that the relatively early stage of the technology, along with current uncertainties around issues such as carbon prices and liabilities, means that public sector support will be required to help incentivise demonstration projects.

As well as finance, the main factors that will encourage the development of CCS include the creation of a supportive regulatory and commercial environment that drives investment, political support and appropriate incentives along with public acceptance of CCS as a technology.

The Scottish framework for CCS

The Scottish Government is already taking action to promote this agenda. A decarbonisation target of 50g CO₂/kWh by 2030 – in line with independent advice from the UK Committee on Climate Change – is contained within Scotland's revised Offshore Wind Route Map⁵ and also in the Scottish Government's draft second report on proposals and policies (RPP2)⁶ to meet overall emissions targets. To put this in context, 2010 emissions from electricity grid activity in Scotland were estimated to amount to 347g of CO₂ /kWh of electricity generated.

Important elements required to achieve the 2030 electricity decarbonisation target include:

- Increased interconnection and transmission upgrades capable of supporting projected growth in renewable capacity;
- Demonstrating carbon capture & storage (CCS) at commercial scale in Scotland by 2020, with full retrofit across conventional power stations thereafter by 2025-30; and
- Demand management (with a 2020 target to lower final energy consumption by 12%).

A Scottish Government Roadmap for CCS makes the commitment, once the technology is proven viable, to introduce a requirement for all new build coal plants from 2020 to be fitted with 100% CCS from the outset as well as retrofitting full CCS to those coal plants built between now and 2018.

Scottish Government policy on CCS is clearly defined and is outlined in our draft Electricity Generation Policy Statement⁷, to be finalised in summer 2013. In summary, the building of any new thermal-based stations above 50 MW requires consent from Scottish Government Ministers under section 36 of the Electricity Act 1989⁸. We made the following announcement in November 2009:

- From 9 November 2009, any application for a new coal plant in Scotland will need to demonstrate CCS on a minimum of 300MW (net) of capacity from their first day of their operation;
- Further new builds from 2020 will be expected to have full CCS from their first day of operation;
- A 'rolling review' of the technical and economic viability of CCS will take place by 2018 looking specifically at retro-fitting CCS to existing coal plants, with the likelihood of having existing plants retro-fitted by no later than 2025; and
- If CCS is not proven to be technically or financially viable then we will consider low carbon alternatives which would have an equivalent effect.

⁵ [Offshore Wind Route Map](#) (January 2013)

⁶ [Draft Second Climate Change Report on Proposals and Policies](#) (June 2013)

⁷ [Draft Electricity Generation Policy Statement for consultation](#) (March 2012)

⁸ [UK Electricity Act](#) (1989)

This policy relates to coal stations only. The Scottish Government's position on gas, oil and thermal stations is that for stations over 300 MWe, applicants will have to demonstrate that any new applications demonstrate carbon capture readiness.

The governance structure on CCS at Scottish level includes an Industry Leadership Group is in place for thermal generation and CCS, which advises the Scottish Government and its Enterprise Agencies on common strategy and helps ensure a strong evidence base with clear allocation of roles across public/private sectors.

Research & Innovation priorities

Cost reduction is of course a key driver for future research. The CCS Cost Reduction Taskforce, a joint industry taskforce initiated by the UK Government Department for Energy and Climate Change, reported⁹ recently that the cost of CCS could compare with other forms of low carbon technology by the 2020's and also outlined a clear series of actions required to achieve that aim (a cost approaching £100/MWh by the 2020's). It is clear that continued research, innovation and development along the full CCS chain are crucial to realising that ambition.

Enhanced Oil Recovery must be considered as an option for significantly reducing the cost of CCS. A report¹⁰ commissioned by Scottish Enterprise showed that, in Scotland alone, the value of EOR is put at £2.7bn GVA resulting in 5300 person years project employment and is based on 0.8GT of CO₂ being injected into wells to produce another 2.5Bn barrels of oil.

Technology strategy should not only address the development of capture technologies, but must cover the whole CCS chain. This should include infrastructure requirements such as the technical feasibility of using existing pipelines for CO₂ transport to offshore storage sites. Increased focus should be placed on promoting innovation to facilitate supply chain diversification from oil and gas to CCS.

While the focus is on power generation and coal stations initially, CCS will need to be developed in other areas, not only in other thermal generation types such as gas but also for other industrial processes such as the production of cement and iron and steel.

The EU Energy Roadmap 2050 recognised the need to develop CCS on gas technology, yet current initiatives at the centre of the EU's energy strategy – notably the NER 300 financing mechanism and the Energy Infrastructure package – discriminate against CCS on gas in their design, which is focused on coal plants. This is in spite of the fact that there are larger numbers of gas fired power stations in planning or likely to be constructed in future than coal stations across the EU. It is essential that the future EU framework for CCS as part of the proposed 2030 climate and energy package, gives clear financial support to ensure that CCS is demonstrated at commercial scale on gas power stations, to allow widespread deployment before 2030.

Through accumulation of experience, learnings from a series of small power plant and industry projects could reduce costs faster than one big project. Such an approach would be facilitated by the establishment of a CO₂ storage hub around which diverse projects could be connected.

Sharing of knowledge and learning from early demonstration projects should be encouraged wherever possible, especially when public funding of demonstration projects is involved.

⁹ [CCS Cost Reduction Task Force – Final Report](#) (May 2013)

¹⁰ [Economic impacts of CO₂-enhanced oil recovery for Scotland](#) (October 2012)

Infrastructure development

Scotland welcomes the inclusion of a CO₂ transport and storage network among the European Commission's proposed priority areas in the Trans-European Energy Network Guidelines tabled in October 2011, and the intention to support CO₂ infrastructure development through the Connecting Europe Facility. Scotland also supports the inclusion of CCS transport and storage infrastructure in the focus areas of the Horizon 2020 programme. This recognises that it is essential that the required infrastructure for CO₂ transport and storage is developed alongside the capture technology.

As mentioned above, a hub approach – seeking to look at the potential of developing networks based around large scale emitters, possibly on a wide geographical basis – will be beneficial in accelerating development and bringing down costs.

In addition there should be a focus on usage of existing infrastructure, such as pipelines, if this is technically possible. This has an implication for decommissioning activity and it will be important to consider what options for CCS might be available before any such activity gets underway.

The EU Energy Infrastructure package should also recognise the further need for supporting infrastructure initiatives related to CCS activities such as port capacity for the importation of CO₂ from across Europe for key potential storage sites such as Scotland.

A recent report¹¹ from Scottish Enterprise details the opportunity for a CO₂ storage hub in the Central North Sea to receive and store as much as 100 million tonnes of CO₂ a year by 2030 and 500 million tonnes a year by 2050 – equivalent to 25 per cent of total EU emissions in 2007 – if all opportunities are effectively exploited.

Following on a ground breaking “Dry Run” study led by the Scottish Government and the [Global CCS Institute](#) on the consenting and regulatory frameworks for a hypothetical large scale CCS demonstration project, Scotland will now work with a CCS Regions Network of European partners in the North Sea area to widen the exercise to consider CCS chains involving cross-border transport.

The offshore siting of the CO₂ storage hub solution mitigates public opposition to CCS, which is apparent in some European countries.

¹¹ [Central North Sea CCS Storage Hub report](#) (September 2012)

Annex – Summary of Scottish projects

Grangemouth – Captain Clean

CO2DeepStore and Summit Power are currently progressing the design for the Captain Clean Energy Project (CCEP), a full chain CCS project. The planned IGCC power plant will be at the Port of Grangemouth on the Firth of Forth. With full carbon capture, the coal feedstock plant will generate extremely low-carbon electric power and also produce hydrogen gas for commercial use. The carbon dioxide (CO₂) captured will be transported via pipeline to St. Fergus by National Grid Carbon and then transferred offshore for geological sequestration deep underground, beneath the North Sea.

The project has applied for funding from the Department of Energy and Climate Change (DECC) CCS Commercialisation Programme where they are currently on the reserve bidders list. The location provides the benefit of being close to the UK North Sea's most suitable CO₂ storage sites and is enabled by the re-use of existing pipeline infrastructure.

Peterhead

Shell UK Limited and SSE are looking to develop the world's first commercial-scale full-chain gas carbon capture and storage (CCS) demonstration project – the Peterhead CCS Project. Up to 10 million tonnes of carbon dioxide (CO₂) emissions could be captured from the Peterhead Power Station in Aberdeenshire, Scotland and then transported by pipeline and stored, approximately 100km offshore in the depleted Goldeneye gas reservoir, at a depth of more than 2km under the floor of the North Sea.

The proposed Peterhead CCS Project will be a significant step forward in developing CCS technology and helping to decarbonise the UK's power sector. Adding CCS to a gas power plant can reduce CO₂ emissions by more than 90%. In addition, CCS is the only way to collect the CO₂ from heavy industry, such as cement and other industrial facilities.

In November 2012, the joint Government and Industry CCS Cost Reduction Task Force reported that gas and coal power stations equipped with CCS have clear potential to be cost competitive with other forms of low-carbon power generation.

In this way, gas can play a long-term role in the low carbon electricity mix and address the intermittency challenges with renewable forms of energy. The Task Force report also expects that, through CCS clustering, new jobs will be created in the CCS industry by 2030, as well as protecting existing jobs.

Subject to securing the necessary approvals, and with the appropriate commercial arrangements in place, the project is expected to capture in the region of 10 million tonnes of CO₂ during the 10-year life of the project.

In March 2013, the Peterhead CCS Project was chosen as one of two CCS demonstration projects to progress to the next stage of the UK Government's CCS Commercialisation Competition funding. The project is currently in negotiation with DECC over the terms of a proposed FEED study.