

## **BERR Carbon Capture and Storage consultation**

### ***Submission by the Energy Institute***

**September 2008**

### **Introduction**

The Energy Institute (EI) is pleased to make the following submission to BERR's Carbon Capture and Storage consultation. This document is a synthesis of contributions made by EI members through a focus group consultation.

The EI is the professional body for the whole energy industry. It has a membership of over 13,000 individuals and 300 organisations and provides an independent focal point for the energy community, bringing together industry, academia and Government. The EI's purpose is to promote the safe, environmentally responsible and efficient supply and use of energy in all its forms and applications. In fulfilling its purpose the EI can address a wide range of topics in detail, from upstream and downstream hydrocarbons and other primary fuels and renewables, through power generation, transmission and distribution to sustainable development, demand side management and energy efficiency.

As a charity incorporated by Royal Charter with membership across the full range of the energy sector, it is not appropriate for the EI to promote specific technologies or options. Instead we seek to assist the policy process by helping clarify the key issues and by improving the evidence base on which decisions will be made. This submission reflects the views of CCS specialists within our membership and where useful, notes divergence of opinion. Due to the range of expertise within EI membership, not all questions were answered.

### **Key recommendations**

Key points made by EI members on what is a comprehensive and very detailed consultation can be highlighted as follows:

- One significant barrier to development and deployment of CCS technology both in the UK and globally is a lack of financial support for initial demonstration projects.
- Governments need to provide a clear signal of the need for CCS if it is to be rapidly deployed. Some EI members suggest making CCS mandatory within the foreseeable future to be a possible option.
- The UK Government could influence public perception of CCS via objective, fact-based dissemination of information from a trusted source.
- Timely development of robust legislation (such as that discussed in this consultation) could also help to reassure the public that CCS projects will be implemented safely and with due consideration of environmental concerns.
- The UK Government could contribute to dissemination of standards and guidelines for CCS best practice. These could be based on the work carried out by the EI and the Health and Safety Executive that has included sharing best practice and learning from various industry sectors.

- The legislative approach to CCR should not be highly prescriptive, but based on key CCR principles, enabling developers to select the appropriate technology for their specific set of circumstances.
- CCR projects should be subject to feasibility studies that encompass both storage and transport aspects as well as very low-cost, but necessary, modifications to the combustion plant.
- Governments should consider whether it would be more appropriate for the threshold set under Article 32 of the Draft EU CCS Directive to be based on CO<sub>2</sub> emissions rather than electricity output.
- Commitment to Article 32 of the Draft EU CCS Directive should be made by governments at European level unless an alternative approach which ensures that combustion plant developments are CCR is identified and implemented.
- In the absence of such a European-level commitment leading to CCR plants, the UK Government should implement a set of measures that meets the objectives of Article 32.
- Government could consider whether a CCS Authority be set up to complement the work of the Environment Agency and draw on the expertise of a large number of stakeholder bodies. What industry requires is a 'one-stop shop' facility as a focal source of expertise and guidance, whichever organisation it lies with.
- There should be consistency across all CO<sub>2</sub> storage projects in terms of environmental principles.
- The UK Government should commission a study to review options for the development of the transport and storage infrastructure in the UK. This study should build on previous work (such as research previously undertaken by BGS, North Sea Basin Taskforce and Yorkshire Forward) and explore the pros and cons of different options for Government intervention to ensure that an effective infrastructure is developed.
- Offshore storage is a reasonable immediate priority for the UK Government but onshore storage may be important for some projects.

## **Section 1: Fossil fuels: electricity generation and climate change**

*Question 1: We would welcome views on what more the Government might do to promote the development and deployment of CCS technologies in the UK, EU and globally.*

A strong signal from Government that CCS will be required at some point in the foreseeable future is needed for CCS to be deployed as soon as possible. A suggested option by some EI members for governments (in the UK, EU and globally) to send this signal would be a statement that they expect that CCS to become mandatory. If industry is convinced that Government will implement and effectively enforce a mandatory requirement for CCS in the foreseeable future, then this may act as a reasonable proxy for current proposals to require developers to consider CCR, such as the proposed Article 32 discussed in Section 3 of this consultation.

If, however, Government decide that specific CCR legislation is required, it is crucial that the legislation is not highly prescriptive on how CCS might be added to the plant later. Even the technologies closest to commercial deployment are not yet fully mature and significant developments are expected between CCR permitting activities and detailed design and implementation of CCS retrofits. In addition, it is likely that detailed preparations will differ, potentially widely, from site-to-site and between different technologies. Thus, we suggest that any CCR regulation should be based on ensuring that developers implement key CCR

principles. We are concerned that a prescriptive approach to CCR could be counterproductive and, in the worst case, might ultimately impede effective CCS implementation in the future (since developers could be unable to make use of best available technology for retrofit due to unintended consequences of the CCR legislation).

In its response to the 2006 Energy Review, the HSE highlighted a number of areas requiring attention for deployment of CCS<sup>1</sup>. They suggested that these could be “divided into three groups of issues, relating to research, standards, and the existing safety regulatory framework”. The EI has been working with HSE and others to address these and support the development of the required industry competencies for HSE related to CCS. As this work has progressed we have noted the importance of promoting learning between different industry sectors that have not traditionally needed to share lessons and best practice. For example, many of the HSE issues that are new to power utilities considering deployment of CO<sub>2</sub> capture at their sites are already well understood in the industrial gases sector. We expect that Government could have an important role in ensuring that best practice guidelines and standards are used and implemented widely, including across different sectors involved in CCS projects, both within the UK and elsewhere.

Our work with HSE has convinced us that it should be possible to deploy CCS without significant risk to human health or unacceptable risk to the environment (especially when compared to the risks associated with not developing CCS as an option to help mitigate the risk of dangerous climate change). It is likely, however, that the public will need to be reassured that CCS will be developed and deployed responsibly. Government could have an important role in shaping public perception by reassuring the public that an appropriate regulatory framework is being developed and effectively implemented. Where appropriate, it could be important to launch supporting information campaigns via a non-biased channel that the public will trust as they weigh up the pros and cons of CCS development and deployment.

It seems likely that one of the most significant barriers to CCS development and deployment in the UK, EU and globally is currently the lack of financial support for initial demonstration projects. Successful completion of the UK CCS competition to fund a commercial-scale demonstration is important in this context, including sharing lessons learned at all stages of the project development process as soon as possible. For longer term development of CCS, additional support beyond the ongoing competition is likely to be required. For example, a broader range of technologies require support for initial commercial-scale demonstration as soon as possible and Government could play an important role in facilitating (and, if appropriate, providing) additional funding for some of these projects.

It should be noted that the challenge of commercial roll-out of CCS globally is significant partly because of the need to develop supply chains and a skilled workforce to design, construct and operate CCS projects. Since this need for capacity building is urgent if CCS is to be available for widespread commercial deployment from around 2020, it is likely that Government support for a second tranche of early CCS plants will be required (after initial demonstration but before universal roll-out of CCS at all plants). The case for intervention seems to be similar to that made to overcome market failures associated with the development and deployment of renewables, but different mechanisms are likely to be most suitable for CCS projects.

Finally, in the longer term it is likely that national or international action to require deep cuts in global CO<sub>2</sub> emissions (e.g. through a cap and trade scheme) will be sufficient to encourage widespread deployment and use of CCS. Government has a critical role to play, however, in ensuring that international negotiations lead to conclusions that provide the long-term signal required to support investment in CCS. As discussed above, it may also be

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<sup>1</sup> <http://www.hse.gov.uk/consult/condocs/energyreview.htm>

appropriate for Government to consider a mandatory requirement for CCS at some point in the foreseeable future to ensure that unabated fossil fuel use does not continue indefinitely. It is also possible that there could be significant benefits associated with a Government-led strategic approach to planning for CO<sub>2</sub> transport and this is discussed in more detail in our response to Q38.

### Section 3: Article 32 of the Draft CCS Directive. Carbon Capture Ready (CCR)

*Question 2: Do you agree that developers should have suitable space on site or adjacent to it to accommodate future carbon capture and processing plant?*

We agree that developers should identify suitable space for the footprint of a future carbon capture and processing plant and that this could be on site or adjacent to it. It is also necessary that space required for access, materials lay down during construction etc and at critical access points for CO<sub>2</sub> capture to be connected to the combustion plant, are identified.

*Question 3: What do you see as the appropriate space requirements to accommodate different types of capture technologies, and why? How might these vary in relation to different sizes of plant?*

Expected footprints will be technology-specific, but one set of potentially useful indicative assessments has been undertaken for power plants by the IEA Greenhouse Gas R&D Programme<sup>2</sup>, as shown in the table below. It should be noted that some space should be left in different locations for different technologies and, as noted in Q2, that additional space will be required for retrofit construction activities.

Approximate minimum land footprint of CO<sub>2</sub> capture plant  
 (Table 3-10 from IEA GHG report 2006/8)

	CCGT with post-combustion capture	CCGT with pre-combustion capture	CCGT with oxy-combustion	USCPF with post-combustion capture	IGCC with capture	USCPF with oxy-combustion
Site dimensions – generation equipment (m)	170 x 140	170 x 140	170 x 140	400x400	475x375	400x400
Site dimensions – CO <sub>2</sub> capture equipment (m)	250x150	175x150	80x120	127x75		80x120
Capture Plant Site footprint (m <sup>2</sup> )	62,000	50,000	34,000	170,000	180,000	170,000

Acronyms: CCGT – combined cycle gas turbine; IGCC – integrated gasification combined cycle; USCPF – ultra-supercritical pulverised fuel

*Question 4: Should developers be required to assess the feasibility of retrofitting carbon capture technology to their combustion plant?*

<sup>2</sup> IEA GHG (2006) CO<sub>2</sub> capture as a factor in power plant investment decisions

As discussed in our response to Q1, we believe that developers should assess the feasibility of retrofitting carbon capture technology to their combustion plant, but a sufficiently clear signal from Government on a future requirement for CCS deployment may avoid the need for a CCR requirement in law. If a legal requirement for CCR is introduced Government should provide a clear indication of requirements for the expected scope and level of detail to be included in feasibility assessments. For example, developers will need to know whether their study should consider an option that would treat all flue gas produced at their plant and also what % of produced CO<sub>2</sub> is required to be captured. Government will also need to provide guidance on how expected improvements in CCS technologies are treated within conceptual retrofit studies. We suggest that developers should be required to demonstrate that a currently available CCS option could be retrofitted, but that developers should have freedom to use a different technology when they actually undertake their retrofit in the future.

*Question 7: Should a developer have to identify a potential storage area or areas when it develops new combustion plant? If so, do you think that identifying a potential area by reference to the DTI study is appropriate or can you identify other studies on storage sites that might be relevant?*

We believe that developers should identify a potential storage area as part of their CCR design activities and that it is appropriate to use studies such as the DTI study as a reference for identifying a storage area. As with the combustion site, if a legal requirement for CCR is to be implemented, we suggest that developers should be required to propose a feasible storage area that could be used with current technology when the CCR feasibility study is undertaken, but they should not be required to use this route when their retrofit is undertaken.

*Question 8: Is a feasibility study for each application the appropriate means of addressing the transport component of CCR?*

We think that it is reasonable for each CCR project developer to identify an outline proposal for a feasible transport route to a potential storage area/site, but we discuss in Q38 the likely importance of some overall strategic planning of a CO<sub>2</sub> transport network. Clearly, transport network developments may affect which routes to transport and storage are most effective for individual CCS projects. Thus, as with requirements at the combustion site, we think it is necessary that developers outline a feasible transport route that could be implemented with current technology when the CCR feasibility study is undertaken, but they should not be required to use this route when their retrofit is undertaken.

*Question 9: Should this transport assessment address the three issues set out in paragraph 3.25?*

The assessment should address the three issues set out in paragraph 3.25.

*Question 10: Are there any other factor(s) you believe should be included in Article 32? If so, why?*

We believe that the factors included in Article 32 are appropriate. It will also, however, be necessary for developers and Government to consider how these factors are treated in a broader integrated CCS system context (e.g. depending on any evolving plans for the development of a national strategic CO<sub>2</sub> transport infrastructure).

*Question 11: Should the UK support a 300MWe threshold or should we be arguing for a higher or lower threshold? Why?*

If CCR legislation is to be implemented, the proposed 300MWe threshold seems likely to be generally reasonable. The focus on electricity output could, however, lead to some perverse exemptions where some plants with higher CO<sub>2</sub> emissions potential are under the threshold because they have a significant output that is not electrical (e.g. CHP). Government might, therefore, consider whether an alternative measure based on CO<sub>2</sub> emissions potential should be used as a threshold for application of CCR requirements.

*Question 12: Should the coverage of CCR extend to all fossil fuel power plants with a capacity of 300MWe or more?*

We believe that all fossil fuel power plants with a capacity of 300MWe or more should normally be CCR, although there may be special cases where exemptions could be appropriate (as discussed in our response to Q23).

*Question 13: What impact might a CCR requirement have on the likelihood of new build, whether for 300MWe or move standalone CHP or Good Quality CHP plants attached to coal and gas generating stations?*

It is not yet clear what impact a CCR requirement would have on CHP plants.

*Question 14: Should the Government explore with the Commission and other Member States the possible disincentive effect on proposed "Good Quality" CHP plants which might otherwise be caught by a CCR requirement? If not, why not?*

Government should explore how CCR requirements could affect CHP with other relevant stakeholders, including the Commission and other Member States.

*Question 15: What might be the impact of the potential costs of CCR for 100% biomass power plants and so the implications for their future build? Should the Government explore excluding 100% biomass schemes from the proposed Article 32?*

It seems likely that CCR costs for 100% biomass power plants should be relatively insignificant (as with other fuels). Biomass plants with CCS also have the potential to have net negative CO<sub>2</sub> emissions for the whole plant lifecycle (since CO<sub>2</sub> removed from the atmosphere as biomass grew is not emitted back to the atmosphere if it is captured). This could be a very important opportunity to provide an offset for CO<sub>2</sub> emissions that are difficult to avoid in some other sectors (or to handle any overshoot in atmospheric CO<sub>2</sub> levels). Hence, we do not believe that Government should explore excluding 100% biomass schemes from the proposed Article 32.

*Question 16: In EU negotiations do you agree that the UK Government should support the proposals in Article 32 relating to carbon capture ready?*

As discussed in Q1, we think that a clear signal from governments that CCS will be mandatory in the foreseeable future may be a proxy for CCR legislation if industry is convinced that Government will implement and effectively enforce a mandatory requirement for CCS. Unless this commitment is made by governments at the European level, we agree that UK Government should generally support the Article 32 proposals relating to CCR.

*Question 17: If, following the negotiations, the adopted EU Directive does not contain Article 32, should UK Government take steps domestically to introduce requirements equivalent to Article 32 in England and Wales? Why do you think this would be justified?*

If Government do not commit to a mandatory requirement for CCS in the foreseeable future, we think that Government should take steps domestically to introduce requirements equivalent to Article 32 domestically, if it is not adopted with an EU Directive. This could be

justified by the action required to meet the CO<sub>2</sub> emissions targets proposed in the climate change bill. It can also be argued, however, that the climate change bill alone would be sufficient to send a clear signal to UK industry that CCS retrofits will be required. One purpose of additional legislation would be to assure the public that appropriate measures will be taken by industry so that excessive costs will not be required to meet climate change bill requirements.

*Question 19: Is the Environment Agency (EA) the appropriate agency to advise the consenting body on whether the proposed plant could be built CCR? If not, who might be better placed to do so?*

It seems likely that the Environment Agency will be the most appropriate agency to lead on advising on whether a proposed plant could be built CCR. It is likely to be necessary, however, for them to strengthen available resources to handle some aspects of CCR applications and/or draw on expertise from others. Depending on the number of bodies identified as required to make a robust assessment of a CCR application, it might be appropriate for Government to consider establishing a separate CCS Authority responsible for all CCR and CCS permitting issues. Any CCS Authority would need to draw together relevant regulators from other bodies, while maintaining close links to these bodies so that relevant experience can be shared between CCR/CCS projects and any other projects with some similar requirements but that do not involve CCR/CCS considerations.

Industry needs a competent 'one-stop shop' facility, with whichever organisation that might rest.

*Question 20: Are there any of the proposed factors another body might be better placed to advise on and why?*

It seems likely that other bodies will be better placed to advise on some aspects of one or more of the proposed factors. For example, HSE could make some useful contributions on various points and the British Geological Survey may be best placed to judge the suitability of proposed storage sites/areas. The EI is best placed to facilitate and develop industry good practice as per its track record in the oil and gas industry.

*Question 21: Should a plant only be consented if the studies and assessments carried out demonstrate that it could be capable of being built CCR?*

If a legislative requirement for CCR studies is introduced, we think that a plant should normally only be consented if these studies and assessments demonstrate that the plant could be capable of being built CCR. We agree, however, that in certain circumstances Government should be permitted to consent plants that do not meet all criteria, as discussed in our response to Q23. We also suggest that any CCR regulations should include appropriate measures to allow for follow-up inspections to ensure that proposals for CCR are included in the plant as built.

*Question 22: Do you agree that the CCR factors might have the consequences described in paragraphs 3.71-2? Would such consequences cause concern and if so why?*

We agree that there is a risk that CCS might have a negative impact on plant flexibility as discussed in paragraph 3.72, but also note that it could have a positive impact. Since CCR is expected to be inexpensive and can require relatively minimal changes to plant design, we do not expect there to be significant security of supply concerns associated with making a plant CCR in most cases. One exception to this could be if plant location for voltage support is difficult for access to transport and storage. This is discussed in our response to Q23.

More generally, if it is to be argued that service requirements mean that a development is not suitable to be CCR (as in the examples given in paragraph 3.71) we suggest that Government should require that a thorough study of alternative approaches to deliver the same service be undertaken if CCR is being implemented as a legal requirement. For example, for the CHP case discussed in the consultation document it may be possible to produce hydrogen remotely (with CCS used if the hydrogen is generated using fossil fuels) and then transport it to the area where the heat is required.

*Question 23: Do you agree that in certain circumstances Government should be permitted to consent to power stations that do not meet all the four factors that underpin the CCR criterion? If yes, what might such circumstances be?*

If a legal requirement for all power stations to be CCR is introduced, we agree that there may be certain circumstances where it should be acceptable for Government consent power stations that do not meet all four factors that underpin CCR criterion. These cases should, however, be carefully limited to ensure that the general principles of CCR are not undermined. Particular circumstances where consenting without meeting CCR requirements might be acceptable include cases where it has been demonstrated that a plant will be required for electricity network support services (e.g. peaking power plant that will have very limited operating hours or plant required for voltage support which must be located in an area unsuitable for accessing transport and storage). For these cases, it may be appropriate for Government to require evidence from National Grid long-term plans before granting consent.

#### **Section 4: The Safe Storage of Carbon Dioxide**

*Question 24: We would welcome views on our proposals for dealing with CO<sub>2</sub> storage projects involving EOR.*

It is important that proposals for dealing with CO<sub>2</sub> storage projects involving EOR are consistent with environmental principles applied to other CO<sub>2</sub> storage projects. We think it is likely that Government proposals will meet this requirement.

*Question 25: We would welcome your views on this model licensing and lease structure. Can you see any problems with our conceptual model? If so, how might we address such problems?*

We have not identified any significant problems with this model licensing and lease structure. We would, however, recommend that Government considers whether it may be beneficial to establish a CCS Authority (as discussed in Q19 and Q36) so that the number of individual bodies involved in implementing this model can be reduced. Some EI members have also expressed concerns that the proposed requirement for a seabed lease, in addition to a licence, may be detrimental to CCS project development if Crown Estate is able to charge excessive fees. Therefore, we recommend that Government reviews the processes to be used for issuing leases including appropriate controls to ensure that leasing fees are capped at a reasonable level.

*Question 26: We would welcome views on how the perimeter of a store should be described in the case of a carbon dioxide store in an unconfined space such as an aquifer.*

It seems likely that appropriate use of modelling techniques available to predict CO<sub>2</sub> movement within an aquifer and consideration of cost-effective monitoring methods will be required to determine a suitable approach to defining the perimeter of a store. If maximum CO<sub>2</sub> storage is to be achieved then it will be important that the licensing regime is able to

take some account of reservoir engineering requirements to optimise the use of available pore space, where possible.

*Question 27: Is it important to retain the possibility of using the sub-surface space for multiple purposes so long as these do not conflict?*

Yes, it is important that the ability to use the sub-surface for multiple purposes is retained. It seems likely that clear procedures for conflict resolution would also be valuable. EI members with experience in offshore operations point to existing experience in the North Sea (where commercial and legal agreements have normally proved successful in managing potential conflicts, independent of Government intervention) as an indication that this should be possible.

*Question 28: Are the suggested arrangements for dealing with potential interference between carbon dioxide storage and petroleum production adequate? If not, what would you suggest?*

We have not identified any inadequacies in the suggested arrangements.

*Question 30: We would welcome your views on the criteria that should apply to the termination of a licence and our preferred approach, also set out in Article 18(1) of the proposed Directive.*

We support the Government's view that it will be necessary to transfer long-term liability for stored CO<sub>2</sub> to the State. Clearly, there are a number of issues that must be carefully balanced in determining the criteria that should apply to the termination of a licence. We believe that two important principles that must be adequately addressed are that (i) society is protected from operator negligence but (ii) operators have reasonable opportunity to demonstrate that CO<sub>2</sub> should be "permanently contained within the storage complex for the indefinite future" so that they can transfer liability to the State relatively quickly after the cessation of CO<sub>2</sub> injection. It seems likely that a criteria-based approach (where industry is given clear guidance on what it is required to achieve in order to initiate transfer of liabilities) would be the most appropriate way to balance these concerns.

*Questions 31 to 33: Financial security and guarantee arrangements*

We do not wish comment on the details of the arrangements discussed in the consultation document as this is not a specialist subject among EI membership. We do, however, wish to note that these arrangements can place significant burdens on developers so it is important that any measures adopted are not excessive. In particular, Government must balance the need to protect its risks against the potential to reduce the speed and spread of CCS deployment in the UK as a result of the additional costs and other implications of requiring financial security and guarantee arrangements.

*Question 35: We would welcome your views on the measures covered by Annex 2, particularly if you think that anything is missing or unnecessary.*

We have not identified any missing or unnecessary measures in Annex 2.

*Question 36: We would appreciate views on the appropriate licensing authority for offshore carbon dioxide storage*

We agree with Government's assessment that "many of the techniques and knowledge of the geological structures required for licensing carbon dioxide storage have more in common with petroleum production and combustible gas storage than with traditional environmental control regimes". We think that this suggests that it could be most appropriate for the

licensing authority for offshore carbon dioxide storage to be the BERR Secretary of State. We also agree that it is important that licensing arrangements should be implemented with close co-ordination between relevant bodies. As in our response to Q19 for CCR, it may be appropriate to consider establishing a CCS authority if expertise from a large number of bodies is required.

*Question 37: We would welcome any information about the effect that this proposed permit review might have on potential storage site operators.*

The proposed permit review process introduces a risk of significant delay with potential implications for developer and investor confidence. There may be sufficient value associated with the proposed review to justify this risk depending on how the process is implemented. We suggest, however, that this potential value is carefully reviewed. Some EI members suggest that it is not yet clear how current Commission competencies that seem likely to contribute to this review would be valuable in many cases (and, hence, justify the additional risk of project delay).

*Question 38: Although we think the proposed Directive provides sufficient scope for Government intervention in the future should it be necessary, we would welcome any views you have on the way in which the transport and storage network might develop in both the UK and EU.*

Some initial studies have explored the potential value of using gathering hubs with a shared network of major trunk pipelines to transport CO<sub>2</sub> from capture sites to storage locations in the UK<sup>3</sup>. It seems likely that this approach could be important to provide the most cost-effective route for deploying CCS, as well as helping to minimise the environmental impacts of CO<sub>2</sub> transport. Government intervention is, however, likely to be required if this approach is to be implemented. Government should, therefore, consider commissioning a study to review the pros and cons associated with different options for Government intervention in CO<sub>2</sub> transport infrastructure development. It is also important to consider how the potential to reuse existing infrastructure (pipelines or, at least, their existing routes with associated permissions for access etc) might affect the way that the transport and storage network develops. Government could consider whether there may be a case for incentives to encourage reuse of existing infrastructure since this could make a valuable contribution to cost-effective CO<sub>2</sub> transport and storage in the UK with minimal environmental impact. Finally, third party access could play an important role in determining how the transport and storage infrastructure is developed and operated so should also be considered at an early stage drawing on current upstream pipeline legislation.

*Question 40: Assuming EU legislative barriers to onshore storage of carbon dioxide are removed by the Directive, do you agree with the Government's assessment that offshore storage should be the priority in the first instance? Do you envisage any other barriers to onshore storage of carbon dioxide?*

We agree with Government's assessment that offshore storage is likely to take priority in the UK in the first instance. It is, of course, possible that onshore storage will be important for some projects though. It has been argued that public acceptance for onshore storage will be more difficult than for offshore projects. It is not yet clear whether this will be the case and it seems reasonable to expect that there will be different views from different communities.

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<sup>3</sup> Element Energy Ltd et. al. (2007) Development of a CO<sub>2</sub> transport and storage network in the North Sea. <http://www.nsbtf.org/documents/file42476.pdf>  
Poyry Energy Consulting (2007) Analysis of Carbon Capture and Storage Cost-Supply Curves for the UK. <http://www.berr.gov.uk/files/file36782.pdf>

### **Acknowledgments**

On behalf of the Energy Institute, this submission was prepared by Hannah Chalmers GradEI of Imperial College and the University of Surrey, with contributions from EI members with specialist knowledge on Carbon Capture and Storage. It was peer-reviewed by Chris Mansfield, UK regulatory affairs adviser for Shell's European exploration and production business and chair of the CCSA policy and regulatory committee, as well as members of the EI staff team.

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