



# CO<sub>2</sub>-EOR Stakeholder Perceptions and Policy Responses

CO<sub>2</sub>-EOR JIP Work Packages 1 and 10

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## Executive Summary

Across the investigations undertaken in WP1 and WP10, analysis has been made of eight different stakeholder constituencies and their perceptions of CO<sub>2</sub>-EOR. The stakeholder groups investigated include both members of the public and professional groups with direct interest in energy and / or climate change issues.

WP1 started this analysis with an investigation of the perceptions and concerns of Scottish environmental NGOs during 2012-13. WP10 sought to test these findings via qualitative focus groups undertaken with relevant publics and stakeholder groups in Aberdeen, Edinburgh and London during 2014.

This report sets out an overview of the research process, the analysis undertaken, and the key themes identified.

It finds that:

- **There is a strong alignment of diverse stakeholder views that CO<sub>2</sub>-EOR needs to be considered within a broader context of energy and climate change, with objectives for its deployment articulated with respect to its coherence with climate change policy objectives;**
- **Even those stakeholders who were most receptive to the concept of CO<sub>2</sub>-EOR (Aberdeen public and offshore stakeholders, London Finance stakeholders) see an essential role for policy to drive long-term investment and secure social and environmental benefits beyond those accruing to individual project operators;**
- **More broadly, there is a desire across stakeholder groups for CO<sub>2</sub>-EOR policy to provide an explicit coherence with decarbonisation objectives and the need for transition planning – both for the North Sea in particular and for a longer-term shift away from fossil fuel production more generally;**
- **Policy options and political framings will need to address these broader concerns, as a more narrow focus that positions CO<sub>2</sub>-EOR solely as part of an effort to maximise the economic recovery of North Sea oil is unlikely to attract stakeholder support beyond those who stand to gain through employment or direct financial benefit, and may even stimulate opposition more widely;**
- **There is however a large gap between stakeholder views on what would be desirable outcomes and what they expect to be delivered in practice. This provides an opportunity for policy makers to set out a longer-term vision for how CO<sub>2</sub>-EOR could form part of broader transition objectives;**
- **Stakeholders closest to the practical delivery of CO<sub>2</sub>-EOR investments (Aberdeen offshore stakeholders, London Finance stakeholders) are the most skeptical about the ability of policy makers to deliver on any kind of outcome beyond a decline in North Sea production. This challenges policy makers to identify robust policy interventions that can provide a credible ‘private interest’ business case to drive investment while also providing a coherent ‘public interest’ framework that can appeal to multiple constituencies.**

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## Introduction: testing WP1 findings across stakeholder groups

During 2012-13, WP1 considered the public positions and private concerns of Scottish environmental NGOs in respect to the potential inclusion of CO<sub>2</sub>-EOR within UK and / or Scottish CCS policy. As a key shaper of public debates and a trusted messenger to the public, the views of NGOs are important influences on how policy can best be developed to reflect social concerns and objectives. WP1 provided an overview of how NGO approaches had engaged with the development of UK CCS policy and highlighted how NGOs had made judgments as to which kinds of CCS project could be supported in line with broader climate objectives. WP1 also included a discussion session with Scottish NGOs to explore emerging views on CO<sub>2</sub>-EOR. The full WP1 report is included in Appendix 1 below.

Across these activities, WP1 found that:

- **As has been the case previously with UK CCS policy, it is evident that the broader policy context is important for informing perceptions of the acceptability or otherwise of CO<sub>2</sub>-EOR as well as the form of individual projects.**
- **Generally, Scottish NGOs considered that CO<sub>2</sub>-EOR is ‘a bad price to pay for a good thing’. Alternative forms of CO<sub>2</sub> storage are preferred, and alternative policies are viewed as more likely drivers for the development of CO<sub>2</sub> infrastructure and storage capabilities in line with public interests.**
- **Policy actions that could link CO<sub>2</sub>-EOR operations to other climate benefits (e.g. restrictions on exploration / production in new fields) would have intuitive appeal, but are currently not being considered by policy makers.**
- **Individual CCS projects considering the integration of CO<sub>2</sub>-EOR will have to carefully consider how they communicate this impact on project benefits.**
- **Policy makers need to consider the overall coherence of policy aims, and the extent to which they enable CCS projects to provide a clear and positive decarbonisation role.**

In order to further test these findings, WP10 was developed to engage with a broad spectrum of stakeholder constituencies and locations. Through a series of focus groups held in Summer 2014 we have identified key themes and perceptions that reflect different levels of proximity to, and engagement with, questions of oil production and action on climate change.

This report reviews how these investigations relate to the theoretical literature, before presenting key findings from the focus group discussions. We do this by assessing stakeholder reactions to the scenario framework used, together with an analysis of the key themes to emerge. This includes perceptions of barriers to CO<sub>2</sub>-EOR and potential policy enablers of CO<sub>2</sub>-EOR deployment. Where appropriate we include reference to findings from WP1.

## Literature review

Although there is no shortage of work on public and stakeholder perceptions of CCS, the field of literature exploring public and stakeholder views on CCS in the context of CO<sub>2</sub>-EOR is much more limited.

A recurring theme emerging from research into *stakeholder* perceptions of CO<sub>2</sub>-EOR is the potential for EOR to make CCS more attractive by giving an additional economic incentive. For instance, Chaudhry et al (2013) in a comparison of policy stakeholders across four US states found greater (albeit not universal) support for CCS in Texas – largely due to the possibility of using captured CO<sub>2</sub> for EOR in the state's oil fields. Research with stakeholders in the contexts of Saudi Arabia (Liu et al, 2012) and China (Reiner and Liang, 2012) has likewise found that there tends to be more enthusiasm for CCS when it is linked with the possibility of CO<sub>2</sub>-EOR to boost yields from existing nearby oil fields.

Setiawan and Cuppen (2013) however argue in the context of Indonesia that stakeholders do not see a clear connection between CCS and EOR, instead associating CCS with centralised coal-burning power plants. It may thus be the case that stakeholders without so much exposure to oil extraction do not so readily see value in utilising captured CO<sub>2</sub> for oil recovery. Even in cases where stakeholders are familiar with oil operations, they may not view the links between CO<sub>2</sub> and EOR favourably – Mabon and Shackley (in press) noted Scottish environmental stakeholders expressing concern that EOR utilising CO<sub>2</sub> captured from CCS processes may shift CCS from being a 'bridge' to renewables to a means of perpetuating a fossil fuel economy. Klock et al (2010) indicate the possibility for heterogeneity in stakeholder perceptions of CO<sub>2</sub> utilisation in Norway by suggesting the distribution of value and risk among value chain stakeholders ought to be researched further.

There is even less work on *public* perceptions of CO<sub>2</sub>-EOR. Nunez-Lopez et al (2008) hypothesise that sequestration of CO<sub>2</sub> in mature oil fields offers dual benefits in the form of EOR potential and public support due to the proven ability to have trapped hydrocarbons over periods of geological time. Hovorka and Tinker (2010) likewise believe CO<sub>2</sub>-EOR offers advantages over sequestration in brine formations due to the potential for royalties, fees for surface access and potential for jobs in host communities, and Sacuta et al (2013) add that long and positive public experiences with CO<sub>2</sub>-EOR developments in North America based on one-on-one dialogue can offer lessons for engendering public support for CCS projects elsewhere. Melzer (2012) also believes public familiarity with oil infrastructure can engender support for storage in the form of CO<sub>2</sub>-EOR, but warns that incentivising operators to undertake CO<sub>2</sub>-EOR may "be met with cries of corporate welfare given to an industry already burdened with image problems" (Melzer, 2012: 12).

Many of these issues are borne out in one of only a small number of empirical studies to look specifically at this issue - Boyd (2015) on Weyburn in Canada. Boyd found positive public support for the Weyburn CO<sub>2</sub>-EOR project among community members, linking this to trust in the developers, local pride in technological innovation, and the role of the operators as major employers in the community. Boyd however warns of over-generalising from these findings, noting that perceived benefits and risks may differ depending on local contexts. Also in the context of Weyburn, Sacuta and Anderson (2014) note positive discussions around CO<sub>2</sub>-EOR, but stress the need to distinguish between CCS and CO<sub>2</sub>-EOR in public engagement.

What can be concluded from research to date into public and stakeholder perceptions of CCS in the context of CO<sub>2</sub>-EOR is that a more favourable stance towards CCS may be expected among both communities and stakeholders spatially proximate to existing oil extraction infrastructure, where there could be perceived economic and job benefits. At a wider societal scale, however, it may be the case that stakeholders and publics who do not perceive themselves as benefitting directly from CO<sub>2</sub>-EOR may not view EOR as making CCS any more viable, and/or may even react negatively to the possibility of CCS perpetuating production and use of fossil fuels. It is also vital to stress, however, that much of this research – especially with regard to community and public perceptions of CCS – relies on secondary sources as evidence of the likely society perception. Work Package 10 has therefore attempted to build on this extant body of research by collecting empirical data with publics and stakeholders, and by assessing claims made in the literature against this.

## References

- Boyd, A (2015) 'Connections between community and emerging technology: Support for enhanced oil recovery in the Weyburn, Saskatchewan area' *International Journal of Greenhouse Gas Control* 32: 81-89.
- Chaudhry, R, Fischlein, M, Larson, J, Halle, D.M, Peterson, T.R, Wilson, E.J, and Stephens, J.C. (2013) 'Policy Stakeholders' Perceptions of Carbon Capture and Storage: A Comparison of Four U.S. States' *Journal of Cleaner Production* 52: 21-32.
- Hovorka, S, and Tinker, S (2010) *EOR as sequestration--Geoscience perspective: White Paper for Symposium on Role of EOR in Accelerating Deployment of CCS* Gulf Coast Carbon Center: Austin TX. <http://18.9.62.56/system/files/hovorka.pdf>, accessed 05/02/2015.
- Klokk, O, Schreiner, P.F, Pages-Bernaus, A, and Tomsgard, A (2010) 'Optimizing a CO<sub>2</sub> value chain for the Norwegian Continental Shelf' *Energy Policy* 38 (11): 6604–6614.
- Liu, H, Garcia Tellez, B, Atallah, T, and Barghouty, M (2012) 'The role of CO<sub>2</sub> capture and storage in Saudi Arabia's energy future' *International Journal of Greenhouse Gas Control* 11: 163-171.
- Mabon, L and Shackley, S (in press) 'More than meeting the targets? The ethical dimensions of carbon dioxide capture and storage' *Environmental Values* Advance online version: <http://www.ericademmon.co.uk/EV/papers/Mabon.pdf>;
- Melzer, L.S (2012) *Carbon Dioxide Enhanced Oil Recovery (CO<sub>2</sub> EOR): Factors Involved in Adding Carbon Capture, Utilization and Storage (CCUS) to Enhanced Oil Recovery* Melzer Consulting: Midland, TX.
- Núñez-López, V, Holtz, M.H, Wood, D.J, Ambrose, W.A and Hovorka, S.D (2008) 'Quick-look assessments to identify optimal CO<sub>2</sub> EOR storage sites' *Environmental Geology* 54 (8): 1695-1706.
- Reiner, D, and Xiang, L (2012) 'Stakeholder Views on Financing Carbon Capture and Storage Demonstration Projects in China' *Environmental Science and Technology* 46 (2): 643–651.
- Sacuta, N, Gauvreau, L, and Greenberg, S (2013) 'Emergency Response Planning: An Example of International Collaboration in CCS Community Outreach and Project Development' *Energy Procedia* 37: 7388-7394.
- Sacuta, N, and Anderson, K (2014) 'Creating core CCS messages: Focus Group Testing and Peer Review of Questions and Answers from the IEAGHG Weyburn-midale CO<sub>2</sub> Monitoring and Storage Project' *Energy Procedia* 63: 7061-7069.
- Setiawan, A.D and Cuppen, E (2013) 'Stakeholder perspectives on carbon capture and storage in Indonesia' *Energy Policy* 61: 1188-1199.

## WP10 Focus Group Methodology

### Overview

Six discussion groups were convened for WP10: two in Aberdeen (May 2014), two in Edinburgh (June 2014) and two in London (July 2014). In order to include a range of relevant public and stakeholder perspectives, and following feedback from the steering group, the researchers elected to carry out focus groups with the following categories of people in the following locations:

- Members of 'the public' in an area with close proximity to oil production and a potential near-term CCS project (Aberdeen);
- Members of 'the public' in an area more distant from oil production but close to past and future proposals for CCS projects (Edinburgh);
- Stakeholders with an interest in the marine environment (Aberdeen);
- Academics and other professionals with an interest in environmental issues, but not working on CCS directly (Edinburgh);
- Representatives of the financial sector, particularly 'green investment' (London);
- Environmental NGOs (London).

Subsequently, a further discussion session was held in November 2014 with early career oil and gas professionals studying at Robert Gordon University. These participants had particular experience of the development of new oil fields overseas.

Summaries of all seven of these focus groups are provided in Appendix [x] below.

### Sampling

Participants for the 'public' focus groups were recruited through a professional recruiting agency, which was asked to provide – for both Aberdeen and Edinburgh – a sample of ten members of the public broadly representative of the Scottish population demographic in terms of gender, age and income divisions. Participants with high knowledge of CCS were 'screened out' at the recruiting phase. (It had been considered whether to screen out anyone with a high knowledge of energy issues, but it was decided this would be impossible in Aberdeen given the importance of the energy sector to employment in the city). Recruited members of the public were paid a small cash incentive to participate.

Participants for the four stakeholder groups were recruited through a combination of personal contacts, 'snowball' sampling and strategic sampling to ensure a diverse range of participants. The stakeholder participants were not paid a financial incentive, but refreshments were provided during the sessions.

### Process

Each session lasted two hours, and was facilitated by the WP leaders. The two WP leaders jointly facilitated the Aberdeen and Edinburgh sessions. Due to other research commitments abroad one of the WP leaders was unable to attend the London sessions, so slight variations were undertaken for the London sessions:

- The NGO session included the participation of Jamie Stewart of University of Edinburgh as the second presenter, to enable discussion of life cycle analysis and technical geological details if required, as these issues had been identified as of interest to NGO participants. Jamie had previously attended the Edinburgh focus groups as an observer, so was familiar with the format and content.
- The finance session similarly saw the participation of Harsh Pershad and Emrah Durusut of Element Energy in order that they could respond to technical and financial questions from participants – these had again been identified as likely issues in advance, in association with the Ecofin Research Foundation which helped to recruit participants and convene the session.

After introductions, the sessions started with a short presentation on climate change, the need

for decarbonisation and the possible role of CCS. A 5-10 minute facilitated discussion was then held to get participants' initial thoughts on CCS as a whole system and energy/climate change more broadly. This was followed by a presentation on CO<sub>2</sub>-EOR, and a slightly longer (10-15 minute) facilitated discussion on CO<sub>2</sub>-EOR before a coffee break. The WP leaders then presented the four scenarios, before progressing to the main (30-40 minute) facilitated discussion on CO<sub>2</sub>-EOR. As a conclusion to each session, participants were asked (a) which of the four scenarios they *wanted* to happen; and (b) which of the four they thought was *most likely* to happen.

Each session was audio-recorded and transcribed. The transcripts were then anonymised to remove reference to particular individuals and (where appropriate) organisations. Participants had signed a form to confirm they consented to having their contributions stored and transcribed, and to indicate the extent to which they were happy with their contributions being shared in project outputs (i.e. WP researchers only, with JIP partners, in external reports and peer-reviewed publications). In a few cases, individual participants requested that certain remarks be removed from the record. All participants were willing to contribute to the discussions on the basis that they were held under the Chatham House rule.

## Analysis

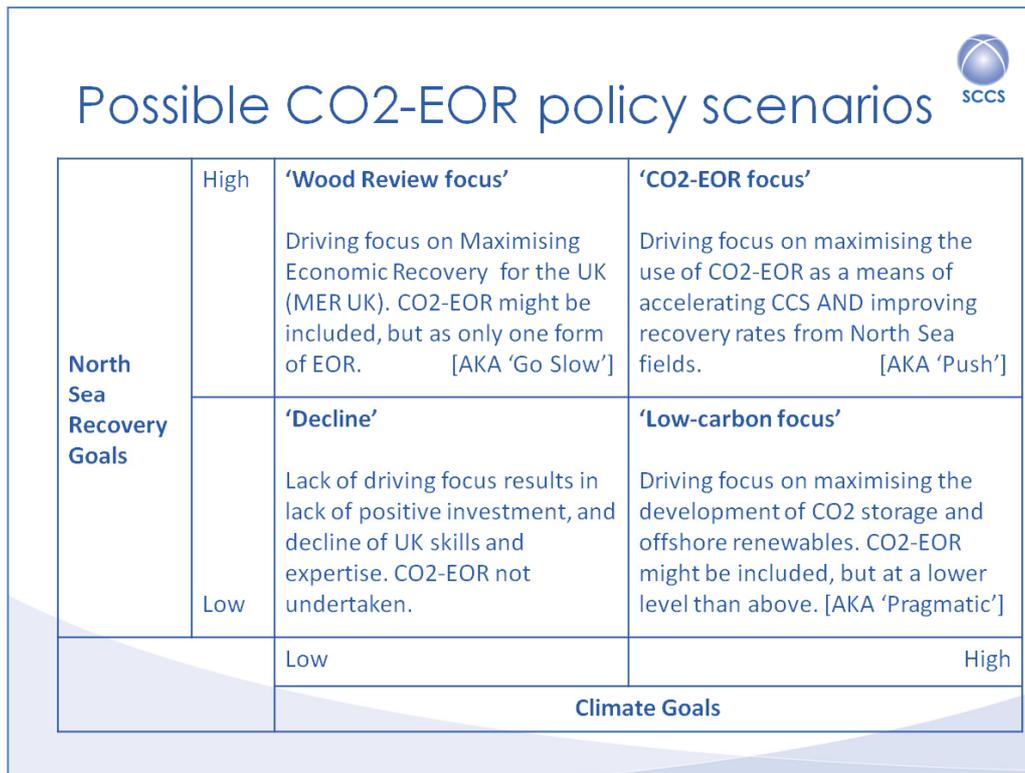
The audio transcripts were analysed qualitatively, reading to identify themes and then refining identified themes iteratively. In order to increase the validity of the conclusions drawn, both WP researchers read the transcripts independently of one another and then compared their findings afterwards. Additionally, the perceptions of each group on CO<sub>2</sub>-EOR were plotted onto a matrix according to how strongly they identified with the four scenarios presented.

## The scenarios

As a prompt for discussion, the WP leaders elected to provide the discussion group participants with four different possible 'scenarios' for the future of the North Sea, focusing on (a) the extent to which CO<sub>2</sub> storage was deployed; and (b) the extent of climate ambition. This gave four scenarios, which were loosely related to the four scenarios drawn up by Element Energy for an earlier WP in the JIP:

1. Maximise recovery, limited climate focus – this scenario was also termed the 'Wood Review' scenario for ease of participant identification. The aim of this scenario would be to maximise oil recovery, injecting only enough CO<sub>2</sub> to recover as much oil as is potentially viable;
2. Maximise recovery, maximise climate focus – this was termed the 'CO<sub>2</sub>-EOR' scenario. Under this scenario, oil would be recovered to a high degree, but large quantities of CO<sub>2</sub> would also be injected as part of climate change mitigation;
3. Limited recovery, maximise climate focus – this was termed the 'low carbon' scenario. This scenario would see limited CO<sub>2</sub> injection but a high drive for decarbonisation, with a focus on say offshore renewable development in the North Sea as opposed to CO<sub>2</sub>-EOR;
4. Limited recovery, limited climate focus – this was termed the 'decline' scenario. This scenario would see a decline in oil production in the North Sea, with nothing replacing it.

Figure 1: CO<sub>2</sub>-EOR scenarios



It was made explicitly clear to participants from the outset that these scenarios were intended only as caricatures, developed for the purpose of stimulating discussion among the group on the possible trajectories for the North Sea. Indeed, participants were encouraged to challenge the framings made by the WP leaders, and/or to suggest alternative conceptualisations of their own.

Furthermore, the details on each of these scenarios were deliberately kept to a minimum during presentation, in order to encourage the participants themselves to consider the conditions that could lead to the emergence of such a scenario, and to think about the context (if any) in which such a scenario could be desirable. In some cases participants - especially stakeholders working closer to energy - expressed initial difficulty at being able to identify a scenario in the absence of further contextual information (such as government climate policy, carbon price etc), but as the discussions progressed they were soon able to reflect on how each scenario might come to pass.

The sessions were then opened up for discussion on what participants thought about each of the four scenarios.

## Focus group views on policy scenarios

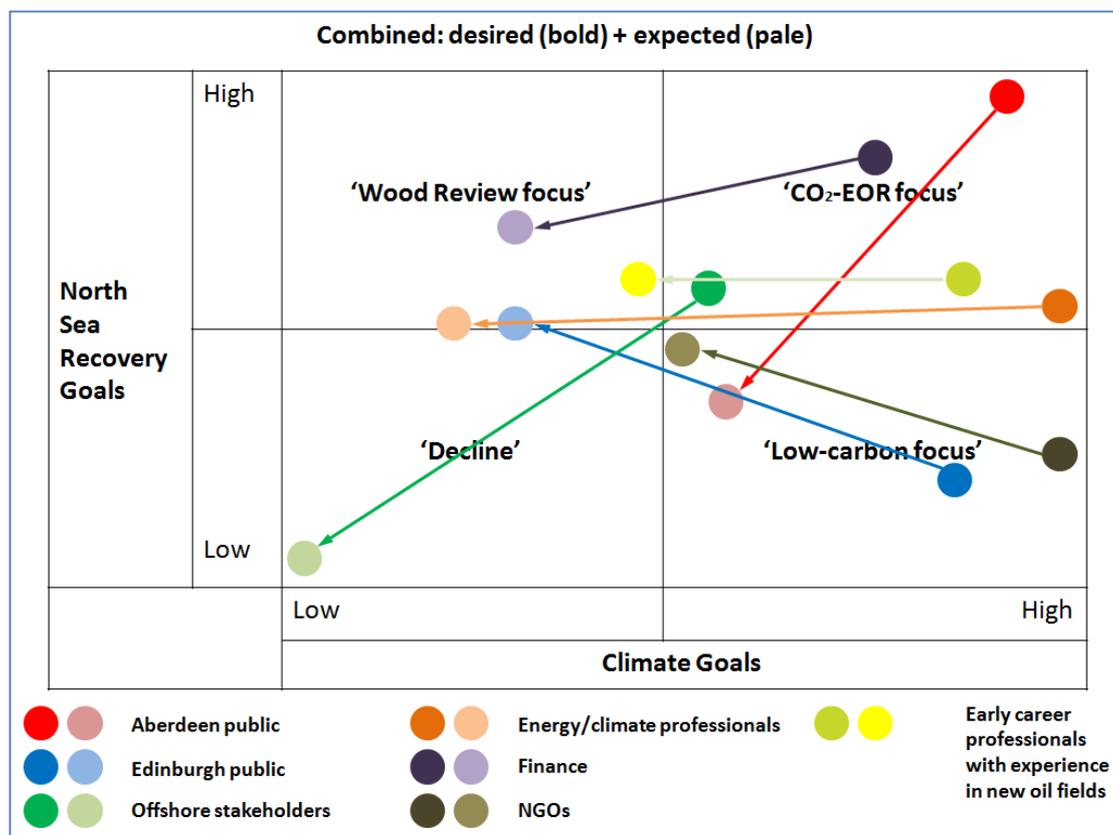
Across the seven focus groups undertaken in WP10 we used the same scenario framework as a means of introducing the CO<sub>2</sub>-EOR concept and collating comparative views on what kinds of policy action could be attractive to different stakeholder groups.

Figure 2 below provides an overview of the desired and expected positions that we have attributed to each focus group. It should be noted that these positions are a composite assessment of multiple views expressed in each focus group discussion, and are therefore not necessarily reflective of individual participant views or difference of opinion that may have occurred between participants within groups. Such differences are, however, picked up on in the qualitative analysis of discussion transcripts that follows.

By providing a visualization of stakeholder perceptions, Figure 1 helps to identify how broad policy framings and objectives around climate change and North Sea recovery goals will position CO<sub>2</sub>-EOR, and what combination(s) of these are most attractive to different stakeholder constituencies.

The headline finding is that in each of the focus groups it was the 'right hand side' of the matrix that was viewed to be desirable – i.e. participants believed that it was important for policy to reflect a need to mitigate climate change via a transition to a low-carbon economy. This held true even in the cases where stakeholders simultaneously were positive about the potential development of CO<sub>2</sub>-EOR. In part this can be explained by the fact that the highest levels of CO<sub>2</sub>-EOR deployment are associated with action on climate change, given that this is the basis on which significant volumes of CO<sub>2</sub> would be provided via onshore CCS projects. As will be discussed below, this preference was reflected in themes such as the importance of investing the proceeds of CO<sub>2</sub>-EOR into further deployment of renewables technology

Figure 2: desired and expected outcomes of CO<sub>2</sub>-EOR scenarios



The strong preference for the right hand side of the matrix provides an opportunity for policy

makers to appeal to the aspirations of multiple stakeholders. Framings that present a future-oriented vision of North Sea transition and the role of CO<sub>2</sub>-EOR within it are likely to be more favourably received. Conversely, approaches that only seek to maximize North Sea recovery goals without attention to climate goals are likely to be viewed negatively, and may even in cases be a trigger for opposition to CO<sub>2</sub>-EOR. (As discussed in WP1, there is a risk that CO<sub>2</sub>-EOR projects make visible pre-existing incompatibilities between different policy objectives).

The second key finding is that there is a clear gap between desired and expected outcomes across all stakeholder groups. It is notable that this includes a retreat from climate change aspirations back towards what were perceived to be 'business as usual' objectives on fossil fuel extraction – aligned with the 'Wood Review' box in the matrix.

But we would suggest that this dynamic should not be interpreted as solely suggesting that climate policy is at risk from non-delivery. More broadly, this dynamic is also repeated in respect to a lack of confidence in and skepticism of policy makers' ability to deliver more broadly, and was particularly marked in respect to the views of stakeholders most closely linked to the pursuit of current objectives on oil and gas production. Participants in the Aberdeen Offshore Stakeholders focus group strongly underlined the challenge of technical credibility of any proposed policy framework, given the lag-times and inertia of private sector investment cycles in North Sea assets. Their view was therefore that the most likely outcome was one of 'Decline' rather than increased investment in either oil production or broader North Sea transition activities (including CO<sub>2</sub>-EOR).

The combined impact of these two trends (desire for future-orientated objectives, but gap between desired and expected outcomes) suggests that this is a challenging area for policy makers where aspirations are difficult to deliver in reality. However this does provide an opportunity for policy makers to develop longer-term and coherent objectives in association with diverse stakeholders as a means of addressing multiple concerns. A number of practical options for this were identified and are discussed below.

## Thematic analysis of WP10 focus group discussions

Through a review of relevant literature into public and stakeholder perceptions of CO<sub>2</sub>-EOR, key themes driving perception of CO<sub>2</sub>-EOR were identified (see literature review for an overview of these concepts). The transcripts of the focus groups were re-read, seeking to identify places where themes raised in previous research were either confirmed or challenged. Particular attention was paid to any new themes that may have arisen in the WP10 data not identified in earlier studies. The data was thus analysed in an iterative way, reading the transcripts first to identify relevant themes, and then refining these themes and concepts accordingly in light of their relation to findings from other studies. The following analysis is structured to reflect the main emergent ideas from this process. The distribution and emergence of these themes across the groups is summarised in the tables at the end of the section - these are divided into factors which may inhibit support for CO<sub>2</sub>-EOR, and factors which may engender positive public and stakeholder perceptions of CO<sub>2</sub>-EOR.

### 1. What is the purpose of CO<sub>2</sub>-EOR?

The first theme arising from the data concerned the question of what the purpose of CO<sub>2</sub>-EOR was. It is important to register from the outset that nearly all participants – stakeholder and public - agreed human-induced climate change was occurring, and that changes to energy production and consumption were required to mitigate the effects of climate change. Within this, there was also good general agreement that CCS and associated CO<sub>2</sub>-EOR could in principle be considered part of the suite of low-carbon energy sources that may be drawn on to mitigate climate change:

*[CO<sub>2</sub>-EOR with CCS] will give you, you kind of, giving yourself more time to buy something else, another sort of energy source basically cause the way I have understood it is that if you are able to get more oil what seems to be over CO<sub>2</sub>, into the atmosphere, then you are able to delay the climate change process, giving you time for the technology to develop which over time is a cleaner energy source (citizen, Aberdeen public, M)*

*on a case to case basis per if you start to work out barrel costs, it doesn't make any sense to do CCS but if you then take a step back and look at the fact that the climate is changing and is going to have a negative impact on a variety of things, including our economics, if you look at that scale surely we need to make these technologies as part of a portfolio of successful things, something to aspire to perhaps (marine biologist, Aberdeen offshore stakeholders, M)*

*I think again simplistically if you were to think about renewable energy you think about solar, wave and wind energy but we are actually quite a way off technology especially solar um and we have this immediate problem where we have got a lot of CO<sub>2</sub> being omitted and so I see particularly carbon capture and storage being a way to help in the immediate short term, when I say short term I mean in the next 50 years or so, rather than a long term solution, I don't think it is a long term solution at all but I think it will it would help immensely to drop the the concentration of carbon dioxide from the atmosphere and one way to do that would be carbon capture and storage (scientist, Edinburgh climate professionals, M)*

Where there was less agreement was on how CO<sub>2</sub>-EOR and CCS would be deployed in practice. There was discussion over whether carbon dioxide storage was indeed part of a move to a decarbonised energy system, or whether it gave means to uncritically perpetuate a fossil fuel-based economy. In particular, some participants worried about a reliance on 'technical fixes' and short-term economic gain without wider reflection on how society is governed and organised or longer-term climate and energy issues:

*[CO<sub>2</sub>-EOR] has to be in that context of significant global leadership and sort of a shift towards a true transition rather than a just a technical fix in terms of CO<sub>2</sub> emissions (sustainability consultant, Edinburgh climate professionals, M)*

*if it's driven by climate and it's driven by a vision that says hey, this is going to make it more socially and politically acceptable to use these things as part of a transition, and there is a real defined transition (researcher, London NGOs, F)*

Nonetheless, there was also recognition of the embeddedness of fossil fuels within contemporary society, both in terms of the reliance on oil and also on coal- and gas-fired power stations for electricity (it is interesting to note that only limited mention was made of CO<sub>2</sub> emissions from industrial sources such as steel and cement works, from stakeholders with significant energy and environmental knowledge). Under this more pragmatic stance - which was also adopted by some stakeholders more cautious or critical of fossil fuels - CO<sub>2</sub>-EOR combined with CCS was perceived as a means of decarbonising remaining thermal power plants, whilst also extracting remaining required oil in a less carbon-intensive manner:

*we think as part of the UK's climate targets for 2030, there is still room for some gas by 2030 and if you can capture some of the carbon from that good. If you can link that with industrial process emissions as well to capture some of that, we're supportive (economist, London NGOs, M)*

*You don't need gas in the electricity mix, but you need gas for heat, which is not going to be replaced very quickly (political advisor, London NGOs, M)*

*Well I think, just trying to be pragmatic about it, ideally we probably wouldn't be using fossil fuels, we all agree that if we had that option, but we're clearly going to. Governments are not going to give up and we all live lives that are dependent on it, so I guess the question in that context of where does one aim for the most sensible outcome, putting aside any sort of aspirations of going back five thousand years in time and having a different life (finance stakeholder, London finance stakeholders, M)*

As well as being part of a transition to a low-carbon energy system, there was also some (albeit limited) discussion of the role of CO<sub>2</sub>-EOR in a transition to more socially sustainable ways of living. What is meant by this is giving a less sudden and more realistic trajectory away from employment in fossil fuel-based industries, especially in locations like Aberdeen where the local economy is heavily dependent on oil and gas industries. 'Social sustainability' in this sense also means a more gentle transition away from fossil fuels, with CO<sub>2</sub>-EOR giving extra time to address issues such as intermittency and potentially high bills perceived as being associated with a rapid transition to renewables:

*I imagine this is part of a, you know, progressive policy to address fuel poverty and you know, bring a whole load of stuff together as part of that transition, and you say so [names operator] is making a lot of money but you know someone has got to operate the rig, that's, that's fine. If it is seen as being government bending over backwards, if it's seen to be allowing their friends in oil to make even more money at the expense of people in Easterhouse, who can't afford to pay for anything, but that is a completely different situation so it is about the reality and the perception of that reality is crucial to this in terms of public acceptability, in my view (sustainability consultant, Edinburgh climate professionals, M)*

This theme of what the purpose of CO<sub>2</sub>-EOR in the context of CCS is - and in particular what advantages it may offer to society - leads into the second theme identified as driving perceptions. Namely, who benefits from CO<sub>2</sub>-EOR?

## 2. Who benefits from CO<sub>2</sub>-EOR?

The second emergent theme driving perception of CCS-EOR concerned who was perceived as benefiting from its implementation. Similar to findings into research on 'conventional' CCS, publics in particular expressed concerns over CO<sub>2</sub>-EOR being used not for climate change mitigation, but for operators to continue uncritically generating large profits:

*I think you would have to find something really, really positive to offset that we are not subsidising oil companies per se but we are subsidising their research to help climate change or to extract more oil etcetera (citizen, Edinburgh public, F)*

*So okay this is [names operator], this the [names operator] that is literally pulling out of Aberdeen, four rigs offshore or something and they've set aside their money, for their putting down on, this is a company that, will we make a couple of bucks here as we are leaving sort of thing, the oil and gas thing, isn't it? (citizen, Edinburgh public, M)*

At a rather more abstract level, questions were also raised over who ought to be allowed to benefit from EOR. This split into three groupings, which we consider in turn.

### 1. - less economically developed countries:

*an interesting question that comes up is should we be investing in CCS in other countries where they actually have moral permission to use fossil [fuel] for longer? Maybe that's the way we approach CCS because if we do it in the UK we know that it will have tighter regulations to make it more challenging (youth activist, London NGOs, F)*

*in larger countries like China and India, the use of fossil fuels is absolutely going to be essential for the development of their economies. It is all around us, sitting here in Scotland being arrogant about the use of fossil fuels but those that are trying to move up the economic ladder eh have different sorts of challenges, and it is seeing things through their perspective I think is quite important (science communicator, Edinburgh climate professionals, M)*

### 2. - developers of other kinds of low-carbon energy, in particular renewables:

*I was just wondering if that could be done in the North Sea but that value reinvested in other sources of our energy, wind turbines, tidal wave energy and so on, I think that is it important to have a balance of where our energy is coming from, and alternative sources as well (citizen, Edinburgh public, M)*

*"there is always potentially a mechanism, it is, whether you know the detail, always hear about Norwegian oil fund, well people are saying there is potential from these income streams for these sorts of scenarios and if we are serious about a transition, then the one way about getting that is setting up a national transition fund or something" (sustainability consultant, Edinburgh climate professionals, M)*

### 3. - communities that relied on oil and gas industries for employment, and may be at risk were these industries to close down or decline rapidly:

*I think you have also got to remember that the oil companies are in many cases rightly portrayed as pariahs but they make an awful lot of money that pays an awful lot of people's pensions, because they are shareholders and the main shareholders are pension companies, financial and the likes, it is not just Russia, or somebody*

*sitting at the top counting all the cash that is made and you have to make sure that these companies remain profitable eh so you don't want to cut them off completely because so many people rely directly on them (citizen, Aberdeen public, M)*

*if we have a narrative of the North Sea about, the unions and [NGO NAME] would all agree that you can't just shut an industry overnight, you have to have a just, managed transition away from it, I really do believe that CCS could be part of that (economist, London NGOs, M)*

A key idea running through these quotes is that CO<sub>2</sub>-EOR ought to be of benefit to society as a whole, rather than to the profits of private developers. Within this, there is also a sense that CO<sub>2</sub>-EOR and CCS should be used for morally 'good' purposes, such as allowing less economically advantaged nations to develop, generating funds for research, development and deployment of renewable energy sources, and aiding communities heavily dependent on oil and gas industries for employment. Suggestions made as to how this ethical use of CO<sub>2</sub>-EOR could be facilitated included ring-fencing a share of the tax revenue generated through continuation of oil extraction, or the establishment of a nationalised storage company to oversee developments:

*We thought for [the CO<sub>2</sub>-EOR focus] to be done we would offer incentives, maybe a tax break or something like that. And we also thought that there would be more, there would be more tax because there's more oil, so we would set aside a portion of that to invest in the low-carbon focus, that was our long-term plan (student, Aberdeen young professionals, F)*

*Going back to the public body thing, I guess the remit for that public body makes a massive difference, because they could just sort of be in the pocket of the oil and gas industry versus a public body with a really robust remit and a priority to tackle climate change versus one who's not. In that situation it seems preferable to just being led by industry (youth activist, London NGOs, F)*

Underneath these discussions on the 'right' purpose of CCS-EOR was an even bigger question on whether society even ought to be spending time and resources pursuing developments. This issue of the appropriateness of CO<sub>2</sub>-EOR formed a third cluster of discussion.

### **3. Is CO<sub>2</sub>-EOR appropriate in terms of being viable and/or worthwhile?**

The third and final theme concerns the question of whether or not CO<sub>2</sub>-EOR could be considered appropriate. What was meant by the appropriateness of CO<sub>2</sub>-EOR in the discussions was (a) if CO<sub>2</sub>-EOR was technically, economically and politically viable; and (b) whether CO<sub>2</sub>-EOR was ultimately worthwhile in terms of the positive effects it offered. Indeed, this acknowledgment of the finite nature of fossil fuels, limited global progress on CCS and the perceived inevitable need to switch to renewable energy sources led some participants to question whether CO<sub>2</sub>-EOR and indeed CCS as a whole system were even worth pursuing:

*How much of a difference is that going to make globally if nobody else is doing anything else, if you are only storing the CO<sub>2</sub> in these fields there and the rest globally, the rest are going to say you know what we are not going to bother with this, would that make any difference to the climate then? Just this wee pocket in the North Sea, storing you know the carbon storage and using it for enhance oil (citizen, Aberdeen public, F)*

*How much gas, how much oil is there left there, from what we've got at the moment?*

*[...] This government, the governments are very good at doing knee-jerk reactions like five years in front or ten years but we should be thinking about twenty or thirty or fifty years in front, where we are going with the thing before they start putting money into projects (Edinburgh public, M)*

*I'm just concerned about the overall extent of the infrastructure you would need to make that meaningful dent in CO<sub>2</sub> emissions. I mean I just don't have a proper sense of the physics, I mean I do remember once someone saying to me that you know if you wanted to get rid of ten percent of the world's total carbon emissions you'd need an industry the size of the oil industry to be able to do that, just in terms of the infrastructure (finance stakeholder, London finance, M)*

Opinions on the finite nature of fossil fuels tended to come from the focus groups with members of the public or less technically engaged stakeholders. By contrast, in the more specialised focus groups (especially offshore stakeholders and carbon finance professionals), concerns were raised over the viability of CO<sub>2</sub>-EOR with regard to the suitability of the current political, economic and technical regimes:

*CO<sub>2</sub>-EOR still doesn't make economic sense because I can guarantee you that if it did make economic sense oil companies would already be doing it (energy analyst, Aberdeen offshore stakeholders, M)*

*I think on that point part of the problem is that the oil companies won't touch this, because it's just magma, you couldn't build a strategy round it at the moment (finance stakeholder, London finance, F)*

*many of these power stations have shut or are going to shut not just for CO<sub>2</sub>-related reasons, but also barrages of legislation around removing particles. So that seems to be removing one source of CO<sub>2</sub>. At the same time, as I understand it, gas is increasingly being pushed to be a balancing type of technology in a brave new world, where I guess the emissions are actually much less than CCGT. So struggling a bit with the idea that you build a transport infrastructure against this CO<sub>2</sub> volume decline that seems to be imminent for the power sector (finance stakeholder, London finance, M)*

*I deal with a lot of older platforms which makes it very hard to make run efficiently to get it, to be honest we struggle sometimes. But basically that is what we are looking at, to reduce emissions rather than zero, where I work, we are not really in a place at the moment to look at carbon capture and storage, the newer technology to come in will be better, but not where I am working at at the moment to be honest with you (oil and gas engineer, Aberdeen offshore stakeholders, M)*

*most of the North Sea, their platforms are beyond their expected life so you are not going to spend money, for instance the Brents they are still producing but they are also being decommissioned on paper, so they are not going to spend one penny, on the Brents, for instance to do that, the Dunlain (energy analyst, Aberdeen offshore stakeholders, M)*

*90% of the platforms offshore won't be suitable [...] viable with regards to what you might want to do it may be viable to do it, the small congested platforms and if you gotta put a whole new whole bridge next to it [laughter] it becomes even less economically viable (oil and gas engineer, Aberdeen offshore stakeholders, M)*

By contrast, just as there was acknowledgment of the finite nature of fossil fuels and the potentially large political and fiscal challenges required, there was also acknowledgment of the need for continued fossil fuel use and the challenges of decarbonising industrial sources

of CO<sub>2</sub>-EOR emissions. Building on the points made above about CO<sub>2</sub>-EOR forming part of a managed transition away from fossil fuels, it was also the case that ongoing oil extraction – and also other CO<sub>2</sub>-intensive processes - were in cases seen as not being viable unless linked to CO<sub>2</sub> injection:

*it depends what you're comparing it to. Comparing CCS to renewables is different to comparing CCS to a power plant with no CCS on it...one of the things I do think about CCS is that it is a good idea for industrial applications for chemicals and cement and paper and all that list of things (energy advisor, London NGOs, F)*

*I think that governments can encourage companies to adopt CCS technology through incentives, like when a company is applying for licences you can tie that to the licence and encourage companies to explore CCS technologies. In the end they are not losing, because they can use this carbon dioxide to pull out more oil. So the government gains and industry also gains, because they are getting to improve climate change, and industry is also going to get more oil out of the ground if the industry could do that through regulations and incentives like that, tie that to licencing (employee of west African operator, Aberdeen young professionals, M)*

Whilst many participants did not necessarily see CCS and CO<sub>2</sub>-EOR as being viable in and of themselves, it was nevertheless suggested that CO<sub>2</sub>-EOR injection had a pivotal role to play in reducing the carbon intensity of ongoing oil recovery. A policy challenge that arose out of this was to find ways to encourage - or even mandate - CO<sub>2</sub> injection as part of ongoing extraction operations. Key to note as well is the perception that national governments are seen as having a responsibility to create the conditions in which CCS and CO<sub>2</sub>-EOR become viable for industry, and to ensure such developments are governed in the public interest (as discussed above in respect to the policy scenarios).

## Relation of findings to existing CO<sub>2</sub>-EOR research

Building on the challenge laid down by Klokk et al (2010) with regard to researching the range of stakeholder perceptions across the CO<sub>2</sub> chain, the findings of WP10 in some ways support the results of existing research into perceptions of CO<sub>2</sub>-EOR, but in other ways add extra granularity to the body of literature

In terms of CO<sub>2</sub>-EOR making CCS more attractive to stakeholders by giving potential for boosting yields from nearby oil fields (Chaudhry et al, 2013; Liu et al, 2013; Reiner and Liang, 2012), some WP10 stakeholder participants likewise spoke positively about CO<sub>2</sub>-EOR prolonging the life of the North Sea whilst helping towards climate goals through associated CCS. This included not only those directly involved in oil and gas, but also others (such as fishers and shipping operators) who enjoyed mutually beneficial and economically positive relationships with oil and gas developers, and saw CO<sub>2</sub>-EOR as a way of sustaining these relationships whilst meeting climate challenges.

Nonetheless, whereas previous studies tended to show higher support for CO<sub>2</sub>-EOR among stakeholders with experience of the oil and gas industries, in WP10 the participants with the most experience and knowledge of offshore operations were among the more sceptical of the likelihood of CO<sub>2</sub>-EOR linked to CCS occurring in the North Sea. This more cautious stance stemmed from such participants' concerns over the technical suitability of existing North Sea infrastructure for CO<sub>2</sub> injection, and scepticism over whether CO<sub>2</sub>-EOR would ever be viable in the North Sea given the complexities and perceived investment risks involved. Indeed, participants with backgrounds more closely aligned to financial and energy systems analysis noted that if CO<sub>2</sub>-EOR were economically viable, operators would likely be doing it already. In short, whilst research of Chaudhry et al (2013) and Liu et al (2013) showed more positive perceptions of CO<sub>2</sub>-EOR among stakeholders close to oil and gas operations, the broad-reaching nature of the WP10 research reveals that stakeholders' positive perceptions may in cases be tempered by a perception of technical and financial difficulties lying ahead.

Fitting with the findings of Setiawan and Cuppen (2013) in Indonesia and Mabon and

Shackley (in press) in Scotland, stakeholders with a more environmental focus tended to emphasise the links between EOR, CCS and what they viewed as the deleterious effects of a fossil-fuel based economy. At a general level, these stakeholders saw a risk that the usage of captured CO<sub>2</sub> for EOR could lead to 'mission drift' from CCS as a bridging technology to a low-carbon energy future to a means of allowing the unabated extraction of fossil fuels to continue. The 'low-carbon energy future' such participants ultimately envisioned involved not only renewable energy sources, but also reduction in energy demand through behaviour change at the personal level and re-consideration of how society is governed more widely. Nonetheless, this more cautious group of stakeholders did also express a pragmatic recognition – which does not come across so explicitly in previous studies – that some oil would continue to be required during the transition to a low-carbon economy, and that CCS offered a means of decarbonising existing gas- and coal-fired power stations (and heat provision and industrial sources) during the transition. Although the environment-focused stakeholders participating in WP10 did share the concerns of previous research about the negative connotations of a fossil fuel-driven energy system, this data illustrates that there may nonetheless be cautious and qualified support for some CO<sub>2</sub>-EOR if it is framed strictly in terms of producing and utilising remaining fossil fuel resources in more controlled and sensitive manner (e.g. utilizing existing fields rather than further exploration), and regulated/governed in such a way as to be embedded within a transition to renewable energy sources and more sustainable forms of energy use and behaviour.

Among publics, it may come as little surprise to discover that similar to research carried out in areas where there was high familiarity with oil and gas infrastructure, the participants in Aberdeen were generally positive about CO<sub>2</sub>-EOR. The reasons given for this were broadly similar to those identified in Sacuta et al (2013) and Boyd (2015) – trust in operators to carry out CO<sub>2</sub>-EOR safely; familiarity with the infrastructure, processes and technology involved; dependency of the area for the jobs and economic benefits provided by oil and gas industries, which CO<sub>2</sub>-EOR was seen as prolonging. However, whilst work such as that carried out by Hovorka and Tinker (2010) emphasises the job creation/retention aspects of CO<sub>2</sub>-EOR, it is worth noting that publics in Scotland – including those in Aberdeen – widely acknowledged the need for climate change mitigation and the move towards renewable sources of energy as part of this. Alongside the goal of maximising economic return of oil reserves, therefore, publics in Scotland also felt that CO<sub>2</sub>-EOR had a role to play in proving the viability of CCS as a system for producing low-carbon electricity. Nunez-Lopez et al (2008) and Hovorka and Tinker (2010) discuss the possibility of using CO<sub>2</sub>-EOR to demonstrate storage capability, but in the case of the WP10 findings publics themselves go even further to argue that more than 'demonstrating' storage capability, there must from the outset be a clear climate imperative for undertaking CO<sub>2</sub>-EOR as part of CCS.

Following the observations of Melzer (2012), a key question among both stakeholder and public participants in WP10 was that of who benefits from CO<sub>2</sub>-EOR. Building on Melzer's thought that incentivisation of CO<sub>2</sub>-EOR ought not to be seen as a way of boosting oil company profits, what the WP10 data suggests is that in order to minimise the potential for negative perception, CO<sub>2</sub>-EOR as part of CCS ought to be carried out in the public interest, benefitting society at large through climate change mitigation, job creation or manageable energy bills. Key here is that regardless of whether or not oil and gas companies would significantly profit financially from CO<sub>2</sub>-EOR in the North Sea, if operators come to be *perceived* as the primary beneficiaries of CO<sub>2</sub>-EOR then support may be limited. This data thus suggests that a role for governments in overseeing (or even directly delivering) CO<sub>2</sub>-EOR and associated CO<sub>2</sub> storage is thus crucial in building positive perception.

In sum, the findings of WP10 are largely consistent with those of previous research into stakeholder and public perceptions of CO<sub>2</sub>-EOR. However, as an intensive qualitative study spanning a range of stakeholder groups, the WP10 data adds additional granularity and nuance to the field of extant literature. In particular, the data showed that stakeholders working close to oil and gas do see CO<sub>2</sub>-EOR as making CCS more attractive, but also that due to their experiences with technology and finance may be more cautious as to the short-term viability of CO<sub>2</sub>-EOR. By contrast, although concerns over the links between CCS and a fossil fuel economy among more cautious stakeholders were borne out in this study as well, discussions revealed that there was still potential for qualified and limited support for CO<sub>2</sub>-EOR if framed and governed strictly in terms of a *managed transition* away from fossil fuels to a low-carbon energy system.

## Barriers and potential enablers identified

Any consideration of CO<sub>2</sub>-EOR by policy makers will need to include an assessment of how it will be perceived by stakeholders, and whether this provides opportunities for policy options – or indeed risks that should be managed in advance.

As a means of providing a foundation for any such consideration, we present here an overview of key themes identified across focus groups. Two figures are presented to illustrate the relative strength of engagement in respect to key barriers to support for CO<sub>2</sub>-EOR, and in respect to policy initiatives that might help address these and engender support.

For the purposes of comparison, notes are included as to issues identified in WP1 analysis of Scottish NGO concerns. In both figures, the shading reflects the extent to which the respective focus groups discussed the different themes, with darker colours reflecting stronger engagement. This enables identification of priority areas within and across stakeholder groups. It should be recognized that focus groups were time-limited and sought to enable input across a range of topics. It should not be assumed that themes which appear to be absent for a particular group were unimportant, just that they did not emerge strongly in the initial discussions. What this approach adds, however, is a means of identifying potential areas of risk or opportunity that can be further tested with other stakeholder groups. This will enable identification of whether policy approaches or political framings will resonate across different audiences.

### Key barriers to support for CO<sub>2</sub>-EOR

Figure 3 below identifies key barriers to support for CO<sub>2</sub>-EOR, as identified via our analysis of focus group discussions. It should be noted that there was a strong engagement across multiple ‘negative’ implications of CO<sub>2</sub>-EOR by participants of both the London NGO and Edinburgh Climate Professionals focus groups. This finding is in line with the assessment of Scottish NGO concerns undertaken in WP1, and reflects the tension identified between CCS being seen as a positive attempt to address climate change and the negative perception of CO<sub>2</sub>-EOR as a continuation of fossil fuel extraction. Both of these focus groups identified ethical / moral concerns over fossil fuel production and the challenge of leadership for the UK and Scotland in the light of historical use of fossil fuels and relative levels of economic development.

The London Finance focus group shared a number of these concerns, but participants identified a different rationale for this. From the perspective of considering investment in CCS and / or CO<sub>2</sub>-EOR projects, this stakeholder group was concerned about the absence of a credible and sustainable business case for investment. This suggests that policy makers may be able to address multiple stakeholder concerns through effective policy – i.e. by finding solutions that provide both ‘private interest’ business case and ‘public interest’ benefits.

Interestingly, however, the top issue for engagement across all focus groups was in respect to the perceived clash between short term decision making (linked in particular to electoral cycles) and the need for longer term planning for infrastructure deployment and the delivery of a credible North Sea transition plan. This reinforces the finding noted above that there was skepticism as to the efficacy of policy interventions and the gap between desired and expected outcomes across all stakeholder constituencies.

**Figure 3: Key barriers to support for CO<sub>2</sub>-EOR**

CO <sub>2</sub> -EOR Focus Groups – Key barriers to support for CO <sub>2</sub> -EOR								
	Aberdeen public	Aberdeen stakeholders	Edinburgh public	Edinburgh climate professionals	London finance	London NGOs	New field early career professionals	WP1 – Scottish NGOs
Fossil fuels are finite anyway, so why bother?								Comparison with continued exploration
CO <sub>2</sub> -EOR yields small returns: why bother?								Risk of CO <sub>2</sub> -EOR as driver of increased production
CO <sub>2</sub> -EOR diverting from renewables								Primacy of renewables goal vs CCS costs
Electoral timescale vs long-term planning								Importance of targets for Renewables
Unclear role of power sector CCS in future						[Positive interest in industrial emissions]		[Positive interest in industrial emissions]
CO <sub>2</sub> mitigation vs wider sustainability								Stewardship approach possible if strong policy
Ethical/moral contestations to fossil fuel use								UK Responsibility for early transition

*Darker shading = theme emerged strongly in group. No shading = no sustained discussion.*

**Policy Initiatives that could engender support for CO<sub>2</sub>-EOR**

Figure 4 below sets out our assessment of themes identified across the different stakeholder discussions that could help engender support for CO<sub>2</sub>-EOR. As above, there was again a close alignment with issues identified by Scottish NGOs in WP1.

The most intense engagement across themes took place in the discussion with Edinburgh Climate professionals, reflecting both the professional background of participants and their interest in considering how potential negative implications of CO<sub>2</sub>-EOR could be mitigated.

More generally, Figure 3 arranges themes which reflect the tendency for stakeholders to engage more strongly with broad principles rather than specifics. Within this context, specific policy options such as the potential management or delivery of CO<sub>2</sub>-EOR via a national CO<sub>2</sub> storage company were considered in the light of whether they were potential means of delivery, rather than being the main focus of discussion. More detailed testing of potential policy interventions would be a valuable further step beyond the scope of this project.

As a consequence, it should be noted that there was strong engagement across all 3 of the themes of: 1, managed transition for the North Sea; 2, decarbonisation and renewables; and 3, social sustainability in terms of long-term employment, fair distribution of risks and benefits, and energy security. These share a common link in respect to CO<sub>2</sub>-EOR being a means of enabling different elements of a transition to a low-carbon economy – whether via the financial receipts of oil production or more directly via employment benefits and the accelerated deployment of CO<sub>2</sub> infrastructure. What is also evident here is the need for CO<sub>2</sub>-EOR to fit within long-term, integrated thinking on the governance of climate change and renewal of energy systems, in a way that perhaps transcends short-term political cycles.

**Figure 4: Policy initiatives that could engender support for CO<sub>2</sub>-EOR**

### CO<sub>2</sub>-EOR Focus Groups – Policy initiatives that could engender support for CO<sub>2</sub>-EOR

	Aberdeen public	Aberdeen stakeholders	Edinburgh public	Edinburgh climate professionals	London finance	London NGOs	New field early career professionals	WP1 – Scottish NGOs
Benefit to society rather than profits								Yes
Managed by national CO <sub>2</sub> storage company					[Interest in Regulated Asset Base approaches]	[As means of securing social benefits]		Considered in passing
Pragmatism: fossil fuels embedded in soc. for now								Need for transition
CO <sub>2</sub> -EOR as managed transition from fossil								Yes
Narrative of decarbonisation and renewables								Yes
Situated in context of social sustainability								Yes

*Darker shading = theme emerged strongly in group. No shading = no sustained discussion.*

It is worth noting here that even in the groups which on the whole were more cautious towards CO<sub>2</sub>-EOR (especially Edinburgh Climate Professionals and London NGOs), there was a pragmatic recognition that reliance on fossil fuels would not cease immediately and that any large-scale transition to renewable sources, energy efficiency and / or behaviour change would take place over decades. For instance, it was acknowledged that although the electricity sector in the UK could potentially be decarbonised over the next ~15 years, it was more likely that emissions of CO<sub>2</sub> from industrial processes and usage of fossil fuels in heat and transportation would need to be addressed over the medium term.

There is thus possibility for CO<sub>2</sub>-EOR to be framed in policy terms as making the most efficient use of existing oil fields whilst simultaneously reducing atmospheric CO<sub>2</sub> emissions from electricity generation and industrial sources. As above, though, to retain credibility this must be couched in a wider framework of transition and a move to low-carbon technologies.

## Conclusions

### Coherence with WP1 findings

WP1 identified that Scottish environmental NGOs were skeptical as to the potential role of CO<sub>2</sub>-EOR, seeing it as 'a bad price to pay for a good thing'. It identified that any policy approach seeking to support CO<sub>2</sub>-EOR deployment would need to carefully consider and communicate wider benefits to social and climate objectives.

This finding has been supported by the analysis of the focus groups undertaken with seven different constituencies during the course of WP10. While each stakeholder group had their own specific areas of interest and concern there was a broad alignment around the necessity of situating CO<sub>2</sub>-EOR within a context of the low-carbon transition. Across the different focus group discussions there was a repeated identification of the need to meet climate objectives and for 'social' value to be derived, not just private benefits. Notably, this was the case even for those stakeholders who were more positively disposed towards CO<sub>2</sub>-EOR.

### Key issues for policy maker consideration

The analysis undertaken across both WP1 and WP10 identified that policy makers will need to consider a broad canvas of policy options and public interest framings. There was a noticeably limited positive response for a narrow 'Wood Review' focus on using CO<sub>2</sub>-EOR solely as a means of maximizing economic recovery of North Sea oil and gas. Instead, broader narratives of transition and future vision for the North Sea had greater appeal and were seen to provide a context within which the scale of (public) investment in CO<sub>2</sub>-EOR could be economically and socially justifiable.

However the skepticism across stakeholder groups as to the deliverability of desired outcomes underlines the need for policy solutions to be technically robust as well as attractive to a range of stakeholders.

### Next steps

The discussions undertaken in the WP10 focus groups started to identify options that could achieve these kinds of end goal, in particular in respect to the desire for public / state oversight or delivery of CO<sub>2</sub> storage and the positioning of CO<sub>2</sub>-EOR within a North Sea transition framework. However WP10 did not set out to identify or test specific policy propositions, meaning that further investigation of options would be warranted. Such analysis may prove valuable in the short term given that CO<sub>2</sub>-EOR has been identified as an issue during parliamentary consideration of the creation of the new offshore regulator in Infrastructure Bill 2014.

Subsequent to steering group approval of this draft report, we propose to present the findings of this study to relevant policy makers. Not only will this provide valuable feedback on how CO<sub>2</sub>-EOR is being considered within political debates and policy processes, but will help us to identify specific policy options that would benefit from further testing. More specific recommendations to policy makers would then be incorporated into a final report.

### Areas for further research

- We would highlight the significant emergence and growing political salience of 'pro-independence' stakeholders in Scotland during the period of this study. We believe that the views and perceptions of this constituency with regard to energy and climate will be important influencing factors on future policy prioritization, and should be addressed directly in any further investigations;
- Further research may also wish to consider in more depth what the end goal is of the 'managed transition' many participants spoke about. Issues that may be explored

here include the kinds of renewable energy technology that could be involved and the time frames/costs associated with their deployment, how changes to governance and individual behaviours may be enacted in practice, and how CO<sub>2</sub>-EOR may facilitate this transition. Such work could enlist further engagement with environmental NGOs and professionals, and also experts in energy analysis and energy systems;

- It may also be worthwhile considering the difference between other parts of the world – where there is familiarity with CO<sub>2</sub>-EOR and a ready source of CO<sub>2</sub> – and Scotland. Of particular interest in this regard is the fact that development of CO<sub>2</sub>-EOR in, say, North America was initially an economic decision, whereas in Scotland the motivation is more likely to be climate change mitigation. It may thus be of value to explore how publics and stakeholders' perceptions of CO<sub>2</sub>-EOR relate to their perceptions of coal/gas or industrial CCS, and to consider the extent to which policy and engagement lessons from CO<sub>2</sub>-EOR in other parts of the world are transferrable to Scotland.

## Appendices

WP1 report pp xx - xx

WP1 analysis of Holyrood debate, January 2013 [to follow]

WP10 Summaries of focus groups pp xx – xx

WP10 presentation slides [to follow]

# CO<sub>2</sub>-EOR Stakeholder Perceptions and Policy Responses

## CO<sub>2</sub>-EOR JIP Work Package 1

9 September 2013

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### Executive Summary

- The development of CCS in UK has been policy dependent – it has been shaped by political decisions and NGO influence. NGO positions have been important in supporting the development of CCS within a decarbonisation framework.
- CO<sub>2</sub>-EOR is only now being considered in the UK; this is significantly different from the situation in North America, China etc where it is a more important driver for action.
- There has been limited NGO engagement over recent years in UK offshore policy, however there is now increasing criticism at UK level regarding production subsidies. This has not yet touched on CO<sub>2</sub>-EOR, but this could change rapidly depending on the selection of CCS projects.
- Scottish political and policy debate is much more open. There is a strong political narrative in favour of maximizing oil production. Scottish NGOs are proactively engaged in policy debates on the environmental impact, safety, and international influence of the sector as well as in respect to climate change concerns.
- CO<sub>2</sub>-EOR is already being explicitly considered in the Scottish policy context. NGOs are beginning to engage. As previously with UK CCS policy, it is evident that the broader policy context is important for informing perceptions as well as the form of individual projects.
- Generally, NGOs consider that CO<sub>2</sub>-EOR is ‘a bad price to pay for a good thing’. Alternative forms of CO<sub>2</sub> storage are preferred, and alternative policies are viewed as more likely drivers for the development of CO<sub>2</sub> infrastructure and storage capabilities in line with public interests.
- Policy actions that could link CO<sub>2</sub>-EOR operations to other climate benefits (e.g. restrictions on exploration / production in new fields) would have intuitive appeal, but are currently not being considered by policy makers.
- Individual CCS projects considering the integration of CO<sub>2</sub>-EOR will have to carefully consider how they communicate this impact on project benefits.
- Policy makers need to consider the overall coherence of policy aims, and the extent to which they enable CCS projects to provide a clear and positive decarbonisation role.
- CO<sub>2</sub>-EOR projects would intersect climate and energy policies, which are increasingly perceived to be in conflict. There is therefore a risk that by making this conflict more visible it could trigger opposition that would rebound negatively on CCS more generally.

# 1. Context

## 1.1 Introduction

Carbon Capture and Storage technologies provide a potential means of lowering emissions of CO<sub>2</sub> from the use of fossil fuels in electricity production and industrial processes. When combined with biomass they could result in 'negative emissions' that effectively reduce the level of CO<sub>2</sub> in the atmosphere. As such, the widespread deployment of CCS has been identified as a key mitigation option that can help address the causes of climate change.

In the UK and Europe, the development of CCS to date has been entirely driven by policy. In North America, the long-standing use of CO<sub>2</sub> for Enhanced Oil Recovery (CO<sub>2</sub>-EOR) has provided an additional commercial driver that has supported the development of initial CCS projects even in the absence of climate objectives and associated policy instruments.

Environmental NGOs have been active in shaping the policy context for CCS and public debates in the UK and EU.<sup>1</sup> NGOs are regularly featured as key voices in media discussion of climate policy. With public trust in NGOs often higher than for other relevant actors, NGOs play an important role as messengers. NGO positions thereby help to inform broader public perceptions – on topics as broad as views of risk, technology choices, or political credibility.

### Work Package Rationale

To date there has been little public debate or policy-maker consideration of the merits and challenges facing the development of CO<sub>2</sub>-EOR operations in the UK. This contrasts with significant historical experience and stakeholder engagement with CO<sub>2</sub>-EOR in the USA, and, to a lesser extent, Norway.

The continued development of UK CCS projects and their potential linkage to CO<sub>2</sub>-EOR operations means that consideration of these issues will now begin to occur. While CCS has seen broad stakeholder support to date in the UK, this has been within the context of CCS being perceived as a climate mitigation technology. The addition of CO<sub>2</sub>-EOR operations complicates this headline message, impacting upon stakeholder perceptions. Conversely, the potential economic benefits that could result from CO<sub>2</sub>-EOR may help to unlock public funding support for CCS.

However there is currently a low level of underlying knowledge about CO<sub>2</sub>-EOR among non-specialist audiences, including policy makers. In order to inform these nascent debates, this work package will therefore engage with key interest groups and decision makers to identify:

- **Existing levels of understanding, knowledge gaps and areas of further interest**
- **Existing perceptions of CO<sub>2</sub>-EOR and its potential merits and challenges**
- **The implications for CCS projects considering CO<sub>2</sub>-EOR operations**
- **The implications for government policies that will influence both the technical execution and stakeholder perception of CCS projects integrating CO<sub>2</sub>-EOR operations.**

With the potential development of CO<sub>2</sub>-EOR in the UK now being more actively considered by

<sup>1</sup> For a full discussion of the influence of NGOs on UK CCS policy see Littlecott, C (2012) Stakeholder interests and the evolution of UK CCS policy, ENERGY & ENVIRONMENT, VOLUME 23, No. 2&3.

policy makers, the focus of WP1 has therefore been to identify likely areas of concern from an NGO perspective and anticipate implications for policy. As set out below, the Scottish policy context was identified as the most important venue for explicit discussion of CO<sub>2</sub>-EOR, so has therefore been the area of initial focus.

However, it is likely that any developments in CCS policy that accelerate EOR would have UK-wide and potentially broader EU implications. As such, it would also be valuable to engage with stakeholders outside Scotland to understand views and develop policy frameworks that could address any concerns.

## 1.2 Carbon Capture and Storage: perceptions and policy development

Public attitudes towards CCS have been important influences on the deliverability of projects and the shape of government policies. In Germany, outright opposition to CCS from local campaign groups and NGOs has resulted in the cancellation of projects and a very restrictive legal context.

To date, the UK has benefited from a constructive approach from leading NGOs towards CCS. There has been no direct opposition to projects on the basis of the inclusion of CCS technology itself. Where projects have been opposed (principally at Kingsnorth and Hunterston) this has been due to the projects being viewed as damaging to the climate due to the inclusion of large unabated capacity which could result in lock-in to fossil fuels without a clear requirement for CCS. As such, the NGO position in the UK has sought more CCS rather than less.

Importantly, debates about the appropriateness of individual CCS projects have been able to take place largely within a broader policy context that aims to secure the decarbonisation of the power sector and the broader economy. Despite recent political rumblings as to the future revision of carbon budgets, the current policy context provides a positive foundation from which to take forward CCS projects in the UK.

The UK government proposes to integrate CCS into its current Electricity Market Reform efforts, and this has been viewed by NGOs as being coherent with the overarching decarbonisation framework. Furthermore, the Committee on Climate Change has advised that the power sector should aim for an average emissions intensity of around 50gm/kWh in 2030. This has strengthened the argument in favour of CCS being deployed at scale.

It is notable that recent NGO campaigns and direct action protests have concentrated on the political support being given to fracking<sup>2</sup> and unabated gas,<sup>3</sup> rather than on the use of CCS. Such efforts have sought to highlight the perceived incoherence of government policies that claim to address climate change while simultaneously promoting unabated fossil fuel use.

With the UK's CCS Commercialisation Programme due to select projects for further development in the near future, there is inevitably a risk that local issues may result in criticism or opposition to individual CCS projects. Of specific relevance for this paper is the question of whether projects might intend to undertake CO<sub>2</sub>-EOR operations, how this might impact on perceptions of the acceptability of CCS, and how the policy framework might evolve to help address any such concerns.

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<sup>2</sup> See <http://www.guardian.co.uk/environment/2013/mar/04/anti-fracking-rig-george-osborne>

<sup>3</sup> Notably the 'no dash for gas' occupation of West Burton power station for 7 days in October 2012. [www.nodashforgas.org.uk](http://www.nodashforgas.org.uk)

### 1.3 The emergence of CO<sub>2</sub>-EOR in the UK

The integration of CO<sub>2</sub>-EOR into CCS projects is a new consideration for UK policy makers and broader stakeholder groups. While there has been long-standing industry, academic and policy maker interest in different forms of EOR technologies that could be deployed in the North Sea, the lack of sufficient CO<sub>2</sub> for use in EOR had previously resulted in CO<sub>2</sub>-EOR not being under active consideration. In recent years, however, the continued pursuit of a UK CCS sector has resulted in project developers coming forward with proposals for CCS projects that would seek to integrate CO<sub>2</sub>-EOR operations into their business model.

This approach draws from the long-standing commercial experience of CO<sub>2</sub>-EOR in the USA and Canada. In the absence of climate legislation, leading NGOs in those countries have been proactive in policy debates on CO<sub>2</sub>-EOR, and have championed the use of tax credits and other incentives to stimulate additional efforts in CCS and CO<sub>2</sub> storage.<sup>4</sup> Similarly, CO<sub>2</sub>-EOR is being considered in China as a means of stimulating development of CO<sub>2</sub> infrastructure, particularly via the use of CO<sub>2</sub> sources with low cost of capture.

It should be noted, however, that in North America and China the development of CO<sub>2</sub>-EOR can be viewed as being a progressive, pro-climate action when considered in the context of their respective domestic climate policy efforts. In the UK context, by contrast, there is a risk that CO<sub>2</sub>-EOR could be viewed as a negative step compared with the previously default CO<sub>2</sub> storage solution of injection into saline formations or depleted oil and gas reservoirs without the inclusion of EOR activities.

### 1.4 UK debate – subsidies in focus, but not yet considered for CO<sub>2</sub>-EOR

The principle policy levers of relevance to both CCS and oil and gas production currently reside at UK level. DECC is the sponsor of the UK CCS Commercialisation Programme, and leads on North Sea production licensing. HM Treasury is the recipient of tax revenues and determines the form of fiscal incentives for operators.

In respect to CO<sub>2</sub>-EOR, there has been relatively little political attention or policy interest. In 2010 DECC published a study on the potential for the optimization of CO<sub>2</sub> storage in CO<sub>2</sub>-EOR operations. CO<sub>2</sub>-EOR has also been more recently identified by the joint DECC-Industry Cost Reduction Taskforce as a potentially valuable approach in respect to overall project costs and financing requirements.<sup>5</sup> However CO<sub>2</sub>-EOR has generally received only passing reference in government publications. For example, the April 2012 CCS Roadmap dedicates a whole section to R&D, but on EOR more sparsely states:

*“1.3. If large volumes of CO<sub>2</sub> become available in the North Sea they could be used for enhanced hydrocarbon recovery, improving the economics of the whole CCS chain – turning CO<sub>2</sub> into a valuable commodity rather than a costly liability, making better use of the country’s hydrocarbon reserves and helping to accelerate deployment of CCS.”<sup>6</sup>*

Despite the significant impact of North Sea oil and gas production on the UK economy, there is little NGO capacity dedicated to offshore matters on a continuing basis. However, NGO actions have in the past had significant influence on public perceptions – for example the direct actions, legal cases and consumer boycotts linked to the proposed disposal at sea of the Shell Brent Spar oil storage installation in the early 1990s.

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<sup>4</sup> See for example the National Enhanced Oil Recovery Initiative coalition of NGOs and industry <http://neori.org/>

<sup>5</sup> CCS Cost Reduction Taskforce interim report

<sup>6</sup> DECC, CCS Roadmap, April 2012

In the light of increasing use of field allowances as a means of stimulating further production, UK NGOs have begun analysis and media comment critical of government policy. This has focused on both the impact of economic subsidies<sup>7</sup> and the unsustainable use of tax revenues<sup>8</sup> (particularly when viewed in comparison with the approach taken in Norway).

As yet, there has been no direct policy or media discussion of CO<sub>2</sub>-EOR incentives. If they were to be considered or introduced, this would however take place against a backdrop of increasing awareness of the broader policy incentives in place seeking to maximize North Sea production.

### 1.5 Scotland debate – maximizing production, including via CO<sub>2</sub>-EOR

Compared with the UK situation outlined above, there is a much more prominent media and policy debate in Scotland regarding continued North Sea production and the potential role of CO<sub>2</sub>-EOR within this.

Policy interest in CO<sub>2</sub>-EOR has been increasing over recent years<sup>9</sup>, spanning the Scottish oil and gas strategy 2012-2020, previous SCCS studies on CO<sub>2</sub> transport and storage opportunities in Scotland, the scoping analysis undertaken on behalf of Scottish Enterprise by Element Energy in 2012, the formation of the EOR-CO<sub>2</sub> JIP itself. These approaches have been developed in the political context of repeated public support from the First Minister and other leading politicians, often with relevance to the broader Independence debate. In January 2013, the Scottish Parliament held a debate on *Oil and Gas – the success and opportunities*, with cross party interest in the future of the sector.<sup>10</sup> The role of CO<sub>2</sub>-EOR was explicitly noted by Minister Fergus Ewing and others, and was critiqued by Green MSP Patrick Harvie as being inconsistent with broader policy objectives aimed at decarbonising the Scottish Economy. Annex 1 below identifies key themes from the Parliamentary debate.

Within this context, and given the closer proximity of North Sea operations, Scottish NGOs have tended to take a more active interest in offshore matters. Over recent years this has included domestic concerns such as delivery of climate policy, concerns on safety,<sup>11</sup> and environmental impacts. Similarly, NGOs and campaigners have also made the link between Scottish companies and international oil sector issues – including in relation to Arctic drilling by Cairn,<sup>12</sup> and the financing of tar sands developments by RBS.<sup>13</sup>

The Scottish political debate is therefore far more open to the discussion of the potential role of CO<sub>2</sub>-EOR within the broader offshore policy framework. NGOs take a more proactive role in commenting on offshore policy matters, including on safety and environmental issues. In January 2013, NGOs used the 20<sup>th</sup> anniversary of the Braer oil spill to highlight continued

<sup>7</sup> See [http://www.foe.co.uk/resource/briefings/tax\\_breaks\\_2013.pdf](http://www.foe.co.uk/resource/briefings/tax_breaks_2013.pdf) and [http://www.foe.co.uk/resource/press\\_releases/n\\_sea\\_oil\\_bonanza\\_25022013.html](http://www.foe.co.uk/resource/press_releases/n_sea_oil_bonanza_25022013.html)

<sup>8</sup> See <http://platformlondon.org/2013/02/25/osbornes-tax-breaks-for-north-sea-oil-and-a-thatcherism-flashback/>

<sup>9</sup> Note, however, that the Scotland CCS Roadmap in 2010 made very limited reference to CO<sub>2</sub>-EOR, stating “There may also be some opportunity for the use of carbon dioxide for Enhanced Oil Recovery (EOR), which can increase oil production levels, although, as the Scottish study stated, there are a number of technical and cost issues which need to be considered before EOR can be developed in the North Sea.”

<sup>10</sup> Full debate transcript available at <http://www.scottish.parliament.uk/parliamentarybusiness/28862.aspx?r=8022>

<sup>11</sup> See <http://www.bbc.co.uk/news/uk-scotland-scotland-politics-21643231>

<sup>12</sup> See <http://www.foe-scotland.org.uk/news291112>

<sup>13</sup> See <http://www.foe-scotland.org.uk/node/1520>

problems in the sector. WWF Scotland set out a six point plan that in their view would reduce the risk of future spills and accidents by the oil and gas industry:

- **Ministers to commit to transition away from oil and gas (including following Norway's lead by investing money raised by taxing oil and gas drilling in clean renewables)**
- **Avoid oil and gas drilling in dangerous deep-water locations, such as West of Shetland**
- **End government subsidies and other tax breaks for the oil and gas industry**
- **Agree a permanent solution to Emergency Towing Vessel cover around Scotland's coastline**
- **Banning companies with a poor pollution record from operating in the North Sea**
- **Scottish oil and gas explorers commit to avoiding sensitive areas elsewhere in the world, such as the Arctic**<sup>14</sup>

Within the Scottish political debate, NGOs are the central voice contesting the appropriateness of efforts to maximise North Sea production of oil and gas. This critique has implications for ongoing policy processes (particularly consideration of the draft Report on Proposals and Policies) and the coherence of political messages that seek to set out a way forward that combines climate action and continued oil production.

This clash of viewpoints was highlighted in October 2012 in a Guardian article entitled "Scotland's North Sea energy policies 'irreconcilable with green government'".<sup>15</sup> Published to coincide with a speech by the First Minister to the Low-Carbon investment conference, this contrasted pro-climate rhetoric with the impact of increasing oil and gas production. Climate scientists and NGOs were both quoted to this effect:

*Kevin Anderson, deputy director of the Tyndall Centre on climate change in Manchester and one of the UK's most senior climate scientists, said the world was dangerously close to breaching safe CO<sub>2</sub> levels in the atmosphere. "Without a shadow of a doubt, this is a significant and serious contradiction," he said.*

*"You cannot reconcile the position of exploiting additional fossil fuels whilst holding to our commitments [to cut carbon emissions]. In order for us to meet our international obligations, we cannot justify the extraction of additional fossil fuels."*

...

*Richard Dixon, director of the environment group WWF Scotland, said: "It is clearly indefensible to plan to make Scotland a low-carbon economy but at the same time quite happily export billions of barrels of oil for someone else to burn."*

The article closed by noting the Scottish Government position, stating:

*The Scottish government said exports of fossil fuels had no bearing on Scotland's domestic carbon emissions and said some of that energy use was covered by the European Union's carbon trading scheme.*

*Scotland needed to secure its future energy supplies and cut reliance on fuel imports, while still supplying the fuels needed for transport and industry into the foreseeable future, and insisted it was "leading the way" on new low carbon technologies.*

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<sup>14</sup> See [http://scotland.wwf.org.uk/what\\_we\\_do/press\\_centre/?6406/Braer-oil-disaster-WWF-issues-pollution-warning](http://scotland.wwf.org.uk/what_we_do/press_centre/?6406/Braer-oil-disaster-WWF-issues-pollution-warning)

<sup>15</sup> See <http://www.guardian.co.uk/politics/2012/oct/09/scotland-energy-policies-attacked>

*"Our oil and gas strategy aims to maximise the proportions of oil and gas which are recovered from each field. This is the sensible approach to stewardship of what are finite resources," a spokeswoman said.*

This article encapsulates the core fault lines of the evolving debate on oil production into which the role of CO<sub>2</sub>-EOR will be considered, as similarly repeated in the Scottish Parliament debate in January 2013. Big picture concerns about climate change are perceived to be in conflict with policy decisions aiming at maximizing resource recovery. A narrative of stewardship is advanced in relation to the recovery of resources from individual fields. But such arguments fail to convince critics in the absence of a clearer commitment to a transition away from oil and gas production towards the deployment of renewables and CO<sub>2</sub> storage.

A similar set of conflicting arguments were set out on the Guardian's 'Scottish Independence' blog of 7<sup>th</sup> March 2013, titled "Climate change poses a far greater threat to Scotland's future oil revenues".<sup>16</sup> The article connected a current political debate about the potential future revenues from oil and gas production to the implications of climate policy and the implications for both demand and oil price.

Of particular reference for this review, the article set out how the implications of climate science might be translated into national policy making and political debate. This article is notable for its focus on future challenges – this is commonly an approach taken by NGOs, but is in this case the work of a political journalist. This suggests that while the current debate on CO<sub>2</sub>-EOR has limited reach and participation, there is potential for it to be incorporated into live political debates.

Highlighted in bold below are elements of the article that have a direct bearing on Scottish policy considerations and / or political debate:

*"Next year, just as Scotland is preparing to stage its referendum on independence, the UN's International Panel on Climate Change – the scientific body charged with mapping climate change and its impacts - will put forward a series of challenging new scenarios about what the world faces.*

*In its fifth assessment report, it will offer a series of future pathways: some highly optimistic, such as utterly reshaping the global economy to see "negative" emissions – where CO<sub>2</sub> levels are actually cut, or the most pessimistic, where a business as usual scenario would see temperatures hitting 6C or more by 2100.*

*The IPCC's mapping exercise will include detailed predictions about the regional effects of global warming: how some areas, low-lying Pacific islands or vulnerable coastal countries like Bangladesh, are already facing permanent inundation, or land-locked regions, such as Pakistani and Indian interiors, larger areas of Africa, face severe temperature rises.*

***And with it will come challenging political questions for Salmond's parallel narratives that Scotland is simultaneously capable of relying on 40 years worth of untrammelled fossil fuels sales (its economy underpinned by putative £1.5tn oil and gas sales) while being a world leader on climate policy and renewable energy.***

***Last October, the Guardian disclosed that that £1.5tn sales, based on 24 billion barrels of oil equivalent, would lead to the release of some 10 billion tonnes of CO<sub>2</sub>; Salmond responded that he knew oil producing nations had a "moral obligation" to deal with climate change. What he failed to do, however, was spelt out how both conclusions were compatible."***

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<sup>16</sup> Severin Carrell, Scotland correspondent, Thursday 7 March 2013 Available at <http://www.theguardian.com/politics/scottish-independence-blog/2013/mar/07/scotland-independence-oil-climate>

The article then quoted directly the head of the IPCC, interviewed on a visit to Scotland:<sup>17</sup>

*“The significance of that challenge was sketched out, carefully, by Dr Pachauri on a visit to Edinburgh’s Heriot Watt university last week.*

*In an interview with the Guardian, Pachauri made several central points: firstly, that mature oil economies needed to urgently **begin planning the transition from fossil fuel dependency**, and secondly, that **the case of action will intensify, not lessen**.*

*The demands for a higher price on carbon – the costs to the environment from burning oil, gas and coal, will intensify. Asked about the impact of the fifth report’s conclusions for fossil fuel producers like Scotland, Pachauri said this:*

*“It’s for policy makers and the global community to decide what they want to do: it may very well be that some would say we need to do away with fossil fuels altogether as early as possible.*

*Others may say well there has to be a very carefully orchestrated transition and you can’t just stop using fossil fuels right away, because you’ve got infrastructure, you’ve got technologies which are totally dependent on fossil fuels.”*

*Whichever path is chosen, the fast or slow ones, Pachauri argues that every nation needs to begin its transition planning: within two years, the world needs to start cutting carbon emissions, if only to stop temperatures getting higher than 2.4C.*

....

*For an oil-rich country like Scotland, those questions could not be side-stepped.*

*“It’s for the people of Scotland to decide what’s best, in their own interests. I mean, we’re all part of the global community and we also have to do things which are not purely in our narrow interests. We have to do things that are also in the global interest.”*

....

***Salmond and Swinney could look to Norway for inspiration on planning a low-carbon transition economy – it has unveiled tough carbon taxes on its own oil and very tough targets on energy efficiency for Norwegian vehicles and homes, and the best model for an oil nation taking tougher, more immediate action on climate. Pachauri is saying that avoiding this issue is no longer an option.”***

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<sup>17</sup> It should be noted that the quotes from Dr Pachauri are carefully diplomatic, and the implications for Scotland are made by the journalist. Nevertheless, the appeal to authority of climate science is an approach that is likely to be repeated in the context of the release of the IPCC 5<sup>th</sup> Assessment Report.

## 2. Emerging NGO views on CO<sub>2</sub>-EOR

### 2.1 Introduction

As a consequence of increasing political interest in CO<sub>2</sub>-EOR, Scottish NGOs have begun to consider its implications, although are yet to undertake detailed analysis or campaigning activities specifically on the topic. Some NGOs were interviewed as part of the Element Energy study during 2012, and the launch of the Summit Power project at Grangemouth resulted in media comment on the inclusion of CO<sub>2</sub>-EOR – see below. The author has similarly had a number of informal conversations with NGOs (both in London and Edinburgh) over the past year.

On 24 January 2013 a workshop was held in Edinburgh with representatives from Friends of the Earth Scotland, RSPB Scotland and WWF Scotland. The presentation slides used to inform discussion are provided as Annex 1. This session provided an opportunity to share insights into the technical and geological background to CO<sub>2</sub>-EOR, particularly in respect to CO<sub>2</sub> storage and potential impacts on project life cycle analyses. The discussion then considered the potential impact of CO<sub>2</sub>-EOR on perceptions of CCS and policy implications more broadly.

The workshop was held under the Chatham House rule. Sections 2.3 and 2.4 below collate key ideas discussed, presenting them as a series of themes relevant for further consideration.

### 2.2 NGO media statements on CO<sub>2</sub>-EOR

To date, the only occasions on which UK NGOs have made specific reference in the media in respect to CO<sub>2</sub>-EOR has been regarding the announcement of the Summit Power project at Grangemouth in March 2012 and its subsequent confirmation in the UK competition.<sup>18</sup>

The Guardian included quotes from both WWF and RSPB in its coverage of the project announcement in March 2012:

*“...The company, which has teamed up with the UK based energy firms National Grid Carbon Ltd and Petrofac, said it eventually planned to use the CO<sub>2</sub> to pump out hard-to-reach oil deposits from the bedrock in the St Fergus field, a process known as enhanced oil recovery.*

*WWF Scotland said it would support the project, but only if that element of the proposal was dropped. Dr Sam Gardner said this scheme could also help capture CO<sub>2</sub> from the Grangemouth refinery and nearby industries, but its contribution to helping the climate would be significantly damaged by helping produce more oil.*

*The Royal Society for the Protection of Birds Scotland said this scheme was significantly more ambitious and serious than Peel Energy's deeply unpopular proposal, which would start operating with just over 20% carbon capture.*

*But it said the risks to local wildfowl populations on the Firth of Forth could not be minimised. Aedán Smith, RSPB Scotland's head of planning, said: “[Carbon capture and storage] must not be used to justify harm to our most important wildlife sites, either through direct damage as a result of new infrastructure, or by continuing our addiction to oil through unsustainable enhanced oil recovery.”<sup>19</sup>*

The full quote from WWF, as featured in other specialist media at the time, was:

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<sup>18</sup> Note that the 2CO Don Valley power project had previously secured planning permission under the ownership of Powerfuel. The incorporation of CO<sub>2</sub>-EOR activities was subsequently proposed following its takeover, and did not result in media comment from NGOs. There has been limited media coverage of the Teesside CCS project, and its potential incorporation of CO<sub>2</sub>-EOR has received little specific coverage to date.

<sup>19</sup> See <http://www.guardian.co.uk/environment/2012/mar/20/petrofac-carbon-capture-storage-grangemouth>

*"Unlike the climate trashing Hunterston coal proposal, the close proximity of this latest scheme to Grangemouth means it has the potential to reduce climate change emissions from the heavy industry located there.*

*However, if it is to make a credible contribution to Scotland's low carbon future the developer must drop its plans to use the captured carbon dioxide to pump out more oil from the North Sea."*<sup>20</sup>

Subsequently, in October 2012, WWF Scotland commented on the confirmation of the inclusion of the Peterhead and Grangemouth projects in the UK commercialization programme, stating:

*"While the Grangemouth scheme has the potential to develop CCS technology for use with the heavy industry located there, it would still mean the construction of an additional fossil fuel power station. In addition, the developer has raised the prospect of using captured carbon dioxide to pump out more oil from the North Sea, something that would actually lead to additional carbon emissions."*<sup>21</sup>

These media statements continue the approach taken by UK NGOs of cautiously welcoming CCS projects where they provide clear carbon benefits and limited risk of lock in to unabated emissions, as discussed above. They therefore indicate a presumption against CO<sub>2</sub>-EOR. This provided a useful reference point for the more detailed discussions of the potential implications of CO<sub>2</sub>-EOR at the workshop held in January 2013.

### 2.3 Existing perceptions of CO<sub>2</sub>-EOR and its potential merits and challenges

During the NGO workshop, participants highlighted the following areas as being particularly important for perceptions of CO<sub>2</sub>-EOR:

- **The present political emphasis on maximising oil extraction runs counter to the aims of UK and Scottish climate policy –**
  - The potential recovery of more oil, more cheaply, was viewed as being a negative outcome when considered from the perspective of climate change.
  - The pursuit of maximized production was seen as being directly at odds with the positive political rhetoric of leading politicians in respect to Scotland's climate objectives.
  - Doubts were raised in particular in regard to slow progress in the areas of transport and heating, which are end users of oil and gas produced via CO<sub>2</sub>-EOR.
  - There is therefore a problem of perceived incoherence between policy aims and political commitments, which undermines the case for deploying CCS.
  - This would be further heightened if there were to be direct competition between spending on CCS versus Renewables or Energy Efficiency.
  - The use of CO<sub>2</sub> for EOR could result in cost savings for operators (particularly when compared against other forms of EOR), thereby increasing the potential quantities of recoverable oil on both per field and on aggregate across the sector.
  - Similarly, the development of CO<sub>2</sub> infrastructure might result in life extensions to fields that would otherwise cease production in the near future, and which would not be able to deploy alternative forms of EOR before closure.

<sup>20</sup>See [http://www.e2bpulse.com/Articles/305094/E2B/Pulse/News/News\\_Articles/2012/US\\_power\\_firm.aspx](http://www.e2bpulse.com/Articles/305094/E2B/Pulse/News/News_Articles/2012/US_power_firm.aspx)

<sup>21</sup> See [http://scotland.wwf.org.uk/what\\_we\\_do/press\\_centre/?6284/Peterhead\\_and\\_Grangemouth\\_make\\_short\\_list\\_for\\_UKs\\_CCS\\_competition](http://scotland.wwf.org.uk/what_we_do/press_centre/?6284/Peterhead_and_Grangemouth_make_short_list_for_UKs_CCS_competition)

- There was interest in the fact that EOR is already undertaken in the North Sea with non-**CO<sub>2</sub>** methods, notably the use of natural gas at the Miller Field, and (in the near future) via desalinated water at Clair.
- It was therefore recognized that there may be potential advantages from using **CO<sub>2</sub>** for EOR instead of these alternative forms of EOR as a 'least-worst' option that provided **CO<sub>2</sub>** storage as co-benefit.
- However it was also noted that multiple forms of EOR might be deployed, with **CO<sub>2</sub>**-EOR potentially opening the door to other approaches via the extension of field lifetimes / development of offshore infrastructure.
- **There are alternative, preferable forms of **CO<sub>2</sub>** storage –**
  - There was a clear view that **CO<sub>2</sub>** storage without the integration of EOR was preferable – whether that would be in saline formations or depleted oil and gas reservoirs.
  - Such an approach was seen to be consistent with NGO positions that supported the development of **CO<sub>2</sub>** capture projects that did not entail the construction of new unabated capacity. Support for CCS projects had been on the basis that they were providing an approach that reduced emissions now and into the future.
  - While current proposals for CCS projects in the UK all propose to provide 'complete capture' of emissions at the power plant, the potential incorporation of **CO<sub>2</sub>**-EOR would reduce the desirability of such projects given the negative impact on overall emissions.
  - In respect to particular projects, the Peterhead project was therefore seen to be more attractive than the Grangemouth proposal – as featured in the WWF press release noted above.
  - Given that the developers of UK CCS projects have stated that they would be able to deliver full chain projects with **CO<sub>2</sub>** storage in saline formations thanks to the provision of public funding, then this was viewed as the baseline consideration of whether the incorporation of EOR provides any benefits.
  - The inclusion of EOR activities was acknowledged as providing the potential for increased commercial returns for projects and / or tax revenues to government. However it was not clear that this automatically translated into increased public benefit – any offsetting of project costs versus increased carbon emissions did not provide an attractive solution.
  - As a consequence, the incorporation of **CO<sub>2</sub>**-EOR was viewed as being 'a bad price to pay for a good thing'.
  - The development of **CO<sub>2</sub>**-EOR in North America does not provide a direct analogue to policy discussions in the UK / EU. Use of **CO<sub>2</sub>** for EOR in the USA predates concern for climate change, and has been accelerated as a consequence of a desire for higher domestic oil production.
  - NGO support for **CO<sub>2</sub>**-EOR in the USA and Canada was recognized as being part of an effort to generate momentum for a coherent climate and energy policy, rather than being a model immediately applicable to UK and Europe.
- **The development of **CO<sub>2</sub>** infrastructure might also be better supported through alternative measures –**
  - Just as it was acknowledged that the development of **CO<sub>2</sub>** storage was a positive outcome, similarly there was a view that the development of North Sea **CO<sub>2</sub>** infrastructure could help accelerate the wider deployment of CCS in the UK and EU.
  - However the stimulation of infrastructure via EOR was queried as the most appropriate way of improving prospects for deployment. Given the history of opposition to CCS in Germany and elsewhere, it was noted that alternative

policy measures such as Emissions Performance Standards or targeted **CO<sub>2</sub>** taxes might be more effective at requiring CCS and pushing projects towards the use of North Sea **CO<sub>2</sub>** storage options, while enabling improved public acceptability of CCS.

- Similarly, the location of CCS projects to enable the integration of additional emissions from industrial facilities has been supported by NGOs, yet doubts were raised as to whether this should be catalysed via demand for **CO<sub>2</sub>** for EOR rather than via targeted policy measures and strategic infrastructure investments.
- **The pursuit of CO<sub>2</sub>-EOR in the context of a North Sea transition plan that limited exploration and production of new fields held intuitive appeal –**
  - There was a recognition that maximizing production at an existing field could be viewed as good stewardship, while the maximization of production across all fields was viewed as incompatible with climate goals.
  - As a consequence, there was a view that limiting the development of new fields while supporting **CO<sub>2</sub>**-EOR in existing fields could be a way of reducing the overall level of emissions that would come from North Sea production.
  - This would position CCS and **CO<sub>2</sub>**-EOR as a means of accelerating a North Sea transition from production through to **CO<sub>2</sub>** storage, and would be compatible with the existing political interest to date in stimulating offshore renewables.
  - Similarly, such an approach could offer additional environmental benefits, such as by reducing the risks from production in new deep water fields West of Shetland.
  - Such an approach has however not yet been advanced by policy makers. Given the view that **CO<sub>2</sub>**-EOR represents a significant negative impact on the emissions associated with CCS, there would need to be a clear policy approach that addressed this with a 'policy win' of similar scale if a more positive view of **CO<sub>2</sub>**-EOR were to be achieved.

## 2.4 Areas of further interest

The workshop discussion also helped to identify a number of areas where further information and / or analysis would be valuable for informing views of CO<sub>2</sub>-EOR.<sup>22</sup> These included:

- **Infrastructure lock-in –**
  - Would the incorporation of **CO<sub>2</sub>**-EOR activities into the CCS chain increase the likelihood that CCS on power generation (and therefore fossil fuel extraction) would continue for decades to come, with a negative impact on carbon emissions overall?
  - Given the high recycling rates achieved in North American EOR projects, could the development of **CO<sub>2</sub>**-EOR infrastructure result in a further expansion of EOR activities that would significantly increase the amount of oil recovered, without substantially increasing the amount of **CO<sub>2</sub>** stored?
  - Given the age of existing North Sea infrastructure, and recent associated leakage incidents, would there be a risk of increased risks to safety and environmental impact from the significant life extension of offshore facilities to enable **CO<sub>2</sub>**-EOR deployment?
- **Development of non-EOR CO<sub>2</sub> storage –**
  - How might the deployment of **CO<sub>2</sub>**-EOR help catalyse the development and use of **CO<sub>2</sub>** storage in saline formations and / or depleted oil and gas reservoirs?

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<sup>22</sup> It was noted that some of these questions may be addressed by other areas of the EOR-CO<sub>2</sub> JIP, in which case information would be provided to workshop participants where possible.

- Would **CO<sub>2</sub>**-EOR be in competition with other forms of storage rather than helping to catalyse broader storage clusters, particularly if left to commercial drivers?
- **Quantifying the benefits of accelerated CCS deployment –**
  - If the claim is made that **CO<sub>2</sub>**-EOR is enabling the development of **CO<sub>2</sub>** infrastructure for use by other UK emitters and / or EU countries more rapidly, what are the timescales for this, and how would the relative levels of additional **CO<sub>2</sub>** emitted (by EOR) and stored (from other sources) compare?
  - What scenarios would be realistic for this, given the likelihood that other climate policy drivers would also be required, rather than assuming that **CO<sub>2</sub>**-EOR would provide sufficient pull for CCS deployment on its own?
- **Displacement vs Additionality –**
  - These approaches to considering the increased oil produced need to be considered in respect to how carbon is accounted for under emissions trading rules. How would this be managed under situations where **CO<sub>2</sub>** is being used for EOR operations at a number of locations and / or stored in saline formations?
  - This raises questions for potential future commercial models of **CO<sub>2</sub>** storage as well as how initial full chain models handle both the liability for **CO<sub>2</sub>** and the potential benefits from EOR revenues.
  - Furthermore, there is the broader consideration of how emissions from the ultimate combustion of oil produced are viewed in relation to national carbon budgets. It would be interesting to consider how associated policy approaches that seek to limit fossil fuel imports from either high carbon sources or fragile ecologies may provide benefits that offset the likely negative perceptions of **CO<sub>2</sub>**-EOR.

## 3. Implications of CO<sub>2</sub>-EOR for projects and policy

### 3.1 Introduction

Section 2 above has identified current and emerging areas of interest which will inform NGO perceptions of CCS projects that propose to incorporate CO<sub>2</sub>-EOR activities. This section looks at the implications for both individual CCS projects and broader government policies, again drawing on the discussions at the NGO workshop in January 2013.

### 3.2 Implications for CCS projects considering CO<sub>2</sub>-EOR operations

As discussed above, it is clear that on a like-for-like basis, CCS projects that intend to integrate CO<sub>2</sub>-EOR activities are less favoured by NGOs than an equivalent project that would only undertake CO<sub>2</sub> storage. These latter projects have clear advantages in being able to communicate an unambiguously pro-climate message as a justification for receipt of public funding. This is important when considering how public opposition has derailed the development of CCS projects elsewhere in Europe.

The perceived reduction in climate benefits stemming from the integration of CO<sub>2</sub>-EOR raises risks that any such projects might be perceived as attempting to 'greenwash' or obscure their climate impacts, increasing the risk of opposition and direct action campaigns.<sup>23</sup>

It was noted in this context that it was unclear as to whether CO<sub>2</sub>-EOR was considered an intended or potentially additional aspect of the Summit Power / Captain Clean Energy Project at Grangemouth, with different messages having been heard direct from the project and via national and international media during the past 12 months.

In order to address such concerns, CCS projects will need to be able to clearly communicate information about how the integration of CO<sub>2</sub>-EOR operations would impact on a number of project features. This will of course need to include the overall level of carbon emissions stored / additionally generated, but also extend to include project revenues and tax payments. Given that CCS projects will be in receipt of significant levels of public funding in order that carbon emissions are captured and stored, it will be necessary for projects to explain how any EOR revenues received are directed towards public benefit rather than purely private returns.<sup>24</sup>

Given that the development of CO<sub>2</sub>-EOR in the North Sea is likely to form part of a broader approach to CO<sub>2</sub> infrastructure deployment, it will also require the early consideration and communication of the chain of responsibility for CO<sub>2</sub>. For example, if there were to be a separate provider of CO<sub>2</sub> storage functions, this might make it easier for the operator of a CO<sub>2</sub> capture plant to 'hand over' responsibility for the CO<sub>2</sub>. Such an approach would however also need to be consistent with accounting for CO<sub>2</sub> emissions under Emissions Trading regulations. It is likely to also be complicated by the range of commercial arrangements envisaged for early CCS projects.

### 3.3 Implications for government policies

While it is clear that there would be additional public communications challenges for individual CCS projects seeking to incorporate CO<sub>2</sub>-EOR, it is also apparent that many of the key influencing factors lie in the domain of government policy rather than individual projects.

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<sup>23</sup> See for example the very negative reaction to the Summit Power Grangemouth proposal from members of Coal Action Scotland <http://coalactionscotland.org.uk/?p=2914>

<sup>24</sup> Similar risks would fall on CCS projects that would intend to seek additional public funding for running unabated under the proposed capacity mechanism.

To illustrate by way of analogy, the UK CCS sector has benefited from being developed in the context of a commitment to decarbonisation, as instituted by the Climate Change Act 2008 and the subsequent setting of carbon budgets.<sup>25</sup> This has helped provide a context against which projects could be readily assessed as to whether they contribute to (or detract from) the achievement of overall climate objectives. This helps explain why proposed projects at Kingsnorth and Hunterston have been withdrawn, while all 4 of the current remaining bidders in the Commercialisation Programme do not propose to add any new unabated capacity.

Similarly, UK and Scottish government policies on North Sea oil production will provide the policy context within which individual CCS projects will be judged. An approach that seeks to enable a transition from oil production to CO<sub>2</sub> storage is likely to be far more conducive to the acceptability of CO<sub>2</sub>-EOR than one that seeks to maximize production across the board. In the context of an explicit transition policy framework, an individual CO<sub>2</sub>-EOR project could be more credibly presented as a positive approach to resource stewardship, including potentially via the reuse of existing infrastructure.

At present, there is a clear view among NGOs that such a policy context is lacking. The Scottish Government is particularly perceived to have an inconsistent approach in seeking to maximize oil production with one hand, while promoting climate action and power sector decarbonisation with the other.<sup>26</sup> A CCS project that incorporates CO<sub>2</sub>-EOR would straddle this policy discontinuity, and would therefore run the risk of being targeted as an exemplar of a perceived unsustainable approach.

To address this risk, further policy actions would be required to address questions regarding the end use of oil produced in UK / Scottish waters. This has both a technical accounting component and a broader question of policy responsibility. This is a live policy debate, with concerns raised by Stop Climate Chaos Scotland regarding the level of ambition for a number of sectors of the Scottish Economy in the draft Report on Proposals and Policies.<sup>27</sup> Notably, this includes both transport and heat – areas of direct relevance for the end use of oil and gas – while emissions from the combustion of oil and gas are not addressed at all.

Furthermore, given continued national and international scrutiny of fossil fuel subsidies, it is likely that any specific fiscal incentives for CO<sub>2</sub>-EOR are likely to receive significant scrutiny. Given that there is a strong NGO preference for CO<sub>2</sub> storage in non-EOR geological formations, any such incentive is likely to be viewed as more acceptable if it prioritises CO<sub>2</sub> storage in these locations.<sup>28</sup>

To date, the UK has avoided public opposition to CCS projects (albeit in large part thanks to disappointingly slow progress on the ground), and enjoyed the positive if cautious support of environmental NGOs. The potential development of CO<sub>2</sub>-EOR would complicate this context.

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<sup>25</sup> Note that this would be further strengthened by the inclusion of a specific power sector decarbonisation target for 2030, as currently under discussion in the Energy Bill. Disputes within government over recent months have undermined confidence in this approach, as has efforts to exempt unabated gas from future Emissions Performance Standard limits out to 2045. Predictably, this resulted in direct action being taken against a new gas fired power station.

<sup>26</sup> Note that the same conflict is also present for the UK government, but has not yet been forced into focus by policy action – it is likely that this would have occurred if Treasury had offered tax incentives for CO<sub>2</sub>-EOR, for example. However, the challenge to policy coherence is particularly perceived in Scotland due to the strength with which both the decarbonisation and maximised production narratives are advanced in parallel, with as yet the perceived absence of a coherent resolution to the tensions between them.

<sup>27</sup> See <http://www.stopclimatechaos.org/news/2013/02/27/ministers-called-parliament-explain-climate-change-plan-deemed-%E2%80%98not-credible%E2%80%99>

<sup>28</sup> This has been the case in the USA, where tax credits for CO<sub>2</sub>-EOR have been half that for storage in saline formations.

Experience to date shows that the clearer the overall policy framework is in guiding the achievement of positive low-carbon outcomes, the easier it will be to secure support for individual projects. This provides a model for policy makers to consider for application to the offshore sector.

If such a policy framework could be developed to enable a decarbonisation transition for the North Sea, then there are sufficient elements available that would allow for the construction of a credible narrative that would support the inclusion of CO<sub>2</sub>-EOR. Positive elements would include the effective stewardship of resources, and the acceleration of CO<sub>2</sub> infrastructure and storage capabilities. Challenges would need to be addressed in respect to the ultimate end use responsibility for additional oil produced, and the timescales under which different sectors of the economy are expected to be decarbonised.

However, if it is not possible to provide a broader policy framework that provides a coherent framework for CO<sub>2</sub>-EOR, then there is likely to be an increased risk that any CCS projects proposing CO<sub>2</sub>-EOR may be opposed through relevant planning and permitting processes, media campaigns, or direct actions. This has already been experienced in respect to the projects proposed at Kingsnorth and Hunterston, on the basis of their unabated capacity rather than their inclusion of carbon capture technology. If CO<sub>2</sub>-EOR projects are perceived to be incompatible with a decarbonisation framework, then there is a risk that such opposition is more explicitly tied to the project because it is capturing carbon, rather than for insufficient carbon capture. This poses a different kind of perception risk, and one with potentially serious implications for the broader CCS sector, including its deployment on industrial sources.

The timing of media and policy debates on the acceptability or otherwise of CO<sub>2</sub>-EOR is likely to follow practical developments. If the UK Commercialisation Programme selects projects that intend to incorporate CO<sub>2</sub>-EOR, then there may be a rapid and reactive discussion of the potential benefits and negative implications for CCS projects and the broader policy framework. A similar reaction may be sparked by the announcement of tax incentives for CO<sub>2</sub>-EOR, particularly if this were to be in the absence of accompanying efforts on non-EOR CO<sub>2</sub> storage.

If CO<sub>2</sub>-EOR projects or policies are likely to gain prominence, the further proactive engagement with NGOs and other stakeholders is likely to be beneficial in identifying specific issues of concern ahead of any announcement. Policy makers would however also need to consider the coherence of policy messaging across power sector and fossil fuel production objectives.<sup>29</sup> The core test for the NGO community is how coherently these relate to decarbonisation goals. At present, the nascent nature of consideration of CO<sub>2</sub>-EOR means that further efforts are required to identify and communicate a coherent narrative that makes this case, backed up by supporting policy measures.

In the absence of such an approach being possible, it should be recognized that the integration of CO<sub>2</sub>-EOR operations increases the risks of opposition to CCS projects, and by extension to the broader support from UK stakeholders to CCS in principle. This needs to be carefully considered and incorporated into policy decisions and messaging.

## **Work Package 1 Annex: Scottish Parliament debate, 9th January 2013**

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<sup>29</sup> To date, the separation of these two policy areas has resulted in domestic fossil fuel policy being somewhat insulated from a direct campaigning focus at the UK level. However the rapid rise of shale gas as a topic of political interest and the granting of field allowances for North Sea production over recent years have resulted in increased NGO attention. As noted above, the potential introduction of CCS and CO<sub>2</sub>-EOR could provide a trigger point for campaigns due to it making visible currently overlooked policy contradictions.

## Scottish Parliament debate, 9<sup>th</sup> January 2013

### Oil and gas – the success and opportunities<sup>30</sup>

Extracts of relevance to CCS, CO2-EOR and climate change policy.

Colour-coded:

Positive towards CCS / CO2-EOR

General reference to climate policy

Negative towards CCS / CO2-EOR

Additional comments added into body of text in italics.

#### Summary:

- Both the Green party and Labour party noted the perceived contradictions between increased / continuing oil production and climate goals – the ‘unburnable carbon’ framing was used. However only the Green party amendment mentioned climate change – all other parties focused on other issues including safety and decommissioning;
- The Green party drew particular attention to the question of end-use emissions from increased oil production, and noted that CCS was not a potential solution for transport or heating – and that CO2-EOR was not an appropriate approach in light of climate objectives;
- Minister Fergus Ewing explicitly mentioned the benefits of CCS in combination with CO2-EOR, but didn’t address the question of end use emissions from oil production – referring only to CO2 reductions from power generation;
- Other parties also noted the potential for CCS more generally, with the Conservative Party drawing attention to its use in combination with hydrogen production and chemical feedstocks;
- Key themes from the debate of policy relevance included:
  - The need to ensure compatibility between Scottish climate commitments and continued North Sea production, or risk policy contradiction (and policy instability) and threats to international efforts;
  - The need for a clearer transition plan for the North Sea – the Green party argued that this should be supported by an immediate focus on investment in Renewables, while other parties also flagged importance of existing skills and export opportunities for the Oil and Gas sector;
  - The implications for Independence – and how a planned North Sea transition should be contemplated, to enable Scottish prosperity beyond the anticipated 40 years of oil and gas reserves.

#### The Minister for Energy, Enterprise and Tourism (Fergus Ewing):

...

Here in Scotland and worldwide, hydrocarbons will remain a central element of the energy mix for some time to come. Our draft electricity generation policy statement gives our clear

<sup>30</sup> Full transcript available at <http://www.scottish.parliament.uk/parliamentarybusiness/28862.aspx?r=8022>

view on the need for both rapid expansion of renewable electricity throughout Scotland and the underlying requirement for new efficient thermal capacity. Carbon capture and storage is the only technology that is capable of cutting fossil fuel emissions by up to 90 per cent.

**Patrick Harvie (Glasgow) (Green):** Will the minister take an intervention?

**Fergus Ewing:** Not just yet.

Linking CCS with enhanced oil recovery could accelerate its development and unlock 3 billion barrels of hard-to-reach oil—worth £190 billion—from the North Sea.

The centre for North Sea enhanced oil recovery with CO<sub>2</sub>, which was launched in May last year and is based in Edinburgh, will develop understanding of enhanced oil recovery technology. That could create a commercial use for CO<sub>2</sub> that is captured from power plants and industry. The new centre will become a hub for collaboration across the energy sector to help realise CO<sub>2</sub>-EOR's true economic potential for Europe.

I recognise industry's view that more work needs to be carried out before EOR is fully commercially viable, but I will continue to push for a partnership of industry and Government to see our CCS ambitions become a reality.

*Comment: Specific reference to CO<sub>2</sub>-EOR from Minister at start of debate.*

**Patrick Harvie:** I am sure that the minister will accept that even if CCS technology can be brought to maturity, it has no effective role to play in relation to the carbon emissions that come from the vast majority of our oil consumption, which is in transport and heating, not energy generation.

Is it not a wee bit like putting the cart before the horse to say that we should use the CCS industry as a way of extracting ever more oil and ever more fossil carbon from the ground, which will end up in the atmosphere?

**Fergus Ewing:** No, I do not agree with that. It will allow huge reserves of oil to be extracted, which will be hugely beneficial. Frankly, I would have thought that the Greens would welcome the application of CCS, because it will allow reductions of 90 per cent in carbon emissions. I thought that that was a good thing.

*Comment: Note: this refers to power generation emissions, not life cycle, so doesn't address specific critique of Patrick Harvie re emissions from end use of oil*

Furthermore, without CCS, I do not know how the European Union's energy emissions targets can be achieved. Only the application of CCS to power stations can make reductions in emissions of the scale that is necessary to achieve the targets. Those are not my views; they are the views of the International Energy Agency, whose chief executive spoke at the Council of Ministers meeting that I attended in November 2011. I disagree with Mr Harvie.

...

**Rhoda Grant (Highlands and Islands) (Lab):**

I will touch briefly on carbon capture and storage, which the minister spoke about. Although we boast some of the most ambitious carbon reduction targets in the world, I do not believe that we can ignore the reserves of oil and gas that we have, so it is extremely important that we have in place CCS technologies that allow us to mitigate the impacts of what is a carbon-intensive industry. It is wrong to say that we are in a position to ignore our oil and gas reserves, because when it comes to fuel for things such as heating and transportation, we do not have the technology to replace that now. We need to move on apace in delivering such technology so that as well as meeting our climate change targets, we can loosen our dependence on carbon-intensive forms of fuel.

...

**Patrick Harvie (Glasgow) (Green):** I like to begin with a note of consensus when I can—Alex Johnstone looks sceptical already.

I agree strongly with all three members who have spoken on the point about the safety issues

around the industry—we can all agree on the importance of safety as regards people and the marine environment. Despite the fact that we will disagree on the future that we want to see for the industry, I hope that everybody in the chamber would come together in paying tribute to those who work hard to protect the safety of people and of the environment.

I want to give credit where it is due to the Scottish Government. The Scottish Government has a clear focus on its renewable energy targets and I have consistently welcomed that. For the first time last year, we saw a £1 billion investment in renewables in Scotland. There is high confidence that the 100 per cent target for 2020 can be achieved and that there will be big increases for the marine sector after that so that we can export efficiently to help to decarbonise Europe's electricity production.

However, that is not the whole story in terms of decarbonising our energy system. Renewables cut carbon emissions only if they replace fossil fuels. We need to reduce demand. Not only investment in renewables is necessary if we are serious about climate change, but disinvestment in the high-carbon industries and sadly the current minister seems not to agree with that. Indeed, since he took on the job I have only ever really noticed the fire come into his eyes when he talks about another 40 years of oil and gas extraction in Scotland.

Under the Scottish National Party Government, there has been an increase in opencast coal extraction, a relaxed attitude to unconventional gas, coal-bed methane and fracking potentially, support for deepwater drilling and now an oil and gas strategy that is focused on squeezing out every last drop from the North Sea.

I refer members to the document that I mention in my amendment, the International Energy Agency's "World Energy Outlook 2012", which concludes that

"no more than one third of proven fossil fuel reserves can be consumed"

prior to 2050 if the world is to achieve the goal of constraining climate change to 2°C unless carbon capture and storage technology is widely deployed. As I mentioned earlier, CCS cannot be deployed in relation to uses of fossil fuel for transport and heating, for example, which is where most of our oil goes.

The International Energy Agency is generally a conservative body—it is not where we would look to if we wanted to find an overly alarmist approach. The next Intergovernmental Panel on Climate Change report seems likely to focus minds on just how much tougher the 2°C target is than was previously thought.

There are three ways of resolving that contradiction. One is to say that domestic production is necessary in order to reduce our reliance on imports. Pretty much every country that has any fossil fuel to extract domestically will use that argument—indeed, they are using it—with the result that nobody budges and we carry on putting more fossil carbon into the global economy and therefore into the atmosphere.

*Comment: Key theme for green discussions of compatibility of CO<sub>2</sub>-EOR with climate targets.*

The second option in response to the contradiction is to say that we need to continue our reliance on fossil fuels for a while to bridge the gap before we transition properly to a genuinely low-carbon economy. That argument boils down to saying, "Lord, make me chaste—but not yet." In fact, it does worse. Increased production will help tendencies to keep prices down, so it will delay the transition towards the low-carbon economy that everybody says that they want.

The third argument is the one that the minister used. CCS is talked about as the essential technology to take fossil carbon back into the ground after we have consumed fossil fuels. As I have made clear, we cannot apply that approach in relation to the fossil carbon that comes from the oil industry. That is simply not an option.

*Comment: Inability to deploy CCS on end use emissions seen as significant problem.*

**Mark McDonald (North East Scotland) (SNP):** I know that Mr Harvie and I have different

opinions on economic growth, but what would be his message to the many constituents whom I represent whose livelihoods and family incomes are entirely dependent on the offshore industry in the oil and gas sector?

**Patrick Harvie:** My argument would be one of transition, not about ending an industry and putting nothing in its place. It would be about transitioning to the renewables industry, which can create jobs and is already doing so.

*Comment: Transition to renewables seen as essential element of North Sea policy*

If we are remotely serious about the 2°C target for the world to try to meet, as we all said that we were when we passed the world-leading climate change legislation, the bulk of our existing proven reserves of fossil fuels must remain unused, especially those in respect of which CCS cannot play a role. Therefore, it follows that, globally, the oil and gas industry is hugely overvalued. That increases the risk to Scotland from our economic reliance on that overvalued industry.

There is another way: committing not only to a cap on our ultimate extraction of fossil fuels, but to investing the income from that resource into something to replace the revenue from it for the future. The scale of the profits from renewable energy in Scotland—especially from wave and tidal energy—will be astonishing, and we will miss a trick if we do not keep a portion of them in the public sector. I am delighted to welcome the likes of Vattenfall, which is a successful public sector entity, to come and invest in renewables, but I am sad that we do not have a public sector entity like it that is owned by our public sector.

The building of a Scottish public renewables company is the best priority that we could set. What a legacy to leave for future generations.

I move amendment S4M-05310.3, to leave out from “welcomes” to end and insert:

“notes the findings of the International Energy Agency’s World Energy Outlook 2012, which states that no more than one third of proven fossil fuel reserves can be consumed without losing any hope of constraining climate change to 2°C; notes also that the fossil fuel industry is largely valued in relation to reserves; considers therefore that the industry is dramatically overvalued and that there is great danger for Scotland in allowing such an overvalued industry to continue to play a central role in the economy; recognises that the transition from fossil fuels to renewable energy is urgent but cannot be accomplished overnight, and calls on the Scottish and the UK Government to adopt a long-term approach to fossil fuels that would result in a substantial portion of existing reserves remaining unused, to end the support for exploration for new reserves and to invest much of the remaining revenue from the fossil fuel industries in a public renewable energy business that can generate revenue for the public purse without destroying the life chances of future generations.”

...

*Comment: Identification of ‘new reserves’ important – could be point of differentiation from CO2-EOR on existing fields.*

**Kevin Stewart (Aberdeen Central) (SNP):** We have already heard some statistics relating to the oil and gas industry, but I will go over some of them again because it is vital that everyone in Parliament recognise the importance of our oil and gas industry. It provides 196,000 jobs in Scotland; it makes a £32 billion contribution to the balance of payments; it accounts for £7 billion in exports; it contributes £13 billion pounds in corporation tax—a quarter of the total that is collected in the UK—and £6 billion in corporate and payroll taxes; and there are 24 billion barrels of oil, worth £1.5 trillion, still to be recovered. That shows the importance of the industry.

However, for those of us who come from the north-east—Aberdeen loons like me—it means much more than that, because a great many of our family and friends are employed in the industry. Earlier, when Mr McDonald asked Mr Harvie what he would do with the oil and gas industry, which Mr Harvie seems to be keen to get rid of, Mr Harvie responded, “Transition”. I

have to say to Mr Harvie that it would be a huge transition, because according to Aberdeen city and shire economic future, 77 per cent of direct employment in Aberdeen city and shire is attributable to the oil and gas industry.

**Patrick Harvie:** This is a phenomenally difficult problem, but it is a problem for both of us. The SNP does not imagine that oil and gas resources will last forever. Where does Kevin Stewart think Scotland's income will come from after Fergus Ewing's 40 years of oil and gas extraction have finally come to an end?

**Kevin Stewart:** A 40-year period is a huge amount of time in which to achieve a transition, and we are undergoing that transition. It will take a long while to get renewables on stream, and the skills that we are discussing are transferable, as Rhoda Grant has said.

...

*Comment: Differences of view in respect to timeline of transition – could be explored by scenarios.*

**Stewart Stevenson (Banffshire and Buchan Coast) (SNP):** I will pick up on what my colleague just said. Banff and Buchan College, which is based in Fraserburgh and elsewhere and is part of the energy skills academy, is a welcome addition in employment and in supporting what the industry needs in the way of skills.

The energetica corridor extends from Aberdeen up to Peterhead in my constituency. It will be an important axis for the next generation of energy, just as it has been in the exploitation of oil and gas resources off our coasts over the past decades. That axis has largely insulated the north-east of Scotland from the economic downturn. If members go to Aberdeen, they will see an environment that is different from almost all the rest of Scotland, so we value the industry highly.

*Comment: Energetica corridor includes potential for CO2 transportation.*

Hydrocarbons, about which we have been talking and of which we have many decades yet to come, are not only used to generate electricity and to power transport but are important as a chemical feedstock. One of the things that we will see over the period of our exploitation of that natural, but limited, resource is a move away from using it for transportation and generating electricity.

*Comment: Hydrocarbons as chemical feedstock could be an interesting element for future scenarios work, particularly if linked to CO2 utilisation.*

**Patrick Harvie:** Does Stewart Stevenson worry—as I do—that the MSPs who stand here to debate such issues in the 2050s will curse us for burning the hydrocarbons that they will consider too valuable to burn?

**Stewart Stevenson:** We must map our transition not just in Scotland but across Europe and the world. A huge economic and environmental opportunity comes from the development of carbon capture and storage not simply for us, but as an exportable technology and a technology that we can use our engineers to support.

*Comment: Theme of transition and international coherence again noted.*

I have discussed that subject on a couple of occasions—for example, with ministers in the Polish Government. In Poland, 90 to 95 per cent of the electricity comes from coal or lignite, which is not just CO2 polluting but is hugely sulphurous. We could play a key role in helping countries such as Poland to address their issues, because their transition to a different world will be much lengthier and more difficult. That is not simply a matter of economic imperative; it also has an environmental benefit.

...

**Mike MacKenzie:** In these days of unemployment—and, especially, youth unemployment—we hear of significant skills shortages in oil and gas, yet we also hear that young people are reluctant to embark on careers in the industry, despite the prospect of rewarding employment. One good reason for that is that we continually see scaremongering in the press and media about uncertainty in the industry. No wonder young people are reluctant to contemplate careers in oil and gas.

It is not oil resources that are unpredictable so much as it is UK Government policy. As far as Scotland is concerned, let us hope that the UK management of those resources comes to an end soon. Scotland's oil and gas reserves certainly deserve to be talked up as being a valuable economic resource—all the more so with the exciting development of carbon capture and storage just around the corner.

...

16:06

**Claudia Beamish (South Scotland) (Lab):** Although I agree with previous speakers that the oil and gas industry has been of tremendous economic benefit to Scotland and the UK as a whole, members perhaps will not be surprised that, in my capacity as shadow minister for the environment and climate change, I would like to draw attention to the detrimental impacts fossil fuels have had and will continue to have on the global environment and to pose some questions about long-term strategy.

The oil and gas industry will continue to play a significant role in providing employment and attracting investment in Scotland, but one cannot help but recognise that it is a finite resource—in spite of members' points today. As we are continuously told by the Scottish Government, Scotland is a world leader in renewables technology, and I certainly would not wish to dispute or undermine that claim. That being the case, it seems that we should concentrate more on moving transferable skills to the renewables industry from the oil and gas industry to ensure the long-term health of the Scottish and British economies. As Stewart Stevenson said, we have to map our transition, and I would like to hear more from the minister about that transition and what the plans are for it.

*Comment: Finite nature of oil and gas reserves noted, and contrasted to Renewables potential.*

Does the Scottish Government's "Oil & Gas Strategy 2012-2020" sit well with the Scottish Government's commitment to a low-carbon economy? I am pleased to see that the strategy contains provisions to create opportunities for supply chain companies in the offshore and carbon capture and storage sectors.

*Comment: Theme of coherence between different policy objectives again highlighted.*

The increase in oil recovery is very welcome, as the minister highlighted. In the context of climate change, the UK CCS demonstration projects are deeply significant, as highlighted by my colleague Rhoda Grant and others. It is disappointing that the UK Government is cutting funding to those demonstration projects and it might be helpful if the minister could update us on that, especially as one of the projects is to be in the gas sector.

One of the more striking elements of the oil and gas strategy is the intention to help expand the oil and gas industry abroad, with Brazil, west Africa and others being cited as recipients of support from Scottish Development International.

I believe that the Scottish Government—though no doubt with good intentions—has missed the central point: that we work with other countries to reduce emissions rather than increase them. Indeed, when I spoke to our Minister for Environment and Climate Change on his recent return from the international climate change negotiations at Doha, I was pleased to hear his thoughts on the progress of negotiations and his continuing commitment to reduce carbon emissions in Scotland, so as to set an example to the wider world. How does that ambition sit with increases in oil production in the longer term?

Indeed, members will be only too aware that this very chamber recently passed legislation committing the Government to emissions reduction targets under the Climate Change (Scotland) Act 2009. Now that we have unfortunately failed to meet the first annual targets for decreasing emissions, I am concerned about the oil and gas industry's impact on the next annual targets. The contradictory nature of these competing aims must have occurred to the Scottish Government; strengthening the oil industry in the long term and reducing carbon emissions surely cannot sit comfortably together. The Rural Affairs, Climate Change and Environment Committee will soon be scrutinising the draft second report on policies and proposals, and many share the view that we need to shift transport modes away from oil and that, as well as cutting fuel poverty and the high demand for oil and gas in house heating, energy efficiency measures will be key to cutting our emissions. In Rhoda Grant's words, we need to loosen our dependence on carbon in the long term.

...

*Comment: RPP2 noted as venue for policy debate on coherence of objectives.*

**Brian Adam (Aberdeen Donside) (SNP):** I would like to make a particular reference to carbon capture and storage. We should not be left behind. Others are trying it, and it will be applied in the North Sea, so why should we not benefit from research? Mr Harvie would like us to say "No more oil and gas", but we cannot do that, so I do not agree with him.

...

**Patrick Harvie:** Members will appreciate that, from my point of view, the debate has been full of contradictions. The industry is one that is full of contradictions: it is an industry in which the recovery of a resource means the burning of that resource and in which managing a resource means consuming it as quickly as possible. This is a debate in which we can recognise the vital role that a particular source of income has for the public purse, but in which most members agree that they want to get through that as quickly as possible, as though there is no tomorrow. It is also a debate in which rhetoric about world-leading climate change legislation goes right alongside "It's Scotland's oil" rhetoric.

*Comment: A range of contradictions noted, in reference to how value derived from oil and gas production and use as well as climate impacts.*

The central contradiction that I sought to highlight in my opening speech and in my amendment is between the 2°C target that we have set to give our world a reasonable chance of having a sustainable future and all the consideration of how many jobs and how much money can be made from burning through the fossil carbon as quickly as possible. It is the contradiction between the low-carbon economy that we have all said that we want and the ever-increasing supply of fossil fuels and therefore the ever-increasing release of fossil carbon into the atmosphere.

In answer to those contradictions, Fergus Ewing talked about CCS, but he did so as a means of achieving ever more oil extraction through enhanced oil recovery—which basically means extracting fossil carbon for power generation, getting some of that carbon back through carbon capture and then using it to extract even more fossil carbon to put into the global economy in industries that cannot be served by CCS. All of that amounts to a continued emphasis on dumping ever more carbon into the atmosphere.

**Fergus Ewing:** Could Mr Harvie clarify whether the Greens are against carbon capture and storage? I genuinely do not know the answer.

**Patrick Harvie:** We have not been against research to see whether it can work, but it has a limited transitional role to play. It cannot be something that we can rely on to take the carbon out of what the oil industry produces and put it back under the ground.

Rhoda Grant mentioned CCS and called for investment in new technologies to replace a reliance on fossil fuels in those industries in which CCS cannot play a role, but we are already failing to achieve our carbon targets. That is why demand reduction in, for example, transport—especially aviation—is so important.

I mention in passing to my SNP colleagues something that will be relevant for the next couple of years: I want Scotland to be independent for more than 40 years and to have a viable economy for more than just one generation. The SNP seems to be in denial about the long-term future. For the life of me, I cannot understand why there is an argument against having a publicly owned renewables company, which would ensure that at least a proportion of the profit from Scotland's long-term energy resource serves the common good. What is not to like about that?

**Maureen Watt:** Is that not precisely why we need independence, so that we can set up an oil fund like Norway's? The income from that fund is now more than the income from oil and gas in that country.

**Patrick Harvie:** That depends on what that fund would be used for. We will disagree across the chamber about the need to keep our fossil carbon, or at least a proportion of it, in the ground or under the sea. However, I ask all members, after they have voted down my amendment this evening, to consider the long term. The climate cannot wait 40 years for us to act, but even if climate change was not happening Scotland would need an economy after oil.

...

[re Re renewables fund:]

That is the opportunity that we should be seeking to exploit. If it means exploiting a proportion of our fossil fuels to that end and leaving another proportion where they are—where the fossil carbon belongs and ought to stay—that is the opportunity that we should be looking to for the future.

...

**Alex Johnstone (North East Scotland) (Con):** During the debate, we have occasionally centred too much on the idea that we need the resource that comes from the North Sea. Over time, as production falls, its value will increase to compensate. It is unfortunate that basic assumptions have been made in the debate that fail to take into account the options that the oil and gas industry has for the future. I do not agree with the idea that it is all about burning that resource. One or two members, including Stewart Stevenson, highlighted the fact that the resource that the industry produces has a value beyond that of simply burning it.

In developing a hydrogen economy for the future, it is inevitable that the North Sea oil and gas sector will be a source of raw material. We have talked about carbon capture and storage as a post-combustion option, but it is open to us to use carbon capture and storage as a pre-combustion option by producing hydrogen for another market. The technology to do that already exists and there are proposals to bring that forward. That is a transitional technology that will deliver against the green agenda that we heard about from Patrick Harvie.

...

**Ken Macintosh (Eastwood) (Lab):**

[re providing a message of support for North Sea oil and gas production]

It is also an important message because it is clear that the industry itself does not enjoy the most favourable public profile. On the whole, oil companies are viewed with suspicion and many of us deeply resent the rising prices we constantly have to cope with, whether at the petrol pump or when paying our domestic heating bills. If we add to that mix the recognition that we will have to move away from carbon-based sources of energy if we are to protect and preserve our global environment, the overall impression can be one that often comes across as quite hostile to the industry. In its briefing for today's debate, Oil & Gas UK made the point that one of the problems it foresees for the future is:

“Poor public and political perception of the continuing importance of the industry and of oil and

gas in the UK energy mix”

Of course, I do not expect many people to shed tears for Chevron, BP, Esso, Shell, or whoever.

I certainly do not wish to diminish the importance of the move to renewables, but even if we are to expand our use of renewable energy sources, as I hope that we will, we will still have to rely to a huge extent on carbon-based fuels. At the moment, the industry estimates that oil and gas provides more than 70 per cent of our primary energy needs and in 10 years' time that will still be the case. Whatever sympathy members might have had with Patrick Harvie's case, many of us feel that he took his argument too far. Most members were far more realistic about the challenges that are facing us and what we need to do in response. That point was made by Rhoda Grant, Claudia Beamish, and the minister himself when they talked about the importance of developing CCS technology.

**Patrick Harvie:** To pacify me and encourage me not to go so far, will the member explain to me how maximising the extraction of oil and gas is compatible with reducing carbon emissions?

**Ken Macintosh:** It is interesting to note that, in his amendment, Mr Harvie talked about the warnings from the International Energy Agency but he did not finish the quotation. He finished it in his speech when he talked about making sure that we do not go beyond the 2°C rise in temperature

“unless carbon capture and storage technology is widely deployed”.

It is interesting that that quotation was missing from his amendment but was in his speech. That is very important. Most members emphasised our important role in helping to develop CCS technology.

...

[Notably, climate implications absent from final contribution to debate by Minister Fergus Ewing].

# WP10 Appendices

## Focus group summaries

### Aberdeen: public

Date: Monday 19 May 2014, 7pm-9pm

Venue: Robert Gordon University Students Union, central Aberdeen

Participants: 10 (5 male; 5 female)

The public focus group was held on the evening of Monday 19 May using citizens recruited through a market research agency to be broadly representative of the local demographic.

#### Themes participants raised by themselves:

Awareness of CCS and EOR were generally high among the members of the public recruited for the Aberdeen focus group. More than half of the participants had heard of CCS, and were aware of the previous plans at Peterhead – although few knew about the recent awarding of the FEED contract, or of the public engagement activities that had taken place in the preceding months.

During the initial discussion, there seemed to be a sense that CCS was a possible strategy for mitigating climate change, but also that there may be risks associated with leakage and safety. There was a readiness to consider other energy technologies that might be usable in the longer term, beyond another 40 years of oil extraction.

Perceptions of the companies involved in CCS (and the CO<sub>2</sub>-EOR JIP) was readily tied to the actions of the companies in the local area. The potential investment of Shell in Peterhead was contrasted with their perceived withdrawal from oil production operations.

Local issues of jobs, skills, recruitment and training were repeatedly mentioned as factors that might help or hinder the deployment of CO<sub>2</sub>-EOR.

#### Reaction to scenarios:

Moving on to CO<sub>2</sub>-EOR, the scenario that seemed to find the most favour as a desired outcome was the 'CO<sub>2</sub>-EOR' scenario, the scenario under which high amounts of oil were recovered and high amounts of CO<sub>2</sub> injected. The reasons given by the participants for this were that it could maximise employment and economic potential for the north-east, perhaps creating extra revenue on top of the 'Wood Review' scenario (maximise recovery with limited CO<sub>2</sub> injected) – which nonetheless was also popular.

A few participants suggested the importance of transitioning away from fossil fuels given their finite nature and potential to contribute to climate change, and advocated the 'low carbon' scenario (limited CO<sub>2</sub>-EOR, transitioning to renewables) if it were possible to re-train oil and gas workers and use existing infrastructure to keep the north-east as a centre of operations and expertise. Nobody saw the 'decline' scenario as being a desirable option.

Opinion was divided on what the most realistic scenario outcome was, but some group members saw the shift towards a low-carbon society ('low-carbon' scenario) as an ultimately inevitable outcome.

#### Policy implications:

The members of the public taking part in the Aberdeen group were generally supportive of both CCS and CO<sub>2</sub>-EOR, and appreciated the need for decarbonisation. Some but not all were familiar with the proposals for the Peterhead CCS project, and many appeared to understand well the nature of the oil and gas industry and oilfield operations.

The topic of the (better) use of any revenues from CO<sub>2</sub>-EOR was raised several times, particularly in comparison with the Norwegian oil fund and the potential for a similar approach in Scotland. This was seen to be a positive option, particularly by those who also mentioned

the prospect of an Independent Scotland in positive terms.

However the costs of investment in CO<sub>2</sub>-EOR and the risk of negative implications for alternative low-carbon options was also raised.

In combination, these attitudes reinforce the view that policy makers will need to be able to positively describe both the social benefits of CO<sub>2</sub>-EOR and its relevance and impacts in respect to the low-carbon transition.

## **Aberdeen: offshore stakeholders**

Date: Tuesday 20 May 2014, 2pm-4pm

Venue: Robert Gordon University campus

Participants: 6 male, representing fisheries, marine biology, decommissioning, engineering, risk management and media.

### **Themes participants raised by themselves:**

The participants in the offshore stakeholder focus group had broadly high awareness of both CCS and CO<sub>2</sub>-EOR, but expressed some skepticism during the initial discussion as to the viability of full-scale CCS and the application of CO<sub>2</sub>-EOR in an offshore environment. Reasons cited for this included the unsuitability of some older infrastructure, and the absence of a business case that might make CO<sub>2</sub>-EOR viable.

Issues identified by participants as of relevance included the challenge between long-term actions required to address climate change versus short-term drivers for private sector and government decision makers. The challenge of societal and personal responsibility was raised, and contrasted with how governments have sought to support renewables via subsidy regimes. The importance of cooperation between sectors was underlined in respect to the implications for fishing of energy infrastructure investments.

### **Reaction to scenarios:**

Much discussion centered around the economic barriers that would have to be overcome before any of the four scenarios presented could even be feasible, and the participants suggested that an economic case for CO<sub>2</sub>-EOR would have to be made in the first instance.

Once the discussion had been steered towards the scenarios, a range of viewpoints emerged as to which scenario was most favourable. A number of participants discussed the merits of the 'Wood Review' scenario of maximising recovery, on account of their concerns over the economic and legislative viability of large-scale CO<sub>2</sub> storage. There was some support for the 'low carbon' scenario – especially from those with more environmentalist leanings who were concerned about the risks (and associated costs) of unabated climate change from ongoing hydrocarbon extraction – but also skepticism from those with infrastructural experience that the north-east would be able to attract renewables workers in the short term if the salaries offered to oil and gas workers could not be matched.

In a 'straw poll' at the end of the session, the majority of stakeholders indicated that they preferred the 'right hand side' of the scenario options (Low-carbon and CO<sub>2</sub>-EOR), but that they believe that the 'decline' scenario was what would actually happen.

### **Policy Implications:**

Within the offshore stakeholder group, a range of views existed on the urgency and extent of climate change, and on the viability of CCS as a potential solution. Nonetheless, the different stakeholders were able to agree on the need to take into account environmental considerations more generally, and to either prolong the life of the North Sea in a sustainable way or deploy a replacement in the form of renewable energy.

The group thus came down on the border between the 'CO<sub>2</sub>-EOR' and 'low-carbon' scenarios as desirable outcomes, however nearly all agreed that 'decline' was by far the most likely outcome in their opinion, due to the inertia of current investment pathways and the difficulties associated in seeking cooperation between private sector actors.

The expertise present among this group highlighted that any presentation of a CO<sub>2</sub>-EOR strategy must be sufficiently robust to withstand immediate critiques on technical grounds.

## Edinburgh: public

Date: Tuesday 19 June 2014, 7pm-9pm

Venue: Old College, University of Edinburgh

Participants: 10 (5 male; 5 female)

The public focus group was held on the evening of Tuesday 19 June using citizens recruited through a market research agency to be broadly representative of the local demographic.

Notes: with the permission of the researchers and participants, two SCCS members – Indira Mann and Jamie Stewart – attended to provide practical support and to observe the discussion

### Themes participants raised by themselves:

- Need to balance short-term oil recovery from the North Sea with longer-term climate goals – how to do this?
- Energy security an increasing concern, need for diverse and broad-based energy supply;
- Concern over entire session and its focus on CCS – gave impression that researchers were trying to ‘convince’ the participants over the merits of CCS.

### Reaction to scenarios:

- The Scottish independence referendum was perceived as having a major bearing on which scenario was most likely – ‘Wood Review’ scenario if independence; ‘decline’ if not.
- Preference for scenarios may change depending on timescale – ‘push’ or ‘Wood Review’ in short-term, ‘low-carbon’ as longer-term goal?
- High CCS scenarios desirable if they were part of a trajectory that had societal benefits, i.e. investment in renewables or cheaper energy rather than maximising profit.

### Policy Implications:

The publics in the Edinburgh group again generally accepted the need for decarbonisation, but were much more split on the merits of CCS as a way of achieving this.

A small minority of the group were familiar with the Longannet proposal and the University of Edinburgh’s research activities on CCS, but for others CCS was a new concept. Some participants expressed concern that the session was excessively ‘biased’ towards CCS, as if the researchers were trying to convince them of the benefits of the technology.

In this group, the ‘low-carbon’ scenario was met with broad support, but government control on CO<sub>2</sub> storage was seen as making the EOR scenarios more palatable. Most reserved judgment on which scenario they viewed as most realistic – the ‘maximising recovery’ scenario was seen as likely if Scotland became independent, ‘decline’ if not.

## Edinburgh: Environment Professionals

Date: Wednesday 20 June 2014, 10am-12 noon

Venue: Old College, University of Edinburgh

Participants: lecturer in ethics and philosophy (F); marine biologist (F); professional science communicator (M); sustainability facilitator (M); reader in chemistry (M); representative of government agency with stake in environmental issues (M).

Notes: several SCCS members attended to provide practical assistance and observe out of general interest – Matthew Ball, Gordon Sim and Jamie Stewart. Both the researchers and the participants were comfortable with this.

### Themes participants raised by themselves:

- Tension between need for technological climate mitigation strategies on one hand; versus need to think about changes in the way society is governed and structured on the other;
- Pragmatic need for CCS in the short term, but must be part of a longer-term transition towards 'sustainable' energy production and use;
- **CO<sub>2</sub>-EOR** part of this pragmatic realisation that fossil fuel use will not stop overnight, however a share of revenue must be used for investment not just in renewables, but also in working towards different systems of governance.

### Reaction to scenarios:

- Lack of contextual information (e.g. political landscape surrounding each scenario, wider trajectory the scenario was part of) made engagement with scenarios difficult;
- Some participants found it hard to 'pick' one scenario without knowing where the scenario had come from or to where it would lead;
- Everyone agreed that the '**CO<sub>2</sub>-EOR**' scenario was the most desirable, with the caveat that it would facilitate and lead to decarbonisation, and not at the expense of other low-carbon technologies – there was an overall preference for the right hand side of the scenario matrix;
- Depending on contextual factors, either 'Wood Review' or 'Decline' scenarios were seen as most likely outcomes from current policy.

### Policy Implications:

This group contained universal consensus on the severity of climate change and the potential for CCS to be a solution. Some members talked more about the technical and infrastructural 'solutions' that would mitigate climate change, whilst others argued for the need for deeper structural changes in society to respond to environmental challenges.

There was broad support for the CO<sub>2</sub>-EOR scenario on the condition that some revenue was ringfenced to implement renewable/longer-term solutions, but a belief that either the 'maximising recovery' or 'decline' scenarios would actually come to pass.

## London: Environmental NGOs

Date: Friday 18 July 2014, 15:00 – 17:30

Venue: NGO office, London

Participants: energy specialist (F), economist (M), lawyer (M), political advisor (M), youth activist (F), policy advisor (F), researcher (F), researcher (M). Apologies were also received from campaigners and analysts who were keen to participate but unable to attend.

Notes: Session facilitated by Chris Littlecott. Jamie Stewart attended to present section on CO<sub>2</sub>-EOR technology and answer any questions which arose on geology or life cycle analysis issues.

The focus group took place shortly before the House of Lords was due to consider government proposals for the creation of the new North Sea regulator. The Labour Party had already indicated that it would propose amendments that included reference to achieving climate targets and the integration of CO<sub>2</sub>-EOR as a specific element of the regulator's remit.

This helped give the discussion a 'real world' relevance.

### Themes participants raised by themselves:

Similarly to the group of Edinburgh environmental professionals, the London NGO discussion centered heavily around more profound questions on the role of fossil fuels in society, and the fairness of more economically developed nations like the UK continuing to extract fossil fuels.

The limitations of the UK carbon budgets were highlighted, in respect to their consideration of consumption of carbon versus production of fossil fuels. The 'carbon bubble' concept and its implications for per capita emissions globally was seen to be a challenge to the UK in this regard.

There was significant skepticism in respect to the role of HM Treasury and their perceived focus on North Sea revenues rather than any concerns about climate change impacts and enabling a North Sea transition.

### Reaction to scenarios:

In line with the above, the 'low-carbon' scenario was discussed as the most desirable and – for some – the *only* viable outcome. Within this, the role of CCS would be one of assisting rapidly industrialising countries in managing their CO<sub>2</sub> emissions, or helping to prevent an 'overshoot' scenario in the very short term. The need to rapidly move away from a fossil-fuel based economy was widely discussed.

The inclusion of CO<sub>2</sub>-EOR within any UK CCS deployment strategy was therefore seen as a significant risk factor for UK international credibility, unless policy actions were taken to counterbalance increased extraction from existing fields through limitations on extraction and / or import of fossil fuels from elsewhere.

The prospect of a nationally owned company undertaking CO<sub>2</sub>-EOR as part of a North Sea transition strategy aroused interest, but also concern that it might be 'captured' by existing fossil fuel interests and not have a sufficiently robust remit to deliver on climate change objectives.

As per the feedback received from Scottish NGOs in 2013, there was a clear message that CCS and CO<sub>2</sub>-EOR would only make sense within a robust policy framework.

### Policy Implications:

The rich and detailed discussion with NGOs highlighted that there is potential for CCS to play a bigger role in UK decarbonisation efforts, and for this to gain NGO support, provided that a clearer policy framework could be put in place that helps mitigate perceived negative implications of CCS.

The position of CO<sub>2</sub>-EOR is perceived more negatively because of its direct association with continued fossil fuel extraction in way that is currently excluded from the UK policy framework. Specific attention would be required in respect to what alternative or compensatory measures could be taken to address these risks, were CO<sub>2</sub>-EOR to be pursued by policy makers and the private sector.

As with the feedback from other focus groups, the appropriate use of the rewards from CO<sub>2</sub>-EOR is seen to be a key indicator of policy intent, while the nature of the delivery vehicle(s) is a test of the credibility and perceived motivations of actors. This suggests that careful thought would be required in respect to the roles of public vs private actors, and the remits and regulatory frameworks put in place.

The continued Parliamentary scrutiny of Infrastructure Act 2014 over the coming months will provide further opportunity for engagement with NGOs on this topic.

## London: Finance Stakeholders

Date: Wednesday 23 July 2014, 14:00 – 17:00

Venue: Investec offices, London

Participants: policy advisor (M), oil and gas analyst (M), CCS finance expert (M), utilities investment expert (F), 6 investment analysts / advisors (all M).

Notes: Session facilitated by Chris Littlecott, with input from Element Energy on technical and financial questions raised by participants. Session co-convened with support of Ecofin Research Foundation, which is active in the field of CCS – particularly in respect to engaging the finance community in policy development.

The financial group combined participants with extensive experience of working on CCS and in-depth knowledge of the economics behind CCS and CO<sub>2</sub>-EOR with others from the financial sector who had a broad interest in energy, utilities, and / or climate change, but no direct engagement on CCS.

### **Themes participants raised by themselves:**

There was a strong preference for business cases that could be developed without the need for government subsidy, as this was believed to be unsustainable. There was therefore significant interest in the role that CO<sub>2</sub>-EOR was playing in respect to CCS in the USA, and questions as to the potential role it might play in the UK.

Participants raised the question of alternative business models, including the use of Regulated Asset Base options for infrastructure development.

More generally, there was skepticism as to whether government policy makers were willing to move sufficiently strongly to create new market mechanisms and policy drivers that would deliver CCS, even with the potential benefit of CO<sub>2</sub>-EOR. The negative impact of current liability requirements was also raised as a barrier to investment in CCS and CO<sub>2</sub>-EOR.

### **Reaction to scenarios:**

Perhaps unsurprisingly, support for a 'CO<sub>2</sub>-EOR' scenario was qualified for the need for an economic case to be made for CO<sub>2</sub>-EOR. In the absence of such a case, throughout the group the 'maximising recovery' scenario was perceived as being the most likely outcome.

There was therefore a view that CO<sub>2</sub>-EOR might be more likely as a follow on strategy rather than as the leading edge of CCS deployment.

### **Policy Implications:**

The strong preference for 'market' solutions rather than subsidies from finance sector stakeholders will need to be considered by policy makers, as the provision of finance will be a determining factor of the success or failure of any CO<sub>2</sub>-EOR projects.

This would suggest that early consideration of business models and incentive structures that can de-risk investment in CO<sub>2</sub>-EOR would be particularly valuable.

Ongoing efforts by Ecofin Research Foundation to engage with policy makers were welcomed by participants, and the session was seen to be a useful means of opening up further areas for consideration. If desired, this could provide a useful option for deeper discussion of alternative policy options at a later date.

## Aberdeen: Young Professionals with Experience in 'New' Oil and Gas Fields

Date: Tuesday 25 November 2014, 1-3pm

Venue: Robert Gordon University campus

Participants: 9 (5 male, 4 female) – MSc Corporate Social Responsibility and Energy students, with professional experience in areas including oil and gas development in Ghana and Nigeria, NGO work in West Africa, and UK government environmental protection agency.

Notes: This group was held at the end of November, after the Scottish independence referendum but before the decline in oil prices and subsequent challenges for the North Sea oil and gas industry had reached a high public profile. The group was considered to offer an interesting perspective on CO<sub>2</sub>-EOR, as many of the participants had experience in 'new field' development in West Africa where the socio-economic contexts around energy and climate change are somewhat different to those encountered in the UK. The session was facilitated by Leslie Mabon of Robert Gordon University.

### Themes participants raised by themselves:

The participants were largely of the opinion that the primary interest of operators is to return profit, and thus that it would be unrealistic to expect developers to get involved in CCS and CO<sub>2</sub>-EOR projects if it was not economically viable to do so. Nonetheless, the group also recognised that developers had a duty to operate within the confines of the law, and thus that the government had a central role to play in creating a regulatory landscape that would facilitate both CCS and CO<sub>2</sub>-EOR.

It was suggested that the regulatory landscape for CO<sub>2</sub>-EOR could involve both 'push' and 'pull' factors. The 'push' factors may include making investment in CCS or using CO<sub>2</sub> captured from CCS in EOR processes mandatory for prolonging the life of oil fields. The 'pull' factors suggested by the group included giving priority during licensing rounds to operators committed to climate change mitigation through their support for CCS and CO<sub>2</sub>-EOR.

The time frame over which the scenarios were desirable was also discussed. One point raised was that a percentage of the tax revenues from oil extraction should be 'ring fenced' for investment in renewable sources, so that CO<sub>2</sub>-EOR becomes part of a managed longer-term transition away from fossil fuels.

A final, more abstract, theme that arose in discussion was that technological development is not static, and that it may be the case alternative technologies arise in future that present different opportunities for energy. The underlying point here was the importance of remembering that the way in which energy systems are set up and governed at present may not in themselves lead to a low-carbon transition, i.e. there may be a need and benefit to thinking more widely about how society and energy systems are structured.

### Reaction to scenarios:

There was a general preference in the group – over the short term at least – for the 'High CO<sub>2</sub>-High EOR' (i.e. 'push') scenario. The reasons were given that this was perceived as being the best of both worlds, acknowledging the reality that (a) climate change mitigation needs to take place, but also (b) that oil will be required into the foreseeable future. The High CO<sub>2</sub>-High EOR scenario was therefore seen as the most effective way of achieving these goals.

Thinking further into the future, the 'Low Carbon' scenario was also viewed favourably. The group themselves suggested that over time there could be a transition from the High CO<sub>2</sub>-High EOR scenario to the Low Carbon scenario, with investment in research and development of renewable technologies funded by ring-fencing a proportion of the tax revenue from oil extracted through CO<sub>2</sub>-EOR. This was perceived as being not only desirable but also feasible, as long as the government took seriously its responsibilities with regard to climate change mitigation and a move to low-carbon energy systems.

The 'Wood Review' scenario was perceived as being a more realistic scenario (at least over the short term). This perception was very much tied to the group's view that the primary aim of developers is to return profit, and thus that high levels of CCS and CO<sub>2</sub>-EOR are unlikely to

occur unless it is economically viable to do so. In other words, the thinking in the group was that even if CO<sub>2</sub> were to be used for EOR, only the amount required to extract an 'economically viable' amount of oil could be expected.

The 'Decline' scenario received only limited attention. It was acknowledged that fossil fuels are finite, but the participants also pointed to the significant levels of infrastructure and knowledge in the north-east as factors that would make prolonging the life of the North Sea a more sensible option. There was also discussion on the high costs of decommissioning, and the potential value of CO<sub>2</sub>-High EOR (or even sub-seabed CO<sub>2</sub> storage) as a means of delaying the need for decommissioning.

### **Policy Implications:**

A key policy implication arising from this group was the perceived responsibility of national governments to mitigate climate change by setting a regulatory landscape that would lead oil and gas operators to get involved in developments that reduced their CO<sub>2</sub> impact. That is, it was suggested it was not the responsibility of developers to get involved in CCS and CO<sub>2</sub>-EOR voluntarily, rather it was the responsibility of government to create the conditions that would make CCS and CO<sub>2</sub>-EOR a viable option within a context of a move towards low-carbon energy.

This viability could come, it was suggested, from a range of 'push' and 'pull' factors. 'Push' factors may include stricter regulation (i.e. making investment in CCS or using CO<sub>2</sub> for EOR a condition of being granted a drilling licence). 'Pull' factors could include looking more favourably on operators involved in CCS when assessing licence applications, or granting tax breaks to those involved in CCS/ CO<sub>2</sub>-EOR. In either case, the group suggested that closer linkage between industry and government (and alignment of goals/expectations) as per the recommendations of the Wood Review were vital in creating a positive relationship to allow the regulatory landscape to develop in a mutually beneficial way.

In terms of taxation, it was also interesting to see CO<sub>2</sub>-EOR being situated very much in the context of a transition to low-carbon energy. This came across most clearly in the suggestion that a portion of tax revenues from oil extracted via CO<sub>2</sub>-EOR being used to fund R&D into renewables, but also the wider discussion within the group on the possibility of future technological innovation and the kind of thinking and societal organisation required to address energy and climate challenges.

## WP10 – Focus Group presentation Slides

The slides used for the purposes of focus groups are presented in a separate document. Please visit [www.sccs.org.uk](http://www.sccs.org.uk) for more details.