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Deliberative decarbonisation? Assessing the potential of an ethical governance framework for low-carbon energy through the case of carbon dioxide capture and storage

Abstract. In this paper we explore the potential of a framework of ethical governance for low-carbon energy. Developing mainly in the field of information and communications technology, ethical governance is concerned with the marginalisation of ethical and moral issues during development and deployment of new technologies. Focusing on early carbon dioxide capture and storage (CCS) projects, we argue that a focus on technical arguments in the governance of low-carbon energy similarly risks sidelining deeper issues such as fairness, justice, and values. We believe an ethical governance approach does have potential for low-carbon energy technologies like CCS, but also that climate change mitigation technologies pose particular challenges for the implementation of ethical governance.
Keywords: carbon dioxide capture and storage (CCS), deliberative democracy, epistemic justice, ethical governance, public engagement

1 Introduction

Carbon dioxide (CO_2) capture and storage (CCS) is widely considered to offer significant potential in the effort to mitigate anthropogenic climate change. But early attempts to deploy CCS have been faced with notable public opposition, in Europe at least, which has resulted in delays and setbacks and has probably contributed to outright cancellations. We argue that the answer to this problem that decision makers usually imagine—an increased focus on communication strategy—misses the very premise on which publics' perceptions of CCS are based. After giving some contextual background, we explore the concepts of ethical governance and epistemic justice. We suggest that CCS public engagement processes thus far could be open to claims of epistemic injustice due to the way in which they close down the terms of engagement. We then reflect on the implications of ethical governance for low-carbon energy more broadly, offering some suggestions as to what a model of ethical governance for future energy systems might look like, and what challenges may lie ahead. Although our argument is that new governance processes are required that bring societal concerns into the innovation and decision-making process at a much earlier stage, in the first instance it is necessary to look to controversies at specific sites to understand where extant governance processes may have fallen short of expectations. We therefore spend some time reviewing CCS public engagement efforts for specific projects to date, using those findings to suggest the implications for enacting more effective governance firstly for specific projects and subsequently throughout the whole decision-making process.

2 Context: CCS and public engagement

CCS is a process for capturing CO_2 formed by the burning of fossil fuels during energy production or industrial processes before it enters the atmosphere, transporting it by pipeline or ship, and then injecting it into underground rock formations. The key justification for this is that CO_2 emission into the atmosphere is one of the main causes of climate change, posing potentially serious threats to people, wildlife, and habitats worldwide. According to the Global Carbon Capture and Storage Institute (GCCSI, 2013), as of August 2013 there are

twelve large-scale integrated CCS projects in operation globally (http://globalccsinstitute.com), albeit capturing and/or storing CO_2 as part of ongoing oil and gas extraction. The first CCS power stations are currently under construction—for example, Boundary Dam in Canada, and possibly Maasvlakte in the Netherlands. Numerous pilot projects also explore different sections of the CCS chain at smaller scales.

Public responses to early CCS projects have been mixed. Otway in Australia (Ashworth et al, 2011) and Decatur in Illinois, USA (Ibarolla et al, 2012) demonstrate local community support for projects. Yet in cases like Barendrecht in the Netherlands (Feenstra et al, 2010) and Beeskow-Oderbruch in Germany (Duetschke, 2010) public opposition has contributed to outright cancellation of proposals. Perhaps in response to these public consensus difficulties, recent years have seen increased interest from CCS developers, public relations and communications companies, and social researchers in the communication of CCS to publics and the importance of building public acceptance. This mode of governing public engagement is reflected in the number of toolkits, guidelines, and case studies that have emerged for CCS over the last few years, including from Climate Change Central (2007), the National Energy Technology Laboratory (NETL, 2009), Simpson and Ashworth (2009), the Commonwealth Scientific and Industrial Research Organisation (CSIRO, 2010), and the World Resources Institute (WRI, 2010). We believe that this strong focus on communication perhaps misses the premises on which publics' perceptions of CCS are based, and risks marginalising more deep-seated ethical or moral concerns.

Although CCS itself is a relatively new technology, thinkers in science and technology studies and associated disciplines have long sought to consider public engagement in relation to technological developments. Wynne (1992) was among the first to criticise traditional ideas of 'public understanding of science' (PUS)—that is, the assumption that if publics are brought to understand science, they will accept associated technologies. Wynne argues that such an approach is not only alienating and patronising to publics but also does not necessarily engender support towards science and technology. Rather, Wynne proposes that people's definition of risk is intrinsically linked to the trustworthiness and credibility of social institutions—if it is too difficult to assess a risk directly, people's views will depend on their opinion of the institution taking the risk.

Rogers-Hayden et al (2007) suggest this shift from PUS towards earlier 'upstream engagement' with citizens has at least three bases, characterised by Fiorino (1990) as normative, instrumental, and substantive. Normatively, wider involvement in the decisionmaking process is a good thing in and of itself, so earlier engagement will lead to more democratic outcomes. Instrumentally, public engagement gives decisions more legitimacy in that the public can be seen as giving their support to the outcome. Substantively, inclusion of publics can broaden the evidence base and thus produce more socially acceptable, and in some cases technically superior, outcomes (Rogers-Hayden et al, 2007). Jasanoff (2004) goes even further to suggest that innovation in natural science knowledge and technology requires an equal level of social innovation, and that these two forms of innovation are intrinsically linked in a process of 'coproduction'. In light of this long history and the significant potential for CCS deployment globally, we find it somewhat surprising that, with a few exceptions (Gough and Boucher, 2013; McLaren, 2012), there has been little critical engagement on the governance of the ethical dimensions of CCS.

3 Why reconsider governance?

At base, governance concerns how society makes decisions whilst balancing many expectations, perceptions, and moral and ethical standpoints. Such governance normally occurs through processes of representative democracy (Andrews, 1982). However, Dobson (1996) argues that these processes of representative democracy may struggle to encompass the range of perspectives associated with contemporary environmental issues, as spatial and temporal complexity make it difficult to know who to represent and how to represent them. Similarly, Lavelle et al (2011) believe the complex ethical and moral issues raised by

recent technological innovations such as information and communications technology (ICT), genetic modification (GM), and nanotechnology throw up challenges for existing governance frameworks due to their potentially far-reaching and long-term implications, which may be irreversible or lead to society being 'locked in' to a particular trajectory of technological development.

CCS is both a new technology and a response to a contemporary environmental problem, a strong indication that it may require a different set of governance arrangements to fully respond to the challenges associated with its deployment. Indeed, storage of CO_2 will occur over long geological timescales (thousands of years), and it may not be possible to retrieve all the injected CO_2 at a later date. Research into the likelihood and effects of any potential leakage is ongoing (for example, Blackford et al, 2009). There are bigger questions about the extent to which CCS can actually mitigate climate change and whether it leads to carbon 'lock-in' (Markusson et al, 2012).

The limitations of representative democracy for low-carbon energy technologies like CCS become particularly problematic if society at large still believes existing governance arrangements are up to the job of dealing with the complexities of contemporary technologies and environmental issues. As Lo (2011) points out with regard to environmental management, society has come to expect 'moral' decision making from democratic processes; however, failure to take into account a wide range of potentially irreducible standpoints can lead to decisions being made that do not live up to this expectation. Representative democracy also finds it difficult to tackle uncertainty on issues of science and technology, as there is a lack of awareness of scientific complexity and uncertainty in policy and politics and a tendency for politicians to favour short-term fixes that they need to claim will work with certainty.
If, owing to the shortcomings of existing governance processes, people feel their concerns have been marginalised and/or they have been excluded from the process of defining societal 'problems' and potential 'solutions', claims to epistemic injustice could arise—injustice in the way society answers a complex question or interprets a significant phenomenon (Anderson, 2012). In the literature on governance of low-carbon energy a common distinction is made between distributive justice (fairness in the way risks and benefits are distributed socially, spatially, or temporally) and procedural justice (fairness in the processes through which decisions are made). de Groot and Steg (2011) and McLaren (2012) comprehensively review these justice issues in CCS, and Shrader-Frechette (2002) covers justice in energy and environmental matters more generally. What has not been so fully explored is the role of epistemic injustice in the governance of low-carbon energy—injustice in the very way particular technologies come to be conceived as solutions to the problems of climate change. Fricker (2007) suggests that epistemic injustice can take two main forms: testimonial and hermeneutical. Testimonial injustice occurs when a hearer discounts the credibility of a person's testimony on account of their social identity. Hermeneutical injustice arises when society lacks the interpretative resources to make sense of a speaker's experience, because that speaker has been marginalised in meaning-making activities. When evaluating the governance of public engagement around CCS to date, evidence of these kinds of epistemic injustice having been committed could play an important role in pointing towards elements of existing governance processes that struggle to address the issues associated with new technologies.

Viewed this way, epistemic justice may sound similar to procedural justice. Where it differs is that epistemic justice takes into account not only the processes through which the problem is discussed but also the effects of framing. We do agree procedural justice is important, but striving for fair processes alone could risk a narrow focus on creating instruments to ensure fairness (like best practices, guidelines, and toolkits) whilst leaving bigger questions about who defines the problem, field of questioning, and potential solutions unanswered. In this context, epistemic justice seeks to go further and consider if the very concept and framing of CCS is socially acceptable. Even if fair procedures are in place, an epistemic injustice may still be committed if publics and stakeholders are not able to have a say in how the problem of climate change and low-carbon energy is defined, and what the

solutions might be.

Of course, different aspects of justice are difficult to separate in practice. As McLaren (2012) observes, distributional injustice may occur if fair procedures are not in place, and procedural injustice can occur if there are not procedures to challenge an unfair outcome. We would add that good processes are necessary to allow society to discuss the framing of a problem, and that the distributional outcomes open for discussion in any situation will depend on how the problem is framed. Although we focus primarily on epistemic matters in this paper, some overlap with distributive and procedural matters is inevitable.
Ethical governance is one potential alternative framework that has been proposed in response to the shortcomings of extant governance processes for new technological innovations. What we take ethical governance to mean is not a 'more ethical' mode of governance per se, but rather, following Goujon and Flick (2011), a form of governance that aims to integrate ethical and moral issues more fully in the decision-making process. Ethical governance expresses discomfort at the cognitive closure of debates over new technologies to scientific perspectives and associated values alone, which leads to the marginalisation of concerns grounded in more ethical or moral factors (Rainey and Goujon, 2011). In this concern with the framing of discussion, the link to epistemic justice is clear. We believe that the concept of ethical governance has some value in helping to understand how claims to epistemic injustice may arise and how these may be opened up to scrutiny.
Ethical governance has its origins in the realms of ICT, but given the similarity of concerns (uncertain effects, potential irreversibility), it is worth exploring for low-carbon energy as well. Goujon and Flick (2011) explain that, in the governance of new technologies in which risks are involved, debates tend to be limited to scientific perspectives, with politicians favouring traditional 'top-down' governance models that deploy processes like cost–benefit analyses. Such cognitive closure, argue Goujon and Flick, limits the potential for discussion on wider issues such as the nature of different forms of knowledge or underlying cultural and social challenges. Drilling down further into the concerns of ethical governance, we see three key related issues. First is the conceptualisation of the possible outcomes of debate, a worry that, as Goujon and Flick put it, "the agreed resolutions end up having little real effect on the actual trajectory of the project" (page 105). That is, most of the major decisions over the course of action are already decided before society at large has a chance to give an opinion. Second is a narrow focus on process, where procedures and strategies ostensibly designed to facilitate greater stakeholder and societal involvement (such as information sessions and focus groups) remain constrained within the dominant framing of the issue without allowing for discussion of alternative framings or perspectives. Third is the privileging of scientific discourses and associated values, the risk being that 'knowledge hierarchies' are created in which strict scientific knowledge is given priority.

Given ethical governance proponents' concern with avoiding a reduction to uncritical rule-making, attempting to delineate a strict framework for 'ethical governance' would be counterproductive. It is nonetheless helpful to get a sense of what kinds of improvements a framework of ethical governance might hope to achieve. Goujon and Flick see the opening up of cognitive closure as crucial, something they claim can be achieved through inclusive participation of a range of actors in the decision-making process, so that a range of perspectives are actively involved from early stages when tangible changes can still be affected. Goujon and Flick also believe that allowing adequate opportunity for reflexivity is key to understanding the effects of existing governance arrangements—ensuring actors have the space and time to reflect on their own values, biases, and assumptions and think about what their role is in the decision-making process. Rainey et al (2012) further suggest the use of scenarios as a means of understanding potential ethical and moral issues 'in context' and emphasising relationships between different world views. This use of scenarios, it is argued, can help developers to start to understand how issues from outwith their narrow expertise may arise when a technology is deployed, and can help stakeholders and publics to consider how technological deployment may affect them.

In section 4 we use the concerns proposed by the ethical governance framework to

explore how claims to epistemic injustice may arise from the existing governance processes for CCS. In section 5 we then consider how a framework of ethical governance like the one outlined above could transfer to the field of low-carbon energy; however, we also argue that energy and climate change throw up particular challenges that make implementation of such a governance model more complicated.

Indeed, at this juncture it is worth noting two main differences between the domains in which ethical governance has emerged and large-scale energy infrastructure. What sets CCS and most low-carbon energy options apart from some other new technologies is the limited potential for public agency in their consumption. Owing to the huge financial, technological, logistical, and cognitive demands involved, low-carbon energy is clearly not something that members of the public can 'do' themselves in the way they might use a computer, consume food, or adopt more environmentally friendly forms of behaviour. The governance of public engagement on technologies like CCS will thus be concerned primarily with ensuring that different sections of society are not marginalised in discussions over development and deployment. A further complication with low-carbon energy is that there may be equally large questions associated with choosing *not* to deploy technologies. With ICT or GM, if ethical questions cannot be answered in a socially acceptable way, there is the opportunity to place a moratorium on technological deployment, or for the end user to perhaps 'opt out' of participation. However, uncertainties over the future effects of anthropogenic climate change mean that electing not to do something in this context could equally give rise to ethical contestations if it is seen as putting society and ecosystems at greater risk of exposure to negative impacts.

4 How might claims to injustice arise from existing governance of CCS?

We now turn to existing engagement efforts on CCS. Looking in turn at three related concerns of ethical governance outlined above—framing of possible outcomes, a narrow focus on procedures, and privileging of scientific discourses—we argue the assumptions underpinning the existing governance of CCS leave it open to claims of epistemic injustice.
The first assumption we wish to highlight pertains to the framing of possible outcomes. This is where an ethical governance framework and epistemic (in)justice come together most clearly. In much CCS public engagement there is seemingly an assumption that the desired end goal is the public 'accepting' CCS, and deployment of the technology proceeding. This is logical and to be expected—the goal of a developer is clearly going to be to implement a project; and in order to do so as efficiently as possible, they will want to create a positive impression when engaging with the public. Consider the opening sentence from the "Communication/engagement toolkit for CCS projects" from CSIRO (2010):
""Understanding public perceptions towards CCS projects and knowing how to effectively engage and communicate with stakeholders is crucial to successfully deploying the technology" (page 2).

From the outset, the objective of understanding public perceptions of CCS, and of consulting with publics and stakeholders, is to facilitate deployment. There is no debate on whether or not CCS is even a socially acceptable technology—it is assumed the hallmark of 'effective' engagement is that the public 'accepts' CCS, and the technology is able to be deployed. Even in public engagement work done as part of large academic research projects as opposed to a real-world CCS development, it is often the case that the goals of the project are to understand how CCS can be implemented. As one call for proposals for EU research funding puts it:
""Identification and characterisation of sites for CO_2 storage proposed to be used in the near term … . The project(s) should include advancing public awareness of CCS in the concerned storage areas … . The project(s) should facilitate and support the large scale demonstration of CCS in the EU" (European Commission, 2009, page 19).
The implication here seems to be that research done into the geological storage of CO_2, including the advancement of public awareness, all contributes to the end goal of large-scale CCS deployment. This in itself is not an issue for ethical governance if projects are honest and transparent about their underpinning assumptions and motivations. What is problematic,

however, is if publics get involved in the engagement process—for either a real development or academic research—believing they can 'choose' whether they want CCS or not, when in reality the decision-making process is already at an advanced stage and only very practical matters such as, say, the siting of pipelines (Bradbury et al, 2011), are open for public input. It is interesting to note that, for the public engagement aspects of the SiteChar Project (2011), the citizens involved were somewhat shocked when they came to believe the plans for CCS in Scotland were much more concrete than they had anticipated, writing this in their own positioning paper:

""It came as a surprise to many of us that the Scottish Government developed a CCS Roadmap three years ago, but apparently with no public consultation or discussion. What with the Government's plans and priorities, this gives the impression that CCS in Scotland is a *fait accompli*, in which case what is the purpose of public engagement—just to rubber-stamp the existing strategy?" (Moray Citizens, 2012, page 17).

What appears to be happening here is a form of testimonial epistemic injustice (Anderson, 2012), in that decisions about energy strategy and technological deployment are made by a closed community, with only very small details left for discussion by the time publics are brought into the engagement process. Stephens et al (2011) argue that the international CCS community displays all the signs of such an epistemic community, in which problems, rationales, and solutions are tightly defined by the community, with well-rehearsed responses to challenge or criticism from external actors. In such a model the epistemic community essentially defines the role of the public as one of receiving information and being consulted on only minutiae.

If publics believe they themselves can choose whether or not they want CCS—be it for their specific community or as an energy strategy more generally—when they enter the engagement process, and consequently suffer disappointment when they find out the reality of the decision-making process, this is a clear illustration of a gap between public expectations of representative democratic processes and the reality. Going back to the ethical governance framework, the nature of the problem under discussion and the range of possible outcomes are already tightly constrained by the framing of the issue *before* publics and stakeholders have a chance to get involved. Furthermore, ability to influence projects at a stage where the framing of the problem and the range of possible outcomes are still up for discussion is limited to those identified as 'experts' or 'decision makers'. This privileging of particular identities in framing an issue that does after all affect all of society (like climate change mitigation) may give rise to claims of epistemic injustice.

The second key concern of ethical governance we identify is a narrow focus on procedures and 'rule making'. In CCS this manifests itself primarily in the proliferation of toolkits, 'best practices', and guidelines we identified in section 2, many of which are preoccupied with outlining procedures to allow publics to discuss the risks of the technology. 'Risks' here refers to the technoscientific risks that are commonly raised in relation to CCS: risk to human or other forms of life via asphyxiation or modifying chemical or biological processes from leakage of stored CO_2 or pipeline rupture; climate change impacts of release back to atmosphere of stored CO_2; and health risks associated with disposal of amines used at the capture stage to separate CO_2 (Evar and Shackley, 2012). Indirect effects such as loss of fish or food stocks due to leakage are also sometimes mentioned (Blackford et al, 2009). Again, these toolkits are not in themselves problematic and may even be useful if developed and used carefully; rather, the problem lies in the underlying assumptions—namely, that societal concerns over CCS do stem largely from worries over technoscientific risks, and that conventional processes such as consultations allow these issues to be dealt with appropriately. This overlooks the fact that publics have been neglected when evaluating the technology and the need for its implementation.

The focus on risk stretches right across CCS public engagement thought, from scholarly pieces through to more practically oriented work. Riesch and Reiner (2010) discuss the need

to adopt different risk communication strategies depending on how the risk in question is perceived by the public, and Bradbury et al (2011) thoroughly explore how publics are likely to conceive of the risks of CCS and how this can best be responded to. This is mirrored by the advice found in some CCS public engagement toolkits, which has a strong focus on taking seriously 'irrational' perceptions of technical risks, on demonstrating the safety of CCS to publics, and on the provision of information (such as NETL, 2009; WRI, 2010). Consider the following two extracts from guidelines produced by the (US) NETL and the WRI, respectively:

""Any concerns that have been identified, including perceived risks, should be addressed in language and formats suited to the intended audiences. In some instances, stakeholders may need to hear information more than once and in a different format in order to gain an understanding of the subject matter. Having multiple types of materials available provides the outreach team with the flexibility to use different options" (NETL, 2009, page 24).
""Providing a forum for exchanging information and discussing the risks and benefits of a project is central to the overall community engagement process. Beyond this, it is important that the project developer and regulator proactively attempt to involve the community in all decisions that affect it" (WRI, 2010, page 73).

In both these sets of guidelines there is an assumption that publics will be primarily concerned with the perceived risks of any potential CCS development. The remit of public engagement is closed down to focus narrowly on risk and risk communication before publics have even had a chance to give their views on CCS. The scope of the discussion is thus limited, and the 'solution' comes through the application of a narrow set of procedures that are themselves constrained within this framework of risk communication. This could give rise to claims of epistemic injustice if, by setting out the discourse around which the public engagement process will proceed, it shuts those who may not want to talk about risks and benefits out of the discussion and as such leads to the kind of hermeneutical epistemic injustice that Fricker (2007) and Anderson (2012) discuss. Indeed, there are numerous examples of public opinion on CCS being grounded in factors other than risk perception. The work of Corry and Riesch (2012) on perception of CCS among UK climate camp participants raises the possibility of opposition being based in an entirely different view of how the environment and society ought to be managed and who has a right to make decisions about the use of the atmosphere. Buhr and Hansson (2011) look at the contrasting cases of Norway and Sweden, linking slightly higher public support for CCS in Norway to the centrality of the oil and gas industries to Norway's wider economic and political context. By limiting the scope for discussion to technoscientific risks and marginalising people who may wish to speak about CCS on different terms (but may nevertheless still be positive towards CCS), some processes of CCS engagement to date leave themselves open to claims of epistemic and procedural injustice.

The third and final ethical governance concern to discuss is the privileging of scientific knowledge and associated values. Many empirical studies on public perceptions of CCS seek to develop the 'best' information to allow publics to make an informed decision (for example, de Best-Waldhober et al, 2009; Tokushige et al, 2007). Yet again, understanding how to make good scientific information available to society at large as part of the decisionmaking process is not in itself an issue. Rather, a potential problem of marginalisation arises when this 'good science' is marshaled in an attempt to convince people of a certain argument or interpretation of science, such as the unlikelihood of CO_2 leakage:

""helping an individual visualize CO_2 trapping can foster a clearer understanding … personnel have used imagery that depicts ready absorption of fluids but difficult extraction, likening CO_2 storage, for example, to condensation dripping down the side of an iced drink into a sandstone coaster. In this example, the water is readily absorbed, yet turning the coaster upside down or shaking it will not release a drop" (NETL, 2009, page 25).

The implication here seems to be that if the physical properties of the geology into which

CO_2 will be injected can be explained, then concerns over potential leakage can be allayed. This idea that opposition to CO_2 storage can be reduced if publics 'correctly' understand the associated science runs the risk of creating 'knowledge hierarchies' which suggest alternative knowledges and interpretations are in some way inferior to the dominant scientific understanding. By contrast, evidence suggests people's perceptions are largely shaped by things they experience in their everyday lives, and these understandings will by necessity be fragmented. Torvanger and Meadowcroft (2011) explain public perceptions of technologies like CCS are not fixed, but shaped through interactions with other people and via experience. Concerns around CO_2 leakage at Weyburn, Canada and opposition to CCS in Barendrecht, Netherlands were both fueled by publics' observation of dead animals in the locale, in each case unrelated to CCS. In Weyburn it was claimed that an animal had been asphyxiated by CO_2 leaking from a storage site (Sherk et al, 2011), whereas in Barendrecht ducks asphyxiated by a leaking pipe taking CO_2 to a greenhouse were cited to demonstrate the 'dangers' of CCS (Desbarats et al, 2010).

Sections of the public who interpret the scientific basis of CCS in an alternative way, or who may have a cultural background with a different way of looking at problems—such as the Scottish citizens who expressed concern over the fact CCS was not compatible with principles of permaculture[1] (Moray Citizens, 2012)—may find themselves marginalised in discussion. If such exclusion arises on the basis that knowledge gained from embodied experience or 'gut instinct' is always trumped by proper understanding and interpretation of the science behind CCS, then claims to hermeneutic epistemic injustice could arise. Such claims could be magnified if the scientific evidence presented to publics is being used to support a particular standpoint, with publics excluded from the process of interpreting the meaning and significance of these data for the 'problem' of climate change and the 'solution' of CCS.

5 What might a model of ethical governance for low-carbon energy look like?

In some cases at least, the governance of CCS projects reflects concerns of ethical governance thinkers. It is thus worth digging deeper into the solutions proposed by ethical governance models in order to better understand what an ethical governance framework might look like for low-carbon energy. We assess in turn the possibility of implementing three of the ethical governance principles from section 3—opening the cognitive framing, exposing stakeholders to scenarios, and creating opportunities for reflexivity—to low-carbon energy. We also argue, however, that some of these ethical governance principles run up against problems when it comes to implementation in the field of low-carbon energy, and thus that the management of public and stakeholder expectations with regard to what new forms of governance might achieve is vital.

Potentially the biggest challenge is the opening up of the cognitive framing of CCS. The rationale usually deployed by proponents of CCS relies on those outwith the epistemic community buying into multiple shared assumptions that fall in linear sequence (Markusson et al, 2012). The usual narrative of the rationale for CCS begins with anthropogenic climate change and the need to limit global warming to two degrees Celsius. Deep and urgent cuts in anthropogenic CO_2 emissions are required, so the story goes, to mitigate this dangerous climate change. Proponents of CCS then argue that—owing to the technical immaturity of renewable energy and the costs, dangers, or unpopularity of nuclear power—CCS is the only way of achieving these deep cuts in the required time frame without major societal upheaval. Such a narrow rationale for a low-carbon energy technology is problematic for a framework of ethical governance, in that, by necessity, it marginalises those who do not follow the dominant narrative all the way to its conclusion. For instance, there may be some people who will never accept the anthropogenic climate change argument, others who may

[1] A form of agriculture focused on human activity in harmony with nature over many generations to come (http://www.permaculture.org.uk).

see behavioural change as more important for climate change mitigation, and others who argue a rapid move away from fossil fuels is required if changes to energy systems are to be sustainable.

In short, the current governance of CCS is highly susceptible to claims of epistemic injustice, because in order to make logical sense, its dominant justification relies on arguments that have not been discussed in public and with the public such as the 'problem' of climate change and what a realistic 'solution' might be. This is not necessarily the case for all low-carbon energy technologies, though—wind farm developer PNE Wind (2013) cites energy security, decreasing costs, the permanence of wind, and the general reduction of pollution as benefits of wind energy, fully explaining climate change only in a further link (http://www.pnewind.co.uk). In such a case a much more broad-based discussion on the social acceptability of a low-carbon technology could be imagined, allowing a range of positive and negative viewpoints to engage in the discussion. Indeed, Stirling (2008) gives an example of how this 'opening up' might operate in practice, citing work with stakeholders during GM debates in the UK. Stirling notes that, in this case, different interpretations of uncertainties around GM crops were systematically explored in an iterative process with stakeholders, explicitly addressing ambiguities between perspectives and gaps in knowledges. The result of this, Stirling explains, was a "final neither red nor green light conclusion … a limited and stylized form of plural (if not fully conditional) advice" (page 280).

The case of GM crops in the UK presented by Stirling suggests that more open outcomes can be achieved in practice. We see no reason why this could not be broadened out to include publics and civil society actors as well. This sort of approach is especially important for low-carbon energy, where public awareness of the available options is low (Eurobarometer, 2011; Howell et al, 2012), so many people will still be forming opinions of the technology when specific projects are proposed. In order to ensure such people can participate fully and fairly in debates, it is crucial not to prescribe the terms and premises over which engagement takes place and close the discussion down before publics have even had a chance to form and/or express their opinions. Nonetheless, the case of CCS poses an interesting dilemma for a framework of ethical governance: is a more inclusive form of governance even possible for a technology whose rationale is tightly bounded and therefore by nature potentially exclusionary to many sections of society?

Scenario exercises have also been suggested by proponents of ethical governance as a means of contextualising debates and acknowledging alternative world views (Rainey et al, 2012). Such use of scenarios has been relatively well explored for environmental issues, but what is clear is that, for a scenario exercise to be effective in this domain, the context of place must not be lost. For example, Burgess et al (2000) studied the use of scenarios in contingent valuation (CV) exercises with publics for the Pevensey Levels Wildlife Enhancement scheme in the UK. From observation of the CV process and subsequent discussion with participants, Burgess et al found that people's responses were very much affected by their knowledge of local places—especially when it came to anticipating potential problems with deployment of the enhancement scheme.

Bickerstaff and Walker (2003), too, argue that seemingly irrational standpoints can often be explained when one considers such viewpoints within the wider context of relationship to a particular place. For a scenario exercise to be effective as a way of understanding the potential issues that may arise with a specific low-carbon energy development, it thus seems imperative that the scenario is constructed in a way that allows discussion of the socioenvironmental context within which the development will happen. There are already efforts within the CCS community to better understand the role of place history and local context in public perception (Bradbury et al, 2009; Brunsting et al, 2012); however, these focus more on demographic factors and recent experiences with large infrastructure developments. For something closer to ethical governance of the deployment of low-carbon energy at specific locations, we would prefer to see an in-depth approach that seeks to understand

people's relationship to place, with particular focus on how energy choices will shape future scenarios in terms of land use, environmental change, and emotional attachment to place. The value of a scenario-based approach in working round issues of epistemic injustice is that (if the scenario exercise is constructed appropriately) stakeholders and publics can together build a vision of what future problems and solutions might be—there is the possibility to consider future energy scenarios before the problem and solutions have been closed down by a narrow epistemic community.

Nonetheless, questions of who should ultimately make the decision about what course of action to take, and how to avoid issues of identity epistemic injustice creeping into invitation to participate in the scenario exercise, remain. Owing to the highly contingent nature of place, even the form of discussion and the nature of debate may depend on the local context—as Gray et al (2005) note in the case of offshore wind consultation in the UK, fishing communities' reluctance to participate in engagement processes was in no small part due to a formalised engagement process at odds with their own community dynamic. Cultural constructions and cultural values of this kind thus need to be taken into account, and across and within places different perceptions of fairness, responsibility, blame, and so on exist that will affect the nature of ethical and moral issues under discussion. It may therefore prove very difficult—if not impossible—to give more generalised and transferable advice on how place-based scenarios can fit into an ethical governance framework.

Finally, underpinning Goujon and Flick's (2011) entire conceptualisation of ethical governance is allowing opportunities for reflexivity, where actors can reflect on their own values and beliefs and better understand how these play out in decision making. Building such reflexivity into existing governance processes (like consultations over specific projects) alone does not solve the problem of the range of outcomes being narrowly defined before society at large can get involved, but it could be an important first step in making explicit the values and beliefs motivating particular technologies. For instance, it may be beneficial for publics to hear about the ethical and moral arguments behind low-carbon technologies, rather than purely the technological arguments. Likewise, for future projects, governments and developers may find it useful to know about the principles affecting how society perceives certain low-carbon technologies.

Creating a space for this kind of reflexivity could, however, be difficult. Hammond and Shackley (2010) and Howell et al (2012) explore cases of public scepticism towards engagement processes, where some members of the public have viewed attempts as partisan and carrying an agenda of promoting CCS. People may thus be wary of participating in renewed attempts at engagement if past experience has not lived up to expectations. It may therefore be the case that, in order to kick-start the long process towards ethical governance and allow a wider debate to grow out of existing processes, an organisation viewed as nonpartisan has to lead the engagement. To ensure that a drive towards a framework of ethical governance in low-carbon energy produces tangible changes in practice, perhaps some ethical guidelines are also required for the low-carbon research community on whether to participate in public engagement in the first place. If the developer's or funder's engagement is viewed as being too piecemeal or unresponsive to the extent that it may give rise to concerns over epistemic justice, perhaps researchers should not agree to get involved with or support the project.
An additional concern we have about the ethical governance call for reflexivity is that it sometimes seems to assume ethical issues are sidelined mainly due to unconscious, uncritical assumptions, and that ethical and moral dimensions can be brought into play as soon as all actors have reflected on their own implicit values, biases, and assumptions. By contrast, the history of large infrastructure development suggests that developers or those in positions of power may actively and knowingly resist efforts to develop more deliberative processes, or at least find ways to subvert such efforts. O'Neill (2007, page 150) describes how international companies can use processes of stakeholder engagement in a sophisticated way to disaggregate different actors, wryly noting that "the origin of the focus group technique in market research is not without its implications." Wynne (1982) explores how the inquiry into the Windscale nuclear facility in the UK was set up in such a way as to virtually guarantee approval of the

facility. Commenting on Wynne's seminal work, O'Riordan (1983) hints that the one thing the nuclear industry dislikes the most is democracy, as democracy means that plenty of time is given for thorough review and discussion—which itself leads to indecisiveness and delays. A process of reflexivity could also be never ending, and it may be the case that, in order to take action, actors do have to cease this reflexivity at some point and take a standpoint. There is thus potential, albeit limited, for a framework of ethical governance to develop for low-carbon energy technologies like CCS. However, given that our exploration of alternative forms of governance stems from the problems that can arise when existing processes of representative democracy fall short of societal expectations, it is crucial also to register that expectations have to be managed with any new form of governance. A drive to create fair and inclusive processes has to be tempered with reflection on what each party believes can realistically be changed. Linkage to government departments responsible for energy policy, environmental assessment, and planning consent is often not as clear as many publics believe. As Conrad et al (2011, page 778) put it in the case of the planning process in Malta, "a problem emerges when the objectives of public engagement are vaguely and ambiguously delineated, producing expectations that are not met, with subsequent disappointment and disillusionment."

This balancing of imagining alternative forms of governance, on one hand, with the management of expectations, on the other, is especially important when it comes to energy. Public agency is arguably more limited than with ICT, and opportunities to shape the 'end product' are constrained by physical factors such as location of geological storage sites or appropriate climatic conditions for, say, wind farm developments. The potential for disappointment is therefore heightened; hence it is crucial to set out, at the outset of engagement, what participants can realistically hope to achieve—what is at stake, what can be changed, what can *not* be altered. Developing 'better' processes for public engagement may be insufficient to guard against claims to epistemic injustice if publics do not have a sense of the extent to which their participation can actually influence the conceptualisation of solutions to the low-carbon energy problem. This should not, however, be seen as a deterrent to aiming towards better forms of governance. Even small-scale changes to existing processes can help in the move towards a framework of ethical governance running right the way through the low-carbon decision-making process.

Furthermore, given the reality of the need to renew energy systems, it must not be forgotten that decisions ultimately do have to be taken. Representative democracy struggles to encompass the full range of concerns that may arise from complex new technologies; hence there is a need to explore new forms of governance. Yet at the same time there is no guarantee that a more ethically tuned mode of governance will produce 'better' processes and outcomes in the time frame available. Hajer and Kesselring (1999) note that deliberation can sometimes end in paralysis, whereas more traditional 'power brokering' between stakeholders can lead to acceptable outcomes. It could even be argued that governments or developers can use deliberation as an opportunity for delaying action, such as by always postponing the final investment decision. Nonetheless, whilst it will never be easy to reach outcomes amenable to all, we believe ethical governance ideas have significant potential in the emergence of more socially acceptable low-carbon energy futures, and are something that the low-carbon research community should aim towards.

6 Conclusions

The concept of ethical governance could be a useful tool for improving societal involvement in the discussion over low-carbon energy technologies. As well as highlighting limitations of existing governance processes for new technologies—for example, the framing of issues and the creation of knowledge hierarchies—it also offers suggestions as to how more ethical modes of governance may be enacted in practice: among them greater reflexivity from practitioners and scenario-building exercises.

The far-reaching implications of both climate change and the technologies that may be

deployed in mitigation suggest the need for a framework of ethical governance that can encompass a fuller range of arguments and enable a just consideration of options in the short time frame available. With reference primarily to CCS, we have illustrated that existing strategies for engaging publics in the decision-making process risk committing epistemic injustices by constraining the framing of the problem to the form proposed by decision makers in the absence of any public participation.

Whilst there are good reasons to strive for more just and ethical governance of low-carbon energy, the ethical governance framework must, however, be used with some caution in the context of low-carbon energy. Ethical governance responses such as scenario building and allowing for reflexivity may well help to 'build in' a wider range of viewpoints during project development. But more work is required on the management of societal expectations about the potential to influence real-world decision making. Decisions about future energy systems do have to be taken, and the process needs to acknowledge the limits of any alternative governance framework. Failure to spell these factors out could result in even greater claims to injustice if overly ambitious attempts to deploy ethical governance for decarbonisation prove unworkable in their entirety.

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