Insights lost at points of vulnerability in UK policy evidence gathering on Carbon Dioxide Removal

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Ethics declaration

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Competing Interests

The authors report there are no competing interests to declare.

ABSTRACT

The methods, quantity, and timing of carbon dioxide removal (CDR) is impacted by, and has implications for, decarbonising energy, land use change, agriculture, the earth system response, and global society. Uncertainties in each plus the rapid development of CDR methods and policy, make decision-making challenging.

Insights from the social sciences and humanities are underrepresented in CDR decision-making. Qualitative evidence and theoretical insights are challenging to synthesise with quantitative policy outputs and decision tools. Real-world complexities may therefore be missed from feasibility assessments and decision-making around CDR, with consequent risks to delivery.

We focus on expert consultation procedures to identify points where real-world insights may be lost. The focus is non-statutory consultations with significant two-way dialogue and multiple stakeholders. Non-statutory processes are less scrutinised and more fluid, with greater scope for the quality of evidence to be impacted by institutional and human biases.

Twenty-six semi-structured online interviews were conducted with individuals from NGOs, policy, industry, and academia who work on CDR and related areas. Interviews capture both inside (i.e., policymaker) and outside (i.e., stakeholder) perspectives on evidence gathering procedures.

Interviews provide insights into the contexts in which evidence is gathered, which procedures are working well and where changes may promote more robust evidence gathering. We identify points at which insights are lost: (1) expert selection (as this determines the types of evidence heard), (2) during panel sessions (e.g., if some voices are silent or marginalised), and (3) evidence synthesis (e.g., if insights do not fit easily into the intended output).

1. Introduction

The Paris Agreement (2016) states that action on climate change needs to be undertaken in tandem with a variety of other goals including the promotion of equity, sustainable development, the eradication of poverty, the promotion of food security, just transition, and the integrity of all ecosystems. However, most models used to create scenarios for climate policy and decision-making (e.g., IAMs used by the IPCC and the UK's CCC) do not explicitly consider either social or environmental sustainability (Cortinovis et al., 2024; Geden et al., 2024). Where these are included, models have been found to lack transparency on the socio-cultural and institutional-regulatory dimensions (e.g., Butnar et al., 2020)**.** Carbon dioxide removal (CDR) is now included in all scenarios and often on large scales which would result in a variety of environmental and socioeconomic impacts (Geden et al., 2024). It will be crucial that the social and environmental costs and benefits of CDR are more clearly recognised and accounted for to better understand their real-world feasibility (Forster et al., 2020; Geden et al., 2024).

CDR includes both technological (e.g., BECCS, DACCS) and land management (afforestation, peat restoration) strategies to remove and store carbon for long periods. One thing which these different CDR methods have in common, and which distinguishes them from efforts to decarbonise, is the long timeframes on which they operate – looking to 2050 and beyond. This is because the technological CDR solutions are largely still in development phases, requiring both policy support and significant capital investment in infrastructure for them to function at the required scale (Geden et al., 2024). While land-based CDR strategies are already practiced they would need to be scaled up whilst avoiding conflicting with other land uses (e.g., food, biodiversity), and many take a long-time to store carbon (e.g., time taken for trees to mature or peat to form).

To date research on CDR has been led by the natural sciences, integrated assessment, and energy system modelling communities and in collaboration with policymakers (Markusson et al., 2020; Szerszynski & Galarraga, 2013). Academic and policy assessments consequently give emphasis to the technological, physical, and economic aspects of CDR feasibility (Jewell & Cherp, 2023; Nielsen et al., 2020). While interdisciplinary work does take place (e.g., see Markusson et al., 2020 for examples) many disciplines have held relatively marginal roles such as filling in perceived knowledge gaps and being tasked with overcoming specific barriers (e.g., social acceptability) (Carton et al., 2020; Healey et al., 2023; Victor, 2015; Waller et al., 2020). There is a mismatch between the potentially large societal impacts of CDR and current factoring in of insights relating to, for example, society (Castree et al., 2014; Minx et al., 2017, 2018). To summarise, the research and deliberation space informing policy and political action on CDR can be seen as dominated by techno-economic research at the expense of other types of insight (e.g., on socio-ecological challenges, implications of trade-offs) (Hansson, 2021;2024).

One reason that certain disciplines dominate CDR research and associated modelling is that they are more closely related and easier to integrate (e.g., the natural sciences), having more complementary ways of framing problems and finding solutions (Dowell et al., 2020). In contrast, including insights from more distantly related disciplines (e.g., sociology, philosophy) is more challenging and can raise fundamental issues relating to epistemology and ontology, especially where the insights offered are more qualitative in nature (Szerszynski & Galarraga, 2013). On a practical level, the task of combining complex mathematical modelling with, for example, theoretical insights or interview themes on public perceptions are difficult to resolve. The consequence has been that the humanities and social sciences have been largely (although not entirely) 'sequestered' from CDR related research and modelling pathways (Markusson et al., 2020).

While debates over which disciplines (or experts) are invited to contribute and how this is achieved may seem purely academic, there are far-reaching and real-world consequences. First, modelling future pathways is not a neutral exercise but rather a value-laden one (Braunreiter et al., 2021). Each discipline has its own assumptions and ways of framing issues and addressing them and these core assumptions are embedded within models then used in policy making. Second, any one chosen pathway necessarily excludes other options and results in trade-offs (Waller et al., 2020). A future with large investment in renewable energy and the promotion of low carbon lifestyles, for example, looks very different to one where the focus is heavily reliant on technological CDR.

Furthermore, the exclusion of some kinds of data within models means that many potentially relevant factors which could help to assess the realism of model assumptions, help understand uncertainties, assign likelihoods to outcomes, and evaluate the feasibility of the pathways are absent (Workman et al., 2024; Hansson, 2024; Jewell & Cherp, 2023). Models are optimized, for example, for cost criteria rather than to seek acceptable trade-offs between competing options (Rodriguez Mendez et al., 2024). This has led to concerns about a growing gap between model solutions that are feasible within their very own specific parameters and 'real-world' feasibility – where climate action must take place amid a host of competing political, institutional, and social concerns (Jewell & Cherp, 2020; Riahi et al., 2015). Arguably, extra caution is also needed in assessing CDR because the gap between model outcomes and so-called 'real-world' feasibility is muddied both by the relative infancy of CDR technologies and the distance into the future within which any CDR (technological or land based) may deliver the desired outcomes.

Here we focus on the research into policy interface at the point of evidence gathering, looking at expert consultation processes. The design and implementation of consultation processes are shaped by a variety of factors which influence consultation outcomes, but which may go unacknowledged and without reflection (as discussed by Stirling, 2008). Such factors include decisions on the bounding of remits and framing of questions, which disciplines, stakeholders, and methodologies will be represented, the management of stakeholder dynamics, and the documenting and communication of findings to policymakers. In each there is scope for significant variability and inadvertent bias (see Stirling, 2008).

In this study we conducted interviews to explore the details of procedures for convening expert consultations (e.g., panels, round tables, committees) used to inform policymaking and feasibility assessments. The focus was on consultations involving multiple-stakeholders and two-way dialogue between stakeholders and policymakers. Interviewees discussed their positive and negative experiences of a range of CDR related consultation types. Here we focus on identifying points of vulnerability in procedures where insights from the social sciences and humanities (especially the more qualitative and theoretical) may be vulnerable to loss (see Table 1 in Appendix A for example insights). We argue that the risks are greater for more informal or ad hoc consultations. These have more fluid procedures and there is therefore greater scope for the quality of evidence gathering processes to be impacted by a variety of human and institutional factors (Stirling, 2008). We define informal consultations as having the following characteristics: (1) they are non-statutory; (2) they may be short term and can include one-off meetings; (3) they may lack administrative support (e.g., a secretariat); (4) they tend to have stakeholders who are identified and invited by convenors (i.e., they are not formal appointments which tend to be advertised with published person specifications); and (5) they may lack a formal term of reference.

We selected individuals who work on CDR and related areas (e.g., net zero, climate change, energy, biomass). Interviewees included representatives from NGOs, academics and people working in or with industry (hereafter collectively referred to as "stakeholders") and policymakers. Together, these

are the groups usually associated with evidence gathering consultations for CDR. The following questions were explored during the interviews:

1. How are stakeholders and types of evidence selected?
2. What it is like to be part of evidence gathering panels?
3. What are the challenges for synthesising more qualitative and theoretical insights with quantitative evidence?
4. Are there certain points within these processes during which more social and/or qualitative insights are vulnerable to being lost?

2. Methods

A total of 26 semi-structured online interviews (using Teams) were conducted between September 2023 and January 2024, lasting around 60-minutes each. A combination of purposeful and convenience sampling was used to identify participants with specific characteristics from target populations (Tongco, 2007). First, potential interviewees were identified by looking at the lists of contributors to written outputs (e.g., reports) from expert consultations on CDR and related areas.[1] Once interviewing commenced, however, the snowball method was employed with the final interview question asking participants to suggest others we could approach (Parker & Scott, 2019). The lead researcher kept a log to monitor the types of individuals interviewed to ensure that sufficient diversity of perspectives would be captured.

Data collection was concluded after three months due to project timelines. An additional constraint on timing was anticipation of a forthcoming UK election, and whether this would occur in the spring (election held July 2024). The researchers were keen to speak to participants about their more recent and relevant experiences of panels before the policy landscape changed – with an associated change of roles and focus, especially for policymakers. There was therefore a relatively brief temporal window for data collection.

We set out to find interviewees who would bring insider (i.e., policymaker) and outsider perspectives (invited stakeholders), and we therefore included representatives from:

- policy (n = 6) (for example, departments such as Defra and organisations such as the National Infrastructure Commission),
- commerce/industry (n = 4) (e.g., trade body associations, start-ups),
- environmental NGOs (these were campaigning organisations) (n = 3),
- academia (n = 13) (a range of disciplines including social sciences, economics, modelling, and standards development).

Interview topics included: factors considered when identifying stakeholders to contribute to a consultation, details on why, when, and how consultations are held, the types of evidence presented (including discussion of potential challenges to the greater inclusion of qualitative insights), types of outputs (e.g., reports), and personal experiences of participating and convening (both positive and negative). The interview schedules can be found in Appendix A.

Interviews were conducted by AH. Transcripts were generated using the function in Teams. Each transcript was quality checked by AH against the interview recording. AH did an in-depth read-through of each interview, creating a document summarising content. This provided the researchers with a detailed overview of the whole data set which was helpful as a first step in the interactive

[1] To protect the confidentiality of participants we do not list the reports used.

process of identifying themes. Based on these initial analyses a preliminary report was produced and discussed by AH and NV. Initial findings were then presented to the project's Co-Design group for member checking to help increase the trustworthiness of the analysis. There was consensus between the Co-Design group and author (NV) that the report findings (produced by AH) were credible, both resonating with and accurately reflecting their lived experiences of panel participation (Birt et al., 2016; Cresswell & Miler, 2000). The Co-Design group was composed of individuals from academia and policy who had in-depth experience of participating in and/or convening panels. Two of the three members also participated in the interview. NV had over 6 years' experience of panel participation including chairing, and the project was sparked by a personal interest in this experience of evidence gathering procedures.

The data analysis was conducted in NVivo and involved deductive-inductive coding, with topics established by the interview schedule being combined with codes emerging from the data set (Klaever & Verlinghieri, 2024; Zoltán et al., 2023). Analysis of the content allowed for thematic patterns to be identified within the data set (Zoltán et al., 2023). AH led the coding process and iteratively developed the coding framework. This was crosschecked and discussed by NV to ensure coding accuracy and thoroughness. The first coding phase aimed to provide a set of descriptive labels summarising the content of each section of text and generated ~224 codes. In the second stage the number of codes was reduced by grouping, merging, and re-categorising to develop a set of high level and sub-themes. This stage further enabled the identification of patterns across the data set. Table 2 (Appendix A) shows the main and sub-themes with the number of interviews in which the theme was identified.

In the results section the following abbreviations are used to identify the source of quotations: AC for academic, PM for policymaker, NGO for Non-Governmental Organisation, and IND for industry. Quotations with text in bold have emphasis added by the authors.

3. Results

Details on individual interviews including participant type, level of panel experience, experience type (convenor, participant, or both), key topics discussed and self-described area of expertise are provided in Table 3 (Appendix A).

After each results section, a recommendation is made based on the findings. These recommendations were reviewed by our Stakeholder Co-design group, selected academics, and policymakers. See Table 4 – 'Guidance for Expert Consultations' (Appendix A) for a version intended for use by panel convenors.

3.1 Stakeholder selection

Stakeholder selection emerged as an important and reoccurring theme in 18 interviews. Individuals from policymaking discussed how they identified relevant experts. For example, research into the relevant fields (e.g., via a literature review) and consideration of panel composition (e.g., diversity and inclusion, avoiding 'group-think', stakeholders' ability to reach consensus). Importantly, policymakers also highlighted an internal culture of referring to the knowledge and contacts (i.e., networks) of colleagues in selecting experts:

> I think seeking input from colleagues within the department, you know, trusted academics, advisors, industry peers and who can […] suggest names (PM12)

> there will be obvious names for some of these things, and we'll discuss those with the chair and […] come up with a list [….] We try and think about balance, various diversity considerations […] and, you

> know, making sure you don't have too much of "group think" […] we probably do it in the slightly informal way, maybe there should be guidelines, I don't know. Probably if I was ever to leave […] then I probably ought to write some of these things down […] a very long list (PM21)

Institutional factors such as staff turnover can be seen as a point of vulnerability, particularly where stakeholder selection is reliant on the personal knowledge and networks of contacts as these may be lost when that individual changes post. Several academics also noted this as an issue (e.g., not knowing who to contact when seeking to disseminate evidence). Turnover was seen as a particular issue due to the promotions structure within civil service which encourages rapid change of roles. Notably, at least one policy interviewee changed position within the timeframe of the study.

A second point of vulnerability is due to individual differences, as highlighted in Interview NGO19. For example, the values, attitudes, and beliefs of individual policymakers may impact on who they think is important to invite to consultations:

> […] it **feels very random** […] **my suspicion is it's left down to individual civil servants**. Individual civil servants can think: 'You know what? I think would be really good to get a more, you know, diverse set of voices here and include those people from civil society […] kudos to them. Well done. But really is that how you do it? (NGO19)

The academic stakeholders felt that some disciplines were valued less than others, reducing their impact and representation on panels:

> **But social sciences other than economics, it's still the third leg,** if you like, in the science community. The engineering and physical science advice system and evidence system has got better I think, but I still felt at the time **social science was a poor relation** (AC2)

> **They wouldn't claim to want [a] sociologist so much** […] I think that's partly a dominance of behavioural economics within government departments and thinking […] **the framing is so narrow. And I think that framing continues into advisory boards […] more dominance is given to more economic quantitative modelling results than it would be to what they might see as softer ideas on norms and values and perceptions** (AC17)

On this topic, one senior policymaker commented that while qualitative forms of evidence may be equally important, they were also more difficult to work with. This individual therefore expressed a preference for quantitative data:

> So, you know, we like the quantitative stuff, and **we struggle […] when things aren't quantitative** […] qualitative stuff is always difficult, but it's, you know, it's just as important (PM21)

The ability of policymakers (especially more junior staff) to manage competing deadlines and where appropriate to resist pressures from internal politics – was another aspect of individual differences potentially impacting on stakeholder selection. Interviewee PM24, for example, noted pressures from colleagues to include certain "warm" stakeholders even where their expertise may not be the most relevant. Here over reliance on networks of contacts can be seen to pose a risk that certain individuals are repeatedly consulted, potentially reducing the diversity of perspectives on expert panels:

> people are very protective about their stakeholders and want them to be seen to be involved. So, there was quite a bit of shuffling around […] I had to make sure I'm clear about the topic because some of the people that were suggested were around wider [issues] […] [I]n central government we used to call them "warm stakeholders" […] [namely those who] are particularly open to talking to us […] you keep them warm by keeping talking to them. But **then that means you get like evidence from always the same sources**. (PM24)

Stakeholders also observed that some individuals had privileged access and dominated the policy space:

> **it's just like a set of people - there's probably 20 of them, you know, in terms of scientists [and big industry] who are the ones that advise government all the time** (IND6, startup who had disengaged with consultation processes)

The challenges of achieving a good balance of stakeholders was discussed, with tensions between achieving sufficient diversity of perspectives and the desire to reach some sort of consensus. While the presence of more radical voices was seen as potentially important, they were also deemed disruptive. In contrast, stakeholders who had more in common tended to get along better and dynamics were easier to manage:

> it **was just a really good workshop. I think partially because everyone there had very similar focus** […] I guess they were trying to solve very similar problems even though they were coming at it from different angles, and it meant that they were just bouncing off each other. **I didn't really have to do anything other than listen** (PM26)

> **you don't want too radical a view derailing every conversation** […] It's a balance that we probably haven't always got right. Like you know, I think if you use the stakeholders you know […] we probably knew **their views and they probably were quite aligned with our own** and maybe we didn't quite get as much of that challenge (PM18)

While such consultations may seem to 'flow' better, there is a risk that they may not be as good at capturing a diversity of insights as those where there is more contestation. As such insights may be vulnerable to loss or marginalisation. Panels may 'flow' better because certain stakeholders are missing or due to a reluctance of participants to speak out to challenge a dominant view ("group think"):

> it was very much like a whole group of […] scientists [and] economists […] that was it basically, apart from me [saying] "have we thought about politics and society and sociocultural issues?" (AC20 social scientist, junior, less panel experience)

Rather than avoiding potential conflicts (which may mean that important dissenting voices go unheard), having facilitators equipped to resolve conflicts may enable a wider range of insights to be presented.

Interviewee AC10 had participated in a wide range of panels and emphasised vulnerabilities (i.e., unforeseen negative impacts of decision-making) resulting from not having a more 'rigorous' stakeholder selection process. AC10 highlighted the need for convenors to consider not only the areas of expert knowledge represented by stakeholders but also where potential gaps in knowledge might be. The importance of having interdisciplinary researchers was emphasised in this interview:

> what happens is you get a bunch of people together and they all know about their own little thing. And some of them have got very vested interests as well. And so, because there's nothing to say otherwise, outcomes are whatever they are from that process. **There's no rigorous information input to this process, and I think this is a real problem** (AC10)

A final point of vulnerability identified here is the routine absence of certain types of stakeholders from in-person panels. A debate emerged around the relative costs and benefits of holding meetings online versus in person. Having some meetings online was seen to be important in widening participation by enabling stakeholders to attend who would have otherwise been excluded (e.g., located outside London, smaller organizations with limit budgets, part-time employees, or those with caring responsibility where travel time is a barrier):

> But one thing I would say about **online is it's a bit of a leveller**, 'cause there is a strong London policy community which could easily dominate […] [online] you can participate now wherever you live. (AC17)

> I suppose is a capacity problem […] The smaller the participant is – the [less] probable [it] is that they will find half a day or one day to participate […] it's only the big ones coming and then the big ones are influencing decision making (AC1)

Three recommendations for practitioners arise from these stakeholder selection insights. First, prior to selecting stakeholders consider the purpose of the engagement, i.e., define the key questions, time frames and whether potentially valuable insights are at risk of being excluded (e.g., by question/issue framing), and whether evidence gathering could remain more open. Secondly, when selecting stakeholders identify relevant expertise, consider diversity of perspectives and potential power (im)balances (e.g., lobbying), ability to reach consensus, previous work, and frequency of past engagements with stakeholders. Finally, consider the method of engagement, i.e., the consultation format (panel, roundtable) and how to be accessible (e.g., online meetings).

3.2 What it is like to be part of evidence gathering panels.

The management of meetings can be another potential vulnerability in terms of getting a broader range of evidence heard. Poor Chairing and limited support may allow some voices (and evidence) to dominate (e.g., AC9 below), while others may be marginalised or even silenced. 'Feeling heard' emerged, therefore, as a dominant theme within the interviews:

> I don't find it useful because it's just everybody going and shouting, not listening […] not getting to anything constructive (AC1)

> industry stakeholders […] **lobbied very heavily for the outcome that that they wanted** […] they had left **a very junior member of staff to convene the advisory group**. And just **didn't give that person enough support** (AC9)

Policymakers also stressed the importance of well Chaired and sufficiently supported meetings, and the need to tailor facilitation to online or in-person meeting formats. The risk of some stakeholders dominating the space was seen as higher in online environments where social cues may be harder to observe. Online meetings may also need a dedicated staff member to manage the chat function. This was seen as important in ensuring that all voices were heard, including those who participate in writing:

> the **way it was chaired** […] having sufficient capacity to support that process from within the team has turned out to be really important (PM21)

> I think it's **easier for me to chair something that's in the room** because I can tell who's interested in coming in […] more easily than in an online screen where I can't see everybody. [...] Whereas **in a room […] I think people are also more aware of everybody around them**, whereas I think when you're in a virtual environment, it can feel just like it's you (PM26)

> it's almost impossible to chair a meeting and look at the chat at the same time. People can't do two things at the same time. […] The positives of chat are **people don't like speaking up and it's their way of offering their views** which are very valid but in a different format, **so there's a bit of inclusivity that like that is beneficial** (PM18)

The online environment also presented specific challenges in terms of 'breaking the ice' between different stakeholder groups, especially where trust may be lacking, underlining the importance of effective meeting facilitation online:

> some of the NGO colleagues, [are] quite suspicious of business and […] **ideally it would be a mix of in person and online. Online for expediency. In person to build the relationships** (NGO11)

An important factor in shaping stakeholders' experiences of participating in consultations was how well their expectations were managed by convenors:

> a young academic say[s] to me: "Here's my paper. When will the policy be changing?"
> And I had to […] explain the policy making process […] Setting up clear terms of reference for the groups […] so they understand what their scope is, what we intend to do with this information is really important […] **[F]or someone to come and speak to a government department can be a really big deal […] sometimes it's that person's sort of only shot to come and […] influence policy** […] (PM12)

'Transparency' emerged as an important and related theme and included having a clearly outlined remit. This enabled stakeholders to decide whether they could meaningfully participate, to present more tailored evidence, and to gain a sense of personal satisfaction when goals were being met:

> they were really targeted with really clear questions. And then it's […] rewarding to be able to pull out the evidence and show the trade-offs, which is what I usually do […] a defined scope, it's easier to […] suggest a better way […] or suggest if they left anything out (AC1)

Furthermore, transparency was especially important in those instances where the panel remit changed, or outcomes were not those hoped for:

> They ended up not having […] [a] target […] which in a way you could argue is a bit of a failure, but at the same time I did feel they went through a very evidence driven approach to come to that conclusion, not one I entirely agreed with, but I understood the argument […] you felt that it was treated with a certain sort of logic and robustness […] the process in itself was rewarding (AC17)

A tension can be seen between having a more closed remit (which is helpful in, for example, expectation management) and having space for stakeholders to be able to push back against this where they feel that important insights may be lost due to being deemed out of scope. This was particularly highlighted as a challenge both by those working within the social sciences and by an NGO. Both wished to challenge the core assumptions being made, but by doing so risked becoming irrelevant.

> **if you accept the idea that about the basic question** […] "Should we do the emissions trading?", then there was quite a lot of opportunities to say things. I mean, at least if you tweak the questions a little bit and shoehorn in some, it was possibly possible to get some critical angles in there and they were interested. […] **In my experience […] taking a step back in your answers, in your responses and say[ing], "look, you're – we think you're asking the wrong questions, you should talking about X instead"**. (AC23)

> there's a kind of **moral argument** or something from the NGO's that **is quite hard to integrate** […] should we be really going down [the] GGR route for instance […] **[this] stuff is actually slightly outside the policy making process** that you're currently engaged in […] so it doesn't have a natural home (NGO11)

The challenges of presenting more theoretical insights (e.g., moral perspectives on CDR) are noted here by NGO11. The issue here is that such insights may be at too high a level (questioning fundamental assumptions), meaning they are far beyond the more applied remits of a panel, and would need to be included earlier in policy cycles. This contrasts with the issues often faced by more qualitative insights (e.g., case studies) where the criticism tends to relate to the transferability of findings.

Policymakers also commented on the challenges of working within the remit of a panel. This included responding to stakeholders who questioned or pushed back against the remit because they felt that important points were being missed – acknowledging their points while also ensuring the panel output would still be useful:

> that's so tricky because it might be that we're asking a particular question and we can't really tell you why […] because there's policy developing in the background […] there might be things that […] the government has got a really clear position that 'we will not do this' […] Sometimes it's helpful to have that evidence anyway […] But then bringing in our perspective too, and kind of meeting in the middle, so we're producing something that's useful (PM12)

The recommendation for practitioners arising from these insights relates to meeting management, i.e., find an experienced neutral chair, consider using facilitators (e.g., for online meeting chat functions) and put steps in place for transparency with stakeholders on processes and outputs.

3.3 Evidence synthesis

The final point of vulnerability for evidence inclusion we've identified is whether the evidence 'fits' or "falls through the cracks" and is lost (PM26, below). Insights may be gathered to inform a particular model, output, or synthesis and some types of evidence will be easier to directly feed-in to this than others. When insights cannot be directly used, they often need to be transformed into a format which fits the output. For qualitative insights, this may mean that a quantitative proxy must be found. One policy maker explained the challenges of gathering evidence to inform social sustainability criteria and of ultimately needing to convert complex and diverse forms of evidence into something which could be input to a spreadsheet for monitoring, reporting and verification purposes:

> social sustainability can be really hard to quantify […] there might be groups that have no documentation but have ancestral rights to a place and aren't able to demonstrate it in that kind of paperwork trail. That doesn't mean that that claim isn't valid, but that's very hard for a regulator […] **because they need to be able to basically input it into a spreadsheet and be able to show it to their auditors** […] it threw up quite a lot of questions around what constitutes as evidence and what constitutes as good evidence […] **the process we went through was trying to convince particularly people in government, that that's a real space for qualitative information** […] **[But] ultimately you would need to be able to convert it into some kind of a quantifiable policy […] otherwise, it does kind of fall through the cracks a little bit or it happens underneath it and it's not really measured** (PM26)

This process of translating qualitative insights was seen to be valuable but also demanding, for example, in terms of requiring time to be factored in to allow for different groups of experts to work together iteratively:

> **Not every single bit of a storyline was translated in the end because some of them, you know, models could not accommodate** […] It was time consuming […] I think that's part of the learning for any interdisciplinary project to build in that time that's required […] to discuss – whether it's talking about methodologies, or while translating assumptions from qualitative to quantitative and back (AC3)

> it would be very easy for us to just try and create some really super rough quantitative proxies that measure something but then don't really do justice to the to the work that's out there […] to how in depth it is and how and how nuanced it is (AC20)

As observed by AC3 and AC20 (above) there may be losses during the process of translation itself. Quantitative proxies cannot always be found, and the new format may not capture the complexity of the original, with resultant losses in terms of depth of insight added or nuances of meaning.

Another and related point of vulnerability is the ability of stakeholders to effectively communicate insights to the panel. It was noted that finding relevant examples or case studies for CDR was challenging. This is because (a) many forms of CDR are new and developing so there are fewer examples, (b) because drawing on cases from other areas may risk of bringing 'unwanted baggage' acting as a barrier to effectively sharing insights (e.g., comparisons with waste disposal, nuclear, fracking, and fossil CCS), and (c) because of issues of transferability:

> All of the case studies […] seem to be very specific […] we're developing an entire industry […] we just haven't managed to demonstrate it yet […] I occasionally get asked by people […] "Can you give us some case studies?" and all of the case studies I can give: 'A' are not about CDR (they're from completely other sectors) and 'B' […] I don't have any positive case studies where […] it actually worked really well […] nobody ended up blockading anything (AC20)

While cost and carbon provide a readily understandable metric that can be applied to different contexts findings from social sciences are often more nuanced and context specific:

> And when you get to the […] **qualitative […] inverted commas "softer issues"** [they are] difficult to pin down and harder to address and more kind of contingent, I suppose, on context and events [...] it's much more specific to the time and the place and the technology. So, in that sense it's much harder to talk in generic terms. Whereas if you're talking about a pipeline and what pressures you need and that sort of thing, that's obviously more applicable across a range of contexts, potentially. So, I think that makes it hard […] they're **harder to quantify**, they're harder to get to the bottom of as well and predict. […] it's not necessarily that that these advisory groups didn't try […] it's much **harder to incorporate those things in in formal reports** (AC7)

Wider issues in evidence synthesis

Beyond evidence gathering procedures, our results identified two further points where social and/or qualitative insights may be vulnerable to loss – evidence creation and evidence reporting. It was argued that the integration of social sciences and more qualitative insights with other evidence types needs to be planned for from the outset of projects, for them to have policy impact:

> always pushing the researchers to **make sure they integrate things early and don't do the old-fashioned thing of doing a bit of social science on the side and then kind of trying to stitch it all together at the end** […] it's harder, but there's better ways of doing it. You know to really […] mainstream those concerns and bring social science right to the front end so that when you're designing […] you're really thinking about how you're going to engage stakeholders through it (AC2)

In relation to evidence reporting, wider social and qualitative insights, even when heard by a panel may be at risk of not being meaningfully integrated into the output or synthesis (e.g., being presented as ancillary in a report), also reducing their potential for policy impact:

> what came out was better than it had been before because before they weren't actually planning on including it at all. T**hey were just gonna publish it as a completely separate piece of work with no integration** […] We managed to get some integration […] [and] as far as I'm aware, did inform the […] strategy (AC20)

The recommendation for practitioners arising from these insights relates to outputs, i.e., consider whether there are ways to capture insights that cannot be directly or fully translated into policy output formats, or ways to meaningfully integrate qualitative insights into reports.

Discussion

In this research we focused on decision-making around and feasibility assessments of CDR, arguing that this area poses unique challenges. A major challenge is that while CDR is envisaged as taking place on unprecedented scales from the latter part of the century and far into the future, very little technological CDR currently exists (e.g., pilot plants) (Geden et al., 2024). Nonetheless, the decisions made now lock in some trajectories while excluding others (Waller et al., 2020). For example, by channelling funding at BECCS and DACCS, the UK government is already potentially limiting the diversity of the CDR portfolio, with consequent implications for risk to delivery for net zero (DESNZ, 2023; Smith et al., in prep). This focus on future CDR has been seen as a distraction from efforts to decarbonise now and from using methods which are already demonstrated to work (e.g., renewables, reduced demand) (Carton et al., 2023; Anderson & Peters, 2016; Fuss et al., 2014; McLaren, 2020). We argue therefore, that it is essential that the costs, benefits, and trade-offs involved in current decision-making for CDR are better recognised and accounted for to understand real-world feasibility (Forster et al., 2020; Geden et al., 2024). In doing this, opening-up, broadening out and making more robust the evidence considered by policymakers to improve the quality and diversity of insights considered is essential (see, for example, discussions and approaches outlined by Bellamy et al., 2013; Healey et al., 2023; Stirling, 2010; Stirling et al., 2018; Van Zwanenberg et al., 2014). Currently, however, the political decision-making arena is dominated by techno-economic research and integrated assessment models (IAMs) optimised for cost-effectiveness. Many other types of insights which may be important in understanding the real-world feasibility of CDR are therefore lost or marginalised during evidence gathering procedures (see discussions by Hansson, 2024; Markusson et al., 2020; Rivadeneira & Carton, 2022).

To better understand the challenges of opening the decision-making arena to wider insights, we focused on evidence gathering procedures. We aimed to identify potential points at which insights beyond cost and carbon may be vulnerable to loss or marginalisation. We found that the "closing down" or exclusion of insights occurs from the very outset of procedures, with decisions around remits and the framing of questions (as posited by Stirling, 2008). Remits set boundaries shaping which stakeholders are (not) invited to participate. While for many expert panels these important decisions will be formalised and therefore more transparent, this is not the case for more ad hoc panels. For these, processes are less scrutinised and more fluid with greater scope for the quality of evidence to be impacted by a variety unrecorded of human and institutional factors. For example, we found that whether someone was invited to give evidence could be dependent on a convenor's ability to select stakeholders based on their relevance rather than on internal pressures to include certain "warm stakeholders", or on whether that individual convenor valued insights from the humanities or social sciences. While there has been progress including important work in up-skilling researchers from social sciences to engage with policy and evidence gathering (e.g., ACCESS, ESRC funded project), whether they are heard is still dependent on selection processes. Unrecorded, informally made decisions which are not subject to scrutiny, can still have potential shut out certain types of insight from the outset.

The interviews also revealed the importance of human factors such as the interpersonal dynamics of meetings, highlighting further points of vulnerability where insights may be lost or marginalised. One factor was whether evidence is heard at a meeting (Stirling, 2008). Feeling like the token social scientist, or humanities representative, for example, may not be conducive to speaking out to challenge 'group think'. Furthermore, where the expectations of stakeholders are initially high (e.g., with respect to influencing outcomes), careful management is needed on the part of convenors to avoid negative experiences (e.g., feeling unheard, disempowered) leading potentially to

disengagement. The impacts of dominating stakeholders (e.g., lobbying interests), gaps in knowledge due to a lack of interdisciplinary individuals and power imbalances are all factors potentially influencing evidence quality which may not be recorded or reflected upon. Convenors highlighted the importance of good chairing and facilitation in ensuring worthwhile outputs. While this is arguably especially needed for more ad hoc evidence gathering procedures, these tend to be the most poorly resourced.

Specific challenges for incorporating insights from more theoretical and qualitative work were identified by our interviewees. One was a lack of case studies for more novel CDR methods, e.g. BECCS, DACCS, enhanced weathering, ocean alkalinity enhancement. This was attributed to few technologies being operational or at large scale. Another issue was transferring insights gained from work on other technologies and applying these to CDR without bringing in unhelpful and misleading associations and framing effects (as discussed by Bellamy & Raimi, 2023; Cox et al., 2022). Yet another issue was in having the time, resources, and expertise to do work such as synthesising and translating qualitative and theoretical insights, while maintaining their integrity (see Bickerstaff et al., (2015) for a worked example of good practice). This is especially likely to be a challenge for more informal and ad hoc evidence gathering which tends to occur on very tight time frames and with limited resources. This issue is further exacerbated by a lack of capacity from within research communities. Historically the humanities and social sciences have received a far smaller proportion of funding (as discussed by Foulds et al., 2022; Overland & Sovacool, 2020) and this has often been targeted at specific downstream issues such as pre-empting public perceptions of technologies. Our work therefore contributes to various calls from within the literature for greater resourcing of these disciplines both to work independently from policy agendas and to have opportunities for leading research agendas (e.g., Markusson et al., 2020). This would promote a greater diversity of insights being created.

In this work we have attempted to bridge the gap between theory and practice by offering a series of recommendations designed to assist those convening informal and ad hoc evidence gathering panels (see Table 4, Appendix A for complete list). We brought together examples of good practice as discussed by our interviewees and combined it with available grey literature (e.g., civil service guidance) on running panels. While there is always the risk that such guidance may simply become a tick-box exercise, we hope that it may provide a tool which can be used and adapted to assist with the selection of stakeholders, meeting management, and the synthesis of evidence.

Conclusions

While debates over which disciplines (or experts) are invited to contribute and how this is achieved may seem purely academic, there are far-reaching real-world consequences. Decisions about future pathways to net zero are shaped by values and assumptions with any one course of action excluding others. The loss of some kinds of insights from evidence gathering and associated decision support tools means that potentially relevant factors for assessing the realism of assumptions, understanding uncertainties and trade-offs, and assigning likelihoods may be absent, with consequent risks.

Finally, while informal and ad hoc evidence gathering is vulnerable to losses of certain types of insights, we would like to emphasise that these consultations still play an important role in informing decision-making. As one of our interviewees observed, ‘we don’t need perfect decision making, just better decision-making’ (paraphrased). We would agree that a pragmatic approach is needed as imperfect consultations are arguably still preferable to none.

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Appendix A: Supplemental Materials

Table 1 – Examples of insights vulnerable to loss

Examples for land-based and technological CDR methods illustrating cultural, social, and institutional insights which may be vulnerable to loss during evidence gathering procedures.

Example insight	**Methods and author affiliations**	**Point(s) of vulnerability**
Cultural: Upland hill farmers' may resist woodland creation where this is perceived as a threat to their sense of place, culture, and way of life (Iversen et al., 2022).	A case study in Cumbria combining a survey (Q Method) with semi-structured interviews. Disciplines/ Affiliations: Agro-ecology, Department of Science, Natural Resources & Outdoor Studies.	Agenda setting / stakeholder selection. Evidence synthesis.
Cultural: Communities where industrial heritage and industrial employment are especially valued may be more welcoming of negative emissions technologies, especially where these are framed as ways of protecting and rejuvenating manufacturing (Thomas et al., 2018).	A 2-day workshop close to Drax Power Station, in an area with mining heritage. Disciplines/ Affiliations: School of Psychology, School of Social Science, Understanding Risk Group.	Agenda setting / stakeholder selection. Evidence synthesis.
Social: Farmers' decision-making factored in community relations, namely how their neighbours would respond to changes in the appearance of the landscape resulting from tree planting (Convery et al., 2012).	A case study in Cumbria combining focus groups (upland, lowland, and combined farmer groups) and semi-structured interviews. Disciplines/ Affiliations: National School of Forestry.	Agenda setting / stakeholder selection. Evidence synthesis.
Social: Moral hazard for future generations. Large scale CDR may act as a mitigation deterrent delaying rapid and near-term emissions reduction and increasing the risk of lock-in to fossil fuel dependency, increased burdens on future generations to act, and potentially more severe climate impacts (Carton et al., 2023).	Advanced review. Disciplines/ Affiliations: Centre for Sustainability Studies, Department of Food and Resource Economics, Environment Centre.	Agenda setting / stakeholder selection.
Institutional: Insights into grant scheme design. Complexity, bureaucracy, and insufficient payment rates are well known barriers to land use change. Tree planting grants may be more successful when codesigned with stakeholders (Westaway et al., 2023).	Review (non-systematic) of peer reviewed, policy and grey literature with focus on UK and Northwest Europe. Disciplines/ Affiliations: Royal Agricultural University, Moinhos de	Agenda setting / stakeholder selection.

	Vento Agroecological Research Centre, School of Agriculture, Policy and Development	
Institutional: Social License to Operate. A communities' level of trust and confidence in institutions to safely manage projects was dependent on both on the track record of the institutions (e.g., previous conflicts) and the communities' past experiences with different technologies (e.g., residents in Lancaster evaluated CCS in relation to experiences of fracking) (Gough et al., 2018).	Mixed methods: stakeholder interviews and focus groups in two case study locations. Disciplines/ Affiliations: Tyndall Centre Climate Change.	Agenda setting / stakeholder selection. Evidence synthesis.

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Table 2 – Coding Framework

Superordinate (top level) theme (no. interviews)	**Examples of sub-themes**
Challenges for science-policy actors (26)	• Positive and negative experiences of panels e.g., feeling heard, interpersonal dynamics • Power and networks e.g., 'warm stakeholders', hierarchies • Impact e.g., ability to contribute to the panel • Transparency (challenges around) e.g., within processes, what is auditable, policy outputs
Challenges for science-policy landscape (22)	• Panel remit e.g., terms of reference, tensions around scope • Institutional and structural e.g., staff turnover, time pressures, resources / capacity
Challenges for increasing evidence diversity (18)	• 'Fit' of evidence e.g., synthesis and reporting, dealing with uncertainty • Social science and qualitative related (e.g., translating insights)
Processes (11)	• How meetings are run (e.g., Stakeholder selection, online vs. in person, chairing)
Topic specific challenges (19)	• CDR feasibility (e.g., social, and political acceptability, markets, and finance) • Climate change emergency • Mitigation measures (farming practices, behaviour change)
Understanding of policy processes (12)	• Policy as a "Black box" analogy (i.e., processes are hard to understand)

Table 3 – Interview Sample

Details on individual interviews including participant type, level of panel experience, experience type (convenor, participant, or both), key topics discussed and self-described area of expertise.

Int.	Sector	Participant / Convenor experience	Experience (high or low)[2]	Types of panel experience discussed	Topics of discussion	Self-described area of experience (anonymised)[3]
1	Academic	Participant	High	National, international, and local government engagement.	CDR	Biomass energy, CDR
2	Academic	Convenor	High	Senior advisor-type roles including with Parliament. Chairing experience.	CDR, net zero	CDRs, net zero targets, emissions reduction, policies to support demonstration and deployment of CDRs, CCS economics and policy
3	Academic	Participant	High	Written and oral evidence provision. Work for Parliament. A secondment.	CDR, climate change	Energy system modelling, low-carbon scenarios
4	Academic	Participant Convenor	High	Engagement with Westminster and Scottish government. Has convened own stakeholder events involving policymakers. A secondment.	CDR	Biomass Energy, CCS, Agriculture, Energy
5	Industry	Participant	High	Involved in various consultations on behalf of employer. Recent CDR related engagement.	CDR, climate	Environment and energy policy, bioenergy, global carbon cycle modelling, climate change mitigation, net zero policy, carbon sequestration in soils/vegetation,

[2] High = multiple engagements in providing expert advice to policymakers in forums where there is significant two-way dialogue and where there are multiple stakeholders present (e.g., expert panels, round tables, committees, both formal and ad hoc consultations) or of convening these. Low = fewer or no engagements in these types of activity. Ratings are inferred by the authors based on interview content rather than self-assigned by interview participants.

[3] Identifying details have been removed (e.g., job titles, employment duration) to protect participant confidentiality.

						engineered GHG removals, agriculture, land use policy
6	Industry	Participant	Low	Has collaborated with academics among others on written submissions. Had disengaged from evidence provision.	CDR	Direct air capture
7	Academic	Participant	High	Formal and informal positions e.g., has worked with Cabinet members and consultancies hired by government.	CDR	CCS, BECCS, CDR, socio-technical assessment
8	Policymaker Industry	Participant	High	Representing other organisations, trade association. Recent CDR related engagement.	CDR	Biomass Power, Biomass Heat, Energy from Waste, Biogas, Renewable Transport Fuels, Bioenergy, Carbon Capture and Storage
9	Academic	Participant	High	Engagements including with Westminster, Scottish government and internationally. Both self-appointed and invited roles. Has chairing experience for commercial organisation on policy related issues.	CDR, GHG	Greenhouse gas accounting
10	Academic	Participant	High	High level/senior advisory roles (e.g., Cabinet level).	Environment and land-management based CDR	Interdisciplinary science
11	NGO	Participant Convenor	High	Attends on behalf of employer. Long-standing panel member and also convenor for own organisation.	CDR, CCS	Emissions trading, chemicals safety, industrial decarbonisation
12	Policymaker	Participant Convenor	High	Civil service – has compiled advisory groups, acted as a liaison between policy makers and panels, reviewed outputs,	More process focused but touches on climate and CDR	Policy - biomass energy, carbon capture and storage, BECCS

				commissioned research/evidence for policymaking, sat on panels.		
13	Academic	Participant	High	Formal and senior (e.g., House of Lords, Select Committees) and informal positions.	Energy related, touches on climate change	Energy related
14	Academic	Participant	High	Formal and senior (e.g., standing committees, ministerial) and informal positions. Interactions with policymakers include 1:1 and regular networking.	CDR (land related), environmental impacts	Environmental assessment, bioenergy systems, BECCS. Engineering and environmental life cycle perspectives
15	Academic	Participant	High	A variety of engagements with policymakers in the UK and several other countries. Also works with commercial organisations. Member of various panels.	CDR	Carbon management, CCUS, CDR
16	Industry	Participant Convenor	High	Various roles relating to policymaking and working with business. Experience in chairing.	CDR, business	CCS and carbon removals
17	Academic	Participant	High	Formal, invited (e.g., where there was a statutory requirement for a panel) and senior (e.g., Select Committees, Cabinet Office), has had specific roles for publications.	Decarbonisation, net zero	Scenario modelling, net zero for multiple sectors
18	Policymaker	Participant Convenor	High	Provides expert advice to government. Does research and stakeholder consultation.	CDR	Engineered greenhouse gas removals, carbon capture and storage infrastructure
19	NGO	Participant	High	Organisation does evidence gathering. Part of this individual's role is to synthesise evidence. Experience includes participation in Select Committees.	CDR	Climate policy and technology, nature, land use, agriculture

20	Academic	Participant	Low	Some but more limited panel experience.	CDR	Social science of greenhouse gas removal
21	Policymaker	Convenor	High	Organisation works to identify knowledge gaps and commission evidence gathering to feed into government policymaking. Convenes panels, has chairing experience. Senior staff member, very experienced.	Process focused interview	Biomass energy, CCS, CDR, energy
22	Policymaker	Participant Convenor	High	Civil servant, secretariat, panel observer. Policy support including reviewing evidence and advising. Intermediary roles.	CDR	Land Use and Bioenergy Science
23	Academic	Participant	Low	More limited experience e.g., submitted oral evidence. Not keen on increasing involvement. Has been on other kinds of panel e.g., academic.	CDR	Social science of greenhouse gas removal
24	Policymaker	Convenor	Low	Recent but more limited experience of chairing and convening in current organisation. Makes use of 1:1 consultation for evidence gathering. Has previous relevant experience e.g., with local government.	Net zero, behaviour change	Demand side measures for Net Zero
25	NGO	Other	Low	Very senior member/representative of NGO who works to review outputs of panels (rather than being a panel member or convenor). Has worked with senior members of Government.	Negative emissions	Energy and climate policy and politics
26	Policymaker	Convenor	High	Recent CDR related experience in policymaking, commissioning evidence gathering and convening groups. Has also worked in similar roles in other sectors.	CDR, biomass	Net Zero, Climate

Table 4 – Guidance for expert consultations

Guidance for non-statutory expert consultation processes used to gather evidence and inform policy relevant decision-making

1. Identify purpose of expert consultation

1.1 Define the key research question(s) or topic and scope.

1.2 Decide on consultation time available and the type of panel feasible within this e.g., scoping or ideas development, testing assumptions, feedback on the implementation or finalisation of plans.

Other considerations:

- How will the defined questions and scope shape the way potential issues are framed and limit the insights that will be gathered?
- Are any potentially relevant insights at risk of being excluded?
- Are there other ways of framing the question to keep the evidence gathering more open (e.g., setting a discussion topic rather than a specific question)?
- Consider undertaking a short literature review to demonstrate the gaps you have identified as the research questions and sharing these resources during the consultation (i.e. to show that your research question is backed up by evidence).

2. Selection and assessment of stakeholders

2.1 Draw up a list of stakeholder groups that you and your colleagues think should be involved (e.g., academics, NGOs, industry representatives).

2.2 For each stakeholder group you list, identify *more than one* named individual. Ask your colleagues to individually suggest names to identify a greater diversity of people who hold similar expertise.

Considerations for expert selection:

- Has stakeholder engagement previously been undertaken on this topic/area and, if so, are there existing stakeholder relationships to build on? Where stakeholders have already been consulted, might inviting other individuals with comparable expertise offer fresh insights?
- Do the stakeholders have peer recognition and established expertise?
- Does the stakeholder expertise represent a thorough coverage of the area under investigation?
    - Map out the areas of expertise represented by the named individuals to identify potential gaps. For example, are technical, environmental, economic, socio/cultural, institutional, and geographical expertise covered?
    - Identify experts who work at boundary areas and in multidisciplinary research.
- Are certain types of insights (e.g., cultural) and/or evidence types (especially qualitative) at risk of being excluded or underrepresented? Will it be possible for these types of insights/evidence to be included in the policy output?
- Will your group be able to provide sufficient challenge or is there a risk of "group think"?
- Is there diversity of perspectives, knowledge and/or knowledge systems?
- Equality, diversity, and inclusion factors. What steps can be taken to utilise the talents and resources offered by underrepresented groups (e.g., early career researchers, women, people of different ethnicities)?
- Are you aware of stakeholder motivations and current views about the topic/area on which you are consulting?
- Consider how well stakeholders may work together on the panel. Is there a risk of imbalances in power, lobbying interests, issues with interpersonal dynamics, or of an inability to reach consensus/produce the required output? Can any of these be pre-emptively addressed?

3 Method of engagement

3.1 Decide on which format is appropriate (e.g., advisory committee, workshop, round table discussion).

3.2 Decide if meetings will be in-person, online, or a mixture to limit biases (e.g., London centric, larger organisations may be able to afford to send dedicated staff while smaller organisations, part-time employees or those with caring responsibility may find travel a barrier to participation).

3.3 Inform stakeholders what their involvement will require in terms of resource and time commitment (meeting type, duration, frequency, project timeline) as well as risk and public perceptions.

Other considerations:

- Is there a way to capture insights for future use or reference that are beyond the remit of the current panel?
- Is there time for insights (e.g., from qualitative evidence) to be included (e.g., translated into usable formats)?
- Will the time frames on which different stakeholder groups operate (e.g., large corporations, NGOs, academics) impact their ability to participate?
- Do methods with anonymous responses need to be considered to bolster engagement for fractious areas?

4. Meeting Management: ensuring all stakeholders contribute

4.1 Select an appropriate chair with sufficient experience (e.g., area of expertise, neutrality, respect of members).

4.2 What kind of accountability mechanisms might help keep a chair aligned to the objectives?

4.3 Be transparent about the panel aims and likely outcomes from the start.
This will help stakeholders to contribute and know what to expect from participating. While this can be done with a formal Terms of Reference, it could also be managed more informally such as by an open discussion with stakeholders at the start or in the email invitation to participate.

4.4 Be clear on any code(s) of practice, roles, responsibilities, how decisions will be recorded and explained, and how confidentiality and conflicts of interest will be managed. Provide guidance on how the panel process will work including timelines and what will happen to the evidence provided (e.g., in terms of outputs including expectations around format, length, quality, opportunities for comments, review procedures, and etc).

4.5 Secure any other support needed, such as administrators, technical support, facilitators to enable breakout groups or manage online chat discussions.

4.6 Are any additional measures needed to ensure that all panel members can fully contribute? E.g., feeling comfortable to participate and feeling heard. Are there plans for managing issues such as vested interests, lobbying, unequal power dynamics?

5. Outputs: synthesising insights
5.1 Is there a way to capture, record or acknowledge insights which cannot feed in directly, or where the proxy does not capture the insight sufficiently (e.g., a written example somewhere within the written output to illustrate the nature of the insight)?
5.2 Is there a way to integrate qualitative or social insights within the main report? For example, are these insights included in the conclusions and recommendations? Treating these insights as ancillary such as being presented separately to the other evidence can minimise their value.

Resources:

- https://assets.publishing.service.gov.uk/media/5a7b8ad8ed915d41476210e1/dh_134407.pdf
- https://gcs.civilservice.gov.uk/publications/ensuring-effective-stakeholder-engagement/#Best-practice
- https://assets.publishing.service.gov.uk/media/5a79791eed915d07d35b5cc2/smpg-vol2-appa.pdf
- https://www.ukri.org/councils/epsrc/guidance-for-reviewers/peer-review-panels/panel-guidance-and-protocols/

Interview Schedules

Contributor Interview Schedule (for Stakeholders participating in panels)

The focus of Beyond Cost and Carbon is on **greenhouse gas removal (GGR)** (including both land-based strategies such as afforestation and technological methods including BECCS and DACS). In your responses, we would be particularly interested in any examples relating to GGR and/or to related areas (e.g., bioenergy, agriculture).

To begin with could you tell me …

1. How much experience have you had of acting in advisory roles (e.g., offering expert advice to policy makers)? What was your most recent engagement?
2. How did you end up taking part?
3. Could you briefly give me an example of a panel that felt very worthwhile to you and why? And conversely one that felt less worthwhile and why?
4. If you are invited to multiple advisory roles, how do you decide which to attend?

Thinking back to your work on advisory panel(s) / committee(s) …

5. What advice would you give to someone going to do this kind of engagement for the first time?
6. Thinking about your most recent engagement – how were the sessions run?
7. Just thinking about the timing of the engagement. At what stage was the consultation held?
8. Were there clear goals and objectives?
9. Was there a wide range of expertise?
10. Did some kinds of evidence 'fit' better than others and why (e.g., into the model or framework being used)?
11. Was the process able to adapt to changes?
12. Thinking about your personal experience of the procedure, did you feel valued?
13. On reflection are there any elements of the process that you would like to change?
14. Would you be willing to participate in a panel in the future?
15. Do you have any suggestions for other people who I could approach to interview?

Convenor Interview Schedule (for Policymakers)

The focus of 'Beyond Cost and Carbon' is on greenhouse gas removal (GGR) (including land-based strategies and technological methods). We are also interested in related areas (e.g., bioenergy, net zero more broadly).

The focus of the interviews is **procedural** (e.g., decision-making around the commissioning and convening of expert panels, how evidence is compiled, which practices work well).

Interviews are online and typically last 30-60 minutes but their length can be adjusted to fit your availability.

Interviews are recorded to generate a transcript. The recording will be deleted within 30 days. The transcript will be anonymised and stored at the University of East Anglia's repository and will not be publicly available. You will only be identified by your self-stated **sector** and self-stated **expertise**.

Topics for discussion:

1. How much experience do you have of commissioning or convening things such as: workshops, expert advisory groups, task and finish groups, panels, or similar?
2. Are you aware of any guidance on how to run panels? What guidance would you give someone doing this for the first time?
3. Could you briefly give me an example of a panel that felt very worthwhile to you and why? And conversely one that felt less worthwhile and why?
4. Is any advice given to participants? For example, to those doing this kind of engagement for the first time?
5. Thinking about a panel or similar that you have been involved with - How was it organised?
6. How did participants provide their evidence (e.g., was it by formal presentations)? In giving evidence, did you feel that they had the end-user in mind?
7. Just thinking about the timing of the engagement. At what stage was the consultation held?
8. How were participants selected?
9. How are expectations managed? / Were there clear goals and objectives?
10. Did you find that some kinds of evidence 'fitted' better than others and why (e.g., into the model or framework being used)? What happens to the evidence after the consultation, (i.e., can you help me to understand the process)?
11. Was the process able to adapt to change?
12. On reflection are there any elements of the process that you would like to change?
13. Do you have any suggestions for other people who I could approach to interview about their experiences of commissioning/convening panels or complaining evidence from panels?