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LETTER

# Deliberative polling increases non-expert confidence in assessments about carbon dioxide removal technologies

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## Abstract

Carbon dioxide removal (CDR) plays an important role in climate scenarios, and multiple CDR research and development efforts are ongoing. For instrumental, substantive and normative reasons, the public should be involved in decision-making related to CDR. We simulate a consultation process using online deliberation groups based on random draws from the Norwegian population, bookended by surveys. Using a multi-mode approach, we find that deliberation enhances participants' assessment of land-based bioenergy carbon capture and storage by .29 steps on a 1–4 scale, compared to a control group, while causing no significant changes in the assessments of four other CDR options presented. At the same time, the deliberation treatment reduces the incidence of 'do not know' and 'no opinion' responses by 71% for the main questions about the five technologies. Analysis of deliberation transcripts shows that participants emphasize the effectiveness, feasibility, and potential for unintended consequences of CDR, whereas questions of scale and relations with climate targets receive little attention. We conclude with observations on how deliberative formats may be used and enhanced as a research approach and procedure for involving the public in formulation of net-zero policy.

## 1. Introduction

The 2015 Paris Agreement seeks to limit greenhouse gas (GHG) concentrations in the atmosphere at levels so that average world temperatures this century do not exceed pre-industrial levels by more than 1.5 °C or 2 °C. All emission scenarios that stay within 1.5 °C include a CDR contribution (Keller *et al* 2018, Moustakis *et al* 2025). As a supplement to deep GHG emission reductions, CDR may contribute to global mitigation efforts by lowering net emissions in the short term, counterbalancing emissions from sectors that are difficult to abate, and achieving net negative GHG emissions in the future (Lee *et al* 2023).

Research on various CDR technologies is ongoing (Smith *et al* 2024). Besides technical challenges, CDR faces socio-economic barriers as it is bound to cost money and require public consent both for the expenditure and the building of infrastructure, which will demand areas on land and potentially at sea. As CDR implies costs in the form of direct expenditure, prices, and environmental effects, the public should have the opportunity to engage in decision-making around the methods. Public engagement can have different justifications: instrumental, to ensure the smooth running of a project; substantive, to inform and improve a process, a project or a policy; and normative, where a participatory process is desirable based on democratic principles (Stirling 2008, Baatz *et al* 2025).

Knowledge and awareness of most CDR methods, except afforestation, is very low in the general population (Pidgeon and Spence 2017, Merk *et al* 2019, Jobin and Siegrist 2020, Baum *et al* 2024). Therefore, there are several studies that have analysed the effects of prior awareness and information

on the perception of CDR methods. Earlier studies that examined the effect of self-reported familiarity with CDR on attitudes toward these methods found no effects or mixed results (Pidgeon and Spence 2017, Klaus *et al* 2020, Smith *et al* 2024). Studies that experimentally varied the amount of information and/or deliberation found mixed results. When respondents were informed about both the risks and benefits of large-scale afforestation and carbon capture and storage (CCS), support was lower than in a parallel group where respondents received only general information on the methods (Braun *et al* 2018). Respondents with at least some prior awareness viewed direct air capture with CCS (DACCS) more positively after receiving additional information (Scott-Buechler *et al* 2024). Cox *et al* (2022) found more positive views on enhanced rock weathering after two days of information and group discussions, which they mainly attribute to the resolution of initial uncertainties around the method in the process. By contrast, participants in a citizen jury with three weekends of intensive deliberation did not change their opinions about bioenergy CCS (BECCS), and their attitudes in the post-survey were not different from the reactions toward BECCS in a general population survey (Merk *et al* 2019). These mixed results point toward context dependence of perceptions (Merk *et al* 2023).

Besides the effects on technology perceptions, some studies also assessed people's degree of confidence in or uncertainty about their views on CDR and related approaches. A study on stratospheric aerosol injection found that prior knowledge was negatively correlated with self-assessed uncertainty about the technology. After receiving additional information from a stakeholder, respondents' self-reported level of uncertainty decreased for participants with medium levels of support but not for participants with low or high levels of support (Merk *et al* 2019). This might be explained by respondents choosing medium levels of support when they are uncertain and a 'do not know' (DK) option is unavailable. Scott-Buechler *et al* (2024) also showed a decrease in DK responses after receiving additional information among participants previously aware about the technology. Cox *et al* (2024) however, found that respondents voiced similar uncertainty about ocean alkalinity enhancement (OAE) or DACCS irrespective of whether they had only received basic information or additional information about socio-technical configurations of the methods.

Public perceptions CDR research has so far mostly focused on land-based options, particularly afforestation, BECCS, and soil carbon restoration, and up until very recently there have been no studies on OAE (Bertram and Merk 2020, Smith *et al* 2024) or macroalgae farming (Rischer *et al* forthcoming). In our study, we compare the land-based options BECCS and enhanced weathering (EW), with their marine counterparts, macroalgae farming for BECCS (mBECCS) and OAE, respectively. In addition, we look at macroalgae farming with subsequent sinking of the biomass to the seafloor.

BECCS tends to be viewed more positively compared to other configurations of CCS (Dütschke *et al* 2016, Itaoka 2022). Results on the relative ranking of EW, BECCS, and DACCS are inconclusive; in some studies EW is perceived more positively (Jobin and Siegrist 2020), in others more negatively (Carlisle *et al* 2020, Cox *et al* 2020, Baum *et al* 2024) compared to BECCS or DACCS. For EW, people worry about tampering with nature or negative side-effects on marine organisms (Cox *et al* 2020, Jobin and Siegrist 2020, Spence *et al* 2021). Concerns about BECCS relate to the safety of underground storage (Cox *et al* 2020) and the availability of land (Bellamy *et al* 2019, Low *et al* 2024). People also tend to favour approaches that are seen as more natural over engineering-based solutions (Bertram and Merk 2020).

OAE is mostly perceived negatively. It raises associations with marine pollution (Veland and Merk 2021). It evokes more negative emotions and associations compared to other methods such as DACCS, coastal restoration, or mBECCS, raising concerns about environmental impacts and controllability (Nawaz *et al* 2023, Cox *et al* 2024). In case studies (Hilser *et al* 2024, Nawaz and Belotti 2025, O'Sullivan *et al* 2025), local participants did not outright reject the deployment of OAE but their support depended on transparency, public involvement, and the distribution of benefits and burdens. The only study on macroalgae farming for CDR found that perceptions strongly depend on the storage component. Sinking macroalgae to the seafloor for storage is perceived more negatively compared to using it for BECCS (Merk *et al* 2023).

Overall, the literature on public perceptions of CDR shows relatively low levels of familiarity with the various technology options. Most studies focus on terrestrial and few on marine approaches. Levels of confidence in assessments are also rarely studied. While some studies use information treatments, the effects of such treatments are not consistent across studies.

To address these gaps in the literature, we ask the following research questions:

1. Does deliberation change people's opinion about CDR and climate change (CC) mitigation more generally?
2. Does deliberation influence people's level of confidence in their assessments of CDR?

## 2. Material and methods

To answer our research questions, we conducted a deliberation experiment with parallel online events

for one treatment and one control group, using the Stanford online deliberative platform, which facilitates audio and video conversations as well as pre-recorded automated prompts (Fishkin *et al* 2019). Similar surveys were administered before and after deliberation. In addition to analysing the survey results, we examined what topics were emphasised in discussions about different marine CDR options among non-experts by means of qualitative analysis of deliberation transcripts.

### 2.1. Deliberative poll

A deliberative poll is a method of measuring public opinion that combines elements of traditional surveys with deliberative processes (Fishkin *et al* 2000). Deliberation may be defined as 'mutual communication that involves weighing and reflecting on preferences, values, and interests regarding matters of common concern' (Bächtiger *et al* 2018, 2). A pre- and post-survey is used to measure the effect of a treatment that typically consists of providing participants with detailed information, allowing time for discussion with peers and posing questions to experts on the matter. This design has the potential to capture more informed and thoughtful opinions than traditional surveys. It can also provide more knowledge and generate more engagement.

The method is well-suited for exploring public opinion on technical and complex issues such as CDR. The deliberative survey we conducted encompassed the evaluation and discussion of CDR approaches in the following order:

- Terrestrial bioenergy with CCS (BECCS), which involves using biomass farmed on land.
- Marine BECCS (mBECCS), which involves using biomass farmed in the ocean.
- Sinking macroalgae in the ocean.
- EW on land.
- OAE, using ground alkaline rock.

The deliberation event took four hours. Approximately half of the total discussion time was allocated to addressing broader questions related to net-zero targets, net-negative emissions, and the responsibility for $CO_2$ removal from the atmosphere. The aim was to help participants engage with the arguments about the desirability of deploying CDR in general and to understand how they perceive CDR within the wider context of climate policy and emissions reduction strategies. More detail on the deliberation is available in the supplementary information (SI). The schedule for the deliberative event is shown in text box S-1.

We employed a design with random assignment to a treatment or a control group. The control group discussed another matter, specifically artificial intelligence in decision-making (Arnesen *et al* 2025). The participants were recruited using a random sample of 24 000 individuals from the Norwegian population registry, of whom 6574 were reached by phone, 463 agreed to participate and 206 ended up completing the deliberative events including the surveys before and after. Each individual took part in one out of two events: one held in June and one in September 2022. Respondents were more likely to be highly educated and to be younger, compared to the overall population, whereas no significant differences were seen in gender, income or immigrant background.

In the pre- and post-surveys, each of the five CDR technologies was first introduced by a text of between one and three paragraphs describing the technology. The presentation was designed to approximate a conversational style and introduce the more familiar options first, starting with land-based BECCS and moving on to ocean-based and non-BECCS approaches, and with later descriptions referring to previous ones. Then respondent views were recorded using a question of the following form: 'To what extent are you positive or negative to bioenergy with CCS to remove $CO_2$ from the air, when the plants used are grown on land?'. Responses were recorded on a four-point scale from 'Very negative' (1) to 'Very positive' (4) with the additional options 'do not know' (DK) and 'no opinion' (NO). The DK/NO options allow us to measure changes in respondent confidence before and after deliberation. An additional 25 questions related to beliefs and concerns about CDR methods, as well as attitudes toward nature, tampering with nature (Raimi *et al* 2020), CC, and climate policy, were also asked in the surveys. See SI for the full text of all items.

### 2.2. Methods

The experimental treatment in the quantitative survey on individuals' placement on four-point scales was analysed using linear regression over pre/post survey, treatment/control group and the interaction term between pre/post and group following the difference-in-difference approach. We calculated average treatment effects on the treated (ATT) to identify any changes in each methods' evaluation before and after comparing treatment and control group. Using Stata version 18.5, cluster-robust standard errors were estimated using the *vce cluster* option on the individual respondent identifier.

To analyse variation in the prevalence of DK/NO responses to the questions about the five technologies, we generated a count variable for the number of DK/NO responses per respondent, ranging from zero to five and with a mode of zero. Two similar count variables were calculated, one for the 16 further CDR-specific questions and one for the nine general CC questions. ATT was calculated using Poisson regression.

In the text analysis, we initially focused on distinguishing between arguments aligned with the briefing materials, broader arguments related to multiple themes, and novel arguments. This task was led by one team member and resulted in a detailed classification comprising 112 codes that captured the nuances of the arguments used in the discussion groups. This classification was then discussed within the research group and used to develop the 11 categories employed in the quantitative content analysis, see table 1. The recoding into these 11 categories was carried out through an iterative process. First, two researchers independently coded 200 statements (17%, of all statements), achieving an intercoder reliability of 82.5%. We then utilised this outcome to identify discrepancies in the application of categories and to refine the coding scheme. A third researcher subsequently applied the improved coding scheme to recode all statements. The results were discussed within the research team until consensus on the coding was reached.

## 3. Results

### 3.1. Public perceptions of CDR

Figure 1 shows the evaluation of the five CDR methods in the pre-deliberation survey on a 1–4 scale. The average evaluations of the five technologies are relatively even, with EW (mean = 2.79) and macroalgae sinking (mean = 2.76) seen slightly more positively and OAE somewhat more negatively (mean = 2.52) than the two BECCS methods.

The two BECCS options are the ones about which most had an opinion, with 41 and 45 responding DK/NO on the terrestrial and marine options, respectively, in the pre-survey. Conversely, the greatest number of DK/NO responses—103—was seen for sinking macroalgae. The number of DK/NO responses is significantly lower for mBECCS than for OAE (45 vs 84, chi-squared = 14, $p$-value = 0.0002).

### 3.2. Effects of deliberation

Figure 2 displays the ATT for the five CDR technologies. For BECCS using land-based biomass, deliberating CDR led to a positive change of evaluation by .29 steps on average relative to the control group. This effect corresponds to .3 of a standard deviation and is significant at the p = .067 level. We find no statistically significant differences (p < .1 level) between the treatment and control groups for the other four technologies.

While directional shifts in opinion are limited, we find that participation in the deliberative event increased respondents' confidence in their opinions about the five technologies. Specifically, figure 3 displays how the overall number of DK/NO responses falls significantly after deliberation for the treatment group. The effect is somewhat stronger for the sum of the five CDR technology options, where the treatment effect corresponds to a reduction of 71% (CI: 37%–87%). Examining the individual technologies, the experimental effect is particularly strong for EW (treatment group: from 14 to 1 DK/NO; control group: from 19 to 16 DK/NO, chi-squared = 5.5, simulated $p$-value = 0.019) and OAE (treatment group: from 12 to 0 DK/NO; control group: from 25 to 14 DK/NO, chi-squared = 5.7, simulated $p$-value = 0.020).

### 3.3. Frequently discussed topics

Table 1 shows the results of the quantitative content analysis of the transcripts of the deliberation. The three most frequently discussed topics are *Efficiency/effectiveness/economy* (21%), *Norwegian conditions* (18%) and *Uncertainty/Risks* (16%).

The statements coded as belonging to the ***Efficiency/effectiveness/economy*** topic discussed the costs and benefits of the various policy options, including effects on the economy, jobs, and alternative uses for money and energy. Norway's responsibility as a rich country was brought up as an argument in favour of CDR development. Mentions of constraints on resources, such as arable land for biofuels, also belong to this topic. An example of a statement is 'What is nice about this proposal is that it can give additional income, because here you actually get something back from the investment you make, it is not just money out the window' (man, 60–69 years old, higher education). Another example is 'I see that one of these [arguments] 'against' … that it will demand building a costly infrastructure for transportation and storage' (man, secondary education, age not provided).

Statements in the category ***Norwegian conditions*** discussed whether Norway has the prerequisites to host CDR projects in a useful way. Space was mentioned as one auspicious condition: 'Norway happens to be a fairly large and unpopulated country. We have space to do quite a lot more if you just bother to use the space' (man, 20–30 years, higher education). Funds and experience were also mentioned by several participants, for example 'We clearly have an opportunity here, both when it comes to an oil industry that's on its way out, and, yes, we can contribute as a rich country' (man, 40–50 years, higher education). Conversely, statements raising concern about suboptimal conditions, for example as regards agricultural land, are also found.

The third category, ***Uncertainty and risk***, organises statements pointing out concerns about the predictability and control over CDR processes, especially at sea. For example: 'I think it seems like we have more control over what is on land, and that at sea it gets very uncertain, and many unknown factors that may, well, make it fail' (woman, 50–60 years, vocational

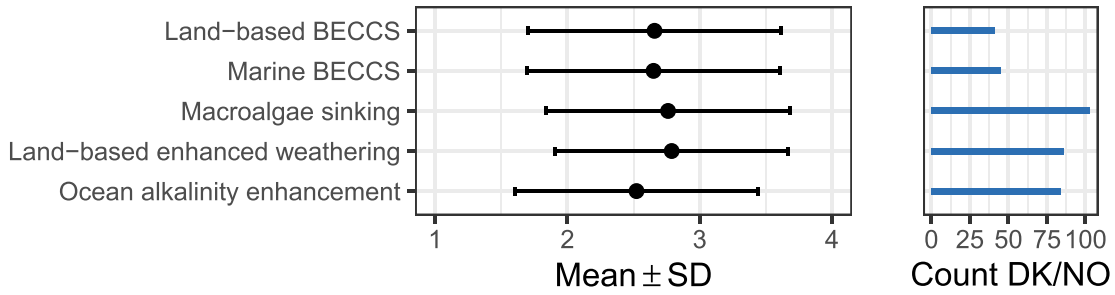


**Figure 1.** Respondents'views on the five CDR approaches before deliberation: averages and standard deviations (left-hand panel) and number of do not know/no opinion (right-hand panel). Both treatment and control groups are included. $N = 698$ including do not know/no opinion; 389–451 without.

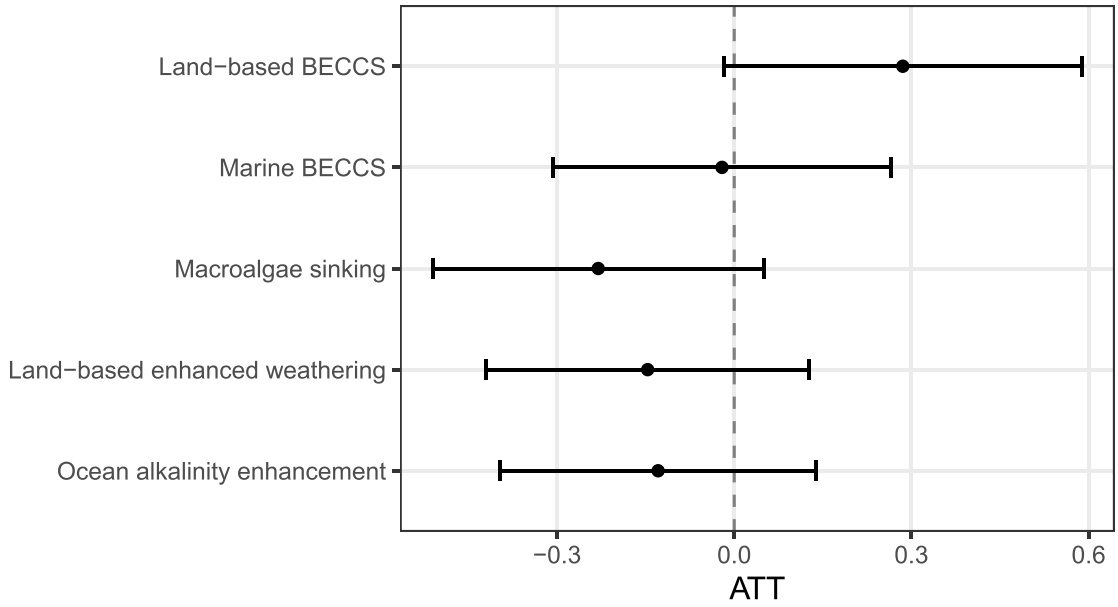


**Figure 2.** Estimated average treatment effect on the treated (ATT) for five CDR technologies evaluated on a four-point scale, using linear regression models, with 95% confidence intervals. For regression models including additional model specifications, see table S-4.

schooling). Several participants also voiced scepticism of large-scale and invasive projects, preferring smaller projects: 'But this is perhaps where I think that one should prioritize the things that are both inexpensive and ecologically safe. Not do big interventions that have big consequences' (woman, 40–50 years, higher education). While BECCS garnered some support in several answers, partly due to its relative maturity, there were also worries about it: 'I agree that we can use the biomass that is left over from existing processes, but … [am] very sceptical toward replacing a natural flora with something we do not know the consequences of' (woman, 40–50 years, higher education).

Other frequently discussed topics include the need for more research on CDR, the need for climate action in general, and Norway's responsibility for climate action as a rich country producing oil and gas. Worries that CDR could crowd out efforts to reduce emissions (moral hazard), and scepticism toward tampering with nature, were also brought up.

We note that very few participants mentioned the need to remove $CO_2$ from the atmosphere to reach the Paris temperature goals. Furthermore, the concept of negative emissions appeared difficult for participants to engage with, not least as regards the scale of the interventions needed and the required infrastructure.

Participants also showed a tendency to prefer what they saw as 'natural' options rather than 'technical' ones, even though this could mean very low $CO_2$ uptake. In general, the options' removal potential—small or large—seems to matter little in the discussions.

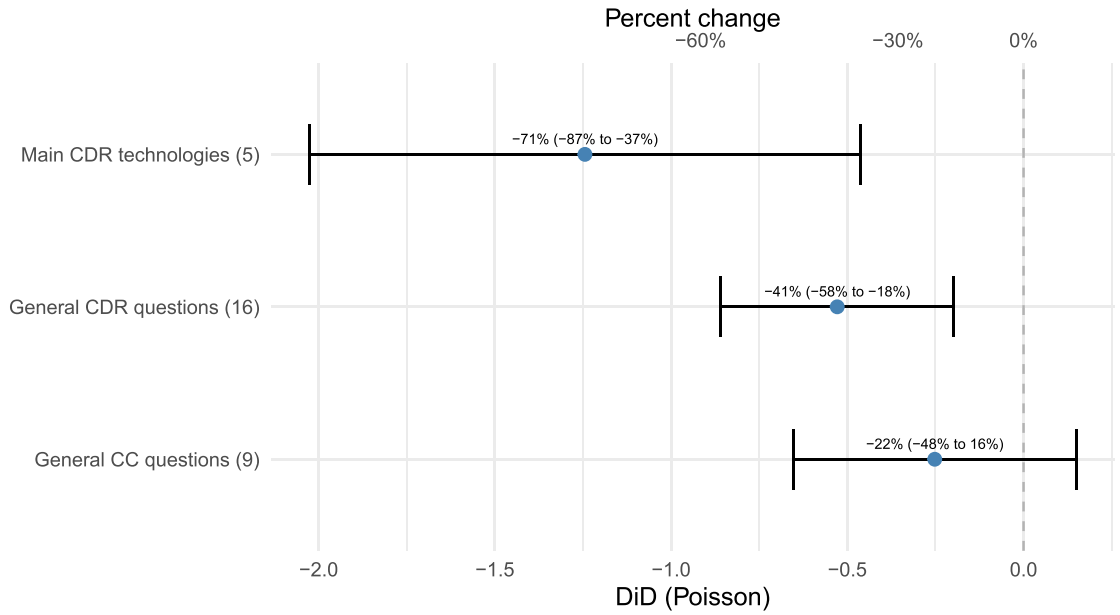


**Figure 3.** Experimental effect on the summed number of do not know/no opinion (DK/NO) responses to three sets of questions about CDR and climate change (CC). The primary axis (bottom) shows the Poisson regression coefficient on the experimental treatment variable. For interpretation purposes, the secondary axis (top) displays the corresponding percentage change for the estimates. For regression models including additional model specifications, see table S-5.

**Table 1.** Most frequently discussed topics in the deliberations. Each statement may be classified into multiple topics. $N = 1{,}199$.

| Topic | Topic description | Freq. | Share |
|---|---|---|---|
| Efficiency/effectiveness/economy | Arguments related to economic consequences of CDR use, including job creation, need for investments, costs. The topic also covers the efficiency of methods. | 253 | 21% |
| Norwegian conditions | Arguments related to Norway having or not having favourable conditions to deploy a specific method or CDR in general. | 213 | 18% |
| Uncertainty/risks | Arguments that underline the uncertainties or risks related to CDR or lack knowledge of a specific approach. | 190 | 16% |
| Research and development | Arguments for more research on the methods, or in favour of deploying at small scale so that we can develop along the way. | 147 | 12% |
| General climate action | Arguments related to general climate change. Also includes statements on whether climate change is human-made or not. | 120 | 10% |
| Norway—responsibility | Arguments that CDR is the responsible thing to do/not to do. The topic includes arguments of the type 'Norway has a special responsibility' and more general 'we should do it' arguments. | 120 | 10% |
| Moral hazard | Arguments related to the potential risk of CDR reducing motivation to reduce emissions. | 63 | 5% |
| Tampering with nature | Arguments against CDR because it means tampering with nature or natural processes. The topic also includes arguments for restrictions on deployment to reduce interference with natural processes. | 60 | 5% |
| CDR benefits | Arguments that highlight the potential benefits or co-benefits of deploying a method, or more generally of using CDR. | 55 | 5% |
| Portfolio | Arguments for combining several methods, instead of just using one. | 31 | 3% |
| No opinion | Participants saying that they do not have an opinion on an issue, frequently because they need more information. | 64 | 5% |

## 4. Discussion

Our results show that deliberative polling, besides having a slightly positive effect for land-based BECCS, did not substantially change attitudes toward CDR. By contrast, we find that deliberation significantly increased participants' confidence in their opinions about CDR. Methods with deployment and storage in the water or on the ocean floor, i.e. OAE and sinking biomass, were perceived more negatively compared to EW on land or options with geological storage. Participants' discussions focussed on matters of feasibility, indicating that they found it more difficult or less interesting to engage on broader matters of net-zero policy, while broadly favouring emissions reductions over removals.

Our study advances scientific knowledge in four key areas: deeper understanding of the effects of information and deliberation in an experimental setting; explicit analysis of DK/NO answers; public opinion on CDR methods for which few studies exist, notably comparing marine and terrestrial options; and insights into what citizens emphasise when discussing emerging climate technology in the broader context of net-zero climate policy.

First, as regards information effects, our study shows that even in a comprehensive discussion about climate policy, views on CDR do not change substantially compared to their initial assessment. This result implies that engagement or more information does not necessarily change perceptions, echoing some previous findings (Merk *et al* 2019) but contradicting a larger body of studies that have found changes in perceptions (Braun *et al* 2018, Scott-Buechler *et al* 2024).

Second, we explicitly analyse patterns of DK/NO responses, which is important in the study of emerging technologies where public opinion is often 'complex, dynamic, and potentially un-formed' (Stoneman *et al* 2013, 851). We expand on previous results on how information treatments enhance confidence (Merk *et al* 2019, Scott-Buechler *et al* 2024). Our experimental design pinpoints the effect of deliberation and information on participant confidence in various technologies. The clear increase in respondent confidence suggests that the information and deliberation exercise helps participants form their own views, resolve uncertainties and potentially also buffer against misinformation or attempts to influence opinions.

Third, our study is the first to examine public perceptions of macroalgae sinking and macroalgae farming with BECCS, and we specifically enable the comparison between ocean- and land-based counterparts. While evaluations of BECCS with marine or terrestrial biomass were similar, possibly due to their similarity with respect to the geological storage and the co-benefit of energy generation, sinking biomass and OAE were perceived more negatively. This pattern may reflect the Norwegian context, where strong cultural and economic ties to the sea and fisheries make the population more sceptical and sensitive to interventions that have the potential to directly alter marine ecosystems. It also appears in the discussions, where marine options are seen as less controllable. As regards DK/NO answers in the initial survey, confidence in answers about BECCS (terrestrial and marine) was the greatest, whereas macroalgae sinking had the highest share of undecided respondents. The deliberation treatment increased respondent confidence markedly, notably for EW and OAE. These results may be explained by greater initial knowledge of the principles behind BECCS in Norway (Merk *et al* 2022) and less familiarity with the type of interventions exemplified by EW and OAE.

Finally, our qualitative analysis of discussion transcripts shows that participants engage with the practical questions surrounding CDR, bringing up topics such as feasibility, efficiency, and suitability of land and sea areas for the proposed projects. They also discuss broader issues related to the desirability of CDR (Baatz *et al* 2025) like tampering with nature, immature technology, and to some extent the risks of moral hazard. However, the practical aspects of feasibility dominate over discussions about whether the deployment of CDR methods is desirable in the first place.

The preference for 'natural' solutions echoes earlier findings in the literature (Bertram and Merk 2020, Nawaz *et al* 2023). At the same time, general openness toward CDR does not remove scepticism about specific features of described technologies. Risks and near-term adverse effects are problematised in the discussions, whereas the long-term need for $CO_2$ uptake and storage receives less attention. This suggests that public resistance to specific CDR projects can be expected even from a public without *a priori* strong feelings for or against CDR in general. It also illustrates the challenges of communicating the importance of action in the present to keep long-term targets within reach.

Our conclusions have some constraints. The automated facilitation in the group discussions equalizes facilitation effects across groups, which has been shown to promote equal participation and the consideration of opposing arguments (Gelauff *et al* 2023). At the same time, given the novelty of the topic, meeting in person might have helped to resolve more of the uncertainties that still featured prominently in the discussions, made the presentation of the CDR methods more vivid, and thus potentially changed perceptions (Cox *et al* 2022, p 13). In general, study participants have been found to have a harder time grasping chemical or geological storage approaches, like EW or DACCS, compared to biological sequestration methods (Cox *et al* 2020, Low *et al* 2024). Thus, splitting up the session into shorter units with time to digest in-between might have yielded results more in line with previous studies (Cox *et al* 2022). Furthermore, the fixed order in which the technologies were presented means that question-order effects cannot be ruled out.

Recruitment took the form of a random draw from the Norwegian population registry, which is a strength, but the response rate was very low, which points to an overall modest interest in participating in engagement activities. However, Arnesen and Skiple (2025) found that despite the low response rate the recruitment for our study yielded a good representation of younger cohorts and immigrants, groups that are often underrepresented. Unevenness in distributions on socio-demographic variables may also be reduced in future studies with a higher number of participants, although skewed distributions constitute a less acute problem in panel studies such as

the present one unless one assumes substantial heterogeneous effects for different population segments.

It is also possible that a study with a larger sample could produce stronger statistical effects, notably in the case of macroalgae sinking, where a negative but not significant deliberation effect was found. Increasing the monetary incentives (Arnesen and Skiple 2025), reducing the length of the deliberative session, or tailoring the content even more strongly to the invitees' contexts (Cox *et al* 2022, Fritz *et al* 2024) may address these problems, but may also introduce additional bias related to participant motivations. As for the country case, Norway represents a distinctive context for examining public views on CDR due to its dominant oil and gas sector and comparatively high public trust in technology and industry (Fritz *et al* 2024). These factors may shape how citizens assess the risks and acceptability of CDR, and findings may differ in countries with other economic structures, climate experiences, or levels of institutional trust.

Satterfield *et al* (2023) see deliberative polling as an engagement method at a late stage of development, however, our findings suggest that deliberative polls may function as a useful consultation exercise to 'open up' discussion about complex climate technologies (Stirling 2008). Deliberative polling is not aimed at generating consensus (Fishkin *et al* 2000) and can also be used to reach broader publics at earlier stages of public discourses. The highly structured and comprehensive setup quickly brings participants up to speed on the main arguments from expert discourses and offers contrasting perspectives of a broader public. Future research should build on this experimental design on additional samples, including physical meetings, and on related themes in climate technology and beyond to further explore the effects of deliberation.

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## Data availability statement

The pre- and post-survey data are attached alongside the submission. The deliberation transcripts can be shared on request.

Supplementary information available at https://doi.org/10.1088/1748-9326/ae61cf/data1.

Briefing material (English) available at https://doi.org/10.1088/1748-9326/ae61cf/data2.

Pre-survey (Norwegian) available at https://doi.org/10.1088/1748-9326/ae61cf/data3.

Post-survey (Norwegian) available at https://doi.org/10.1088/1748-9326/ae61cf/data4.

Survey items (English) available at https://doi.org/10.1088/1748-9326/ae61cf/data5.

Briefing material (Norwegian) available at https://doi.org/10.1088/1748-9326/ae61cf/data6.

CDR survey data available at https://doi.org/10.1088/1748-9326/ae61cf/data7.

Missingness analysis syntax available at https://doi.org/10.1088/1748-9326/ae61cf/data8.

Experimental analysis syntax available at https://doi.org/10.1088/1748-9326/ae61cf/data9.

Figure 1 syntax available at https://doi.org/10.1088/1748-9326/ae61cf/data10.

Figure 2 syntax available at https://doi.org/10.1088/1748-9326/ae61cf/data11.

Figure 3 syntax available at https://doi.org/10.1088/1748-9326/ae61cf/data12.

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## Conflict of interest

The authors report no conflicts of interest.

## Ethics statement

Data were collected from participants using informed consent. The data management plan was approved by the Norwegian Centre for Research Data (NSD—Norsk senter for forskningsdata) and deemed to comply with Norwegian data protection regulations based on data protection impact assessment (DPIA) No. 139156.

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