



Short communication

What a waste! Assessing public perceptions of Carbon Dioxide Utilisation technology



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ABSTRACT

Carbon Dioxide Utilisation (CDU) technologies hold promise by helping to limit atmospheric releases of CO₂ while simultaneously generating saleable products; however, to date there has been very little systematic research into public perceptions of the technology.

This short communication reports briefly upon the results of a small pilot study designed to (a) test a methodology for investigating public perceptions of CDU; and (b) elucidate new understanding of people's attitudes towards the technology.

The results indicate that while people believe that CDU will have economic benefits (e.g., creating employment opportunities and saleable products) there is scepticism over the perceived long-term environmental benefits of the technology (e.g., in mitigating climate change).

The findings of this research have important implications for the framing of communications about CDU technology within the public sphere.

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1. Introduction

Carbon Dioxide Utilisation (CDU) technologies hold promise by helping to limit atmospheric releases of CO₂ while simultaneously generating saleable products [1]. However, while there is growing investment in the research and development required to test the technical and economic viability of CDU [e.g., 2,3], to date there has been very little systematic research into public perceptions of the technology.

The importance of gauging public opinion should not be underestimated. Numerous analogues exist to illustrate where a failure to properly assess the acceptability of new technologies and then appropriately engage with the general public and/or anticipated 'host' communities, can negatively affect the ease, speed or chance of real-world, commercial-scale deployment. Examples include GM food [4], and renewable energy [5]. Recently, these public failures have prompted shifts towards more participatory and 'upstream' forms of public engagement around the introduction of new technologies, for example in nanotechnology [6], which seek to engage the public at a much earlier stage [7,8]. With this in mind we firmly believe that research and

development of CDU would benefit from systematic research into public perceptions and acceptance of the technology.

2. The current research

In view of the present lack of research into public opinion of CDU, as part of the new UK Centre for Carbon Dioxide Utilisation (CDUUK) and through the CO₂Chem network (<http://co2chem-co.uk/>) we are conducting a series of studies aimed at learning more about the perceived benefits, risks, utility and relevance of CDU among members of the UK public. This communication will report briefly upon the results of a small pilot study, conducted on 16 participants (10 male, 6 female; 19–54 years) recruited from a University of Sheffield volunteers list, designed to: (a) design and test a methodology for investigating public perceptions of CDU; and (b) elucidate *new understanding* of people's attitudes towards the technology. We hope that, as with ongoing research into CCS communication [9–12], the understanding yielded by our research can be used to aid the development of better means of engaging and communicating with members of the general *publics* about CDU.¹

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¹ The term *publics* is used deliberately so as to recognise the inherent diversity that exists within society; diversity that might co-determine interest, understanding, involvement and opinion of technological innovation, including Carbon Capture Storage and Use technologies.

3. Method

As a new, unfamiliar family of technologies, CDU presents a challenging context for attitude research. Cognate research into CCS has indicated, for example, that unfamiliarity and low-levels of awareness can leave people prone to registering 'pseudo-opinions' [13,14]; 'uninformed' opinions that are problematic as they can be weak, changeable, and non-directive of people's later thoughts and behaviour. As such, these opinions are not ideal for making policy, investment or facility siting decisions.

In our current programme of studies we are using a mixed methods approach, which combines qualitative focus groups and a follow-up information choice questionnaire (ICQ) to assess opinion as described below. Both these techniques have been utilised successfully in studies assessing public opinion of cognate technologies, such as CCS, and offer good forums for the provision and deliberation of information about unfamiliar and/or contentious topics and thus have been associated with the registering more 'informed' opinions [11,14].

For general guidance on the application of social science methods to real world research settings, see, for example, Robson [15] and Bickman and Rog [16].

3.1. Focus groups

The aim of the focus group element of the research was to inform participants about CDU and to promote general discussion of the technology. After completing a short questionnaire designed to record basic demographics and initial awareness about CDU, participants received a short verbal introduction to the technology and watched a short video illustrating the purpose and process of CDU.² Using the video a stimulus, participants were then guided through a discussion of CDU technology for approximately 45–60 min and were invited to comment on their general perceptions of the technology, perceived risks and benefits, and the utility of CDU in tackling climate change relative to other options.

3.2. Information choice questionnaire (ICQ)

All participants then completed an ICQ within which they were invited to compare CCS and five CDU process/product options: cement production, plastics manufacture, transport fuel production, methanol production and enhanced oil recovery based on seven criteria: (1) investment payback time; (2) market potential for the products; (3) carbon reduction or abatement potential; (4) safety; (5) cost benefit to the consumer; (6) date to commercial viability; (7) ability to promote 'business as usual' operations. Table 1 summarises the details of the assessment criteria. Information about each option was provided in a comparative 'top trumps' style format.³ Brief annotations and an illustrative pictorial image were provided alongside a 0–10 expert rating for each criterion.⁴ A depiction of our 'methanol production' CDU 'top trumps' card can be seen in Fig. 1 (see Electronic Supplementary Information for full criterion definitions and averaged expert ratings of the technology options).

Having read about the CDU/CCS technologies, participants were asked to: (1) rank the options in order of preference (most to least

Table 1

Description of the 'top trumps' assessment criteria used to compare different CDU options.

Criteria	Description
Investment payback time	How long it will take the money invested in the storage process or the new technology to be paid back. <i>The lower the rating, the longer it will take and so the less economically efficient it is.</i>
Market potential	Whether the product produced by the captured CO ₂ will have the potential to sell. <i>The higher the rating the more potential it has.</i>
Carbon reduction	Refers to how much carbon is actually being taken out the atmosphere or used to produce another product. <i>The higher the rating, the more carbon that is removed and therefore the more effective it is.</i>
Cost benefit to consumer	Refers to whether the price of capturing the CO ₂ or transforming it into another product will cost the customer through increased energy prices or whether the profits from the end product will offset this cost. <i>A higher rating means that the technology is less likely to make energy prices increase.</i>
Business as usual	Refers to the extent to which the option will enable/disrupt the current ways in which business and society operate; how much 'business' will remain as usual. For example, are we still able to live our day lives and use transport to the same extent. <i>A higher rating suggests business as usual is more achievable.</i>
Commercial availability ^a	Measures, in years, how long it will be before this technology is on the market (i.e., available for commercial use). <i>The greater the number of years the lower the commercial availability.</i>

^a 'Commercial availability' was the only criterion where a higher value equated to a less favourable evaluation.

preferred); (2) rate the extent to which they based their decisions on each assessment criterion; (3) rate how good or bad each option was in the context of reducing CO₂ emissions from industry; and (4) rate the quality of the provided information for bias, trustworthiness, credibility, sufficiency and understandability.

4. Results

The results below detail the headline findings from our pilot research activity. These findings should be considered a prelude to ongoing and more comprehensive work in this area.

4.1. Focus group

Pre-participation awareness of CDU was low with only one respondent registering that they had heard of CDU. All participants indicated that they did not know a lot about the technology. Nine participants had no opinion of CDU, three said they were neutral and four said they were fairly or very positive to the technology.

Content analysis of the written notes and audio-recordings from the focus groups has identified a number of key themes/issues raised by participants, which apparently have implications for how CDU is presented and communicated.

(1) *Delaying the inevitable*: People believe that CDU may only delay the inevitable release of CO₂ to the atmosphere at high cost, both in terms of financial and energy-related costs. There is a feeling that the considerable energy used for CDU could be put to better, and more direct, use elsewhere, for example in providing homes with electricity. This concern is augmented by the belief that the potential carbon savings actualised by investment in CDU will be small, leading people to question the perceived utility, impact and worth of the technology,

² The video and other key materials associated with the research (e.g., 'top trumps' comparison cards) are publically available at: www.co2chem.co.uk/research-clusters/public-perception.

³ 'Top trumps' is a card game where you compare things (e.g., cars or superheroes) on selected criteria (e.g., speed or strength). The higher the score for each criterion the better the thing is. The CDU 'top trumps' were developed in accordance with this concept.

⁴ The information and ratings used to create the 'top trumps' cards were produced and validated by 10 academic experts working in the field of CDU, contacted via the CO₂ Chem Network.

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