



Demonstrating a Refinery-adapted cluster-integrated strategy
to enable full-chain CCUS implementation - REALISE

D4.2 Social Acceptability Framework

Report on development and trialling of EPE Programme

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Executive Summary

This deliverable builds upon work undertaken from D4.1. *Critical review of EPE initiatives* as well as other research projects to develop and trial a framework for developing an Education and Public Engagement programme for carbon capture and storage in the context of the Cork case study area. A methodological approach is detailed for the creation of EPE programmes informed by just transition literature, illustrating a variety of EPE activities that are typically employed as part of consultative, collaborative and co-creative public engagement processes. Examples of good EPE practice of Irish organisations are explored. Informed by this review a framework for EPE was developed for the Cork case study area – including the creation and curation of content meeting the needs of the target audience. Key elements of this framework were trialled in local communities to evaluate its effectiveness, identify areas of potential improvement and ascertain its transferability. Finally, to aid in the measurement of such a programme’s success, key performance indicators (KPIs) are presented for each of the three dimensions of justice – distributive, procedural, and recognition justice.



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Glossary

CCS	Carbon capture and storage
CCUS	Carbon capture, use, and storage
CO ₂	Carbon dioxide
EIA	Environmental impact assessment
EPE	Education and public engagement
GDPR	General data protection regulation
NGO	Non-governmental organisation
SA	Social assessment
WP	Work package



1 Introduction

1.1 Background

REALISE is an EU Horizon 2020 funded innovation project, which aims to develop and demonstrate an integrated strategy for carbon capture, (use) and storage (CCS/CCUS) for the refining industry. The REALISE project plans to demonstrate a novel multi-absorber concept, which will enable the inclusion of small variable concentration sources. In doing so, it aims to capture up to 90% of CO₂ emissions from operating refineries, at a substantially reduced cost compared to existing capture methods. Cognisant that both technical and social aspects are important to the deployment of CCS (Markusson *et al.* 2012), REALISE not only evaluates the entire CCS chain from emitter to storage, but also considers the societal, socio-political and commercial aspects of novel technology deployment. The work presented in this report is a component of a package of work considering these socially orientated aspects of deploying the developed CCS technology. Specifically, this report focuses on the design and initial trialling of an Education and Public Engagement (EPE) programme in the context of the Cork case study, which will aim at contributing to the greater social acceptability of CCS.

Carbon capture and storage (CCS) involves a set of existing and emerging technologies for capture, transport, and storage of carbon dioxide (CO₂) that together can be used to reduce the greenhouse gas emissions from fossil fuel power generation and other industrial sources. Achieving cuts in energy-related CO₂ emissions is critical to avoiding more than a 1.5 degree Celsius (°C) rise in global temperatures by 2050 and the irreversible and damaging impacts such a temperature rise would have on people and ecosystems (Pörtner *et al.*, 2022). The scale of the climate change challenge requires a portfolio of clean energy technologies and energy efficiency efforts, and most credible analyses project that CCS will have to play a substantial role in achieving the necessary emissions reductions. In Europe, CCS/CCUS has been identified as a key technology breakthrough in the move towards a circular economy, as such it is designated as a priority area for the development of commercial applications under the European Green Deal (European Commission 2019). Praetorius and Schumacher (2009) conclude that CCS offers a cost-effective measure to reduce CO₂, which (given a supportive regulatory framework) should be included in a portfolio of measures¹ of a greenhouse gas mitigation strategy.

CCS has been tested scale, and there are a few industrial operations around the world, including in North America and Europe, which already captured store small quantities of CO₂ emissions underground. However, the technology has not yet been demonstrated at the scale required for application to commercial power and industrial plants. Commercial-scale CCS demonstration projects are required to demonstrate whether or not the technology should play a major role in bridging today's fossil fuel-driven world and tomorrow's low- or zero-carbon economy.

¹ Along with energy efficiency and certain other complementary mitigation measures.



Yet, as with the introduction of many new technologies, proposed CCS projects have been met with mixed reactions from the public, and in particular from the local communities asked to host them. For instance, significant public opposition to the Barendrecht CCS project², near Rotterdam led to the project being cancelled (Limousin 2010). In part, this outcome has been seen as a ‘public engagement failure’ (Brunsting, De Best-Waldhober, and Terwel 2013; Terwel *et al.* 2011), which others are keen to avoid. At the same time, good instances of education and public engagement have led to successful projects, like that of the Otway project in Australia and Ketzin project in Germany (Mabon *et al.* 2013). Thus, it is increasingly acknowledged that social acceptance will play a crucial role in the development and realisation of CCS projects (van Alphen *et al.* 2007; Ashworth *et al.* 2009; Dowd *et al.* 2014; Kraeusel and Möst 2012).

1.2 Context

While once considered a wholly techno-economic domain, energy systems may be better understood as a socio-technical system, which ‘*are both socially constructed and society shaping*’ (Hughes, 1987). As Rip and Kemp (1998) observe, social processes may shape technology development, just as technological artifacts can influence changes in social and cultural practices. In this light, the energy socio-technical system can be conceptualised as a configuration of interconnecting technological and social elements including institutions, regulations, social practices, cultural values, beliefs and expectations (Einsiedel *et al.* 2013). This deliverable was produced as part of work package 4 of the REALISE project, specifically in line with Task 4.1 ‘*Education and public engagement best practice*’. REALISE WP4 seeks to develop an in-depth understanding of the societal, socio-political, and commercial context of CCS deployment.

Whilst the primary focus of the planning and implementation phases of a CCS project might be on the technical and geological aspects, understanding the social characteristics of a potential host site and developing an appropriate education and public engagement (EPE) strategy can be an important factor influencing its successful rollout (Ashworth *et al.* 2009; Breukers *et al.* 2008; Reiner *et al.* 2006). Understanding this importance, an earlier report from this WP³ provided a comprehensive review of EPE around large infrastructure projects. This was a preparatory task that directly informed the development of the EPE engagement programme outlined in this task (T4.2) titled ‘*Social acceptability, societal impact*’.

This deliverable builds upon work undertaken as part of a number of research projects. Firstly, it is supported by knowledge generated as part of REALISE’s critical review of EPE initiatives³. Similarly, within the context of the SafeWAVE EMFF Project, Smith *et al.* (2021)⁴ suggested a framework for the

² Barendrecht involved the storage of c. 9 million tonnes of CO₂ in a depleted gas field under a residential area.

³ Dunphy, N. P., Lennon, B., Quinlivan, L., Velasco-Herrejón, P., & Curran, R. (2021). *Critical review of EPE initiatives* (D4.1). A research output of the REALISE Horizon 2020 Project (grant Agreement No 884266). <https://doi.org/10.5281/zenodo.7029984>

⁴ Smith, A. L., Quinlivan, L. & Dunphy, N. P. (2021). Education and Public Engagement Framework for Ocean Literacy (D7.4). A research output of the SafeWAVE Project Co-Funded by the European Maritime and Fisheries Fund (EMFF) Program of the European Union. <https://doi.org/10.13140/RG.2.2.35191.29600>



development and implementation of education and public engagement (EPE) programmes. Both reports furthered the development of SafeWAVE's Deliverable 7.5, *Tailored Ocean Literacy Programmes Focusing on Wave Energy*, which outlined a methodological approach for the creation of EPE programmes centred around wave energy. This deliverable, *Social Acceptability Framework*, outlines an EPE programme designed by UCC in consultation with citizens (supported by Ervia and UEDIN), informed by just transition concepts and leverages the researchers' experiences of EPE across the aforementioned research projects.

The literature review included in this deliverable illustrates a variety of EPE activities that are typically employed as part of consultative, collaborative and co-creative public engagement processes. Education and public engagement processes frequently adopted by organisations in Ireland are explored in some detail, and the REALISE EPE programme is proposed.

1.3 Structure

The body of this document is divided into five main sections.

- The first introductory section presents an overview of the report, details the background to the work, provides context for the task undertaken.
- The second section brief overview of education and public engagement concepts and theories drawing from previous work. It outlines and characterises engagement methods which could be used in a CCS EPE programme.
- The third section comprises the EPE programme. It outlines the need for an education and public engagement for CCS; it explains the approach taken to developing the programme considering socio-demographic specificities of the Cork case study; it presents indicative content to; and details the trialling of key elements of the programme.
- Section four presents Key Performance Indicators for each of the three dimensions of justice: distributive, procedural and recognition justice, along with a fourth dimension restorative justice.
- The final section comprises a conclusion, providing a summary of the key findings.



2 Education and Public Engagement

2.1 Background

There has been some movement from the traditional public engagement approach of ‘decide-announce-defend’⁵ toward one involving ‘consult-consider-modify’ (Halliday 1993). This entails a shift from (exclusively) techno-economic deliberation on issues to a more democratic inclusive form of decision-making – requiring an open-mindedness and an appreciation of different (and perhaps even opposing) perspectives (Wolsink, 2007). It is arguable that this more participative approach is important not just for the implementation of specific projects, but also for improving the image of businesses⁶, wider industry and for increasing public support for technologies (Aitken *et al.*, 2016).

There is a growing expectation of civic participation in decision-making around infrastructure developments. Richardson & Razzaque (2006) suggest the several interrelated factors have contributed to the growth of participation in decision-making, including: increased stature of human rights within legal and political systems; application of participatory mechanisms to address concerns for ‘good governance’; and reduced trust in governments and perceived legitimacy of the state. Increasingly stakeholders impacted by decisions relating to for example infrastructure development expect transparency and accountability relating to such decisions, and demand increased public consultation’ (Dunphy *et al.* 2021, p. 12).

2.2 Education and public engagement

Education and public engagement (EPE) are of increasing significance in the implementation of infrastructure projects, due in a large part to obligations under environmental regulatory and planning systems, but increasingly also to a recognition that public acceptance is a significant potential barrier to realising the scale of infrastructure required to achieve decarbonisation. Preventing or overcoming social opposition to infrastructure developments such as carbon capture and storage requires acceptance by the public generally (of the technology), but also, and more critically, acceptance by prospective host communities (Dunphy *et al.*, 2022).

Effective EPE programmes can contribute to achieving both societal acceptance of the technology and a prospective host community’s acceptance of specific deployments. This requires selecting the appropriate approach to engaging the focal community. Richardson & Razzaque (2006, p. 165) observe that engagement concerned with environmental decision-making can assume a variety of forms including ‘*education, information dissemination, advisory or review boards, public advocacy, public hearings and submissions, and even litigation.*’ The choice of the method(s) used for engagement depends on the specificities of the community and the nature and scale of the proposed deployment.

⁵ Often sardonically renamed as decide-announce-defend-abandon or DADA

⁶ Dunphy *et al.* (2022, p. 2) note that “... experiences with one project (and particularly when negative) will inform responses to subsequent projects associated with similar technologies or promoted by the same companies.”



Fiorino (1990) distinguishes three main rationales for public engagement. The first is normative, it holds that all those with a stake in the decision should be engaged and involved in some way in the decision-making process. The second is substantive, arguing that engaging the public in such processes will provide diverse knowledge and experiences, which will inherently improve decision-making. The third rationale is instrumental, acknowledging that EPE can (and therefore should) be used to achieve a specific goal *e.g.*, meet legal obligations, increase public acceptance, *etc.* (Whitmarsh *et al.*, 2019, p. 2). In the words of Smith *et al.* (2005, p. 220): ‘*under a normative view, participation is just the right thing to do. From an instrumental perspective, it is a better way to achieve particular ends. In substantive terms, it leads to better ends.*’

2.3 Approaches to EPE

In previous work, we described three broad types of public engagement – consultation, collaboration and co-creation illustrated in Figure 1 below (Smith *et al.*, 2021) – that parallel Sherry Arnstein’s famous ladder of participation (1969).

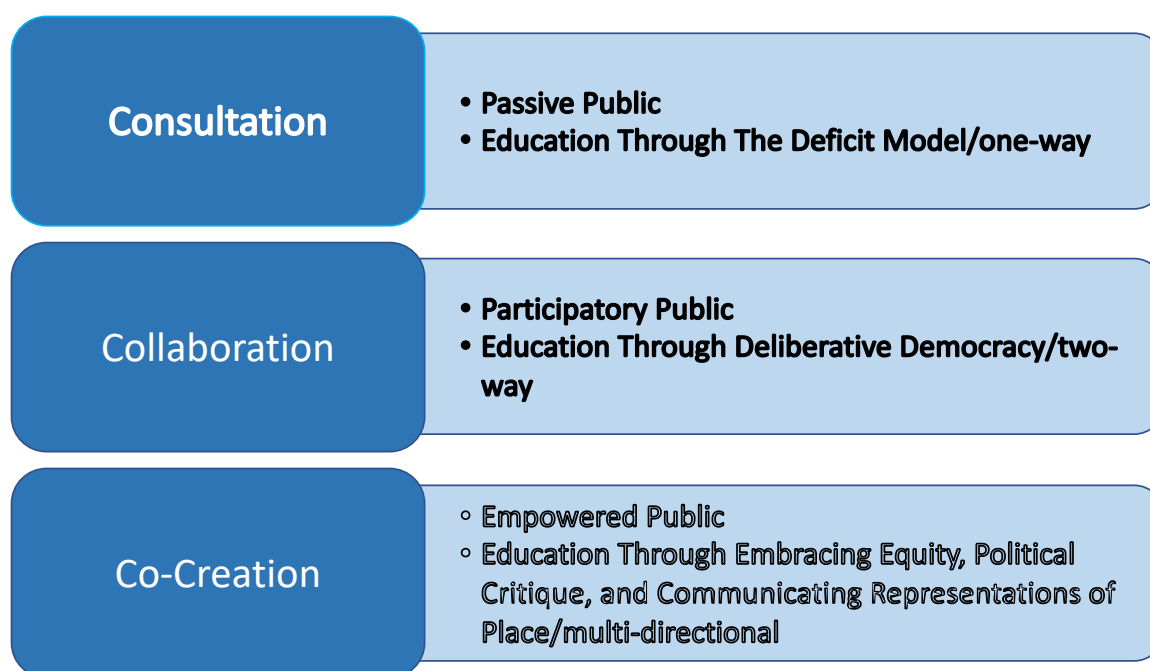


Figure 1: EPE framework (After Smith *et al.*, 2021).

However, we do not assume a hierarchical structure to these levels of participation. Rather than labelling consultation as inferior and co-creation as ‘the best’, it could be argued that different levels and types of public participation are appropriate for different situations and publics. In the following sections, we consider each of these three EPE framework types and describes examples of activities typically utilised for each.

2.3.1 Consultation

Of the three types, consultation represents the least active form of engagement; despite this fact, participation still takes place, though it remains a top-down process, usually operating as a vehicle for information distribution. Other times the consultation process may offer opportunities for public



contributions on the stipulations necessary to gain public support for the project or intervention (Haggett, 2011). In consultative engagement, the public is frequently offered a single choice *i.e.*, to get with the programme (*e.g.*, accepting a project if that is what is proposed). The consultation tier frequently carries negative connotations, though this is not always justified. Not every project or activity must be debated endlessly before every citizen; at the same time, the public must be provided with information on current topics of importance (*e.g.*, the recent vaccination roll-out for COVID-19 is a good example). Even when considering from an equity and justice stance, there are many instances where this top-down, (mostly) one-way communication may be all that is required (Reed *et al.*, 2018).

2.3.2 Collaboration

Collaboration activities represent an increase in public participation, whereby the flow of information shifts from unidirectional (from organisers to participants, as typified in consultation activities) towards a more collaborative process which incorporates the values, concerns, and knowledge of the public into a consensus-building, decision-making process (Harris, 2002). A more limited view of collaboration involves the unidirectional flow of information from the public to organisers; despite the lack of two-way dialogue, this scenario still allows for the incorporation of the public's views into the decision-making process. The activities discussed below begin with examples of this more minimal type of collaboration, and end with activities which centre around a dialogue and exchange of ideas. This type of engagement is symbolic of the public pedagogical theme of deliberative democracy, in which decision-making revolves around reasoned debate, rather than just voting (Chambers, 2003).

2.3.3 Co-creation

Change is the central focus of co-creative⁷ engagement, which seeks to bring about progress and change through a partnership between government/academic/corporate representatives and the public. The process remains deliberative, though the public – through representatives within the organisations voicing their interests – hold greater influence over the direction of the intervention and decision-making process (MacKenzie & Warren, 2012). This type of engagement “*constructively advances an argument that has been building in the participation literature amongst practitioners for some time about the need for governing institutions to more carefully listen to and be responsive to public voices rather than ritualistically carrying out invited public engagement processes as an end in themselves*” (Pallett *et al.*, 2019, p. 609). As Engels *et al.* (2019) describe “*test beds and living labs represent an experimental, co-creative approach to innovation policy that aims to test, demonstrate and advance new sociotechnical arrangements and associated modes of governance in a model environment under real-world conditions*”. Co-creation activities whereby members of the public are trained to take on leadership roles within their community as part of the proposed policy or project represent the height of public participation within EPE programme activities involving an initiating organisation.

⁷ Smith *et al.* (2021, p. 58) Observe that the “...difference between collaborating and co-creating is one of the degree to which the public wishes to accept responsibilities of leadership for the innovation or project development.”



2.3.4 Engagement methods

In this section a range of methods for education and public engagement are described. Table 1 which follows on page 16 provides a summary of characteristics of each method.

Brainstorming session: this method focuses on a single problem or issue, Brainstorming aims to generate a list of possible ideas or answers. There are three basic rules to follow: generate as many solutions as possible; wild ideas are encouraged; and no criticism is allowed. It can be verbal or involve writing, the latter may be more effective for those uncomfortable with speaking in groups. At the end of the session the ideas are discussed and ranked in order of preference. The technique can be used on its own, or as part of another engagement method such as a workshop, focus group or charrette.

Citizen panels: this typically involves members of the public sitting as a committee to inform and advise on a particular topic. This usually takes place over an extended period. The cost involved with an advisory group is usually quite low, though time commitment involved required can be onerous for some participants. A key strength is that it can help identify potential problems early in the project and give participants the opportunity to share new perspectives with the project team (Sanoff 2000).

Citizens' Jury: this method utilises a (usually) representative sample of people from a focal population. This so-called mini public deliberates on a given issue and provides recommendations to organisers. The emphasis is placed on informed consideration. The 'jury' is briefed in detail on the background and current thinking on a particular issue before their deliberation. This approach is often deployed alongside other consultative processes, or as one component of a broader participatory processes (Mullally *et al.*, 2022).

Consensus conference: this approach typically involves a panel of citizens who engage with experts at a public event on a specific topic. The panel is given time in advance to prepare for this engagement and may receive preparatory training. Panel members lead the engagement, defining the key points for debate and the selection of experts, before they reach their own conclusions from the proceedings. Similar in some respects to citizens' Juries, the aim of is to inform and consult, with the added dimension that take place in the public arena (O'Connor *et al.*, 2016).

Design Charrette this participatory process that brings together stakeholders in one or more intensive meetings which can last several days, with the objective of resolving a particular issue. Different parts of the process may include workshops that engage participants in the development of ideas, recommendations and decisions. The initial design charrette should result in a clear vision of both project goals and individual responsibilities, but not necessarily reach final decisions (Smith 2012).

Design games: this involves solving problems or generating ideas through role-playing of real-life situations. An issue or problem is identified, examined and a game devised to capture its essence. Sanoff (2000, p 78) explains *'In each design game the individuals make choices, hold positions, and debate them. In making choices individuals have to examine their feelings, self-concepts and values. The final goal of the exercise is a plan of action for an entire group of people – a goal that usually requires some compromising.'*

E-panel: E-panelling is a methodology where data is collected from participants by conducting interviews online. This can be thought of as variation on the citizen panel model, whereby ordinary



citizens are recruited to discuss a specific theme, with the innovation use of online tools (O'Connor *et al.*, 2016).

Focus group: A focus group is a qualitative research tool whereby c. six to ten selected individuals are brought together to discuss their understandings, opinions, or attitudes around a particular issue, idea or product. The discussion is guided by a facilitator who engages with the participants and helps to steer the conversations towards the issues that most concern to the organisers. Sanoff (2000, p 56) notes “... *focus group discussions help to generate insights into those community characteristics that are not visible through direct observation.*”

Hackathon: This originated with programmers coming together to work intensively on specific software projects. The thinking behind such events is that bringing together a diverse range of participants can stimulate practitioners to produce innovative solutions. The method gained increasing popularity and has been taken up and applied by those in other disciplines including the social sciences (see *e.g.*, Kvamsås *et al.* 2021).

Semi-structured Interviews: these interviews involve interacting with an individual on a one-on-one basis, engaging in a discussion, where the conversation is steered through a series of (usually) predetermined questions. Though subsequent analysis, a deeper understanding can be developed of the interviewees' perceptions, opinions and behaviours. Dunphy *et al.*, (2021) note the importance of allowing sufficient time and scope in the engagement such the interviewees to give their point of view and to tell 'their story'.

One-on-one consultation: this involves citizens being engaged individually to inform them about a project and canvass their opinions. It may involve, for example, calling door-to-door in a building or neighbourhood. Such door-to-door canvassing may be a preliminary to other methods of consultation such as a public meeting. Such methods may be found particularly useful in cases where it there are hard-to-reach prospective participant (*e.g.*, by reasons of age, poverty, low educational attainment, transitory residence) (O'Connor *et al.*, 2016).

Online forum: this is another method where researchers use the internet to engage with a large group of people on an issue, usually at the early stages of a project. The numbers of potential participants can be quite large, with information on the topic being sent via email or the project's website. Participants then invited to engage on an online forum set up for the same purpose. The strength of this approach will in its ability to engage with large number of people including those perhaps unwilling to respond to traditional research methods (O'Connor *et al.*, 2016).

Open day: This have traditionally used by educational institutions and industry practitioners to give the general public access to the institution itself, increasingly used also as a means to provide information on a specific project or proposed development. They provide an opportunity for a wide range of stakeholders to receive information on a project, talk directly to members of the developer team, and directly offer their own feedback (O'Connor *et al.*, 2016).

Opinion poll: a type of survey designed to measure attitudes towards a specific topic or series of topics. This is usually conducted through asking questions of selection of respondents designed to reflect that of the focal population. From this sample wider attitudes and opinions on the subject being researched can be inferred.



Participant observation: Participant observation involves researchers accompanying the subjects of about their daily activities and recording their observations in a field diary. It has potential to provide in-depth information on the lived experience of the participant, which might inform the project design as well as future engagement strategies. An alternative is to ask selected occupants and users to complete a 'diary', recording their own behaviour in the context of their daily routines, habitual practices and social interactions (Storm-Mathisen, 2018)

Public meeting: This is an open meeting held to present information about a project to a wide audience. It can take place at any time during the process. Such meetings allow members of the project team or community leaders offer relatively detailed information on the project to those present. However, such meetings have a tight schedule which limits time for discussion. Also, it is likely that only the dominant personalities will speak up and that these will lead the discussion. Public meetings may also incorporate a vote on a specific proposal through a show of hands.

Public talks / Public lecture: this can be a good approach to raising awareness and increasing knowledge on a topic relevant to the development project. Careful selection of the speakers, ensuring they have reputable credentials and perceived independence, will enhance the credibility of the event

Social media: this is a means of cheaply and easily engaging a broad group of the public a project. By setting up and publicising a dedicated Facebook page, X/Twitter account or other social media platform for the project, occupants and users can be kept informed about ongoing developments as they happen, the project team can receive instant feedback, and issues or problems can be flagged up as they arise. However, it needs to be borne in mind that comments on social media may not always be representative of wider views, as the most vociferous and opinionated typically come to the fore (O'Connor *et al.*, 2016).

Surveys: Surveys help to gather information, attitudes, and opinions. They involve citizens completing questionnaires which ask them about their view on a project or proposal, energy consumption patterns, routine behaviours and attitudes. Surveys can involve door-to-door canvassing, be conducted online, or sent through the post. Depending on the needs of the engagement questions can be closed, with respondents asked to choose among a limited number of options, or open, offering the respondent more room to elaborate on their answer.

Visioning exercises: Visioning is a process in which participants are encouraged to think about how their building or community might be in the future and to find ways to clarify, strengthen and work towards that vision. Various tool can be employed in such exercises including e.g., sense-making, empathy mapping, story-boarding, community mapping and audience polls (Mullally *et al.*, 2022).

Workshop: this is a face-to-face working session held with the purpose of discussing issues in order to reach an in-depth understanding of their various dimensions and agreement on the way forward. Workshops are not focus groups. A workshop is about working towards an outcome: achieving a task, reaching goals or arriving at a consensus. In contrast, a focus group is more about process, it is about conversation, eliciting different viewpoints, *etc.* (O'Connor *et al.*, 2016).



Table 1: Characteristics of engagement methods (adopted from O'Connor et al., 2016 and Rowe & Frewer 2005)

Method	Depth of participation	Inclusivity	Cost	Demand on participants
Brainstorming session	Consultation Collaboration Co-creation	Limited	Minimal	Low
Citizen panels	Consultation	Low	Low	Significant
Citizens Jury	Collaboration	Moderate	Moderate-Significant	Significant
Consensus conference	Consultation Collaboration	Moderate	Moderate	Significant
Design Charrette	Collaboration Co-creation	Variable	Moderate	Significant
Design games	Collaboration Co-creation	High	Low	Moderate
E-panel	Consultation	Variable	Moderate-Significant	Low
Focus group	Collaboration Co-creation	Variable	Low	Moderate
Hackathon	Collaboration Co-creation	Limited	Moderate	Moderate-Significant
Interviews	Consultation	Limited	Moderate-Significant	Low-Moderate
Online forum	Consultation Collaboration	Moderate	Low	Minimal
Open day	Consultation	High	Moderate-Significant	Low
Opinion poll	Consultation	High		Minimal
Participant observation	Consultation	Limited	Moderate-Significant	Moderate
Public meeting	Consultation	High	Minimal	Low
Public talks / Public lecture	Consultation	High	Low-moderate	Low-moderate
Social media	Consultation Collaboration	High	Minimal	Minimal
Surveys	Consultation	high	Low-Moderate	Minimal
Visioning exercises	Collaborative	High	Low	Low
Website	Consultation	High	Low	Low
Workshop	Collaboration Co-creation	Variable	Low	Moderate



3 REALISE EPE Programme

3.1 Why do we need a Public Engagement Programme?

The public has often been cited as a “barrier” to Carbon Capture and Storage (CCS) deployment, because decisions on whether projects move forward often depend on the local community’s acceptance (or at least their passive acquiescence). In July 2008, the G8 set a goal of launching 20 CCS demonstration projects globally by 2010, with wide-scale deployment in 2020 (WRI 2010). Nonetheless, this goal has not been met mainly due to local opposition, which has often been cited as one of the reasons for project delays and cancellations (Slavin and Jha 2009). Deliverable 4.1 showed that CCS will not be widely deployed at the pace needed without local community support. Not all proposed CCS projects will move forward, and many will be opposed by local communities for different valid reasons. Thus, realising the public-good potential of CCS-generated climate mitigation will require establishing trusting, respectful, and stable relationships among project developers, regulators, and local communities.

Communities not only have a right to be included, but their engagement is also critical for the successful deployment of CCS. Effective community engagement can help identify project risks, improve project design, and establish ways to resolve communities’ concerns about a particular project (Herbertson *et al.* 2009). In turn, these benefits can contribute not only to an individual project’s outcome but also to the longer-term perception of CCS. Anticipating community concerns and providing clear guidelines on community engagement can be critical components in project development and large-scale deployment of CCS. In summary, when implementing CCS projects, it is important both in principle and in practical terms to listen to and respect local community concerns and sensitivities, and that projects are planned, designed, sited, operated, and maintained in a way that local voices are at the centre.

3.1.1 What is community engagement?

Community engagement can be defined as the process through which a project developer or/and a regulator builds and maintains constructive relationships with communities, involving them in a timely and transparent way over the life of a project (Herbertson *et al.* 2009).

This process is often initiated by either the developers and/or regulators. Although it is possible for communities to take the initiative to host CCS projects and contact developers, project developers have been, in the vast majority of cases, the ones that lead the characterisation of potential sites, selecting project locations and determining which communities are eventually engaged.

As seen in Dunphy *et al.*, (2021) community engagement can take many forms, from more passive processes, where the community formulates questions and receives answers, to more active processes, where communities can express concerns and see how these are translated into a new design, and even the cancellation, of the project. In some of the most active forms of engagement, communities may codevelop the project and even own it financially – as it sometimes the case in wind and photovoltaic projects, where the community owns the project and enjoys the economic returns from them.



It is important to note that any given community is monolithic or a single entity, but rather a diverse collection of interests and parties who may view a CCS project differently. The composition and character of a community are political and thus vulnerable to resolutions that may not always be just and democratic. It is therefore important to acknowledge that, there is not a single local community, but several interested local groups within a community, and even within different groups, stakes and perspectives may differ (van Veelen and Haggett 2017). As in other sites, therefore, community *'is a contested, multi-dimensional concept, based on identity, practice, objectives and the places to which these apply'* (Brown 2007). Therefore, all involved in a community engagement process should expect to work with dissenting voices, which might not only come from the local community, but also regulators and developers.

3.1.2 Community engagement timeline

Community engagement for a CCS project does not end with project construction or operation, but rather extends over the project life cycle. For CCS, the post-closure stewardship phase of CO₂ storage sites—the period after geological injection of carbon dioxide is complete, but periodic monitoring and maintenance are still required—may span many generations. This highlights the need for community engagement not only during the planning and operational phases of the project but also for the long-term engagement—usually conducted by the regulator or responsible governmental agency—that may continue indefinitely through the post-closure stewardship phase.

This long-term engagement may take different forms depending on the country or region where the storage site is located. For example, the EU's CCS Directive states that long-term stewardship will be the responsibility of the state or another competent authority after a minimum 20-year closure period; in other regions of the world this proposed shift in responsibility is still being discussed by policymakers (WRI 2010).

3.2 Developing the EPE Programme

This section will present the development and trialling of key elements proposed of the Education and Public Engagement Programme described in section 4. These pilots will be useful to evaluate its effectiveness, identify areas of potential improvement, and to ascertain transferability of the programme. To this end, community interviews will input into the process. First, an initial social characterisation of Cork Harbour Area will be presented. Then, with the aid of semi-structured community interviews a stakeholder analysis map will be drawn. This information will feed into an initial plan for the communication materials for the project, and finally, the results of the community dialogue session will be presented, which integrate community members narratives about their life near the harbour, public engagement experiences, and perceptions of CCS.

3.2.1 Methodology

Building on the work in previous tasks (particularly T4.1 Critical review of EPE), the Education and Public Engagement Programme (EPE) was developed through a mixed methods approach combining a literature review and engagement with community members through semi-structured interviews.



3.2.2 Literature review

The approach undertaken for the literature review was adopted from the work of Smith *et al.* (2021) in which we undertook a comparable study on key concepts of EPE programmes associated with wave energy. The method of gathering and analysing the secondary data is best described as an integrative literature review. This *“is a form of research that reviews, critiques, and synthesizes representative literature on a topic in an integrated way such that new frameworks and perspectives on a topic are generated”* (Torraco 2005:356).

Scholarly interest in public engagement accelerated rapidly from the dawn of this century (Sandlin, Schultz, and Burdick 2010) though the practice itself can probably be said to date back to the ancient Greeks (Lane 2020). Acknowledging this increase in research, most peer-reviewed articles and books examined were written within the last twenty years, with exceptions granted for important works and foundational texts published before this time. To ensure that the analysis was integrative, sources were chosen from the works of scholars from all over the world and in a wide variety of disciplines including, but not limited to, education, philosophy, sociology, psychology, public administration, political science, and science-technology-society studies. The search and analysis are organised around each of the three terms in *education and public engagement*, extracting themes and multiple meanings from the literature and organising them in relation to each other to create the framework. This search was both systematic and dynamic. Systematically, the approach was to use similar search expressions in multiple databases available such as Elsevier Scopus, Google Scholar and UCC library OneSearch and set the search parameters to relevancy, citations, and date in that order (see Table 2 below). Dynamically, both a forward and reverse snowballing approach was used for references found in the bibliographies of multiple publications, examining both original sources and other articles linked to these.

Table 2: Search term examples and databases

Examples of search terms used	Databases searched
Education AND public sphere	Web of Science
Conceptions of publics	Science Direct
The public of public pedagogy	Safe Journal JSTORS
Typologies of public engagement	ProQuest
Social movement AND public pedagogy	Cambridge core
Importance of place in social representations	Wiley online Library
Learning out of school	Taylor & Francis eBooks and eJournals
Deliberative democracy AND engagement	Scopus
Ethics of social intervention	SocINDEX
Rationality and emotion in public engagement	OneSearch (university search energy for books and journal articles)



3.2.3 Semi-structured interviews

To complement the literature review and enable an in-depth investigation into attitudes towards CCS and perspectives on EPE programmes in the Cork Case Study, key informants were engaged through semi-structured interviews. The participant briefing sheets, consent forms and interview guide are included as Appendices 1–3 respectively. The aim of semi-structured interviews is to gain an appreciation of the perspective of interviewees about a focal matter. Dunphy *et al.*, (2021) note the importance of allowing sufficient time and scope in the engagement such the interviewees to give their point of view and to tell 'their story'. Gill *et al.* (2008) suggest that building a rapport with the interviewees is important and even argue that doing so in advance “*can have a positive effect of the subsequent development of the interview*”. The interviews in this task complemented and supplemented the desk-based research, and they offered insights which would not necessarily have emerged through a wholly literature-based analysis.

The semi-structured interviews were carried out using pre-formed, concise, easily understood, open-ended questions – the informants were invited to talk about their own community, the way they acquire trusted information, their knowledge of climate change, experience of consultation and public engagement programmes, and perceptions of CCS. Prompts were used to guide the conversation. The interviews were held in person and were recorded with the permission of the participants. To encourage interviewees to respond openly and freely, participant anonymity and confidentiality were guaranteed, and all responses were anonymized during the coding process. The resultant notes were analysed as described in the following section.

Analysing interview notes can be an iterative laborious and often time-consuming process that involves a qualitative analysis to interpret what was communicated and theorising from this analysis (Schwandt 2007). All interviews were manually transcribed. Following this initial stage, the text was carefully analysed to capture key information to identify themes according to the dimensions proposed for the EPE programme. Emerging information was cross-referenced and linked to that from the literature review, and in so doing resolving inconsistencies filling some knowledge gaps and identifying others. The relatively small dataset made it possible to code the text by hand and significantly reduced the iterative analysis and interpretation process. In each case, the researcher who interviewed the respondent also analysed the notes.

3.2.4 EPE Social context

Coastal regions represent one of the highest concentrations of human activity (*e.g.*, energy, recreation and tourism, commerce and trade, fisheries) and settlement (O'Mahony *et al.* 2009) that can result in a range of development pressures and associated impacts. Serving as an economic and cultural powerhouse for the south of Ireland, Cork Harbour is no exception.

Cork Harbour is one of the largest coastal water bodies in Ireland and the most industrialised estuary in the Irish State (Johnson *et al.* 2002). The Harbour extends approximately 25 km from Cork City to the Harbour mouth at Roches Point on the South-West coast of Ireland (See the map in Figure 2 below). The Harbour is bordered by the towns of Passage West, Cobh, Crosshaven and Monkstown, which each have a population of between 1,500 and 6,500. The towns of Carrigtwohill, Midleton and Carrigaline are situated in the immediate hinterland totalling a population of 72,000. Other smaller



settlements along the harbour's shores include Whitegate, Aghada, East Ferry and Ringaskiddy (which is home to a ferry port and a large industrial presence).

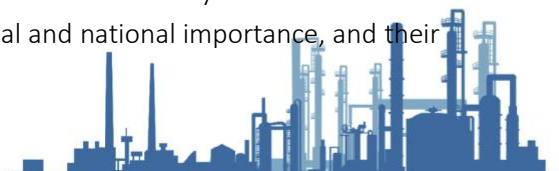


Figure 2: Aerial view of Cork Harbour showing key residential settlements (Kopke and O'Mahony 2008)

Cork Harbour has been the scene of many historic events throughout the centuries. Britain's colonies provided a strategic importance to Cork, not only as an assembly point for convoys, but as a major victualling port for the Royal Navy. This resulted in the extensive series of fortifications, still standing on the shores of the harbour, as well as the former Royal dockyard at Haulbowline. The booming emigrant trade to United States and Australia from the mid- eighteen hundreds increased the importance of the harbour both as a point of departure and as the first landfall for cross-Atlantic traffic. The port probably assumed its greatest importance during the Napoleonic Wars, when Cork was the main provisioning port of the British Royal Navy (McCarthy 2019). The Cork Harbour area is served by a network of roads, rail, air, and sea transport. Motorway systems (M8) to Dublin, regional roads (e.g., N21 to Limerick and N25 to Waterford), Cork International Airport and ferry to Europe (Ferry from Cork to Roscoff, France) (Conway Lenihan & McGuirk 2017).

In 1918 the first US Naval Airbase in Ireland was located in Aghada, in the eastern part of the harbour. However, in the first half of the 20th Century, Cork Harbour suffered from loss of traffic due to economic recessions, the decline of passenger emigrant trade, the decline in ship repairs and political problems. The passenger trade never recovered after World War II and continued to decline with the advent of large-scale commercial air travel (McCarthy 2019). From 1960, modern Cork Harbour began to emerge, with the construction of oil terminals, steel mills, shipyards, deep water ferry port and industrial base. The entire concept of transporting general cargo underwent radical changes with the introduction of containerisation. In 1972 the Cork Harbour Development Plan was designed by the newly formed planning and development department which included sites such as that at Ringaskiddy, Little Island, and Cobh areas (McCarthy 2019).

Today, Cork Harbour is a multi-resource and multi-use environment. The diversity of activities within the harbour includes the presence of numerous sectors of regional and national importance, and their



associated infrastructure (O'Mahony *et al.* 2009). The marine infrastructure in the Cork Harbour area includes both leisure and commercial landing/harbour facilities. Commercial marine activity in the Cork Harbour accounts for approximately 10% of total commercial marine traffic arriving in Ireland (CSO, 2017d). In 2015, 1,174 vessels arrived into Cork Harbour, 90 of which were passenger vessels (CSO, 2017d). This luxury cruise liner business is worth approximately €12 million per annum to the local economy, with each passenger spending on average, €73 a day while onshore (English 2017). Marine related businesses in the Harbour area include, chandlers, boatyards, sail making facilities and boat sales as well as passenger boat/ferry services and cruise/sightseeing operators (Conway Lenihan & McGuirk 2017).

Cork Harbour is the location for the headquarters of the Irish Naval Service, situated on Haulbowline Island and the National Maritime College of Ireland. The harbour also comprises substantial facilities servicing the pharmaceutical and bio-pharma industries, with over 30 companies having operations located along the shores (O'Mahony *et al.* 2009). According to the 2016 census, there are 93,451 jobs in Cork county, of which 29,171 are based in the harbour area. Critically, 67% of this harbour area population are under 45, while over 300,000 persons live within a 45 minute journey time of the harbour (CSO 2016). Even though the apparent widely available jobs, interview respondents perceived that there was an important rate of unemployment in the town of Cobh, which is increased in the wintertime when tourism levels drop. Cork Harbour is also home to Whitegate—Ireland's only oil refinery. Since it opened in 1959, the facility has played a key role in the country's energy infrastructure by supplying 40% of Ireland's transport and heating fuel.

3.2.5 EPE Stakeholder Identification and Analysis

The following section will build a stakeholder map based on the social characterisation of section 5.1.1 and semi-structured interviews undertaken in Cobh during October and November 2022 (see section 1.3 for more about the methodology).

Interview participants concurred that the town of Cobh has a strong sense of community. They described the community as supportive each other, a support is particularly palpable in times of crisis, when the town organises to address community and global problems.

In the past, an important institution for community cohesion was the church who oversaw social life and education. Today, an important number of community groups formed by volunteers have emerged to help tackle the town's most pressing problems, particularly linked to raising environmental awareness and improving the appearance of the town. In particular, there two groups mentioned by interviewees, Tidy Towns and Cobh Zero Waste.

Tidy Towns is an initiative launched in 1958 by Fáilte Ireland as a local initiative to improve the environment and make the towns a better place to work and visit. The organisation launches an annual competition with an average of 700 entrants per year (Tidy Towns 2019). In Cobh, volunteers contributing to the Tidy Towns initiative pick rubbish from the streets, paint fences and public walls, plant trees and flowers among other activities '*you can see them selecting a shabby looking corner in town and making it look beautiful again*' commented one of our interviewees. In 2021 Cobh won the Ireland's Tidiest Large Town in 2021, the Pollinator Award winner in 2022, and the Tidy Towns Gold Medal Winner from 2015 to 2022. Respondents agreed that the Tidy Towns initiative has raised the



standard of living of Cobh by improving the appearance of the town and decreasing insecurity levels as a result.

Cobh Zero Waste is a group that encourages citizens to take an active role in *'making Cobh a greener, lower waste and more sustainable island'*. They lead community initiatives and events such as talks, clothes swaps, repair cafés and monthly market stalls at the Cobh Farmers Market. The committee is made up of representatives from Cobh Tidy Towns, Cobh Community Allotments, the Green Step, Cork Harbour Alliance for a Safe Harbour (C.H.A.S.E.), business owners, and locals (Cobh Zero Waste 2019).

Other local initiatives are the many sports and activity groups that are ran by local volunteers. These include the rugby and soccer club, as well as the yacht, tennis and golf club. *'The weather is not a hindrance for people to engage in sports and other activities...'* Mentioned one of the participants, *'They just put waterproof gear on and continue doing them as normal'*.

The community centre plays an important role in generating cohesion within the town. They organise activities for people of all ages such as bingo nights, parties, workshops for children, outings to pubs for older men, and singing lessons for older women.

Respondents argue that these initiatives have surged due to the lack of involvement and agency of the local council. They described that they are underfunded and not well organised mainly due to political clashes between political parties. Another reason is that Cobh Council is now practically been absorbed by Cork County Council, which limits the actions of councillors locally and as well as their commitment to the town. This has generated mistrust in the local council among people living in Cobh, and as a result, they have then organised themselves to address the town's challenges *'They don't wait for the government to do this job, they do it themselves'* remarked one of the interview respondents. Inhabitants in Cobh have organised events and have applied to grants to fund projects such as the construction of the local playground and an outside gym.

Local businesses also play an important role in Cobh. *'Business owners have a sense of taking care of their businesses'* maintained one of the interviewees, *'They do everything so that the business is well and clean. They don't rely on workers to clean toilets or make beds, they are always ready to do it themselves'*. To belong to and to support a local business gives a sense of pride to people in Cobh. For instance, this year people made a pledge to buy local for their Christmas presents. Furthermore, local cafes and shops are crowded by local inhabitants.

Once the main stakeholders have been identified, following the guideline of section 4.1.3, stakeholders were placed according to how much influence and interest they have in the project (Figure 3). This map will assist in identifying the greatest and least efforts that are likely to be required for the communication strategy. Stakeholders in the greatest effort group who might have little or no interest in the CCS project but that can have a large potential to influence a CCS project such as local businesses, the community centre, inhabitants of the Cork Harbour Area and the town councils, will require a proactive engagement plan. Education will be the key strategy for this group and communication activities will need to be focused around the technology and the benefits of the project. By informing these groups with effective and credible information early in the process, the project developers can start building trust and relationships with their members.



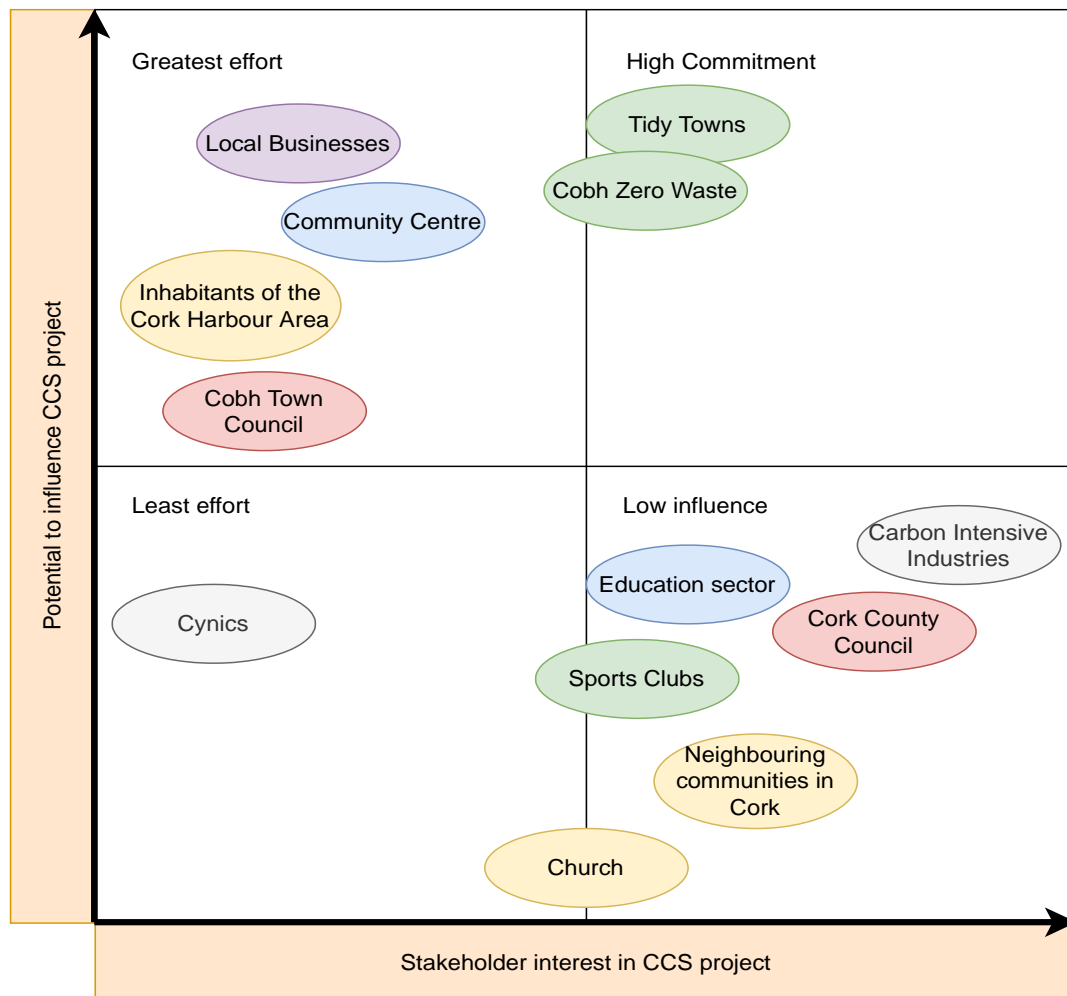


Figure 3: Stakeholder map for the Cork Harbour Area

In the highest commitment group are stakeholders that have an important influence in the community and that also could have a potential interest in the development of a CCS project. Examples of these are citizen groups that have an environmental commitment such as Tidy Towns and Cobh Zero Waste. These stakeholders would require a less proactive engagement than the former quadrant but still can be used as a resource for the communication activities that will take place with other stakeholders.

Stakeholders that fall into the category of the least effort are actors that do not have as much influence in the CCS project and also might have low interest in it. These can include potential opponents to the project that do not live in the Cork Harbour Area. It might be difficult to shift strong views and therefore communication with these groups will be monitored but not proactive. Stakeholders are to be actively engaged only if misinformation is being disseminated.

In the last quadrant are stakeholders that could have a potential influence in the CCS project but that do not have a high influence in its development. Groups can include the Cork County Council, Sports Clubs, the Education Sector, the Church and neighbouring communities in Cork county. Stakeholders in this group generally need to be kept informed but are least likely to be interested in being engaged. However, it's important to note that stakeholders can change quickly and therefore need to be monitored to make sure that these groups do not require a more active engagement.



3.2.6 EPE Content curation and development

Communication materials were developed and curated based on the inputs from the social data gathering and the stakeholder mapping. This material present in the following pages has been selected to enable community members to explore the concepts around of decarbonisation and to gain an appreciated of the context of carbon capture and storage technologies.

Video

What is Carbon Capture and Storage

British Geological Survey | Video 4'45"

Description:

This UK-centric video from the British Geological Survey explains the need for, the concepts around, and the technologies for, carbon capture and storage.

Potential EPE application:

This video presents high-level concepts and ideas about carbon capture and storage in an accessible manner (particular geological storage). It is a useful resource for general audiences hearing about CCS for the first time. For many people, the involvement of the British Geological Survey as a public scientific body will lend credibility.

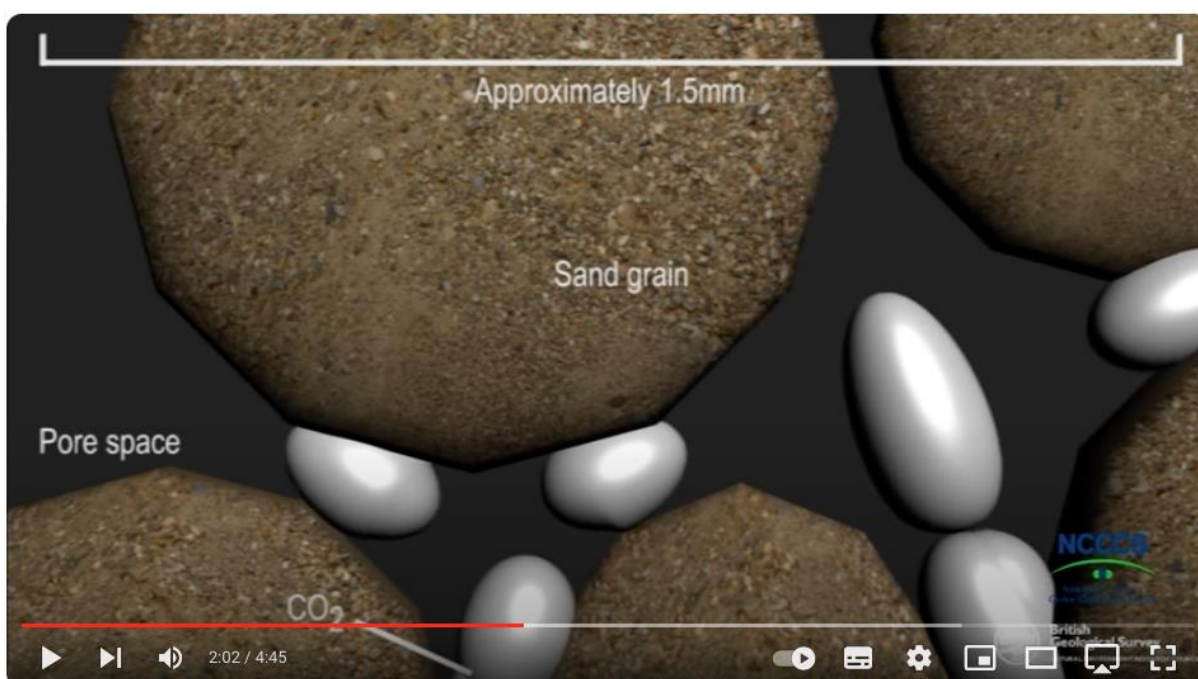


Figure 4: Screen capture of British Geological Survey video

URL: https://www.youtube.com/watch?v=4v2_4Dr2Gds



Video

What is Carbon Capture and Storage (CCS) - Full Length Explainer Video

Global CCS Institute | Video 3'55"

Description:

This video from the Global CCS Institute explains the need for, the concepts around, and the technologies for, carbon capture and storage.

Potential EPE application:

This is a short introductory video which presents the concepts and ideas about carbon capture and storage in an accessible manner making it a useful resource for general audiences hearing about CCS for the first time.



Figure 5: Screen capture of GCSSI video

URL: <https://www.youtube.com/watch?v=sPbSb2aBDxo>



Video

Carbon capture: the hopes, challenges and controversies

Financial Times | Video 21'31'

Description:

This c. 20 minute video from the Financial Times seeks to weigh the pros and cons of carbon capture and storage.

Potential EPE application:

This video offers some differing perspectives on carbon capture and storage, and would be useful to prompt discussions (and debate) within a group setting (such as a focus group workshop).



Figure 6: Screen capture of FT video

URL: <https://www.youtube.com/watch?v=laGtd-b0vMY>

Related reading is available from the Financial Times⁸ at

<https://www.ft.com/content/3df3f408-57a0-4718-b8d6-f8629118b7eb>



⁸ Hook, L. & Hodgson, C. (2022). Carbon removal 'unavoidable' as climate change alarm bells ring. *Financial Times* (April 6) <https://www.ft.com/content/3df3f408-57a0-4718-b8d6-f8629118b7eb>



*Video***How Does Carbon Capture Actually Work?**

Engineering with Rosie | Video 15'52"

Description:

A quarter-hour episode from the 'Engineering with Rosie' team focusing on carbon capture. The presenter Rosemary Barnes notes "I've been hearing contradictory things about carbon capture. It's apparently a mature technology, but on the other hand we are expecting an imminent breakthrough that will see costs drop and adoption rise. This sounded strange to me, but since I didn't actually know how carbon capture works, it was hard to get an idea about where the technology maturity is right now, and how it's likely to develop. So I tracked down a chemical engineer - Marc Allen - who has been working in industrial gases and sustainability for the last 20 years. And Marc answered all my questions about what kinds of carbon capture there are, what applications they can be used for, and how carbon capture actually works."

Potential EPE application:

The video provides a good overview of a number of concepts and technologies associated with carbon capture. It is best suited for those with a basic scientific and engineering knowledge, could be used for more advanced engagements or as a useful resource to recommend to those for whom other summaries have led them to seek further information.

*Figure 7: Screen capture of Engineering with Rosie video*URL: <https://www.youtube.com/watch?v=fC388uNjUY>

Video

How does carbon capture and storage actually work?

ABC News In-Depth | Video 12'02"

Description:

ABC News In-depth is an online service provided by ABC News Australia where they share their long-form journalism and explainers to help people understand what's going on in the world around you.

The Australian government is relying on carbon capture and storage as a significant part of its Net Zero plan, leading to question – will it work? This news item offers a discussion of carbon capture and storage with contributions from both proponents and those with more critical views

Potential EPE application:

Offering differing perspectives on carbon capture and storage, this video is ideal to prompt discussions (and debate) within a group setting (such as a focus group workshop).



Figure 8: Screen capture of ABC News Australia video

URL: <https://www.youtube.com/watch?v=Z5I4ZE3GcEQ>



Video

Reaching Net Zero: Does BECCS work?

Chatham House | Animated video 4'36"

Description:

The short animated video introduces the concept of negative emissions through "Bioenergy with Carbon Capture and Storage – BECCS".

Potential EPE application:

This video introduces Bioenergy with Carbon Capture and Storage in an accessible manner suitable for general audiences. It offers a supplementary perspective on carbon capture and could assist in generating discussions – particularly in rural areas, where such an approach could make the concept of CCS more relatable



Figure 9: Screen capture of Chatham House animated video

URL: <https://www.youtube.com/watch?v=24ESIXSa1sU>



Video

ZEP - Safe Storage: Closing the carbon loop - CO₂ Capture and Storage

Zero Emission Platform | Video 3'42"

Description:

This short animated video enquires “how do we store CO₂ safely and permanently underground?”

“By exploiting the same trapping mechanisms used by nature to store CO₂, gas and oil for millions of years; and by using existing technology to transport and inject the CO₂. This technology has already been used for over 30 years by the oil industry to improve oil extraction.

Storage starts by pumping liquid CO₂ into a carefully chosen reservoir. There are two main types: deep saline aquifers (which contain undrinkable salt water) and depleted oil and gas fields. Both have the same key geological features for storing CO₂ safely and are usually sandstone or limestone.”

Potential EPE application:

This video on the geological storage of carbon is suitable for a general audience (*e.g.*, following a video an introduction to the context of, and basic concepts associated with, carbon capture).

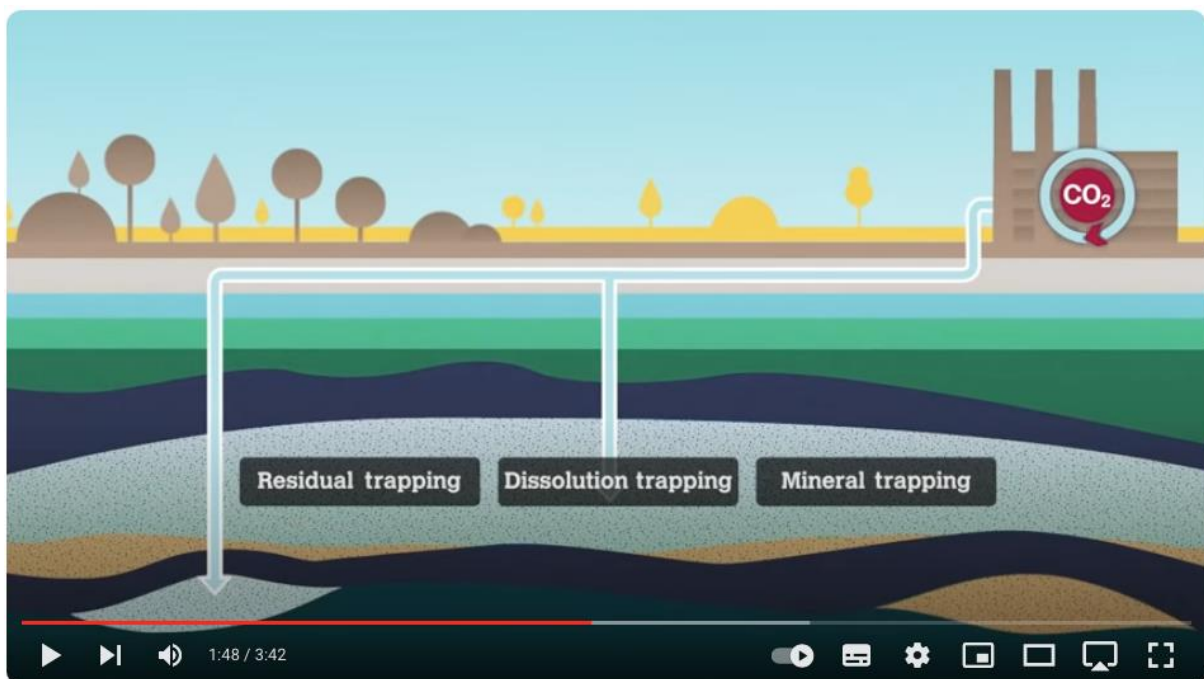


Figure 10: Screen capture of Zero Emissions Platform video

URL: <https://www.youtube.com/watch?v=GgISLuWP5cM>



Videos

How Carbon Capture Works

Reactions | Video 7'36"

Description:

This video offers an introduction to carbon capture and storage by researchers at the University of California, Los Angeles (UCLA). The video is intended as an accessible introduction to the concept and a mechanism for attracting people to read the proposal⁹ that the team developed carbon removal technologies.

Potential EPE application:

This first part of the video up to 3' includes a high level treatment of carbon capture and storage which is suitable for a general public

(The later part of the video, which speaks the XPrize Carbon Removal and the concept developed by the team carbon removal may be interesting for some, but perhaps is less relevant for most audiences and should be used advisably).



Figure 11: Screen capture of UCLA Reactions video

URL: <https://www.youtube.com/watch?v=wu3hoo3p4Kk>

⁹ Callagón La Plante, E., Simonetti, D. A., Wang, J., Al-Turki, A., Chen, X., Jassby, D. & Sant, G. N. (2021). Saline Water-Based Mineralization Pathway for Gigatonne-Scale CO₂ Management. *ACS Sustainable Chemistry & Engineering*, 9 (3): 1073-1089. <https://www.doi.org/10.1021/acssuschemeng.0c08561>



Video

Carbon Capture Explained. How it happens

The New York times | Video 1'50"

Description:

This brief video from the New York times introduces the concept of carbon capture.

Potential EPE application:

This short video is a high level overview told in a rather straightforward manner; it is suitable for use as introductory material to carbon capture for the general public.



Figure 12: Screen capture of New York Times video

URL: <https://www.youtube.com/watch?v=kigGiWQw8E8>



Audio

Can carbon capture save the planet - and make money?

BBC Sounds | Radio show 27'20"

Description:

This c. half-hour business radio show from BBC Radio 4 asks the question "Can carbon capture save the planet - and make money?". "Evan Davis speaks to the head of The East Coast Cluster, a project awarded some of this financial support, alongside other industry leaders, to understand whether this revolutionary technology could solve our climate change problems, or whether it is another way to evade our environmental obligations."

Potential EPE application:

This radio show offers a discussion of the "business" of carbon capture, providing a useful resource to stimulate discussion in more in-depth public engagements. It also serves as a good resource to recommend to those who seek more information after initial engagements.



Figure 13: Image of the radio show on BBC Sounds

URL: <https://www.bbc.co.uk/sounds/play/m0010qb7>



Audio

Today I learned about carbon capture.

MIT Environmental Solutions Initiative | Podcast episode 12'24"

Description:

TILclimate (today I learned climate) is a podcast from the MIT Environmental Solutions Initiative, which explores different aspects of the climate change challenge. Season two “focuses on our global energy system, its relationship to climate change, and what our options are for keeping the lights on while creating a clean energy future”, with this episode talking “about capturing, using, and storing carbon emissions, and how it fits into a clean energy future.”

Potential EPE application:

In this podcast, scientific and engineering experts explain the concepts and technologies associated with carbon capture. It is a good resource to recommend to those, who after initial engagements, seek more information about the ‘science’ of carbon capture, use and storage. It could also be useful for group discussions with *e.g.*, students and other with at least basic scientific literacy.

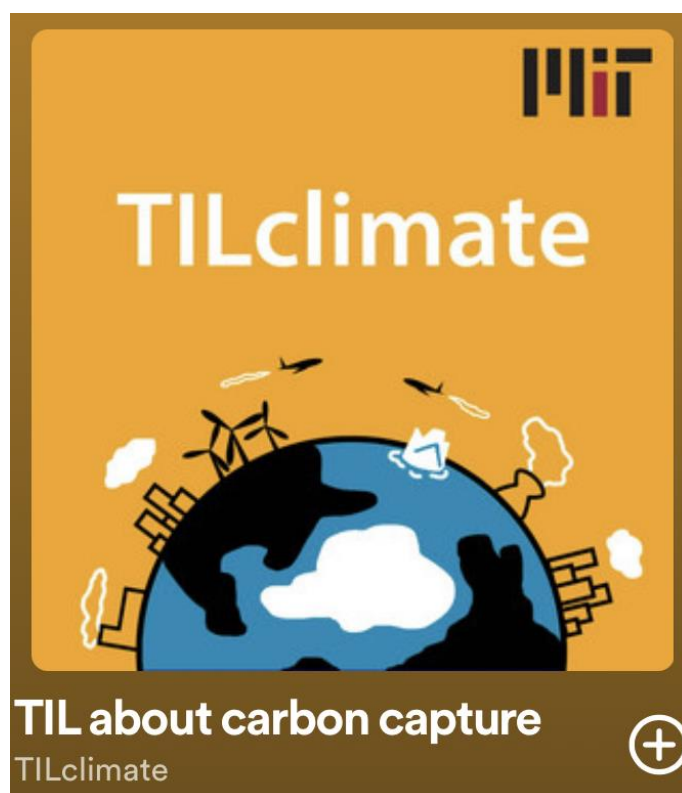


Figure 14: TILClimate title card for Season 2, Episode 7

URL: <https://climate.mit.edu/podcasts/e7-til-about-carbon-capture>



Audio

What is Carbon Capture and Storage, and why do we need it?

The Greentalk podcast | Podcast episode 28'21"

Description:

The Greentalk podcast from Veyt aims to make complex climate-related issues easier to understand, with each episode covering a different topic related to climate, energy and sustainability. In this almost half-hour episode with Hanne Rolén (Head of Sustainability at Aker Carbon Capture), the podcast looks to *"define what Carbon Capture and Storage actually is and how it can help tackle climate change in an efficient way."*

Potential EPE application:

This podcast episode comprises an seeks to explain carbon capture and storage and to explore why it is needed. This industrial contribution is a very good basis for a group discussion especially when used in conjunction with other resources which include more sceptical voices.



Figure 15: The Greentalk title card for episode 3

URL: <https://open.spotify.com/episode/76wbMmtazBzESRyPaiGoOU?si=ZX0olQiQSomq2gQpiBLH3g>



Graphic

CCS is part of the Solution

Shell Infographic

Potential EPE application: Initial introduction for general audiences

URL: <https://www.eurekalert.org/multimedia/656968>

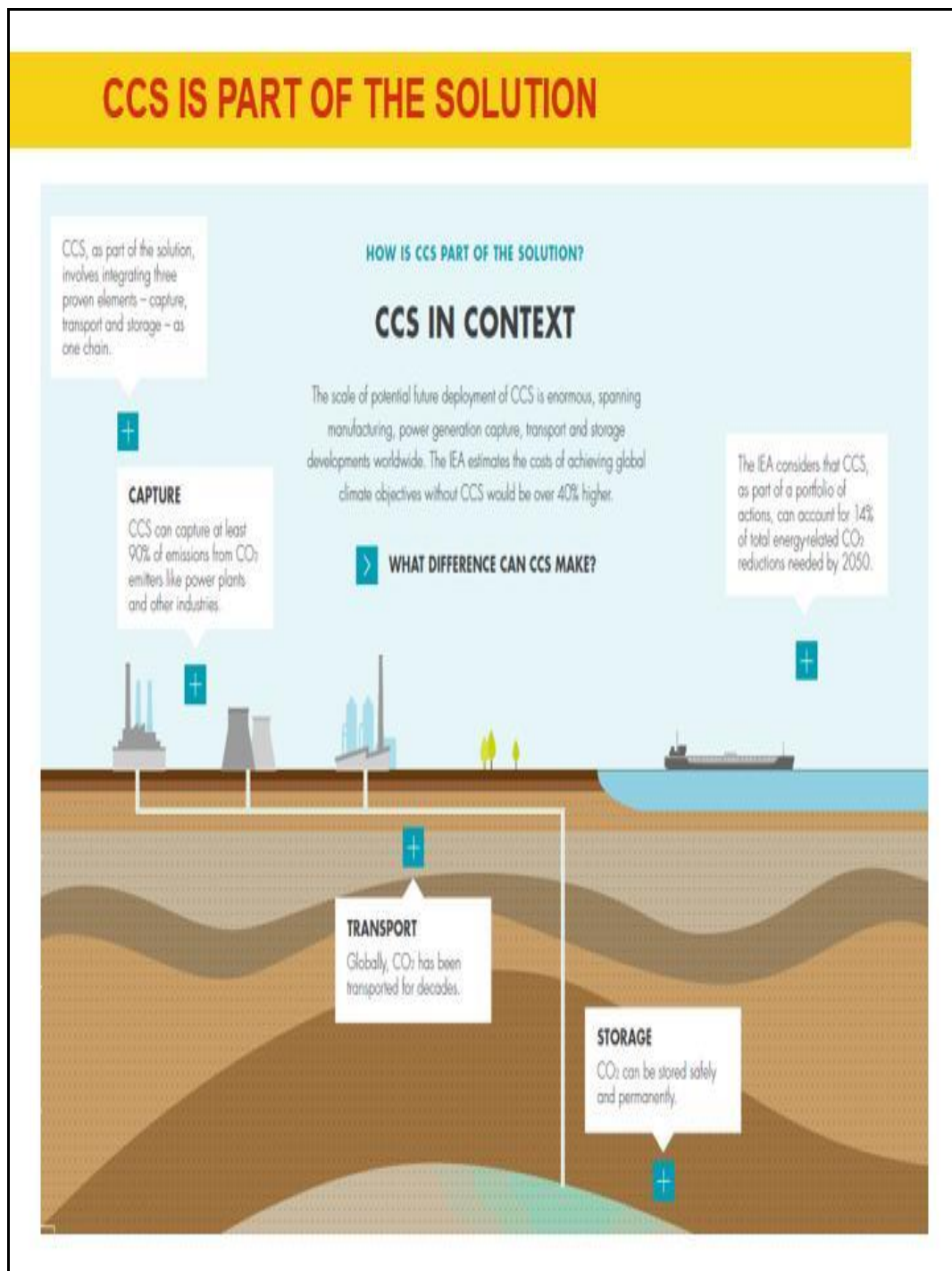


Figure 16: Infographic entitled “CCS is part of the Solution”



Graphic

Carbon Capture and Storage

Scottish Carbon Capture & Storage | Infographic

Potential EPE application: Initial introduction for general audiences

URL: https://www.carbonbrief.org/media/203750/screen_shot_2013-06-21_at_14.17.06.png

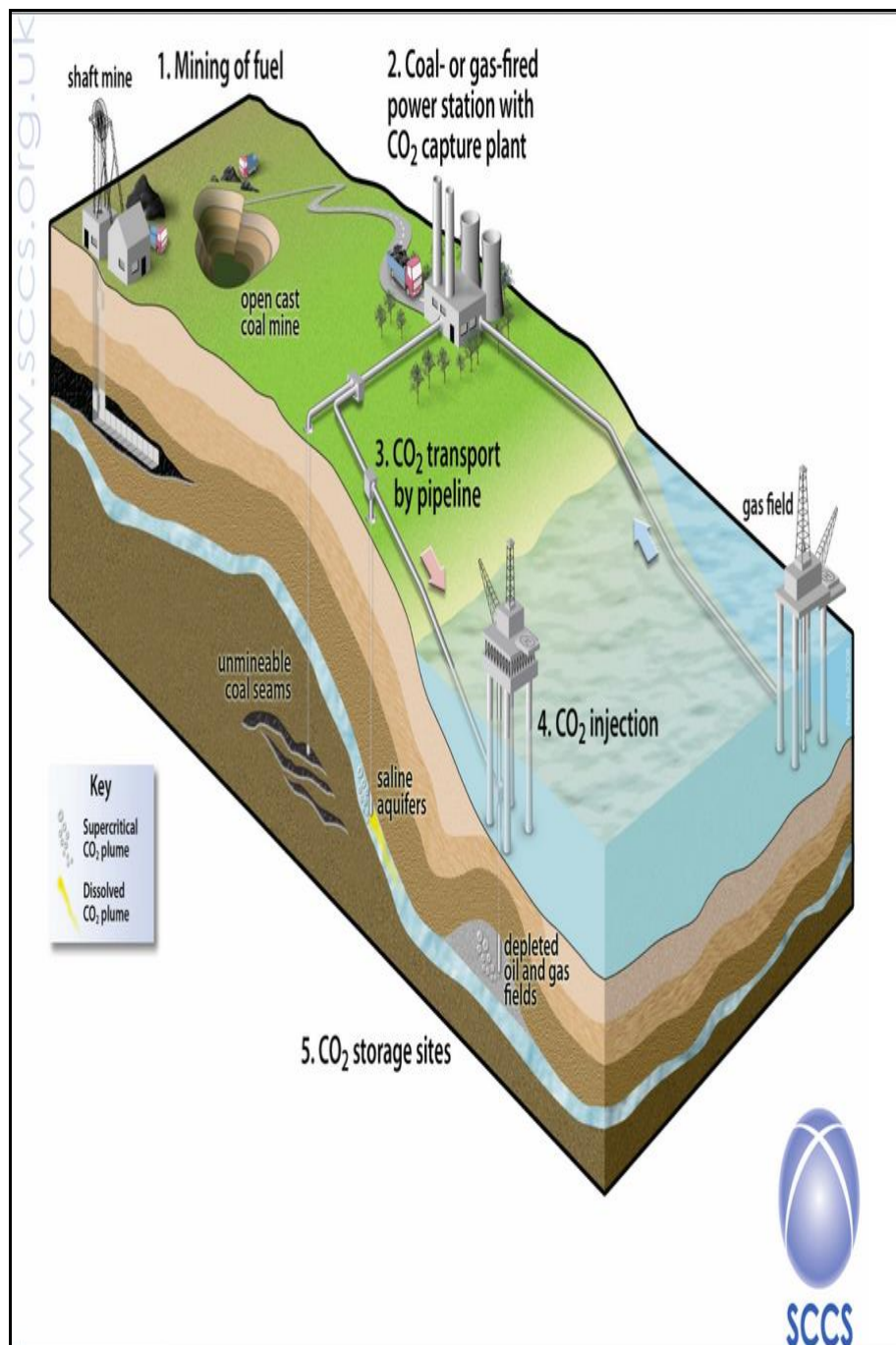


Figure 17: Infographic on carbon capture from SCCS



Graphic

Carbon Capture, Use and Storage

United Nations Economic Commission for Europe | Infographic

Potential EPE application: Initial introduction for general audiences

URL: https://carbonneutrality.unece.org/images/CCUS_EN.jpg

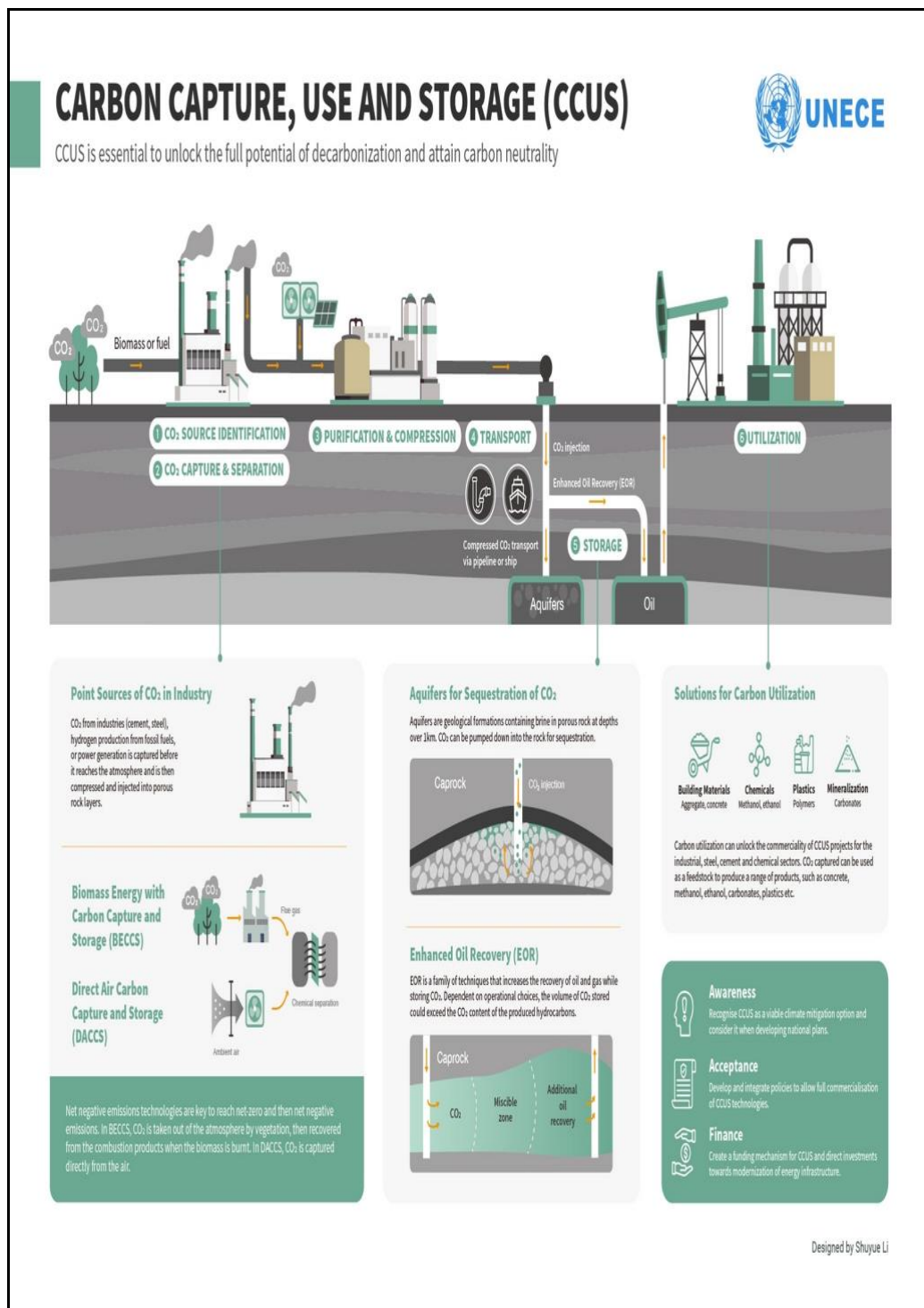


Figure 18: Infographic entitled “Carbon Capture, use and Storage (CCUS)”

Additional Resources

Carbon Capture & Storage

GeoBus University of St Andrews | Learning resources

Description:

This resource has been designed to provide teachers with an introduction to carbon capture and storage (CCS), a carbon emissions reduction technology. It provides experiments, activities, lessons and homework ideas as well as links to a number of other useful CCS education resources.

Potential EPE application:

While the material is targeted at school children, elements of the content could be using in engaging members of the general public.

URL: <https://geobus.st-andrews.ac.uk/resources/carbon-capture-storage-2/>

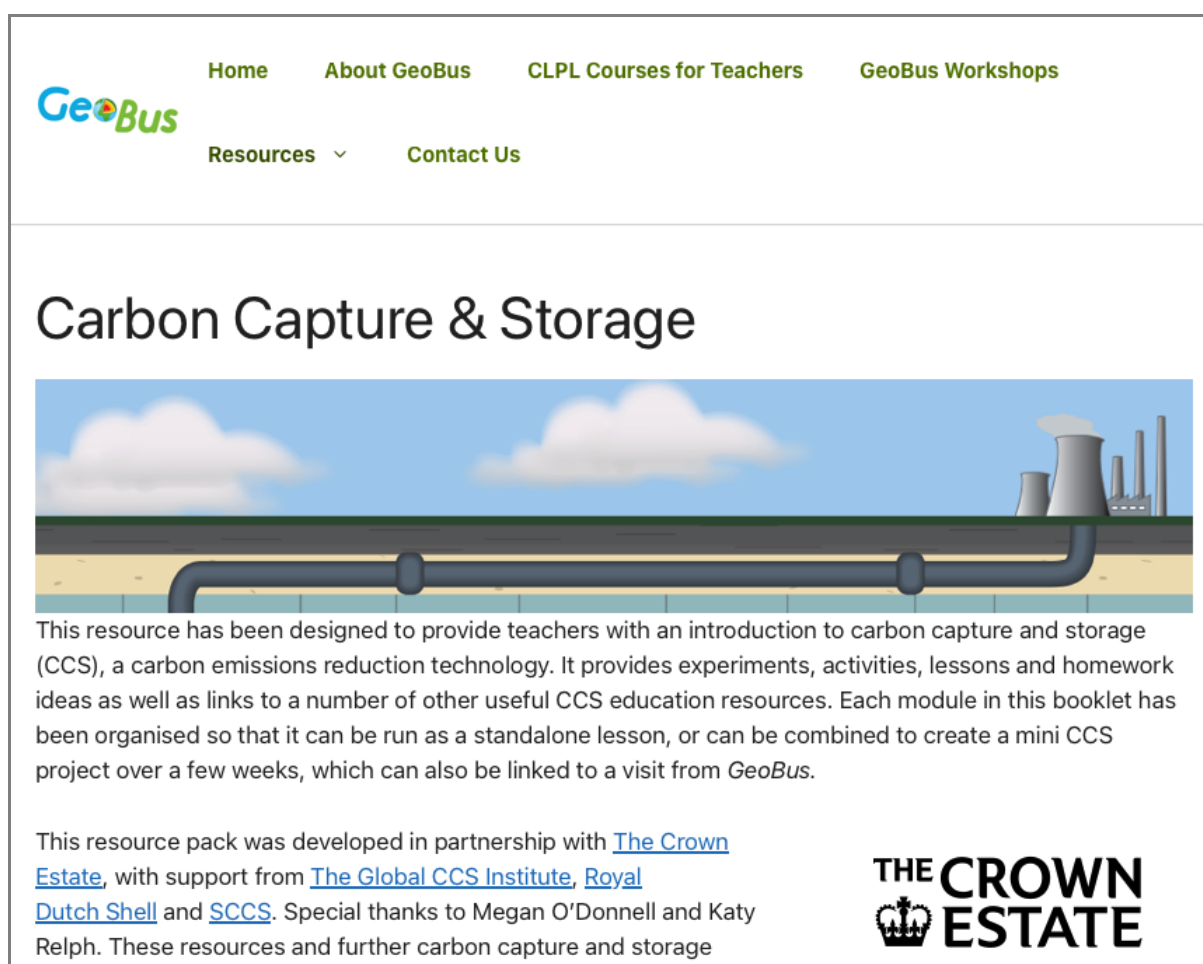


Figure 19: Screen capture from Geobus learning resources website



Additional Resources

Towards Net Zero - Realising CCUS in Portugal

Innovation Norway | Conference talks

Description:

Conference on carbon capture use and storage (CCUS) held in Lisbon, 29 November 2022. Jointly organised by Alterna Infrastructure, Norwegian Embassy in Portugal, Innovation Norway.

Potential EPE application:

These conference talks offers good resources for those seeking more advanced more material on various aspect of CCS / CCU.



Figure 20: Images from Innovation Norway CCUS conference in Portugal

Full conference:

URL: https://www.youtube.com/watch?v=6R_piJgZhlw 3h 41'52"

CCS' Role in Decarbonisation (Tor Syverud, Alterna Infrastructure)

URL: https://www.youtube.com/watch?v=6R_piJgZhlw&t=494s

Why CCS is part of the solution (Eivind Berstad, Bellona Foundation)

URL: https://www.youtube.com/watch?v=6R_piJgZhlw&t=11029s

CCUS Regulatory Framework – status and way forward (Ingild Ombudstvedt, IOM Law)

URL: https://www.youtube.com/watch?v=6R_piJgZhlw&t=9765s



3.3 Trialling the EPE

Key elements of the developed education and public engagement outlined in the previous sections were trialled to evaluate effectiveness, to identify areas of potential improvement, and to ascertain transferability of the programme. As outlined below, the trials in both local communities and amongst practitioners took the form of face-to-face interviews, outreach event, world café, lecture & discussion, conference engagement.

3.3.1.1 Citizen engagement

Potential interviewees were identified through a snowballing approach (Seale 2004), starting with a small number of initial contacts that fit the research criteria, (with participants being selected to achieve a balanced representation in terms of age, gender, socioeconomic status and relationship to the harbour; see Table 3) who then made referrals to other potential interviewees in their networks. A total of seven semi-structured interviews were conducted with inhabitants of the Cork Harbour Area. A copy of the interview guide is included as Appendix 3, with the relevant participant briefing document and consent form in Appendix 1 and 2 respectively.

Table 3: Interview participants

Code	Position/Profession
A1	Employee of a local business <50 years old (female)
A2	Employee of a local business <50 years old (female)
A3	Housemaker <50 years old (female)
A4	Retiree >50 years old (female)
A5	Social worker >50 years old (male)
A6	Bee keeper >50 years old (male)
A7	Academic researcher <50 years old (male)

Participants were asked questions about themselves and the community in which they live to get context and background. They were asked about the most pressing question facing their community currently. Responses to this question helped to better understand the perspective of the interviewee. The third category of questions concerned information and trust, in this current age of scepticism, conspiracy theories and the ever prevalent ‘fake news’, it is most useful to be familiar with where members of a focal community get their information and who they find trustworthy. Next they were asked questions about their knowledge of climate change and related issues, the answers to which inform our approach to talking about climate issues. Finally, the interviewees were asked about their experience of education and public engagement programmes – offering another datapoint in our review. Next the participants were provided with a brief description of carbon capture and storage before being questioned on their perceptions of CCS. These interviews informed the development of the EPE programme and in themselves constitute testing of a key preparatory part of an EPE programme (developing an understanding of target audience).



3.3.1.2 Public engagement

In conjunction with the project General Assembly, a regional outreach event entitled “Reducing Industrial Emissions through Carbon Capture & Storage” was held in Cork, Ireland May 2022. This predominately in-person event (although there was an online options also) was open to the general public and attracted a wide range of people from industry, public authorities, NGOs and academia. There was a good deal of interaction between the audience and the speakers. In addition, the attendees were invited to a working buffet lunch after the event, which facilitated a great deal of feedback from attendees both on the event itself and on the approach to education and public engagement outlined in the presentation.

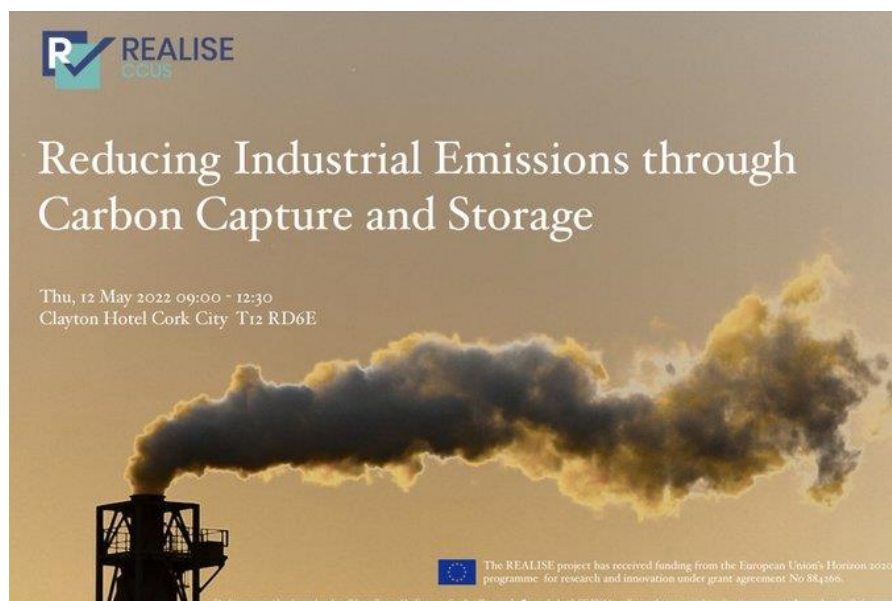
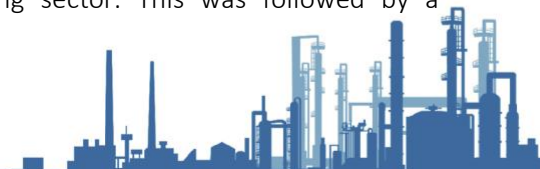


Figure 21: Regional outreach event Cork, Ireland

The Agenda for the event is presented as Table 4 below. The content was at a fairly general level and focusing primarily on the non-technical aspects of the project. It commenced with a talk about the climate challenge and why decarbonisation is required. Next there was a high level introduction to carbon capture and storage. A representative from Concawe then gave the industry perspective on the relevance of carbon capture and storage for the refining sector. This was followed by a



presentation of the REALISE project by the Project coordinator. The next topic was the societal and socio-political context of CCS, which was followed by a presentation from the ICC team on engaging the public on infrastructure

Table 4: Agenda for Cork Regional Outreach Event

Contribution	Speaker and affiliation
Welcome and open remarks	Niall Dunphy, Senior Research Fellow, School of Engineering & Architecture / Environmental Research Institute, UCC, Ireland
Contextualising decarbonisation	Breffní Lennon, Research Fellow, Environmental Research Institute UCC, Ireland
Introduction to Carbon Capture & Storage	Philippa Parmiter, Programme Manager, Scottish Carbon Capture & Storage, UK
Relevance of CCS for refining	Damien Valdenaire, Science Executive for Refinery Technology, Concawe, Belgium
REALISE CCS project	Inna Kim, Senior Research Scientist and REALISE project Coordinator, SINTEF, Norway
Socio-political context	Niall Dunphy, Senior Research Fellow, School of Engineering & Architecture / Environmental Research Institute, UCC, Ireland
Engaging the public on infrastructure	Paola Velasco-Herejón, Postdoctoral Researcher, Environmental Research Institute UCC, Ireland

Feedback

The content was well received, and the participants particularly liked the narrative flow of the talks. The initial presentation on the climate challenge and the need to decarbonise, the introduction to CCS, and its relevance for refining (including especially for the petrochemical sector) set the scene well for the need for the REALISE project. The description of the project in turn brought the discussion to the consideration of the socio-political context and the risks associated with same, and finally the need to meaningfully engage with the public on infrastructure deployment such as CCS.

There was a general receptiveness to carbon capture and storage as a technology, albeit with some safety and environmental reservations. This included an openness to the use of CCS in the refinery sector. Although here, there was a distinction made between refining oil for petrochemicals, which was seen as potentially necessary and refining oil for fuel about which reluctance was expressed. Support for CCS quickly dropped when it was seen as a means of prolonging the use of fossil fuels, highlighting the need to correctly frame discussions on CCS, and to reflect this in the content created and/or curated for the EPE programme.



3.3.1.3 Community engagement

This community workshop took the form of a modified World Café¹⁰ which was held in Cobh, a town on the south side of Great Island in Cork Harbour. The purpose of the workshop was to facilitate a two-way communication with community members on carbon capture and storage, including a hypothetical deployment in the Cork Harbour area – discussing risks, benefits, uncertainties, and mitigation / contingency plans. A secondary objective was to encourage the participants to share their prior EPE experiences. Participants were drawn from the local community and recruited through local advertising (see Appendix 6) and via a community gatekeeper. The group had a good mix of gender and age and was quite diverse in terms of nationality, occupation, etc. which added further depth to the discussions.

This World Café approach *“is based on the premise that engaging small groups in conversation about topics ‘that matter’ will foster collaborative thinking and social learning”* (King 2018, p. 17). It is a form of dialogic inquiry, a participatory research approach based on conversations, where participants are involved in the creation of knowledge through sharing perspectives. We held the workshop in a central location in Cobh – the public library, which offered an excellent meeting space that was warm, bright and inviting. The café was set up in advance, tables and chairs were set up to provide for no more than five participants in each conversation cluster. The World Café approach used in this workshop was modified. It involved both plenary sessions and so-called conversation clusters. The communication style of the plenary sessions was designed to be dialogically divergent while the conversation clusters were deliberately convergent (Faulkner and Bynner 2020).

The workshop commenced with a greeting, introductions and light socialising. Coffee, tea and snacks were provided which helped to establish an atmosphere conducive to conversation. Following this, the REALISE project was introduced and the context of the workshop explained. Two plenary sessions followed introducing concepts and issues around decarbonisation and carbon capture and storage using some of the material outlined in Section 3.2.6. Following these plenary sessions and the brief questioning that followed, the group divided into two conversation clusters. The first cluster was tasked with exploring the advantages and disadvantages of CCS to elicit narratives that may play either



¹⁰ The World Café, is described by Juanita Brown its co-creator as *“an innovative methodology for, collaborative learning, and knowledge creation. It is also an evocative metaphor enabling us to notice the generative power of conversation in human systems at increasing levels of scale”* (Brown, 2001, p. iii)



for or against deployment in the Cork Harbour area. The cluster was provided with an initial set of factors to discuss (and expand upon as they wished) (See Appendix 6), considering whether that were a positive or negative. The second conversation cluster was requested to consider four questions, namely: What is the community's attitude towards new infrastructure projects? What has been your experience of public consultation or information programmes? How would you feel about having a CCS project in this region? What would be the best methods to engage with the public of the Cork Harbour area and provide information about CCS? Each cluster was provided with large sheets of paper and participants were provided with markers and encouraged to document their conversation by writing and drawing key ideas on their sheets. After the last round of conversation, synthesised their findings and presented their insights and discoveries in a whole group conversation. Following the session, participants were requested provide feedback on the information supplied and the way in which it was delivered (see Appendix 7).

Feedback

The first conversation cluster had many interesting points and questions. Overall, participants agreed that CCS would be hugely beneficial, particularly to clean up the air of a refinery, and possibly stabilising reservoirs. However, participants also voiced some negative concerns and questions, particularly linked to environmental and economic distributive factors. For instance, they wondered what the impact of leakages of the environment and the quality of the infrastructure that would be used when scaling up the technology. Other concerns were linked with the possible chemical waste. They wondered if this was going to be disposed of economically and responsibly. And pointed out that the focus should be on the responsible part, which should be prioritise over the economical. One of the major questions raised was who was going to fund CCS projects, if it would be industry or the government and by extension citizens, *'that is very important because people's that are profiting from fossil fuel's lifestyle are enjoying it at the cost of someone else'* stated a participant. *'If it's for the refinery, the refinery should be the one paying for that'* mentioned another. Furthermore, participants in this conversation cluster asked if CCS is a question of life and death? *'we were wondering who gets to make that choice, is it companies, government, and whether the wider people fit into that too'*.

The purpose of the conversation cluster was to share experiences and lessons of public engagement in their context, identify the best methods to engage with the public of the Cork Harbour area, discuss community risks, benefits, uncertainties, and mitigation and contingency plans and consider benefit sharing approaches. The participants saw their community's attitude towards new infrastructure projects being adaptable to change *'we are used to change in the harbour'* mentioned one participant, the inference being that a CCS project would not be a problem. *'There will always be people that are against change'* added another participant, *'people are afraid about what they might find'* and this is why it will be very important to be very honest about the positive and negative impacts of a project. Participant's experience of public consultation is that they are interested in them but are unsure of whether they reach their goals. One participant shared that he is *'indifferent about them. At least here in Cobh we have parents or grandparents that have worked in very dirty industries around the harbour. Our souls sold to the chemical devil'*. He therefore raised the question of whether a consultation for CCS would be needed in the Harbour, *'if it needs to be done, then it needs to be done'*. Given this perspective, he said that a consultation would then only delay a possible project. One important point



to consider however, is who will be benefiting from the project. He also mentioned that, by allowing everyone to share their opinion, a consultation could bring other contentious topics to the table that might not be linked to the project. The attitude of participants in group two towards CCS is that the technology might help, as long as it is not used as ‘greenwashing’ whereby that the technology is used so that the fossil fuel industry continues or even increases their production, reinforcing the message received from the initial outreach event.

3.3.1.4 Conference Engagement

An opportunity arose to engage with decarbonisation social science scholars in the context of the Royal Geographical Society (with IBG) Annual International Conference 2023 held in London, at the end of August. At this conference, the RGS Energy Geographies Research Group (EGRG) hosted a double session on the topic “The emerging geographies of industrial decarbonisation”, in which a paper was presented from the REALISE project¹¹. In these sessions, papers were invited to focus on critically thinking on how to develop better understandings of the importance of place and cognate concepts within industrial decarbonisation contexts, with speakers asked to consider the: spatiality of infrastructure for industrial decarbonisation; place-making effects and politics regarding industrial decarbonisation policies and projects; the entanglement of spatial imaginaries and socio-technical imaginaries; and the (re)-industrialisation of landscapes/seascapes through the deployment of decarbonisation technologies

2.3 Negotiating acceptability with energy publics through education and public engagement, perceptions of risk and reward in energy transitions

Breffni Lennon¹, Niall Dunphy¹

¹ University College Cork

Place, as a defining geographical specificity, plays a central role in the siting of strategic energy infrastructure projects. This is especially true for carbon capture and storage (CCS), and carbon dioxide capture and utilisation (CCU). However, place also plays a critical role in the social dimensions of such activities, contributing to the narratives and negotiations around public acceptability, and by extension public acceptance, of strategic energy transitions infrastructure. CCS and CCU are both increasingly presented as a potential key contributors to decarbonising the industrial sector, and by extension wider climate change mitigation efforts. However, their potential impact remains negligible with public awareness of the associated technologies being relatively low. Where there is awareness, perceptions that the technologies ‘do not work’, a lack of trust in those leading such projects, fear of the risks associated with transport and storage, and concerns of potential environmental damage all inform citizens’ perceptions of these technologies. Interestingly, the refusal (by some) to accept the causes for the ongoing climate crisis has also been seen as a notable barrier informing local attitudes. However, social acceptability of CCS and CCU can be greatly facilitated and encouraged through meaningful and constructive engagements with local citizens. Drawing on ongoing research from the REALISE H2020 project, this paper examines the key role place has for local stakeholders when designing education and public engagement (EPE) programmes and consequently transform often negative perceptions of decarbonisation technologies.

Figure 22: Abstract of Lennon & Dunphy paper delivered at RGS-IGB Annual International Conference 2023

¹¹ Lennon, B. & Dunphy N. P. (2023). Negotiating acceptability with energy publics through education and public engagement, perceptions of risk and reward in energy transitions. *Royal Geographical Society (with IBG) International Conference*, London, UK. 29-Aug to 01-Sep.



The Energy Geographies Research Group (EGRG) has long contributed to furthering knowledge around energy and organisers recognise that the decarbonisation of the industrial sector remains a key societal challenge in the context of climate change. Consequently, it represents an important area of study for energy geographers. The UCC paper contributed to this discussion, speaking to several of the themes mentioned above. After the paper was presented a panel discussion took place between presenters and the audience, with the UCC team contributing to these discussions by focusing on the theme of education and public engagement and the role it can play in terms of industrial decarbonisation.

To stimulate further discussion, the UCC team presented examples of social media messaging in the context of ‘conducting an education and public engagement programme’, with practitioners asked to deliberate on the different styles or approaches of messaging presented. This generated an interesting debate on the rollout of EPE programmes to date and the role deliberative democracy approaches have in framing both perceptions of the EPE programme and in achieving more just outcomes for communities impacted by CCS deployment. Informal discussion continued after the conference sessions, which proved very useful.

Feedback

The importance of knowing your target community was stressed during the discussions. Understanding a community’s socio-political context provides a window into better appreciating their attitudes and motivations which contribute to shaping their perspectives on issues such as deployment of CCS. This type of knowledge is vital for developing communication strategies tailored to the needs and expectations of a focal community.

The issue of transparency was raised by several contributors, along with the potential querying of agendas. A long discussion took place on the danger that the messaging around CCS would be co-opted as a means to prolong oil and gas production. Here we see again the possibility for CCS to be seen as a tool of extending fossil fuel use – even when that is not the case – clarity of messaging is therefore so important.

Others stressed the need to acknowledge the social justice dimension to carbon capture in its implementation and in societal engagement around it. This was considered especially important given the history of energy extraction globally. This discussion allowed us to ‘road test’ some of the justice KPIs developed for this EPE programme.

The discussion also raised the issue of trust, not only in terms of the messaging but also trust in those delivering the message – in this context historical examples of actions taken by the fossil fuel industries, but also the marketing and legal firms they hired, have framed local opinion of what their true agenda might be before people have even experienced the messaging around CCS.



3.3.1.5 Youth Engagement

Building on the outputs arising from the Cobh workshop and the engagement with decarbonisation experts at the RGS-IBG conference in London, UCC hosted a hybrid public outreach event at Mary Immaculate College – University of Limerick. Informed by previous discussions, the objective was to test social media messaging relating to the carbon capture and storage with a cohort of young people, many of whom could be described as digital natives and who are more likely to be consumers of such messaging.

This engagement took place in conjunction with a REALISE public lecture on negotiating public acceptability of carbon capture and storage through education and public engagement. This was delivered as a hybrid event with some 94 in-person and remote attendees.

Following the public lecture, there was a workshop-like session of those attending in-person. The focus of this engaged deliberation was on social media messaging around carbon capture and storage. Several examples of social media messaging from the online platform X (formerly Twitter) were presented to the participants. These examples included posts from government agencies, research institutions and industry bodies. Some were text only, others had graphics, and some include videos. Most were informational but some included call to action – to download a report to visit a website *etc.*

The posts were displayed for the participants with links followed and videos played. Participants were asked to reflect on what they thought of each of the posts, before considering which message they considered to most successfully communicate about carbon capture and storage. Participants used Slido, the polling app, to rank each post according to personal preference.

The post shown in Figure 23 across received the most votes and was considered the most effective presented. Its popularity is perhaps not surprising given that embedded video introducing CCS was visual attractive and quite engaging. We note also the effectiveness of bullet point style of the text in the tweet outlining the UK government's view on the advantages of CCS. This is a visually strong means of displaying a message in short consumable sippets of information. The tongue-in-cheek reference to the CCS link to elephants¹² was a fun way of enticing people to engage with the post and play the video.

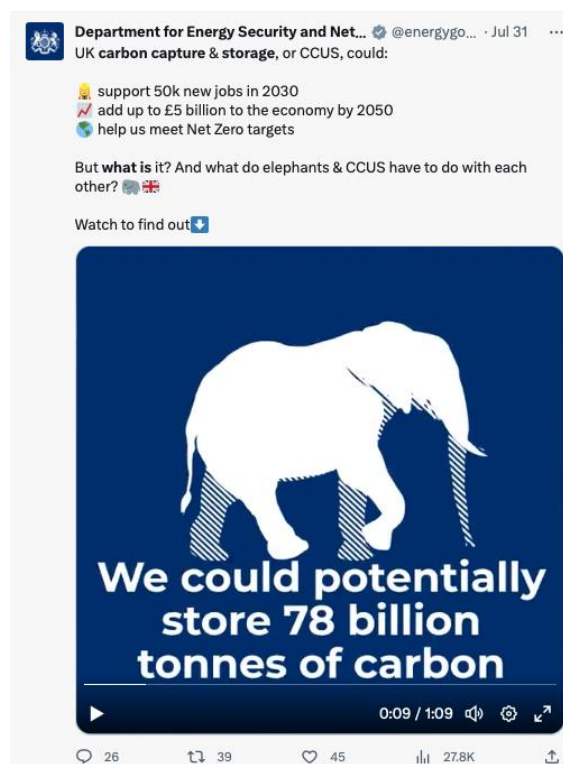


Figure 23: Tweet from UK Department of Energy

¹² the video that the estimated possible UK carbon storage was c. 15 billion elephants equivalent



The second ranked post was one from The Geological Society as shown in Figure 24 across. The infographic is attractive and engaging. It introduces carbon capture and storage in an accessible manner explaining the high-level details. The relevance of CCS to achieving the sustainable development goals (specifically SDG 7, SDG 11 & SDG 14) is also highlighted. The tweet links its content to a governmental commitment to carbon capture immediately marking it as current and making it relevant to prospective readers. The infographic is maybe a little busy, requiring zooming to see details even on a computer. There is no call to action or link for further details, which is a potential missed opportunity.



Figure 24: Tweet from The Geological Society

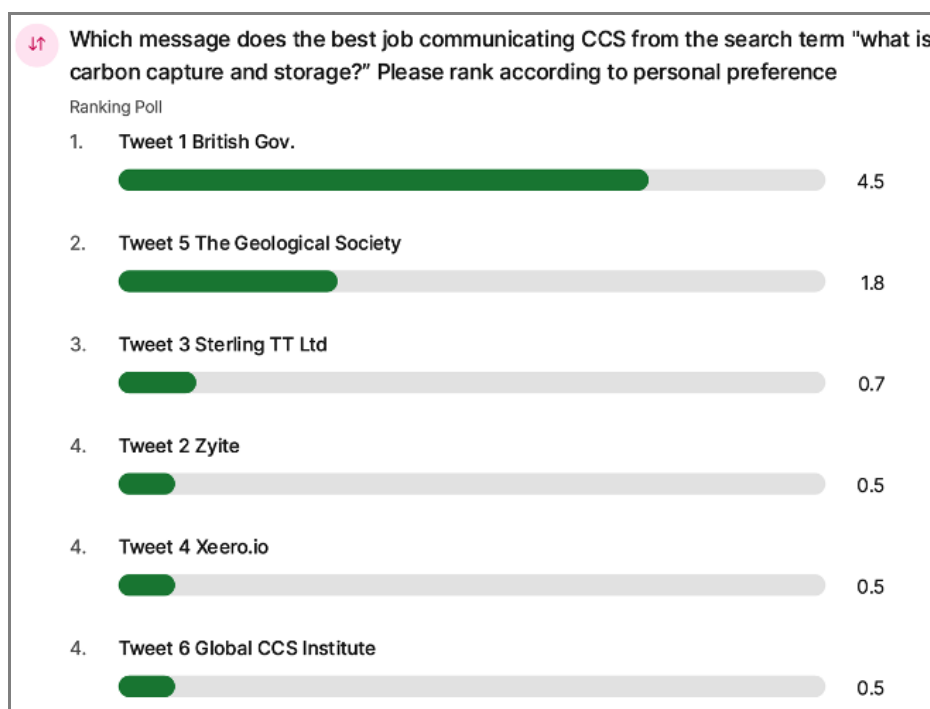


Figure 25: Ranking of top six social media posts from the Limerick youth engagement

Figure 25 above illustrates the ranking of the top six media posts as selected by the participants at the Limerick youth engagement. It is perhaps noteworthy that the top two ranked posts were from government department and a non-for-profit organisation. Indicating that trust in these types of organisations is likely higher than businesses, which rightly or wrongly are seen to have less credibility. There is then a large drop to the posts from organisations that may be perceived to have financial motivations, i.e., tweets from businesses and industry associations (including one that links to newspaper article written by a petroleum engineer).



Figure 26 below shows the next two posts. The first on the left is from Sterling TT Ltd. a manufacturer of heat exchangers – it links to a blog post explaining CCS and outlining the role that their products can play in its realisation. The image used is quite ineffective in communicating the content of the blog; it is a stock image more associated with reducing carbon emissions. A more appealing image or a video would likely have resulted in better engagement. The post displayed on the right of the figure is from Zyite, a retailer of electric bicycles and scooters, it links to a newspaper article¹³ promoting CCS. The message of the tweet is quite direct, and the associated graphic grabs attention and so can be said to be quite effective. Although the non-use of hashtags is likely restricting visibility.

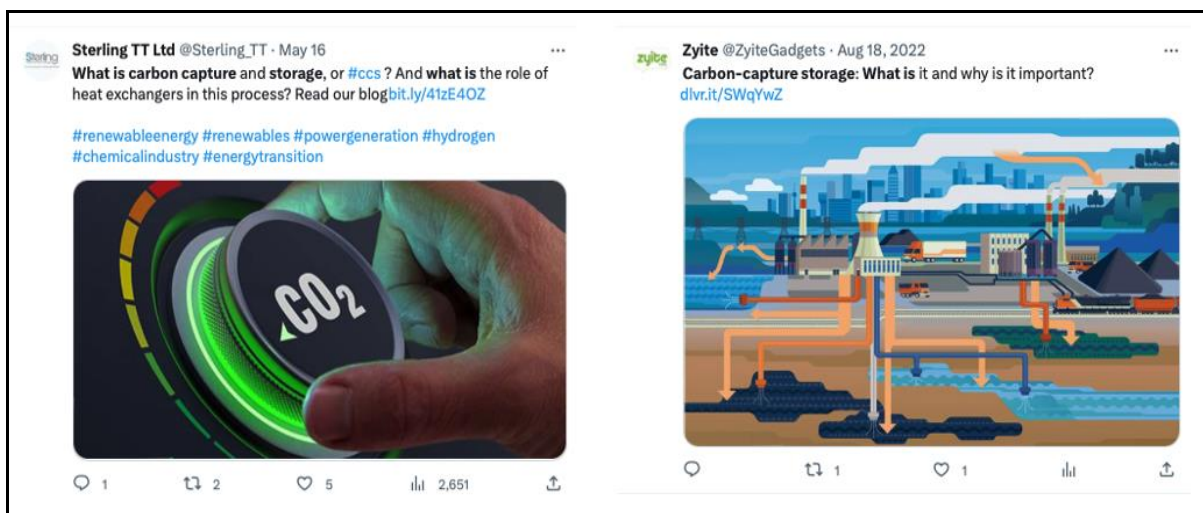


Figure 26: Tweets from Sterling TT Ltd (L) and Zyite (R)

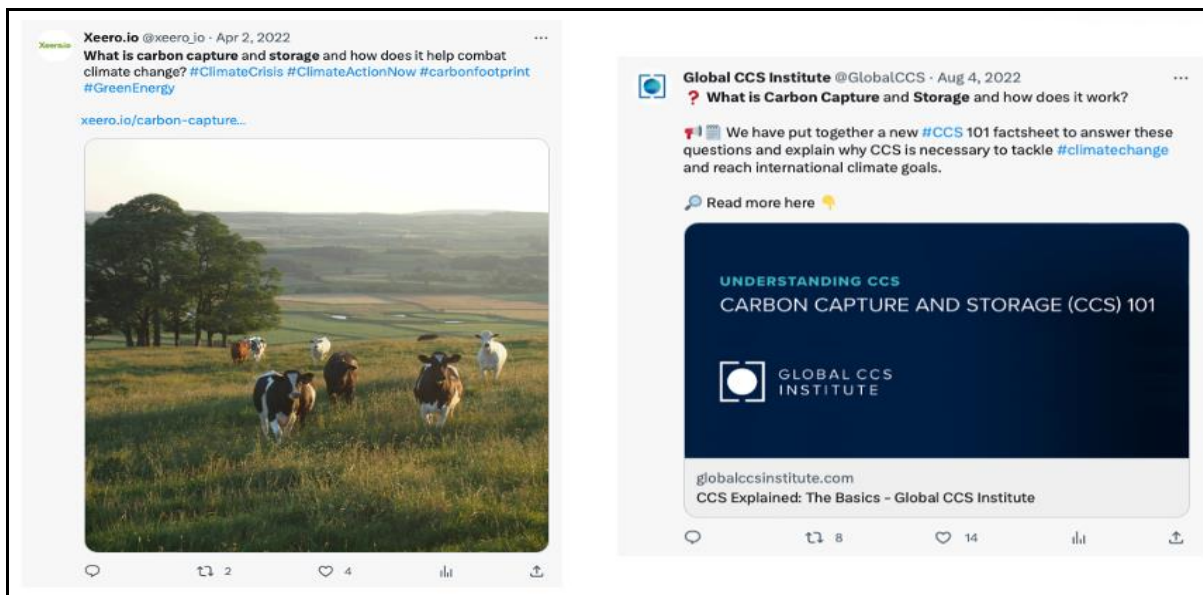


Figure 27: Tweets from Xeero.io (L) and Global CCS Institute (L)

¹³ Sobers, L. (2022). Carbon-capture storage: What is it and why is it important? (Newspaper article). *Trinidad and Tobago Newsday* (18-Aug). <https://newsday.co.tt/2022/08/18/carbon-capture-storage-what-is-it-and-why-is-it-important/>



The image on the left of Figure 27 above shows a social media post from Xeero.io (carbon offset platform) linking to a page on their website portraying carbon capture and storage as a good means of off-setting carbon emissions. The associated image of cattle in a pasture is of little relevance, and might even be seen as misleading. The image on the right is a tweet from the Global CCS Institute, the text and call to action are on message but perhaps a little wordy. The associated image is very corporate looking and not at all inviting¹⁴.

Following on this discussion, participants were presented with an example of social media messaging developed for the REALISE H2020 project, as shown below in Figure 4. Participants were asked to consider this hypothetical post and a discussion on its comparative merits followed.

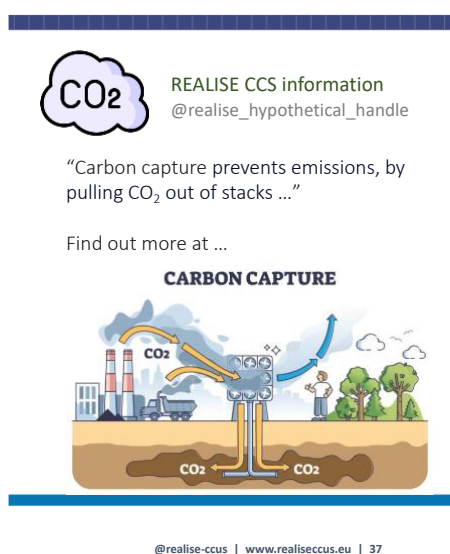


Figure 28: Example social media post presented at the event in Limerick

The objective of this post was to attract attention and direct users to a website for information on CCS. It aims to be accessible to general audience. The participants noted and appreciated the direct language used, comparing it to an advertising slogan. They liked the inclusion of a strong call to action. They also liked the simplicity of the image, noting that it communicated all that it needed to do. Two-thirds of the participants found this approach to the social media post to be more effective than those discussed previously as shown by the poll results below.

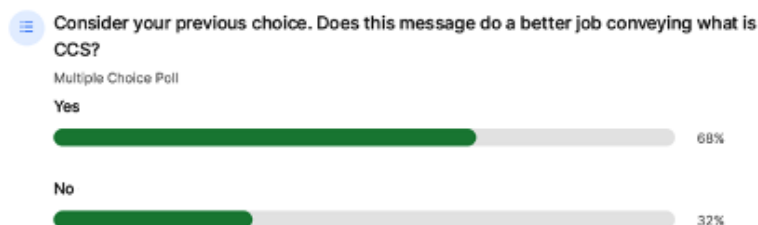


Figure 29: Polling result for which social media messaging participants found most appealing

¹⁴ Indeed participants suggested that it could almost be conceived as doorkeeper guarding the entrance.



4 Justice Key Performance Indicators (KPIs)

The mass deployment of strategic infrastructure associated with decarbonisation, including carbon capture and storage, is dependent on substantial societal buy-in. There needs to be acceptance at different levels – the general public needs to be supportive of, or at least neutral towards, the technologies involved, while prospective host communities need to accept¹⁵ the specific proposals for deployment of these technologies in their midst (Dunphy *et al.*, 2022). However, such buy-in has not always been apparent, as evidenced by the public opposition to many projects, which is seen as an impediment to the ongoing transition (Enevoldsen & Sovacool, 2016). Feelings of unfairness are often key to understanding opposition to the development of infrastructure and the deployment of often novel technologies. Indeed, fairness can almost be said to be a prerequisite for a successful decarbonisation (Dunphy *et al.*, 2023).

There is a perceived social gap between the support for decarbonisation (and especially renewable energy projects) amongst the general population and the local opposition to specific projects (see *e.g.*, Bell *et al.*, 2007). While often attributed to simple NIMBYism¹⁶ (not in my back yard), Lennon *et al.*, (2019) argue that this is an oversimplification (at best) and the reality is far more complex, and that there is no one explanation for opposition. They note “*local people’s relationships with, and perceptions of, the energy system (are) framed by their day-to-day lived experience*” (*ibid.*, p. 14). Understanding local specificities and perspectives and reflecting them in project design and/or implementation is key to the successful realisation of decarbonisation projects (Dunphy *et al.*, 2023).

Drawing from the just transition (see *e.g.*, Newell & Mulvaney 2013) and energy justice literature (see *e.g.*, McCauley & Heffron 2017), fairness or justice in this respect can be seen as having three principal dimensions¹⁷. The first, recognition justice is concerned with the appropriate identification and acknowledgement of stakeholders, ensuring social groups do not feel marginalised (see McCauley *et al.* 2013); the second, procedural justice is focused on decision making, ensuring inclusive, fair and transparent decision-making processes (see *e.g.*, Sovacool & Dworkin 2015); while the third, distributive justice: considers the fairness of how benefits and ills arising from projects are allocated (see *e.g.*, Lee & Byrne 2019). For some communities impacted by existing or previous projects, restorative justice is also important in attempting to addressing past and ongoing harm caused by past decisions (see *e.g.*, Heffron & McCauley 2017).

¹⁵ Moreover as Dunphy *et al.* (2022) suggest “... realizing the necessary infrastructure at scale requires not just ‘social acceptance’ by host communities and society at large, which often implies acceptance of something imposed, a passive acquiescence so to speak. It also, and more importantly requires ‘social acceptability’ of the novel technology and specific proposed deployment projects.” This requires not simply persuading citizens to accept predetermined decisions, but rather to understand perspectives within communities and work to reflect these in the project design. In effect, building acceptability (in so far as possible) into the project.

¹⁶ Such claims of NIMBYism often are linked to calls for majoritarianism holding that popular support should “*overrule the local concerns at project implementation stage.*” (Mullally *et al.*, 2018, p. 75).

¹⁷ A fourth, restorative justice is sometimes included, addressing past and ongoing harm caused by past decisions (see *e.g.*, Heffron & McCauley 2017). The need to reflect it in this work, strongly emerged from our discussions with citizens.



Recognition justice: Discussions of social justice tend to focus on two primary dimensions, namely: who wins and who loses (distributive justice) and claims of unfairness in the process (procedural justice). However, perhaps a more fundamental element of justice is recognition, which can be expressed as cultural domination¹⁸, non-recognition¹⁹, disrespect²⁰. Velasco-Herrejón *et al.* (2022, p. 25) for instance note that “*while theories of distributive justice offer models and procedures by which distribution may be improved, these do not examine the social, cultural, symbolic and institutional conditions underlying unfair distributions and processes in the first place*”. In the context of implementing an education and public engagement programme (around CCS and related projects), the following key performance indicators are suggested.

1. Comprehensive: There is general agreement that stakeholders have been identified. There are no legitimate complaints regarding exclusion and there is no social mobilisation around access to EPE process).
2. Recognition: An appropriate process (*e.g.*, social survey) is undertaken at the commencement of the EPE programmes to develop an understanding of socio-cultural specificities of the community. Reports on stakeholder recognition to be made public within one week.
3. Inclusive: All stakeholders identified in #2 above, who wish to be involved, are engaged through the EPE programme.

Procedural justice: People’s perceptions of fairness are strongly shaped by which decisions are made, who is involved and who has influence (Walker, 2012). Unjust procedures and structures can lead to the dominance of one group resulting in (perceived) injustice. Power dynamics are central to understanding the process of side-lining and exclusion. It is important that an EPE programme is itself implemented fairly but also that it supports procedural justice in the proposed developmental project. In the context, the following key performance indicators are suggested.

1. Responsive: 95% of complaints about EPE process addressed within two weeks, 100% within one month; Complaints process available to all stakeholders.
2. Ethical: 100% of engagements to reflect informed consent processes.
3. Transparent: Report on 90% of engagements published within two weeks, 100% with one month. Reports on stakeholder feedback on decision-making process prepared for developers to be made public within one week.

Distributional justice: The fundamental division with a lot of infrastructure projects, is that while developers and other economic stakeholders will likely gain substantially, there is often little if any net gain for local communities (notwithstanding so-called community benefit schemes). Perceived fairness in the allocation of benefits and ills associated with a project is an important component in its

¹⁸ “... being subjected to patterns of interpretation and communication associated with another culture alien to one’s own.” (Velasco-Herrejón *et al.* 2022, p. 25).

¹⁹ “Being rendered invisible via the authoritative practices of one’s culture” (*ibid.*).

²⁰ “... being depreciated in stereotypic public cultural representations and/or everyday interactions.” (*ibid.*).



acceptability to local populations. In the context of an EPE programme the following KPIs are suggested.

1. Receptive: Mechanism for community stakeholders to provide feedback on distributional justice aspects of proposed project to be put in place within first two weeks of EPE programme.
2. Transparent: Reports on stakeholder feedback on distributional justice process prepared for developers to be made public within two weeks.

Restorative justice: Healy *et al.* (2019) note that this dimension of justice concerns “... a process for resolving crime (or injustices) by focusing on redressing harm done to victims, holding offenders accountable, engaging communities in conflict resolution and reducing future harm through crime prevention.” In the context of an education and public engagement programme, the focus is on ensuring that information on past (perceived) injustices is fed into the decision-making processes in an open and transparent manner

1. Informed: Report on identification of historic decisions that impacted negatively on community to be completed within first month of EPE programme. Report to be made public within one week.
2. Transparent: Proposal for addressing any identified negatively impacting decisions to be made public within the second month of EPE programme.

5 Conclusions

The work reported in this deliverable built on the knowledge developed within Task 4.1 critical review of EPE initiatives; it outlines how one would develop an effective EPE programme that addresses the needs of multiple stakeholders with differing degrees of agency and connection to the prospective development. In consultation with community stakeholders in the Cork case study, the work took an intersectional approach, considering the socio-demographic specificities of the relevant communities, including gender; economic privilege; and life stage.

The report first outlined a methodological approach for the creation of EPE programmes informed by just transition illustrating a variety of EPE activities that are typically employed as part of consultative, collaborative and co-creative public engagement processes. Then, education and public engagement processes frequently adopted by organisations in Ireland were explored in some detail, to finally propose an EPE for REALISE. Key elements of this framework were trialled in local communities to evaluate its effectiveness, identify areas of potential improvement and ascertain its transferability. Finally, to aid in the measurement of such a programme’s success, key performance indicators (KPIs) were presented for each of the three dimensions of justice (distributive, procedural, and recognition justice).



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Appendices



Appendix 1 – Participant briefing document Interviews.



Participant Briefing Document - interviews

Project Overview: REALISE is an ambitious EU Horizon 2020 funded project to support decarbonisation of oil refining through carbon capture, utilisation and storage (CCUS), a critical technology in the net-zero transition. CCUS technology is seen as crucial to decarbonise energy-intensive industries with high levels of emissions, such as refining. According to the International Energy Agency, without CCS the cost of reaching Paris Agreement targets will increase by 40%. An important component of the project is to understand the societal, socio-political and commercial context. As part of this the project is engaging with the public to understand their knowledge about CCUS and their perspectives on its potential use.


Potential involvement: Accordingly, we wish to engage with members of the public about CCS. We will engage with interested participants through interviews.

What does it mean for me?

- Participation is entirely voluntary and nobody 'has to take part' just because they live in a particular community. Participants should be over 18 years of age.
- Contributions will be anonymised.
- Participants retain the right to withdraw at any time in the process.
 - where data can be linked to specific an individual participant, participants can withdraw consent at any time during and up to two weeks after the collection of the data – in which case the material will be deleted.
- Data collected will be used only for this project and follow-on studies. It will be stored securely and not made available to anybody outside of the research team.
- Any physical documents will be stored in locked cabinets in the offices of the research team. The data will be securely stored for a period of ten years before disposal.

Further Information:

 <http://realiseccus.eu>

 @realiseCCUS

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Appendix 2 – Consent Forms Interviews



Consent Form – Interviews

I _____ (Print Name) agree to participate in the REALISE project.

- The purpose and nature of the study have been explained to me in writing
Yes ☐ No ☐
- I confirm that I am over 18 years of age and that I am participating voluntarily
Yes ☐ No ☐
- I understand that I can withdraw from the interview, without repercussions, at any time, and up to two weeks post interview
Yes ☐ No ☐
- I understand that data provided to the project will be treated confidentially and that anonymity will be ensured in the write-up by disguising my identity
Yes ☐ No ☐
- I give permission for my interviews with the researchers to be audio-recorded
Yes ☐ No ☐
- I agree to disguised anonymised extracts from my interview being quoted in any subsequent publications
Yes ☐ No ☐

Signed:

Date:



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Appendix 3 – Interview Guide

Semi-Structured Interview guide

Participant information

1) Can you tell be a little about yourself?

Prompts: Area of residence; Age range; Gender; Occupation

Information about the community

2) What are the people like that live in this area??

Prompts: demographics *e.g.*, population size & shifts, age, ethnicity, employment, income *etc*

3) What are the main businesses that operate in the community?

4) What schools, colleges are there in the community?

5) Is there a strong sense of community?

6) What kind of community groups are active in your area?

7) What are the most pressing issues that your community is currently facing?

Prompt: What does your community need to overcome these issues?

Information and trust

8) What are the main sources of information within the community?

9) Who do the community trust in regard to information about infrastructure projects? Why?

10) Who are seen in the community to be trusted leaders? Why?

Prompts: What type of people?

Knowledge of climate change and related issues

11) What do you understand about the term climate change?

12) How do you feel about Climate change?

Prompts: Do you believe climate change is occurring? What do you think has caused it?
Where did you get information on climate change?

13) Are you aware of technologies that can contribute to minimising climate change?

Prompts: Have you heard of the term Carbon Capture and Storage? What do you understand by it? What are your thoughts on it? (if any)

Knowledge of climate change and related issues

14) What has been your experience of public consultation or information programmes?



Perceptions about CCS

Provide a description of CCS before Asking these questions

CCS Description

Carbon dioxide capture and storage (CCS) is a broad term that encompasses a suite of technologies that together can be used to reduce the carbon dioxide (CO₂) emissions from industrial sources such as power plants; steel, cement and chemical production plants; and oil and gas processing facilities.

These technologies include the capture or separation of carbon dioxide; compression and transportation; and, finally, injection of the carbon dioxide into deep subsurface geological formations, permanently preventing its entry into the atmosphere (storage). CCS technology has been the subject of extensive research and demonstration over the past decade.

The first CCS project of significant scale was the Sleipner project in Norway, which has been injecting 1 million tons of carbon dioxide per year since 1996. Current efforts are focused on scaling-up the technology and integrating it with commercial power plants and other industrial facilities, primarily through government-sponsored demonstration projects.

Policies for environmental regulation of CCS, requirements for CCS at new industrial facilities, and incentives for first- of-a-kind projects have been established in some countries to enable this first wave of demonstrations. Although research to date has been promising, more will be learned about the technology with larger-scale experience gained through demonstrations.

15) If CCS was a viable climate change mitigation option for Ireland, would you be in support of the application of this technology?

If "Yes", Why? If "No", why?

16) How would you feel about having a CCS project in this region?

17) Would you have any concerns about a CCS project in this region?

18) How would you like to access information about these concerns?

19) What do you believe your local community would require for it to support CCS?



Appendix 4 – Participant Briefing Document Workshops.



Participant Briefing Document – Information sessions

Project Overview: REALISE is an ambitious EU Horizon 2020 funded project to support decarbonisation of oil refining through carbon capture, utilisation and storage (CCUS), a critical technology in the net-zero transition. CCUS technology is seen as crucial to decarbonise energy-intensive industries with high levels of emissions, such as refining. According to the International Energy Agency, without CCS the cost of reaching Paris Agreement targets will increase by 40%. An important component of the project is to understand the societal, socio-political and commercial context. As part of this the project is engaging with the public to understand their knowledge about CCUS and their perspectives on its potential use.

Potential involvement: Accordingly, we wish to engage with members of the public about CCS through information sessions.

What does it mean for me?

- Participation is entirely voluntary and nobody 'has to take part' just because they live in a particular community. Participants should be over 18 years of age.
- Contributions will be anonymised.
- Participants retain the right to withdraw at any time in the process. Withdrawal is possible up to when anonymous feedback form is provided researchers. Due to the anonymous nature of this feedback form it will not be able to possibly after this time
- Data collected will be used only for this project and follow-on studies. It will be stored securely and not made available to anybody outside of the research team.
- Any physical documents will be stored in locked cabinets in the offices of the research team. The data will be securely stored for a period of ten years before disposal.

Further Information:

 <http://realiseccus.eu>

 @realiseCCUS

Contacts:

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Appendix 5 – Consent Form Workshops.



Consent Form – Information Session Feedback

I _____ (Print Name) agree to participate in the REALISE project.

- The purpose and nature of the study have been explained to me in writing
Yes ☐ No ☐
- I confirm that I am over 18 years of age and that I am participating voluntarily
Yes ☐ No ☐
- I understand that my feedback on the information session will be anonymous
Yes ☐ No ☐
- I understand that I can withdraw from the study, without repercussions, at any time, up to when I provide my anonymous feedback form to researchers. Due to the anonymous nature of this feedback form, I understand that I will not be able to withdraw after this time
Yes ☐ No ☐
- I understand that data provided to the project will be treated confidentially and that anonymity will be ensured
Yes ☐ No ☐

Signed:

Date:



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Appendix 6 – World Café Workshop



What to do with CO₂?

CARBON CAPTURE AND STORAGE, AND WHAT IT MEANS FOR OUR SHARED FUTURE

**06
DEC**

World cafe workshop
Everyone welcome!

11:00AM – 12:00PM
Cobh Library
Cake and refreshments will be provided



THIS PROJECT HAS RECEIVED FUNDING FROM THE EUROPEAN UNION'S HORIZON 2020 RESEARCH AND INNOVATION PROGRAMME UNDER GRANT AGREEMENT NO 884266



Discussion Items for Conversation Cluster 1

1. **RETROFIT CCS** can be added to existing CO₂ sources, reducing the cost of implementation and the need for materials.
2. **EOR (ENHANCED OIL RECOVERY)** CO₂ injection can increase the lifetime of fossil fuel reservoirs that are running low by increasing the pressure enough to drive out extra reserves.
3. **LESS FREE CO₂**: Atmospheric CO₂ will be reduced.
4. **KEEPS FOSSIL FUELS IN THE PICTURE**: CCS allows fossil fuel reserves to continue to be exploited.
5. **SPACE and MATERIALS**: In comparison to solar or wind energy technologies, the space and materials required to implement CCS are minimal.
6. **ASSOCIATED EMISSIONS**: The CO₂ emissions associated with the separation of CO₂ from combustion waste, transportation and compression at the site, should be considered.
7. **PROVEN CASE STUDIES**: There are numerous long-term case studies proving the success and safety of CCS on a variety of scales and in a variety of locations. As each site is unique proven case studies do not guarantee safety for every project. However it is an indication that if best practice is used CCS can be successful and safe.
8. **STABILISING RESEVOIRS**: When oil or gas is removed from a formation it creates a pressure imbalance due to removal of supporting material. CO₂ injection can help to stabilise this imbalance.
9. **Employment**: CCS implementation creates jobs requiring many different levels and types of skills.
10. **COST**: CCS is currently an expensive practice. Improvements in efficiency of capture and transport technology could reduce this cost.
11. **RESEARCH**: A drive to implement CCS will fund academic research in this field. This will aid the progression of science in this field.
12. **PUBLIC VIEWS**: The public have a poor view of CCS, which is likely to hinder planning applications and funding. This is because of the likely social impact of transportation by tankers and uncertainty surrounding changing underground pressure.
13. **WASTE**: CCS creates chemical waste that must be dealt with responsibly and economically.
14. **SCALE**: CCS is always going to be a risk if implemented on an untested scale or formation.
15. **ENVIRONMENTAL CONCERNS**: There are many concerns with how CCS will impact on the environment. Most are based on leakage scenarios that are unlikely if implementation follows best practices.



Appendix 7 – Feedback form



Information session feedback (please write on back of sheet if you require additional space)

1. The content of the session was useful and interesting

Strongly Disagree

1	2	3	4	5
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 Strongly agree

2. The session was structured and well organised

Strongly Disagree

1	2	3	4	5
---	---	---	---	---

 Strongly agree

3. Have you any suggestions for the organisation of the session

4. What did you think of materials presented?

Strongly Disagree

1	2	3	4	5
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 Strongly agree

5. What additional information on CCS would you like to see provided?

6. Was adequate time provided for questions and discussion?

Strongly Disagree

1	2	3	4	5
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 Strongly agree

7. Have you any other comments?



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