# CCUS Forum WG on public perception of CCUS Working Group Paper

## September 2023

- final version -

This paper is an outcome of the Working Group (WG) on public perception of CCUS, set up by DG ENER in 2023, as a follow-up to the 2022 CCUS Forum[1] and anticipating the development of the EU's strategy, currently announced as the Industrial Carbon Management Strategy (hereafter, the Strategy).

The aim of this WG is to support the European Commission (hereafter, the Commission) by studying and communicating how public perception of and engagement with CCUS emerge, and what role they play in delivering CCUS in the EU. The main objective of this WG is to contribute to the upcoming Commission's Communication on the Strategy, expected by the end of 2023, by providing the Commission with recommendations on accounting for public perception of CCUS in the Strategy.

This paper aims to present the main concepts and the state of knowledge on public perception of $CO_2$ capture, utilisation and storage (CCUS) and technology-based carbon dioxide removals (CDRs) in the EU, by building up on discussions hold during the Working Group meetings and on existing literature.

[1] DG ENER (n.d.). CCUS Forum

# Contents

# 1 The importance of public perception of CCUS

The role of CCUS technologies in climate policy portfolios and emissions reduction scenarios has long been debated and often still is, leading to the slow deployment of the technology and projects. However, framing the technology is essential to understand where it stands in terms of public perception and how to address related concerns.

In this regard, it becomes essential to define the topic and framework of the discussion - CCUS technologies and public perception, engagement and acceptance, respectively - and to outline the reasons for the importance of public perception of CCUS technologies, such as the rationale behind the development of the technology, as well as the concerns related to its deployment, and how the EU is addressing them in its EU regulatory framework for this technologies.

## 1.1 The case for CCUS technologies: motivation and rationale

The use of CCUS technologies dates back to the 1950s when some of these technologies were first introduced to improve oil recovery in the United States of America. But it is only since the 1990s that CCUS technologies became associated with efforts to decarbonize the energy sector, and more recently industry[2], worldwide. In Europe, the first carbon capture and storage (CCS) project - Sleipner $CO_2$ Storage – was implemented in 1996 in Norway[3].

Since the 1990s, CCUS technologies have progressively gained international attention. In 2008, the G8 committed to deploying 20 large-scale CCS projects globally, and two years later, negotiators at the 16th Conference of Parties (COP16) recognised CCS as an eligible project activity under the Clean Development Mechanism (CDM) and thus as a climate mitigation tool.

However, in spite of this international recognition, the implementation of CCUS projects to date has been slow for many reasons. Due to the relative lack of support under the CDM, as well as low and unstable carbon prices in geographies such as the EU, there has been a lack of investment in CCUS deployment. Generally, these shortcomings have not been adequately addressed by national funding programmes or policies to incentivise CCUS[4].

Currently, key organisations, such as the Intergovernmental Panel on Climate Change (IPCC) and the International Energy Agency (IEA), have recognised CCUS technologies as being necessary for climate mitigation in different degrees in a wide range of scenarios to achieve net-zero emissions[5].

CCUS technologies also have the potential to contribute to a just transition, which the EU defines as a transition to climate neutrality which leaves no one behind[6]. CCUS technologies can help create opportunities and potentially prevent the negative social impacts of the transition to a climate-neutral economy, for instance by offering employment to workers from the oil and gas sector due to the

[2] Ma, Ji. Li. L., Wang. H., Du. Y., Ma, Ju., Zhang, X., Wang, Z. (2022). Carbon Capture and Storage: History and the Road Ahead.

[3] Global CCS Institute (2022). Global status of CCS 2022

[4] Marcu, A., Zakkour, P., and Zaman, P. (2021). Scaling up and trading CO2 storage units (CSUs) under Article 6 of the Paris Agreement

[5] For more information, please consult the IPCC's Sixth Assessment Report (AR6), Working Group III, and the IEA's Net Zero by 2050 Report

[6] European Commission (n.d.). The Just Transition Mechanism: making sure no one is left behind

similarity in required competencies between this sector and CCUS project implementation and management.[7]

## 1.2 Scope of the paper and definitions

The definition of CCS used in this paper follows that of the $CO_2$ Storage Directive (2009/31/EC) in its preamble. The Directive defines CCS as consisting of "the capture of carbon dioxide ($CO_2$) from industrial installations, its transport to a storage site and its injection into a suitable underground geological formation for the purposes of permanent storage".

Next to CCS, $CO_2$ capture and utilisation (CCU) is also a technology that falls within the scope of this paper. A comprehensive definition of CCU does not yet exist in the EU legislative framework, as different uses of $CO_2$ are regulated individually[8]. This paper uses the IPCC definition of CCU, namely that CCU is a "process in which carbon dioxide ($CO_2$) is captured and the carbon then used in a product"[9]. This broad definition covers a variety of CCU applications with different implications regarding their climate impact.

Finally, technology-based carbon dioxide removals (CDRs) are also considered under the scope of this paper as they are based on CCUS technologies. The main examples of CDRs are direct air carbon capture and storage (DACCS) and bioenergy with carbon capture and storage (BECCS), among others. An EU-level definition has not yet been adopted[10]. The definition used in this paper is that of the IPCC, which defines carbon dioxide removals as "anthropogenic activities removing carbon dioxide ($CO_2$) from the atmosphere and durably storing it in geological, terrestrial, or ocean reservoirs, or in products"[11].

CCS, CCU and CDRs rely at least partly on the same process chain, which can be split into three main stages: (1) capture and, if necessary, preparation; (2) transport; and (3) storage or utilization of $CO_2$. Each process chain component can use different technologies or solutions (e.g., $CO_2$ transport can be done by pipeline, road, rail, or maritime modes)[12].

The terminology used in this paper is aligned with that currently used by the Commission. Therefore, the term "CCUS" and "CCUS technologies" will be used to encompass all applications of $CO_2$ capture, utilisation and storage technologies, including technology-based CDRs, along the entire process chain, unless otherwise specified, and irrespective of their contribution to climate change mitigation. As the

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7 Bell, R., and Parmiter, P. (2020). The role of CCUS in a just transition. 3rd report of the Thematic Working Group on Policy, regulation and public perception

8 The three most common CCU pathways are (1) combining captured CO2 with renewable hydrogen to make renewable fuels of non-biological origin (RFNBOs); (2) using captured CO2 as a feedstock to replace fossil resources for chemicals production; and (3) storing CO2 in construction products, notably via mineral carbonation. CCU pathways have different climate impacts according to the way CO2 is utilised

9 IPCC (2022). Sixth Assessment Report (AR6), Working Group III. Annex I: Glossary. Page 1796

10 In Article 2 of the Commission's proposal for a Regulation establishing a Union certification framework for carbon removals (COM2022 672 final - 2022/0394 (COD)), carbon removal is defined as "the storage of atmospheric or biogenic carbon within geological carbon pools, biogenic carbon pools, long-lasting products and materials, and the marine environment, or the reduction of carbon release from a biogenic carbon pool to the atmosphere". The proposal has not yet been adopted. The text is available at https://climate.ec.europa.eu/document/fad4a049-ff98-476f-b626-b46c6afdded3_en

11 IPCC (2022). Sixth Assessment Report (AR6), Working Group III. Annex I: Glossary. Page 1796

12 For more details refer to the issue paper of WG 1 on CO2 infrastructure entitled ' Vision for Carbon Capture, Utilisation and Storage in the EU'. It is available on the Commission's website at CCUS Forum

focus is on public perception, such analysis is out of the scope of this paper[13]. Furthermore, a technology-neutral approach is adopted, with no intention to advocate for the implementation of specific CCUS pathways, technologies, or applications.

This paper also frequently uses the terms public perception, public engagement and public acceptance. Firstly, the word "public" is used in this paper to refer to all CCUS stakeholders including citizens, policymakers, NGOs, technology providers, project developers, and others. Where findings refer specifically to certain stakeholders, this is specified. Secondly, public perception of CCUS technologies refers to the beliefs and opinions about CCUS technologies that exist among stakeholders. Thirdly, public engagement with CCUS technologies refers to the involvement of stakeholders in activities relevant to CCUS, such as policymaking or project development. This ranges from sharing information to participatory decision-making. Finally, public acceptance of CCUS technologies refers to the degree to which the public accepts CCUS technologies and can occur at different levels (as shown in Chapter 3).

This paper broadly explores public perception of and engagement with CCUS technologies. The goal is to provide insights into the complexities of public perception of and engagement with CCUS, by focusing on how public perception is formed and why it is important for CCUS technologies.

## 1.3 Why does CCUS need public perception and engagement?

CCUS technologies are being progressively included in EU and global climate policies and have the potential to play an important role in the transition to climate neutrality. This already calls for informing and engaging all stakeholders – citizens, businesses, institutions and organisations – during the policymaking and project implementation processes. In addition, there are several specific reasons for incorporating public perception and engagement into CCUS deployment.

Firstly, despite the international recognition of CCUS as a climate mitigation tool, there are concerns that its deployment may undermine efforts to implement other emissions reduction measures. At the same time, in the EU, there is a wide variation between the Member States in terms of the political attitude towards CCUS. For example, the Netherlands and Denmark are leaders in commercial-scale CCUS projects, while other countries, including Germany and Poland, currently have a ban on onshore $CO_2$ storage.

Furthermore, CCUS is rarely included in a meaningful way in national climate neutrality strategies, making it difficult to clearly ascertain how CCUS will be used as part of a portfolio of climate mitigation measures. The strategic approach to CCUS is also fragmented - for example, while some Member States include CCS and/or CCU in their national energy and climate plans (NECPs)[14], CDRs are usually included in national long-term strategies submitted to the UNFCCC and are governed by a variety of policies[15], with little room for public engagement[16]. These differences result in a fragmented political

[13] For more details, refer to the issue paper of WG 1 on CO2 infrastructure, entitled ' Vision for Carbon Capture, Utilisation and Storage in the EU', and the issue paper of WG 2, entitled 'Vision for Carbon Capture, Transport and Storage in the EU'. They are available on the Commission's website at CCUS Forum

[14] Wettengel, J. (17 Januart 2023). "Quest for climate neutrality puts CCS back on the table in Germany"

[15] As an exception, Germany is the only EU country to have concrete plans to develop a dedicated CDR strategy. Ibid

[16] Meyer-Ohlendorf, N., and Spasova, D. (01 September 2022). Carbon Dioxide Removals in EU Member States. National frameworks for Carbon Dioxide Removals: State of play and how to improve it

signal and a potentially incoherent image of CCUS technologies, which could result in vacillating public perceptions and opinions (see Chapter 3).

Secondly, CCUS technologies are seen by some as presenting well-known and researched risks in the area of environmental and health safety, such as $CO_2$ leakage from storage sites. Standardised risk management procedures are being developed reflecting the current state of implementation. Moreover, additional perceived risks will influence public perception, alongside the capital intensity and high cost of CCUS projects, which means that these projects require public funding to be deployed, in most cases.

The need for public funding, as well as the fact that CCUS projects are large infrastructure projects, means that their implementation requires good governance and involvement of the public, particularly local communities affected by actual construction and deployment.

Public perception can also be significantly affected by proximity to projects. This is sometimes discussed as the so-called "not under my backyard" (NUMBY) effect, which is manifested when local communities or individuals oppose the development of projects close to their homes. For these reasons, appropriate consideration of public perception and efforts for engaging the public are key components of both the policymaking and project deployment processes for CCUS. Such siting decisions require interaction with affected local communities, as they raise questions about the distribution of benefits and burdens within societies, as well as risk and safety measures.

Finally, learnings from efforts to deploy other technologies further evidence the importance of considering public perception when deploying CCUS. Other approaches and technologies, including nuclear power, large hydropower projects, transmission lines, and environmental product markets, have been impacted by various concerns from the public. However, in many cases, these concerns changed due to exogenous effects, for example, the recent shift in public perception on nuclear power in the EU, which moved from a risk-based framework to an economic-based framework related to the energy crisis[17]. It is therefore important to take into account the impact of these exogenous effects on public perception, which can change perceptions of CCUS technologies, sometimes drastically, based on which issues become more relevant.

## 1.4 How current EU policies and regulations on CCUS approach public perception and engagement

The EU has a number of policies and regulations relevant to CCUS, as well as a number of recently launched regulatory initiatives and consultation processes (such as the proposal for a Net Zero Industry Act, the carbon removal certification framework (CRCF), as well as the CCUS Forum and its WGs). These demonstrate an increased interest in CCUS on the part of the EU institutions and will invariably influence public perception by signalling the political will to deploy these technologies.

However, CCUS-related policies and frameworks at the EU level mostly limit themselves to highlighting the importance of public perception and engagement in CCUS project implementation, leaving it up to the Member States to specify how this engagement should be operationalised. Examples are provided by both the $CO_2$ Storage Directive and the CRCF. The former recommends efforts on CCS demonstration projects which include, *inter alia*, a legal framework for public awareness measures, and

[17] Fondation Robert Schuman (27 March 2023). A return to grace for nuclear power in European public opinion? Some elements of a rapid paradigm shift

states that environmental information relating to $CO_2$ storage should be made publicly accessible. The latter references the Aarhus Convention (Regulation (EC) No 1367/2006), which obligates the Member States and the EU to guarantee public access to information by establishing rights for the public and imposing obligations on public authorities[18]. However, the CRCF proposal does not specify how the provisions of this Convention should be considered regarding CDRs.

[18] European Commission (n.d.). The Aarhus Convention and the EU

# 2 What influences public perception of CCUS?

Public awareness of CCUS technologies has historically been low across European countries, and this is still the case today.[19,20,21] This lack of awareness and knowledge is found among citizens, but also in institutions, organizations and policymakers.[22] At the same time, research has examined the perceptions of citizens more often than those of other groups. Studies have also identified some variations, indicating that awareness and knowledge tend to be higher in some countries that are more actively involved in CCUS technologies, such as Norway.[23] Overall, this means that current perceptions of CCUS technologies are still emerging which means they are subject to change.

In terms of public perception, earlier studies have documented scepticism, particularly towards $CO_2$ storage, for example around unsuccessful projects in the Netherlands, Poland or Germany. [24] More recent studies, partly from the same countries, suggest a neutral or slightly positive public perception of CCUS technologies.[25][26][27] After a decline, more large-scale CCS projects are currently announced a decade ago,[28] and the debate on the role of CCUS in climate change mitigation has shifted to focus more on industrial emissions rather than those from coal-fired power generation. However, it is not yet possible to draw conclusions on the extent to which this different context has influenced the changes in perceptions observed in the studies. Furthermore, it is important to note that since the 2011 Eurobarometer survey[29], there has been no study on public perceptions of CCUS technologies covering all EU Member States.

Perceptions of CCUS technologies vary due to a number of factors, including the geographical and political context, existing levels of acceptance, the specific application or pathway being investigated, and the effectiveness of communication and participation activities.

## 2.1 Acceptance dimensions: perceptions in a multi-actor system

When looking at perceptions through the lens of social acceptance, it is helpful to distinguish between three dimensions. Socio-political acceptance refers to the general social climate towards a technology or innovation within a society (see Figure 1), i.e. it refers to typical discussions about an issue or socially

[19] European Commission (2011). Special Eurobarometer 364. Public Awareness and Acceptance of CO2 capture and storage

[20] Whitmarsh, L.; Xenias, D.; Jones, C.R. (2019): Framing effects on public support for carbon capture and storage

[21] Dütschke, E.; Alsheimer, S.; Bertoldo, R.; Ataberk, B.; Delicado, A.; Gonçalves, L. et al. (2022): Community Acceptance. Findings from community profiles and first local survey

[22] Karimi, F.; Komendantova, N. (2017): Understanding experts' views and risk perceptions on carbon capture and storage in three European countries

[23] Whitmarsh, L.; Xenias, D.; Jones, C.R. (2019): Framing effects on public support for carbon capture and storage

[24] Oltra, C.; Upham, P.; Riesch, H.; et al. (2012): Public Responses to CO2 Storage Sites: Lessons from Five European Cases

[25] Whitmarsh, L.; Xenias, D.; Jones, C.R. (2019): Framing effects on public support for carbon capture and storage.

[26] BVEG (2023): Das denkt Deutschland über die Gas- und Ölförderung im eigenen Land

[27] Oltra, C.; Dütschke, E.; Preuß, S.; Gonçalves, L.; Germán, S. (2022): What influences public attitudes and acceptance of CCUS technologies on the national and regional level? Results from a survey study in France and Spain

[28] e.g. Global CCS Institute: 3. Global Status of CCS

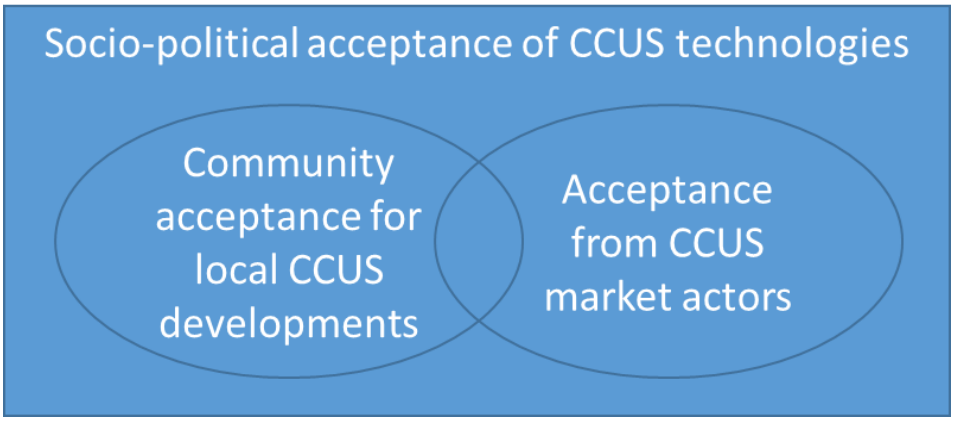
[29] European Commission (2011). Special Eurobarometer 364. Public Awareness and Acceptance of CO2 capture and storage

desirable opinions. Socio-political acceptance provides the general background against which perception develops and is shaped by opinion leaders and the media on the one hand, and by policy makers on the other. As mentioned above, surveys can provide a good image of the current state of socio-political acceptance.The second dimension, community acceptance, is relevant when it comes to siting decisions and refers to the attitudes and behaviours of those residing or conducting activity close to an installation, or others who are somehow affected by an innovation or technology without actually using it. Finally, the third dimension refers to market acceptance: the adoption of a technology by actors in the relevant market, i.e. investors, supply and demand side as well as intermediaries such as installers, consultants, etc. In the case of CCUS, these market actors include, for example, energy-intensive industries as $CO_2$ sources, operators of $CO_2$ transport systems and, on the demand side, $CO_2$ users or storage site operators. It is important to note that all of these actors play a role in the overall system, e.g. because new developments may change their business models or affect their operations. All of these actors are needed to some extent for the emergence of a functioning system. Socio-political acceptance interacts with community and market acceptance, which also overlap - however, these three dimensions of acceptance are also partly independent of each other. Differentiating these dimensions can contribute to more clarity in further analysing perceptions of CCUS and developing the societal debate around these technologies.

This differentiation also points to the different scales of discussions around perceptions and acceptance, i.e. the different political levels (socio-political acceptance) and the local project level, connected by the market level. A variation of this approach has also been applied recently: for example, the GEFISS[30] project uses a similar conceptualisation, distinguishing technology legitimacy (socio-political level) and the quality of deployment (local level).

[30] The aim of the GEFISS research and development project is to build a foundation of knowledge on social governance in the field of subsurface engineering in the context of the energy transition. It is implemented by a multidisciplinary team, funded by a public and private institutions from France. https://www.gefiss.eu/en

**Figure 1: Dimensions of acceptance for CCUS (based on Wüstenhagen 2007[31])**




## 2.2 Differences across Europe

European countries have adopted different policy approaches to climate change mitigation, and within that foresee different roles for CCUS technologies, as mentioned in Chapter 1. [32,33,34] These can be interpreted as manifestations of socio-political acceptance, or more specifically political support for CCUS technologies. Countries mainly in the Northern part of Europe, in particular, Norway and more recently Denmark, but also the UK and the Netherlands, have made significant steps towards implementing CCUS technologies. The technical potential for $CO_2$ storage in these countries may have expedited the development of CCUS projects. Additionally, the presence of traditionally higher levels of trust in government and public institutions[35] could have played a role in facilitating the coordination of citizens and stakeholders in Scandinavian countries for the successful implementation of typically complex CCUS projects. Countries such as France, Portugal, Greece, Italy and Spain are involved in CCUS technologies, largely through EU-funded projects and with different levels of (financial) commitment, while the policy frameworks are not fully developed. In central Europe, Germany has not been very active in developing CCUS, despite high industrial emissions, and is only now re-opening the political debate on this topic. Central and Eastern European (CEE) countries generally show a lack of knowledge and awareness about CCUS among the public and stakeholders. In addition, attitudes towards climate change mitigation are less favourable in some CEE countries compared to the rest of the EU, and CCUS development is very slow. However, some project-based activities such as CCS4CEE or StrategyCCUS are trying to ignite the societal debate around CCUS in CEE countries.

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31 Wüstenhagen, R.; Wolsink, M.; Bürer, M.J. (2007): Social acceptance of renewable energy innovation. An introduction to the concept

32 Rütters, H.; Hladik, V.; Koteras, A.; Schmidt-Hattenberger, C.; Tveranger, J,; Vincent, C.; Wheeler, W.H. (2021): State-of-play on CO2 geological storage in 32 European countries - an update

33 Miu, L.; Nazare, D.; Catuti, M.; Postoiu, C.; Dudau, R. (2021) Assessment of current state, past experiences and potential for CCS deployment in the CEE region. Current context and opportunities for CCU and CCS in Central and Eastern Europe

34 Duscha, V. (2022) Regulatory framework for CCUS in the EU and its Member States. An analysis for the EU, six Member States and the UK

35 See analysis of trust in institutions such as by the EU or the OECD

## 2.3 Perceptions of different CCUS technologies

Research and past experiences have revealed variations in the support for and opposition to CCUS technologies depending on the specific application case, i.e. where the $CO_2$ is captured from, or whether and where it is stored and used. It is important to note that this section refers to findings from research and is not intended to qualify different CCUS pathways or technologies as more or less preferable. Instead, it should be understood as a summary of the current knowledge on tendencies in public perceptions and point to the need to increase societal awareness and public debate.

Looking more specifically at CCS, studies have found that storage of $CO_2$ from energy-intensive industries or in conjunction with biomass tends to be viewed more positively compared to the storage of captured $CO_2$ from coal-fired power generation. Positive perceptions of industrial CCS were found to be linked to the perceived significance of the industry for a country's welfare.[36] Other studies found that scenarios involving the use of captured $CO_2$ (CCU) tend to be viewed more positively than storage scenarios (CCS).[37,3839]This difference may be attributed to the fact that discussions and negative perceptions surrounding CCUS have predominantly centered around storage sites, while CCU has received comparatively less scrutiny. Perceptions regarding storage may be influenced by a lack of general familiarity with the subsurface and its characteristics, as well as its potential for exploitation and associated risks, which may potentially contribute to more negative attitudes. These tendencies need to be contextualised in the current low levels of knowledge and awareness of CCUS; how discussions on the climate mitigation impact of CCUS pathways will affect public perception remains an open question.

Research around other CCUS components and application pathways is less extensive. The perception of CCUS transport options have rarely been analysed, and public perception of CDR technologies, such as DACCS and BECCS, has been less researched.[40] Some studies show that typically, nature-based solutions such as reforestation and afforestation are favoured by citizens over more technology-based solutions such as direct air capture.[41,42] This perception is also shared by some societal groups such as NGOs.[43]

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[36] Dütschke, E.; Wohlfarth, K.; Höller, S.; Viebahn, P.; Schumann, D.; Pietzner, K. (2016): Differences in the public perception of CCS in Germany depending on CO 2 source, transport option and storage location

[37] Linzenich, A.; Arning, K.; Offermann-van Heek, J.; Ziefle, M. (2019): Uncovering attitudes towards carbon capture storage and utilization technologies in Germany. Insights into affective-cognitive evaluations of benefits and risks

[38] Oltra, C.; Dütschke, E.; Preuß, S.; Gonçalves, L.; Germán, S. (2022): What influences public attitudes and acceptance of CCUS technologies on the national and regional level? Results from a survey study in France and Spain

[39] Whitmarsh, L.; Xenias, D.; Jones, C.R. (2019): Framing effects on public support for carbon capture and storage

[40] Smith, S. M.; Geden, O.; Nemet, G. F.; Gidden, M. J.; Lamb, W. F.; Powis, C. et al. (2023): The State of Carbon Dioxide Removal - 1st Edition. The State of Carbon Dioxide Removal

[41] Jobin, M.; Siegrist, M.(2020): Support for the Deployment of Climate Engineering: A Comparison of Ten Different Technologies.

[42] Bertram, C.; Merk, C. (2020): Public Perceptions of Ocean-Based Carbon Dioxide Removal: The Nature-Engineering Divide?

[43] https://www.negemproject.eu/wp-content/uploads/2022/06/NEGEM_D5.2_Stakeholder-views-on-the-business-case-for-NETPs.pdf
https://www.negemproject.eu/wp-content/uploads/2021/12/D-5.1-NETP-analogues-and-Social-License-to-Operate.pdf

In relation to $CO_2$ storage, recent research indicates a range of opinions on potential storage areas, encompassing scepticism as well as stated support.[44] Furthermore, the same studies do not show clear preferences for certain $CO_2$ storage locations, e.g. onshore or offshore. While onshore storage is usually nearer to inhabited areas, which is a possible source of concern, offshore storage is sometimes perceived as a threat to fishing, tourism or marine or coastal habitats. This shows that perceptions of CCUS need to be seen in the local and wider contexts of how CCUS technologies are used, and to what end; it also highlights the influence of local context and circumstances on perceptions of the technology. For example, in Denmark, the rapid progress in $CO_2$ storage for imported emissions has been attributed to a narrative of solidarity with other nations. Conversely, although perceptions of CCUS technologies have traditionally been positive in Norway, a recent study finds that these perceptions may be less positive when it comes to imported $CO_2$.[45]

Overall, perceptions of CCUS technologies are influenced by various factors, and understanding these nuances is crucial in shaping effective strategies for public engagement. While several current projects include research into perceptions and acceptance, European-wide studies and up-to-date comparisons of different CCUS application scenarios are missing.

## 2.4 The role of local engagement and participation (project level)

A variety of factors influence perceptions of CCUS projects on the local level (cf. Figure 2). It is important to note that the influence of these factors is not linear or simple, e.g. similar community characteristics, such as familiarity with underground activities like mining or fossil fuel extraction, can have a positive or a negative influence on attitudes towards $CO_2$ storage, depending on the specific local history and narratives including past incidents and their handling. Therefore, recent research, e.g. the GEFISS project, recommends an analysis of the local context for a planned CCUS project early on.[46] Similarly, engagement and participation processes are key factors and can take a variety of forms from providing information to local audiences to including them in the decision-making or providing financial compensation. What is most appropriate depends again on the project and the local context, including existing practices. Based on a broad review[47], other authors point out that factors such as (i) feeling heard by the government and playing a role in the decision-making process and (ii) having a positive established relationship with industry contribute to a more favourable perception of the engagement process. These aspects are further detailed in Chapter 3.

Overall, this implies that local perceptions are influenced by multiple actors, and only some of the factors influencing public perception of CCUS are in the hands of project developers (e.g. project characteristics and the engagement process). Others, such as the socio-political context, are shaped by actors outside the project context, such as national governments or media.

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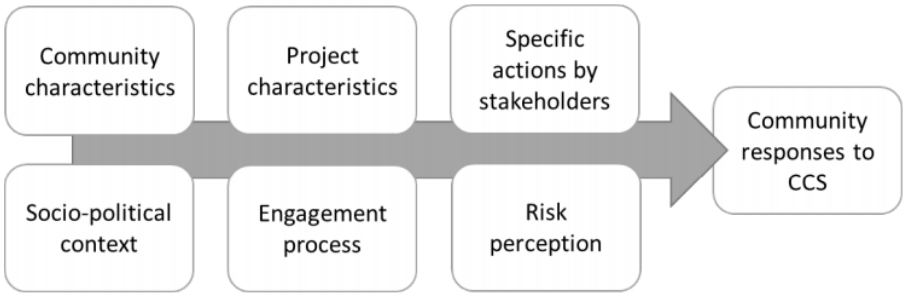
[44] Dütschke, E.; Alsheimer, S.; Bertoldo, R.; Ataberk, B.; Delicado, A.; Gonçalves, L. et al. (2022): Community Acceptance. Findings from community profiles and first local survey

[45] Merk, C.; Nordø, Å.D.; Andersen, G.; Lægreid, O.M.; Tvinnereim, E. (2022): Don't send us your waste gases: Public attitudes toward international carbon dioxide transportation and storage in Europe

[46] https://www.gefiss.eu/en/en/

[47] Rothkirch, J. von; Ejderyan, O. (2021): Anticipating the social fit of CCS projects by looking at place factors

**Figure 2: Factors influencing community responses from CCS (from Oltra et al., 2012[48])**




In summary, the existing knowledge on CCUS technology perceptions indicates that the broader societal discussion, particularly among citizens, is still at an early stage across Europe. Oftentimes, most research covers countries more advanced in the deployment of CCUS technologies, with little knowledge being produced for countries where CCUS deployment is less advanced. Due to the overall limited level of public awareness of CCUS, perceptions of these technologies are likely to be subject to change once the debate progresses and should be monitored by future research.

[48] Oltra, C.; Upham, P.; Riesch, H.; et al. (2012): Public Responses to CO2 Storage Sites: Lessons from Five European Cases

# 3 The who and how of public perception

Communication about CCUS is an important factor in shaping public perception,[49] particularly given that the public has relatively low awareness of these technologies[50,51] and as a result has vacillating opinions which are easily and heavily influenced by new information.[52,53] Alongside the message being shared, the conveyor of CCUS communication (the communication source), as well as the way the communication is distributed (the method and channel of communication[54]), will in turn influence the perception of CCUS of the target audience. For instance, it is likely that a CCS storage operator will generate a different perception of the risks of a CCUS project than a representative of a local community. Trust in the communication source also influences opinions, with distrust of the source being associated with more negative perceptions of these technologies.[55]

Any communication about CCUS needs to adopt the dual role of familiarizing audiences with CCUS, by providing information on which they can formulate an opinion,[56] and of ensuring open and transparent dialogue between the public and entities implementing CCUS (such as project developers), tackling not just the risks of deploying a CCUS project but also those of not deploying it. Research on public perception of CCUS and stakeholders' inputs on the WG Public Perception both highlight the complexity of the relationship between CCUS communication and public perception.[57] This chapter briefly outlines the role of CCUS communicators and of methods and channels of communication in formulating perceptions of these technologies.

## 3.1 Communicators and communication methods

The influence of the communicator and the communication method on public perception of technologies has been observed for instance for renewable energy,[58,59] nuclear energy,[60] and more generally on climate change[61]. In addition, the public perception of lesser-known technologies, such

[49] Boyd, A., 2017. Communicating about Carbon Capture and Storage

[50] Daly, D., Wade, S., 2013. Message Mapping for CCUS Outreach: Testing Communications Through Focus Group Discussion

[51] Dütschke, E., Duscha, V., 2022. Is there a future for CCUS in Europe? An analysis of the policy framework and societal support

[52] Pietzner, K. et al., 2011. Public awareness and perceptions of carbon dioxide capture and storage (CCS): Insights from surveys administered to representative samples in six European countries

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[54] Wright, S., Neimand, A., Steinman, M., 2021. Finding the Right Messenger for Your Message

[55] Broecks, K. et al., 2021. How do people perceive carbon capture and storage for industrial processes? Examining factors underlying public opinion in the Netherlands and the United Kingdom (universiteitleiden.nl)

[56] Daly, D., Wade, S., 2013. Message Mapping for CCUS Outreach: Testing Communications Through Focus Group Discussion

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[58] Zhou, J., 2022. Whose policy is it anyway? Public support for clean energy policy depends on the message and the messenger

[59] Peterson, T.R., Stephens, J.C., Wilson, E.J., 2015. Public perception of and engagement with emerging low-carbon energy technologies: A literature review

[60] Bearth, A., Siegrist, M., 2021. The Social Amplification of Risk Framework: A Normative Perspective on Trust?

[61] Bolsen, T., Palm, R., Kingsland, J., 2019. The Impact of Message Source on the Effectiveness of Communications About Climate Change

as solar geoengineering, is likely to be highly influenced by how messages around these technologies are framed.[62] This could also apply to CCUS technologies, which are similarly lesser-known and which in some cases involve the use of the subsurface, which cannot be perceived or experienced directly by communication recipients and whose attributes are unfamiliar to many people.

### 3.1.1 Communicators

Public perception of CCUS can vary depending on who the communicator is. Journalists, institutional representatives, and influential individuals (e.g., politicians, celebrities, local leaders, scientists) interpret and disseminate complex issues for the public, through various channels, and become information sources that the public looks to in order to collect information and form opinions. These communicators can both formulate a baseline understanding of and positioning on CCUS (e.g., by an "opinion-maker" such as a politician endorsing CCUS as a climate mitigation tool), as well as deliver messages around a specific CCUS project (e.g., by a "messenger" such as a developer promoting a CCUS project planned for a certain location). This links to the differentiation between socio-political and local levels of acceptance, as referred to in Chapter 2. For the purpose of this paper, opinion-makers and messengers are considered under the umbrella term of "communicators"; however, it is worth considering the different roles they have in public engagement with CCUS.

The role of communicators in influencing public perception has been widely researched in the context of public messaging on critical issues, such as climate change or the Covid-19 pandemic. One research theme relevant to CCUS is the observed polarisation of public opinion when political leadership has divergent opinions[63,64] and the tendency to view issues as less pressing if there is wide political disagreement over their importance[65]. Divergent opinions on climate change are less of an issue in the case of European political leadership than in more polarised countries, such as the United States.[66] However, despite CCUS often being presented as an issue of climate change mitigation, political commitment to and interest in these technologies varies across Europe, and could lead to divergences in public opinion on the topic.[67] On the other hand, the reconciliation of leaders' positions on CCUS may also reconcile public opinion[68]: cross-party support for CCUS in Denmark may have helped to shape more positive public attitudes towards these technologies. More research is needed on the effect of political consensus on public perceptions of CCUS.

Another finding of importance is the relationship between perceptions and the „closeness"[69] and trustworthiness of the communicator, as well as the perceived goals of the communicator, and the alignment with the goals of other communicators.[70] "Closeness" of the communicator to the audience

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62 Bolsen, T., Palm, R., Kingsland, J.T., 2022. How Negative Frames Can Undermine Public Support for Studying Solar Geoengineering in the U.S.

63 Allcott, H. et al., 2020. Polarization and public health: Partisan differences in social distancing during the coronavirus pandemic

64 Kousser, T., Trantor, B., 2018. The influence of political leaders on climate change attitudes

65 Pew Research Center, 2019. Views of major problems facing the U.S.

66 Fisher, S.D. et al., 2022. The politicisation of climate change attitudes in Europe

67 Wesche, J. et al., 2023. CCUS or no CCUS? Societal support for policy frameworks and stakeholder perceptions in France, Spain, and Poland

68 Kousser, T., Trantor, B., 2018. The influence of political leaders on climate change attitudes

69 "Closeness" refers to the perceived psychological proximity between a communicator and a communication recipient

70 Tcvetkov, P., Cherepovitsyn, A., Fedoseev, S., 2019. Public perception of carbon capture and storage: A state-of-the-art overview

is shown to be correlated to how influential the message of said communicator is, including the likelihood to cooperate[71], and trusted local messengers may amplify messages from less „close" communicators[72], such as CCUS project developers (e.g. to show the scientific research on the risks of CCS projects). Although it is unclear how cooperation between project developers and other communicators might influence perceptions of CCUS, examples of such cooperation exist in actual CCUS projects: for example, France's Pycasso project used public-private partnerships to communicate CCUS.

Other findings of interest relate to i) the purposeful use of communicators, and ii) the role of the public in shaping communicators. In the first instance, different communicators may be better suited for different roles in communicating CCUS: scientific experts may be better suited to "transform knowledge" (raise awareness and provide information), while local leaders may prove better at "transforming values" (connect a message to an audience's identity).[73] Secondly, the public also plays a role in shaping the positions of CCUS communicators. For example, the "newsworthy" themes that media actors position themselves on, and the way that they frame them, are also driven by the interests of their readers[74]. This means that the concerns and priorities of the public, which vary widely depending on geographical, socio-economic, and demographic factors, will influence which aspects of CCUS are amplified by communicators. An understanding of these underlying priorities can anticipate how different opinion-makers might address CCUS, and what type of framings can be expected at national and local levels in Member States. More research is needed on this topic.

### 3.1.2 Communication methods and channels

Aside from the influence exerted by communicators, the way in which messages are disseminated is also a factor in shaping the public opinion of CCUS. This is a function of the method of communication (such as written, spoken, or visual) and the communication channel (such as media channels, public meetings, education programmes, or interpersonal communication)[75]. There will be a variation in how these methods and channels resonate with different audiences, and how accessible and appealing they are perceived to be. For example, the culture underpinning a specific audience or community will influence the type of communication tools used for public engagement on CCUS. In Japan, the Tomakomai CCS Demonstration Project used manga cartoon strips to explain CCS and how it could contribute to climate mitigation.[76] Furthermore, different characteristics of the communication channel can also affect the absorption of information and the formation of a perception – for example, the "pacing" of a channel (the speed at which information is presented, and the receiver's level of control over it) and whether it is one-sided or two-sided communication.

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71 Dubois, D., Bonezzi, A., De Angelis, M., 2016. Sharing with Friends versus Strangers: How Interpersonal Closeness Influences Word-of-Mouth Valence

72 Global Forum on Migration and Development, 2020. GFMD Communications Guide on Shaping Public Narratives on Migration

73 Wright, S., Neimand, A., Steinman, M., 2021. Finding the Right Messenger for Your Message

74 Santos, I., Carvalho, L.M., Portugal e Melo, B., 2022. The media's role in shaping the public opinion on education: A thematic and frame analysis of externalisation to world situations in the Portuguese media

75 Brunsting, S. et al, 2011. Communicating CCS: Applying communications theory to public perceptions of carbon capture and storage

76 CCUS Projects Network, 2020. Public perception of CCS: A Review of Public Engagement for CCS Projects

Because of the low level of awareness of CCUS, the implementation of public information channels is important to communicate scientific advances and industrial developments in the area. Social media technologies could play an important role in disseminating CCUS information to certain audiences, if used to present CCUS technologies in an "authentic, transparent and accessible" way[77]. In-person communication is frequently used in public engagement of CCS projects; the Shell Quest project in Canada engaged communities in their local coffee shops, as well as through more permanent fixtures such as a Community Advisory Panel to raise issues during the project implementation.

When it comes to engaging communities with specific CCUS projects, whether communication is one- or two-way can make a significant difference in the formulation of public opinion. Active listening and seeking and responding to feedback help to build trust in messengers and may shift public perception of CCUS.[78] Participatory formats such as deliberative town halls, citizens' assemblies and citizen juries may be important formats for public engagement on CCUS.[79] In addition to offering meaningful engagement through actual co-development of the project, they can help depoliticise the issues being deliberated.[80] Such an approach can be used in addition to more one-sided communication methods such as surveys or consultations, which are primarily analytical tools. However, it should be noted that the choice of communication tool will depend on the "level" of engagement being sought (for example, informing, consulting, empowering, or collaborating with recipients). For example, in the Shell Quest project, developers sought to keep citizens informed by offering landowners adjacent to the storage site sampling and testing services for their groundwater, to ensure freedom from contamination with stored $CO_2$. If the project was looking to empower citizens, rather than just inform them, a "citizen science" approach may have been considered instead, to ensure two-way communication and raise collective awareness.[81]

In summary, both the communicator and the method of communication, and more generally of engagement, are shown to influence the perception of CCUS by receivers such as members of the public. While public awareness of CCUS technologies is low, perceptions may be volatile and subject to change. However, beyond the information deficit related to CCUS, the complexity of the relationship between public perception and the communicators as well as methods and channels of communication must be recognized.

## 3.2 Transparency and trust

A range of research and experience highlights that transparency and trust in communicating CCUS is paramount for high-quality discussions on these technologies. Transparency on and a structured framing of the benefits, costs, timing, and risks of CCUS technologies, projects and counterfactuals, as well as on the impact of project-related construction, serves to build trust in communicators and make public engagement more meaningful. Which benefits resonate will depend on the country and the local context, as pointed out in Chapter 2. Therefore, tailoring project information to the interests of

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77 Arning, K. et al., 2019. Same or different? Insights on public perception and acceptance of carbon capture and storage or utilization in Germany

78 CCUS Projects Network, 2020. Public perception of CCS: A Review of Public Engagement for CCS Projects

79 Climate Assembly UK, n.d. The path to net zero: Greenhouse Gas Removals

80 Citizens' Assembly of Scotland, n.d. Doing Politics Differently: The vision and recommendations of the Citizens' Assembly of Scotland

81 Tauginienė, L. et al., 2020. Citizen science in the social sciences and humanities: the power of interdisciplinarity

communities being addressed can help sustain interest, as well as to deconstruct myths around CCUS technologies.[82] Some stakeholders also point to the importance of context provision in CCUS communication: for example, when talking about importing $CO_2$, communications should include arguments related to the scaling of transport and storage infrastructure, as well as solidarity with countries with no storage capabilities. Finally, a key element of CCUS communication is transparency of risks (both scenarios including CCUS and the counterfactuals) and mitigation measures; a key learning from the QICS project was that citizens do not want to be told that "storage sites are completely secure and will never leak", but rather be transparently presented with the mitigation measures in place for $CO_2$ storage risks.[83]

The trust placed in CCUS communicators and stakeholders is also significantly correlated with the perception of CCUS technologies and products.[84,85,86] Trust is determined by a number of factors including competence, objectivity, consistency, and faith. Trust is a crucial element of public engagement of CCUS, not least because once lost, it is not easily regained. In the UK, repeated attempts by the national government to develop the British shale gas industry led to an increasing level of public distrust, including distrust of external actors and organisations. A low level of trust in risk-managing institutions, especially policymaking institutions, is also linked to a tendency to amplify perceived risks.[87] Moreover, the motivation of CCUS communicators is an important element of trust: for example, if a CCUS stakeholder is perceived to have purely commercial interests,[88] such as a perceived motivation to prolong fossil fuel use if they are associated with fossil fuel production), or in general if their message is perceived as incongruent with their inferred motives, this may lead to distrust.[89,90,91]

Beyond the motivations of CCUS communicators, knowledge and reputation play a role in shaping trust. The perception of a pro-CCUS communicator as knowledgeable about CCUS has been shown to have a positive influence on the perception of CCUS, and vice versa,[92] similar to other technologies.[93]

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82 Ashworth, P., 2010. Communication of carbon capture and storage: Outcomes from an international workshop to summarise the current global position

83 CCUS Projects Network, 2020. Public perception of CCS: A Review of Public Engagement for CCS Projects

84 L'Orange Seigo, S. et al., 2014. Predictors of risk and benefit perception of carbon capture and storage (CCS) in regions with different stages of deployment

85 De Beus, N., 2021. BioCO2Recover: Social acceptance of CO2-based products

86 Offermann-van Heek, J. et al, 2018. Trust and Distrust in Carbon Capture and Utilization Industry as Relevant Factors for the Acceptance of Carbon-Based Products

87 Cox, E., Pidgeon, N., Spence, E., 2021. But They Told Us It Was Safe! Carbon Dioxide Removal, Fracking, and Ripple Effects in Risk Perceptions

88 Given that most private actors involved in CCUS projects will have a commercial interest to justify their investments, other actors (such as academic experts or local authorities) may be useful in explaining why the success of CCUS projects depends on a solid business case for private actors.

89 Terwel, B.W. et al, 2009. How organizational motives and communications affect public trust in organizations: The case of carbon dioxide capture and storage

90 CCUS Projects Network, 2020. Public perception of CCS: A Review of Public Engagement for CCS Projects

91 Department for Business, Energy and Industrial Strategy, 2021. Carbon Capture Usage and Storage

92 L'Orange Seigo, S. et al., 2014. Predictors of risk and benefit perception of carbon capture and storage (CCS) in regions with different stages of deployment

93 Bearth, A., Siegrist, M., 2021. The Social Amplification of Risk Framework: A Normative Perspective on Trust?

In addition, the perception that trusted actors have little influence on the decision-making process around CCUS negatively affects public perception of CCUS projects. This was found, for example, in an analysis of the failed Barendrecht project (Netherlands)[94], where among other factors, local residents felt that the actors they trusted (local authorities and environmental groups) had too little influence relative to distrusted actors (the project developer and the national government).[95] The same can be said about perceived procedural unfairness, which is amplified by pre-existing resistance to or poor opinion of certain actors involved in CCUS projects, such as project developers with a history of subsurface exploitation.[96] Although trust in these communicators will likely be lower than in other entities involved in CCUS projects, their involvement in deploying CCUS will be important due to their transferable knowledge or track record in delivering large, complex projects with multiple societal and environmental benefits. Furthermore, if entities which become involved in CCUS projects already have a good standing and a history of benefits provision within a community, trust may be increased. On the other hand, if the involvement in and provision of benefits to the said community is sudden and coincidental with a CCUS project, it may be perceived as an attempt to force acceptance.

Which communicators and stakeholders are trusted by the public will vary between and within Member States. In many countries, NGOs and scientific institutions are often among the most trusted organisations, linked to their public-serving motivations.[97,98] However, there is variation across countries in trust in other actors, most notably the government: for example, while a majority of Norwegian citizens report trusting their government with monitoring $CO_2$ storage sites, only 30% do so in Greece, and 22% in Germany.[99] In some cases, trust in individuals may be higher than in organisations overall as it is easier to become familiar with them and to understand their goals and motivations. However, despite all these findings, other research indicates that it may be difficult for the public to rely on trust to formulate a perception of CCS, because stakeholder positions are often unknown or unclear, and few have demonstrated a satisfactory management of CCS project risks.[100]

The conclusion of this chapter is that the picture of public perception of CCUS is further complicated by the influence of factors relating to the communicator and the channel of communication and by the role that communicators play in sharing information, as well as the associated trust and transparency. The heterogeneous nature of the relationship between the public and CCUS technologies, mediated by the relationship with the communication itself, is stressed in recent research on the topic. The variety of factors involved means that there is no "one-size-fits-all" approach in terms of the most appropriate way to communicate CCUS.

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94 In the Barendrecht project, opposition by local communities to the onshore $CO_2$ storage component of the project eventually led to its abandonment

95 Terwel, B.W., ter Mors, E., Daamen, D.D.L., 2012. It's not only about safety: Beliefs and attitudes of 811 local residents regarding a CCS project in Barendrecht

96 Arning, K. et al., 2019. Same or different? Insights on public perception and acceptance of carbon capture and storage or utilization in Germany

97 Terwel, B.W. et al, 2011. Going beyond the properties of CO2 capture and storage (CCS) technology: How trust in stakeholders affects public acceptance of CCS

98 Offermann-van Heek, J. et al, 2018. Trust and Distrust in Carbon Capture and Utilization Industry as Relevant Factors for the Acceptance of Carbon-Based Products

99 Otto, D. et al, 2022. On the Organisation of Translation; An Inter- and Transdisciplinary Approach to Developing Design Options for CO2 Storage Monitoring Systems

100 L'Orange Seigo, S. et al., 2014. Predictors of risk and benefit perception of carbon capture and storage (CCS) in regions with different stages of deployment

# 4 Recommendations

Based on the findings of this paper, we recommend that the European Commission consider the following when formulating its upcoming Strategy.

1) Public perception of CCUS technologies and projects will shape their deployment and implementation in the EU. Hence, the Strategy should **recognize the significance of public perception**, consider the existing state of public opinion in the EU, and **commit to enhancing public understanding and awareness** of CCUS. Moreover, the Strategy should strive to **incorporate meaningful public engagement** as an essential component of CCUS policies and subsequent project development.
2) As a first step, it is crucial to **establish the legitimacy of CCUS technology** among the public and to initiate discussions on deployment plans at the national and territorial level. The decisions arising from these discussions will provide the framework for local implementation. **Policymakers** play a vital role in **promoting societal discourse** on CCUS and should actively facilitate dialogue and engagement with the public on this topic.
3) When communicating about CCUS, it is important to bear in mind that this takes place in a **wider context**, including discussions about portfolios of potential **decarbonisation pathways,** and ongoing **transitions** and associated targets and conditions within the EU.
4) We recommend that the Strategy embraces a **comprehensive approach to public engagement with CCUS**, integrating it into all stages of policymaking and project development rather than treating it as a separate entity. It is essential to also consider the **wide range of factors** that influence public perception.
5) It is crucial to ensure that **all stakeholders**, including citizens, organisations and institutions, have the opportunity to be informed and to participate in discussions on CCUS. The objective is to build trust, share information, and create opportunities for dialogue.
6) Communication on CCUS also has a role to play in **familiarising society** with CCUS and sharing knowledge, given the prevailing lack of awareness in society. Communication and participation strategies should be **adapted to the target audiences**, using appropriate communication sources, methods, and channels.
7) To facilitate informed societal decision-making regarding CCUS technologies, it is imperative that communication at the EU, national, or project level enables **clear and transparent presentation of the benefits, costs, and risks** associated with CCUS, as well as those associated with alternative pathways.
8) This involvement should take place before, during and after the policy-making and project implementation processes, avoiding one-way dissemination of information and facts. It is important to **involve stakeholders proactively,** allowing for their input and preventing decisions from being made without their participation.
9) The Strategy should establish an **accessible knowledge network on public perceptions** of CCUS to share lessons learned from projects and other activities for the benefit of Member States, project operators, civil society organisations/NGOs and other interested parties, and to enable continuous learning.

10) Additionally, ongoing **monitoring of discussions and perceptions** on CCUS technologies, among the public including all types of stakeholders should be implemented incl. an update of the CCUS Eurobarometer survey. This allows for responsiveness to evolving needs and expectations for CCUS applications. The EU research community should continue engaging in **multidisciplinary research on public perception** of CCUS, studying the underlying priorities of different communities in various contexts, to inform how CCUS messages are received and guide project considerations.
11) Once the Strategy has been adopted, it is proposed to communicate it at EU, national and sub-national levels, using clear and **consistent messages and harmonised definitions**, which should also be used in future policies.

This document was prepared by the Working Group co-chairs based on an extensive consultation and engagement process with the Working Group members.

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- DG CLIMA
- Dioxycle
- Dow
- Drax

- E3G - Third Generation Environmentalism
- EBN / Aramis project
- EERA
- eFuel Alliance e.V.
- Eni
- EPCM Global Engineering
- Equinor
- ETN Global
- EuLA - The European Lime Association
- Eurogas
- EUROPA Danismanlik
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- Ghent University
- Global CCS Institute
- HAFFNER ENERGY
- Hafslund Oslo Celsio
- Heidelberg Materials
- Heirloom Carbon
- Helmholtz-Centre for Environmental Research
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- Innovation Norway
- Institut Symlog
- Institute for Energy and Fuels
- Institute of Building Materials Research / RWTH Aachen University
- Interconnector Limited
- IOGP Europe
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- Italcementi Spa
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- Kiel Institute for the World Economy
- Klaipėdos nafta AB
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- KOREAN EMBASSY
- LanzaTech
- MCi Carbon
- Ministry of Economic Affairs and Climate Policy NL
- Ministry of Environment and Spatial Planning of Slovenia
- Ministry of Transport Baden-Wuerttemberg
- Mission of Norway to the EU
- Nabu e.V., nature conservation union
- National Agency for Mineral Resources
- Negative Emissions Platform
- Neptune Energy
- Nippon Gases
- Norsk e-Fuel AS
- Norsk Hydro
- North Denmark EU Office
- Northern Lights JV

- Norwegian Ministry of Petroleum and Energy
- NRW.Energy4Climate
- OMV Petrom
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- Port of Aalborg
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- Repsol
- RITE
- romgaz
- RWE
- Salonit Anhovo d.d.
- Sandbag Climate Campaign
- Shell
- Sia Partners
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- South Scania Waste Company
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- TANECS Engineering Consultancy Inc
- TES-H2
- The Norwegian Ministry of Petroleum and Energy
- TNO
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