# Annex 2. Interviews with community members

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**Date:** September 2022
**Filename and Version:** V1
**Project ID Number:** 101022664

The PilotSTRATEGY project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 101022664

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# 1. Introduction

The objective of this task was to map the perceptions, attitudes and points of views around a potential CCS project of the key stakeholders in the study communities. The goal was to explore the social acceptance, as well as the scope of critical issues and needs in each community under study. To this end, we proceeded to a) identify the relevant actors for a social debate around CCS in each community; b) conduct semi-structured interviews with selected representatives of the interest groups in the regions studied (representatives from the industry and the local and regional administration, researchers and the civil society). This task builds on the work done in the social characterization of the study regions, the community profiles.

The field work in this report focuses on the following communities and/or regions: on-shore and off-shore site in Spain and Portugal and on-shore site in France, Greece and Poland.

In the following pages, we report the main results from the analysis of the interviews conducted by the research group and the local teams with representatives of the stakeholders' groups in the study communities. We first provide a summary of the research strategy adopted by the research team. Second, we summarize the results for each of the communities under study. Finally, and after providing a summary of results, we provide a more detailed version of the results for each community studied (Annexes).

# 2. Method

Semi-structured interviews based on a predefined protocol were conducted with selected members of the stakeholders' groups in each of the study regions to understand stakeholders' overall assessment of CCS technologies and CO2 storage, their level of acceptance of CCS developments in their regions, sources of concern, perceived benefits and costs of storage development for the region, conditions for acceptance, perceived barriers and facilitators of CCS development in the study regions, and preferences and expectations.

*Table 1. Interviews by region and type of actor.*

| | ES_on | ES_off | PT | FR | GR | PL |
|---|---|---|---|---|---|---|
| **Public administration** | 1 | 1 | 9 | 1 | 2 | 1 |
| **Industry** | 3 | 4 | 6 | 1 | - | 1 |
| **Research** | 2 | 1 | - | 4 | 4 | 3 |
| **NGOs** | 4 | 2 | 3 | 2 | - | - |
| **Media** | - | 1 | - | - | - | - |
| **Total** | 10 | 9 | 18 | 8 | 6 | 5 |

As we expected low levels of knowledge and familiarity with CCS technologies and CO2 storage, social scientists and technical experts worked hand in hand to conduct the interviews. Our technical experts provided clarifications and explanations on the technical aspects (when requested) in a neutral and balanced way to facilitate more informed conversations. This interaction worked well as part of the transdisciplinary approach in Pilot STRATEGY.

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Table 1 shows the number of interviews conducted by country and type of stakeholders. As indicated in the DoW, a higher number of interviews were conducted in the main regions, especially in Portugal and Spain as they should contribute to the decision between the on-shore and the off-shore options in both countries. Interviewees were identified from a previous task in the work package. They were contacted via email and/or phone by the research team. The interview was conducted in person or via phone or videoconference software. The interviews lasted between 30 minutes and one hour.

A semi-structured protocol based on a literature review was developed to conduct the interviews. It included, mainly, the following topics regarding the interviewee's perceptions of CCS developments:

- Characterization of the community
- Familiarity with CCS
- Global Benefits of CCS
- Risks of CCS
- Local benefits and opportunities of CO2 storage
- Local negative impacts of CO2 storage
- Acceptance conditions
- Key actors and public involvement
- General position towards the CO2 storage project

All the interviews were recorded and partially transcribed. We conducted a thematic analysis of the collected data to examine in depth the main perceptions and perspectives of the interviewees.

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# 3. Main results

## 3.1. Spain

### 3.1.1. Ebro Basin Onshore

The onshore region was characterized by the interviewees as having several strengths regarding future potential CCS developments: It is a particularly proactive area in terms of sustainability and renewable energies, it has a low population density and an increasingly reduced economic activity, due to the gradual closure of the different mines and power plants that were in the area. These factors might contribute to a greater acceptance by the public, especially if the CO2 storage project has clear socio-economic local benefits. The local opposition to renewable energy projects in the past, the defense of rural life by some local groups and the negative experience with fracking projects in the community were characterized by the interviewees as threats to a potential CCS project.

The stakeholders mentioned several global benefits of CCS such as climate change mitigation and the sustainable transition of local industries. For others, CCS had no clear global benefits. In terms of local benefits, the interviewees mentioned the potential attraction of new companies and investments to the area bringing direct employment for the region. It was also considered that CCS projects could help the transition to sustainability of the companies currently operating in the region as well as the reputation and leadership of the region in climate change issues. The potential economic compensation for the municipalities and residents affected by a CO2 storage was a main potential benefit for some stakeholders.

Most of the interviewees mentioned the risks to the safety and health of the local population and ecosystem as a possible negative impact of a storage project. Interviewees were concerned about possible leaks of stored gas and seismic activity. In general, the interviewees were unaware of the risks to public health, but they consider that the population will be concerned about these issues. Other key local risks discussed by the interviewees were the possibility of contamination of the aquifers, the impacts on the landscape, the impacts on land use (agricultural), annoyances in the construction phase and the potential injustice in the impacts (unfair social distribution of the benefits and costs)

As for the key conditions for the acceptance of the project, the interviewees mentioned the need for clear local economic benefits (the attraction of investments, the generation of local employment and compensations to the affected local community and/or residents), as a first necessary condition for its acceptance. Ensuring a very low environmental impact of the project was another necessary condition for acceptance, according to several interviewees. Transparency, public involvement, and honesty (the majority of the interviewees considered the consultation, information and involvement of the community to be very important from the beginning of the project) as well as a having a good narrative for the project were also critical conditions, according to the interviewees.

In general, we found three fundamental positions among the interviewees:

i. Support and psychological identification. For some interviewees, the CO2 storage project should be an opportunity for the region in terms of leadership in the fight against climate

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change, technological research and development, and economic revitalization. These interviewees tended to show a significant degree of support for the storage project.

ii. Acceptance. Several interviewees showed an attitude of acceptance towards the storage project. The project generated interest among these interviewees. They also believed that the project could generate several environmental, socio-economic, and scientific benefits for the region.

iii. Ambivalence. Some interviewees were ambivalent about the CO2 storage project, since they considered, in the same way, the possible benefits of the project (generally global) and the possible costs of the project (local). Some interviewees showed a reluctant acceptance: they would accept it if the public administration considered it appropriate, but they convey a certain perception of injustice in the impacts.

### 3.1.2. Ebro Basin Offshore

The Tarragona area was characterized as having an important industrial tradition and, therefore, extensive experience in the implementation of this type of projects. It is considered that there is a balanced coexistence between two models that, a priori, seem antagonistic: the industry and tourism. It is a balance that must continue to be worked on, according to the interviewees, so it can represent a strength and a continuous challenge.

The local benefits perceived by the interviewees were, first, the possibility that CCS projects could bring wealth and economic benefits to the local region. These benefits could go along the lines of job creation and the future sustainability of current industries, and therefore the jobs of the petrochemical companies in the area. It is perceived that a future CCS installation could not only maintain the existing industrial activity, but it could also contribute to the development of a complementary industrial activity. In addition, another factor that could benefit the region, especially in relation to tourism, would be the prestige it would achieve if it were considered a pioneer region in carbon neutrality.

Regarding the main challenges for the project in the region, the previous local experience with the Castor Project[1] is considered decisive, since the inhabitants of the Ebro Delta are concerned about the seismicity induced by this installation. Thus, the interviewees mentioned that there is significant opposition to any type of industrial project, especially in the Delta area. In relation to this opposition, the population of the Delta is believed to have a significant capacity for mobilization as they have previously been able to stop industrial projects that they saw as threatening to the territory. In both areas, in Tarragona and in the Delta, there is a perception of unfair distribution of costs and benefits: they contribute much more than they receive, since they believe that all the industrial facilities that nobody wants in Catalonia end up being implemented in their area.

The perceived local risks were, firstly, that the project does not have a direct economic impact on the territory and the probable low generation of specialized labor that these projects usually have at the local level. Another risk perceived by one of the interviewees was the idea that it is another macro-project, like those that have been previously proposed in the area (industrial and other) and that he considers that they do not diversify an economy that is already excessively concentrated in the industrial and tourist sectors. In the Delta area, some interviewees considered that a CCS project

[1] The Castor project was an administrative concession granted in 2008 for the exploitation of an underground gas storage facility using a geological structure of an old oil field the Mediterranean, close to the coast of Castellón and Tarragona. After more than 200 earthquakes, the gas injections were stopped.

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would never favor the area, since it is a Biosphere Reserve, linked to other nature and agro-tourism related activities. Finally, it has been seen how in the offshore zone they perceive an injustice compared to the rest of Catalonia and consider that any industrial facility that nobody wants is installed in their territory.

The conditions of acceptance were related, first, to the project generating local benefits, both environmental and economic. Another condition was that the environmental impact is minimized since they consider that it is a territory with a significant industrial overload. In addition, they considered that the region, especially in the Delta area, has great natural attributes. Another necessary condition was related to the need for transparency and communication with the different social actors and the public, in addition to establishing communication channels to reach agreed solutions.

## 3.2. Portugal

Two key issues are to be highlighted: the overall low level of knowledge and familiarity with CCS and the high number of questions posed by the interviewees on the one hand, and the concerns about CCS risks on the other.

Several interviewees mentioned how the local community in the area of study opposed projects that had environmental impact in recent years: waste management facilities, oil and gas exploration, pig farms, paper mills, a natural gas underground storage facility. They mentioned the protest strategies used (demonstrations, roadblocks, street protests) and how successful they were in some cases (oil and gas exploration). In other cases, after the initial resistance and successful information campaigns, populations accepted the facilities and no longer consider them a problem. Thus, several stakeholders expected the community to oppose CCS. Two stakeholders also mentioned the diversity within the region, based on the economic characteristics of some municipalities: industry in Marinha Grande (rendering the residents more likely to accept CCS), agriculture in Alcobaça, tourism and surf in Nazaré and Figueira da Foz.

Opinions varied on whether onshore or offshore CCS would be preferable in Portugal and quite a few interviewees declined to elect an option due to the lack of information about the subject. Some stakeholders considered that the decision should be made based on technical, safety, and economic criteria: which is more viable and/or less expensive. The offshore option was considered by many as the one that would lead to the least public resistance because it would not directly affect populations and would be less visible ("out of sight, out of mind"), particularly if it could not be visible from the shore. Onshore was considered less expensive (so less of a burden on the tax payer) and swifter to achieve (in view of the urgency to reduce $CO_2$ emissions), with fewer regulation hurdles, fewer institutions to contend with and less construction, technical and transport challenges.

When asked about the potential opportunities of CCS for their region, most interviewees had difficulty in answering, due to their lack of knowledge about CCS. Some of them see no added value of CCS locally, but rather globally, and one interviewee clearly stated that he does not see many opportunities associated with the project. One of the benefits mentioned by interviewees was that CCS can help local industries in their carbon transition. However, this was a minority position and not everyone agreed with it. For example, one representative from a local authority rejected this idea indicating that the glass industry in the municipality is no longer the main economic activity and

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that they are investing in other activities. Although some interviewees mentioned the possibility of CCS creating new jobs in the region (business representatives), most believed that it would not have a relevant impact on employment. Finally, some stakeholders considered that CCS can be an opportunity for the carbon transition image of the region. Municipal authorities that have invested more climate change and carbon transition policies are the ones more open to having a CCS project implemented on their territory since they see it as an opportunity to further improve the municipality track record in this issue.

The local impacts of a potential CCS project identified by the interviewees mostly overlap with the concerns and risks analyzed above. Five main dimensions of local impacts emerged from the interviews: 1. Environmental impacts in protected areas; 2. Impacts on local aquifers; 3. Impacts on the quality of life in the region; 4. Impacts on tourism; 5. Overall impacts.

Several conditions were mentioned by the interviewees as important for the acceptance of a potential carbon storage project in the region. First, some interviewees explained that for the project to go ahead it would have to go through a thorough impact assessment by representatives from government agencies. Second, several interviewees indicated that to ensure acceptance it is important that the population will be compensated for the implementation of the project in their region. Third, another issue that was often mentioned was transparency. Fourth, some of the interviewees pointed out that the location of the infrastructure is key for public acceptance. However, there was no consensus on what the most acceptable location is. Fifth, some interviewees from business associations stated that acceptance was also dependent on the existence of high-quality information on all aspects of the project that could impact the local population (risks, costs, economic benefits, business models, etc.) so that the public can make informed decisions.

In terms of how the engagement with the local population should be done, interviewees recommended different aspects related to the information made available to the public, the approach strategy, and the most suitable formats for the engagement: 1. Create a clear narrative; 2. Early engagement; 3. Engagement formats.

Overall, we found five different positions towards CCS among the interviewees.

- In favor: Some interviewees are clearly in favor of CCS. They value its environmental benefits and its role in fighting climate change, and its potential economic benefit for the region and some industry sectors.
- In favor, but with reservations: These interviewees show support for the technology, but only under specific conditions, i.e. the existence of guarantees that the technology has no significant risks or impacts on the environment.
- Not against, but only in specific conditions: These interviewees are more reticent about the role of the technology in carbon transition, and the benefits of its implementation in Portugal. They support the technology only as a last option, and in absence of alternatives to fight climate change.
- Neutral: In some cases, the interviewees declared being neutral in relation to the technology, being in need of more information to be able to state a position.
- Against: Some interviewees are against the implementation of CCS in the region, since they are very distrustful of both the risks associated with CCS and the public reaction to the technology.

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## 3.3. France

One interviewee pointed out that the community living in the Nangis territory was an industrial community, meaning that the industrial company Total had been active there for years. Their livelihood had been improved, still according to the interviewee, thanks to its activities. A local participant, who is a member of her commune's municipal council, indicated, by contrast, that people in her community doubt the efficacy of CCUS. The interviewee pointed out that most residents of the area are not informed of the existence of PilotSTRATEGY or of the proposed investigations in view of a potential storage site.

Most of the interviewees doubted the efficacy of the technology. For example, they thought that the lack of familiarity by the public might create problems in terms of acceptance. Some expressed that CCUS could be used in favor of industrialists and their financial interests. For example, an environmental activist and another person having worked in various environmental research projects told us that CCUS would not encourage needed changes in our lifestyle. Instead, it might simply enable a context in which industrialists could continue to produce without adapting their production methods.

The experts mentioned the potential local benefits of carbon storage, whereas other participants who did not share the same knowledge were not very supportive of it. Some participants, particularly those positioned against CCUS, saw its risks as **unknown or even unknowable,** whereas experts mainly viewed that risks (even if unknown) can be assessed, and that precautions or mitigations can be taken. For example, the activist points to the imponderables of nuclear waste storage.

According to our interviewees, there could be opportunities to engage stakeholders, and conditions for acceptance of a potential storage might be possible. Most of our participants did not live near the targeted potential pilot storage site in the Parisian basin; nonetheless, we report the experts' views (which were the most explicit on this dimension) as they may be illustrative of the social phenomenon around CCUS at local level, as well as at national level. This does not mean that specific local dynamics could not have an impact on social acceptance and stakeholder engagement. Each societal characterization could be specific to different social contexts. The principal condition of social acceptability, according to the experts we interviewed, is **communication.** Those working in the field should correctly communicate and inform the public of CCUS; there should also be an **active consensus across actors** to contribute to this informative effort.

The overall position towards carbon storage was **ambivalent**. We heard a clear difference between experts and others in their representations of CCUS, but there was common ground where they shared the same ideas and feelings. We can interpret that the differentiation was due to the manner of saying things, rather than fundamentally divergent thoughts. Everybody was aware, for example, that the risks imposed by this technology were present, but their reasoning behind risk identification was not identical. We call the general position "ambivalent" because people were not consistent in their responses considering the utility or desirability of CCUS.

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## 3.4. Greece (Western Macedonia)

While the interviewees identified some challenges and sensitive topics, overall, they see an openness to further pursue CCS as an option - also in the wake of the declining coal industry. The interviewees agreed on a set of elements that allow us to characterize the community:

i. The Greek government has decided to phase out coal and to shut down lignite mining and combustion, which is dominant for Western Macedonia. This is connected to a high probability and related concerns of rising unemployment rates in the region. Interviewees observe disappointment in the region due to this (anticipated) development. There is a need to develop new job opportunities.
ii. The area also contains natural protected areas, which are also important.

Once it was mentioned that past green energy infrastructure projects have also received negative receptions. The need of accurate information and community involvement was emphasized by this person.

The expected local benefit that was repeatedly mentioned by the interviewees were the potential positive effects on employment. Further local benefits mentioned included that CCS supports the existing coal fired power plants, contribution to energy autonomy by using local lignite and, finally, could trigger broader economic benefits also to tourism, agriculture/ fishing by reducing environmental pollution.

Overall, interviewees mentioned several aspects as risks, concerns or barriers regarding CCS. The most prominent aspect was around leakages and how to prevent them. In terms of local risks, the interviewees did not expect negative impacts from CCS on the region. Getting a bit more speculative, as they say themselves, two of them vaguely referred to possible negative impacts on tourism or other economic activities e.g. if the scenery is reduced or on wildlife.

Half of the interviewees expected positive reactions from the affected communities, one pointed towards neutral perceptions while another expected a negative response. The reasons for these expectations varied between interviewees.

A variety of conditions were mentioned in the interviews that influence acceptance. The interviewees emphasized:

i. the importance of accurate information and community involvement
ii. that an experimental phase with a pilot facility is important
iii. that aesthetics of the installation will play a role
iv. that public discussions can take different routes and that in case of opposition a CCS pathway should be reconsidered
v. that safety and expected environmental impact are very important including the impact on natural protected areas

Thus, none of the actors interviewed were negative or critical about CCS as an option and several of them regarded CCS as an important option in the fight against climate change.

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## 3.5. Poland (Upper Silesia)

Upper Silesia was described as an area that is shaped by coal mining and the need for transition. Interviewees emphasized that it is urbanized and dense in several areas, but also has a natural heritage and rural parts.

CCS was perceived to be in an early phase in Poland as a political strategy and a legislative framework are missing and other preconditions such as viable business models are lacking. The main argument brought forward by several interviewees in favour of CCS was the potential economic benefits including the possibility of providing additional jobs, creating cooperation between various stakeholders, making the region attractive and competitive for future investors. However, it was also mentioned that CCS projects will probably not be a very large employer, but they may become an economically attractive niche for specialists such as engineers.

The risk/cost that was repeatedly brought forward by several interviewees is the potential negative impact of CCS on the attractiveness of Silesia - which could affect economic development, e.g. tourism and agriculture or impact the natural environment. The possible reduction in regional attractiveness was also related to safety issues as concerns could drive people away from the, already in parts, depopulated area. Other concerns around potential negative impacts referred to prolonging the coal focused pathway instead of developing renewable energy as the better alternative.

In line with responses to earlier initiatives about CCS in Poland, the interviewees tended to expect that residents, environmentalists and innovative companies will be against a further CCS development.

A variety of conditions were mentioned in the interviews that influence acceptance. Some parts of the discussion on conditions of acceptance were less about project characteristics, but more about pre-conditions that need to be fulfilled before an implementation is feasible, such as the implementation of the legislative framework or a viable business model. Several of the conditions mentioned elaborated on approaches to enable acceptance, such as public engagement and participation or the compensation scheme either to individuals, or the community.

The opinions from the interviewees covered the full range from strongly negative about CCS in general to positive for a variety of reasons. The main role for CCS was seen in its potential contribution to mitigate climate change. One of the rationales was also the lead time needed to develop CCS combined with the assumption that it will get more imminent once the decarbonisation of transport or industry becomes more important.

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# 4. Conclusion

The objective of this task was to collect the views, beliefs and concerns of the local stakeholders around a potential CCS development in the study communities. We conducted semi-structured interviews with members of the community and experts in the onshore and the offshore areas in Spain (Ebro basin) and Portugal, and in France, in the Western Macedonia in Greece and the Upper Silesia in Poland.

Overall, we have found a variety of views on CCS developments in our study communities. In all the regions, some stakeholders had a very positive attitude towards a potential CO2 storage project based on a general positive view on the technology (given its perceived contribution to climate change mitigation) as well based on an expectation of significant local benefits from the project. Other stakeholders were more ambivalent in their position. These interviewees were more negative about the role of the technology in carbon transition, and about the benefits of its implementation for the local communities. In some regions a smaller number of interviewees was opposed to CCS development and/or had strong concerns.

In some communities, the stakeholders emphasized the potential local benefits of a CO2 storage site in terms of job creation, attraction of private and public investments, the ecological transition of the local companies and, very importantly in some contexts, the existence of compensations for the local municipalities. Not all the stakeholders agreed on the potential benefits, but job creation and compensations were critical issues according to the stakeholders in the onshore area in Spain as well as in Portugal and Western Macedonia.

Regarding the risks and costs of CCS developments for the affected communities, stakeholders identified several risks that they were concerned about such as safety and health impacts, environmental (in the local aquifers and protected areas) and visual local impacts as well as impacts on local activities such as tourism and agriculture. The idea of the impacts being unfair for the local community was raised by several stakeholders in Spain, in both regions, and Portugal. Of course, some areas were perceived by the stakeholders as more negatively affected by CCS operations than others (e.g. protected areas, areas with special natural and heritage attributes).

Finally, stakeholders identified several conditions that would increase the local support for CCS developments. They mainly referred to information, communication and community engagement actions, but also to having clear and positive compensations for the local municipalities and residents, as well as minimizing the environmental and visual impacts.

Although this study does not allow to draw quantitative conclusions regarding the social acceptance of future CCS developments in the local communities, our data allow a better understanding of stakeholders' views and concerns around CCS developments. This should inform future CCS projects and activities.

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# Annex 1 (Country reports)

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# Spain

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## Introduction

The objective of this task is to map the perceptions, attitudes and interests of the stakeholders in the two communities studied in Spain, which will allow determining the social acceptance, as well as the scope of the critical issues and needs in each community. To this end, we have proceeded to: i) identify the relevant actors for a social debate around CCS; ii) conduct semi-structured interviews with selected representatives of the interest groups in the two regions studied. This task builds on the work done in the social characterization of the study regions task and on the identification of potential stakeholders to be interviewed in the study.

## Method

Semi-structured interviews were conducted with selected members of the stakeholders in each of the study regions to understand stakeholders' overall assessment of CCS technologies and CO2 storage, their level of acceptance of CCS developments in their regions, sources of concern, perceived benefits and costs of storage development for the region, conditions for acceptance, perceived barriers and facilitators of CCS development in the study regions, and preferences and expectations.

*Table 2. Interviews by region and type of actor.*

| | offshore | offshore |
|---|---|---|
| Public administration | 1 | 1 |
| Industry | 1 | 2 |
| local business associations | 2 | 2 |
| Research | 2 | 1 |
| NGOs | 4 | 2 |
| Media | 0 | 1 |
| **Total** | **10** | **9** |

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## Results

### Onshore (Lopin)

The table below summarizes some key ideas about the affected community expressed in the interviews.

*Table 3. Strengths, challenges and key conditions Onshore.*

| Main strengths | Main challenges | key conditions |
|---|---|---|
| ▪ Proactive region in sustainability issues<br>▪ Area with low population density and economic activity<br>▪ Desire to attract financial investment | ▪ Recent local opposition to wind farm and photovoltaic projects<br>▪ Opposition, a few years ago, to fracking projects<br>▪ Perception of injustice in the impacts of energy projects<br>▪ Possible incompatibility with agricultural uses of the land and defense of rural life | ▪ Idea of a single area to house a storage and positive narrative of the project<br>▪ Minimization of environmental impact (especially aquifers)<br>▪ Local socio-economic benefits (local employment, well-designed compensation)<br>▪ Honesty, transparency, consultation and local involvement |

#### *Community Description*

The interviewees agreed on a set of elements that allow us to characterize the community:

i. Aragon as a center of renewable energies with high political consensus. Several interviewees mention the existence of significant support for the development of projects related to sustainability and the fight against climate change in Aragon. The interviewees refer to the existence of an administration that is very favorable to these projects, some innovative and active small companies and a broad political consensus. This positive environment in the region does not necessarily lead, according to those interviewed, to a positive reaction in local communities to specific projects. But, in general, this positioning of the region is considered an opportunity for the CO2 storage project.

ii. Low population density, low per capita income, aging, agricultural tradition, mining basin and unemployment. The interviewees refer to the situation of depopulation in most of the regions of Aragon. Although the areas differ from each other, some with more tradition of agriculture, others with tradition of mining, in general the existence of problems of depopulation and unemployment is underlined. Strengthening the structuring of these regions is considered an opportunity to which the CO2 storage project could be associated. As stated by an interviewee, "also betting on this territorial rebalancing in a population that, although it is close to Zaragoza, is not and has practically almost nothing, is an argument very much in favor at the moment in this type of community where the idea of an empty Spain is very important" (5k). Another interviewee refers to the low per capita income in the region as a favorable condition for

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accepting technological projects: “Of course, the main thing is that there is little population. And then it is a poor area and any project that is economically profitable, well, in the end, everyone ends up accepting it. I do not know of any case of someone who has been told to put a wind turbine on it and has said no out of conviction” (2L). For other interviewees, the low population density, the aging population and the absence of university graduates means that even if technological projects are located in the area, few job opportunities would be generated.

iii. Local opposition to renewable energy projects. Several interviewees refer to the existence in the community of social protest movements against the installation of wind and solar farms. They are characterized as small groups, initially with little relevance, but very active in opposing the installation of new parks. An interviewee from an environmental organization expresses his position on the matter: “There are people who show a lot of resistance, us too, but it is not to renewable energies but to the implementation method. For example, there are huge photovoltaic plants on hundreds of hectares that do have a visual impact and are also built on agricultural land, many of which also produce food” (1L). Another interviewee refers to a mobilization against the most important renewable energy parks in the Maestrazgo area. Another interviewee comments on the local opposition to water pumping projects in the area. For this interviewee, a negative climate is being created in the community towards any industrial and technological project, perceived, in general, as projects that are developed in their community because they are not desired in other richer areas. In general, it is considered that the activity of local environmental groups should be considered as a significant challenge for any CO2 storage project.

iv. The defense of rural life in the community. There is a narrative connected to the previous idea that is important to consider, according to some interviewees. It is about the defense by part of the population and civil society of small-scale rural activities in the community, such as rural tourism. This defense is considered incompatible with the installation of new technological projects (renewable energy parks or, potentially, CO2 storage) perceived as projects with a high local environmental impact (landscape and local fauna and flora). As one interviewee stated, more and more people in the area want to protect traditional life. This is how an interviewee stated: "towns and areas that were in favor, that there was no problem, however, now with the development of solar and wind parks, as there are many and they are already talking about their landscape and their landscape identity even in rural areas, right? From what you have said, the impact on the landscape is going to be minimal, right?” (5k). For another interviewee, the Belchite area could have a more favorable attitude towards the project than other areas of the region such as the Mataraña area: “When I opened the brochure map, I saw that the entire Belchite area was there. If you had gone further up, which is the entire area of Mataraña, which is called the Aragonese Tuscany, which has a lot of scenic and tourist value, I would say “you have nothing to do”. You are going to have a frontal rejection, you can do it, but not with social acceptance, which is already happening with renewables. In the area that you have contemplated on the map, here you have several realities, for which I cannot give you a global answer for the entire area, because they are different realities. In the Andorra Teruel area, it can be seen as part of an economic regeneration project, as an alternative to the closure of thermal activity and as it has an energy tradition, they could better understand this type of project. But if you go further south, towards the area of Belchite, which is more agrarian, you can come into conflict with groups or municipalities that value agriculture more, even if it is deficient” (5L)

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v. Experience with fracking projects. Several interviewees refer to the public opposition or controversy generated around fracking projects a few years ago. Fracking projects were perceived as not very beneficial (in economic terms) for the community and with a high local environmental impact (local pollution and health risks). The mental associations of the local population regarding fracking were negative (risk, contamination). This controversy could be transferred to the geological storage of CO2, according to some interviewees.

### *Familiarity with CAC*

Most of the interviewees were familiar with, had heard and read about the capture and storage of CO2. In general, they consider that the local population, as well as local companies, are not familiar with the technology. By type of actor, we note:

- Administration: They are familiar with CCS. They assume that the local population is very unfamiliar with CCS
- Companies: They have some familiarity with technology. They refer to the work of CIRCE on CCS in Aragón. They believe that there is very little knowledge about the technology among the local population and small businesses.
- Research: They consider that only research centers and universities in the region are familiar with CCS. They believe that there is very little knowledge about the technology and an initial concern for safety (eg leaks in storage)
- NGOs and associations. They have heard about the technology. Two interviewees refer to CO2 capture processes in chemical and oil industries. The Castor project is mentioned as an analogy, as well as the CCS project in Compostilla, associated with a positive narrative (allowing the continuity of the thermal power plant)

### *CO2 Capture and Storage Issues*

In the interviews, the representatives of the stakeholders consulted raised various questions related to CCS technologies, as well as the characteristics and possible impacts of the project in the study phase:

- Administration: Questions around the geological aspects of CCS were raised, mainly: type of geological structures selected, type of analysis carried out, seismic risks. An interviewee also questioned the true interest of companies participating in this type of project (mitigation of climate change vs. economic interest).
- Companies: Few issues related to the project were raised. An interviewee asked about the location of the CO2 emission sources (industries involved) and the means of transportation to the storage location.
- Research: Questions related to the specific characteristics of the project under development were raised: CO2 emission sources, type of CO2 transport, installations to be carried out in storage.
- NGOs and associations: They raised more questions than the rest of the actors, related to: i) current status of the project and expected duration; ii) CO2 storage operation; iii) safety of CO2 storage; iv) economic and energy balance of the CAC; v) size of a storage facility (eg, how much land does it occupy?; vi) landscape impact; vii) benefits for the community and local residents (possible trade-offs); viii) ownership of the land used

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*Global Benefits of CCS*

In relation to the perceived global benefits of CO2 capture and storage, a first observation is that very few interviewees emphasized the global benefits, in terms of climate change mitigation, of CO2 capture and storage. Only two interviewees were able to develop in some depth the benefits of CCS in reducing emissions from certain sectors. Interviewees put forward three main ideas regarding the overall benefits of CCS:

i. CCS is necessary for climate change mitigation. Various interviewees refer to the need for CO2 capture and storage to mitigate climate change. Thus, an interviewee states: “I consider it quite important, especially due to the climate urgency and the evolution we are taking in terms of the necessary carbon reduction objectives. In other words, on the one hand, I see it as very complex to change the entire industrial system so that emissions are reduced as much as necessary, including urban activity itself, as well as agriculture and other diffuse sectors, which is why it is a more complicated challenge, technologically speaking. .” (3L). In general, the interviewees understand the general role of CCS in reducing emissions in the industrial and electricity sector, but do not emphasize or delve into the unique contribution of CCS in mitigating climate change. Rather, it is considered one more option in the set of mitigation options. As stated by an interviewee: “CO2 storage for me is one more option, it will not be the first or the last, neither the best nor the worst, it is one more. And also time and experience will tell us to what extent it is viable or to what extent it will help, because the technology itself will advance, they will give us new solutions, etcetera, etcetera. I see it like this, as an intermediate step that, well, should not be discarded, it should be evaluated very well because it has consequences in this regard, which at this time we could be unaware of” (5K)

ii. Help in the transition of certain economic sectors. Some interviewees perceive a clear benefit of CCS in reducing emissions in certain sectors. CCS would allow the industry to maintain its activity while reducing its CO2 emissions. It would allow the transition to the industrial sector. An interviewee affirms that CCS "would allow certain activities that are also intensive in emissions to continue to be carried out in the future and that would prevent an economic activity from leaving, having the viability of being able to capture carbon" (3L). Another interviewee, a member of an NGO, also expresses himself in this sense: “For me, carbon storage has a very specific use in my scheme, of the global framework of change, of transition of the entire economic fabric. For me it makes sense. In the reconversion, necessary industrial processes that are not going to be able to decarbonise, as can happen with the automotive industry or with electricity generation, will not be possible”.

iii. It has no clear benefits. Two interviewees consider that the benefits of CCS are not very relevant or significant. This position is expressed by interviewees who are members of NGOs or local associations. The interviewees consider that there are other options for reducing emissions and, therefore, do not emphasize or consider the genuine benefits of CCS. As one interviewee stated: “I think it would be more logical to try to remove CO2 than not to capture it. It would be a better option to stop broadcasting than to capture it. I also think that actions of, well, planting trees, CO2 sinks, are preferable, maybe not storage, right?” (2L)

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*CCS risks*

In general, the interviewees are not overly concerned about the possible risks arising from CO2 storage. Several interviewees state that they are unaware of the possible risks of CO2 capture and storage. But even so, they mention possible risks associated with CCS:

i. Seismic risk. Some interviewees intuitively refer to an increase in the seismic risk derived from the storage of CO2. Three interviewees mention this risk. An interviewee is more precise, due to her training, in the risks associated with seismicity and considers that it could be a risk perceived by the population: “It may be that the fear of the population is a little more that these activities pose a risk of seismic instability, those atomic fears that are very easy to shake and that the risk also exists, they must not be ruled out, these studies must be done very well…” (1K). Another interviewee refers to the manipulation of the subsoil: “I am afraid that everything that involves touching the subsoil, I imagine that it will have its risks. Thus, at first glance, I do not see any significant risks, beyond that it affects the subsoil and that may lead to some geological movement” (3L). Several interviewees refer to the Castor project and the seismicity problems and assume that the storage project would be easily associated with these problems.

ii. Aquifer contamination. This is a risk raised by various interviewees. Thus, an interviewee states: “Another thing that can happen, being a saline aquifer, is that they (the public) associate it with water contamination. Then they don't care about the slurry, but suddenly this can come out, the fear of the risk of contamination” (5L). An interviewee considers the issue of water contamination as a relevant issue in the region: "It is that there will also have to be a lot of defense of the issue that there is no type of impact on the aquifers, since you already know that the water in Aragon is a topic where there is a lot of sensitivity and this is one of the topics” (5K).

iii. Landscape impacts. Several interviewees refer to the possibility that CO2 storage has a negative impact on the territory. These impacts will be insignificant for other interviewees, who consider that as it is underground storage, the infrastructure on land would be small. The fundamental debate among the interviewees is whether there would be facilities on the ground and the need for pipelines, perceived as more invasive in the territory. An interviewee from a business association expresses this concern: “Because that area, I say it from memory, there may be some type of environmental impact in the area, especially on species of flora and fauna of that area that is steppe. And the kind of impact there could be outside. Another thing is the deposit as such, but the infrastructures that could be built outside and others…” (5K). Another interviewee, belonging to an environmental organization, refers to various risks: “. Let's see... with the risks that it may have, I don't know in depth the risks that it may have either, that there are leaks, that the waters of other aquifers that are used are contaminated, how it can affect the fields or what is like that other types of activities cannot be carried out. If this is occupied, these upper fields cannot be used, we are taking jobs away from farmers…” (2L). Another interviewee refers, by analogy, to the landscape impact of wind and solar farms: “Ok, I say this because recently there were models of large photovoltaic parks near the Maestrazgo and this did generate some concern. They are places of geological interest, they are trying to promote a certain type of tourism and… that has happened” (3K).

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iv. Leaks and impact on the population. Two interviewees refer to the risk of leaks that impact the health of the population. An interviewee, a researcher on CCS issues, mentions the risk of leaks as a risk with a high potential to be amplified among the local population: “And the only problem that I can see is that if a good job of explaining the project is not done, someone It occurs to him that if there is a leak, then everyone around him can give them a jamacuco and die, do you understand me? In our interviews, two participants refer to the risk of leaks. But they do so without providing details on the possible impact on the health of the population of a CO2 leak.

*Local benefits and opportunities of CO2 storage*

When we ask the interviewees about the possible benefits of CO2 storage in the region, two conflicting views or beliefs appeared: while some participants considered that CO2 storage would bring relevant socioeconomic benefits to the region (economic activity, employment, reputation), others considered that the benefits would be insignificant in this phase of the project (storage). The belief that the project will not have significant local benefits is associated, as we will see, with an attitude of rejection or reluctant acceptance towards the project.

In general, the following benefits raised by the interviewees are discussed in the interviews:

i. Employment derived from the storage project. This is a main question in the interviews. The interviewees refer to the possible employment derived from the implementation of the storage project, as well as the possible attraction of companies to the area. For some interviewees, the number of local jobs generated by CO2 storage would be very low (analogy with photovoltaic parks). An interviewee reflects on this possible impact: “On the one hand, it would be a matter of generating employment, which is very important... Here in our area we have a big problem with the issue of employment, which is that being so close to Zaragoza capital, people come to work here and leave. We have problems to settle population, because it has always happened to us. In other words, to generate employment, but we should try to ensure that this employment is local, that this employment ends up living in our towns. That would be something, working on it for our idea too” (2L). Another interviewee also reflects on the possibility of generating employment in the area associated with the storage project: “I don't know the amount of employment that this activity can generate. We are talking about regions that remain with very little population, so if that little population is towns of 100-500 inhabitants, at the end, if we make sure that it does not disappear, it is already high. The fixation of territory is no longer quantitatively but qualitatively” (3L). Other interviewees consider that the impacts on employment will be very small or null in the territory affected by the storage. An interviewee from an environmental association expresses his skepticism with the analogy of wind and solar farms: “I tell you, with the implementation of solar and photovoltaic panels and windmills, the promoter companies say yes, that it will bring jobs, It's all lies, it's all lies” (4L). Another interviewee from the regional administration stated: "This type of project seems very important to me. Now, it is a phase of the project (storage) that leaves very few counterparts in the regions where the warehouse is located, therefore, the Government of Aragon will prioritize those projects that represent benefits for the territory” (1K).
ii. Attraction of companies. Several interviewees mention the possibility of CO2 storage attracting companies to the area. These interviewees consider that certain companies that

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emit CO2 or related to the transport of CO2 could move to the surroundings of the storage, increasing the economic activity of the region. An interviewee from the business field states: “I also see an opportunity in that it can bring certain companies that require that CO2 capture. Some international company” (3L)

iii. Help in the transition to companies in the region and region. Related to the previous idea, some interviewees consider that CCS projects could benefit local companies and help them in the transition to a low-carbon economy. Here, the benefit would be associated with the capture of CO2 and not so much in the region as in the entire region. An interviewee mentions: "It would allow certain activities that are also intensive in emissions to continue to be carried out in the future and that would prevent an economic activity from leaving, having the viability of being able to capture carbon" (3L).

iv. New uses for mining areas. If the CO2 storage was developed in an area with mining operations, two interviewees mentioned the possibility of giving the mines a new use and the mining economy of the area. Thus, an interviewee states: “Later, in those points (mining areas) where the use of coal has had to be abandoned, from the social or economic point of view, it is to give a second possibility or to give a future perspective of use, to that which had been done before”. (3L)

v. Tourism. Although several interviewees mention that the CO2 storage project could negatively interfere with rural tourism activities in the area, other participants see a possible positive impact of storage linked to the possibility of developing some type of “geological tourism”.

vi. Economic compensation. The interviewees discuss the possibility of economic compensations in the municipalities affected by a CO2 storage. This question is raised again when dealing with the conditions of acceptance of a storage. On this question we found a lot of uncertainty among the interviewees. Some interviewees refer to the possibility of monetary compensations or in terms of projects. But it is discussed whether the amount will be significant or not, as well as which towns would benefit. An interviewee reflects on this possible benefit associated with storage: “Yes, I do not recommend the format used by the renewables of building sports centers… that type of thing is no longer valid… another type of thing is that the city council decides to make a sports center. An initiative that went very well for us was, I invest the taxes I get from the photovoltaic in the electricity bill of the residents, that is great, that type of aid, makes the residents see the direct return. It can be direct to them, or through the town hall. An agreement is made with the city council and the benefit obtained will reduce electricity or gas rates, what people want is for it to directly affect their pocket, as happens with fuels” (2L). For an interviewee from a local association, compensation to the municipalities is an essential issue: "And then what they are generating in the end is income that seems to come mainly to public entities, to city councils, that will then depend on where the municipalities invest that money, for the development of the towns and the territory. I see it as good to do it, but in the end the internal vision passes a bit, I also live in Belchite, I am from here, I live here and it is very good if we collaborate with the environment, we are generating all the light in the city of Zaragoza, now we are going to capture all this CO2, but in some way does it compensate us or does it not compensate us? Doing this kind of thing looks good, right? In this case, it is clear because there are no saline aquifers, it is not a thing that you can choose it because they are where they are. That, on

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the other hand, of course, here we would have to see what benefits we would have by having a facility of this type here" (2L)

It is worth considering the opinion of this local interviewee in relation to the possible benefits and compensations derived from a possible storage of CO2:

> *Of course, the main thing is that there is little population. and then it is a poor area and any project that is economically more profitable because in the end everyone ends up accepting it. I do not know of any case of someone who has been told to put a wind turbine on it and has said no out of conviction. The same has happened, but it will be very few cases. And with the issue of photovoltaic panels, the same thing happens a bit. If near this area not far away they have put a wind farm in a small town of 18 inhabitants with 500 hectares of solar panels, and they have put it. There are many such projects. And we have already had some wind turbine companies, just as you have called us, because now they must be required to make development plans for the territories, so that they are granted wind and photovoltaic parks. And they ask us what development projects could be done. That surely yours I think that maybe it is less impact than the windmills and the photovoltaic ones. So, I think that in the end, well, that, and then it depends on the specific city councils, on the vision they may have of this. (2L)*

vii. Reputation and leadership of the region on climate change issues. For some interviewees, the project could contribute to the image of Aragon as a leading region in matters of climate change and sustainability. This is how an interviewee stated it: "From the point of view of reputation, yes it could be, depending on the challenges that Aragón and, for example, Zaragoza are looking for, they have nominated it (it was in the news today) as one of the chosen cities by Europe to be climate neutral in carbon in the year 2030. If Zaragoza is differentiating itself with this issue, then this is another aspect that adds up and that puts us on the international plane, with respect to actions both for production and mitigation of emissions". (2L). Other interviewees refer to this same idea, although it is not a belief expressed by the majority of the interviewees.

### *Local negative impacts of storage*

The interviewees mention different risks or local impacts about which they are concerned. Some interviewees consider the risks of storage as minimal. Other interviewees are more concerned about these impacts. In general, the following negative impacts are mentioned and reflected on:

i. Security: Most of the interviewees (six interviewees) mention the risks associated with security as a possible negative impact of the storage project. Interviewees are concerned about possible leaks of stored gas and seismic activity. In general, the interviewees affirm that they are unaware of the risks to public health, but they consider that the population will be concerned about these issues. Two different positions appear in the interviews. Among business interviewees, security is mentioned as a potential risk, but it is considered to be a very insignificant risk. An interviewee states: "In the field of security I don't know, I guess it depends on the locations and the proximity to the towns, that would have to be studied. Looking back, for example, in the mining issue in the past, the risks that have been had have also been great and were unknown" (2L). Another interviewee states: "I don't know, I don't see, as long as it is explained, that there is no direct risk to the population, security will not be so relevant; It is not an area with experience of accidents or with social alarm in this

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sense. Unless, again, it is associated with the issue of fracking…" (4K). On the contrary, interviewees from local associations emphasize more the security risk. An interviewee expresses this uncertainty: "As I don't know for sure, I can't speak. What I told you before, I have heard. You see, with the nuclear waste warehouse it was also said, now we have to bury it in caves, salt flats, and of course, I don't have any knowledge here either, but that waste is from thousands, millions of years of activity, so I I really don't see that. Of course, what I'm telling you here is, if you store it there, and what happens afterwards? Sure, you put them there in a huge bag in the subsoil, they can't escape later in a hundred years, for example" (4L). Another interviewee refers, by analogy, to the Castor project: "An important thing that came to mind (and you may also think) is all the problems related to Castor and gas extraction. Apart from technical and other considerations, what happened, or not, the tremors, that's there. And it is very possible that everything that involves injecting is going to be associated… at least by important groups with a lot of influence: "they are going to put a Beaver here" (5L).

ii. Environmental impact. Although the interviewees are not very concerned about the possible environmental impacts, they do refer to the possibility of contamination of the aquifers. For some interviewees, water is a key issue in the region. It is compared to the situation of fracking. As stated by a professional from a scientific association in the region: "Another precedent to take into account is fracking. There were many positions here… But there was a lot of sensitivity in the specific regions and in the affected sites because fracking had a very bad image (environmental impact, pollution, etc.) – this gave rise to anti-fracking movements and demonstrations. If it is not explained well, people may perceive... some injection wells are still something a little strange to conceive...; if it is not explained well, there may be reticence in the territory" (3K). An interviewee refers to the possible impacts on the local flora and fauna. And another interviewee expresses his concern about the possible impacts on the subsoil: "I don't know the details, but for example that there would be no danger of carbonation, or gasification of wells, or any of these. No environmental hazard in general" (1L).

iii. Landscape impact. The interviewees express concern about the impact on the landscape. The analogy of wind and solar farms is generally used. But it tends to be considered that the impact would be less, given that it is an underground storage. In this sense, the infrastructure for storage and pipelines are issues that concern the interviewees. An interviewee affirms: "But then look, if you have to insert pipes to be able to transport them from an industry, the impact would already be greater there. But hey, it's still little, compared to other elements, the pipes would not have a visual impact or even be harmful to animals and such, such as wind turbines, right? (4L). Another interviewee reflects in this sense: "Having pipes to transport that CO2 to the territory, well we are full of grinders and solar panels, a pipe wouldn't bother much more, right?" (2L)

iv. Impacts on land use (agricultural): Two interviewees mention the possibility that the storage of CO2 interferes with agricultural uses of the land. As stated by several interviewees, there is a general concern in the area about the use of the territory (fundamentally after the expansion of wind and solar farms as well as other projects). Interference with agricultural use is considered a potential problem, although the interviewees consider that it would surely be a slight impact. An interviewee from the public administration stated: "In agriculture, I don't think it has much of a negative impact because it's not about occupying

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large areas, right? I don't think this project entails the occupation of large areas, I imagine, right? (1K)

v. Annoyances, noises. The inconveniences associated with carrying out works and transporting CO2 are mentioned by several participants. It is considered that the storage project would be associated with the construction of infrastructure and pipelines in the area, which would cause inconvenience among local residents. An interviewee states: “those from the town who see a return in the form of jobs and what they see are environmental dangers, nuisances (traffic)… Road traffic bothers a lot… - the pipe would be better (3K)”

vi. Injustice in the impacts. Finally, several interviewees are concerned about the social distribution of the benefits and costs of the storage project. As stated by an interviewee from a professional association, "be careful with cleaning the city to dirty the towns" (3K). An interviewee from a local association affirms, in this sense: “Right now what is most in the debate is that attempt by the administration to become a benchmark for renewables and the opposition in the towns that say “They always put us the worst and there is no way back in the area”, you are tiling my field with solar panels but I don’t have a dime left, removing the tax from the city council, it does not generate employment… I am not saying that it is true or a lie, I am saying the feeling that you breathe” (5L).

### *Acceptance conditions*

The interviewees refer to four fundamental and necessary conditions for the acceptance of a CO2 storage project in the community.

i. Local benefits: The interviewee from the regional administration, as well as the representatives of local associations (NGOs) mention, mainly, that the project has significant local benefits, as a necessary condition for its acceptance. The interviewees mention the attraction of investments, the generation of local employment and compensation to the affected local community and/or residents. Some interviewees show a certain distrust towards companies and refer to past projects in which the benefits of technological projects have not favored the local communities. An interviewee affirms: “And then, that part of the benefits of this action will remain in the territory, because with renewables, what we are seeing is that in Aragon and Catalonia (the Terra Alta part) there are large wind farms and the towns are practically the same as they were 20 years ago” (1L). Economic compensation is mentioned by the majority of interviewees as a necessary condition for the acceptance of a future CO2 storage project. Here, some interviewees refer to the need for well-designed and creative compensation, such as co-participation and co- ownership between residents and project promoters, a reduction in residents' electricity bills, etc.

ii. Minimal environmental impact. Ensuring that the environmental impact of the project will be minimal is another necessary condition for acceptance, according to several interviewees. The interviewees mention the need to guarantee the safety of the population and minimize the contamination of aquifers, the impact on land use (agriculture) and on the landscape. An interviewee from a business association develops this idea: "It is that there will also have to be a lot of defense of the issue that there is no type of affectation to the aquifers, since you already know that water in Aragon is an issue where there is a lot of sensitivity and this be one of the themes. And the issue of external impact, right? Because that area, I say it from memory, there may be some time of environmental impact in the area, especially on species

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of flora and fauna of that area that is steppe. And the kind of impact there could be outside. Another thing is the deposit as such, but the infrastructures that could be built outside and others. A point that would be this type of aspects, right? That if they guarantee that the impact will be minimal" (5K). In this sense, an interviewee mentions the need to have good environmental and socio-economic impact studies, which are consistent and accessible.

iii. Transparency, public involvement and honesty. Proactive communication and consultation with the local community (key regional and local actors and the local population) is considered by several interviewees as an essential condition for acceptance. An interviewee, in this sense, mentions as a fundamental value of the project "not deciding on carrying out the project without first consulting the local community". Several interviewees mention the need for transparency in information, honesty, proactive communication, consultation, etc. An interviewee from the field of research expresses this idea: "Because you are thinking of an area that is sparsely populated, but it is a frankly rural area and then you will have to do a job of disseminating the project that it is, but at the level of municipalities. The mayors, the towns have some fundamental factual agents who are the mayor, the doctors, that is, people with a certain entity…transparency, clarity is necessary…we are talking about a positive project. Above all, report, with a lot of transparency, because if not, the rebound effect occurs: what are you doing there that I don't know…" (3K). An interviewee mentions the possibility that a well-designed storage project could become an example of minimizing environmental impact and public involvement: "A project like this could be set as an example in a double sense, of minimal impact (on the environment) and participatory-informative" (5K).

iv. Good narrative. Finally, several interviewees consider it is necessary for the project to develop an adequate narrative that emphasizes the benefits and values of the project in mitigating climate change and the socio-economic development of the region. The interviewees mention the need to connect the project with the concerns of the community (depopulation, low per capita income, unemployment) and with the fight against climate change and technological leadership, which are very important for Aragón, in general. An interviewee mentions this issue: "Make Aragon a benchmark in the fight against climate change and see the project as one of the initiatives in that context... sell the project well... your project is good for the region" (3K). The interviewees also mention the need to combat possible associations with fracking: "If it is associated with fracking, rejection will be generalized. There were several attempts years ago and the opposition was unanimous: "I don't know why, but I am against it, and a lot". In this specific case, the Nature Council also took a position against it" (4K).

*Key actors and public involvement*

Regarding the position of the local community, including the local population and the key actors, the interviewees tend to consider that, initially, there should be a favorable position towards the project, both on the part of the residents and the social actors. Several interviewees mention the experience of social mobilization against fracking projects and, more recently, against solar and wind energy park projects. In this sense, the interviewees reflect on the following actors:

A. Local population: In general, the interviewees consider that the local population would be favorable to a project that was perceived as a promoter of socioeconomic development in the area. Under the conditions of acceptance mentioned above, most interviewees consider

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that the project would be accepted by the local population. However, an interviewee mentions that, since there is some opposition among the local population to renewable energy projects, a CO2 storage project, perceived as more complex and potentially dangerous, could generate local rejection.

B. Special populations: Several interviewees mention the possibility that neo-rural profiles or owners of second homes would oppose a CO2 storage project because it is contrary to their values and lifestyles.
C. Farmers: Interviewees discuss whether they might be against or for a storage project. Several interviewees mention that they might be in favor if the project's trade-offs outweigh the (perceived meager) benefits of local agriculture. The landscape impacts and environmental contamination could motivate the rejection by some farmers.
D. Local companies: Perceived as favorable to climate change mitigation and sustainability projects. Perceived as favorable to everything that involves investments, possibilities for innovation and improvement in sustainability.
E. Environmental groups and local associations. Interviewees do not agree on this point. Some interviewees state that only if there were negative impacts on aquifers or on the local flora and fauna could there be opposition from certain groups. Other interviewees mention that possible associations with fracking or the Castor project could arouse opposition from environmental groups and local associations to a storage project.
F. Town halls. Some interviewees mention that municipalities can be reluctant to any change in their community. In general, the interviewees consider that, under certain conditions of compensation and minimization of local negative impacts, the municipalities would be favorable to a CO2 storage project.
G. Political parties: Several interviewees mention that certain regional political parties could be favorable to the CO2 storage project.
H. Professional associations, universities, research centers. In general, it is perceived that actors such as the college of geologists, universities and research centers would be favorable to a CO2 storage project and should be involved from the beginning.

Regarding the role of public involvement, information and communication, the majority of the interviewees consider the consultation, information and involvement of the community to be very important from the beginning of the project. An interviewee from a business group, in this sense, states: “From the first moment you have to seek the consensus and complicity of as many social groups as possible. Explain it very well and involve all parties” 3L). Another interviewee affirms, in this sense: “Certain groups must be given a period to inform them, to get used to the idea, so that machines do not arrive suddenly and scare them and then that does create rejection, right? ? You have to prepare the ground little by little, right? That is why my question went in that direction, no, because I understand that until one of the two deposits has been defined, no, but yes, it is necessary… important work must be done at the sociological level of society” (5K). In general, the interviewees refer to proactivity in this sense as a source of:

i. Legitimacy and confidence in the project. The interviewees consider that proactive information and transparency are fundamental sources of legitimacy in the affected community. Thus, several interviewees refer to the need to actively inform in order to reduce mistrust and the possible perception of risk. This seems to be a question on which there is a great deal of agreement among the interviewees. An interviewee states: “Well, I

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believe that if, for a change, companies and institutions are capable of being transparent, explaining to people what it really is, there will be no problems. My perception is that there are usually problems when projects are carried out with a halo of secrecy, in everything that is done" (2K). An interviewee affirms, in this sense: "Yes, I believe, that is important. Because it is a way of explaining technology to people and making them see that there is nothing that is hidden, nothing strange, right? And second, I think it's, come on, it'll lighten up the dark areas, I think. Quite the opposite of what is being done with renewable energies…" (4L). Another interviewee states: "The involvement of local actors is essential. It is essential that transparency be perceived" (3K). Another interviewee states, in this sense: "Sometimes you don't need to give people a vote, but you do need a voice. If people feel heard or at least informed, the level of rejection disappears. Then you can sell much better there are technical-economic reasons to do it there and you have communicated it to them and they will understand it and therefore there is no rejection. That doesn't mean you don't have to hold a referendum to see if he has to come or not. There are two things, which, if they are focused well, I think that the first one is enough. And also in Aragón, especially, I think we are the only autonomous community in Spain that has had a broad social consensus since 1989" (5K)

ii. Project improvement. An interviewee mentions the need to consult the local population to learn about possible local specificities and improve the design of the project. Thus, she states: "In other words, once you are clear about the area in which you can implement the project, you have to talk to people, I am convinced of this. Explain the project, what it will consist of, what is the area that is delimited. You have a lot of room in this area where you can find the best place to find the infrastructure, or the wells that you need, which is a safe technology, because that will reassure them because it is true that there are few people but there are still people in those towns, so what know that the fact that you inject CO2 at 800, 900 meters deep is not going to affect the water of the streams at all, nor the fields that are such, nor their cattle that they have there, because this is good that be clear and that without that sense they can participate in the project, I think they will like that and see that it has not gone to waste, regardless of what they think, yes" (2K).

The interviewees mention different actors that should be involved: Local population; Farmers; Town Halls; Aragon Nature Protection Council; professional associations; Foundations; Environmental organizations (Ecologists in Action, SEO Birdlife); counties and county councils; Business associations; University

*General position of the interviewees towards the CO2 storage project*

In general, we find three fundamental positions among the interviewees:

i. Support and psychological identification. For some interviewees, the CO2 storage project is an opportunity for the region in terms of leadership in the fight against climate change, technological research and development, and economic revitalization. These interviewees tend to show a significant degree of support for the storage project.

ii. Acceptance. Several interviewees show an attitude of acceptance towards the storage project. The project generates interest among these interviewees. They also believe that the project could generate several environmental, socio-economic and scientific benefits for the region.

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iii. Ambivalence. Some interviewees are ambivalent about the CO2 storage project, since they consider, in the same way, the possible benefits of the project (generally global) and the possible costs of the project (local). Some interviewees show a reluctant acceptance: they would accept it if the public administration considers it appropriate, but they convey a certain perception of injustice in the impacts.

*Table 4. General position of the interviewees (Onshore).*

| No. | id | actor type | overall attitude | Reasons |
|---|---|---|---|---|
| 1 | 1K | Public administration | Reluctant acceptance | ▪ Does not trust the ultimate intention of the project and the promoters (industry)<br>▪ Receives few local socioeconomic benefits<br>▪ Perception of injustice in the impacts |
| 2 | 3L | Industry | Acceptance-Support | ▪ High perception of global benefits (climate change, energy transition) and<br>▪ Local (reputation, employment, set scientific and technological development in the region) |
| 3 | 4k | Local business associations | Acceptance | ▪ Somewhat neutral attitude towards the project.<br>▪ Perceives benefits in terms of climate change mitigation.<br>▪ He considers that there could be some opposition among local groups. |
| 4 | 5K | Local business associations | Support for | ▪ Perceived as a beneficial project for Aragon's climate change strategy<br>▪ They perceive CCS as one more option in the fight against climate change<br>▪ They perceive important possible socioeconomic benefits for the region (investments, logistics, attraction of companies) |
| 5 | 2K | Research | Psychological support-identification | ▪ It has a very favorable position towards research in CO2 storage<br>▪ He considers it an essential project in the fight against climate change<br>▪ Considers it necessary to inform and involve the local population for the success of the project |

| | | | | |
|---|---|---|---|---|
| 6 | 3K | Research | Support for | ▪ Very favorable to research in CCS and mitigation of climate change in the region (Aragon)<br>▪ Emphasizes the need for local support, involvement, consultation, advocacy for a good narrative, local benefits and compensation |
| 7 | 1L | regional NGO | Acceptance | ▪ Considers that CCS is a necessary technology in the fight against climate change<br>▪ Support for CO2 storage in the area if its environmental impacts are minimal and it brings benefits to the area |
| 8 | 2L | NGO | Ambivalence | ▪ Perception of injustice in the impacts of mitigation actions.<br>▪ Ambivalence about impacts. There may be negative impacts and very few positive impacts for the local population |
| 9 | 4L | NGO | Ambivalence | ▪ Perception of few benefits for the local community<br>▪ Perception of impacts on the landscape and nuisance<br>▪ Preference for alternatives (eg reforestation) |
| 10 | 5L | NGO | Ambivalence-acceptance | ▪ Perceive benefits of CCS in terms of helping energy-intensive businesses transition<br>▪ Considers that there may be problems of social acceptance in the area, given the limited local benefits of this type of project |

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## Offshore (Tarragona and Ebro)

The table below summarizes some key ideas about the affected community expressed in the interviews.

*Table 5. Strengths, challenges and key conditions* Offshore

| main strengths | Main challenges | key conditions |
|---|---|---|
| ▪ Region with an industrial tradition, especially in the Tarragona area.<br>▪ Experience in the implementation of industrial facilities.<br>▪ Synergies already established between industry and sectors of civil society.<br>▪ Coexistence between industry and tourism. | ▪ Experience with the Castor Project.<br>▪ Opposition, especially in the Ebro area, to any industrial project.<br>▪ High capacity for mobilization by the public (especially in the Ebro area).<br>▪ "Solidarity fee"<br>▪ Coexistence between industry and tourism. | ▪ That it can bring benefits at a local level, and not only at a global level.<br>▪ Effects on pollution mitigation.<br>▪ Transparency and consensus with the local population. |

### *Community Description*

Even forming a single study area, the areas of Tarragona and the Ebre Delta have very different natural and socioeconomic characteristics. The interviewees provided the following insights about their community:

i. Territory and political aspects:
   a. The Terres de l'Ebre are a very characteristic population. It is a small territory, with a very low population density, where everything is very dispersed. According to one of the interviewed journalists, its structure at the end of the Franco regime was still of a very cacique type. In addition, he considers that past social movements, such as the anti-transfer movement or the opposition to the Iraq war, were used politically to defeat the hegemonic party in the area, Convergència i Unió, and he believes that today these favors are still being repaid between political parties. *Therefore, well, since we are in this plural territory, small, still influenced by structures with bossy operations, etc., and it is not very socially structured either, we also have the problem that we have a decentralized Generalitat but we do not have a well-constituted veguería, where really they carry out debates or pacts. Here the parties do not agree, there is no way. If there are agreements in Barcelona or Tarragona, here they are unable to agree between them [* L7]
   b. Another participant considers that these projects are often used as a political weapon, *and they are in favor or against depending on the party that supports them, sometimes within the same administration, there are directors of different parties... let's see who comes out in the photo of the project that benefits the territory* [L5].

ii. Economy:

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a. It is considered that there is a significant inequality in the business world in the Delta area. One of the interviewees affirms that, on the one hand, there are some very powerful entrepreneurs who also have very little investment mentality, while on the other hand there are small traders. *There are the big ones, those who have money, they don't even know how much they have and they keep it in the banks, because there is little investment mentality here, very few entrepreneurs, some of them will be young, I hope the children, and then there are the small merchants, small entrepreneurs, workshop, store and such. There is an intermediate level missing, right? [* L7]
b. In the case of Tarragona, it is considered an area with little economic diversity, and the closure or decline of this industry could generate significant social tension and leave many families without work. One of the participants considers that Covid has greatly affected sectors such as tourism or restaurants, but believes that the closure of one of these companies would have an even more notable effect in terms of unemployment and the economy.

iii. Industry Perception:
a. One of the interviewees considers that in the 1970s, with the oil wells in the Delta area, there was a very positive perception of the industry, combined with the time of industrial development in Spain. When the industry later moved to the Tarragona area, he says it was perceived as another lost opportunity. *Oil and such, because there were a few years because the base of operations was in Sant Carles de la Ràpita, and at that time there was a perception, those were also the years of development, there was a very positive perception, that it was seen that it had a port , Okay. Then, when this moved to Tarragona, once again it looks like those from Tarragona are stealing what we have here. [* L7]

iv. Tourism:
a. Terres del Ebre is characterized by family tourism, where nature, environmental quality and top-level agricultural products prevail.
b. On the other hand, in the Tarragona area there is more coastal tourism. In the Salou area, specifically, it is a question of mass tourism and that lives more with its back to the territory.
c. In addition, a characteristic phenomenon occurs in Tarragona and it is the coexistence between tourism and industry, which greatly conditions the area. *Coexistence of vacation hotels with extraction cranes* [L1] . This relationship has been softening and a kind of coexistence and balance has been created.

v. Perception of climate change:
a. In the Delta there is a greater perception of this phenomenon, since it is perceived in a more visual way. *There is greater awareness of climate change there than here, because they perceive it in the rice fields, they eat up the Delta.* [K1]
b. On the other hand, in Tarragona there is also a perception on the part of its inhabitants that it is a city that is particularly polluted due to petrochemicals. Regarding this, one of the representatives of an NGO affirms that these levels of contamination are as high as in the city of Barcelona, while, on the other hand, another participant affirms that the data show similar contamination to other areas.

vi. Perception of risk of the population:

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a. It will be very high. One of the journalists interviewed believes that it is due, among other things, to the victimizing discourse that has been fed for decades by journalists and the media. *From a social point of view, ugh, the perception of risk would be considerable because, mea culpa, we have fed a victimizing discourse over the last 20, 30 years, which has penetrated very deeply into the territory, into the majority of the population* [ L7]. He considers that, although a greater part of the population is favorable, the opinion leaders are installed in a negative to any industrial implantation and the journalists create opinion regarding this line.

vii. Feeling that everything that nobody wants is installed:

a. In Terres de l'Ebre there is a majority feeling that everything that nobody wants is installed there. It is a territory that is sensitive to the environment and distrustful of what can be done in it.

b. In both parts of the region, Tarragona and Delta, there is a perception that it is a battered area. *It is considered that enough solidarity quota is already paid, and any attempt to store CO2 will be seen as excessive. Even the plans for wind and solar farms in Catalonia are located in our territory, they do not appear on the Costa Brava, nor even in the agricultural area of Lleida, nor in the metropolitan area. Everything comes to an end here. Two generations have already had this feeling that we are the backyard of Catalonia* [L2]. It is considered that enough toll has already been paid for the common benefit, with nuclear and petrochemical industries that offer a service that goes beyond the territory.

c. Even so, there are differences between the two areas and a representative of the industry considers that in the Tarragona area there is a greater willingness to listen to this type of proposal.

viii. Mobilization capacity:

a. Almost cyclically there is an open territorial cause that enjoys a lot of consensus, with the majority of political colors and all the social movements united. *There is a mixture of not wanting to have this type of infrastructure and reaffirmation, even local patriotism, I would say. Sense of belonging. These cases are like, in quotes, against the foreign enemy, very unifying. And there are almost all political colors, all social movements.* [L2].

b. In addition, there is the conviction in the Delta area that there is capacity to stop this type of project and, in fact, they already have experience in stopping other facilities. *It is no longer just the perception of whether something is interesting or not, but also the conviction that there is the capacity to stop these projects* . [ L2].

c. Even so, according to a representative of an NGO, not all the territory is mobilized, since he considers that the specific socioeconomic situation of the area, marked by a large workforce with little training and very likely to work in this type of industry, makes that it is an area reluctant to analyze these projects outside of an employment-generating perspective.

ix. Past industry experience:

a. Castor's previous experience is described as *a burden that affects us* [K1] and is decisive, since it had real and highly perceived effects on the community. *The Beaver had real effects on the community, with hundreds of houses cracked, so the fear is understandable* [K1]. In addition, it had other derivatives, such as the compensation

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to the development company that is being paid by the citizens through their electricity bill, *it is not that it just has not worked, and whoever has done it has collected it through the electricity bill. people's electricity that at this moment electricity is at a very high price, which is being paid by the population in their bills* . [L2]. Thus, it will mark public opinion and the social perception of this project.

b. Another determining aspect is the accident that occurred at the IQOXE company in 2020. This incident has also marked a before and after, since it was the first time that an accident caused a fatality outside the premises. The representative of the Port of Tarragona considers that this accident broke a mental framework that the chemical industry not only had the risk of long exposure but could also pose an immediate risk, and it was the last margin of confidence left with this industry. He considers that this affects the possible implementation of other technologies.

### *Familiarity with CAC*

The interviewees coincide in pointing out that the majority of the population is unaware of this technology. *The knowledge of the population throughout this period is practically nil* [N1].

i. As for the interviewees, there are differences:
   a. Many of them were unaware of this technology. Some have never heard of it, while others have only heard of it in a very vague way or have looked for information from the invitation to participate in the interview. *A bit vaguely. There are many proposals like the Green Hydrogen in Tarragona, there are as many proposals. Nothing concrete, but I heard it vaguely* [L4].
   b. Other interviewees do show knowledge on the subject, for example, in the case of the Port of Tarragona, this technology is part of one of its strategic lines. *This is where our interest appears as a port authority because in the end, once CO2 is captured and if it has to be moved by sea, it can be like any other product that moves in the port* [L2].
   c. Some participants were unaware of the effects of this technology and its technical aspects. They show doubts about its operation or characteristics such as its distance from the coast, depth, transport and possible candidate spaces. Other questions that arise are about possible leaks or the presence of CO2 in the atmosphere. Another participant considers that it is a technology that is still in a preliminary phase with few examples and that it should be a complementary measure to others. *I don't know what part of this that is going to be injected is going to remain in the environment, here the technical part escapes me* [L4].

### *CO2 Capture and Storage Issues*

In the interviews, the stakeholders consulted raised various questions related to carbon capture and storage, its characteristics and its potential results in the territory.

- Administration: concern about the effects it may have; forecast if there are some defined lands where such a project would be implemented.
- Industry: what risks from the technical point of view would it imply.
- NGOs and associations: why this particular area was chosen, when it is already an area historically stressed by this type of industrial projects; Possible impacts on the sea, on water

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quality or on marine life and other risks; Community benefits (local employment and other compensation); Previous experience elsewhere; Who are the CO2 emitters; What part of the CO2 can remain in the environment; Technical issues about how CO2 is transported and injected.

- Media: questions about how it is stored, what proportion of CO2 could be stored; Experience elsewhere, state of technology.

### *Global Benefits of CCS*

Regarding the global benefits, some arguments are explained in favor of an improvement in air quality, although it is considered that its effects will not be immediate in general terms.

i. Short-term benefits are relatively unnoticeable. One of the participants considers that this difficulty of obtaining benefits in the short term hinders its acceptance. In addition, the IGME expert assures that the immediacy required for the generation of benefits in these projects plays against them, since they need time to develop, implement and see the beneficial effects. From the political point of view, the times are difficult, since the benefits are not immediate and the politicians and those who make the decisions have other rhythms. *They are long-term projects, incompatible with the deadlines of those who make the decisions. I want to get the credit now, not when I'm* gone [N1]. Another of the interviewees considers that in order to avoid this, there must be an institution or entity with sufficient unity and prestige so that it can give continuity to the project.

ii. It can serve to reduce air pollution. This can be used from the tourism sector, to promote the area. *For tourism it is a very good argument to say that pollution is eliminated, that the air is 'cleaned'* [L1]. For this, he believes that it is essential that they explain what are the success stories already implemented in any corner of the world. *It is that if you started explaining the success stories to me, I would have been more receptive. Take advantage of these arguments* [L1].

iii. The main problem with this infrastructure is storage. So for the public the perception would not be to reduce CO2 levels, but to use the subsoil and therefore they would think of Castor. If CO2 were captured and moved out of the area, it would be seen as a benefit to society and there would be no problem.

### *CCS risks*

On the one hand, there are possible technical risks with this technology.

i. The main risks would be an unforeseen leak or that it was injected at too high a rate and that this would generate pressure and, therefore, an induced seismicity. *The two main foreseen risks are, on the one hand, that there is an unforeseen leak or that you inject at too high a rate, generating an overpressure and this leads to induced seismicity, rock collapse, which causes an alarm and a serious problem* [N1 ].

ii. There is also the risk of not correctly characterizing the site from a technical point of view and that at the time of starting to store the response of the reservoir was not what was expected.

On the other hand, there is another type of social risk.

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i. The effect of Castor and his experience is one of the most determining aspects. The participants consider that it is a topic that is recent and this will generate a lot of insecurities in the public. *People will think that the possible installation of CCS will be done wrong* [L1].
ii. In this line, it is difficult for it to be seen as an opportunity at the territorial level, since part of the public would consider that it would be part of the implementation of the petrochemical industry and there is already a part of the public that does not consider it an opportunity.
iii. Another risk is that of *burning* the concept of CO2 Capture, while it will be perceived as a CO2 project, when it really is a subsoil project where gas or other waste could be stored. If the decision was not correct, the public would associate it with the idea of CO2 capture and would affect the general narrative of this technology. *And the risk is that not making the right decision on these issues may lead to the easy association of it that has caused us animosity to the idea that it is the capture of CO2 and no, what it really is is that it is a storage project in the subsoil. This would have significant damage to the general interest of, or to the general narrative that it is a key technology for reducing climate change* [L2].

### *Local benefits and opportunities of CO2 storage*

Regarding the opportunities and benefits at the local level, the participants name the possible creation of employment as the most relevant effect.

i. One of the most commented aspects is the possibility that implementing a facility of this type would generate wealth and employment for the area. *If it really creates wealth and employment, yes it is. But if in the end it is one more activity that they do not want elsewhere, that does not provide employment or wealth, then we are not interested* [L5]. In the short term, it could serve to sustain industrial sectors that would otherwise no longer be viable. *Local communities can gain both by maintaining the industrial fabric of the region, and by developing new branches or sectors that maintain and promote economic activity in the region. the zone* [N1]. This can be an important factor in areas where the influence of industry on the local economy is notable. For the petrochemical sector itself, it could be a great opportunity since it is necessary and decisive that they reduce their CO2 emissions to be competitive. *It is decisive to reduce CO2 for the future competitiveness of the sector* [L2]. In addition, it can also promote the development of new economic sectors in the area, all with circular economy models.
ii. This, in addition, could benefit the area in publicity, since it could be described as a pioneering technology that would achieve being completely carbon neutral.

### *Local negative impacts of storage*

As for the negative aspects at the local level, one of the most mentioned is the little return that they consider such an installation would have in the area. They consider that neither the employment generated nor the possible compensations would offset possible damages, especially in the Delta area.

i. Several participants do not know if this industry will generate local employment. *I do not know how much employment generation it implies, because I have never seen any practical implementation* [L4], while some representatives of the industry affirm that these projects

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generate little specialized labor at the local level. In this way, several participants consider that at the local level there will be no direct economic impact on the territory.

ii. In addition, one of the participants considers that this project follows the model of macro-projects and considers that it only feeds the same type of economy. *For example, there was also talk of the Hard Rock Casino that was going to be implemented in Tarragona, which was also going to imply 15,000 jobs, we always go with the macro-project model* [L4].

iii. Another aspect that is highlighted is that an installation of this type would serve to improve air quality in the Tarragona area, since CO2 would be eliminated, but it would not return to Terres de l'Ebre. In addition, the Delta del Ebre area is classified as a biosphere reserve and, therefore, any installation of this type will not favor the promotion of agro-tourism and agro-industry. *We have been declared a biosphere reserve zone and we are in the process of economically promoting the benefits of our territory and I do not think it will help us to have a deposit of these characteristics to promote* [L3].

### *Acceptance conditions*

Some of the requirements necessary to accept an installation of this type would have to do, among others, with the technical evaluation of the project and the suitability of installing this technology in a stressed territory where the public could be reluctant.

i. Provide local benefits: an installation of this type to be accepted should bring an economic and environmental return to the area. The participants consider that, apart from being a technology that offers global benefits, it also has to offer them at a local level. *Not only the ecological aspect and the economic aspect, but both together hand in hand* [L3]. They consider that the territory already has enough facilities that serve to improve other areas without a direct return to the territory.

ii. Reduced environmental impact: It would be necessary to assess the emissions and other aspects that allow the territory to assume it, since there is a significant industrial overload. In addition, especially the Delta area, it is an area with great natural attractions, which will cause any installation that they perceive to be dangerous to face significant opposition.

iii. Communication, transparency and consensus: If you want to avoid this opposition, it is very important to be communicative with the territory. It is a territory very accustomed to mobilizations, with a great capacity to organize very powerful social movements against what they consider threats to the territory. To avoid this, communication with the different social actors and with the public is necessary, making it necessary to raise awareness among the population and the need to establish participatory channels in order to reach a consensus.

iv. Technical suitability: in this communicative process with the relevant stakeholders and the public, it is necessary to show the technical suitability of the project, to avoid suspicion. Several actors affirm that in previous projects they have not been told all the possible aspects or risks and this generates mistrust.

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*Key actors and public involvement*

i. Several actors agree on the importance of informing. There are social agents in the territory that are essential to take into account as they could inform the public and this would offer confidence in the project. Among these actors would be, among others, chambers of commerce, industrial associations, the port of Tarragona, the URV, and other people recognized in the territory and with the capacity to influence citizens. *The URV could help explain what is positive for the territory* [L1].

ii. According to an IGME expert, we must be transparent and that people do not have the perception that the choice of the site is arbitrary but rather the result of an exhaustive study, and that is one of the advantages of this project, which is also being developed with the support of the European community. A representative of a chamber of commerce reaffirms this need to be well explained because they often see that it does not happen and they find groups and platforms against it that mobilize and demonstrate.

iii. There needs to be a consensus and it can be debated why the people of the territory are at the limit. Agreements must be reached in the territory about the benefits associated with this initiative. Social democracy techniques could be formulated, such as holding a territorial consultation at some point. There are already actions in this line currently, which could be used to seek consensus against this technology.

   a. is the *Taula del Consens* , a table that gathers both ecological and technical actions and activists or people who are interested in the territory from an economic point of view, the irrigation communities, that what they do is somehow try to define the actions that it has to do the government in the Ebro Delta.
   b. From the Chamber of Commerce of Tortosa the plenary also meets, represented by businessmen from various sectors and it could also be a good space to start working on this issue and later transfer it to other spaces such as unions, town halls and the public. *Every month we have a meeting with the Chamber of Commerce, the plenary, which is the Assembly that is represented by businessmen from different sectors* [L5].
   c. Repsol also carries out actions in this line. It has an agreement with the fishermen where an annual meeting is held, in addition to other meetings to share information if necessary. There is also the *Board of Mayors* , which is held twice a year in the municipalities where they have a presence to have dialogue with them. They also organize a Repsol public panel in Tarragona, *different representatives by sector and territory (tourism, etc.), a profile that is not very inclined to the industry* [K1]. Repsol considers that it is necessary to be transparent and establish relationships of trust with people with credibility in the territory.
   d. A new factor that has appeared in recent years is social networks and their environment. They are an active participation tool for citizens. *This gives citizens even more capacity for active participation, luckily. Groups of informal citizens, they are not registered to any party or entity, they are influencers. They launch city debates. They open the debate and feed it* [L2].
   e. There are participants who affirm that they have previously participated in participatory processes that they consider to have been a theatre. One participant affirms that many participatory processes are carried out that do not leave much room for decision to the public, while another actor affirms that participatory processes start, but nobody ever knows how they end. *The participatory processes*

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*that have been carried out so far start very well, but they end no one knows when, or how, or where* [L7]. Along these lines, another participant states that it is difficult to get people to participate. People go out to protest, but not so much to participate.

The positioning of the actors could be distinguished between those who remain silent, those who are favorable and those who oppose it.

There is a substratum that is not very favorable and no matter how many guarantees are offered, it will not be well received. If there was a possible environmental or sustainability impact, along with the recent Castor experience, and being a tourist area, it is very difficult for someone to welcome it.

The opposition in Tarragona and Terres de l'Ebre will be different. In Terres de l'Ebre the capacity for real mobilization is much higher, due to a much stronger social fabric caused by years of feeling wronged. In addition, this mobilization not only translates into the street, it can also create a lot of protest on social networks.

i. Uncertain reaction:
    a. In the Ebro there are also two irrigation communities, but if they don't touch any of the water they won't intervene.
    b. The administration would play a more questionable role if it perceives that the project will not translate into benefits. Although if it translates into employment and benefits, it will be in favor. *The local administration is key and is very receptive to any investment, especially if it generates jobs* [L5].
    c. As for the Port, Repsol shows doubts, since they consider that it has a political profile and also depends on the Ministry.
    d. The fishing sector is a very affected sector, fewer and fewer boats can live on it and could initially be against it. Even so, Repsol considers that the fishermen's associations can help transmit the message to the fishermen, since from their experience they are an adequate interlocutor. Likewise, one of the interviewees considers that it is important to explain it well to the fishermen, especially in El Serrallo and Cambrils, two of the most important fishing ports.
    e. The media in the Tarragona area are highly fragmented and number more than 40. El Diari de Tarragona has a 90% advantage over the next medium. These media have the capacity for involvement. *The media acts as a transmitter. Transmission of what is cooked in society. They will give everyone a voice. But if there is any mobilization, they will accompany* [L2]. One of the journalists interviewed comments that in the Delta del Ebre area a victimizing discourse has been nurtured for decades, and current journalists have already grown up with it and are currently the ones who dominate public opinion. Therefore, he believes that they must be taken into account, since he considers that currently a single discourse prevails on issues like this.
    f. If this project is accepted from the university and the academic world and they can transmit it to the public, it will be favorable.
    g. *Look, there is a man who has great prestige in the area because he is highly protective of the territory, his name is [anonymized] and he is a doctor in geology, he has an office in Tortosa and this character is one of the people who gives the*

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*territory the most trust [...]. If this man saw it well and the academic world too, well, everything would be possible* [L3].

ii. Favorable reaction:
   a. There are sectors such as chambers of commerce or associations of chemical companies that may keep a low, discreet profile. Although other interviewees consider that they were openly favorable. *EQT, chemistry, Chamber of Commerce, College of Engineers, PIMEC, business organizations* [K1].
   b. The business world is usually in favor of these initiatives. A representative of NGOs considers that it will be especially those entrepreneurs who will benefit through the generation of employment and economic benefits. *The economic sectors that are ultimately going to benefit from this implementation, generation of jobs, economic impact, etc. Well, these are the ones who are going to be in favor* [L4].
   c. The unions could be in favor if it allows the continuity of the industry and, therefore, the jobs. *The unions, it could be, in the supposed case that ensures the continuity of the industrial tradition* [K1].
   d. In the Delta de l'Ebre area, one of the journalists affirms that a new environmental group is being formed in the area, distancing itself from the Platform and with a more open, scientific and technological vision. *They are making a new social movement in the Ebro Delta that is more possible, with those called MOLDE, who are the Defense Movement of the Ebro Delta [...] they are already distancing themselves from the Platform of all life and are saying, Hey, nowadays science and technology [...] that's why I think the mentality is opening up a bit* [L7].

iii. Opposition reaction:
   a. Civil society in the Tarragona area is very powerful and is also influenced by political parties. *Implications of the CUP in various social groups which significantly affects the creation of biased opinions* [K1]. Militant people move around a lot and are in various associations, *collas castelleras* , etc.
   b. Environmental groups are also important players. In some cases they have disclosed biased information. When *Casablanca was closed, environmentalists from [anonymized] began to disclose that Repsol wanted to take advantage of the wells for CO2* [K1].
   c. tourism entrepreneurs. In Salou and La Pineda you will not want anything in front of their beaches. *Salou and La Pineda will be very much against it: in front of my beach I don't want any risk* [L1].
   d. Citizens can also be against it, especially those who are less informed or who have not received information in time.

### *General position of the interviewees towards the CO2 storage project*

In general, we find three fundamental positions among the interviewees:

i. Support and psychological identification. For some interviewees, the CO2 storage project is an opportunity for the region in terms of leadership in the fight against climate change, technological research and development, and economic revitalization. These interviewees tend to show a significant degree of support for the storage project.
ii. Acceptance. Several interviewees show an attitude of acceptance towards the storage project. The project arouses interest among these interviewees. They also believe that the

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project could derive certain environmental, socio-economic and scientific benefits for the region.

iii. Ambivalence. Some interviewees are ambivalent about the CO2 storage project, since they consider, in the same way, the possible benefits of the project (generally global) and the possible costs of the project (local). Some interviewees show a certain reluctant acceptance: they would accept it if the public administration considers it appropriate, but they convey a certain perception of injustice in the impacts.

*Table 6. General position of the interviewees (Offshore).*

| No. | id | actor type | overall attitude | Reasons |
|---|---|---|---|---|
| 1 | K1 | Industry | Psychological support and identification | ▪ Climate change mitigation<br>▪ Generation of secondary industry. |
| 2 | N1 | Research | Psychological support and identification | ▪ Despite the introduction of renewables, backup energies are needed.<br>▪ In the short term we are talking about sustaining industrial sectors that otherwise I do not know to what extent they may be viable.<br>▪ It could give rise to a whole infrastructure around it. |
| 3 | L1 | local business associations | Ambivalence | ▪ Interest in whether it can create jobs.<br>▪ Concerns about environmental impact and sustainability.<br>▪ What does the territory benefit from, if not the reaction will be to do it in another territory.<br>▪ For tourism it is a very good argument to say that pollution is eliminated. |
| 4 | L2 | Industry | Acceptance | ▪ It is decisive to reduce CO2 for the future competitiveness of the petrochemical sector.<br>▪ CO2 reduction is crucial to reduce the evolution of climate change.<br>▪ New technologies are new opportunities. |
| 5 | L3 | Public administration | Ambivalence | ▪ The balance between what is the least harmful, whether to hide that CO2 within nature or allow it to flow through the air.<br>▪ Surely it will mean an improvement for the environment, but I do not see a direct economic transfer. |

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| | | | | ▪ I don't see that it helps us for our objective, which is to promote agrotourism and agribusiness. |
| 6 | L4 | NGO | Ambivalence | ▪ I get the impression that it is the first part of mitigating climate change and that the thread would have to be stretched to close the whole circle.<br>▪ I only see the proposal with skepticism.<br>▪ It would be necessary to evaluate emissions and everything necessary to see if the territory can really assume it. |
| 7 | L5 | local business associations | Ambivalence | ▪ I think it can be very beneficial, the problem is how we control it.<br>▪ A more sustainable environment, and you have a better way of life. But, on the other hand, I don't know what kind of consequences this can have.<br>▪ If in the end it is one more activity that they do not want elsewhere, that does not provide employment or wealth, then we are not interested.<br>▪ It does not have enough indicators to make a judgment of the possible environmental impacts. |
| 8 | L6 | NGO | Ambivalence | ▪ As a measure added to other technologies, it must be taken into account and it is interesting, but it is difficult to understand all its complexity.<br>▪ I have no data to calculate these benefits.<br>▪ What kind of compensation would it have for the region.<br>▪ Once again, the negative externalities of the industry (in this case CO2) are exported to relatively distant areas.<br>▪ I see one more problem in a territory that already has many, and not resolved. |
| 9 | L7 | Media | Acceptance | ▪ The proposal that you make technically has to make some sense, firstly because the big companies get involved in researching and developing it and secondly because the CO2 that has been created over the years will not disappear by itself. |

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| | | | | |
|---|---|---|---|---|
| | | | | ▪ From the planetary point of view it is evident that it is a beneficial thing because there is no alternative that I know of, at least better.<br>▪ I do not perceive risk. |

## Summary of findings

*Onshore*

The onshore region was characterized by the interviewees as having several strengths in terms of CCS developments: It is a particularly proactive area in terms of sustainability and renewable energies, it has a low population density and an increasingly reduced economic activity, due to the gradual closure of the different mines and power plants that were in the area. These factors might contribute to greater acceptance by the public, even more so if the CCS capture facility can attract jobs in an area particularly marked by depopulation and an aging population. The recent local opposition to renewable energy projects, the defense of rural life by some local groups and the negative experience with fracking projects in the community were characterized by the interviewees as threatens to a potential CCS project.

The stakeholders interviewed mentioned several global benefits of CCS such as climate change mitigation and the sustainable transition of local industries. For others, CCS had no clear global benefits. In terms of local benefits, the interviewees mentioned that a CCS project could attract companies and investments to the area and bring direct employment for the region, and in turn, help preventing the loss of population. It was also considered that CCS projects could help the sustainability transition of the companies currently operating in the region as well as the reputation and leadership of the region in climate change issues. The economic compensation for municipalities and residents affected by a CO2 storage was a main potential benefit for some stakeholders.

Most of the interviewees mentioned the risks associated with security as a possible negative impact of a storage project. Interviewees were concerned about possible leaks of stored gas and seismic activity. In general, the interviewees mentioned that they are unaware of the risks to public health, but they consider that the population will be concerned about these issues. Other key local risks discussed by the interviewees were possibility of contamination of the aquifers, the impacts on the landscape, the impacts on land use (agricultural), annoyances in the construction phase and the potential injustice in the impacts (unfair social distribution of the benefits and costs)

As for the key conditions for the acceptance of the project, the interviewees mentioned the need for local benefits, as a first necessary condition for its acceptance. The interviewees mentioned the attraction of investments, the generation of local employment and compensation to the affected local community and/or residents. Ensuring that the environmental impact of the project will be minimal was another necessary condition for acceptance, according to several interviewees. Transparency, public involvement and honesty (the majority of the interviewees considered the consultation, information and involvement of the community to be very important from the beginning of the project) as well as a having a good narrative for the project were also critical conditions, according to the interviewees.

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In general, we found three fundamental positions among the interviewees:

i. Support and psychological identification. For some interviewees, the CO2 storage project should be an opportunity for the region in terms of leadership in the fight against climate change, technological research and development, and economic revitalization. These interviewees tended to show a significant degree of support for the storage project.
ii. Acceptance. Several interviewees showed an attitude of acceptance towards the storage project. The project generated interest among these interviewees. They also believed that the project could generate several environmental, socio-economic and scientific benefits for the region.
iii. Ambivalence. Some interviewees were ambivalent about the CO2 storage project, since they considered, in the same way, the possible benefits of the project (generally global) and the possible costs of the project (local). Some interviewees showed a reluctant acceptance: they would accept it if the public administration considers it appropriate, but they convey a certain perception of injustice in the impacts.

*Offshore*

The offshore zone, as we have seen, can in turn be divided into two zones with remarkably different characteristics. On the one hand, the Tarragona area and, on the other, the Ebro Delta area.

Regarding the characterization of the area, one of its main strengths is that the Tarragona area can be considered as a region with an important industrial tradition and, therefore, with experience in the implementation of this type of installation. In this way, there is a coexistence between two models that, a priori, seem antagonistic, which are industry and tourism. Even so, over the years and with experience, a balance has been achieved between these two sectors, where synergies have even been established between them. Even so, it is a relationship that must continue to be worked on in order to be lasting and, therefore, in turn represents a strength and a continuous challenge.

Thus, the local benefits perceived by the interviewees are, first of all, the possibility that a project like this brings wealth and benefits to the local region. These benefits could go along the lines of job creation and in turn the maintenance of the facilities, and therefore the jobs, of the petrochemical companies in the area. Furthermore, a possible CCS installation could not only maintain the existing industrial fabric, but could also contribute to the development of a complementary industrial fabric. In addition, another factor that could benefit the region, especially in relation to tourism, would be the prestige it would achieve if it were considered a pioneer region in carbon neutrality.

On the other hand, regarding the main challenges, the previous experience with the Castor Project is decisive, since the inhabitants of the Ebro Delta perceived the seismicity induced by this installation, in addition to seeing how some houses cracked. Thus, there is significant opposition to any type of industrial project, especially in the Delta area. In relation to this opposition, the population of the Delta shows a great capacity for mobilization and they have previously been able to stop industrial projects that they saw as threatening to the territory. In both areas, both in Tarragona and in the Delta, they consider that they contribute much more than they receive, since they believe that all the industrial facilities that nobody wants in Catalonia end up being implemented in their area.

The perceived local risks are, firstly, that the project does not have a direct economic impact on the territory and the probable low generation of specialized labor that these projects usually have, at

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the local level. Another risk perceived by one of the interviewees is the idea that it is another macro-project, like those that have been previously proposed in the area (industrial and other) and that he considers that they do not diversify an economy that is already excessively concentrated in the industrial and tourist sectors.

In the Delta area, they consider that a project of this type would never favor the area, since it is a Biosphere Reserve and they consider that its attraction lies in nature and agro-tourism. Finally, it has been seen how in the offshore zone they perceive an injustice compared to the rest of Catalonia and consider that any industrial facility that nobody wants is installed in their territory. But in the Delta area, in addition, a double discrimination is perceived, and it is that they consider that a project like this in front of its coast would benefit the Tarragona area, since it would eliminate the CO2 that they generate, but not them, which they consider that they do not emit as much CO2 and would only receive the negative externalities.

The conditions of acceptance are several. In the first place, that the installation generates local benefits, both environmental and economic, since in previous experiences of other projects they perceived that there were no local benefits. Another condition is that the environmental impact is reduced since they consider that it is a territory with a significant industrial overload. In addition, they consider that the region, especially in the Delta area, has great natural attractions. Another necessary condition is that the implementation process be transparent and there is communication with the different social actors and the public, in addition to establishing communication channels to reach agreed solutions. As has been seen, it is a territory very accustomed to demonstrations, which is a particularly relevant condition in this case. Another condition for acceptance is to show the technical adequacy of the project to avoid suspicions between different actors.

*Table 7. Characterization of the region and social acceptance (Onshore and Offshore).*

| | onshore | offshore | |
|---|---|---|---|
| Characterization of the community | ✓ Low initial local root<br>✓ Low continuity with existing physical, social and cognitive structures<br>✓ Moderate need for socio-economic development (local) and environmental leadership (regional) | ✓ Elevated initial local root | |
| | | <u>Tarragona</u><br>✓ Low need for socio-economic development | <u>Ebro Delta</u><br>✓ High need for socio-economic development<br>✓ High environmental concern |
| Social acceptance | ✓ High benefit perception<br>✓ Low risk perception<br>✓ Moderate perception of injustice in the impacts | <u>Tarragona</u><br>✓ Moderate benefit perception<br>✓ Moderate risk perception<br>✓ Perception of injustice in moderate impacts | <u>Ebro Delta</u><br>✓ Low benefit perception<br>✓ High risk perception<br>✓ Perception of injustice in impacts high |

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# Portugal

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## Introduction/overview:

The report summarises the results of a total of 18 interviews with national and local stakeholders of both onshore and offshore locations. We have also received a (short) written reply from one of the stakeholders.

Based on the document analysis, we identified a total of 39 relevant stakeholders, of the following typology:

- National government agencies (energy and geology, environment, nature protection, maritime resources, civil protection)
- Regional government agencies (development and coordination, nature protection, tourism, civil protection)
- National and local business/business associations
- Local professional associations (fishermen, farmers) and trade unions
- National and local civil society organisations (environment, nature protection, heritage)
- Local government (municipalities)

37 of these stakeholders were given priority and contacted first via email and then through telephone calls. In some cases, we received no reply from any of our contacts. In others, the request for an interview was not granted. Each email contained a brief description of the project, together with a request for an interview, and included a leaflet about the project (with a summary definition of CCS and a map with the locations of the onshore and offshore reservoirs). After the first round of interviews and realising that most stakeholders had so little knowledge of the topic, we prepared a more detailed leaflet, with questions and answers about CCS. This leaflet was sent to local stakeholders with the email requesting an interview. Still, in most cases the interviewees seem to have paid not a lot of attention to the information in the leaflet. All interviewees signed a form of informed consent authorising the research team to record the interviews and to use their statements in publications, though in an anonymised manner.

The final distributions of interviews is as follows:

| | Contacted | Interviewed | Codes |
|---|---|---|---|
| National government agencies | 4 | 1 | #PT1 |
| Regional government agencies | 5 | 4 | #PT3, #PT7, #PT8, #PT16 |
| Businesses/business associations and trade unions | 12 | 6 | #PT2, #PT4, #PT6, #PT10, #PT17, #PT18 |
| Civil society organisations | 7 | 3 | #PT5, #PT9, #PT13 |
| Local government | 8 | 4 | #PT11, #PT12, #PT14, #PT15 |

The first interviews were conducted in February 2022 (national and regional stakeholders) and the last were done in May (local stakeholders). All interviews were conducted online except for the final two, which required a site visit. In almost all interviews a member of the Universidade de Évora team was present to clarify any doubts, except for the face to face interviews and for three interviews with national stakeholders (business and NGO) who were already knowledgeable about the topic

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(members of the STRATEGY stakeholder committee). In some cases there were more than one interviewee present, so the total number of interviewees is 28.

All interviews were recorded and fully transcribed, except one (due to a technical glitch). Transcriptions were then coded into a common grid that follows closely the structure of this report.

## Results

### *Description of the community*

Only some of the interviewees made any comments regarding the local community. In some cases, interviewees were not familiar with the community (national and regional stakeholders, business representatives that although had industrial facilities in the locations, were based elsewhere) or talked only about their area of interest or expertise.

However, quite a few mentioned how the local community in the area of study opposed projects that had environmental impact in recent years: waste management facilities, oil and gas exploration, pig farms, paper mills, a natural gas underground storage facility. They mentioned the protest strategies used (demonstrations, road blocks, street protests) and how successful they were in some cases (oil and gas exploration). In other cases, after the initial resistance and successful information campaigns, populations accepted the facilities and no longer consider them a problem. Thus, several stakeholders expected the community to oppose CCS, since they are "very restless and revolutionary" (PT#11).

One representative from a local authority mentioned high levels of place attachment in the community:

> But we actually have this very fine sensibility of people here. Anything that looks like drilling, no way. They have their land, they want to keep the ownership to give it to their children and grandchildren (#PT15)

Another stakeholder mentioned that the proximity of the region to the coast and the mild climate it causes makes residents less aware and less concerned with climate change.

Some stakeholders also mentioned that Environmental Non-Governmental Organisations (ENGO) are very active in the region and very concerned with natural and geological heritage (Natural Park with caves, dinosaur vestiges).

Two stakeholders also mentioned the diversity within the region, based on the economic characteristics of some municipalities: industry in Marinha Grande (rendering the residents more likely to accept CCS), agriculture in Alcobaça, tourism and surf in Nazaré and Figueira da Foz.

Another interviewee talked about how local companies with younger managers are more open to implementing measures to mitigate the environmental impacts, whereas older generations are more reluctant to acknowledge the benefits of employing environmental engineers, for example. Another interviewee corroborated that local companies were very active and looking for new business opportunities. Yet another mentioned that there were a lot of residents with technical training that would be abler to understand the CCS project.

Several interviewees mentioned the underground gas storage at Carriço as a term of comparison to understand CCS. One stakeholder mentioned the Seveso industries in the region (Carriço gas

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storage, resin factory), how there has never been any problem with them and how workers in these industries played an important role in educating local communities about technological risk and how it is carefully managed.

### *Familiarity with Carbon Storage (and CCS)*

The majority of interviewees had little, if any, familiarity with CCS, except for the ones who participated in the STRATEGY_CCUS Stakeholder Committee (in particular companies and ENGO) or were representatives of emitter industries or ENGO. Some interviewees also are geologists by training, so they were able to understand CCS more easily.

Some stated they were more familiar with natural carbon storage (in forests, habitats or plants, algae), particularly if they worked in the sector (agriculture, nature protections), or the use of $CO_2$ in manufacture (ceramics).

This lack of knowledge has an impact on the information gathered through the interviews, as will be seen below. Also, although the interviewees were selected as representatives of different public and private organisations, the opinions expressed are mainly of a personal nature, since most of them stated that the topic of CCS had never been discussed within their organisations.

### *Questions about Carbon Storage (and CCS) (posed by the interviewees)*

Due to the low familiarity with CCS, the majority of interviewees had more questions than answers for us. These questions were in most cases answered by the experts from U. Évora but can provide us valuable information for the public engagement stage.

Stakeholders' questions can be grouped in seven types:

- Geological/location issues
    - Where is the storage done or where are the repositories located?
    - How deep is the storage?
    - Do these reservoirs already exist or are they going to be drilled for the project?
    - Are the geological structures similar to those in the underground gas storage of Carriço?
    - Why use saline aquifers?
    - Does the limestone massif of Serra D'Aires have anything to do with the selection of the onshore area?
    - Has the low seismic risk of this area had anything to do with the selection of the location?
    - Does the carbon mix with the substances in the repository?
    - Will $CO_2$ be stored forever or will be used later or will it disappear in nature eventually?
    - Is $CO_2$ storage different from gas storage?
    - Is Portugal the only country with conditions for geological storage?
    - What is the storage capacity of underground reservoirs and how long will the reservoirs last?
    - What is being done globally in terms of CCS? Are there any projects already functioning?
    - Could old rock cavities where natural gas was extracted be used for CCS?

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  - Why are the zones outlined on the map?
  - Is there already a preferential zone onshore?
  - Offshore, will it be done in the underwater canyon of Nazaré (that generates giant waves)?
- Technical issues regarding storage
  - Is $CO_2$ poured or pressure injected?
  - How is the carbon injection done offshore?
  - How frequent will be the monitoring (offshore)?
  - Does this technology work with greenhouse gases other than $CO_2$?
  - How much energy is spent in these processes?
  - What are the advantages of CCS?
- Technical issues regarding transport and construction
  - What is the diameter of the pipes (offshore and onshore)?
  - Will the drilling offshore generate waste?
  - How will the carbon be transported offshore?
  - How many holes would be needed?
- Technical issues regarding capture
  - Will carbon be captured from the atmosphere?
  - How is carbon captured?
  - Will the carbon to be stored come from abroad?
- Economic issues
  - How can CCS impact on carbon prices?
  - How much does CCS cost?
  - What is the business model for CCS?
  - Who will pay for CCS to be implemented?
  - Is CCS offshore too expensive?
  - Will people be compensated for having the drills in their land?
  - How many local jobs will be created?
  - Is there a timeframe for implementing CCS in the region?
- Risks
  - Can carbon escape once it is stored?
  - Can CCS cause earthquakes?
  - Is the risk of $CO_2$ leakage only associated the loss of the benefits of the capture and storage, or does it have any other dangers?
  - Can CCS have a negative impact on the environment?
  - Could the salted aquifers contaminate freshwater aquifers during the drilling process?
  - How will CCS affect the landscape?
  - Does the project include a study of Life Cycle Assessment and Life Cost Assessment?
- Promoters
  - Is this project done exclusively by universities or are there companies behind it?

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### *Concerns about Carbon Storage (and CCS)*

Since the majority of our interviewees had little to no familiarity with CCS, they were quite unaware of the risks (see below), but during the interviews they shared what concerned them about this technology.

Many interviewees mentioned specific concerns, related to the potential risks of the technology over the environment and public health, as well as on other social aspects:

- Possibility of an earthquake releasing the carbon back into the atmosphere
- Contamination of underground water
- Impacts on cave-dwelling fauna and flora
- Increased acidity of the oceans can harm marine vegetation and the fish and bird species that feed on them
- Impact over underground caves and natural species (bats, other species)
- Underwater noise doing the construction and monitoring of offshore CCS, that can have a detrimental effect on marine species
- Risks during transportation (pipelines that go across villages and towns)
- Threats to other economic activities (e.g. tourism)

It is interesting to note that some stakeholders (particularly those involved in nature conservation) were concerned with long term impacts: how a carbon release could be harmless for contemporary species but dangerous for species living in the area in hundreds of years from now. These stakeholders were also concerned with the lack of knowledge of particular ecosystems (marine) and natural structures (caves, underground systems of aquifers) in the area that could lead to unforeseen impacts.

Other business stakeholders (other than emitters) were concerned with whether there were enough studies to back this solution, in technical, environmental, economic and social terms.

ENGO had concerns mainly about the transparency of the process of licensing CCS and that it would divert attention from other upstream solutions for climate change (replacing materials and fossil fuels).

### *Benefits of Carbon Storage (and CCS)*

Regarding the benefits of CCS, besides climate change mitigation (see below), some interviewees mentioned the large storage capacity of underground reservoirs, greater than what natural carbon storage can ensure in Portugal (since the soil and vegetation have particular characteristics that render them not very suitable).

The main supporters of CCS's benefits are, of course, $CO_2$ emitters. They regard CCS as necessary for reducing their emissions both in the industrial process and in energy use, where renewable energies are not suitable.

> we can reduce 50% of CO2 emissions with existing technologies and some that may be developed, we are working to reduce fuel emissions and replacing conventional fuels with alternative fuels (…) but we have a problem that is process emissions, we use calcium carbonate and it releases $CO_2$. Those emissions represent 65% to 70% of our emissions and it's more difficult to eliminate process emissions (#PT2)

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CCS would allow keeping some industrial sectors operating in Portugal, maintaining jobs and exports

> There is no such thing as having the cake and eating it, there is always a balance. We want to eliminate (emissions), we want to keep industry in Portugal, we want to remain a country with industry that can export. If we don't want that, there is an alternative that is moving industry to countries without restrictions. I don't know if that is what people want. We have to make decisions for our country about what we really want. (…) all these are choices, all these are balances (#PT2)

They also consider that "we have enough credible institutions that study this topic and that recognise the need for this technology" (#PT2).

However, they also admit that some industrial processes can be changed (e.g. recycled glass does not need $CO_2$) and that carbon reuse would be more advantageous than carbon storage.

> Carbon capture is one of the ways of ensuring carbon neutrality, but what to do with it afterward is a different thing. To use it, for me and for us our first choice, because carbon is at the same time good and evil, it's a villain but it is also a source of life (#PT2)

Other business actors were also keen to highlight some benefits, such as reducing the price of energy, the combination with hydrogen, and general economic benefits (companies will earn money from CCS, will pay more taxes, will employ more people, and will generate wealth to the country).

One representative from a local authority also recognise the benefits of CCS for industry, helping them meet environmental targets, and having a solution for carbon nearby. He mentioned also the public health benefits of sequestering emissions.

### *Risks of Carbon Storage (and CCS)*

As mentioned above, most stakeholders had so little knowledge about CCS that they could not evaluate risks in any meaningful way.

A notable exception were industry emitters, which were very familiar with the technology, having participated in STRATEGY_CCUS and in other European projects. These stakeholders considered that CCS risks are small, well known and well managed. According to them, existing projects have not had any problems and $CO_2$ is an inert gas

> it's a proven technology, it is known, it can be monitored, in terms of risk control we have enough knowledge (#PT2)

Other business actors were also more informed on CCS and also considered the risks as minor and manageable by specialised companies: "[CCS] will be a relatively simple and easy process" (#PT10).

ENGO did not consider that the risks of CCS were too severe but were concerned with the long term risk of $CO_2$ being released back into the atmosphere after a seismic event. Some also mentioned the geological risks posed by fractures, diapirism, and saliferous tectonics.

Conversely, some local stakeholders feared that CCS will make Portugal "the trashcan of Europe", endangering "our territory, our peacefulness, our well-being. We have good water, and we go and risk it for this" (#PT17). They also put in question the safety assurances, based on previous experiences of mishandled impacts and flawed risk assessments:

> You may tell me that there are studies that prove this is safe and whatever, but we also know that a thing that is said that is safe then something happens and it is no longer safe (…) a few years ago there

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> was an earthquake (…) we don't know if faults cannot appear, the [tectonic] plates move (…) so one doubts if this is 100% safe or if there are risks. And I prefer not to risk (…) people are scared (…) they are used to that many things are done will flaws. It doesn't go well, then it's cancelled. (…) People are reticent with things that mess much with nature and that have risks (…) all I can say is that it won't be peaceful (#PT17)

### *Barriers to Carbon Storage (and CCS)*

The main barriers identified by stakeholders are of four kinds.

First, there are legislative and regulation barriers. According to some interviewees, since onshore and offshore locations are sited in natural parks and the regulations of these parks are over 20 years old, there are no provisions that allow nor forbid CCS within their limits. Additionally, the location coincides with an area of National Wood, in which only forestry activities are allowed. Portuguese legislation regulating offshore activities also does not consider CCS, so for now it would not be possible to license such activity.

Second, public acceptance is also considered a barrier by many interviewees. They consider that since this is a little known technology, local communities will be concerned and liable to fall prey of misinformation and disinformation

> So, the problem that I see here is not the geological problem, it's not the technological problem, it's a sociological problem that we're going to have here, that we're going to have here because someone is going to appear, obviously in the age of fake news someone is going to appear who is going to have a narrative, or several people or several institutions who are going to have narratives, who are going to create narratives around this. (#PT3)

Stakeholders often mention recent cases of public resistance to technologies, some even with positive environmental benefits, not just in this community but across the country: lithium mining, wind farms, railway lines, oil and gas exploration, co-incineration of hazardous waste, and fracking. They alert that since the technology is unknown, people will draw comparisons with negative examples from the past, where public communication was unsuccessful or risks were mismanaged (e.g. pollution from a paper mill, radioactive waste). Landscape impacts (the visibility of structures) and risks to local cultural heritage (the Monastery of Batalha) are also cited as a barrier to acceptance, as well as the small size of communities (less perception of CCS benefits).

One stakeholder mentioned that low perception of the risk of climate change (motivated in part by the mild coastal climate) is a barrier for people to being willing to change anything.

Some stakeholders raise attention to the fact that ENGO and other social actors may try to influence public opinion negatively. Others that policy makers are easily swayed ("held hostage" #PT10) by unfavourable public opinion.

Third, the cost of CCS is very high and that can be a deterrent: "economic and financial viability, not only to make this infrastructure viable, but also to ensure that it is then used and that it is supplied" (#PT12). Some business actors also consider that the business model is an obstacle: there is a lack of companies with technical know-how, only oil and gas companies know how to do transport and storage, CCS needs licencing and a concession from the government. Additionally, some consider If $CO_2$ was to be used later, there would be more acceptance of risks, because "there would be a clearer cost-benefit relation, but like this it will be perceived as storing waste (…) reuse would be

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easier to explain [to the population]" (#PT10). An ENGO referred that CCS projects in other countries have faced systematic delays and another that companies are already changing their technologies (hydrogen) and will not need CCS in the near future.

Four, some stakeholders mentioned the difficulties in implementing CCS, in particular the need to negotiate with landowners for placing the pipelines. Scattered settlement means there are houses throughout the territory and thus hundreds of owners with whom to negotiate and compensate.

### *Climate change and CCS*

All interviewees were well aware of the problem of climate change and the need to tackle it. Some even drew attention to the climate credentials of the region (that has local mitigation and adaptation plans). However, some made (ill-informed) comparisons with the ozone layer to illustrate that the planet has ways of rebalancing itself.

Some interviewees recognised that CCS could be an important contribution to mitigating climate change, that it is an alternative that should be considered to meet climate targets, and since the EC was funding these studies this technology must be promising.

One interviewee mentioned that although CCS might not have benefits for the local communities, with would be an added value for all humanity.

However, some also alerted that more studies and an informed debate would be necessary: "It's important to explore this alternative and we should acquire the skills to discuss it as it deserves and as it should be done" (PT#1).

For industries, not meeting the decarbonisation targets is a bigger risk than CCS:

> (decarbonisation) targets are a more likely risk (for local industries) than CO2 leaks. It's a concrete risk, we have targets we have to meet, that are not optional, they were defined top-down and that we are keen to meet (PT#2)

Other stakeholders mentioned the complementarity between technological solutions for climate change, such as CCS, and other measures, such as economic incentives to decarbonisation, legislation, and change of habits.

> All processes – renewables, carbon captures, others that haven't been discussed – will be necessary and let's see if it is enough (#PT10)

Several interviewees mentioned that they would prefer reducing emissions (through renewable energy, energy efficiency, consumption reduction) rather than capturing them ("hiding the problem under the rug" #PT11) and "natural" over technological solutions for carbon storage (forests, soil, marine tundra), though others recognised that these solutions were insufficient or were severely curtailed by the recent forest fires in the region. One interviewee (ENGO) mentioned that the lifecycle analysis of CCS shows that it can even increase emissions.

Some local stakeholders also pointed out that CCS in Portugal would have a limited impact on climate change, considering the carbon footprint of "big polluter countries" (China, the US, Germany) and other sectors (aviation, boats). They said that Portugal was already "doing too much when it pollutes so little" (#PT11).

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### *Preferred option (onshore/offshore)*

Opinions varied on whether onshore or offshore CCS would be preferable in Portugal and quite a few interviewees declined to elect an option due to the lack of information about the subject. Some stakeholders considered that the decision should be made based on technical, safety, and economic criteria: which is more viable, which is less expensive.

> Unlike other processes, the easiest answer would be the usual: "not in my backyard". In other words, the further away, the better. However, I am not much of a supporter of that kind of approach. Why? Either it is properly substantiated and we are shown evidence - and when I say evidence, it is not just perception - that the places where there are better conditions are this, this and this, and also automatically what the disadvantages of that location are. And then there has to be a process of social, political, economic, etc. weighting to then make this selection. (#PT12)

The offshore option was considered by many as the one that would lead to the least public resistance because it would not directly affect populations and would be less visible ("out of sight, out of mind"), particularly if it could not be visible from the shore. Some stakeholders alerted that onshore CCS could be seen by residents as "a bomb under our feet" and offshore as "the lesser evil". Some also considered offshore storage to be more beneficial due to its larger storage capacity.

Onshore was considered less expensive (so less of a burden on the tax payer) and swifter to achieve (in view of the urgency to reduce $CO_2$ emissions), with fewer regulation hurdles, fewer institutions to contend with and less construction, technical and transport challenges. Also, some consider it would be easier to monitor and would pose less risk. However, some stakeholders draw attention to the fact that onshore would have to be very well explained to the public.

Nature protection and ENGO stakeholders drew attention to the fact that onshore and offshore protected areas have the same status but offshore natural heritage is less well known and could be more sensitive to CCS impacts, with a higher degree of uncertainty.

Industry stakeholders suggest that onshore storage could be done as a pilot, to test the technology, but the actual large-scale storage be done offshore due to its bigger capacity and higher social acceptance.

### *Local impacts of a potential storage*

The local impacts of a potential CCS project identified by the interviewees mostly overlap with the concerns and risks analysed above.

Five main dimensions of local impacts emerged from the interviews:

1. Environmental impacts in protected areas

This point was highlighted by the interviewees, both those that work in areas related to the environment and the others. Governmental actors highlighted that this is a region with several protected areas whose safeguard must be ensured not only in the short term but also in the long term (200 years or more). The study area overlaps with a Nature 2000 site offshore and a national wood onshore, which is under full protection (the only activity allowed is forestry). There is also a dune ecosystem with valuable fauna and flora that is very important. There were also concerns about the potential impacts of CCS on bat populations and other fauna that live in caves in the protected areas, and about the risk of increased acidity of coastal waters impact on marine

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vegetation and the birds that feed on it. These apprehensions are reinforced by the fact that some local actors feel that there is negligence on the part of government agencies with responsibilities in this area (especially after the fire of 2017 that destroyed a considerable part of the National woods).

2. Impacts on local aquifers

Many interviewees pointed out that this region is rich in underground freshwater aquifers, both in the limestone massifs region, underground caves, and even close to the shore and that a potential project of CCS would have to consider this specificity.

3. Impacts on the quality of life in the region

Some local actors also expressed concerns in relation to the potential impact the implementation of a technology of this kind could have on the local population during and after the installation. One municipal authority representative referred that the industries that could benefit from the technology are located in the town centre and that the transport of CO2 would cause concerns to the population, even if done through pipelines. A business representative also highlighted that since the region has scattered settlements the installation of the pipelines world means having hundreds of owners with whom to negotiate. This opinion goes against the one of another business representative that sees few local impacts from CCS since the pipelines will be placed next to an already existing one. One interviewee also expressed concerns about having the installation too close to national heritage buildings where there has previously been an attempt to develop an oil prospecting project.

4. Impacts on tourism

There was also reference to the potential impact of CCS on tourism, with interviewees expressing contrasting opinions. Some indicated not being worried about the impact on tourism, since this is an underground activity, whereas others think that this could be the sector more resistant to the idea.

5. Overall impacts

Most pessimist stakeholders in relation to CCS expressed general concern in relation to the impact of technology in the region. One interviewee, for example, stated that he thinks the region is being considered because it has low power, and is too weak to protest, whereas there are other regions in the country with more heavy polluters. Other interviewees, however, especially the ones that have more knowledge of similar technologies, like the underground gas storage in Carriço, were less concerned with the technical aspects of the project but feared a strong reaction from the population.

### *Local opportunities of a potential storage*

When asked about the potential opportunities of CCS for their region most interviewees had difficulty in answering, due to their lack of knowledge about CCS. Many indicated that the project should provide more information on the topic in order for them to be able to judge this issue. Some of them see no added value of CCS locally, but rather globally, and one interviewee clearly stated that he does not see many opportunities associated with the project.

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One of the benefits mentioned by interviewees was that CCS can help local industries in their carbon transition: The idea that CCS was needed to make industries in the region viable was highlighted by representatives of the industry and one local business association.

> It's a good choice for the region. It's a hypothesis, it's a solution. In terms of new jobs, in terms of economy, it may be the difference between making some industries in the region viable or not viable. It will have an impact on employment, in (building) pipelines, transportation, maintenance but mostly ensure the future of industries that depend on capture to keep working (#PT2)

However, this was a minority position and not everyone agrees with it. For example, one representative from a local authority rejected this idea indicating that the glass industry in the municipality is no longer the main economic activity and that they are investing in other activities.

Although some interviewees mentioned the possibility of CCS creating new jobs in the region (in particular business representatives), most believed that it would not have a relevant impact on employment. One of the local stakeholders stated a project like this would probably not create local employment because the companies would search for qualified technicians from elsewhere. An ENGO representative considered that there would be some employment and contracts for local companies during the construction stage, but few jobs during the operation stage. Other interviewees considered that CCS would probably create new employment, but not in a significant way and that new jobs associated with CCS would not be enough to motivate the population to support the project.

Some stakeholders considered that CCS can be an opportunity for the carbon transition image of the region. Municipal authorities that have invested more climate change and carbon transition policies are the ones more open to having a CCS project implemented on their territory since they see it as an opportunity to further improve the municipality track record in this issue.

Finally, CCS is seen by one interviewee as a business opportunity, since storage capacity in Portugal could be used by other Mediterranean countries that do not have as good conditions. However, this idea was not shared by any of the other interviewees.

### *Conditions for acceptance of a potential storage*

Several conditions were mentioned by the interviewees as important for the acceptance of a potential carbon storage project in the region.

First, some interviewees explained that for the project to go ahead it would have to go through a thorough impact assessment. Representatives from government agencies explained that is mandatory to always perform an EIA. The EIA would have to assess the impacts on the species that led to the classification as a Nature 2000 site and the position of the agency would depend on ensuring the conservation of natural values and minimizing negative impacts. The infrastructure, for example, must not separate the territory of the protected species (to avoid habitat fragmentation), waste from the drilling must not be disposed of in the protected area, and construction and monitoring should only be done outside reproduction seasons due to the noise The EIA could determine mitigation measures and be favourable, unfavourable, or favourable with conditions. One stakeholder considered that in the case of CCS it would probably be favourable with conditions and then the conditions would be related to mitigation and monitoring. Environmental (climate) benefits would have to be clearly indicated. There would also be an impact assessment regarding the cultural

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heritage in the region. Another stakeholder also mentioned that a CCS facility would need an internal emergency plan prepared by the promoter and an external emergency plan devised by the civil protection authority.

Second, several interviewees indicated that to ensure acceptance it is important that the population will be compensated for the implementation of the project in their region. These compensations could be jobs and other solutions for the region, social infrastructures for local parishes, or complementarity with forest fire management (reforestation). Benefits for the population should be made clear since they already have many initiatives to mitigate climate change in the region. One stakeholder drew a comparison with the network of natural gas: local authorities were made partners of the gas companies, so that they could benefit and ease the process of licensing and construction.

Third, another issue that was often mentioned was transparency. Stakeholders consider that is essential to be honest on every issue, to always be clear about the funding of the project, the role of the private company GALP, and the risks of the project. They also advise being transparent with anyone involved in the project development since local workers of a CCS infrastructure can have an important role in reassuring the local population about the safety and monitoring of the project. As one interviewee explained, people must feel that the project is not made against them, since they have the perception that they are always being misled.

> If we do this work together with the mayors, with the opinion makers in the area, telling people, not being afraid, (...) I think it is really saying everything we have to say about this. (...) To come out and say that a project like this has no risks, is the same as us saying that other people on the other side are calling us liars. And, therefore, they won't believe us. But if we say, the risk exists and this is it, how are we going to minimize it? This way, this way, this way. What can happen? This can happen. How? Man, the probability here is 1 in 1 million, 100 years or whatever, then we can win the population on our side (#PT16)

Fourth, some of the interviewees pointed out that the location of the infrastructure is key for public acceptance. However, there was no consensus on what is the most acceptable location. Some considered that having the injection wells closer to emitters would be more acceptable, others that their location should be away from sensitive spots, and another that the only way for CCS to be acceptable is offshore, far from the coast, away from view.

Fifth, some interviewees from business associations stated that acceptance was also dependent on the existence of high-quality information on all aspects of the project that could impact the local population (risks, costs, economic benefits, business models, etc.) so that the public can make informed decisions. One stakeholder mentioned how the process of siting wind farms was fairly uncontroversial, since promoters took care to explain the impacts and benefits to local residents.

### *Key actors identified*

During the interviews, interviewees often highlighted the possible resistance from the local population and the specific actors that would need to be engaged to create a fruitful debate around a project of this nature. When asked who should be involved in the process, interviewees referred to several actors that should either be involved or contribute to the project.

At a national level:

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- Government
- National governmental agencies: APA, CCDR, ICNF
- National experts that have been working on climate change and carbon neutrality.
- National environmental NGOs

At the local level:

- Regional governmental agencies
- Intermunicipal communities (coalitions of municipalities)
- Municipal authorities
- Civil parishes (the level below municipalities)
- Local civil society (ENGO, speleologists associations, local clubs, trade unions from the sectors interested in CCS)
- Local businesses (industries from the sectors with interest in CCS, local business associations, fishermen and ship-owners associations, tourism companies and associations, farmer associations).
- Local Higher education institutions.
- Workers involved in the project development and CCS infrastructure.

Many of the interviewees considered that the most important actors to involve in the process are civil parishes. They consider they not only have knowledge about local dynamics and population, but they are also essential for CCS acceptance being able both to reassure the population about the technology or, in reverse, foster opposition to the project.

> Any installation you do today, and that you are going to have to do in this project, the president of the parish council is normally a fundamental person in these things. He knows everyone, he knows… as I usually say, Uncle Manuel, Aunt Cristina, he knows everyone... he calls them, he knows the opinion-makers within that space. He knows what they want and where they are more resilient, where they are more resistant to change... And he is, therefore, a person, I would even say more than the mayor himself (...) (#PT16)

Some stakeholders also mentioned the importance of, once the location of the project is defined, identifying the local "key players", people that have considerable influence in that community, and involving them in the process

All agreed that it is important to involve the local population, but some highlight that this is particularly important in the case of residents who live near the selected locations for the CCS infrastructure. One interviewee also referred to the importance of involving younger generations that are more environment-oriented.

### *Stakeholder engagement*

In terms of how the engagement with the local population should be done, interviewees recommended different aspects related to the information made available to the public, the approach strategy and the most suitable formats for the engagement.

1. Create a clear narrative

One of the concerns of the interviewees was the need for the project to create a clear narrative to share with the public. This narrative should make clear the relationship between CCS and climate

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change and carbon neutrality and explain the advantages of this technology in relation to other alternatives. Climate change should be made less abstract by explaining its local impacts and that the carbon being stored is the one that would go into the atmosphere from the local industries. This narrative should include information on barriers and difficulties, present specific data about risks, and how the disadvantages can be mitigated and minimized.

> We should use a risk scale when talking to people so that they understand what we are talking about. And I think CCS would be well below in this scale (#PT2)

According to some interviewees, every aspect of the project should be quantified and communicated to avoid stirring up controversies. The project should be able to explain technical data: how the pipelines will be built, landscape impacts, and where the injection wells will be located. The project should also be able to show what are the positive impacts on local development and what would be its economic advantages and business models. It should also clarify who are the companies involved and give examples of successful international projects. For the population, it is also important to know what benefits they can derive from the technology, for their health, quality of life, and society in general. It should also make clear what trade-offs the project offers for the population of the location where the project is implemented.

> I would rather tell a story from the end, which is, to go for a narrative that everybody understands. What is the ultimate goal? Is it for us to be carbon neutral? Because without it, the planet's living conditions will end. This is the goal, in fact, it is enshrined in law, we have a climate law, which has just come into force, we have a roadmap, and we have an obligation of carbon neutrality enshrined in law until 2050. How do we get there? This can be explained by a greater European need or planetary need, but Portugal is bound by this obligation. How do we get there? There is a roadmap to carbon neutrality, and this roadmap foresees several solutions: changes in behaviour, efficiency gains, natural-based solutions, planting trees, land-use planning, and soil use. But it is not possible to reach neutrality with the sum of all these. We need retention and use or capture technologies, etc., the so-called CCUS, and so in 10%, in X% we need this. What is the level of risk, what are the economic, social, and environmental impacts, and what are the geological conditions or the morphology of the terrain? The ideal region is close to the industries, with good morphological conditions, then… in this specific zone what are the impacts and the risks? Because seismic risks are different from zone to zone, so, in this zone what is the seismic risk effectively? What are the economic and social and environmental impacts that it could have? And here, I am thinking about tourism and agriculture, landscape, I don't know, everything, the water resources in the area. What is the advantage of this area in comparison to another, perhaps, or in comparison to exporting to Norway? Or at the limit, if this 10% was not storage, what could it be? But I would need to frame this in a more holistic narrative and in a way that people understand that the ultimate goal is that there is a future for the planet. And that we fulfill Portugal's commitment to neutrality by 2050. Because the first question is, but why do we need this? (#PT4)

2. Early engagement:

Interviewees consider the timing of the engagement with the population is essential to the success of the process. Most of them consider that it is important to “prepare your way” and start the involvement of the population early. A local stakeholder considers that it is important that the population start hearing more about the issue, in order not to be taken by surprise as it occurred with the lithium issue. Interviewees also advised putting more effort into the engagement with the population in the areas where pipelines, terminals, and injection wells will be located, engaging early with local opinion makers in these locations, and adopting a gradual involvement, starting with small groups and reaching larger parts of citizens later in the process.

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Another issue mentioned is the involvement of relevant stakeholders. A representative from one local authority explained that he thinks it is important that we started by contacting local municipalities, so they are not taken by surprise when information about the project starts to circulate in the media (as has happened with other projects, such as a hydrogen project in the region). Another interviewee explained that involving stakeholders from the beginning is important because they often are asked to comment on specific projects when all is already decided, and when they can only point to issues that should have been addressed in previous stages. Other interviewees refer to the importance of having local partners informed during the process to help prepare information and communication with the general public.

3. Engagement formats

Interviewees also made suggestions in relation to the engagement and communication format for the project. Some preferred the idea of local meetings and discussions with the population since they were wary in relation to the risks of stirring up opposition using media and social media for these types of projects.

> Nowadays the information circuit of Facebook, social media, and television sometimes turns against us, because the information is small and doesn't reach everyone. It is easily distorted. Anyone can take a piece of television, cut two words in the middle, and the meaning is completely reversed. (#PT16)

Others referred that although preferable, public sessions have a small impact and have low participation rates. One common idea was that the project would benefit from a mixed approach that would include media communication, public sessions, and stakeholders' involvement:

> I don't think this is something for social networks, but it also is; I don't think it's something just for newspapers, but it also is. I think it's necessary, at last... this even sounds bad for a politician to say this, public sessions have little effectiveness because people don't care or don't even want to be present. But, between public sessions, between disseminating as much information as possible, between pieces produced so that people understand the concept, (...) I think that the ideal here is to disseminate the information" (#PT14)

Several local interviewees offered help in disseminating information about the project. A representative from a local authority offered to organize local meetings and send out leaflets together with utility bills, and another to contact local parishes to have their opinion on the project. Another local stakeholder offered to help organize a series of forums with emitter companies and local decision-makers. Interviewees also suggested specific communication strategies, namely creating awareness campaigns for small companies and the population, going to schools and involving teachers in the process, and including celebrities, like famous surfers, in the communication of the project since they have a strong environmental commitment.

### *Overall position towards a potential storage*

Overall, we found five different positions towards CCS among the interviewees.

- In favour: Some interviewees are clearly in favour of CCS. They value its environmental benefits and its role in fighting climate change, and its potential economic benefit for the region and some industry sectors.

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- In favour, but with reservations: These interviewees show support for the technology, but only under specific conditions, i.e. the existence of guarantees that the technology has no significant risks or impacts on the environment.
- Not against, but only in specific conditions: These interviewees are more reticent about the role of the technology in carbon transition, and the benefits of its implementation in Portugal. They support the technology only as a last option, and in absence of alternatives to fight climate change.
- Neutral: In some cases, the interviewees declared being neutral in relation to the technology, being in need of more information to be able to state a position.
- Against: Some interviewees are against the implementation of CCS in the region, since they are very distrustful of both the risks associated with CCS and the public reaction to the technology.

Although there were differences in the position of the interviewees, there was no clear relation between their professional role and acceptance of CCS, with stakeholders with similar profiles having different opinions on the technology. It is also worth noticing, that with the exception of stakeholders that were already part of the STRATEGY_CCUS project, for most of the interviewees this was not a topic discussed in their organization, their positions often reflecting a personal view on the subject, based limited information.

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# France

## Introduction/overview

### *Sample selection*

Invitations for an interview were sent by email to 14 local actors in the study zone (the 10x10 km area for the 3D seismic acquisition) along with the two-page presentation of PilotSTRATEGY and a consent form, all in French. Most contacts had already been identified through the informal authorization process (to grant the right of way for the vibrating trucks and geophones), particularly farmers and mayors as well as industry. Additional potential interviewees resulted from Internet searches (e.g. three local NGOs) and from direct contact in the field (e.g. during a PilotSTRATEGY open doors meeting). Only two persons out of fourteen accepted the interview: a shopkeepers' union representative and a city councilor. Others simply did not answer, with the exception of one person (a local resident who had sent comments about the geophysics campaign) who wrote to explain why he declined[2]. Maybe the overlap with the informal permitting process, along with the local political polarization (see the Field report), can explain in part this low acceptance rate.[3] However, we cannot explain why local actors who were already well informed about the project, such as industry and an energy agency, did not respond to the invitation. We sent only two reminders by email, no phone calls.

To enlarge the sample, we decided to get feedback from a completed CCUS project in the southwest of France (Total's Lacq-Rousse), particularly looking for NGOs as there had been local opposition. The three NGOs contacted did not respond. A self declared opponent declined the interview after having asked for more information about the project. Two interviews were finally obtained from this context, one from industry and the other from a social scientist who had been involved in the Lacq project. Finally, we searched for interviewees who were not experts and not familiar with CCUS to better balance the sample, resulting in four more interviews. Interviewees are labeled as "expert/non expert" according to their explicit professional activity.

The majority of interviewees (6/8) thus are not really familiar with the community investigated by PilotSTRATEGY. A content analysis with IRAMUTEq[4] puts in perspective the results from the interviews (see section 2.11 of the present report). In addition, more local information can be found in the document "Arguments to grant or refuse access to the 3D data acquisition campaign, France". These arguments were put forward by land owners and mayors during the permitting process and for the most part relate to CCUS. A full field report is under preparation as well.

[2] Although not strictly following the format of the interviews, the content of this resident's comments and discussion provides relevant insight and is reported in the document: Field Report, France.

[3] Other explanations might be that the invitation documents were not found to be enticing, and there was low local interest given that only one citizen sent comments after the information campaign (all mayors of the area were informed, flyers were distributed in residential areas).

[4] According to the Reinert technique (1983, 1986), the IRaMuTeQ software performs a top-down hierarchical classification (see also Kalampalikis, 2003). This approach of categorization is based on chi-square relationships between specific contents and semantic contexts, rendering evident content disparities. This approach was therefore seen to be especially helpful for exploring the variety of arguments and connecting them to "carbon capture and storage".

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Mode: f2f/ online : All the interviews were performed remotely, due to diverse localization of participants. We conducted interviews by telephone with those who did not have direct access to the Internet at the moment. The interviews were recorded and transcribed.

Table: Sample characteristics

| Interviewee and date of interview | Local/not local | Expert/non expert | Familiarity with CCUS | Role/activity |
|---|---|---|---|---|
| **Interviewee 1 (I1) -** 10/05/22 | Not local | Expert | Familiar | Legal expert |
| **Interviewee 2 (I2) -** 12/05/22 | Not local | Expert | Familiar | Ex project developer in Total's CCUS project (Lacq, SW France) |
| **Interviewee 3 (I3) -** 13/05/22 | Not local | Expert | Familiar | PhD student in earth sciences |
| **Interviewee 4 (I4) -** 20/05/22 | Not local | Expert | Familiar | Social scientist |
| **Interviewee 5 (I5) -** 19/05/22 | Local | Non expert | Familiar | Shopkeepers' union |
| **Interviewee 6 (I6) -** 23/06/22 | Local | Non expert | Not familiar | Municipal council member |
| **Interviewee 7 (I7) -** 17/06/22 | Not local | Non expert | Not familiar | Environmental activist |
| **Interviewee 8 (I8) -** 15/06/22 | Not local | Non expert | Not familiar | Social and economic research administrator |

## Results

### *Description of the community*

One interviewee pointed out that the community living in the Nangis territory was an industrial community, meaning that the industrial company Total had been active there for years. Their livelihood had been improved, still according to the interviewee, thanks to its activities. A local participant, who is a member of her commune's municipal council, indicated, by contrast, that people in her community doubt the efficacy of CCUS. The interviewee pointed out that most residents of the area are not informed of the existence of PilotSTRATEGY or of the proposed investigations in view of a potential storage site.

### *Familiarity with Carbon Storage (and CCUS)*

Although this was not an explicit criterion to select interviewees, all the participants were interested in environmental questions, and they were active in some way to fight against global warming and its origins. Five of the participants indicated that they were familiar with carbon storage, and with

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CCUS in general. These persons had some professional background in such topics. For example, a PhD student (I3) who worked on this subject explained the technology very simply:

- "I did a master's degree in reservoir geology [...] So it's capturing CO2 that is emitted into the atmosphere and storing it underground" (I3).

Interestingly, a local person (I5), whose city is within the perimeter investigated by PilotSTRATEGY, described CCUS in some detail even if he is from a completely unrelated profession.

- "I know that there are several methods and that in fact in saline aquifers it is possible to capture CO2 deep down. I also know that it will be effective to reduce CO2 emissions at the source, deep down, at the exit of polluting stacks." (I5).

For others, even though they did not previously have knowledge, having read the PilotSTRATEGY documents sent with the invitation for the interview they had formed an idea about the technology. In this sense, we can infer that the presentation and consent documents had an effect on the construction of carbon capture and storage representation among the persons who read it.

One example from the definition given by an environmental activist (I7) :

- "[I know] not much, but anyway the name is quite telling. For me, it is a technology that will improve the situation, a means to wait for an energy transition in France and Europe. And the idea is to capture and store carbon and put it in deep aquifers in the underground rock" (I7).

### *Questions about Carbon Storage (and CCUS) arising during the interview*

Only one person, whose initial position towards CCUS was highly negative, asked questions (specifically about PilotSTRATEGY) (I8). We shared that CCUS is supported by the scientific community of IPCC. She was surprised that this technology was defended by this well-known expert community. The other participants did not ask questions, which might lead us to interpret that the documents which had been sent prior to interviews were sufficient in each case to reply to the level of interest.

### *Concerns about Carbon Storage (and CCUS)*

The majority of our sample doubted the efficacy of the technology. For example, they thought that the lack of familiarity by the public might create problems in terms of acceptance. Some expressed that CCUS could be used in favor of industrialists and their financial interests. For example, an environmental activist (I7) and another person having worked in various environmental research projects (I8) told us that CCUS would not encourage needed changes in our lifestyle. Instead, it might simply enable a context in which industrialists could continue to produce without adapting their production methods.

Three interviewees suggested that CCUS fails to solve the problem at its source. Rather, assimilating carbon to industrial waste (or to radioactive waste), they highlight that better waste management removes the incentive to reduce the emission of greenhouse gasses. They regret that humanity does not change its lifestyle, but designs technologies such as CCUS in order to carry on with current production.

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- “To me, it's like putting on a Band-Aid. I feel like, so it's not going to encourage less pollution. And it doesn't put energy sobriety first. So there you go. Yes, it's a Band-Aid and we're still polluting. We'll just find a better way to manage our waste [...] But afterwards, yes, if not, pragmatically, if it works, it works, but let's say that even if it worked, in my mind it wouldn't solve anything for me... It's not necessarily the right way" (I7).
- "In fact the problem is the model, it's our way of living that is no longer appropriate. So in fact, what worries me a little bit is this technology, it's great, there are people who think, engineers etc. They find solutions, but in fact by finding solutions, it doesn't bring [...] human communities to think about our way of life, of consumption, etc. The more solutions are found, the more we will continue to say, ‘well yes, since there are solutions, we can continue to produce CO2 en masse’" (I8)
- "For example, the big polluting countries. I mean, if we keep proposing engineering solutions to them, saying ‘yes, you can produce, don't worry, you can keep producing CO2. We have found ways to store it’, I don't know if it is going in the right direction" (I8).
- "Somehow, it's true that it was presented to us in a rather positive way. But I think that the fact that there is CO2 storage at the end of the day [enables us to] say in these cases, ‘we can consume as we want, we can pollute as we want. There, now, there, the subsoil, it will absorb everything and everything is fine. We can go all the way’. So those who are more certain to protect the environment or to be attentive to the environment do not necessarily take it in a positive sense." (I6).
- "I make analogies: for example we have nuclear waste. [...] We say that nuclear energy is a clean energy with respect to environmental problems. Nevertheless, it produces a lot of radioactive waste which must be stored underground. But we also know how dangerous radioactive waste is. So it's the same thing, in France we are back to the technology of nuclear power plants, so we will continue to produce radioactive waste. That's the way it is. Keep producing radioactive waste; keep producing CO2. And ‘it doesn't matter, the earth will take all this waste deep into the ground’. So we can see that there is a lot of waste that has been spread on the surface, of all kinds, whether it is plastic, industrial or chemical waste. So there it is, on the surface and in the depths of the seas. This is the whole problem today" (I8)

Experts expressed a different type of concern about CCUS. For example, a legal expert (especially in emission rights) (I1) highlighted:

- "But in itself, it's not the only solution. It's an approach [complementary to] other energy transition efforts. [...] So for the most part, I think CCUS is not the most efficient method of decarbonization..." (I1).

The fact that CCUS could not be the sole method to stop climate change was shared by all the experts in our sample. We refer again to this fact in the paragraph below about views on CCUS as a climate change mitigation strategy.

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### *Benefits of Carbon Storage (and CCUS)*

The experts mentioned the benefits of carbon storage, whereas other participants who did not share the same knowledge were not very supportive of it.

According to the legal expert (I1):

- "I think it's an important technology, with a lot of potential [... T]here are still a lot of [...] projects that can't be decarbonized. And CCUS is a good solution for those projects" (I1).

The same person also thought that CCUS could create collaborations at different levels and permit people to exchange ideas about the technology.

- "And I think there is an opportunity for more collaborations, to exchange technology ideas and to create initiatives for industries to invest in CSS" (I1).

A PhD student in geosciences (I3) shared the same judgment of benefits, viewing higher industrial production as economically desirable:

- "Today [....] reducing the rate of CO2 in the atmosphere [can enable] some companies – that is, oil or industrial – to produce even more. There is a possibility that the CO2 can be stored underground. So it can be an incentive to [...] produce more. [...] If production increases, there will be more jobs. CCUS technology will also create jobs. We need engineering firms for that" (I3).

### *Risks of Carbon Storage (and CCUS)*

Data acquisition methods were described as inherently risky:

- “If I understand correctly, the saline aquifers are very deep in the earth's layers and therefore we will have to dig deep to put it in. [...]I think that the fact of drilling [...], of digging deep, already just this action can have consequences on the ground [...] at depth, that is to say by provoking vibrations that can deteriorate just by the drilling [...as such...]. We know that vibrations are impacts.” (I8)

Some participants, particularly those positioned against CCUS, saw its risks as **unknown or even unknowable,** whereas experts mainly viewed that risks (even if unknown) can be assessed and that precautions or mitigations can be taken. For example, the activist (I7) points to the imponderables of nuclear waste storage.

- "What are we doing? And also in relation to [future] generations? Is it a problem like nuclear waste? [...] Let's imagine humans, but really in a very long time: how will they know?" (I7)

Another (I8) highlights the lack of instructive experience.

- "Once the CO2 is stored in these rocks, if I understand correctly [...], well in these saline aquifers, [...] from what I read of the project, it is relatively at the beginning and there is no hindsight at all on, ‘Does it hold, how does it hold, for how long does it hold?’. (I8)

An expert in social sciences (I4) invokes scenario methods of assessment and risk that, if identified, is not quantified.

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- "I was telling you about the scenario, the link between storage, sequestration and increased land movement. And in fact, we'll say it was a risk, a certain one that is not well known" (I4).

The PhD student (I3) thinks that risks are not major, and they are controlled.

- "...] It's not complicated. We're just going to inject CO2 and it's not toxic. We'll inject it into the subsoil and it will stay there. [...] In terms of geology, storage, energy, they are the same risks.[...T]here are all the risks associated with drilling, there may be leaks, but it is fairly controlled. And also in terms of storage, [...] we can also have leaks, but there too, when the CO2 is not toxic, so even if there are leaks, it's not as dangerous as that." (I3).

The unionist working locally (I5) found the risks to be higher for other phases of CCUS than storage.

- "In my personal opinion, the risk is never zero. For me, the risk that has been identified, in any case from what I know about the subject, is more about transport than, in any case, if we are talking about capture in a deep saline environment, there is no possibility of leakage during capture in this environment. On the other hand, there is a risk of transport, whether by truck or by pipeline. So the risk is not zero" (I5).

### *Barriers to Carbon Storage (and CCUS)*

The principal barriers cited in regard to carbon storage and CCUS in general are the **taxes** imposed by governments, lack of private or public **investment**, and its **costliness**. According to the legal expert (I1), in the United States there is a tax imposed on industries when they wish to apply CCUS. She thought that this could hinder investments, public or private – needed now.

- "I think it's a great opportunity, [...] because CCUS has a lot of potential. But the investments require maybe five or ten years to be developed and in operation. So we need a lot of investments, new projects now" (I1).

**Social acceptability** was an important issue among participants, mostly experts. The legal expert (I1) hypothesized that a host site might object if the carbon dioxide came from another geographic area to be stored in their territory. A social scientist (I4) reflected on past experience of debating the technology (in Lacq), describing how fear and social amplification of risk occurred:

- "And there were representations that were created. Beyond what had been experienced in reality. [...] CCUS was an emerging technology and as it was an emerging technology, we talked more about fear than risk. [Nonetheless, CCUS] can be modeled as risk" (I4).

### *Climate change and CCUS*

Expert interviewees or those intrinsically interested in the subject (five interviewees in all) found that CCUS could be used to fight against climate change – even those who doubt its efficacy.

Despite her opposition, the person who had administered various environmental study projects (I8) represents CCUS among climate change mitigation instruments:

- "I think that this is part of the solutions that are being sought, to try to make up for all the emissions of all kinds that exist, which therefore accelerate climate degradation" (I8).

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The activist in an environmental organization (I7) evolved during her interview to indicate that CCUS could be useful as a compensatory mechanism.

- "I have the impression that this is a technology that will actually compensate for the pollution that we will continue to create. So it fits in. Maybe it's complementary to an approach of energy sobriety..." (I7)

As mentioned above, each expert interviewee recognized that CCUS (or CCUS) is not a stand-alone solution. One who worked actively on Total's Lacq CCUS pilot project (I2) remarked:

- "CCUS seemed to me to be a possibility if you want to fight against global warming in certain issues. CCUS will not solve the problem as a whole, of course, but for some industrialists, in order to continue their industrial business, [...] CCUS can be a solution that is interesting, especially since, in almost all areas, we now have great experience in capturing CO2, especially in the oil and gas industry, separating CO2 from the gasses that must be in our tributaries" (I2).

### *Conditions for acceptance of a potential storage and stakeholder engagement at local and national level*

According to our interviewees, there could be opportunities to engage stakeholders, and conditions for acceptance of a potential storage might be possible. Most of our participants did not live near the targeted potential pilot storage site in the Parisian basin; nonetheless, we report the experts' views (which were the most explicit on this dimension) as they may be illustrative of the social phenomenon around CCUS at local level, as well as at national level. This does not mean that specific local dynamics could not have an impact on social acceptance and stakeholder engagement. Each societal characterization could be specific to different social contexts.

The principal condition of social acceptability, according to the experts we interviewed, is **communication.** Those working in the field should correctly communicate and inform the public of CCUS; there should also be an **active consensus across actors** to contribute to this informative effort.

- "I don't know if there are conditions, it's mostly communication. You have to explain to the population, it's the population concerned since it's engineers, geologists, who know how it works in fact the risk. You know the notion of risk... Symmetrical and mastered technique. For the average person, you have to explain it, you have to communicate from the beginning". (I3)
- "In a way yes very obvious because it is a technology which is not known and that if there is no pedagogy, nobody will understand the meaning. All the public and private actors, rather public, should effectively promote it" (I4).

Project promoters need to apply required procedures, but also recruit credible actors to contribute to the information effort:

- "It is a formal inquiry where a person is appointed and goes to a given town hall, where you are going to install your project, to receive the remarks of the public. So the public can go, study the project and ask questions. And this public investigator will answer. Beyond that, something legal, what we have done is that we ourselves have held public information

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meetings. Where we have a French specialist of CCUS - BRGM or IFPEN - to discuss directly with the public because we did not want the public to say 'they are going to sell us something, they are there to sell us something'. And at that point we were no longer credible and not really objective. So in order to really answer questions from the public, we took scientists who were not, who could not be, who were not part of our company" (I2).

### *Key actors*

We can identify four different categories of actors mentioned in the French interviews:

1) **State.** Most of the participants thought the state was independent from industrialists. There were few open references to the role of the state in CCUS projects, but instead general references to "government".
2) **Industrialists.** Producers who wish to store carbon underground. Interviewees positioned against CCUS represented industrialists in a negative light. For experts, industrialists were important actors who would like to contribute to the fight against climate change.
3) **Public.** This actor was the most important, because it was decisive on the future of the project: without informing the public and without their acceptance, a CCUS project could not be feasible.
4) **Society at large.** Some interviewees referred to "humanity", to "future generations", or to society as composed of persons consuming energy, or behaving in particular sustainable or unsustainable manners.

### *Overall position towards a potential storage*

The overall position towards carbon storage was **ambivalent**. We heard a clear difference between experts and others in their representations of CCUS, but there was common ground where they shared the same ideas and feelings. We can interpret that the differentiation was due to the manner of saying things, rather than fundamentally divergent thoughts. Everybody was aware, for example, that the risks imposed by this technology were present, but their reasoning behind risk identification was not identical.

We call the general position "ambivalent" because people were not consistent in their responses considering the utility or desirability of CCUS. It was called good to fight against climate change, but at the same time seen as contributing to maintaining our present productivity or lifestyle instead of incentivizing sustainability. This ambivalence was not reserved to participants who were unfamiliar with CCUS; experts too expressed this ambivalence.

A more clearly differentiated representation lay in the notion of **feasibility**. For some this technology could not help very much because it was very difficult to apply it at large-scale, and for others it was very promising.

Interviewees emphasized that engagement and social acceptability would require communication at every level. All interviewees (even the two local participants) tended to address a national and global perspective when considering the need for clear, reliable information.

In the light of these interviews, we could make the following suggestions to develop meaningful stakeholder engagement activities. These take into account the fact that although according to the 2022 IPCC report the scientific community does not see an alternative to implementing CCUS in

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future, the issue is absent from societal debate in France, as in most places (during the French presidential election in April, 2022, the climate crisis itself was hardly an object of debate). We also note that, in the context of the Russian war in Ukraine and in preparation of the 2022-23 Winter in France, media report that natural gas is being stored in large quantities in underground storage facilities (aquifers and saline cavities), without raising any discussion about risks.

**Mediatization of CCUS.** Familiarity with and information about CCUS could be targeted for increase. The technology under question could be more largely described and publicized in a pedagogical manner. Experts and industrialists who wish to participate in its construction could speak out in local and national media. This said, because CCUS is not a known technology, reactions might be difficult to foresee.

- **Engaging a range of involved actors** in consensually promoting consideration of CCUS. This responds to one interviewee's recommendation that influential actors should speak with one voice.
    - Identifying and enrolling such a range of actors is in itself a public engagement exercise, and so careful thought should be given to a **multi-level approach**, assessing the feasibility, pertinence, and requirements of such a strategy.
- **Organizing reflexive conversations**. It appeared that certain interviewees evolved in their thinking during the course of the interview. They expressed increasingly nuanced views, examining several sides of questions that emerged during the semi-directive exchange. Their *a priori* positioning against CCUS and their convictions were explained by these interviewees in progressively more detail, but their positioning also appeared to soften to the degree that the interviewees generated and considered more perspectives, and more possible utilities and meanings of CCUS. Three remarks may be made:
    - First, PilotSTRATEGY could organize small conversational public engagement events whose objective is clearly and credibly stated to be "*talking about and thinking about CCUS in order to analyze why it is recommended by the IPCC, and how it could (or could not) fit into local residents' view on climate mitigation*".
    - Second, the evolution and increasing complexity observed during certain interviews speaks well of both these interviewees' openness, and of the interviewer's skill in creating a pressure-free, non-persuasive, exploratory and mutually informative topical conversation. One might surmise that it is motivating to participants to be heard and to be stimulated with more questions.
    - Methods exist in the social sciences to foster progressively deeper explicitation of beliefs and values related to a given (controversial) topic, and also deeper listening to others' expression. One such approach is mediated by an intervener, with a couple of volunteer "debaters" (*a priori* opposed in their position on the topic) who are invited to go through several stages of clarifying their viewpoint to each other. This exchange can be witnessed by a small audience who, after a summary by a volunteer reporter, then gives feedback. Successive clarifications in new couples can then be conducted in a multiple subgroup setting.

*Computer assisted content analysis (Reinert method)*

Transcribed interviews were finally submitted to a computer assisted content analysis (Reinert method) through the IRaMuTeQ software. Iramuteq performs a top-down hierarchical classification following the Reinert method (1983; 1986; see also Kalampalikis, 2003). This method consists of a

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top-down hierarchical classification (DHC) of corpus text segments (i.e. sentences or parts of sentences separated by punctuation with a maximum length of 40 words) which are classified according to lemmatized active forms. This classification method is based on chi-square associations between semantic contexts and particular contents, thereby rendering content differences salient.

The analysis was performed using a corpus composed by the transcription of the 8 interviews, associated with the descriptive variables presented on Table 1 above: familiarity with CCS, local inhabitant, etc.

The results of top down hierarchical analysis show a strong polarization between the interview content produced by participants I2 and I8. The other participants' arguments share commonalities around risks, opportunities, social acceptability, communication, and climate change. This difference appears to be mainly based on expertise: I2, as an expert having worked in a CCS project, is highly supportive of CCS implementation; I8 by contrast describes herself as positioned against CCS, indicating that she was not familiar with it before the interview. The language employed by I2 was technical. For example, he regularly used the technical terms as "transformation", "oxycombustion", "wildlife", "compressor", "reservoir", linking CCS to protection of the environment while talking about its techniques. On the contrary, I8 questioned CCS's efficacy against climate change, highlighting its insecurity. Her representation of CCS was linked to her representation of the underground as a geographical area. The salient terms were "radioactive", "depth", "nuclear", "finding a solution", and "engineering".

These results highlight contrasted representations of CCUS that might appear during the foreseen engagement activities. A constructive dialogue between the holders of these representations may be difficult to achieve in the absence of mediation.

On the next page, the first graph shows the structure of expressed contents; the second graph shows the interviewees who have produced these contents.

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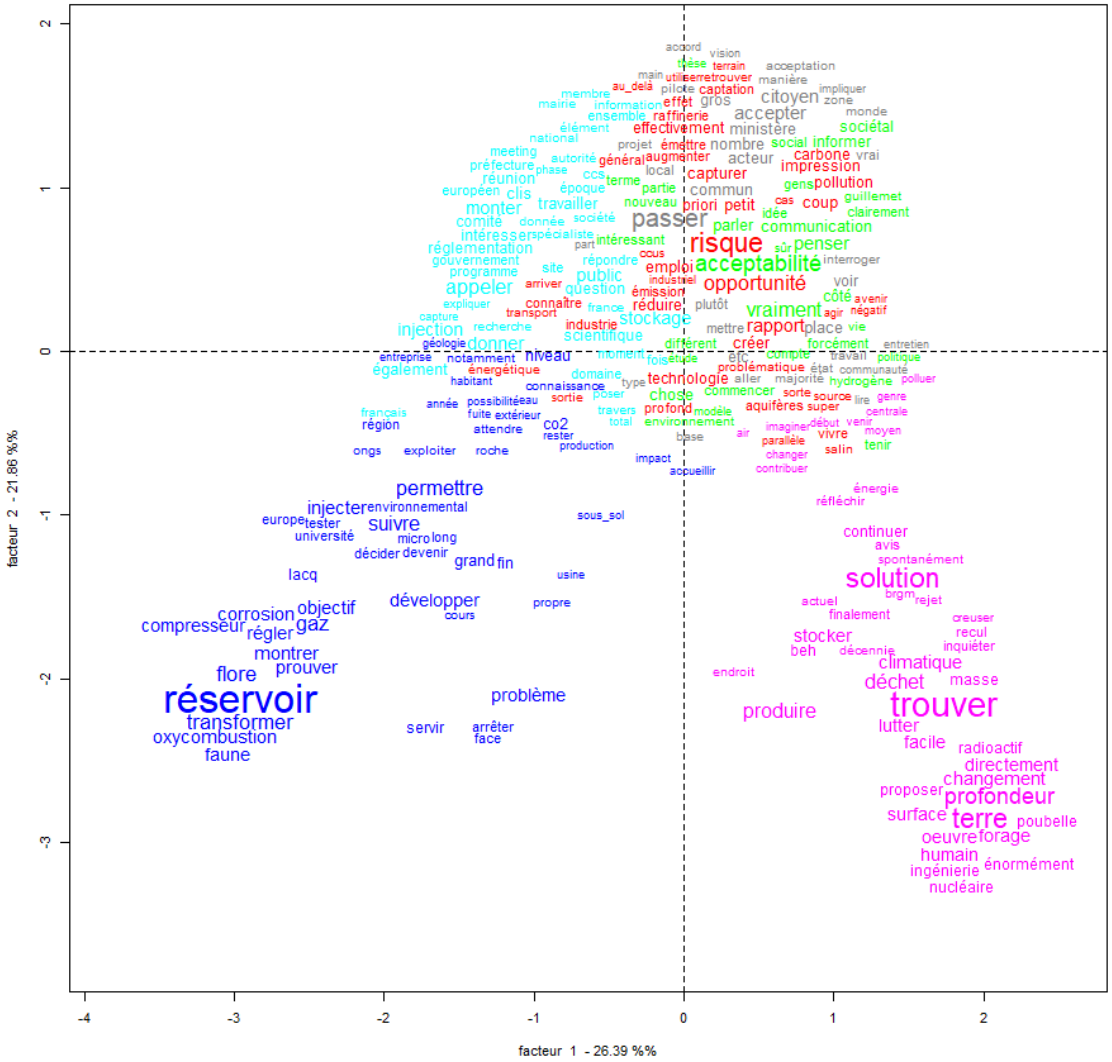
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facteur 2 - 21.86 %%
-4
-3
-2
-1
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1
2
-3
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accord
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terrain
acceptation
main
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manière
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pilote
captation
membre
mairie
information
effet
gros
citoyen
zone
ensemble
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accepter
monde
élément
effectivement
ministère
sociétal
national
projet
émettre
nombre
social
informer
meeting
préfecture
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travail
politique
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énergétique
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majorité
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commencer
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genre
poser
sortie
profond
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centrale
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environnement
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début
venir
attendre
co2
rester
base
air
vivre
moyen
parallèle
salin
tenir
ongs
exploiter
roche
production
changer
impact
contribuer
acqueillir
énergie
réfléchir
permettre
injecter
environnemental
sous_sol
continuer
europe
tester
suivre
avis
université
micro
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spontanément
décider
devenir
grand
fin
solution
lacq
usine
brgm
rejet
développer
actuel
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objectif
cours
propre
finalement
creuser
compresseur
gaz
stocker
recul
régler
beh
décennie
inquiéter
montrer
climatique
endroit
flore
prouver
déchet
masse
réservoir
problème
produire
trouver
transformer
servir
arrêter
lutter
oxycombustion
face
facile
radioactif
faune
directement
changement
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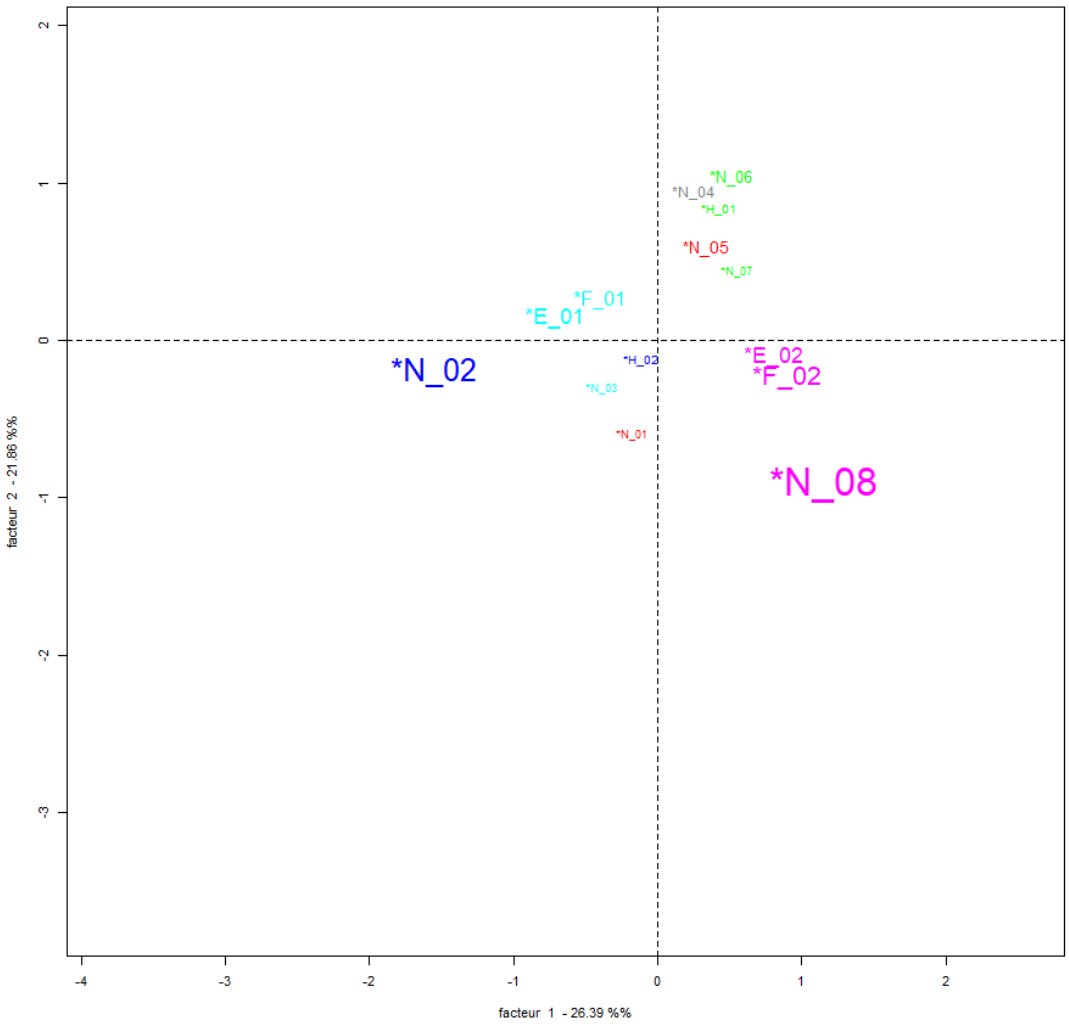


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# Arguments to grant or refuse access to the 3D data acquisition campaign, France. Field data.

During the 1st semester of 2022, the 3D data acquisition campaign unfolded in the French context involving different types of field interventions. Data was generated on a different ground than the interviews: the announced goal of the encounters is instrumental (request to grant access), participants are identified instead of being anonymous. This field data, based upon human interactions during interdisciplinary field work, thus provides an additional level of insight about the research object in context. In this document we present the arguments put forward by land owners to refuse or grant access. The quasi-totality of owners are farmers, but we mention as well the case of an abandoned golf course and of Nangis, the main town in the studied area. While more attention is given to refusal arguments, it has to be noted that they are the expression of a minority. Some 80% of the farmers, as well as all municipalities excepts one, and departmental authorities (for the main roads), granted the right to access. As much access as possible was needed to ensure the quality of the geophysical measurements. The role played by a local power struggle (see the Field report for a more complete view) is underlined as well as the questions this polarized situation raises in terms of research and for the engagement tasks.

## Arguments to refuse access

The map below shows the 10x10km seismic acquisition zone (blue outlined square), the grey dots representing the positioning of the geophones and the red line the paths followed by the vibration trucks (the basic principles of the reflection seismology are summarized in the French field report).

The colored areas represent the properties to which access was denied (excepting that of one owner, in purple towards the middle, who finally decided to grant access after long discussions). While private cross-country access was denied, it was possible for the vibration trucks to circulate and vibrate on any type of public road (this is shown by the red dots on the white lines), thus preserving the chances of obtaining good quality data from the overall campaign. The final evaluation on 20 June 2022 of the measurement campaign reports 26 273 effective vibrating points with 4 971 positioned geophones, which brings us very close to the expected goals.

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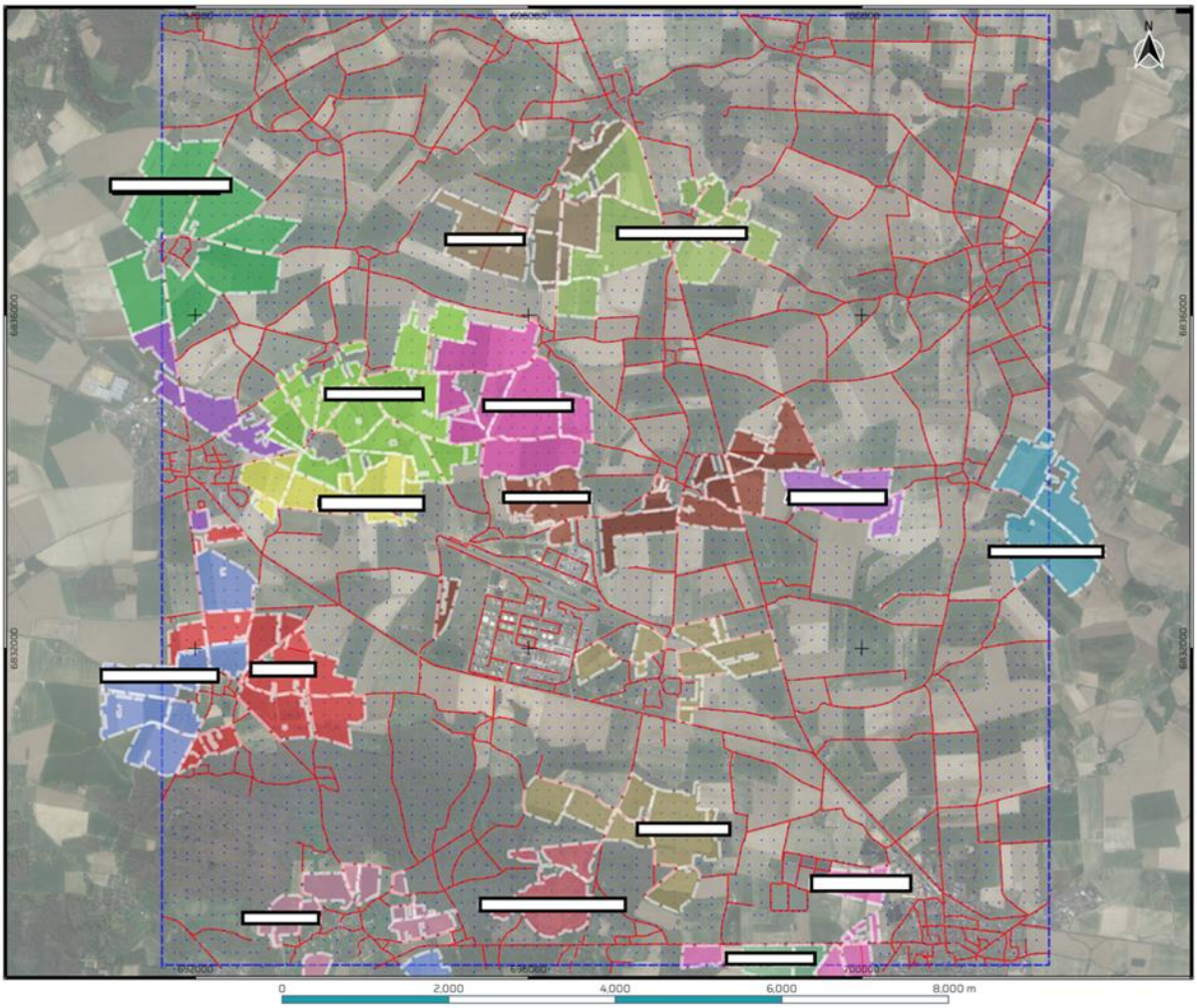


Figure 1: Seismic acquisition zone showing the numerous farming plots; those in color were excluded from the campaign.

Source: $S^3$ and PilotSTRATEGY (14 May, 2022)

Following information and discussion meetings at the Chamber of agriculture and with the Community of communes of Brie nangissienne, field contacts aiming at obtaining right of way permits from landowners and from municipalities were carried out by partner $S^3$ in charge of the 3D seismic campaign. When a request for right of way was turned down, additional information would be presented by BRGM (including technical interventions with a georadar and tests for the clay drains). The arguments founding refusal by individual farmers were collected at these times.

The names of the owners who refused access are erased from the map. Although confidentiality rights probably prevail, it could be worthwhile for the research team to discuss the interest of leaving names visible for engagement activities, e.g. to give these owners the opportunity to further explain what motivated their choice in this peculiar context. As a matter of fact, arguments may be taken in the first degree. However, as it turns out and analyzed in the French field report, some arguments might have been used as circumstantial to justify *a posteriori* a refusal already decided

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and motivated by a hidden agenda, i.e. the (under)ground of local politics. Below, Table 1 categorizes the full range of collected arguments along with some contextual elements and comments. The goal of the Field report as an additional document is to provide a more complete understanding based upon the contextual factors.

Comments in this table for the most part rest upon specialist insight, i.e. they take the arguments at face value and as research has already studied them. For instance, several arguments would demonstrate that the decision-making process is not perceived to be stepwise. It is perceived instead that a "foot in the door" (see Field report, note 6) for data collection may lead directly to farmers' disempowerment, siting of a CCUS project, and expropriation of land. Prior negative experience is invoked.

**TABLE 1: REFUSAL ARGUMENTS**

| **Collected argument of refusal to grant right of way for seismic data acquisition** | ***Context and comments*** |
|---|---|
| **UNCERTAINTY AND RISK** | |
| The air is already polluted by $CO_2$; now you want to pollute the underground? | *This argument couched in sarcasm echoes concerns about risks (it might be the only case where $CO_2$ in the atmosphere is directly mentioned)* |
| We're not sure about storage: is it permanent? What if the $CO_2$ comes back up to the surface? What if groundwater gets polluted? | *Uncertainty and risks* |
| When I see my plot of land highlighted in the theoretical grid of sensors, I say no because I don't know enough about this project. | *Mistrust reaction to insufficiently transparent materials, missing information* |
| The storage of $CO_2$ is dangerous because if there is degassing there can be deaths as in the case of the volcano in Africa | *Appeared in long discussion with a farmer (and elected to the national senate); here a reference to the 1986 limnic eruption at Lake Nyos in Cameroon. (This farmer demanded a guarantee for the drains and maintained refusal even upon gaining it -- see below the drains section)* |
| **EFFECTS ON AGRICULTURE** | |
| The transport and injection of $CO_2$ could affect crops, as we see with the gas pipeline: it is warmer, nearby crops grow faster | *Field observation related to the gas pipeline, generalized to the present situation; lay technological knowledge* |
| **(NON)JUSTIFICATION OF LOCAL $CO_2$ STORAGE** | |
| Climate change is not established with certainty. | *Climate scepticism* |
| You don't want to go and do this in the Creuse department where there are fewer people? | *Leave our locality, find another place, with some humor: Creuse is the French department known for his low population density ("creuse" also means hollow and meaningless)* |

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| | |
|---|---|
| The $CO_2$ emitted by the region's industrialists? The TotalEnergies refinery will become green. As for Borealis, it was to be bought by the Russians and will perhaps be dismantled. | *$CO_2$ storage in the area is unjustified in light of future lowered environmental impact (hypothetical future removal of the source)* |
| The fertilizer produced by Borealis does not remain in the region. | *$CO_2$ storage in the area of production is unjustified because the industrial product is used elsewhere* |
| To capture $CO_2$, why not do it with crops on the surface? | *Another way to capture and store $CO_2$, relying directly upon agriculture, would be preferable* |
| **EQUITY AND BALANCE OF POWER** | |
| When we ask EDF [French electricity company] to move a utility pole, it's quite a long story, so why let you through just like that? | *Give-and-take (G&T) on utilitarian grounds* |
| Will I be paid for the right of way? If I don't get anything out of it, I refuse. BRGM charges for its services. | *G&T on economic grounds* |
| Make me a borehole that gives me 80m3/h of water for irrigation and I'll let you go in my fields | *G&T, or what's in it for me?* |
| You want to probe my land? And afterwards? You will drill? | *"Give an inch, take a mile": distrust and concern about demands that may follow, in reference perhaps to nearby oil drilling* |
| I refuse to grant access for the geophysics measurements because I do not support a CCUS project here | *Refusal of perceived "foot in the door" tactics, or simple strategic determination to cut off an unwanted process in early stages. A clear statement expressed by a farmer at the end of long discussions.* |
| The current CAP (EU's Common Agricultural Policy) is a regression for farmers' income, so I'm not going to support a European research project. | *Anti-European on corporatist grounds, resentment* |
| You arrive on conquered ground, you break everything and then you leave! | *Outrage at power imbalance, rejection of risk and disruption, blaming* |
| **RISK OF EXPROPRIATION (LOSS OF LAND AND PROPERTY)** | |
| I don't want to be expropriated, it has already happened with oil. Moreover, the expansion of the Nangis agglomeration also leads to expropriations. | *Suspicion that granting access will lead to the loss of property; protection of agricultural land (an issue in the larger French context). Generalization of negative prior experience in the context of both oil and urbanization* |
| In the past, there have been expropriations because of the refinery, the railway line, the oil wells. | *Again generalization of negative experience, citing additional infrastructure cases in the local historical context* |
| The French state will not give us a choice if the site is favorable, we will be expropriated | *Concern about authoritarian centralized decisions, resting upon local experience.* |
| **VICTIMIZATION OF FARMERS** | |

| | |
|---|---|
| Farmers are generally mistreated and sometimes physically attacked, for example about pesticide spraying | *Sense of victimization and exposure to unacceptable risk, stigmatization* |
| And if we go to Natura 2000, we won't be able to do any farming anymore | *Protest against environmental legislation that could hamper farming practices, e.g. spraying pesticides, water pollution* |
| **PERCEIVED TECHNICAL INCOMPETENCE OR USELESSNESS** | |
| You're doing it wrong, that's not how it should be done | *Perceived incompetence, rebuking* |
| You already know the geology of the area, you're just here to confirm what you know | *What you do is useless, you have no valid reason to be here* |
| **NUISANCES** | |
| People in other communities report traffic from vibration trucks on Sundays and holes in the road | *Rumors of harm. This is from the city of Nangis (telephone discussion), belied by the fact that trucks did not circulate on Sundays and no damage on the roads was reported* |
| After having made enquiries with other communities about your technical procedures and the potential nuisance caused, your request will not be granted | *Formal letter from the Mayor of Nangis, the biggest city of the area, formalizing a refusal after many efforts by PilotSTRATEGY to establish communication. Nangis is directly involved in the local political polarization.* |
| Nuisance avoidance? No argument provided | *We can only assume this argument, as the owner of an abandoned golf course rejected direct communication while asking her manager to tell us that she refused to grant access* |
| **THREAT TO ECONOMIC AND SYMBOLIC ENTITY: UNDERGROUND POTTERY DRAINS** | |
| The breakage of pottery drains is a problem because the consequences of the damage do not appear immediately. We want a ten-year guarantee | *A significant issue on symbolic as well as overt economic grounds. The drain has emerged repeatedly as a relevant underground entity. Our field report analyzes this topic related to local agricultural patrimony and an expression of vulnerability. Although deeply anchored, it can as well be a circumstantial argument (refusal maintained in spite of responding to the demands, see below)* |
| Give me the assurance that this will not affect my irrigation and drainage system | *After georadar localization of drains and tests with vibration trucks, assurance as well as economic guarantee was given (farmer maintained refusal)* |

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## Arguments to accept access

As in other domains, there is less feedback from the side of acceptance, although actual responses of this type ended up to be more numerous (64 of some 80 farmers located in the seismic study zone granted right of way). Agreement did not call for much more interaction as both parts have found an accord, while refusal triggered reactions on our part, such as requesting explanations, wanting to understand, providing answers to the concerns, negotiating ... all trying to produce a change in position and reach an arrangement.

TABLE 2: ACCEPTANCE ARGUMENTS

| **Collected argument of agreement to grant right of way for seismic data acquisition** | ***Context and comments*** |
|---|---|
| ABSENCE OF NUISANCE | |
| Because the 3D seismic acquisition is not intrusive, with no impact upon the environment | *Vibration trucks remain on the main and country roads, small wireless geophones (about 20cm) are placed in the fields* |
| I do not see any inconvenience in supporting the project as presented during the Chamber of Agriculture meeting | *While representing diverse interests for the agricultural milieu, the Chamber is an influential local actor* |
| JUSTIFICATION OF DATA ACQUISITION AND CCUS | |
| Given the seriousness of the climatic situation, we should go faster, the development of CCUS is too slow | *This comment was made by an elected representative during the initial meeting with the Brie Nangissienne Community of Communes Board, in reaction to the presentation of the PilotSTRATEGY project (see Field report)* |
| Hoping that your investigations can move forward to access new ways to engage with a responsible future | *This positive note was in response to the thank you letter sent at the end of the $S^3$ campaign to all farmers and municipalities involved* |
| INTERPERSONAL RELATIONS | |
| I was first opposed but I am impressed by your diligence and negotiating skills, so I accept | *Social interactions "person -to-person" played an important role in reaching an agreement; explicit in this case of a lasting discussion ending with a change of attitude and positive feeling. This can be seen as an instance of trust-building* |

## Discussion

The longer list of refusal arguments compared to acceptance expressions should not make us overlook the fact that a large majority of farmers and other actors indeed accepted to grant access.

The categories used to present the data to refuse access show that the arguments do not relate directly to the 3D seismic data acquisition itself, with the important exception of the pottery drains. Access is not granted because of opposition to CCUS (uncertainty and risk are mentioned) or because CCS is perceived to be unjustified at local level other issues mentioned relate to imbalance of power (no gain in exchange, expropriation, victimization) and questioning of technical competence.

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However, we note that no reference was made to the risk of induced seismicity. Residents and farmers are used to oil and gas exploration in the area, and no seismicity was detected during the 50 years of oil and gas production.

With the exception of the abandoned golf course owner who declined to share the reasons why she refused to grant access, we note that reluctant owners would engage, sometimes after repeated solicitations, in discussion. These discussions, along with practical actions such as georadar localizations of pottery drains and vibrating tests engaged in response to specific concerns, did not translate automatically into a change of attitude. A reported impression by a member of the research team was that all the contacts for the geophysics campaign bothered some farmers and disrupted their routine, and so they actually found a justification rather than saying directly that they don't want change. While some seemed to lean towards changing their mind, only one owner did and explicitly acknowledged his appreciation of the dialogue he experienced.

As for agreements, much more numerous, they appear here as a virtuous mix resulting from adequate information in a trusted context (e.g. meeting at the Chamber of agriculture), low risk perception, concern for the climate, and appreciated interpersonal relations. The latter likely played a central role during encounters with farmers: while S[3] and BRGM partners had a technical and administrative agenda, they mobilized interpersonal skills and attention as well[5]. The interweaving of technical and social factors in this type of fieldwork should be better recognized.

An important point relates to the local polarization. As the rejection arguments can make sense within a frame of analysis with categories similar to those used for the interview data presentation, we must recall the existence of a power struggle in the study context. The resulting polarization might well constitute another frame of analysis. As mentioned in the Field report: *The nature of this framing is rather simple as it is bipolar: you are in favor of X and opposed to Y, and vice versa. There can exist a swing area where people hesitate or are not interested to join one side or another. Although the CCBN council is at the epicenter where that polarization is the most visible, the impacts can extend to whatever action or decision is influenced by the members (and supporters) of the polarization. The link with arguments heard during the 3D seismic acquisition campaign is simple as well: based upon the proverb "Who wants to drown his dog accuses him of rabies[6]", unfavorable arguments are circumstantial and serve a hidden agenda.*

In such a situation, bad faith arguments serving a hidden agenda can obstruct any attempt at dialogue: refusal is the message consistent with belonging to the polarization. But as this frame is not explicitly claimed as such and remains underground, it can be difficult from a research point of view to ascertain how fallacious is the use of these arguments. Exceptions might be found in the case of the landowner who repeated requests and stipulations and yet did not grant access when these were obtained, or the city hall of Nangis, actively involved in one side of the polarization, which refused access upon rumor-based arguments.

[5] A resident who had sent comments and questions in reaction to the seismic acquisition flyer, also expressed his thanks for the quality of the answers that were provided (email exchanges).
[6] Molière (1672), *The Learned Women*, act two, scene V.

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While it is not our role to take part in the local power struggle, we cannot ignore its existence and the issues it raises in terms of research and engagement :

- Can the arguments be presented upfront, e.g. during engagement sessions, as legitimate concerns and advices, leaving behind the explicative context and the related distortion?
- Should the polarization underlying some of the rejection arguments, and the instrumentalization of a EU research project, be discussed openly?

These issues, and maybe others, would need to be discussed by the research team, particularly in the perspective of the engagement process, possibly considering analogous situations of siting decisions.

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# Greece (West Macedonia) and Poland (Upper Silesia)

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## Introduction

The objective of this task is to map the perceptions, attitudes and interests of the stakeholders in the communities studied, which will allow determining the social acceptance, as well as the scope of the critical issues and needs in each community. To this end, we have proceeded to: i) identify the relevant actors for a social debate around CCS; ii) conduct semi-structured interviews with selected representatives of the interest groups in the regions studied. This task builds on the work done in the social characterization of the study regions task and on the identification of potential stakeholders to be interviewed in the study.

This part of the report focuses on the findings from Poland and Greece. Both countries participate throughout the PilotSTRATEGY project but the level of analysis is less deep than for the other study regions in France, Portugal and Spain. Therefore, the number of interviews is also smaller than in the other countries.

## Method

Semi-structured interviews were conducted with selected members of the stakeholders in both countries. Given the early phase on a potential pathway to implementation in the two countries, the focus was on interviewing people from the respective innovation system that have already some connection to the topic (see Table below). As a result, research actors from a variety of disciplines form a subgroup in both countries within the interview partners. This is complemented by perspectives from policy making and in Poland also from industry. Given the small overall sample size in the two countries and the low number of interviewees per category an analysis according to actor category is not feasible.

*Table 8. Interviews by region and type of actor.*

| | Poland | Greece |
|---|---|---|
| Policy maker | 1 | 2 |
| Industry | 1 | |
| Research | 3 | 4 |
| **Total** | 5 | 6 |

The interviews aim to understand stakeholders' overall assessment of CCS technologies and CO2 storage, their level of acceptance of CCS developments in their regions, sources of concern, perceived benefits and costs of storage development for the region, conditions for acceptance, perceived barriers and facilitators of CCS development in the study regions, and preferences and expectations.

To conduct the interviews a simplified version of the interview guideline applied in the other countries was developed. In addition to this a concept note was provided to the partners from the countries on how to proceed and who to interview. Interview partners were recruited and interviewed by colleagues from partners in the country. They were usually audio-recorded, took partly place in a face-to-face manner, partly over the phone in the national language. Based on the

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audio-recording the partners from the countries wrote English summaries using a template that was provided to them. These summaries formed the basis for the analysis provided in this report. Direct quotes cannot be extracted from the material provided.

## Results: Greece (West Macedonia)

The table below summarizes some key ideas about the affected communities in Western Macedonia expressed in the interviews. While interviewees identify some challenges and sensitive topics, overall they see an openness to further pursue CCS as an option - also in the wake of the declining coal industry.

*Table 9. Strengths, challenges and key conditions onshore.*

| Main strengths | Main challenges | Key conditions |
|---|---|---|
| ▪ CCS as a pathway following on the strong role of lignite mining in the past<br>▪ Job creation potential<br>▪ Openness of local community for a discussion is expected | ▪ General challenges around local acceptance that became visible in relation to other (energy) technologies<br>▪ Integration with other economic sectors such as tourism, agriculture and then historic and environmental heritage | ▪ Public engagement processes including the transparent sharing of information and participation<br>▪ Involvement of regional governments and, additionally, a broad variety of stakeholders<br>▪ High level of safety |

### *Community Description*

The interviewees agree on a set of elements that allow us to characterize the community:

i. The Greek government has decided to phase out coal and to shut down lignite mining and combustion, which is dominant for Western Macedonia. This is connected to a high probability and related concerns of rising unemployment rates in the region. Interviewees observe disappointment in the region due to this (anticipated) development. There is a need to develop new job opportunities.
ii. The area also contains natural protected areas which are also important.
iii. Furthermore it is mentioned by one interviewee that past green energy infrastructure projects have also received negative receptions. The need of accurate information and community involvement was emphasized.

### *Familiarity with CCS*

The interviewees were all familiar with CCS. Their perception was that communities are not or hardly familiar with it and at best associate it with climate change mitigation. The difference between CCS and CCU is likely not clear. The expectation was voiced that also representatives of civil society lack awareness about CCS. One interviewee raised the issue that this could pose a challenge to risk communication around CCS.

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### *Benefits of CCS*

Overall benefits in relation to CCS that were mentioned include its contribution to climate change mitigation as well as the employment opportunities that could come with it as well as social effects. In addition to local jobs one of the interviewees also mentioned opportunities for scientists. The perception that CCS could contribute to local development was voiced. However, one of the interviewees did not see any benefits arising from CCS. Another interviewee pointed out that benefits of CCS are only arising from its combination with burning lignite and without lignite use CCS is not needed. Using CCS was also described as a possibility to increase Greece's energy autonomy. It is not spelt out in the interview summary, but likely this refers to the possibility to prolong the use of lignite power plants while still reducing emissions.

### *Risks, concerns and barriers in relation to CCS*

Overall interviewees mentioned several aspect as risks, concerns or barriers regarding CCS. The most prominent aspect was around leakages and how to prevent them. Many of the other risks were only mentioned once or twice.

i. Leakage of CO2 and concerns about the integrity of the storage site - besides risks associated with leakage to creatures it was also mentioned that leakages would put the overall idea of CCS in question. Concerns related to leakages or how to guarantee impermeability were pointed out by several interviewees.
ii. Induced seismicity was mentioned by three interviewees. Two of them also brought up the issue of the limits of predictability in relation to seismic activities.
iii. Technological readiness and open questions about its efficacy incl. uncertainty of available storage capacity. This aspect was mentioned by two interviewees.
iv. Impacts on water
v. Costs of CCS are high and the interviewee expects that in the end they will be passed on to consumers.
vi. Lack of political frameworks
vii. If CO2 is used for a further extraction of fossil fuels (EOR, EGR) this leads to a vicious cycle and increase emissions.
viii. Potential impacts on fishing and agriculture (not further specified)

### *Expected community response to CCS*

Half of the interviewees expected positive reactions from the affected communities, one pointed towards neutral perceptions while another expected a negative response. The reasons for these expectations varied between interviewees. One of interviewees expected a positive response from the local communities to CCS due to employment opportunities and at the same time expected opposition from environmental groups and some citizens. Another interviewee also expected positive reactions as long as accurate information is shared and communities are involved and misinformation is not dominant. A third voice was also very optimistic as s/he did not any reasons to object such a development and anticipated support from research and industry. Another response found it difficult to predict, but expected a positive response to pilot facilities, but had concerns about the aesthetics. Thus, this person anticipated a mostly neutral attitude in relation to current local concerns. This is in line with the more general deductions of another interviewee who pointed to a generally distrust of the public towards new technologies and a "not-in-my-backyard"-

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phenomenon that emerged in relation to many other energy technologies. In case concerns of seismic activities also gain impact, this interviewee anticipated a negative reaction and pointed to the important role of different societal stakeholders that could change the picture.

### *Local benefits and opportunities of CCS*

The local benefit that is repeatedly mentioned by overall four of the interviewees are positive effects on employment. Further local benefits include that CCS supports the existing coal fired power plants, contributes to energy autonomy by using local lignite and, finally, could trigger broader economic benefits, also to tourism, agriculture/ fishing by reducing environmental pollution.

### *Local negative of CCS*

Interviewees from Greece do not expect negative impacts from CCS on the region. Getting a bit more speculative, as they say themselves, two of them vaguely refer to possible negative impacts on tourism or other economic activities e.g. if the scenery is reduced or on wildlife.

### *Acceptance conditions*

A variety of conditions is mentioned in the interviews that influence acceptance. The interviewees emphasize

i. the importance of accurate information and community involvement
ii. that an experimental phase with a pilot facility is important
iii. that aesthetics of the installation will play a role
iv. that public discussions can take different routes and that in case of opposition a CCS pathway should be reconsidered
v. that safety and expected environmental impact are very important including the impact on natural protected areas

### *Key actors and public involvement*

The interviewees reflect on the following actors and that they should be heard in a process of further developing CCS in Western Macedonia.

A. Regional governments, city councils
B. Environmental agencies, ministry of Natural Environment and Climate Change
C. Ministry of Antiquities
D. The Public Power Corporation as the largest electricity provider in Greece
E. Local industry
F. Labour Unions and engineering chambers
G. Agricultural associations
H. University of Western Macedonia
I. Citizens

Group A is most frequently mentioned by many interviewees. The other groups are usually pointed out once or twice, but they show that overall interviewees are thinking about a very broad societal inclusion of many actors groups and regard them as relevant.

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- Active engagement of citizens is expected and seen as necessary - and embraced by citizens. This includes providing good information, but goes beyond. If citizens' perceptions become negative, this should be taken into account.
- This stretches out to local communities and their governments.
- Of course, the relevant industry needs to be engaged in the discussion - also to share knowledge and insights.

### *General position of the interviewees towards the CO2 storage project*

In general, we find two fundamental positions among the interviewees:

i. Four of them are open and favourable towards CCS as an option
ii. Two are neutral

Thus, none of the actors interviewed were negative or critical about CCS as an option and several of them regarded CCS as an important option in the fight against climate change.

*Table 10. General position of the interviewees in Greece.*

| No. | actor type | overall attitude | Reasons |
|---|---|---|---|
| 1 | Research | Neutral | ▪ Overall tone/attitude was neutral |
| 2 | Policy Maker | Acceptance | ▪ Attitude was generally favourable. |
| 3 | Research | Neutral | ▪ Tone was neutral, cautious and objective. Emphasis on experimental, pilot facility. |
| 4 | Research | Acceptance | ▪ The interviewee was quite calm and positive towards the project. Showed interest and provided useful information and insights about the public acceptance problem. |
| 5 | Research | Acceptance | ▪ The interviewee was quite calm and positive towards the project. He showed interest and provided useful information and insights about the public acceptance problem. |
| 6 | Policy Maker | Acceptance | ▪ The interviewee was quite calm and positive towards the project. He showed interest and provided useful information and insights about the public acceptance problem. |

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## Results: Poland (Upper Silesia)

The table below summarizes some key ideas about the affected communities in the interviews on Upper Silesia. Overall - and although several of the interviewees themselves are positive about CCS - the interviews identify many challenges. CCS is perceived to be in an early phase in Poland as a political strategy and a legislative framework are missing and also other preconditions such as viable business models are lacking.

*Table 11. Strengths, challenges and key conditions onshore.*

| Main strengths | Main challenges | Key conditions |
|---|---|---|
| ▪ Job creation, support for future economic development - however, overall potential not clear | ▪ Low familiarity is (partly) assumed also for stakeholders directly involved in the potential development<br>▪ High costs for CCS<br>▪ Lack of political strategy / implementation of legislative framework<br>▪ Safety standards<br>▪ Not clear how some societal groups will position themselves in relation to CCS<br>▪ Potential of negative regional impacts | ▪ High safety standards<br>▪ Public consultation processes<br>▪ Legislative changes |

### *Community Description*

Upper Silesia is described as an area that is shaped by coal mining and despite many changes already implemented, it has a need for further transformation. Interviewees emphasize that it has a natural heritage.

### *Familiarity with CCS*

One of the interviewees in Poland stated the perception that stakeholders from the region from policy, industry or science have only limited knowledge about CCS and the conditions it comes with. Another interview partner, however, emphasized a growing interest and awareness about CCS, especially on the regional level. A third expected familiarity and support for CCS from climate activists and other people highly aware of the topic.

### *Benefits of CCS*

Avoiding emissions to the atmosphere and the chance that in some cases even negative emissions are feasible is one of the benefits of CCS. However, as pointed out by another interviewee, these positive effects only come later and thus are not tangible.

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It was further pointed out that by applying CCS costs from the emission trading scheme can be avoided. It could help to decarbonize industries that have little other options and is perceived to not require deep changes to the existing infrastructure.

### *Risks, concerns and barriers in relation to CCS*

Overall interviewees mentioned several aspects as risks, concerns or barriers regarding CCS. The most prominent aspects were costs, the lack of a political strategy and safety vs. leakages.

i. Costs of CCS are high and are not justified for aging emission sources. Here, costs for emission allowance play an important role. Financing is lacking. Two interviewees especially emphasized the costs for transport.
ii. Lack of legislative support in the EU and in Poland, e.g. no storage onshore is allowed, no well-defined political strategy
iii. Safety risks around storage sites to the local population; leakages reduce the effectiveness in relation to climate change.
iv. Lack of acceptance due to safety risks
v. Lack of knowledge, e.g. how to fund CCS or to obtain permissions and also outdated knowledge
vi. Extend the lifetime of fossil fuel technologies and delay decarbonisation incl. diversion of investments
vii. Lack of innovation, e.g. in comparison to CCU
viii. Lack of experience with CO2 storage sites

### *Expected community response to CCS*

In line with responses to earlier initiatives about CCS in Poland, one of the interviewees expects that residents and environmentalists will be against a further CCS development. This perspective of critical perceptions from the public and environmentalists is supported by another interviewee who also expects that scientists from some disciplines will be sceptical.

Another interview partner has a different view and states the expectations that climate activists, people highly aware of climate change as well as potential employees to CCS facilities such as people from the mining and related sectors, eager to retrain will be supportive. However, this person also anticipates objection due to lack of knowledge and an overestimation of possible risks as well as due to NIMBY phenomena or - pointed out by another respondent - due to the costs related to CCS development. The typical supporter of CCS is described as someone with a technical background and high climate change awareness. Finally, one of the interviewees sees an ideological influence on the debate around CCS.

### *Local benefits and opportunities of CCS*

The main argument brought forward by several interviewees in favour of CCS are economic benefits including the possibility of providing additional jobs, creating cooperation between various stakeholders, making the region attractive and competitive for future investors (similar in another interview). However, it was also mentioned that CCS projects will probably not be a very large employer, but they may become an economically attractive niche for specialists such as engineers. The economic development pathway for CCS is described in both ways by different interviewees - as prolonging the coal pathway or by supporting its transition.

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*Local negative impact of CCS*

The topic that is repeatedly brought forward by several interviewees is the potential negative impact of CCS on the attractiveness of Silesia - which could affect economic development, e.g. tourism and agriculture or impact the natural environment. One of the interview partners thus emphasizes the need of a thorough environmental impact assessment in case CCS is further developed. The possible reduction in regional attractiveness is also related to safety issues as concerns could drive people away from the already in parts depopulated area. Other concerns around potential negative impacts refer to prolonging the coal focused pathway instead of developing renewable energy as the better alternative.

*Acceptance conditions*

A variety of conditions is mentioned in the interviews that influence acceptance. The interviewees emphasize

i. a focus on the safety of residents that needs to be provided including the geological stability of rock masses; this means carrying out detailed geological research, drilling research boreholes and a pilot injection of the first million tons of CO2. One interviewee points out that successful pilot projects could be very convincing, but they are lacking so far.
ii. the need for public consultations and transparency when developing the project
iii. the need for an integrated action at different levels of government (local and national) with the involvement of energy, industry and local communities
iv. legislative changes (partly ongoing)
v. limiting CCS to applications that lack other effective solutions
vi. acceptance from citizens
vii. proper motivation of land managers or land owners to make storage sites available is key to CCS development
viii. benefits to citizens or better communities who do not benefit directly e.g. if there is a decline in the value of their homes and apartments. Both of these issues should be addressed at the legislative stage by ensuring transparent access to all information, including that related to monitoring, as well as compensation financed also to improve local infrastructures.
ix. that the reception will depend on how CCS is presented by politicians and by trade unionists, and on the balance of arguments

Some parts of the discussion on conditions of acceptance are less about project characteristics but more about pre-conditions that need to be fulfilled before an implementation is feasible, such as the implementation of the legislative framework or a viable business model. Several of the conditions mentioned elaborate on approaches to enable acceptance, such as public engagement and participation or compensation either to individuals or the community. Poland experienced earlier activities to push towards CCS 10-15 years ago which were met by local resistance. One of the interviewees, however, expects that the situation is now different as awareness and knowledge have grown. Another interviewee has doubts on that especially as this person does not see progress in relation to the development of the technology.

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### *Key actors and public involvement*

Among the key actors mentioned to be involved in the further process, citizens are mentioned most frequently. Most of the other groups are mentioned once or twice.

A. Citizens
B. Local communities, representatives of the region and their stakeholders
C. Industry representatives, especially those with high CO2 emissions and from the extractive industries
D. Unions
E. Research institutions
F. Relevant ministries and central administration
G. Operator of storage site and transport infrastructure
H. Organisations providing geological supervision
I. Environmental organisations

Regarding the content of an engagement process, interviewees recommend to implement a public consultation that presents risks and benefits with the aim of finding satisfactory consensus for both sides by emphasizing safety, minimal environmental impacts and visibility, job creation and other benefits. Two interview partners describe engagement as instrumental to achieve acceptance, while another sees the role of participation and engagement to enable informed decision making. The lack of existing CCS projects that are already running is seen as a challenge. Furthermore, it is emphasized that an early start of a campaign using various channels is recommended as well as an analysis of social challenges. One of the interview partners also points to the relevance of including environmental specialists into the consultation to minimize potential environmental impacts. Another suggestion that is raised it is to define and assign the roles for the investment process and the operation phase in the engagement period.

### *General position of the interviewees towards the CO2 storage project*

The opinions from the interviewees cover the full range from strongly negative about CCS in general to positive for a variety of reasons. The main role for CCS is seen in its potential contribution to mitigate climate change. One of the rationales is also the lead time needed to develop CCS combined with the assumption that it will get more imminent once the decarbonisation of transport or industry becomes more important.

*Table 12. General position of the interviewees in Poland.*

| No. | actor type | overall attitude | Reasons |
|---|---|---|---|
| 1 | Industry | Hesitant | ▪ Sees no future for CCS |
| 2 | Policy Maker | Acceptance | ▪ Attitude was rather positive and welcomes research projects to advance CCS. |

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| | | | |
|---|---|---|---|
| 3 | Research | Negative | ▪ Strong preference for other options to mitigate climate change; doubts that CCS is an effective solution. |
| 4 | Research | Acceptance | ▪ Personal position seemed rather positive, but a strong emphasis was put on the perspective of affected citizens. |
| 5 | Research | Acceptance | ▪ Very optimistic that implementation in the region will happen until 2030. |